2019 ITRC Project Proposal Template

Due by July 13, 2018 to Patty Reyes at preyes@ecos.org
Proposals longer than 5 pages will not be accepted. Replace descriptions in each category with proposal response & refer to evaluation criteria prior to completion.

1,4-Dioxane Proposal

Proposal Date

7/13/18

Proposal Contacts

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Proposal Summary

Problem Statement:

Since the 1950's, 1,4-dioxane (DX) has seen widespread use as a stabilizer in chlorinated solvents, with more than 95 percent of its production in the 1970s being used as an additive to 1,1,1-trichloroethane (Mohr, Stickney and DiGuiseppi, 2010). This usage, coupled with the widespread use of chlorinated solvents from the 1950s to the 1980s, suggests that DX may be present at thousands of solvent sites in the United States alone. In addition to being used in the industry workplace, DX can be found in numerous household products including shampoos, dish and liquid soap, cosmetics, and recently as an indirect food additive. Sources containing DX are released into surrounding environment through wastewater discharge, unintended spills, leaks, and historical disposal practices of host solvents and manufacturing waste products. Because it is not a standard compound in typical analytical suites run on hazardous waste sites, it is often overlooked as a contaminant of potential concern. However, observations at over 100 impacted sites suggest DX is likely to be present in groundwater at concentrations and locations comparable to those for chlorinated volatile organic compounds

(Adamson et al., 2014). Additionally, DX was identified in the Unregulated Contaminant Monitoring Rule sampling program, which occurred under the Safe Drinking Water Act from 2013 through 2015 (EPA, 2016), as being present in approximately 7 percent of US drinking water supplies, providing water to nearly 90 million Americans.

These widespread occurrences, coupled with a recently heightened awareness of drinking water issues among the news media and the public, suggest that DX will be identified as a contaminant of concern (COC) at an increasing rate in the near future. In 2016, 1,4-Dioxane (DX) was one of the ten chemical substances subject to chemical risk evaluation under the Toxic Substances Control Act. In 2017, the U.S. EPA classified DX as "likely to be carcinogenic to humans" at levels of 0.35 parts per billion (EPA IRIS 2013). In order to address DX, some states have devised health standards while others have regulatory guidelines for drinking water standards. Remaining states have yet to implement standards or regulatory guidelines for DX. All states greatly lack guidance as they move into drinking water regulations and health advisories. States have expressed a major need for input on how to detect, monitor, and remedy DX.

DX has a combination of chemical characteristics, low sorption potential and miscibility, that allows it to easily spread and poses challenges for remediation. As a result, DX is one of the most mobile organic contaminants, making the expansion of remedial technologies and monitoring networks essential.

Technical Knowledge and Regulatory Barriers:

Characterization of DX sites poses challenges on several fronts. First, 1,4-dioxane is not detected using standard volatile organic compound analytical methods, therefore most solvent sites are unaware of the high likelihood of impacts from this compound. Second, there are no field screening methods (e.g., photoionization detector) that are appropriate for assessing the level of contamination at a site without fixed laboratory analysis. This leads to slow progress in investigation because of analytical turnaround times. Third, lab analytical methods are plagued by the difficulty in separating the DX from the water samples due to its miscibility and low Henry's Law coefficient. As a result, method detection limits are often too high to meet the low standards, especially the sub-part per billion standards being promulgated in some states. Fourth, DX's miscibility and low sorption to organic matter in soils leads to very high mobility. Plumes as long as 7 miles have been documented. This poses challenges for sites late in their lifecycle where outer wells have been abandoned and may need to be redrilled to understand the nature and extent of DX, which can easily be present above standards at greater distances than the host chlorinated solvent from which it was released.

The compound is not treated well by traditional groundwater treatment commonly (and cost effectively) applied at chlorinated solvent sites, such as carbon adsorption, air stripping, zero-valent iron chemical reduction, and anaerobic biostimulation. Therefore, at contaminated sites where DX is newly discovered, existing remedies will need to be supplemented or replaced and, at newly discovered sites, the selection of treatment technologies will be driven by the presence of DX. Notwithstanding these issues, there are a number of technologies that have been successfully implemented for DX groundwater treatment (DX is rarely a soil source area problem):

- Extraction and Ex Situ Treatment (e.g., Pump-and treat)
    - Oxidation processes using hydrogen peroxide with ultraviolet light or ozone
    - Synthetic adsorptive media (e.g., Ambersorb 563)
    - Fixed-film, moving bed biological treatment system (e.g., Bioreactors)
    - Bio-Granular activated carbon (Bio-GAC)
- In Situ Chemical Oxidation
    - Iron or Alkaline activated sodium persulfate
    - Peroxone (ozone + peroxide)
    - Potassium permanganate
    - Fenton's chemistry (iron activated hydrogen peroxide)
- In Situ Biological Solutions
    - Cometabolic biodegradation (e.g., butane, isobutane, propane addition)
    - Metabolic biodegradation (e.g., oxygen and nutrient addition)
    - Bioaugmentation with DX-degrading bacteria (pseudonocardia dioxanovorans)
- Other approaches
    - Electrical resistance heating
    - Phytoremediation
    - In-well combined treatment technologies (sparge, bioenhancement)

Summary and Schedule of Deliverables (primary project product(s))

Over the course of its 24-month span, the team will develop:

(1) Four Fact Sheets (or more)

(a) Review of Detection Technologies

(b) Remediation Monitoring

(c) Regulatory Summary

(d) Risk Communication

(2) Tech Reg Document

(3) Training

(4) Surveys and Case Studies

The primary targeted users of these documents and training will be state and federal personnel in regulatory programs tasked with characterizing and remediating state, UST owners, and for programs that are developing strategies to address this set of emerging contaminants. We also expect consultants to use the products as well as stakeholders and the regulated community.

Deliverable	Schedule
Team Kick-Off	January 2019
Draft Fact Sheets	March - July 2019
External Review Draft Fact Sheets	May - August 2019
Finalize Fact Sheets	June - October 2019
Outline for Tech Reg Document - Fall Meeting	October 2019
Rough Draft Tech Reg Document	April 2020
Internet-based Training Preparation	April - December 2020
Final Tech Reg Document	November 2020
Final Training Course	December 2020

Proposed Team Composition

Many states have regulatory guidelines or health standards in place, and would be interested in this proposal, including Alaska, California, Colorado, Connecticut, Delaware, Florida, Indiana, Maine, Massachusetts, Mississippi, New Hampshire, New Jersey, New York, New Hampshire, North Carolina, Pennsylvania, South Carolina, Texas, Vermont, Washington West Virginia

The areas with major contamination in tap water are Cape Fear River Basin in NC, southeastern Los Angeles County, and Long Island NY.

Industry members with known interest include the Water Research Foundation, CH2M – Jacobs, Langan, EDF, and the Environmental Working Group.

The following academic institutions are involved with SERDP 1,4-Dioxane research and will be solicited for support: Michigan State University, UCLA, Oregon State University, University of Iowa, Arizona State University, and Rutgers State University.

Government Agencies that work on 1,4-Dioxane and will be solicited for support are: California Water Resources Board, DTSC, EPA/ORD, CDC, DOD (SERDP-ESTCP), FDA, and the Agency for Toxic Substances & Disease Registry.

Identification of Potential Funding Sources

Potential funders include EPA/ORD, USACE, and USGS