



REMPLEX
CENTER FOR THE REMEDIATION
OF COMPLEX SITES
@PNNL

WORKSHOP GLOSSARY FOR A HANFORD PERSPECTIVE ON ENVIRONMENTAL REMEDiation

A C D E F G I L M N O P R S T V W

#

200 East

This is a region of the 200 Area (Central Plateau) on the Hanford Site that is home to 66 single shell tanks and 25 double shell tanks. Tanks with letters beginning with A, B, or C, are in 200 East.

200 West

This is a region of the 200 Area (Central Plateau) on the Hanford Site that is home to 83 single shell tanks and 3 double shell tanks. Tanks beginning with letters S, T, or U are in 200 West.

A

AFLU

Anticipated future land use is recommended to start early in the Comprehensive Environmental Response, Compensation, and Liability Act process, as plans can influence remedy selection. (Text adapted from: <https://semspub.epa.gov/work/11/175563.pdf>)

C

CERCLA

The Comprehensive Environmental Response, Compensation, and Liability Act, known also as Superfund, was enacted by Congress on December 11, 1980. This law created a tax on the chemical and petroleum industries and provided broad federal authority to respond directly to releases, or threatened releases, of hazardous substances that may endanger public health or the environment. The tax went to a trust fund for cleaning up abandoned or uncontrolled hazardous waste sites. (Text quoted from: <https://www.epa.gov/superfund/superfund-cercla-overview>)

Ci

Curie is a unit of radioactivity defined in 1910 equal to 3.7×10^{10} disintegrations per second. (Text quoted from: <https://www.dictionary.com/browse/curie?s=t>)

CLUP

A comprehensive land-use plan is a document designed to lay out future actions of a community, presenting a vision for the future that includes long-term goals and objectives. (Text adapted from: <https://community-planning.extension.org/the-purpose-of-the-comprehensive-land-use-plan/#:~:text=The%20comprehensive%20plan%2C%20also%20known%20as%20a%20general%20plan%2C%20master,that%20affect%20the%20local%20government.>)

CRESP

Consortium for Risk Evaluation with Stakeholder Participation is an organization that aims to cleanup nuclear weapons production waste sites through safe and affordable methods. Currently, CRESP is involved with analyzing the best practices at former nuclear defense production sites, such as Hanford, and utilizing current technology for different kinds of nuclear waste management facilities while keeping in mind social and policy considerations associated with implementation of nuclear waste facilities. (Text adapted from: <http://www.cresp.org/projects/nuclear-waste-management-policy-strategy/>)

CSM

A conceptual site model is a description and/or illustration of a site based on existing knowledge of the physical, chemical, and biological processes that affect contamination in the air, water, or ground. It describes the interaction between sources and receptors with the intent of facilitating communication. (Text adapted from: <https://archive.epa.gov/epawaste/hazard/web/pdf/csm.pdf> and https://www.publications.usace.army.mil/Portals/76/Publications/EngineerManuals/EM_200-1-12.pdf)

D

DOD

The United States Department of Defense, established in 1994, is an executive branch department of the federal government that is responsible for all functions related to national security and the United States Armed Forces. (Text adapted from: <https://dod.defense.gov/>)

DOE

The U.S. Department of Energy ensures America's security and prosperity by addressing its energy, environmental, and nuclear challenges through transformative science and technology solutions—including environmental clean-up from the Cold War nuclear mission. <https://www.energy.gov/>

DST

Double-shell tanks were implemented in 1968 as an improvement of the single-shell tanks which began leaking nuclear waste into the surrounding soil in the 1950's. One key attribute of the double-shell tanks is that they have a carbon-steel inner tank along with a steel liner around it. Between the shells is a 30-inch area, the annulus, which is protected by a leak-detection system. Although there have been signs of aging among the double-shell tanks, these tanks meet both federal and state regulations, unlike the old single-shell tanks. (Text adapted from: <https://wrpstoc.com/tank-operations/the-tanks/>)

DVZ

Deep vadose zone refers to areas where the vadose zone is very thick or deep, extending hundreds of feet below the ground surface which is common in the 200 Areas at the Hanford Site (per discussion with Rob Mackley, PNNL).

E

E4D

Real-Time Four-Dimensional Subsurface Imaging Software is a 3D geophysical modeling and inversion code that uses measurements to generate figures representing subsurface contaminant distributions, injection delivery extent, and dynamic biogeochemical processes. (Text quoted from: <https://www.pnnl.gov/projects/e4d>)

EIS

An environmental impact statement is a document used to illustrate the environmental impacts that may result from a proposed project. (Text adapted from: https://www.americanbar.org/groups/public_education/publications/teaching-legal-docs/teaching-legal-docs--what-is-an-environmental-impact-statement-/)

EM

Created in 1989, the U.S. Department of Energy's Office of Environmental Management mission is to address the nation's Cold War environmental legacy resulting from five decades of nuclear weapons production and government-sponsored nuclear energy research. This legacy includes some of the world's most dangerous radioactive sites with large amounts of radioactive wastes, spent nuclear fuel, excess plutonium and uranium, thousands of contaminated facilities, and contaminated soil and groundwater. (Text quoted from: <https://www.energy.gov/em/about-us>)



EPA

The U.S. Environmental Protection Agency is an independent executive agency of the United States federal government, established on December 2, 1970 as a result of public concern for deteriorating city air, contaminated water supplies, and natural areas littered with debris. Today, the EPA's primary mission revolves around protecting human health and the environment. (Text adapted from: <https://www.epa.gov/aboutepa>)

EPRI

Electric Power Research Institute is a non-profit organization that conducts research, development, and demonstration projects in order to benefit the public. Their primary focus is generation, delivery, and use of electricity using safe, cost-effective, and environmentally friendly methods. (Text adapted from: <https://www.epri.com/about>)

ERT

Electrical resistivity tomography is a method that uses electrical resistivity measurements to understand subsurface structures and time-varying changes. Data can be quickly collected using a multi-electrode resistivity meter which is used to interpret subsurface geometry, lithology, hydrology, and/or temporal processes. (Text adapted from: <https://surfacesearch.com/electrical-resistivity-tomography-what-is-it/>)

ESTCP

The Environmental Security Technology Certification Program is a project that was led by the Naval Facilities Service Center which displayed the use of geophysical methods to provide quick, noninvasive, and cost-effective information on spatial and temporal distribution of amendments through the use of electrical resistivity measurements. (Text quoted from: <https://www.serdp-estcp.org/Program-Areas/Environmental-Restoration/Contaminated-Groundwater/Monitoring/ER-201579/ER-201579>)

eSTOMP

Extreme-scale Subsurface Transport Over Multiple Phases is an analytical tool used to investigate subsurface multifluid flow, heat transport, and geochemistry. eSTOMP was developed as a version of STOMP with more efficient computing capabilities when dealing with complex systems regional scale models, model calibration, and uncertainty quantification. (Text adapted from: <https://www.pnnl.gov/estomp>)

F

F&T

Flow and Transport

FS

According to the U.S. Environmental Protection Agency, a feasibility study is used for the development, screening, and evaluation of alternative remedial actions. (Text quoted from: <https://www.epa.gov/superfund/superfund-remedial-investigationfeasibility-study-site-characterization>)

G

GAO

U.S. Government Accountability Office, also referred to as the “congressional watchdog,” is a nonpartisan agency that works for congress by analyzing how taxpayer dollars are spent to help to government spend money efficiently. (Text adapted from: <https://www.gao.gov/about/>)

GW

Groundwater is the water found underground in the cracks and spaces in soil, sand, and rock. (Text quoted from: <https://www.groundwater.org/get-informed/basics/groundwater.html>)

I

IDREAM

Interfacial Dynamics in Radioactive Environments and Materials is an Energy Frontier Research Center composed of radiochemists, geochemists, physicist, computational chemists, and chemical engineers that work together to support innovations in processing radioactive waste. Currently, IDREAM aims to provide scientific research necessary to speed up the processing of millions of gallons of highly radioactive waste stored at the U.S. Department of Energy's Hanford and Savannah River Sites. (Text quoted from: <https://www.pnnl.gov/projects/interfacial-dynamics-radioactive-environments-and-materials>)



L

LDRD

Laboratory Directed Research and Development is research done at Pacific Northwest National Laboratory that is funded by a percentage of their operating budget to support projects that align with Pacific Northwest National Laboratory's and the U.S. Department of Energy's missions. At Pacific Northwest National Laboratory, this research is often addresses multiple scientific disciplines. (Text adapted from: <https://www.pnnl.gov/publications/2018-annual-report-laboratory-directed-research-and-development>)

ILL

Interstitial liquid level is the level of liquid within the tank waste matrix. This is used for determining the amount of liquid that could potentially drain from a tank if there was a leak (per discussion with Mark Triplett, PNNL).

LOW

Liquid observation wells were implemented in the early 1980's to provide a reliable leak detection system for tank farms. These wells are made from fiberglass with one end open and inserted vertically into the tank waste. Neutron probes are inserted periodically to measure the interstitial liquid level. (Text adapted from: https://inis.iaea.org/collection/NCLCollectionStore/_Public/26/042/26042026.pdf?r=1)

LTS

Long-term stewardship is the physical and systematic controls that provide protection for both people and the environment at sites where the U.S. Department of Energy has completed, or is planning to complete, cleanup; this includes land-use controls, monitoring, maintenance, and information management. (Text quoted from: https://www.directives.doe.gov/terms_definitions/long-term-stewardship-lts)

LVZ

Lower vadose zone is the lowermost portion of the vadose zone which is heavily monitored for contaminants because it is most likely to contribute to groundwater contamination (per discussion with Rob Mackley, PNNL).

M

MCL

Maximum contaminant level/maximum concentration limit is a standard set by the U.S. Environmental Protection Agency. In drinking water, this is the level at which there are no anticipated adverse effects on people's health, including a margin of safety. (Text adapted from: <https://www.epa.gov/sdwa/how-epa-regulates-drinking-water-contaminants>)

MNA

Monitored natural attenuation is a technology used for common groundwater remediation. This method utilizes natural attenuation—a mix of natural physical, chemical, or biological processes that act without human intervention to treat groundwater contaminants given favorable circumstances—in order to achieve remediation objectives more efficiently than more active techniques. (Text adapted from: [https://www.enviro.wiki/index.php?title=Monitored_Natural_Attenuation_\(MNA\)](https://www.enviro.wiki/index.php?title=Monitored_Natural_Attenuation_(MNA)))

N

NPSI

Nuclear Process Science Initiative is a Laboratory Directed Research and Development program to support nuclear science and technology research at Pacific Northwest National Laboratory. NPSI aims to change the standard for nuclear materials processing by manipulating complex systems to control chemical processing of nuclear units and discover new classes of signatures of nuclear materials processing. (Text quoted from: <https://npsi.pnnl.gov/>)

O

O&M

An operations and management program is a plan of training, cleaning, and maintenance of physical assets. (Text adapted from: <https://www.epa.gov/asbestos/what-operations-and-maintenance-om-program#:~:text=Introduction,building%20occupants%20to%20asbestos%20fibers.>)



OU

Operable unit means a discrete action that comprises an incremental step toward comprehensively addressing site problems. This discrete portion of a remedial response manages migration, or eliminates or mitigates a release, threat of release, or pathway of exposure. Operable units may address geographical portions of a site, specific site problems, or initial phases of an action, or may consist of any set of actions performed over time or any actions that are concurrent but located in different parts of a site. (Text quoted from: <https://www.law.cornell.edu/cfr/text/40/307.14>)

P

P&T

Pump and treat remediation is a form of technology at Pacific Northwest National Laboratory that treats groundwater to remove harmful contaminants. Groundwater extraction wells are used to pump water into an aboveground treatment system where the groundwater is monitored and treated. Monitoring groundwater allows Pacific Northwest National Laboratory to assess performance and optimize remediation. (Text adapted from: <https://www.pnnl.gov/projects/multi-species-reactive-transport-simulation-software-groundwater-systems>)

PFP

Plutonium Finishing Plant, also known as the 234-5 Z Plant, is a 580 square-mile site created in 1943 to produce plutonium for the nation's defense program. This plant is now one of the Hanford's sites most hazardous buildings after production ended in 1989. (Text adapted from: <https://www.hanford.gov/PFP>)

PHOENIX

The PNNL Hanford Online Environmental Information Exchange is a combination of web applications that provide quick access to valuable data along with visualization and analyses tools. Combining isolated datasets allows U.S. Department of Energy to find new patterns hidden in legacy data which enables them to more effectively deal with complex issues at Hanford. (Text adapted from: <https://www.hanford.gov/page.cfm/PHOENIX>)

PNNL

Pacific Northwest National Laboratory is one of 17 national laboratories. Based in Richland, Wash., PNNL has been operated by Battelle for the U.S. Department of Energy since 1965. Strengths in chemistry, earth sciences, and data analytics are the foundations for innovations that improve energy resiliency and enhance national security. <https://www.pnnl.gov/>

POTW

Publicly owned treatment works refers to sewage treatment plants owned and operated by government agencies. (Text adapted from: <https://www.osti.gov/servlets/purl/5111>)

PRZ

A periodically rewetted zone lies between the vadose zone and ground water. This zone is monitored heavily around nuclear tanks because it connects the vadose zone, which has been contaminated by uranium from tanks at the Hanford Site, to groundwater (per discussion with Chris Johnson, PNNL).

PUREX

The Plutonium Uranium Extraction Plant operated from 1956 to 1972 and then from 1983 to 1988. This plant chemically reprocessed fuel rods irradiated in Hanford's reactors. Two tunnels were designed next to this plant to contain contaminated equipment that was removed from PUREX. The mission of this plant was to provide safety for workers and the environment. (Text quoted from: <https://www.hanford.gov/page.cfm/PUREX>)

R

RAO

Remedial action objectives are general descriptions of what the remedial action is expected to accomplish and are normally used to address concerns involving media of interest, types of contaminants, potential receptors, and exposure pathways. (Text adapted from: https://www.hanford.gov/files.cfm/Chapters_8-11.pdf)

RCRA

The Resource Conservation and Recovery Act is the public law that creates the framework for the proper management of hazardous and non-hazardous solid waste. The law describes the waste management program mandated by Congress that gave U.S. Environmental Protection Agency authority to develop the RCRA program. The term RCRA is often used interchangeably to refer to the law, regulations, and U.S. Environmental Protection Agency policy and guidance. (Text quoted from: <https://www.epa.gov/rcra>)



RECUPLEX

Recovery of Uranium and Plutonium by Extraction was a facility that was built in 1953. When construction was complete in 1955, engineers began processing waste with plutonium feed material. This facility consisted of three tanks that were fed waste in the form of slag, crucible fragments, scrap powders, oxidized plutonium turnings, and remnants from metal sample from the 234-5Z Building. (Text adapted from: <https://www.osti.gov/biblio/807939-history-plutonium-production-facilities-hanford-site-historic-district-june>)

REDOX

The Reduction Oxidation Plant was the fourth processing “canyon” constructed and was in operation from 1952 to 1967. Unlike earlier models, the REDOX plant recovered both plutonium for weapons and uranium from used fuel rods to be recycled into new rods. Although the REDOX plant was more efficient than previous plants, the downside is that it produced more dangerous chemicals and required hexone, a potentially explosive chemical. The REDOX plant remains highly contaminated after being shut down for more than 40 years. (Text adapted from: <https://www.hanford.gov/page.cfm/REDOX>)

REMPLEX

Center for the Remediation of Complex Sites is a Pacific Northwest National Laboratory platform that applies advanced technology to solve complex issues regarding contaminated subsurface environments, specifically at the Hanford Site. RemPlex combines thorough research along with risk-informed solutions based on technological contributions to complete safe and cost-effective clean-up missions. (Text adapted from: www.pnnl.gov/projects/remplex)

RI

Remedial investigation is a method used at Pacific Northwest National Laboratory to evaluate site conditions to determine risk to human and the environment from waste. According to the U.S. Environmental Protection Agency, remedial investigations are used to assess performances and estimate the cost of treatment technologies. (Text adapted from: <https://www.epa.gov/superfund/superfund-remedial-investigationfeasibility-study-site-characterization>)

ROD

Record of decision is a document that explains the reason for a project decision and summarizes additional measures that will be necessary for the project. (Text adapted from: [https://www.fws.gov/endangered/esa-library/pdf/FWS%20Record%20of%20Decision%20\(ROD\)%20Format.pdf](https://www.fws.gov/endangered/esa-library/pdf/FWS%20Record%20of%20Decision%20(ROD)%20Format.pdf))

S

SERDP

Strategic Environmental Research and Development Program is the U.S. Department of Defense’s environmental science and technology program, executed by the U.S. Department of Energy and Environmental Protection Agency. SERDP develops innovative technology to create time and cost-effective solutions to U.S. Department of Defense’s environmental challenges. (Text adapted from: <https://www.serdp-estcp.org/About-SERDP-and-ESTCP/About-SERDP>)

SOCRATES

Suite of Comprehensive Rapid Analysis Tools for Environmental Sites, also a reflection of the way ancient Greek philosophers observed and interpreted the world around them, is a tool designed to analyze subsurface conditions and help support site management. Currently, SOCRATES has four modules: Groundwater AnaLytics for the Environment (GALEN), PLume Analysis Tool (PLATO), Images Online (ION) and A Remote-sensing Image USer Interface (ARIUS). (Text quoted from: <https://energyenvironment.pnnl.gov/highlights/highlight.asp?id=3304>)

SRNL

Savannah River National Laboratory is a laboratory owned by the U.S. Department of Energy and established in 1951. This laboratory applies cutting-edge technology to create valuable solutions to technical problems. (Text adapted from: <https://srnl.doe.gov/about/excellence.htm>)

SRS

Savannah River National Laboratory is one of 17 U.S. Department of Energy national laboratories. It was established in 1951 to refine nuclear materials for deployment in nuclear weapons. Currently, their mission is to protect the environment and public while safely supporting the nation’s nuclear deterrent. (Text adapted from: <https://www.srs.gov/general/srs-home.html>)

SST

Single shell tanks were used between 1943 and 1964 to hold nuclear waste. These tanks were placed 10 feet underground with a carbon steel liner surrounded by a thick layer of concrete. During the 1950’s, an estimated 67 tanks leaked radioactive waste into the ground and nearby groundwater which led to the single shell tanks being replaced by double shell tanks in order to meet state and federal regulations. (Text adapted from: <https://www.hanford.gov/page.cfm/TankFarms>)



SVE

Soil vapor extraction is a remediation approach at Pacific Northwest National Laboratory that involves using vacuum pressure to remove volatile contaminants from the vadose zone. (Text adapted from: [http://www.cpeo.org/techtree/ttdescript/soilve.htm#:~:text=Soil%20Vapor%20Extraction%20\(SVE\),and%20state%20air%20discharge%20regulations.](http://www.cpeo.org/techtree/ttdescript/soilve.htm#:~:text=Soil%20Vapor%20Extraction%20(SVE),and%20state%20air%20discharge%20regulations.))

SZ

Source zones, according to the National Academy of Press, are zones that have been in contact with separate phase contaminants. These volumes act as reservoirs that contain a contaminant plume in the groundwater, surface water, or air. (Text quoted from: <https://www.nap.edu/read/11146/chapter/4>)

T

TCE

Trichloroethene is a volatile, organic compound used mostly as an industrial solvent. In 2010, Pacific Northwest National Laboratory's Energy and Environment Directorate's Hazardous Material Identification and Control Research team developed a method to dechlorinate TCE by injecting iron particles in combination with an increase of temperature by using electrical resistance heating. (Text adapted from: <https://energyenvironment.pnnl.gov/highlights/highlight.asp?id=1332>)

TI

Technical impracticability is when remediation of ground water is unable to meet applicable standards given current remediation system engineering methods or technologies. (Text adapted from: https://nj.gov/dep/srp/guidance/srra/ti_guidance_gw.pdf)

TPA

The Tri-Party Agreement, or the Hanford Federal Facility Agreement and Consent Order, is an agreement for achieving compliance with the Comprehensive Environmental Response Compensation and Liability Act remedial action provisions and with the Resource Conservation and Recovery Act treatment, storage, and disposal unit regulations and corrective action provisions. The U.S. Department of Energy, which operates the Hanford Site in South Central Washington State, the U.S. Environmental Protection Agency, and the State of Washington Department of Ecology signed this comprehensive cleanup and compliance agreement on May 15, 1989. (Text quoted from: <https://www.hanford.gov/page.cfm/TriParty>)

TRAC

The RadioActivist Campaign (now dissolved), also known as SERACH—Nuclear Military America, and Nuclear-Weapons-Free America—was founded by Norm Buske in 1983, as the Hanford Reach Project in order to inform the public of radioactivity around nuclear facilities to encourage site accountability and protect the public and environment. (Text adapted from: <http://www.radioactivist.org/about.html>)

V

VZ

The vadose zone, also referred to as the unsaturated zone, is the area between Earth's surface and the regional groundwater table—an underground layer in which soil and rocks are permanently saturated with water, separating the capillary fringe above from the groundwater zone below. The vadose zone may be less than 1 meter deep, or hundreds of meters deep depending on the depth of the water table. (Text adapted from: <https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/vadose-zone>)

W

WMA C

Waste Management Area C is in the 200 East Area of the Hanford Site. It includes 16 underground storage tanks, called single-shell tanks, associated ancillary equipment, such as vaults, boxes, and piping, and soil contaminated by releases from these structures. (Text quoted from: <https://www.hanford.gov/files.cfm/WMA-C%20INFO%20SHEET.pdf>)

