DRAFT PROPOSED REMEDIAL ACTION PLAN/PROPOSED PLAN ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE OPERABLE UNIT 1 - 881 HILLSIDE AREA

United States Department of Energy
(U S DOE)

November 1994
Golden Colorado

DOE Announces Preferred Alternative For OU-1 Groundwater

The U S Department of Energy (DOE) has announced its preferred alternative to address contaminated groundwater at the Rocky Flats Environmental Technology Site (RFETS) Operable Unit 1 (OU 1) 881 Hillside Area The RFETS is located in Jefferson County Golden Colorado DOE is currently the lead agency for the site cleanup

The preferred alternative for groundwater beneath OU 1 is Alternative 1 Institutional Controls without the French Drain This alternative addresses the identified source of ongoing contamination in the operable unit and ensures protection of human health and the environment through natural degradation and attenuation of contaminants The alternative utilizes the existing *Interim Measure/Interim Remedial Action*[1] (IM/IRA) as a contingency to provide further protection

All interested parties are encouraged to read and comment on this Proposed Remedial Action Plan/Proposed Plan (PRAP/PP) and to submit their comments to the persons identified below This PRAP/PP has been prepared by DOE in cooperation with the Environmental Protection Agency (EPA) and the Colorado Department of Public Health and the Environment (CDPHE) pursuant to both the ***Resource Conservation and Recovery Act (RCRA)*** through the Colorado Hazardous Waste Act (CHWA) and the ***Comprehensive Environmental Response Compensation, and Liability Act (CERCLA)***

The alternative proposed herein is DOE s recommended alternative for OU 1 DOE EPA and CDPHE will make the final remedy selection after considering comments from agencies and the public A summary of responses to all comments will be prepared and included in the ***Responsiveness Summary*** section of the ***Corrective Action Decision/Record of Decision*** (CAD/ROD) The CAD/ROD will be prepared and published by DOE following the public comment period

Mark Your Calendar Opportunities for Public Involvement

Public Comment Period

Public Meeting Location

Public Meeting Time

Send Comments to
DOE E ternal Aff rs Off
P O Bo 928
G ld CO 80402-0928

Information Repositories.
Rocky Flats Public Reading Room
Front Range C mmunity College
Level B
3645 West 112th Aven
Westminster CO 80030

C l rad Dep rtment f Public Health and th Environment
Hazardou M terials nd Waste M nag me t Di sio
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Denv r CO 80222

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8485 Kipling
Arv da CO 80005

EPA Superfund Records Center
999 18 Street, Suite 500
De CO 80202

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ADMIN RECORD

PUBLIC INVOLVEMENT PROCESS

Community acceptance is one of the criteria that DOE and the agencies must evaluate during the process of selecting a final remedy Evaluation of community acceptance can be accomplished through a formal public involvement program DOE s program consists of 1) continuing dialogue with citizens on issues of concern such as the ***RCRA Facility Investigation/Remedial Investigation*** (RFI/RI) and 2) seeking citizen participation in the selection of a final remedy at the site The PRAP/PP is being issued for public review and comment Public interaction is critical to the RCRA/CERCLA process and in making sound environmental decisions

Although this plan identifies Institutional Controls without the French Drain as the preferred alternative for OU 1 the public is encouraged to review and comment on all the alternatives not just the preferred alternative Details on individual alternatives can be found in the OU 1 ***Corrective Measures Study/Feasibility Study*** (CMS/FS) Copies of this document are on file in the ***Administrative Record*** and are located at the information repositories presented on page 1 of this plan

The public comment period for this plan will be from _ _____ to _____ A public hearing will be held on _____ Comments on the PRAP/PP may be submitted orally or in writing at the public hearing or mailed directly to the addresses shown on page 1 Mailed comments must be postmarked no later than _____

Upon timely request the comment period may be extended Such a request should be submitted in writing to DOE postmarked no later than _____ FAILURE TO RAISE AN ISSUE OR PROVIDE INFORMATION DURING THE PUBLIC COMMENT PERIOD MAY PREVENT YOU FROM RAISING THAT ISSUE OR SUBMITTING SUCH INFORMATION IN AN APPEAL OF THE AGENCIES FINAL DECISION

SITE BACKGROUND

The RFETS is a DOE-owned facility and is located approximately 16 miles northwest of downtown Denver Colorado RFETS occupies approximately 6 550 acres of federally-owned land in northern Jefferson County Colorado The majority of the RFETS plant buildings are located within a 400 acre area referred to as the RFETS industrial area The 6 150 acres surrounding the plant

Inside This Plan

buildings provide a buffer zone around the RFETS industrial area RFETS is operated and managed by EG&G Rocky Flats Inc for DOE

In July 1994 the plant was renamed to the RFETS (formerly the Rocky Flats Plant [RFP]) to better reflect its new mission of environmental restoration and the advancement of new and innovative technologies for waste management characterization and remediation Until 1992 RFETS fabricated nuclear weapon components from plutonium uranium beryllium and stainless steel Parts made at the plant were shipped elsewhere for assembly Support activities included chemical recovery and purification of recyclable transuranic radionuclides and research and development in metallurgy machining nondestructive testing coatings remote engineering chemistry and physics

The production process at RFETS resulted in the generation of radioactive and non radioactive wastes On site s orage and disposal of these wastes has contributed to hazardous and radioactive contamination in soils surface water and groundwater Due to the complex nature of the RFETS site it has been divided into sixteen Operable Units (OUs) OU 1 the 881 Hillside Area is the subject of this plan

Previously Building 881 was used for enriched uranium operations and stainless steel manufacturing The laboratories in Building 881 were also used to perform analyses of materials generated during production of various components The building is located south of the plant on a south facing hillside which slopes down to Woman Creek

OU 1 includes 11 areas previously identified as ***Individual Hazardous Substance Sites*** (IHSSs) where past operational practices may have resulted in potential contamination Brief descriptions of the OU 1 IHSSs are presented below

IHSS 102 Oil Sludge Pit Site Area located approximately 180 feet south of Building 881 where

30 to 50 drums of non radioactive oily sludge were emptied in the late 1950s The sludge was generated during the cleaning of two No 6 fuel oil tanks designated as IHSSs 105 1 and 105 2 (listed jointly as IHSS 105 below) The area was backfilled when disposal operations ceased

IHSS 103 Chemical Burial Site A circular pit located approximately 150 feet southeast of Building 881 was identified on 1963 aerial photographs The area was reportedly used to bury unknown chemicals

IHSS 104 Liquid Dumping Site. Reportedly a former (pre 1969) liquid waste disposal pond in the area east of Building 881 The exact location is uncertain due to the poor quality of 1965 aerial photographs

IHSSs 105 Out-of-Service Fuel Oil Tank Sites Located immediately south of Building 881 these storage tanks were for No 6 fuel oil Suspected leaks occurred in 1972 The tanks were closed in place through filling with asbestos-containing material and cement

IHSS 106 Outfall Site An overflow line from the sanitary sewer sump in Building 887 was used for discharge of untreated sanitary wastes in the 1950s and 1960s Due to concerns about discharges from the outfall entering Woman Creek several small retention ponds and an interceptor ditch were built in 1955 and 1979 respectively

IHSS 1u r i lside Oil Leak Site Site of a 1972 fuel oil pill from the Building 881 foundation drain outfall A concrete skimming pond was built below the foundation drain outfall to contain the oil flowing from the foundation drain and an interceptor ditch was constructed to prevent oil-contaminated water from reaching Woman Creek

IHSSs 119 1 119 2 Multiple Solvent Spill Sites Former drum and scrap metal storage areas east of Building 881 along the southern perimeter road The drums contained unknown quantities and types of solvents and wastes The scrap metal may have been coated with residual oils and/or hydraulic coolants

IHSS 130 Radioactive Site 800 Area #1 Area east of Building 881 used between 1969 and 1972 to dispose of soil and asphalt contaminated with low levels of plutonium and uranium IHSS 130 contains plutonium-contaminated soil and asphalt which came from contamination caused by a leaking drum in transit and soil removed from around the Building 774 process waste tanks in 1972

IHSS 145 Sanitary Waste Line Leak A six inch cast iron sanitary sewer line that originated at the Building 887 lift station and that leaked on the hillside south of Building 881 The line had conveyed sanitary wastes and low level radioactive laundry effluent to the sanitary treatment plant from about 1969 to 1973

Note that in 1991 a ***French Drain*** was constructed across a significant portion of OU 1 above the South Interceptor Ditch (SID) to collect potentially contaminated alluvial groundwater draining across the hillside This feature was added as part of the OU 1 IM/IRA previously mentioned Groundwater is collected in the drain and pumped to a UV/H_2O_2 treatment process located in Building 891 (hereinafter referred to as the Building 891 water treatment system)

SUMMARY OF SITE RISKS

As detailed in the Phase III RFI/RI report risks associated with OU 1 are associated primarily from exposure to groundwater contaminants Although groundwater is not available for current residential use the scenario of a residence situated directly above the most contaminated zone in the operable unit has been analyzed in the RFI/RI report The results of this scenario are that an unacceptable risk per the ***National Oil and Hazardous Substances Pollution Contingency Plan (NCP)*** guideline of 10^{-4} to 10^{-6} would occur at the site

The contaminants identified in the Phase III RFI/RI that are of concern in groundwater are the following

carbon tetrachloride
1 1-dichloroethene
tetrachloroethene
1 1 1 trichloroethane
selenium

No significant environmental risks were identified in the Phase III RFI/RI and therefore environmental risks did not warrant further examination In addition no off site risks were identified in the ***Baseline Risk Assessment*** (BRA) that exceeded any regulatory or health based standards.

Soil contamination in OU 1 also does not result in a risk level above the NCP range of 10^{-4} to 10^{-6} This is true according to the results of a number of conservative risk

scenarios Where isolated hotspots of soil contamination were found these locations were excavated (in October 1994) until radioactive contaminant concentrations were at background levels Therefore alternatives were not developed for this medium in the OU 1 CMS/FS

SUMMARY OF REMEDIAL ALTERNATIVES

The following remedial alternatives were identified and subjected to a detailed analysis to identify a preferred remedy for OU 1

No Action This alternative was identified as a baseline against which other alternatives could be compared Under this alternative the French Drain IM/IRA would be decommissioned and the Site would be released for unrestricted use

Institutional Controls without the French Drain This alternative is similar to the No Action alternative with the exception that it assumes that the site is not released for unrestricted use Under this alternative administrative controls such as fencing and security posts would be used to control site access and thereby limit exposures

Institutional Controls with the French Drain This alternative represents the existing conditions at OU 1 Under this alternative the existing French Drain would continue to collect groundwater flowing from the 881 Hillside Area and treat it using the existing Building 891 water treatment system

Modified French Drain with Additional Extraction Wells This alternative is similar to the preceding alternative with the exception that four to six additional wells would be installed in the operable unit to increase the efficiency of the existing IM/IRA

Groundwater Pumping and Soil Vapor Extraction This alternative consists of pumping the groundwater found beneath the IHSS 119 1 area (the most contaminated region in OU 1) to remove groundwater from the *saturated zone* to the maximum extent practical and then applying *soil vapor extraction* (SVE) to remove contaminants found in the subsurface soil zone Extracted groundwater would be treated using the existing IM/IRA system and extracted vapors would be treated via *carbon adsorption* or *catalytic oxidation*

Groundwater Pumping and Soil Vapor Extraction with Thermal Enhancement This alternative is identical to the preceding alternative except that it includes heating subsurface soils prior to implementing SVE to increase the extent of the vapor extraction system Subsurface soils would be heated through either *radio frequency* (RF) energy or *ohmic (electrical resistance) heating* Contaminant extraction efficiencies would be increased through heating by assisting the *volatilization* of contaminants and by opening additional *pore spaces* in the soil matrix

Steam Injection with Mechanical Mixing This alternative utilizes a drill rig with a large wide bladed auger to forcefully mix subsurface soils while injecting steam to help volatilize and extract contaminants Groundwater present at the drilling point would be extracted through the hollow auger and would be treated using the existing Building 891 water treatment system

Soil Excavation and Groundwater Removal with Sump Pumps This alternative targets removal of the most contaminated soils beneath IHSS 119 1 Although the primary concern at OU 1 is groundwater contamination this alternative would remove any potential residual sources of contamination found in the soils themselves while extracting groundwater for treatment in the existing Building 891 water treatment system Excavated soils would be thermally treated on site and shipped off site for ultimate disposal

SUMMARY OF DETAILED ANALYSIS OF ALTERNATIVES

Detailed analysis of alternatives conducted as part of the CMS/FS evaluated each of the remedial alternatives with respect to the following criteria.

Overall Protection of Human Health and the Environment. This is a threshold criterion and is used to evaluate the conclusions of other criteria. The criterion is used to evaluate how human health and the environmental risks are eliminated reduced or controlled through treatment engineering controls or institutional controls

Alternatives 2 and 3 have been determined to be the most protective of human health and the environment Alternative 7 was deemed the next most protective due to its complete removal of the

contaminated media from OU 1 Alternatives 4 5 and 6 offer the next highest level of overall protection since each removes contaminants from OU 1 groundwater and potential residual subsurface sources Alternatives 0 and 1 offer the least protection of the alternatives considered since neither include any treatment or source removal

Compliance with Applicable or Relevant and Appropriate Requirements (ARARs) This criterion evaluates the degree to which the various alternatives meet chemical specific action specific and location specific requirements ARARs are requirements that would apply to the site contaminant or action if the remedial action was not being conducted under CERCLA ARARs are also requirements that apply to similar activities locations or chemicals and that are deemed appropriate for the particular proposed remedial action

All the alternatives evaluated in the detailed analysis meet the identified ARARs for that alternative All alternatives meet State *Maximum Contaminant Levels* (MCLs) at Woman Creek Alternatives 0 1 2 and 3 were ranked slightly higher than Alternatives 4 5 and 6 Alternatives 4 5 and 6 require significant site disturbance associated with remedial activities Compliance with State laws on non game species and federal regulations on wetlands protection would be needed for the surface disturbance activities Alternative 7 ranked lowest due to the severely intrusive nature of excavation activities

Long Term Effectiveness and Permanence This criterion evaluates the long term protectiveness and permanence of the alternatives Preference is given to treatment alternatives since they involve removal of the contaminants or conversion of contaminants to an innocuous form

Alternatives 4 5 6 and 7 provide the highest level of long term effectiveness and permanence since they remove both groundwater contamination and potential residual subsurface sources from OU 1 Alternatives 4 5 6 and 7 provide a permanent solution Alternatives 2 and 3 provide the next highest level of effectiveness and permanence since they involve collection and treatment of contaminated groundwater and thus reduce contamination at OU 1 permanently Alternatives 0 and 1 rank lowest under this criteria since they do not treat or remove any contamination

Reduction of Toxicity Mobility or Volume Through Treatment. This criterion evaluates the ability of the alternatives to reduce the risks at the site through destruction of contaminants reduction of the total mass of contamination reduction of contaminant mobility or reduction of contaminated media volume The NCP and RCRA guidance give preference to alternatives that involve treatment

Alternatives 4 5 6 and 7 provide the highest level of toxicity mobility and volume reduction since they target the contaminant source area identified at IHSS 119 1 Alternatives 2 and 3 would collect and treat contaminated groundwater thereby reducing the volume of contaminated media and preventing contaminant migration away from OU 1 Alternatives 0 and 1 provide no reduction in toxicity mobility or volume of contaminants

Short Term Effectiveness This criterion evaluates community environmental and site worker protection during the construction and implementation of the remedy

Alternatives 0 1 and 2 rank highest under this criterion since they involve no disturbance of the existing site and little or no worker involvement Alternative 3 would have minimal risk to workers involved in the drilling of additional extraction wells Alternatives 4 5 and 6 rank next under short term effectiveness since they involve risk to workers involved in source remediation Alternative 4 would have minor environmental impacts from drilling while Alternatives 5 and 6 would involve significant short term environmental impacts from heating and augering respectively Alternative 7 ranks lowest with severe environmental disturbance risk to workers and potential community risk from contaminated dust produced during excavation

Implementability This criterion evaluates the technical and administrative feasibility of implementing the alternatives including the availability of materials and services needed during implementation This criterion is especially important for evaluating reliability of less proven technologies or those that rely on limited supplies of equipment, vendors or specialized workers

Alternative 2 is the most implementable since it involves only the continuation of current interim measures Alternatives 0 and 1 are the next most implementable since they require only groundwater monitoring Alternative 1 would however require institutional controls such as designating the site a wildlife refuge which could pose administrative

problems Alternative 3 requires several additional groundwater collection wells and continued operation of the IM/IRA Alternatives 4 5 and 6 rank lower since they utilize intrusive treatments that would make technical implementability more difficult Also off gas air quality requirements and other administrative requirements would reduce administrative implementability Alternative 7 is the least implementable both technically and administratively since it requires severe site intrusion Administrative and technical difficulties would be significant for this alternative

Cost This criterion evaluates the capital cost for each alternative as well as long term operation and maintenance (O&M) expenditures required to sustain it Future expenditures are adjusted to present worth amounts by discounting all costs to a common base year using present worth cost analysis

Alternatives 0 and 1 are the least costly since they involve only the continuation of groundwater monitoring Alternative 6 is the next least costly Alternatives 5 is actually less costly than Alternative 4 due to the remediation time frame reduction associated with thermal enhancement Alternative 7 involves excavation of a large area and therefore has large capital costs associated with it Alternatives 2 and 3 are the most expensive due to the continued operation of the Building 891 water treatment facility for 30 years

State Acceptance This criterion addresses the State or support agency s comments and concerns regarding the appropriateness of the proposed alternative This evaluation is presently ongoing through agency review and comment resolution activities Results of this evaluation will be included in the CAD/ROD

Community Acceptance This criterion is used to evaluate the proposed remedial action alternatives in terms of issues and concerns raised by the public Public involvement is encouraged through public hearings and the submittal of public comments The selection of a final remedy will include an evaluation of public concerns and objections Community acceptance will be discussed in the CAD/ROD

PREFERRED REMEDIAL ALTERNATIVE

The OU 1 CMS/FS detailed analysis of alternatives demonstrates that Institutional Controls without the French Drain is the preferred alternative for groundwater remediation Groundwater modeling conducted to support the CMS/FS indicates that under this alternative the State MCLs would not be exceeded at Woman Creek This alternative results in one of the lowest overall costs while still achieving a residual risk level of less than two in a million ($1\ 99 \times 10^{-6}$) The residual risk level is at the lower boundary of the acceptable risk range of one in a million to one in ten thousand chance of developing cancer

The model results used in the analysis are considered conservative based on the initial assumptions Several significant natural contaminant loss mechanisms are not currently included in the model which tends to overestimate actual future predicted concentrations In particular volatilization a significant mechanism in reduction of the ***volatile organic compounds*** (VOCs) would reduce the concentrations of these contaminants prior to reaching Woman Creek The ***retardation*** and ***biodegradation*** factors used in the model are also extremely conservative

This alternative meets both of the threshold criteria identified in the NCP and RCRA guidance Overall Protection of Human Health and the Environment and Compliance with ARARs as well as providing long term effectiveness and permanence through natural attenuation and degradation of contaminants The toxicity mobility and volume of OU 1 groundwater contaminants would be reduced through ***dispersion*** biodegradation and volatilization In terms of short term effectiveness and implementability this alternative is one of the most implementable alternatives proposed which results in the lowest short term risks to workers the public and the environment

In addition if at any time during the designated monitoring period contaminant concentrations appear higher than predicted groundwater collected in the French Drain sumps would be pumped to the existing Building 891 water treatment system to provide additional protection This alternative results in a very low total present worth cost because institutional controls are currently in place at the RFETS Monitoring would be continued under this alternative throughout the institutional control period

It is assumed that six monitoring points will be used for demonstrating compliance with the performance monitoring system of this alternative Up to four new wells will be installed one deep and shallow well cluster downgradient of IHSS 119 1 and possibly two additional wells upgradient of Woman Creek Geological and geophysical support such as photographic lineament

analysis and/or three-dimensional seismic surveys may be used to assist in the placement of the well cluster This would enable paleochannels and faulted zones to be clearly identified prior to well placement

Samples will also be collected from the french drain sump and from the existing recovery well to demonstrate compliance Samples will be collected semiannually and analyzed for organic and inorganic contaminants Analysis of individual species of inorganic contaminants would also be performed to identify individual metal species which have the potential to bioaccumulate This additional analysis requirement will only be performed occasionally in the sampling program Practical Quantitation Limits (PQLs) will be used to determine compliance with CDPHE standards where appropriate

GLOSSARY

Administrative Record Documents including correspondence public comments Corrective Action Decision/ Record of Decision (CAD/ROD) and technical reports upon which the agencies based their remedial action selection

Baseline Risk Assessment (BRA) An assessment of the risks to human health and the environment at a site The methodology employed in risk assessment uses contaminant concentrations and potential exposure routes to quantify risks associated with present and future site conditions

Biodegradation The breakdown of contaminants to other chemical or physical forms by bacteria fungi and other microorganisms

Carbon Adsorption A treatment which traps organic and some inorganic contaminants from air or water on an activated carbon surface as the contaminated stream is passed through a carbon containing vessel The treatment generates clean air or water and contaminated carbon The contaminated carbon can be destroyed or regenerated

Catalytic Oxidation a treatment which destroys organic contaminants in an air stream by oxidizing the contaminants in a special reaction vessel The vessel contains a catalyst which speeds the oxidation and lowers the temperature needed for complete oxidation

Corrective Action Decision/ Record of Decision (CAD/ROD) A public document that explains which cleanup alternative(s) are selected at a RCRA/ Superfund site The CAD/ROD is based on information from the RFI/RI the CMS/FS public and agency comments and community concerns

Comprehensive Environmental Response Compensation and Liability Act (CERCLA) A federal law (also known as Superfund) passed in 1980 and modified in 1986 that provides a comprehensive framework to clean up uncontrolled or abandoned hazardous substance sites

Corrective Measures Study/ Feasibility Study (CMS/FS) The second part of a two-part study guided by both RCRA and CERCLA RCRA requires a RCRA Facility Investigation/ Corrective Measures Study (RFI/CMS) while CERCLA requires a Remedial Investigation/ Feasibility Study (RI/FS) The CMS/FS involves identifying and evaluating the most appropriate technical approaches for addressing contamination problems at a RCRA/ Superfund Site

Dispersion The distribution of contamination within a larger volume resulting in lower concentration and reduced toxicity

French Drain An underground structure consisting of loose stones covered by soil The purpose is groundwater collection or diversion of groundwater flow in a particular direction

Individual Hazardous Substance Site (IHSS) An area which has been identified as being potentially contaminated as a result of previous operations or disposal practices

Interim Measure/ Interim Remedial Action (IM/IRA) An early action taken in the short term to control a release or threatened release of hazardous substances

Maximum Contaminant Level (MCL) The maximum concentration of a contaminant allowed in a public drinking water system under the Federal Safe Drinking Water Act (SDWA) and under associated State drinking water regulations MCLs are established at levels to protect public health

National Oil and Hazardous Substances Pollution Contingency Plan (NCP) The federal regulations implementing CERCLA actions which include the procedures and standards for responding to releases of hazardous substances

Ohmic Heating The use of six phase electrical power to heat subsurface soils and increase contaminant volatilization The process uses grids of six antennae placed in a hexagonal well array

Pore Spaces The small spaces between soil particles which can be occupied by water or air

Radio Frequency (RF) Heating The use of radio frequency energy to heat subsurface soils and increase contaminant volatilization Antennae are placed in vertical or horizontal wells and produce radio waves which heat the surrounding soils

RCRA Facility Investigation/ Remedial Investigation (RFI/RI) The first part of a two-part study guided by both RCRA and CERCLA RCRA requires a RCRA Facility Investigation/ Corrective Measures Study (RFI/CMS) while CERCLA requires a Remedial Investigation/ Feasibility Study (RI/FS) The RFI/RI involves collecting and analyzing information to determine the nature and extent of contamination that may be present at the site

Resource Conservation and Recovery Act (RCRA) A federal law that requires safe and secure procedures to be used in the treatment transportation storage and disposal of hazardous wastes The CDPHE through the Hazardous Materials and Waste Management Division implements RCRA in Colorado

Responsiveness Summary The part of the CAD/ROD that summarizes public and agency comments and provides responses to those comments

Retardation A measure of the difficulty with which groundwater moves through subsurface media Media with higher retardation will exhibit lower groundwater flow velocities under similar site conditions

Saturated Zone The portion of the subsurface which is completely saturated by groundwater that is the volume of soil beneath the water table

Soil Vapor Extraction (SVE) An in-situ treatment for organic contamination in subsurface soils which transfers contaminants from the soil and water in pore spaces to air Contaminants are then removed from the subsurface by extraction wells fitted with vacuum pumps

UV/H2O2 A treatment which combines exposure of contaminated water to ultraviolet light with the addition of hydrogen peroxide Both provide free radicals which catalyze the breakdown of contaminants to innocuous chemicals

Volatile Organic Compounds (VOCs) Organic (carbon containing) compounds that volatilize at room temperature

Volatilization Phase change from liquid to vapor Commonly called evaporation