

T&D Facilities & Equipment: Environmental Issues - Program 51

Program Overview

Program Description

As the nation's electric transmission and distribution (T&D) infrastructure ages and expands, power companies need to manage human health risks and minimize environmental impacts from power delivery system use, operation, and maintenance. Critical components of the system, such as service centers, substations, and cables, face issues related to spills, cleanups and life-cycle decision making. Environmentally acceptable options are needed in selecting and managing treated wood poles and dielectric fluids.

The Electric Power Research Institute's (EPRI's) T&D facilities and equipment program delivers information, tools, and methods for preventing, characterizing and remediating soil and water contamination at T&D facilities, such as substations, service centers, pole storage yards, and pole-setting sites. Data and products from the program support development of scientifically sound regulations and cleanup standards for chemicals associated with T&D facilities and operations, as well as providing engineering, science, and business tools to aid T&D facilities management.

Research Value

This program assesses environmental, human health, and economic risks from leaks and spills of fuels, dielectric fluids, and other liquids from T&D facilities and equipment. The program also offers life-cycle perspective (purchase, use, disposition) on utility pole management and options for recycle and reuse of retired wood poles. Program research has documented savings of \$10 million per year industrywide for used oil management, \$1.5 billion per year for creosote and pentachlorophenol poles to be managed as nonhazardous waste, and \$500,000 at a single site by demonstration of the true risk of a mineral oil spill. In addition, the program offers spill prevention, control, and countermeasure (SPCC) planning, implementation and support. The program helped save one company \$1 million in SPCC regulatory compliance costs. This program provides

- science to inform regulatory developments,
- information and data to help power companies make optimal decisions on equipment choices and remedial approaches,
- characterization information on substances as they relate to environmental and human health risk, and
- strategies to reduce financial risk and O&M costs.

Approach

Aging T&D infrastructure will bring increasing environmental challenges at substations and service centers. This program addresses these challenges with options assessment, fate and transport studies, and remedial approaches. The program facilitates communications with stakeholders through data and life-cycle studies. It examines a growing societal focus on sustainability by looking at issues such as the large resource represented by out-of-service utility poles. This program delivers

- software tools for advanced spill simulation to examine environmental impacts of leaks such as oil spills and to support discussions with regulators,
- pilot tests to expand remediation options for spills and leaching of substances such as arsenic, and
- decision tools that explore management options for selection of wood poles and remediation of contaminated sites.

Accomplishments

Program spill simulation tools are considered to be the industry standard for SPCC planning and are used by many power companies. The decision tool for optimal pole choice allows for selection of pole types based on engineering performance, local differences in climate and availability, costs, and environmental impact. Management options for out-of-service wood poles reduce the quantity of wood entering landfills, resulting in cost savings for power companies and saving space in landfills. Program accomplishments include the following:

- Environmental decision-making profile for utility poles
- Options for remanufacturing/recycling poles
- Foreign practices for managing poles
- Mineral Oil Spill Evaluation System (MOSES) software and related electronic tools for spill prevention, planning, and implementation
- *In situ* chemical fixation, phytoremediation, and hybrid ion exchange for remediation of arsenic in soil and groundwater
- Bioavailability of arsenic for negotiation of cleanup standards
- PCB remediation studies; *in situ* minimally disruptive bioremediation of PCB-contaminated soil and sediment by dehalogenation

Current Year Activities

Program R&D for 2010 will focus on managing environmental and human health risk from operation of the power delivery system. Specific efforts will include

- identifying and developing an assessment of environmental and human health risk from aging T&D infrastructure;
- investigating poles throughout their life cycle to maintain and expand options for selection, use, and disposition and to facilitate communication;
- evaluating emerging dielectric fluids from purchase through disposition; and
- identifying and developing emerging options for remediation of contaminated sites.

Estimated 2010 Program Funding

\$1.4M

Program Manager

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Summary of Projects

Project Number	Project Title	Description
P51.001	Utility Poles: Assessment and Impact	This project develops approaches and provides data to help companies manage poles across the pole life cycle, with practices that ensure engineering performance, manage costs, and protect the environment and human health.
P51.002	Oils: Spill Control, Countermeasures, and Response	This project supports prevention, management, and remediation of leaks and spills of dielectric fluids, thereby reducing operational, financial, environmental, and human health risk.
P51.003	Aging Infrastructure: Environmental Risk Management	This work develops data and tools to manage environmental and human health risks from incidents resulting from aging T&D infrastructure.
P51.004	PCBs: Mitigation and Remediation	This work develops options for remediation of PCB spills, as well as data to inform regulations and decisions involving PCBs.
P51.005	Trace Metals at Substations: Analysis, Modeling, and Remediation	This project develops approaches to assessment and remediation of metals-contaminated substations, with primary emphasis on arsenic contamination.

P51.001 Utility Poles: Assessment and Impact (100315)

Key Research Question

Poles are a huge and valuable asset of a utility company. Companies need to manage poles across the pole life cycle with practices that ensure engineering performance, manage costs, and protect the environment and human health. This process begins with selection of the optimal pole for each setting, continues through careful use, and ends with final disposition that recognizes the asset value. Improved specification of new and replacement poles allows companies to better manage operational, financial, environmental, and human health risk. Optimal processes for prevention of leaching reduce environmental and human health impacts from pole treatments. Information on chlorophenols, dioxins, metals, and supplemental treatment chemicals is critical to obtaining science-based, cost-effective regulatory decisions, as well as supporting optimal business decisions by pole owners. Alternatives to landfilling and giveaway programs for treated wood poles are essential to help companies manage risks and recover the huge resource represented by wood poles at the end of their useful life. Demonstrating low risk for treated wood can save owners billions of dollars by reducing disposal costs and facilitating recycling. Assessing nonwood alternatives can offer companies lower-risk, reasonable-cost options in some settings.

Approach

This work aims to reduce costs and minimize human health and ecological risks from poles across their life cycle, to inform regulatory and public concerns about poles, and to maintain ongoing \$1.5 billion-per-year cost savings from the nonhazardous waste designation for poles. The project will

- augment and maintain EPRI's decision tool to help companies choose both new and replacement poles;
- consider availability of wood species used for poles under climate change scenarios;
- assess both nontreated wood and nonwood alternatives to treated wood poles as these alternatives are proposed and become commercially available;
- explore options for managing poles, including storage, use, recycling, and reuse of poles with minimal health and environmental impacts; and
- conduct long-term fate and transport studies of wood treatment chemicals.

Impact

- Reduces costs and minimizes human health and ecological risks from poles
- Informs regulatory and public concerns about pole use
- Saves the industry \$1.5 billion per year in ongoing cost savings as a result of the nonhazardous waste designation for poles

How to Apply Results

Utility engineers and scientists need to read, understand, and disseminate the results to key stakeholders, both inside and outside utility companies. Internal stakeholders—scientists, engineers, purchasing agents, and others—will incorporate the information into product specifications, O&M procedures, and waste management decisions, as well as environmental policies and procedures and communications programs. External stakeholders, including regulators and members of the public, will use the results as part of environmental decision making and rulemaking. In addition, the Electric Power Research Institute (EPRI) will facilitate broader use and awareness of the results by briefing key stakeholders, including policymakers and other researchers; by developing materials for the public/trade press/media; and by presenting at meetings/seminars.

2010 Products

Product Title & Description	Planned Completion Date	Product Type
Decision Tool for Evaluating Options for Poles: This product will augment the decision model for poles selection (Poles Decision Tool, 1016802) completed in 2009.	12/31/10	Technical Update
Alternatives to Treated Wood for Utility Poles: This product assesses technical, cost, and environmental impact information associated with treated wood, untreated wood, and nonwood options for utility poles.	12/31/10	Technical Update

Future Year Products

Product Title & Description	Planned Completion Date	Product Type
Preventing and Measuring the Impact of Treated Wood Poles: Treated wood and surrounding groundwater and soil samples will continue to be collected and analyzed, and the trends will be evaluated in this long-term fate and transport study.	12/31/11	Technical Update
Decision Tool for Evaluating Options for Poles: This research will continue to augment the decision model for poles selection (Poles Decision Tool, 1016802) completed in 2009.	12/31/11	Software
Impacts of Climate Change on Wood Species: This work will evaluate the potential impacts of climate change on the range and availability of wood species used to make utility poles.	12/31/11	Technical Resource
Alternatives to Treated Wood for Utility Poles: This work will continue to provide current information on the practicality and availability of options for poles as those options emerge.	12/31/12	Technical Update
Recycle/reuse of Treated Wood Poles: This work will explore options for reuse of wood poles and assess markets for the reuse products.	12/31/12	Technical Update

P51.002 Oils: Spill Control, Countermeasures, and Response (Q55817)

Key Research Question

Routine use of dielectric fluids may result in leaks, spills, or fires, with resulting human health and environmental impacts. Compliance and protection require an understanding of the risk of an incident and the toxicity of the fluids involved. Through laboratory and field work, EPRI researchers study chemical composition, environmental fate and transport, and risks from dielectric fluids, as well as developing tools to facilitate use of the scientific information.

Approach

This work aims to streamline compliance and reduce costs by addressing regulatory and public concerns, evaluating substation retrofit options, and protecting groundwater and soil through improved detection and location of leaks. The project has demonstrated to one state agency that non-PCB capacitor fluids could be managed as synthetic oils, saving hundreds of thousands of dollars for one company. The project will

- consider and assess risk factors for alternatives to commonly used fluids, and
- improve state-of-the-art designs for substations to provide enhanced health and environmental protection.

Impact

- Streamlines spill prevention and countermeasure compliance by developing information and tools to address regulatory and public concerns
- Protects groundwater and soil from accidental leaks and spills through improved detection and location
- Demonstrated to one state agency that non-PCB capacitor fluids could be managed as synthetic oils, saving hundreds of thousands of dollars for one company on handling and disposal

How to Apply Results

Scientists and engineers will use the results of fate and transport studies on dielectric fluids to inform development of regulations, assess sites and simulate migration, negotiate site cleanup endpoints, detect and locate leaks, and communicate with all stakeholder groups, including regulators and members of the public. Scientists and engineers will use the results of remediation studies to prepare and implement action plans for contaminated sites. As new information, products, and tools are developed, program participants will have first access and will apply results to environmental decisions. In addition, EPRI will facilitate broader use and awareness of the results by briefing key stakeholders, including policymakers and other researchers; by developing materials for the public/trade press/media; by organizing design workshops; and by presenting at meetings/seminars.

2010 Products

Product Title & Description	Planned Completion Date	Product Type
State-of-the-Art Designs: The product will investigate state-of-the-art designs for transmission facilities and substations for optimal environmental performance, following up on EPRI's 2009 workshop.	12/31/10	Technical Resource

Future Year Products

Product Title & Description	Planned Completion Date	Product Type
Alternate Dielectric Fluids: This work will continue and expand earlier work that identified and assessed emerging fluids for environmental performance and regulatory compliance.	12/31/11	Technical Update
State-of-the-Art Designs: The work will continue to investigate state-of-the-art designs for transmission facilities and substations for optimal environmental performance.	12/31/12	Technical Update

P51.003 Aging Infrastructure: Environmental Risk Management (069220)

Key Research Question

As the electric transmission and distribution infrastructure grows older, risks to human health and the environment from leaks and spills of fuels, dielectric fluids, and other liquids or gases may increase, resulting in increased financial risk to companies as well as increased risk to human health and the environment. Companies need to understand the risks and vulnerabilities, and they need approaches to identifying and assessing those risks and vulnerabilities.

Approach

This work seeks to develop a proactive approach to managing environmental and human health risks from aging infrastructure, by improving understanding of probabilities and ramifications of incidents. This project will

- identify potential contaminants from leaks in the T&D infrastructure and likelihood of incidents,
- assess environmental and human health risks from these contaminants,
- assess related financial risks, and
- identify and develop methods to prioritize actions to minimize risks.

Impact

- Develops tools to evaluate relative risks, prioritize actions, and thereby mitigate negative outcomes to human health and the environment
- Reduces cost and resource use for cleanups and litigation

How to Apply Results

Scientists and engineers will use the results of risk studies to inform development of regulations, to prepare and implement action plans, and to communicate with all stakeholder groups, including regulators and members of the public. As new information, products, and tools are developed, program participants will have first access and will apply results to their decisions. Working with participating utility company scientists and engineers, EPRI staff may communicate directly with regulators or with members of the public.

2010 Products

Product Title & Description	Planned Completion Date	Product Type
Methodology for Determining Risks from Potential and Actual Incidents: This product will identify and assess risks to human health and the environment from spills and leaks from aging infrastructure.	12/31/10	Technical Update

Future Year Products

Product Title & Description	Planned Completion Date	Product Type
Assessment of Consequences and Financial Risk: This work will determine the possible risks and financial outcomes of leaks and spills from aging T&D infrastructure.	12/31/11	Technical Update
Relative Risk Model for Environmental and Human Health Risk from Aging Infrastructure: The model will streamline estimation and comparison of risks to facilitate development of action plans.	12/31/12	Software

P51.004 PCBs: Mitigation and Remediation (100778)

Key Research Question

Historical spills have introduced polychlorinated biphenyls (PCBs) into the environment at electric utility sites. Even after two decades of regulatory control, PCB spills continue to occur and be discovered. Industry has made a huge investment in excavation and landfilling. This option is expensive and limited, and reliable, cost-effective alternatives are needed. Some regulators and risk assessors are focusing on individual PCB congeners, especially the dioxinlike congeners, and are requiring congener-specific monitoring at some sites. Information about monitoring methods and changes to PCB congener mixes over time is needed.

Approach

This work aims to reduce compliance costs by providing information to improve risk assessment and facilitate communication with all stakeholder groups, and to save electrical equipment owners tens of thousands to millions of dollars as regulations continue to develop and as PCB spills continue to be discovered and addressed. This project will

- strengthen risk assessment, improve monitoring, and evaluate promising remedial approaches, and
- track and explore issues related to PCB congeners.

Impact

- Reduces compliance costs by providing information on actual PCB species and their potential impact and health risk
- Helps clarify and reduce risks related to PCB exposures
- Improves risk assessment and facilitates communication with all stakeholder groups
- Saves electrical equipment owners tens of thousands to millions of dollars as regulations continue to develop and PCB spills continue to be discovered and addressed

How to Apply Results

Scientists and engineers will use the results of congener-based studies to inform development of regulations, assess sites and simulate migration, negotiate site cleanup endpoints, and communicate with all stakeholder groups, including policymakers, other researchers, trade press, media, and the public. Scientists and engineers will use remediation study results to prepare and implement action plans for contaminated sites. As new information, products, and tools are developed, program participants will have first access and will apply results to environmental decisions. Working with participating utility company scientists and engineers, EPRI staff may communicate directly with regulators or with members of the public. External stakeholders, including regulators and members of the public, will use the results as part of environmental decision making and rulemaking.

Future Year Products

Product Title & Description	Planned Completion Date	Product Type
Remediation of PCB-Contaminated Soil and Groundwater: This report will include an investigation of options to excavation and landfilling for PCB-contaminated soils and options to pump-and-treat for PCB-contaminated groundwater.	12/31/11	Technical Update
Congener-Specific PCB Issues: This report will update the analysis of congener-specific PCB issues published by EPRI and will include information from specific states and U.S. Environmental Protection Agency regions.	12/31/12	Technical Update

P51.005 Trace Metals at Substations: Analysis, Modeling, and Remediation (069221)

Key Research Question

Arsenic-containing, broad-spectrum herbicides were applied to substation soils from the 1940s to the 1970s, resulting in thousands of contaminated substation sites. In many cases, the contamination is limited to the soil; in some cases, groundwater has been contaminated. EPRI is investigating the results of this practice by developing approaches to assessing and remediating the contamination and to assessing and communicating human health and financial risks from contaminated sites. Routine practices at substations may have generated lead and zinc contamination, most commonly limited to the soil. EPRI will investigate approaches to assessing and remediating the contamination and to assessing and communicating human health and financial risks resulting from lead and zinc contamination.

Approach

Promising remedial techniques, both *in situ* and *ex situ*, are being identified, investigated, and demonstrated. Factors that affect risk to human health and the environment, such as bioavailability, are also being investigated. This project will

- develop an increased understanding of and an improved ability to predict the risks and behavior of metals in the environment,
- investigate the availability of a variety of remedial techniques applicable across different soil types,
- reduce site investigation and cleanup costs, and
- help members manage their environmental and financial risk related to contaminated substations.

Impact

- Reduces costs for site investigation and remediation by developing approaches to cleaning up contaminated substations
- Reduces environmental and human health risks associated with metals-contaminated groundwater
- Reduces costs to manage company environmental and financial risk related to arsenic and other metals at substations
- Saved several million dollars for one company by demonstrating to its state agency that monitored natural attenuation was an appropriate option for several sites

How to Apply Results

Scientists and engineers will use the results of bioavailability studies on arsenic to inform development of regulations, to assess sites and simulate migration, to negotiate site cleanup endpoints, and to communicate with all stakeholder groups, including regulators and members of the public. Engineers and scientists will use the results of remediation studies to prepare and implement action plans for contaminated sites. As new information, products, and tools are developed, program participants will have first access and will apply

results to their environmental decisions. Working with participating utility company scientists and engineers, EPRI staff may communicate directly with regulators or with members of the public.

2010 Products

Product Title & Description	Planned Completion Date	Product Type
Evaluating Biototoxicity/Bioavailability of Arsenic: Several <i>in vivo</i> models to quantify the bioavailability of arsenic have been developed. This work will consider <i>in vitro</i> models that simulate the human digestive system and will evaluate their validity and reliability across a variety of substation soils.	12/31/10	Technical Update
Remediating Arsenic in Soil and Groundwater: Innovative methods for remediating arsenic contamination at substations have been identified and will be discussed in a workshop.	12/31/10	Workshop, Training, or Conference

Future Year Products

Product Title & Description	Planned Completion Date	Product Type
Remediating Arsenic in Soil and Groundwater: Remedial approaches, such as <i>in situ</i> chemical fixation, will be tested at bench and pilot scales.	12/31/11	Technical Update