Apache Powder Superfund Site

U.S. Environmental Protection Agency, San Francisco, CA 94105

St. David, Arizona June 1994

EPA Proposes Cleanup Plan for Contaminated Soil and Groundwater at Apache Powder Site

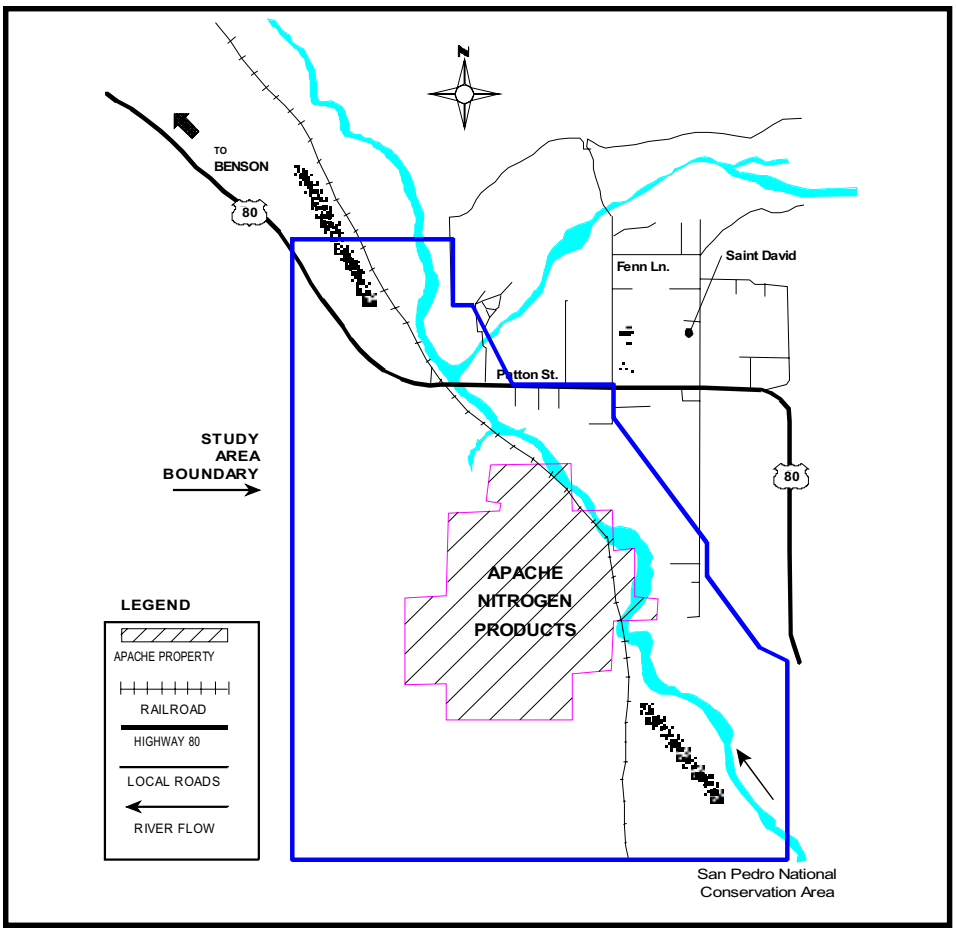

Figure 1: Map of Apache Powder Superfund site and surrounding area

The United States Environmental Protection Agency (EPA), in cooperation with the Arizona Department of Environmental Quality (ADEQ) and the Arizona Department of Water Resources (ADWR), is proposing measures to clean up nitrate-contaminated groundwater and contaminated soils at the Apache Powder Superfund site (Figure 1). This Proposed Plan pertains to areas with contamination due to historical practices at the facility. Concurrently, ADEQ is addressing the company's on-going manufacturing processes to reduce or eliminate the threat of future contamination. The EPA and the State of Arizona are coordinating their respective activities to ensure that the cleanup activities performed by Apache Nitrogen Products, Inc. (ANP) are comprehensive and do not duplicate company or agency effort.

The purpose of this Proposed Plan is to seek your comments on cleanup alternatives, including EPA's preferred alternative, and the information used to develop them.

PUBLIC MEETING

Wednesday, July 6, 1994 - 7:00 pm
St. David Schools, K-Hall, 70 Patton Street, St. David, Arizona

You are encouraged to review all the alternatives, including EPA's proposed remedy, and the Administrative Record.

EPA officials will make a presentation on the cleanup alternatives, respond to questions and accept both oral and written comments from the public regarding the Remedial Investigation/Feasibility Study and the cleanup alternatives.

PUBLIC COMMENT PERIOD - JUNE 23 through JULY 25, 1994

SUMMARY OF EPA'S PREFERRED ALTERNATIVE

EPA's preferred alternative addresses cleanup of historical contamination affecting groundwater and soils in the following five media areas (Figure 2):

1. Perched Groundwater
2. Shallow Aquifer
3. Inactive Pond Soils and Sediments
4. White Waste Materials and Drum Storage Area
5. Wash 3 Area (Excluding the Ash and Burn Area)

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Source: Bechtel Environmental, Inc.

Figure 2: Five remedial action media areas

EPA will select a final remedy for cleanup of the contaminated groundwater and soils at the Apache Powder site after consideration of all comments received on this Proposed Plan. A public meeting will be held on Wednesday, July 6, 1994, for the presentation of oral or written comments. All site information (studies, etc.) considered by EPA in developing this Proposed Plan is contained in an Administrative Record, which is available for your review at the Benson Library in Benson, Arizona (See page 12 for address).

EPA's proposal will accomplish the following: (a) completing additional groundwater investigations (e.g., aquifer testing, groundwater modeling, ecological impact analysis, water resource impact analysis) to determine the extent of the nitrate contamination; (b) treating the contaminated perched and shallow aquifer groundwater to meet the federal and state drinking water standard of 10 parts per million (ppm) for nitrate; (c) treating extracted groundwater to meet state water quality requirements prior to being returned to the shallow aquifer (reinjected) and/or recharged to the San Pedro River; (d) placing a deed restriction on the site to prohibit shallow aquifer groundwater use for drinking purposes on site; and (e) cleaning up historical areas of waste disposal and soil contamination.

SITE HISTORY

The Apache Powder Superfund site is located in Cochise County in southeastern Arizona, about seven miles southeast of the incorporated town of Benson and approximately 50 miles southeast of Tucson. The site study area includes approximately 1,000 acres of land owned by ANP, formerly known as the Apache Powder Company. The site study area also includes areas of nitrate-contaminated groundwater and surface water located outside ANP's property boundary. The site is bordered to the east by the San Pedro River (Figure 1).

ANP began operations in 1922 as a manufacturer of industrial chemicals and explosives. Currently, ANP manufactures nitric acid, solid and liquid ammonium nitrate, blasting agents, and nitrogenous fertilizer solutions. ANP also distributes explosives materials to mining companies. ANP has an interim status permit under the Resource Conservation and Recovery Act (RCRA) for treatment of explosive wastes in its Ash and Burn Area. The Ash and Burn Area, also known as the Open Burn / Open Detonation (OB/OD) Area, is currently undergoing closure review by ADEQ under its RCRA program authority.

Prior to 1971, facility wastewater composed of wash-down and blowdown waters from its power house cooling tower, nitric acid plant, and from the loading, unloading, and storage of raw materials and products was discharged on site into dry washes which flow to the San Pedro River. Since 1971, wastewater has been discharged into unlined evaporation ponds on site causing contamination of a perched groundwater zone, the shallow aquifer, and the surface water of the San Pedro River (Figure 2). The site was first identified as an environmental problem in the early 1980s, proposed by EPA for listing on the National Priorities List (NPL) in 1986, and placed on the list in 1990.

INTERIM CLEANUP ACTIONS CONDUCTED TO DATE

Bottled Water Followed by Replacement Wells

While investigations proceeded and alternatives were reviewed for cleanup of the site, interim actions were taken to address potential threats to public health. In 1989, ANP began supplying bottled water to nearby residents with nitrate-contaminated drinking water wells (wells with nitrate exceeding the federal Maximum Contaminant Level, or MCL, of 10 ppm). In November 1993, EPA requested that ANP submit a revised plan to install replacment drinking water wells for those households with nitrate contamination exceeding the MCL. In February 1994, the contaminated shallow aquifer wells were resampled by ANP to establish current water quality data. The present schedule calls for ANP to install new deep aquifer drinking water wells in 1994 to replace residential wells impacted by ANP's discharges. This Proposed Plan includes completion of this well replacement project.

Wash 3 Soils Cleanup

An investigation of the Wash 3 Area began in 1989. The Wash 3 Area includes the Wash 3 channel leading to the San Pedro River, a drum disposal area, and an area informally called the Main Accumulation Area. (The Ash and Burn or OB/OD Area is also located within the Wash 3 watershed.) The investigation included an inventory of drums and stained soils and a geophysical survey. A total of 127 drums were observed and inventoried, and seven stained soil areas were identified. Excavation and removal of deteriorated 110-gallon steel drums, estimated to be 30-40 years old, began in January 1991. Approximately 230 cubic feet of oily soil were excavated and removed from the Wash 3 area to a fenced on-site storage area.

Additional activities were conducted in May 1993 , including further inventorying of drums, sampling of stained soil areas, and excavation of 45 cubic yards of dinitrotoluene (DNT)-contaminated soil. The final phase of the Wash 3 cleanup (included in this Proposed Plan) will be to consolidate and transport the drums, excavated soils (currently secured in the temporary on-site storage area), and additional soils requiring excavation for off-site treatment and disposal (Figure 3).

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Source: Hargis & Associates

Figure 3: Areas of Soil Contamination

CHEMICALS OF CONCERN AND OTHER WASTE MATERIALS

The following Chemicals of Concern (COCs) and other waste materials have been identified in the five areas addressed in this Proposed Plan:

- Perched Groundwater - Arsenic, Fluoride, and Nitrate
- Shallow Aquifer - Nitrate
- Inactive Pond Soils and Sediments - Antimony, Arsenic, Barium, Beryllium, Chromium, Lead, Manganese, and Nitrate
- White Waste Materials and Drum Storage Area - Nitrate, Vanadium Pentoxide*
- Wash 3 Area (Excluding the Ash and Burn Area or OB/OD Area) - 2,4-Dinitrotoluene (DNT), 2,6-DNT, Lead, and Paraffins*.

* Waste Materials

SITE RISKS

A Baseline Public Health Evaluation and Ecological Assessment was completed for the Apache Powder site in September 1992. The health evaluation process included: (a) identifying contaminants from historical operations that are currently present in ground- water, surface water, soils and sediments; b) characterizing the population potentially exposed to these contaminants; and c) evaluating the potential health effects resulting from exposure to contaminated groundwater, surface water, soil and sediments. EPA evaluated how individuals might be exposed to these contaminants under both current and future conditions. Potential risks to natural resources were also evaluated.

Exposure to Contaminated Groundwater

The primary human health risk posed by the site is the potential for direct ingestion of shallow aquifer groundwater contaminated by nitrate. Nitrate is the primary contaminant of concern due to the potential ingestion risk to infants that could result in methemoglobinemia ("cyanosis"). This condition, commonly referred to as "blue baby syndrome", occurs when methemoglobin is formed when nitrite is absorbed into the bloodstream. Methemoglobin is not capable of carrying oxygen to the same extent hemoglobin is, and the skin takes on a blue pallor due to the bloodstream carrying less oxygen. Because of a higher pH in their intestinal tracts, infants tend to be much more susceptible to this condition. Most cases of infant methemoglobinemia are associated with exposure to nitrate in drinking water used to prepare infants' formula at concentrations greater than 20 parts per million (ppm).

Potential Ecological Impacts

There may be some potential adverse effects to plants, soil organisms, and aquatic organisms from metals (e.g., zinc, strontium, and antimony). The ecological assessment identified raptors, duck species, and selected endangered fish species as potential receptors to chemical exposure from the site.

ECOLOGICAL RESOURCES

The site study area is located approximately one mile north of the San Pedro Riparian National Conservation Area (SPRNCA), an area established by Congress in 1988 to protect the natural riparian (river area) resources of the Upper San Pedro River. The SPRNCA extends one to three miles to the east and west of the San Pedro River from the Mexico border to approximately one and a half miles south of the southern boundary of the site study area. In 1989, the U.S. Bureau of Land Management (BLM) completed an intensive study of native fauna and flora within the SPRNCA. Two major vegetation areas were identified: riparian and Chichuahuan desert scrub. Three listed endangered species and one proposed endangered species under the Endangered Species Act may be found in the site study area.

WATER RESOURCES

The use of surface water and groundwater in the Upper San Pedro River Basin is currently undergoing hydrogeologic and ecological analysis by federal, state, and private parties. The San Pedro River is perennial (flows year round) through the site study area. This river is unique in Arizona due to the presence of a healthy riparian ecosystem. Various public agencies and private organizations are concerned with the effects of groundwater pumping or extraction on riparian areas in the Upper San Pedro River Basin. Unlike many areas of Arizona, the Upper San Pedro River Basin is outside an Active Management Area, resulting in less state regulation of the water resources within this area.

SUMMARY OF REMEDIAL ACTION ALTERNATIVES

GROUNDWATER CLEANUP

EPA considered several alternatives for (1) preventing migration of contaminated groundwater from the perched groundwater to the shallow aquifer, and (2) restoring the shallow aquifer to its designated use as a drinking water supply.

No Action - This alternative would allow contamination to remain in the groundwater with the potential for movement to additional private wells northwest of the site. The cost of this alternative would be approximately $65,000 per year for additional monitoring. The No Action approach is unacceptable to EPA, because threats to public health from groundwater contamination would continue to exist.

Pumping or Well Drilling Restrictions - Restricting access would include limiting the use of groundwater and surface water. However, use restrictions would be limited to on-site restrictions for drinking water use of the shallow aquifer, since off-site use restrictions for privately-owned property is not within the authority of any state or federal regulatory agency.

Alternative Water Supply - Bottled water is currently being supplied to a number of households. A permanent deep aquifer replacement well system to replace the bottled water is currently being implemented by ANP with state and federal oversight. Wellhead treatment systems are complex and generally unreliable for the contaminants of concern unless they are professionally maintained. Wellhead treatment is therefore not considered feasible at the site.

Pumping and Treating Groundwater - Contaminated groundwater can be treated either in the ground (in situ) or pumped out of the aquifer and treated at the surface. The treated groundwater can then be returned to the aquifer (by injection or infiltration), reused at the surface, evaporated, or discharged to surface water.

TREATMENT TECHNOLOGIES FOR CONTAMINATED GROUNDWATER

The following twelve treatment technologies were initially considered for treating extracted groundwater from the perched and shallow aquifer:

BIOLOGICAL TREATMENT

- High Rate Denitrification - Reactors
- Low Rate Denitrification - In Situ
- Low Rate Denitrification - Constructed Wetlands
- Low Rate Denitrification - Land Application

PHYSICAL TREATMENT

- Forced Evaporation (Brine Concentrator)
- Reverse Osmosis (RO)
- Electrodialysis Reversal (EDR)
- Solar Evaporation
- Distillation

CHEMICAL TREATMENT

- Ion Exchange
- Chemical Precipitation
- Electrochemical Precipitation

These technologies were screened; five were retained for further evaluation for the perched groundwater and four technologies for the shallow aquifer (See the Glossary on page 13 for a brief description of these technologies). A detailed analysis of the retained technologies is summarized in Table 1 for the perched groundwater and in Table 2 for the shallow aquifer.

PERCHED GROUNDWATER

- Anaerobic Denitrification in Reactors
- Solar Evaporation
- Forced Evaporation (Brine Concentrator)
- Reverse Osmosis (RO)
- Electrodialysis Reversal (EDR)

SHALLOW AQUIFER

- Anaerobic Denitrification
- Constructed Wetlands
- Reverse Osmosis (RO)
- Electrodialysis Reversal (EDR)

Table 1: Perched Groundwater (Nitrate, Fluoride, and Arsenic Contamination)

EPA's Preferred Alternative

Alternative	Alternative Description	Effectiveness	Implementability	Cost (million $)
P-1A: No Action (Continued Monitoring)	Status quo	Not effective	Implementable	$0.09
P-2: Anaerobic Denitrification (Biological Treatment)	Extraction from 7 wells; biological treatment in a closed reactor vessel; evaporation and disposal of waste sludge; reinjection or recharge to shallow aquifer, or discharge to the San Pedro River	Potentially capable of 97% efficiency for nitrate removal; does not remove fluoride and arsenic without additional treatment	Implementable; requires pilot treatability studies	$2.96
P-3: Solar Evaporation	Extraction from 7 wells; evaporation from lined ponds	Totally eliminates extracted groundwater; leaves solid waste matter requiring disposal	Implementable	$3.52
P-4: Forced Evaporation (Brine Concentrator)	**Extraction from 7 wells; evaporation with a brine concentrator and condensation of distilled water; reuse of the treated water in the ANP plant**	**Highly efficient for removal of all total dissolved solids (TDS), including nitrate, fluoride, and arsenic**	**Implementable; could be implemented as part of ANP's installation of a brine concentrator for process wastewaters**	**$2.35**
P-5A: Reverse Osmosis (RO) (Physical Treatment)	Extraction from 4 wells; physical treatment with a semi-permeable membrane; reuse of the treated water in the ANP plant, reinjection or recharge to the shallow aquifer, or discharge to the river	Highly efficient for removal of all TDS including nitrate, fluoride, and arsenic	Implementable	$3.49
P-5B Electrodialysis Reversal (EDR) (Physical Treatment)	Extraction from 4 wells; physical treatment with permeable membranes; reuse of the treated water in the ANP plant, reinjection or recharge to the shallow aquifer, or discharge to the river	Highly efficient for removal of all TDS including nitrate, fluoride, and arsenic	Implementable	$3.72

Table 2: Shallow Aquifer Groundwater (Nitrate Contamination)

EPA's Preferred Alternative

Alternative	Alternative Description	Effectiveness	Implementability	Cost (million $)
GS-1A: No Action (Continued Monitoring)	Status quo	Not effective	Implementable	$0.39
GS-2A: Anaerobic Denitrification (Biological Treatment)	Extraction from 4 wells; biological treatment in a closed vessel; recharge or reinjection to the shallow aquifer, or discharge to the San Pedro River	Potentially capable of 97% efficiency for nitrate removal with 2-stage design	Implementable; requires pilot treatability studies	$17.60
GS-2B: Constructed Wetlands (Biological Treatment)	**Extraction from 4 wells; biological treatment in shallow basins with aquatic plants; recharge or reinjection to the shallow aquifer, or discharge to the San Pedro River**	**Potentially capable of 97% efficiency for nitrate removal; TDS incorporated into system**	**Implementable; requires longer term start-up period**	**$16.19**
GS-3A: Reverse Osmosis (RO) (Physical Treatment)	Extraction from 4 wells; physical treatment with a semi-permeable membrane; recharge or reinjection to the shallow aquifer or discharge to the San Pedro River	Highly efficient for removal of nitrate and all TDS	Implementable	$22.65
GS-3B: Electrodialysis Reversal (EDR) (Physical Treatment)	Extraction from 4 wells; physical treatment with permeable membranes; recharge or reinjection to the shallow aquifer, or discharge to the San Pedro River	Highly efficient for removal of nitrate and all TDS	Implementable	$23.02

SOIL CLEANUP

EPA considered a number of soil alternatives to reduce the risks from potential exposure to the contaminants and to prevent migration of contaminants to groundwater or surface water at concentrations that would pose a threat to human health.

No Action - Contaminated soils would be left in place. There is no cost associated with this alternative. Neither soil removal nor treatment would occur to diminish potential threats to human health and the environment.

Deed Restrictions and Fencing - Deed restrictions and fencing would reduce the potential for human contact with the contaminants by preventing access to and restricting use of contaminated areas.

Capping - Capping consists of placing compacted fill over the contaminated areas and covering this fill soil with a low permeability clay. Placing a second layer of asphalt concrete, Portland cement concrete, or a synthetic geomembrane over the clay cap may be used to further reduce the permeability of the cap.

Surface Controls - Surface controls include grading the areas surrounding the contaminated areas to prevent surface water from flowing onto pond areas, stabilizing the pond sediments by constructing erosion prevention structures, and diverting and collecting water in lined ditches and canals to prevent surface runoff from flowing into the pond areas.

Soil Treatment - This alternative involves leaving the contaminated soils in place (in-situ) or removing and treating them physically or biologically to remove the contaminants of concern. Physical treatment methods include physically removing (leaching) the contaminants from the soil, or melting soil particles and contaminants into a solid mass (vitrification). Soil washing is not considered applicable due to the limited potential for movement of contaminants within the soils. Vitrification could effectively reduce the risk of contaminant migration by wind or water. Biological degradation consists of enhancing the breakdown of contaminants by naturally occurring aerobic or anaerobic microorganisms in the soil. Most of the metals are not considered suitable for biological degradation.

Chemical treatment alternatives include the use of chemicals that bond to the contaminants contained within a soil mass, thereby reducing their mobility. Both fixation and polymeriziation may be applicable chemical treatment options. Solidification and stabilization include the use of cement or silicates to bond the soil particles and contaminants into a solid non-leachable mass, or the use of high temperature and controlled cool-

Table 3: Inactive Pond Soils (Metals and Nitrate Contamination)

EPAs Preferred Alternative

Alternative	Alternative Description	Effectiveness	Implementability	Cost (million $)
S-1A: No Action	Status quo	Not Effective	Implementable	$0.00
S-2: Off-Site Disposal of Contaminated Soils from Pond 7 and the Dynagel Pond; On-Site Disposal of Remaining Soils in Inactive Ponds	Excavation, backfill and clay capping of all 10 inactive ponds; off-site disposal of waste materials from Pond 7 and the Dynagel Pond at a RCRA permitted treatment, storage and disposal facility	Effective; partial cleanup, but permanent; some contaminated soils remain on site; however, excavation of soils for removal may pose risk to workers	Implementable	$4.68
S-3: On-Site Disposal of All Soils in Inactive Ponds or Cells (Excavation of contaminated soils from Pond 7 and the Dynagel Pond)	Excavation, backfill and clay capping of all 10 inactive ponds; disposal of waste materials from Pond 7 and the Dynagel Pond in a new, on-site, lined, clay capped cell	Effective; partial cleanup, but permanent; all contaminated soils remain on site; however, relocation of soils may pose risk to workers	Implementable, but difficult to meet state technical requirements	$2.59
S-4: On-Site Containment of All Soils in Inactive Ponds (No Excavation)	**Backfill and clay capping of all 10 inactive ponds, with no disturbance to contaminated soils**	**Effective; permanent; all contaminated soils remain on site**	**Implementable**	**$1.93**

Table 4: White Waste Material and Drum Storage Area (Nitrate Contamination and Drummed Vanadium Pentoxide)

EPA's Preferred Alternative

Alternative	Alternative Description	Effectiveness	Implementability	Cost (million $)
WS-1A: No Action	Status quo	Not effective	Implementable	$0.00
WS-2: Excavation, Off-Site Disposal of Soils	**Remove drums; excavation and backfill of all drummed wastes and contaminated soils; transport, treatment (fixation), and disposal at a RCRA permitted treatment, storage and disposal facility**	**Effective; removes all drums and contaminated soils to an off-site RCRA permitted facility**	**Implementable**	**$0.05**
WS-3: Excavation, On-site Disposal of Soils	Remove drums; excavation and backfill of all drummed wastes and contaminated soils; treatment (fixation) and disposal in an on-site, unlined, clay-capped cell containing inactive pond sediments, or in a lined, clay-capped cell containing Wash 3 soils	Effective; affected area cleaned up permanently, but contaminated soils remain on site	Implementable, but difficult to meet state technical requirements	$0.02

ing to melt the contaminated soils into a solid non-leachable mass. These soil treatment options are implementable and well-developed technologies.

Excavation, Treatment and Disposal Off Site - Contaminated soil, including drums, would be excavated and transported to a RCRA permitted hazardous waste facility for treatment and disposal. On-site treatment may be necessary prior to off-site transport and disposal.

Excavation, Treatment, and On-Site Disposal - Contaminated soil would be excavated, treated, and then disposed of at the Apache Powder site. The contaminated soil would be: (1) moved to areas away from the groundwater and encapsulated in clean, low permeability clay; (2) disposed of in clay-lined cells in accordance with state environmental regulations; or (3) used as fill for existing excavations or future grading after being treated. See Tables 3, 4, and 5 for a detailed analysis of the soil cleanup alternatives for the three areas of soil contamination addressed in this Proposed Plan.

Table 5: Wash 3 Area (Excluding the Ash and Burn [OB/OD] Area) (Lead and DNT Contamination)

EPA's Preferred Alternative

Alternative	Alternative Description	Effectiveness	Implementability	Cost (million $)
W3-1A: No Action	Status quo	Not effective	Implementable	$0.00
W3-2: Excavation, Off-Site Disposal (No O&M)	**Excavation and backfill of contaminated soils; transport, treatment (fixation of lead-contaminated soils; incineration of DNT-contaminated soils), and disposal at a RCRA permitted treatment, disposal facility**	**Effective; permanent**	**Implementable**	**$0.59**
W3-3: Excavation, On-Site and Off-Site Treatment and Disposal (30-Year Life Cycle to Maintain Cell Cap)	Excavation and backfill of contaminated soils; on-site treatment (fixation) and disposal of lead-contaminated soils in a new, lined, clay capped cell; off-site transport, treatment (incineration) of DNT-contaminated soils, and disposal at a RCRA permitted facility	Effective; affected area cleaned up permanently, but some materials remain on site	Implementable, but difficult to meet state technical requirements	$0.71

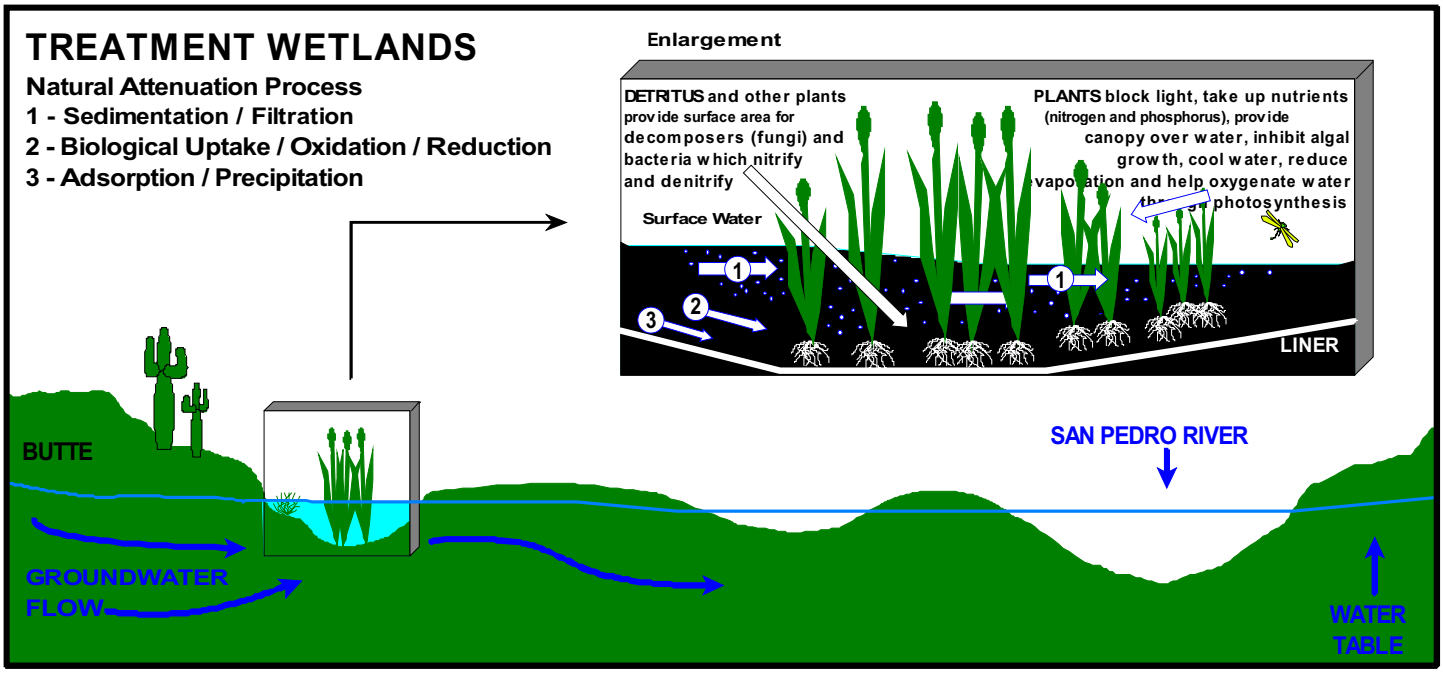


Figure 5a: Simplified illustration of a constructed wetlands used for initial treatment of contaminants

PREFERRED ALTERNATIVE

The FS report contains a detailed evaluation of the various groundwater and soil cleanup alternatives. The preferred site-wide alternative includes the following preferred alternatives for the five areas of historical contamination covered under this Proposed Plan:

(1) **Perched Groundwater - Forced Evaporation:** Clean up to meet federal and state drinking water standards (MCLs) for nitrate and metals. Wells would be installed to extract the perched groundwater for treatment. Forced evaporation (e.g, a brine concentrator) is the preferred treatment alternative. If needed by ANP, the treated water would be recycled for use in plant processes; otherwise the water would be recharged or reinjected to the shallow aquifer after meeting state aquifer and surface water quality standards (Table 1 and Figure 4).

(2) **Shallow Aquifer - Constructed Wetlands:** Clean up to meet federal and state drinking water standards for nitrate. Wells would be installed to extract the shallow aquifer groundwater for treatment. Constructed wetlands is the preferred treatment alternative. Treated water would be recharged to the shallow aquifer by "leaky" habitat wetlands, unless water balance studies during the first phase of remedial design recommend reinjection into the shallow aquifer or discharge to the San Pedro River to maintain adequate water balance for downstream users (Table 2 and Figures 5a and 5b). The installation of deep aquifer replacement wells would also be completed for residences currently on bottled water.

(3) **Inactive Pond Soils and Sediments - On-Site Containment on All Soils in Inactive Ponds:** Backfill with clean soil and cover the following ponds with a clay cap: 4A, 4B, 5A, 5B, 6A, 6B, 7, 8, and the Dynagel Pond (Table 3).

(4) **White Waste Materials and Drum Storage Area - Excavation and Backfill and Removal of All Drummed Waste for Off-Site Disposal:** Excavate and transport contaminated soils and drums containing nitrate, vanadium pentoxide, and cooling tower ceramic packing material to an off-site permitted facility for treatment and disposal (Table 4).

(5) **Wash 3 Area (Excluding the Ash and Burn Area) - Excavation and Off-site Treatment and Disposal:** Excavation, off-site treatment (fixation of lead-contaminated soils and incineration of DNT-contaminated soils), and disposal in a permitted facility (Table 5).

See Table 6 for a summary of EPA's preferred site-wide alternative.

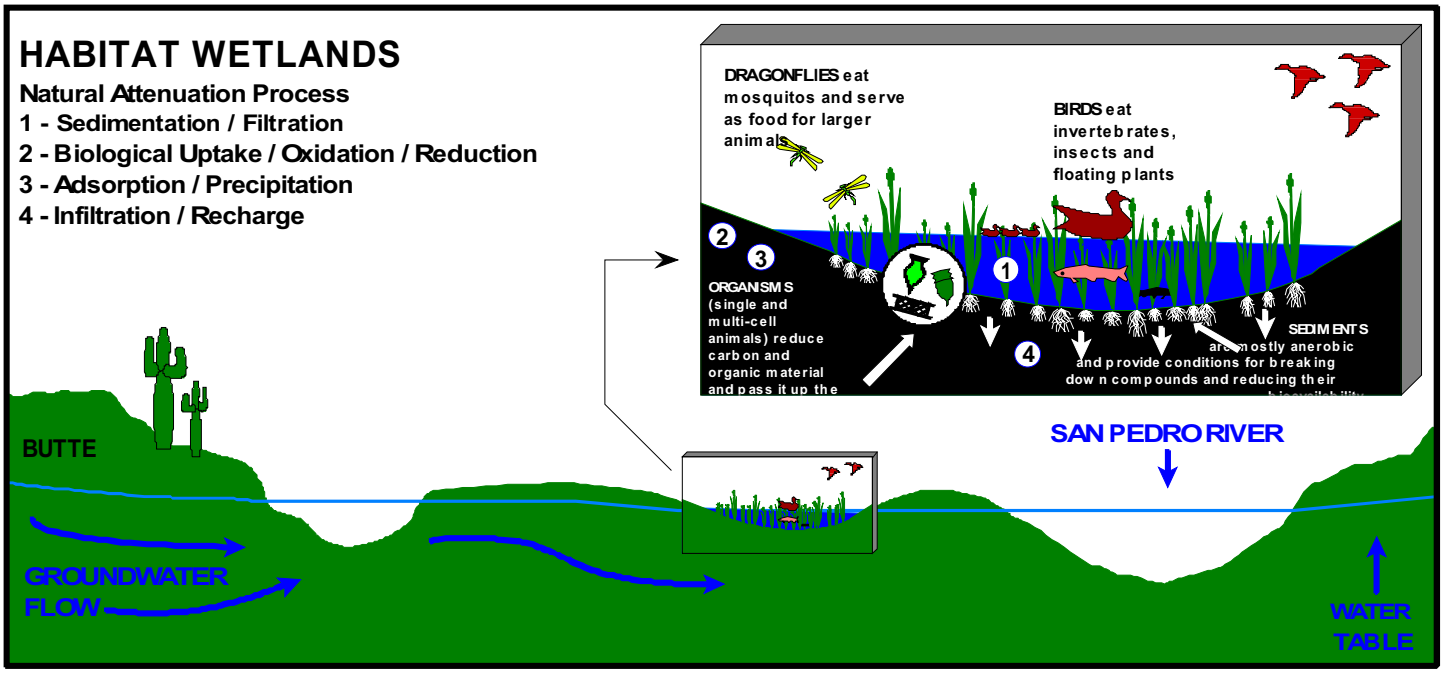


Figure 5b: Simplified illustration of a constructed wetlands used for species habitat and recharge of treated water

PHASING OF GROUNDWATER CLEANUP

The implementation of the preferred groundwater alternatives for both the perched groundwater and the shallow aquifer would be phased. A permanent drinking water supply will be installed during the summer of 1994 for the residences north of the site which have contaminated wells above the federal MCL for nitrate of 10 ppm. A forced evaporation (e.g., brine concentrator) for treatment of ANP's process wastewaters and the most concentrated areas of contamination (perched groundwater underneath the production area) has been designed and is scheduled to be operational by Spring 1995 (Figure 6).

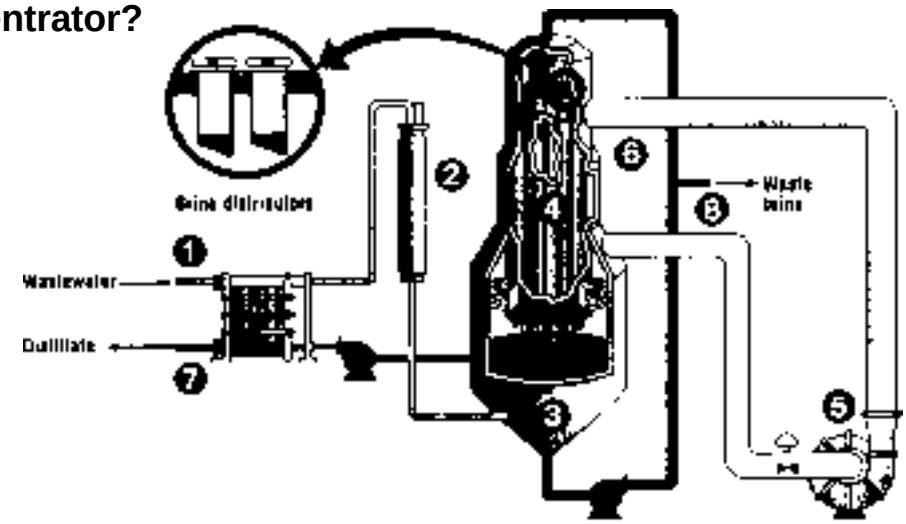
During the first part of remedial design additional groundwater investigation and modeling would be conducted. The purpose would be to determine the lateral extent of nitrate contamination in the shallow aquifer and the perched zone, and the effect of various extraction rates on the shallow aquifer's water balance. The next phase would be the design and installation of the constructed wetlands to treat the shallow aquifer contamination.

Wetlands are dynamic natural water treatment systems. As contaminated water moves through wetlands, contaminants can be treated in several different ways. The biology and chemistry of a wetland supports and enhances the removal of a wide range of contaminants. Low rate anaerobic denitrification in constructed wetlands is a widely accepted treatment alternative for the removal of nitrate. Ancillary benefits of the constructed wetlands would be enhanced riparian habitat for species and a passive mechanism for recharging the shallow aquifer after treatment (Figures 5a and 5b).

TABLE 6: Alternative 1 Site-Wide Costs - Forced Evaporation (Perched), Constructed Wetlands (Shallow Aquifer), On-Site Capping of Inactive Ponds and Off-Site Fixation / Incineration for Soils

Media	Alternative Selected	Description of Action	Cost ($ millions)
Groundwater			
Perched Groundwater	P-4	Forced evaporation	$ 2.35 M
Shallow Aquifer	GS-2B	Constructed wetlands	$ 16.19M
Soils			
Inactive Ponds Soils and Sediments	S-4	Containment; Backfill and clay cap	$ 1.93 M
White Waste Material and Drum Storage Area	WS-2	Excavation and backfill; off-site transport to a permitted facility for fixation and disposal	$ 0.05 M
Wash 3 Area (excluding Ash and Burn Area)	W3-2	Excavation and backfill; off-site transport to a permitted facility for fixation / incineration and disposal	$ 0.59 M
Total Cost			**$ 21.11 M**

What is a Brine Concentrator?



1 The wastewater is pumped through a heat exchanger which raises its temperature to the boiling point.

2 Wastewater passes through a deaerator which removes non-condensable gases such as oxygen and carbon dioxide.

3 Hot feed combines with the brine slurry in the sump. The brine slurry is constantly circulated from the sump to a floodbox at the top of a bundle of heat transfer tubes.

4 Some of the brine evaporates as it flows in a falling film down through the heat transfer tubes and back into the sump.

5 The vapor passes through mist eliminators and enters the vapor compressor. Compressed vapor flows to the outside of the heat transfer tubes.

6 Heat from the compressed vapor is transferred to the cooler brine falling inside the tubes, causing some of the brine to evaporate. As the compressed vapor gives up heat, it condenses as distillate.

7 The distillate is pumped back, through the heat exchanger, where it gives up heat to the incoming wastewater.

8 A small amount of waste brine is blown down from the sump to control the brine density.

Source: Resources Conservation Company

Figure 4: Brine Concentrator Process Flow

BACKGROUND DOCUMENTS

As supporting documentation for this Proposed Plan, EPA completed a Feasibility Study (FS) on June 17, 1994. The FS process involved assessing data generated during the Preliminary Investigation (PI) conducted by EPA in 1988 and the Remedial Investigation (RI) conducted by ANP during the period 1990-1993. The results of the RI were documented in the final RI reports prepared by both ANP and EPA, dated April 2, 1992 and June 15, 1994 respectively. These reports and the FS report developed by ANP, dated April 28, 1993, were reviewed and considered during the development of EPA's FS report. A site specific risk assessment was developed and Applicable or Relevant and Appropriate Requirements (ARARs) were identifled. ARARs are federal or state environmental statutes or regulations which must be complied with by the remedial action.

As part of the FS, remedial alternatives potentially applicable to the remedial action objectives were developed and evaluated in three phases:

- Identification and screening of technologies
- Assembly and screening of media alternatives
- Detailed analysis of alternatives

The RI reports and the FS reports including the original FS reports completed by ANP and EPA, in addition to other documents, are available for public review and comment at the Apache Powder site information repository at the Benson Library.

INFORMATION REPOSITORY

The Administrative Record is a file which includes all documents, including the Remedial Investigation/Feasibility Study, upon which EPA bases the Proposed Plan for a site. A copy of the Administrative Record is available for review at:

Benson Library
302 South Huachuca
Benson, Arizona 85602
(602) 586-9535
Hours: Mon: 9 am - 7 pm
Tues - Fri: 9 am - 5 pm
Sat: 9 am - Noon

GLOSSARY

Agricultural Land Application: Agricultural land application is the direct application of nitrate-rich groundwater to crops which would be grown at or near the site. Nitrate is a fertilizer which the crops would take up and which would be removed when the crops are harvested. Land application may be an applicable process option.

Anaerobic Denitrification: Anaerobic denitrification is a biological treatment in which bacteria reduce the dissolved nitrate to nitrite, then reduce the nitrite to molecular nitrogen. Denitrification only occurs in the absence of oxygen (under anaerobic conditions). An organic energy source is required to act as an electron donor source to achieve the denitrification. The organic energy source can be methanol, ethanol, glucose, acetic acid, or acetone. Suspended growth or attached-growth systems (in constructed wetlands or through land application) may be used for denitrification.

Applicable or Relevant and Appropriate Requirements (ARARs): Remedial actions must comply with all substantive elements of federal laws and more stringent state laws that apply or are determined to be relevant and appropriate to the remedy. ARARs could include water quality regulations, hazardous waste disposal requirements, etc.

Aquifer: An underground formation composed of materials such as sand, soil, or gravel that can store and supply groundwater to wells and springs.

Chemical Precipitation: Chemical precipitation is a system in which dissolved metal ions and dissolved salts are precipitated in the form of insoluble salts. Precipitation is caused by varying the pH. Precipitation has not been used for the removal of nitrate-N for continuous treatment of water at high rates. Precipitation is not considered an applicable process option for nitrate removal, but it could be applicable for removal of arsenic and/or fluoride from the perched groundwater.

Chemical Reduction: Chemical reduction is a chemical treatment in which dissolved nitrate is removed from groundwater by converting the nitrate to molecular nitrogen in a reduction-oxidation reaction through use of a chemical reducing agent. Nitrogen gas is formed, then liberated from the water.

Constructed Wetlands: Constructed wetlands consist of lined, shallow basins with aquatic plants such as bullrush or cattail, where microbial growth at the root systems flourish along with plant growth. Wetlands remove nitrogen from water by two pathways: bacteriological denitrification and ammonia volatilization; and storage (assimilation or adsorption) in the plants. Wetlands remove contaminants through a wide variety of biological, chemical and physical processes. The processes include sedimentation, filtration, plant uptake, biological oxidation, biological reduction, adsorption, and precipitation. Certain metals are bound to sulphurous compounds in the sediments. The complex mixture of microrganisms associated with the structural habitat supplied by living and dead aquatic plants allows for biological treatment of a wide range of contaminants.

Dinitrotoluene (DNT): An organic chemical by product from the manufacturing of trinitrotoluene (TNT).

Distillation: Distillation is a physical treatment process which is very similar to forced evaporation. The wastewater is heated to form a water vapor, then condensed. A brine solution containing the dissolved solids is removed in the process.

Electrochemical Precipitation: Electrochemical precipitation is a system in which dissolved metal ions coprecipitate with ferrous ions generated from steel electrodes. The process is similar to chemical precipitation, except that varying the pH is not necessary. It could be applicable if arsenic removal from perched groundwater is necessary.

Electrodialysis Reversal (EDR): EDR is a water treatment in which wastewater is pumped through a membrane stack consisting of alternately arranged cation-permeable membranes and anion-permeable membranes, separated by spacers. A direct current potential by electrodes located in end compartments is applied across the membrane stack. The net result is ion depletion and ion concentration in alternating compartments. The process also produces a waste brine, which would require further handling and treatment. EDR has been used successfully to remove nitrate-N and fluoride from groundwater.

Forced Evaporation (Brine Concentrator): Forced evaporation is a physical treatment in which the wastewater is heated to the boiling point to form a compressed vapor. Heat from the compressed vapor is transferred to a cooler brine, causing some of the brine to evaporate. As the compressed vapor gives up heat, it condenses as a distillate. The nitrate, arsenic and fluoride would be concentrated in the waste brine as the distillate is evaporated. A small amount of waste brine or sludge is generated by this process.

Hemoglobin: The oxygen-bearing, iron-containing conjugated protein in vertebrate red blood cells.

Ion Exchange: Ion exchange is a treatment in which wastewater containing ions is passed through a cation or anion exchange resin. Ions held by electrostatic forces on the surface of the ion exchange resin are replaced by ions of similar charge in the water. Ion exchange resins are selected to preferentially remove specific ions from the wastewater and replace them with highly soluble, nontoxic ions. This process results in waste materials, which require further handling and treatment.

Lead: A soft, bluish-white, dense metallic element used in solder, bullets, radiation shielding, and paints.

Maximum Contaminant Level (MCL): The maximum permissible level of a contaminant in water delivered to any user of a public water system. MCLs are enforceable standards.

Methemoglobin: A brownish-red crystalline organic compound formed by oxidation of hemoglobin and found in the blood after poisoning by subtances such as nitrate.

Monitoring Wells: Special wells drilled at specific locations on or off a hazardous waste site where groundwater can be sampled at selected depths and studied to determine such things as direction in which groundwater flows and the types and amounts of contaminants present.

Nitrate: A salt of nitric acid (a colorless, corrosive acid containing nitrogen).

Nitrite: A salt or ester of nitrous acid.

RCRA: The Resource Conservation and Recovery Act approved as an amendment to the first federal solid waste legislation, the Solid Waste Disposal Act. Under RCRA, Congress established initial directives and guidelines to EPA to regulate management of hazardous wastes as they are produced.

Record of Decision (ROD): A public document that selects the cleanup strategy at the Superfund site. The ROD is based on information and technical analysis of data generated during the remedial investigation/feasiblity study and consideration of public comments and community concerns.

Remedial Action (RA): The construction or implementation of the selected cleanup alternative which occurs after EPA has signed the Record of Decision.

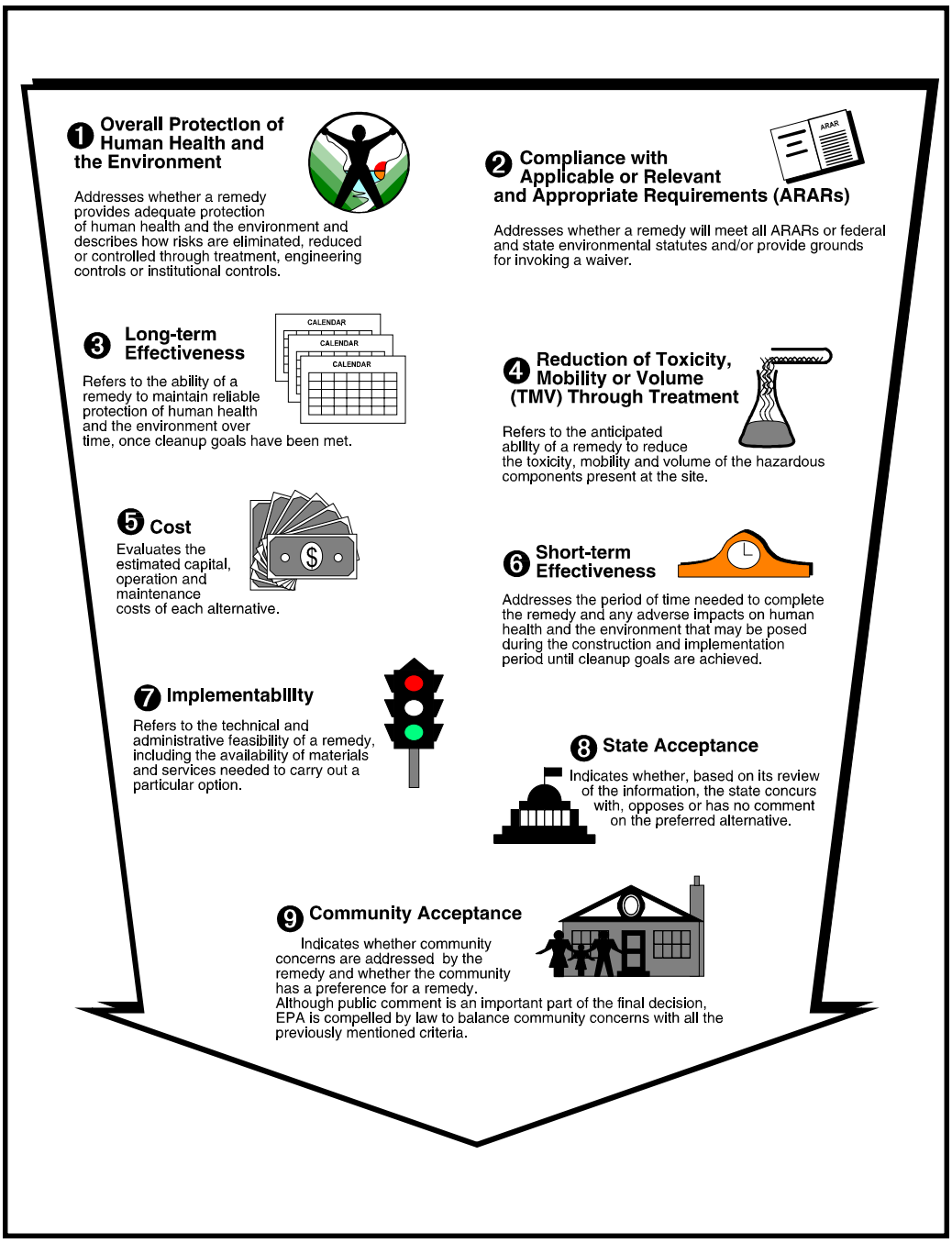
Remedial Investigation/Feasibility Study (RI/FS): A two-part study of a hazardous waste site that must be completed before the site remedy is chosen and implemented. The first part, or Remedial Investigation (RI), examines the nature and extent of site contamination. The second part, Feasibility Study (FS), identifies and evaluates alternatives for addressing the site contamination.

Reverse Osmosis (RO): RO is a physical treatment process in which the wastewater passes over a semi-permeable membrane. The wastewater passes through the membrane leaving behind a waste brine, which would require further handling and treatment. RO has been successfully used to remove nitrate-N and fluoride from water.

Risk Assessment: An evaluation performed as part of the remedial investigation to estimate the risk posed to public health and/or the environment.

Solar Evaporation: Solar evaporation is a process in which wastewater is exposed to the sun in shallow, lined evaporation ponds until almost all the water evaporates and only a cake or thick sludge remains, containing the solids which were dissolved in the water.

Superfund: The common name of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986.

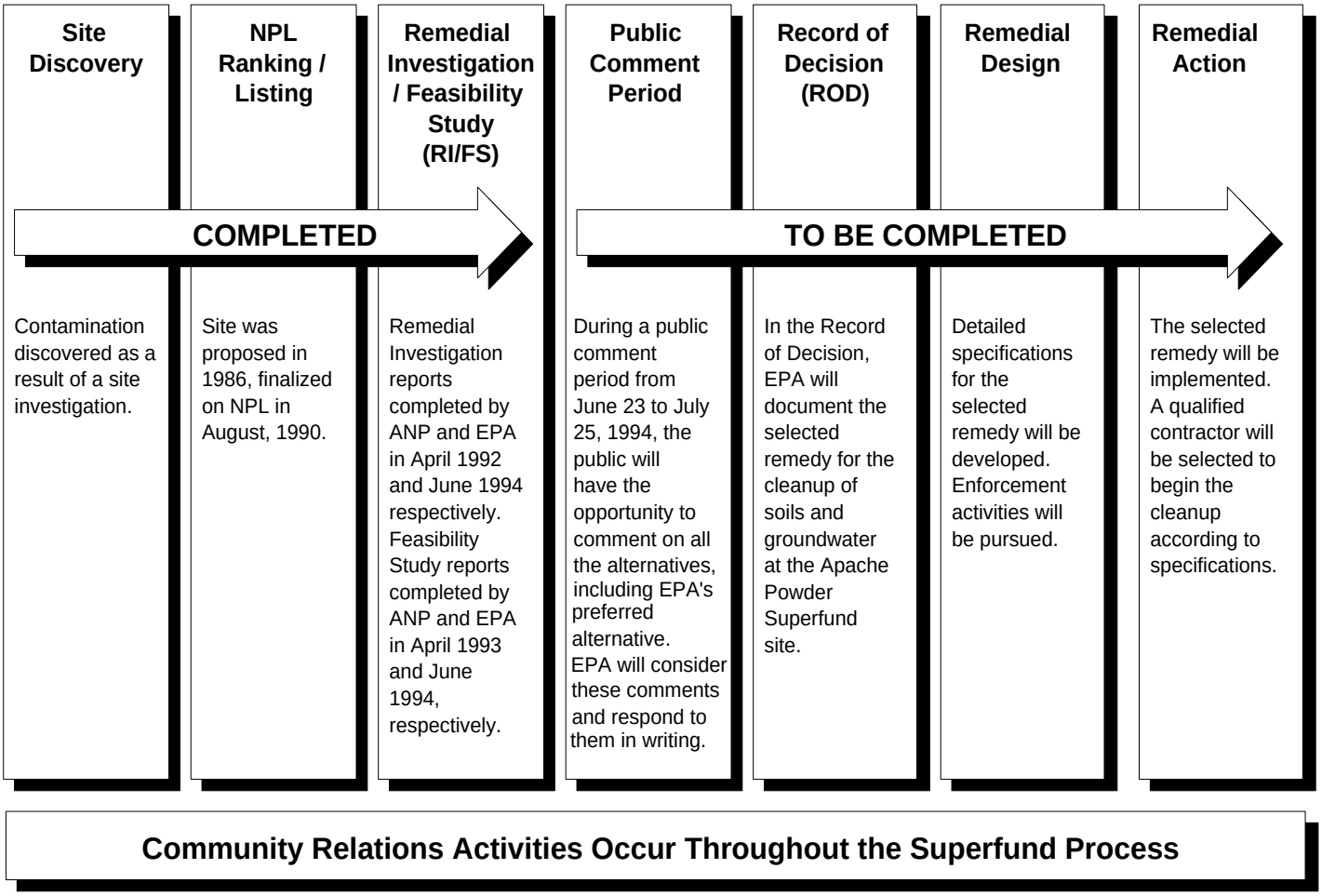


Vanadium Pentoxide: A yellow to red crystalline powder used as a cata-

THE SUPERFUND PUBLIC INVOLVEMENT PROCESS

This Proposed Plan is produced in accordance with Section 117(a) of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), which requires the opportunity for public participation in the Superfund process. It summarizes the Remedial Investigation/Feasibility Study (RI/FS), which assessed the extent of contamination and evaluated possible cleanup remedies. The complete RI/FS is available for public review at the information repository listed on page 12.

The Superfund Process



Community Relations Activities Occur Throughout the Superfund Process

FOR MORE INFORMATION

The Superfund program places a high value on community input in addressing hazardous waste cleanups. Your comments are invited and encouraged. If you have any questions or concerns about the cleanup activities at the Apache Powder site, please contact:

Vicki Rosen
Community Relations Coordinator
U.S. EPA
75 Hawthorne St. (H-1-1)
San Francisco, CA 94105
(415) 744-2187

Andria Benner
Remedial Project Manager
U.S. EPA
75 Hawthorne St (H-7-2)
San Francisco, CA 94105
(415) 744-2361

EPA Media Contact:
Paula Bruin
75 Hawthorne St. (E-2)
San Francisco, CA 94105
(415) 744-1587

or leave a message on EPA's **TOLL-FREE** line: **(800) 231-3075** and we will return the call.

OPPORTUNITY FOR PUBLIC INVOLVEMENT

You will have the opportunity to voice your concerns and make comments in person to EPA at this public meeting. A court reporter will be present to ensure your comments are accurately recorded. You may also submit your comments in writing at that time.

Date: **Wednesday, July 6, 1994**
Time: **7:00 pm**
Place: **St. David Schools, K-Hall**
70 Patton St., St. David, Arizona

EPA will accept written comments on the Proposed Plan and the other alternatives for the Apache Powder Superfund site from **June 23, 1994 through July 25, 1994.** Please send your comments postmarked by **July 25, 1994** to:

Andria Benner, Remedial Project Manager
U.S. EPA, 75 Hawthorne St. (H-7-2), San Francisco, CA 94105.

Following the end of the public comment period, a Responsiveness Summary will be prepared which describes public comments received and EPA's responses to them. This document becomes part of the Record of Decision (ROD).

U.S. Environmental Protection Agency, Region IX
75 Hawthorne Street (H-1-1)
San Francisco, CA 94105
Attn: Vicki Rosen

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