



# Engineering Forum Issue Paper

## Online Hazardous Waste Cleanup Technical Resources

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### I. PURPOSE

The U.S. Environmental Protection Agency (EPA) produces numerous technical resources every year. Some are available in print, but many more are available online. This issue paper is intended to give the reader examples of some online technical resources that can assist with hazardous waste cleanups in the Superfund, Resource Conservation and Recovery Act (RCRA), and Brownfields programs. Other federal and state agencies performing hazardous waste cleanups have great resources as well. Some non-EPA websites are included here, but it should be noted that it was not possible to include all of them. Given the dynamics of online resources, this paper provides only a snapshot of the resources available at the time of publication. EPA will attempt to update this paper at regular intervals to ensure its accuracy. Following background sections on Superfund and the Technical Support Project (TSP), the issue paper is divided into sections describing the various webpages.

### II. BACKGROUND

#### Superfund

Years ago, people were less aware of how dumping chemical wastes might affect public health and the environment. On thousands of properties where such events occurred, the result was an uncontrolled or abandoned hazardous waste site, such as an abandoned warehouse, manufacturing facility, and/or inadequately closed landfill. Citizen concern over the extent of this problem led Congress to establish the Superfund Program in 1980 to locate, investigate, and clean up the worst sites nationwide. Using various resources, project managers review, develop, and implement viable remedial alternatives to clean up the environmental contamination at these sites, typically in soil and groundwater. In addition to the personnel assistance, online resources offer information intended to assist with these technology selections. They include technology overview information, case studies, cost information and contacts for consultation. The bulk of this issue paper will cover these online resources. The other cleanup programs within EPA (RCRA and Brownfields), can also benefit from these online resources, as the cleanup component of those programs is very similar to Superfund.

## Technical Support Project

The EPA's Office of Solid Waste and Emergency Response (OSWER), regional Waste Management Offices, and the Office of Research and Development (ORD) established the Technical Support Project (TSP) in 1987 to provide technical assistance to regional Remedial Project Managers, Corrective Action staff, and On-Scene Coordinators. The TSP consists of a network of regional technical forums and specialized Technical Support Centers located in ORD and the Office of Radiation Programs laboratories, and OSWER's Environmental Response Team. One of the objectives of the TSP is to network with other EPA programs and other Federal agencies.

### Regional Forums and Superfund and Technology Liaisons

The TSP includes three technical Forums within the TSP: the [Engineering Forum](#), the [Ground Water Forum](#), and the [Federal Facilities Forum](#). Members of these Forums include regional Remedial Project Managers (RPMs) and technical support staff who work to improve communications and assist in technical transfer between the Regions and the Centers on nationally significant topics. The forums also act as technical resources and disseminate information resulting from the TSP to their regional colleagues. They meet semi-annually to discuss technical and policy issues and new technologies and to network with others, including EPA Headquarters, ORD, the U.S. Army Corps of Engineers, and state personnel. In addition to providing technical assistance to regional staff, products generated typically include "issue papers" or other reference materials. For more information, go to <http://www.epa.gov/tio/tsp>. This issue paper is typical of the products that the TSP produces to assist practitioners in the waste field, both within and outside EPA.

Rounding out the support network for the waste programs are the ORD Superfund and Technology Liaisons or STLs. The STL program was created to:

- Station an ORD STL in each region to facilitate access to ORD laboratories, national centers, and ORD Headquarters.
- Provide and facilitate ORD's technical support programs in regional Office of Solid Waste and Emergency Response (OSWER) programs.

- Promote the use of sound science and engineering in regional decision making in the OSWER programs. The program was created jointly by ORD, OSWER, and the regional offices in 1990 to expand the technical support available to regional staff. It is managed within ORD's Office of Science Policy in Headquarters.

## III. USEFUL ONLINE RESOURCES

### 1. Clean-Up Information (CLU-IN)



<http://www.cluin.org>

EPA's "CLU-IN" website provides a tremendous amount of information about innovative treatment and site characterization technologies while acting as a forum for all waste remediation stakeholders. Internet training opportunities are also available via this website.

The website's resources are organized as follows: Remediation, Site Characterization and Monitoring, Training, Initiatives and Partnerships, Publications and Studio, Databases (software and tools), TechDirect and Newsletters, and Vendor and Developer Support.

As described on the website, here is the "Mission Statement" for CLU-IN:

*The Hazardous Waste Clean-Up Information (CLU-IN) Web Site provides information about innovative treatment and site characterization technologies to the hazardous waste remediation community. It describes programs, organizations, publications, and other tools for federal and state personnel, consulting engineers, technology developers and vendors, remediation contractors, researchers, community groups, and individual citizens. The site was developed by the U.S. Environmental Protection Agency (EPA) but is intended as a forum for all waste remediation stakeholders.*

The history of CLU-IN notes that "Since 1996, CLU-IN has evolved to offer new information, features, and services to its user community." Here are the services offered at the time of publication:

- TechDirect Information Service Launched (1997)
- Streaming Videos (1998)
- Vendor and Developer Support (1998)
- Internet Seminars (1999)

- Online Databases (1999)
- Technology Focus (1999)
- Conference Webcasts (2000)
- Field Analytic Technologies Encyclopedia (2001) (discontinued)
- Technology Innovation News Survey Archives (2002)
- Contaminant Focus (2003)
- CLU-IN Search Engine (2004)
- Project Profile Databases Search (2005)
- RSS (Really Simple Syndication) Feed (2005)
- Internet Seminar Archive Podcasts (2005)
- Issue Areas (2006)

Although most of this issue paper will highlight different online resources, there are a number of them under the clu-in.org home page that warrant mentioning. These include: *Technology Focus*, the *Annual Status Report*, *Contaminant Focus*, *Field Analytic Technologies* and *Issue Areas* and they immediately follow this section.

## 2. CLU-IN – Technology Focus



<http://www.cluin.org/techfocus>

The CLU-IN Technology Focus area bundles information for particular technologies that may be used in a variety of applications. This information is presented in categories such as “Overview, Guidance, Application, Training, and Additional Resources.” The technologies covered are:

- Air Sparging
- Bioreactor Landfills
- Bioremediation of Chlorinated Solvents
- Bioventing and Biosparging
- Electrokinetics: Electric Current Technologies
- Fracturing
- Ground-Water Circulating Wells

- In Situ Flushing
- In Situ Oxidation
- Multi-Phase Extraction
- Natural Attenuation
- Permeable Reactive Barriers
- Phytoremediation
- Remediation Optimization
- Soil Vapor Extraction
- Soil Washing
- Solvent Extraction
- Thermal Treatment: Ex Situ
- Thermal Treatment: In Situ

## 3. CLU-IN – Treatment Technologies for Site Cleanup: Annual Status Report



<http://www.cluin.org/asr/>

This report documents, as of September, 2007, the status of treatment technology applications at more than 1,900 soil and groundwater cleanup projects at Superfund remedial action sites. It is updated every few years.

## 4. CLU-IN – Contaminant Focus



<http://www.cluin.org/contaminantfocus/>

This section of EPA’s clu-in.org website organizes related cleanup information by contaminant type or group. The types of information included are “Policy and Guidance, Chemistry and Behavior, Environmental Occurrence, Toxicology, Detection and Site Characterization, Treatment Technologies, and Conferences and Seminars.” The contaminants currently included in the database are listed here.

- Arsenic
- Chromium VI
- 1,4-Dioxane
- Mercury
- Methyl Tertiary Butyl Ether (MTBE)
- Perchlorate
- Persistent Organic Pollutants (POPs)
- Polychlorinated Biphenyls (PCBs)
- Trichloroethylene (TCE)

## 5. CLU-IN – Field Analytic Technologies



<http://clu.in.org/char/technologies/>

Material that was previously available in the “FATE” website (the Field Analytic Technologies Encyclopedia) has been moved under CLU-IN resources. As the website states:

*“Technological advances over the past decade have created a whole new set of tools to improve site cleanup and long-term monitoring. Computerization, microfabrication, and biotechnology permit the development of analytical equipment that has capabilities that blur the distinction between “screening methods” and “definitive methods.” In the next decade, technological advances are likely to alter that landscape even more dramatically. Information in this section is structured much like a typical encyclopedia, with standard categories of information provided for each technology class. However, throughout the narrative, we include hyperlinks to more detailed information, further explanations, diagrams, and additional supporting data should the reader be interested in learning more. We are continuously updating information in this section and developing new sections on other technologies.”*

Here are the technologies presently covered on the website:

- **Analytcs**
  - Fiber Optic Chemical Sensors
  - Gas Chromatography

- Graphite Furnace Atomic Absorption Spectrometry
- Immunoassay
- Infrared Spectroscopy
- Laser-Induced Fluorescence
- Mass Spectrometry
- Test Kits
- X-Ray Fluorescence

- **Direct-Push Technologies**

- Analytical Systems
- Direct-Push Platforms
- Geotechnical Sensors
- Groundwater Samplers
- Soil and Soil-Gas Samplers

- **Explosives**

- **Geophysics**

- Ground Penetrating Radar
- Magnetics for Environmental Applications

- **Passive Diffusion Bag (PDB) Samplers**

## 6. CLU-IN– Issue Areas



<http://www.clu.in.org/issues/>

CLU-IN has compiled a number of what might be considered “emerging issues” into the “Issue Areas.” Many of these topics continue to be researched, but some existing resources do exist. The present “issue areas” are listed below.

- Dense Nonaqueous Phase Liquids (DNAPLs)
- Ecological Revitalization
- Mining Sites
- Nanotechnology
- Sediments
- Vapor Intrusion
- Wood Treater Sites

## 7. Cleanup Science and Technology

<http://www.epa.gov/oswer/cleanup/science.htm>

What might be viewed as a subset of CLU-IN, this site presents a useful compilation. This EPA OSWER webpage gives links to OSWER resources (within CLU-IN, the Technology Innovation Program (TIP) and the Office of Underground Storage Tanks (OUST)) with information on the many technologies and tools used by EPA to assess, clean up and monitor hazardous waste site cleanups.

## 8. EPA's Underground Storage Tanks Remediation/Cleanup Technologies

<http://www.epa.gov/swrust1/cat/REMEDIAL.HTM>

Another compilation webpage, this one is geared towards the cleanup of underground storage tanks. OUST's Remediation/Cleanup Technologies page focuses on corrective action technologies at petroleum release sites and provides links to both EPA and non-EPA resources.

## 9. Measurement and Monitoring Technologies for the 21<sup>st</sup> Century (21M<sup>2</sup>)



<http://clu.in.org/programs/21m2/>

EPA's 21M<sup>2</sup> program matches measurement and monitoring technologies with client needs. As discussed on their webpage, some of these technology need areas include:

*“...DNAPL characterization techniques; monitoring mining waste sites; sensor technology development; vapor intrusion monitoring methods; test methods for dioxin, cyanide, mercury, pesticide, perchlorate, MTBE, and emerging contaminants; and remote sensing for a variety of applications.”*

## 10. Federal Remediation Technologies Roundtable



<http://www.frtr.gov>

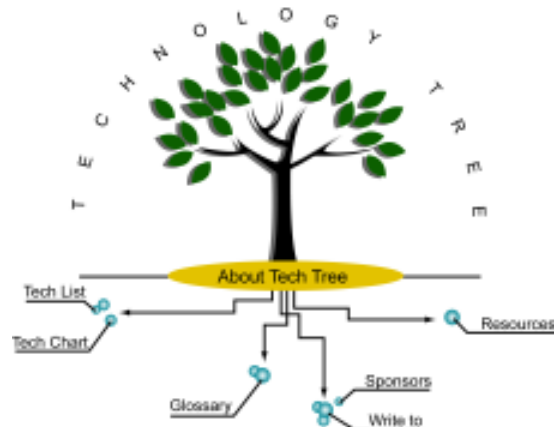
The “Federal Remediation Technologies Roundtable” (FRTR) represents a collaborative effort on cleanup technologies from Department of Defense (DOD), EPA, National Aeronautics and Space Administration (NASA), Department of Energy (DOE), and the Department Of Interior. The FRTR was established in 1990 and brings together cleanup managers and remediation professionals to, as the web site says:

- *Share information and learn about technology-related efforts of mutual interest,*
- *Discuss future directions of the national site remediation programs and their impact on the technology market,*
- *Interact with similar state and private industry technology development programs, and*
- *Form partnerships to pursue subjects of mutual interest.*

The website contains the following information:

- Cost and performance case studies
- Screening tools for site characterization and cleanup technologies
- Optimization information for monitoring, simulation, and treatment technologies

## 11. TechTree Database



<http://www.cpeo.org/techtree/>

This database is offered by a non-profit group called Center for Public Environment Oversight (CPEO),

which is associated with the Pacific Studies Center of Mountain View, CA. It contains a search engine that allows a user to plug in certain elements of a site, including contaminants, media (soil, groundwater, sediments), and technology types. The search returns information on related cleanup technologies. The information in the database is taken from publicly available clean up databases from EPA, DOE, DOD, and others.

## 12. Triad



<http://www.triadcentral.org>

This EPA webpage provides resources related to the Triad philosophy of cleanup, where one integrates systematic planning, real-time measurements, and dynamic work strategies to assist in reaching site cleanup sooner and less expensively. It is more of an approach to cleanup than anything else. The website contains access to information about the tools that allow one to make legally defensible decision in the field. These are related to field-based measurement methods, which have advanced to the point where they are often as accurate as fixed lab results.

Topics covered on the TRIAD webpage include:

- Triad Overview
- Triad Management
- Regulatory Information
- Technical Components
- User Experiences
- References/Resources

## 13. Air Force Center for Engineering and the Environment



<http://www.afcee.brooks.af.mil/>

The Air Force's Center for Engineering and the Environment (AFCEE) is out of Brooks Air Force Base in Texas. The web page says: "... provides Air Force leaders with the comprehensive expertise and Professional services necessary to protect, preserve, restore, develop and sustain the nation's environmental and installation resources."

The site has information on a number of base closure related activities, but also remedial process optimization, long term monitoring, groundwater models and risk based standards (mostly for petroleum sites).

## 14. Strategic Environmental Research and Development Program



<http://www.serdp.org/>

This website describes a development and application program that focuses on high priority environmental cleanup issues confronting the military services. It is a combined effort of DOE, DOD, and EPA. They cover environmental remediation, but also sustainable infrastructure issues for military ranges and training areas. Some of the SERDP environmental restoration projects include:

- Chlorinated Solvents
- Energetics
- Heavy Metals
- Perchlorate
- Emerging Contaminants
- Polycyclic Aromatic Hydrocarbons and PCBs
- Petroleum Hydrocarbons
- Sediments
- Range Management
- Risk Assessment
- Site Characterization

## 15. Environmental Security Technology Certification Program



<http://www.estcp.org/>

The Department of Defense program (known as ESTCP) demonstrates and validates innovative technologies at DOD sites to promote innovation and cost effectiveness. Here are focus areas from the ESTCP website for which fact sheets, completed

technology assessments, final reports, cost and performance reports, and protocols are available:

- *Environmental Restoration* - Demonstrates technologies for the cost-effective detection, characterization, containment, and remediation of chemical contamination in soil, sediments, and water to reduce DOD's current and potential future environmental liabilities.
- *Munitions Management* - Demonstrates detection, discrimination, remediation, and prevention technologies in support of environmentally responsible management of military munitions required to cleanup closed military ranges and to sustain active training and testing ranges.
- *Sustainable Infrastructure* - Demonstrates technologies to sustain training and testing ranges and the installation infrastructure that supports DOD forces in the United States and overseas to ensure DOD meets its environmental obligations and maintains military readiness.
- *Weapons Systems and Platforms* - Demonstrates technologies and materials that reduce the waste and emissions associated with the manufacturing, maintenance, and use of DOD weapons systems and platforms to reduce future environmental liabilities and their associated costs and impacts.

## 16. Interstate Technology and Regulatory Council



<http://www.itrcweb.org>

The ITRC is a nonprofit organization of states that focus on distinct environmental cleanup problems. They are sponsored by EPA, industry and others and work with industry and stake-

holders with the goal of "achieving regulatory acceptance of environmental technologies." At present, 48 states are members of ITRC and there are 14 "teams", which focus on specific cleanup areas. The teams work to produce guidance and training for the States, but both are widely used throughout the cleanup industry by regulators, technology vendors and consultants. The teams, which can transition in and out of existence based on needs, are presently:

### Ongoing Teams:

- Bioremediation of DNAPLs
- Brownfields

- Enhanced Attenuation: Chlorinated Organics
- LNAPLs
- Mining
- Perchlorate
- Phytotechnologies
- Radionuclides
- Remediation Process Optimization
- Risk Assessment Resources
- Sampling, Characterization, and Monitoring
- Unexploded Ordnance

### Closing Teams:

- Alternative Landfill Technologies
- Diffusion/Passive Samplers
- Ecological Enhancements and Land Reuse
- Vapor Intrusion

## 17. State Coalition for Remediation of Drycleaners



<http://www.drycleancoalition.org/>

The State Coalition for Remediation of Drycleaners (SCRD) was established in 1998 with support from the EPA's Office of Superfund Remediation and Technology Innovation. Comprised of representatives of states with established drycleaner remediation programs, participation is also open to states without drycleaner-specific programs that are active in the remediation of drycleaner sites under other authorities. The Coalition's primary objectives are to provide a forum for the exchange of information and the discussion of implementation issues related to established state drycleaner programs; to share information and lessons learned with states without drycleaner-specific programs; and to encourage the use of innovative technologies in drycleaner remediation.

## 18. Mine Waste Technology Program

<http://www.epa.gov/ORD/NRMRL/std/mtb/mwt/index.html>

Active and inactive mines, concentrated mainly throughout nine states in the western US, have contaminated land and waterways. It is estimated that these mines produce between 1 and 2 billion tons of mine waste per year. The production of acid mine drainage is a significant problem from these sites and about 70 of them are on the National Priorities List under the Superfund Program.

Starting in 1991, and funded by EPA and U.S. DOE, a program was implemented at Montana State University that focused on development and demonstration of innovative technologies at bench and pilot scale in three areas:

- source controls
- treatment technologies
- resource recovery

This website provides access to information on technologies that have been researched to assist in the cleanups of these mine sites.

## 19. Environmental Technology Opportunities Portal

Environmental Technology <http://www.epa.gov/etop>

# ETOP

Opportunities Portal

The EPA's Environmental Technology Opportunities Portal

(ETOP) links a user to programs that help fund development of new environmental technologies and offers information on existing environmental technologies. It provides information for what EPA terms the "Environmental Technology R&D Continuum," which describes all aspects of technology development, commercialization and application. With that in mind, the intended users include technology developers and technology end users.

## 20. Environmental Technology Verification Program



<http://www.epa.gov/etv/>

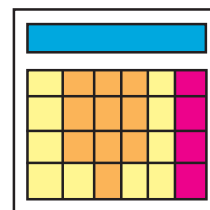
EPA's ETV Program develops testing protocols and verifies the performance of innovative technologies that have the potential to improve protection of human health and the environment. It is not an "EPA approval" program, but helps developers speed up the entry of their environmental technology products into the marketplace through these verifications.

A new element (2006) created under the ETV program are the Environmental and Sustainable Technology Evaluations or "ESTE." Its purpose is to follow the ETV model (QA, stakeholder involvement, and cost-sharing) and respond directly to EPA's needs for technologies that address high-risk environmental problems.

The ETV program's verifications are divided into a number of different "centers" and some of those are outlined here. Other centers previously existed under ETV, but have been discontinued or moved to other EPA programs.

- Advanced Monitoring Systems Center
- Air Pollution Control Technology Center
- Drinking Water Systems Center
- Greenhouse Gas Technology Center
- Water Quality Protection Center
- Pollution Prevention Coatings and Coating Equipment Pilot

## 21. EPA's Office of Research and Development ON-LINE Calculators



<http://www.epa.gov/athens/onsite>

The ON-LINE calculator tools, sponsored by EPA's Office of Research and Development for site assessment at groundwater contamination sites, usually those contaminated with fuel products. It was developed by staff from the ORD Lab in Athens, GA and some regional

staff. They provide the user with the convenience of a “pre-packaged” tool that offers consistency and easy access. They consist of formulas, models, and units conversion.

## 22. National Institute of Environmental Health Sciences Superfund Basic Research Program Research Briefs



# NIEHS

National Institute of Environmental Health Sciences

<http://tools.niehs.nih.gov/sbrp/researchbriefs/>

The Superfund Basic Research Program (SBRP) is a program that concentrates on addressing health risks, toxicity, exposure predictions, fate and transport, and cost effective treatments for hazardous waste sites. It is led by the National Institute for Environmental Health Sciences, but has a clear connection to EPA, which it looks to for guidance as a stakeholder in planning future research and a user for completed research.

Today, the program conducts basic research at 15 universities across the U.S. The SBRP also conducts online training classes and has recently offered a series of trainings on DNAPLs and nanotechnology. Their website lists their mandates, which has become better geared towards serving the end user community (like RPMs) in recent years. These mandates are:

- methods and technologies to detect hazardous substances in the environment
- advanced techniques for the detection, assessment, and evaluation of the effects on human health of hazardous substances
- methods to assess the risks to human health presented by hazardous substances
- basic biological, chemical, and physical methods to reduce the amount and toxicity of hazardous substances

## 23. The Indoor Air Vapor Intrusion Database



<http://iavi.rti.org>

This is a non-EPA (but EPA supported) database on the topic of vapor intrusion. It contains information for users, but also allows user input, with the idea of sharing case studies. Here is text from the home page of the website.

*Vapor intrusion is the migration of volatile chemicals from the subsurface into overlying buildings. Volatile chemicals in contaminated soil or groundwater can emit vapors that may migrate through soil and into indoor air spaces.*

*This website includes general information on vapor intrusion, along with information on some of the efforts being conducted in support of the Environmental Protection Agency's (EPA's) developing Vapor Intrusion Guidance.*

*The Indoor Air Vapor Intrusion (LAVI) Database is designed for regulators and other stakeholders to submit site-specific vapor-intrusion data to support development of screening-level predictions of vapor attenuation. High-quality, representative, and reproducible measurements of soil gas, groundwater, and indoor air contaminant concentrations at VI sites are needed to verify that the screening-level model predictions are protective, to improve understanding of the operating physical phenomena, and to help EPA evaluate and improve predictive models and screening algorithms for the VI pathway.*

*This website also includes presentations and supporting materials for several workshops conducted by EPA in support of the developing guidance. These presentations can be accessed by clicking on the “Workshops and Conferences” link on the left of this page.*

## 24. EPA's Ground Water and Ecosystems Restoration Division Research



<http://www.epa.gov/ada/>

This EPA program offers a number of great resources on research, applications, and technical support that have been compiled by the scientists and engineers at the EPA ORD laboratory in Ada, OK. Their work is related to

restoring impacted ground water, surface water, and ecosystems and the topics covered (some not classic “hazardous waste” related) include the following:

- Arsenic
- Chemical Oxidation
- Concentrated Animal Feeding Operations
- Ecosystem Restoration & Nitrogen Management
- Ground Water-Surface Water Interaction
- Invasive Species
- Monitored Natural Attenuation
- MTBE & Fuel Oxygenates
- NAPL Source Zones
- Permeable Reactive Barriers (generally known as permeable reactive zones)
- Riparian Restoration
- Vapor Intrusion

## 25. Superfund Innovative Technology Evaluation



<http://www.epa.gov/ORD/SITE>

EPA’s Superfund Innovative Technology Evaluation (SITE) Demonstration Program was a cost sharing program with industry that evaluated remedial cleanup technologies and then published the data for use by others looking to potentially use the technologies at their sites. Although not as active as in the past, a tremendous amount of useful data still exists on its website. Here is an excerpt from the SITE program’s homepage:

*The U.S. Environmental Protection Agency’s (EPA) Superfund Innovative Technology Evaluation (SITE) Program was established by EPA’s Office of Solid Waste and Emergency Response and the Office of Research and Development (ORD) in response to the 1986 Superfund Amendments and Reauthorization Act, which recognized a need for an “Alternative or Innovative Treatment Technology Research and Demonstration Program.” The SITE Program is administered by ORD National Risk Management Research Laboratory in the Land Remediation and Pollution Control Division (LRPCD), headquartered in Cincinnati, Ohio. The materials presented on this web site were specifically developed to aid engineers, scientists and other remediation professionals in the efficient monitoring, measurement and remediation of hazardous wastes.*

*The SITE Demonstration Program encourages the development and implementation of:*

- 1. innovative treatment technologies for hazardous waste site remediation and*
- 2. monitoring and measurement technologies.*

*In the SITE Demonstration Program, the technology is field-tested on hazardous waste materials. Engineering and cost data are gathered on the innovative technology so that potential users can assess the technology’s applicability to a particular site. Data collected during the field demonstration are used to assess the performance of the technology, the potential need for pre- and post-processing of the waste, applicable types of wastes and waste matrices, potential operating problems, and approximate capital and operating costs.*

*At the conclusion of a SITE demonstration, EPA prepares an Innovative Technology Evaluation Report, Technology Capsule, and Demonstration Bulletin. These reports evaluate all available information on the technology and analyze its overall applicability to other site characteristics, waste types, and waste matrices. Testing procedures, performance and cost data, and quality assurance and quality standards are also presented.*

## 26. U.S. Army Corps of Engineers Environmental and Munitions Center of Excellence



### US Army Corps of Engineers

<http://www.environmental.usace.army.mil/sitemap.htm>

The U.S. Army Corps of Engineers conducts many environmental investigations and cleanups and has recently merged their Omaha Branch (Hazardous, Toxic, and Radioactive Waste Center of Excellence) with their Huntsville Branch (Munitions Center of Excellence) websites into one site. One can find a number of tools and resources on this site, including those covering cost estimating and remedial systems evaluation.

## 27. TechLinks

<http://www.epa.gov/region09/waste/techlinks>

### a. Technology Web Sites

Provided by EPA Region 9, this page provides links to government, academic and industry Web pages dedicated to both hazardous waste site characterization

and remediation technologies. They are intended for use by Superfund and RCRA project managers, researchers, engineers, the public, or anyone who may be looking for technologies to solve site-specific hazardous waste problems.

#### b. Categories

- Innovative Technology Research and Development
- Technology Validation / Certification / Commercialization / Demonstration
- Technology Databases
- Technology Publications
- Technology Partnerships
- Specific Applications
- Monitored Natural Attenuation Policy
- Technology Transfer

#### IV. REFERENCES

Hazardous Waste Cleanup Technology Resources, talk given by Michael Gill, ORD Hazardous Substances Technical Liaison to EPA Region 9, at the 2006 NARPM conference in New Orleans, LA (June 22, 2006).

EPA Region 9 webpage: <http://www.epa.gov/region09/waste/sfund/superfundsites.html>

EPA Superfund Webpage: <http://www.epa.gov/superfund/about.htm>

(All other webpages are listed in the various sections. During the writing of this paper, every effort was made to accurately quote what the webpages presented at the time, but since webpages are dynamic, differences will exist after publication. EPA will attempt to update the paper at a regular interval.)

#### V. ACRONYM LIST

AFCEE – Air Force Center for Engineering and Environment

CPEO – Center for Public Environmental Oversight

DNAPL – Dense Non-Aqueous Phase Liquid

DOD – Department of Defense

DOE – Department of Energy

DOI – Department of Interior

EPA - Environmental Protection Agency

ESTCP – Environmental Security Technology Certification Program

ESTE – Environmental and Sustainable Technology Evaluations

ETOP – Environmental Technologies Opportunities Portal

ETV – Environmental Technology Verification

FRTR – Federal Remediation Technologies Roundtable

ITRC – Interstate Technology and Regulatory Council

LNAPL – Light Non-Aqueous Phase Liquid

MTBE – Methyl Tertiary Butyl Ether

NAPL – Non-Aqueous Phase Liquid

NIEHS – National Institute of Environmental Health Sciences

ORD – Office of Research and Development

OSC – On Scene Coordinators

OSWER – Office of Solid Waste and Emergency Response

OUST – EPA's Office of Underground Storage Tanks

PAH – Polyaromatic Hydrocarbons

PCB – Polychlorinated Biphenyls

PDB – Paradichlorobenzene

POP – Persistent Organic Pollutants

RCRA – Resource Conservation and Recovery Act

RPM – Remedial Project Manager

RSS – Really Simple Syndication

SERDP – Strategic Environmental Research and Development Program

SCRD – State Coalition for Remediation of Drycleaners

SBRP – Superfund Basic Research Program

SITE – Superfund Innovative Technology Program

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STL – Superfund and Technology Liaison

TCE – Trichloroethylene

TIP – Technology Innovation Program

TSC – Technical Support Center

VOC – Volatile Organic Compound

## **VI. ACKNOWLEDGMENTS AND DISCLAIMER**

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It is recognized that online web resources are very dynamic in nature and every effort will be made to update this document in a reasonable timeframe to ensure its accuracy. Please refer any corrections to Michael Gill at [gill.michael@epa.gov](mailto:gill.michael@epa.gov).

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