



# **2014 ITRC PROJECT PROPOSAL**

## **Remediation Projects Only**

### **Risk Based Decision Making at Petroleum Contaminated Sites**

**PROPOSAL DATE: June 15, 2013**

#### **Proposal Contact**

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#### **Proposals Topical Area**

CHAR/CONT Characterization / Contamination

#### **Proposal Summary**

This ITRC project proposes to review and update methods used for evaluating risk and establishing cleanup requirements at petroleum contaminated sites. Methods used currently by the majority of states were developed prior to 1998. New studies, technologies, and risk assessment methodologies have been developed from 2000 through 2013, however very little current guidance has been developed. First and Second tier cleanup levels adopted into regulations in many states vary by up to several orders of magnitude. Approaches to risk based corrective action (RBCA) also vary widely.

The most definitive work on risk based methods was by The Total Petroleum Hydrocarbon Criteria Working Group (TPHCWG), which was formed in 1993 and released a series of definitive guidance documents from 1996 – 1998. The group's purpose was based on the observation that widely different clean-up requirements were being used by states at sites that were contaminated with hydrocarbon materials such as fuels, lubricating oils, and crude oils. These requirements were usually presented as concentration of total petroleum hydrocarbon (TPH), and ranged from 10 to over 10,000 mg TPH/kg soil.

Members of this multi-disciplinary group, consisting of representatives from industry, government and academia, jointly recognized that the numerical standard was not based on a scientific assessment of human health risk and established the following goal for the effort:

“To develop scientifically defensible information for establishing soil cleanup levels that are protective of human health at hydrocarbon contaminated sites.”

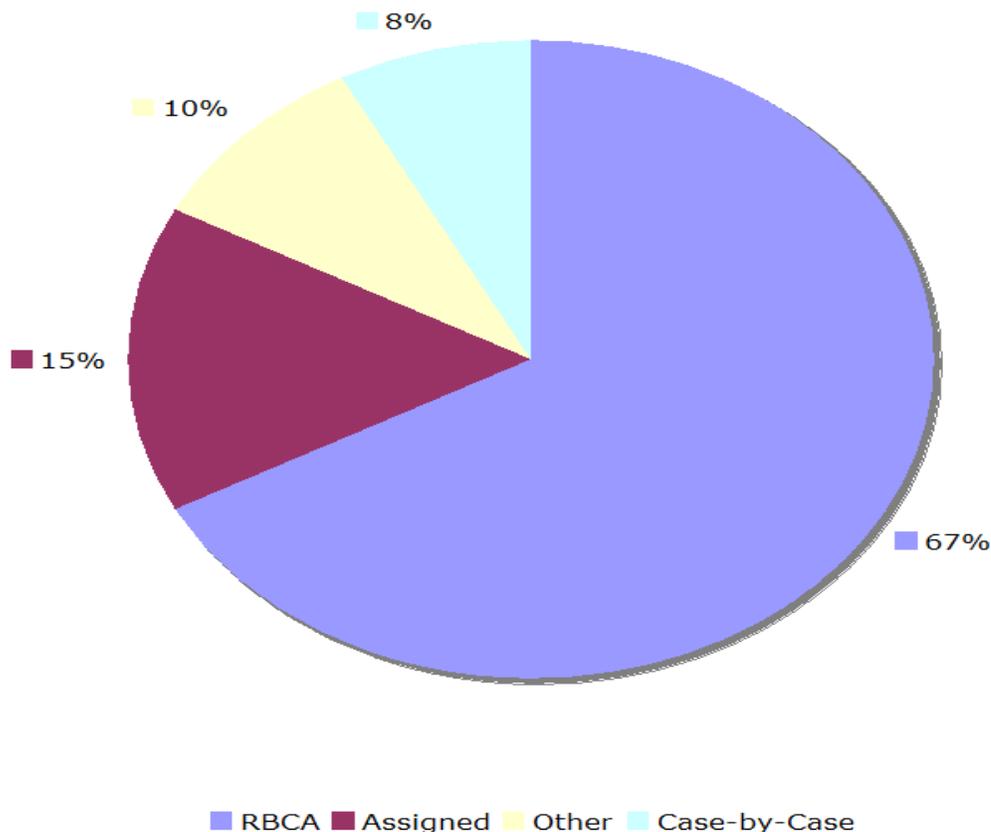
The approach developed by the TPHCWG for TPH hazard assessment consisted of dividing the petroleum hydrocarbon material into multichemical-containing fractions with similar fate and transport characteristics. These fractions were then assigned fate and transport properties (volatilization factor, soil leaching factor, etc.) and toxicity values (RfDs/RfCs) representative of

the fraction. The actual site specific hazard assessment and derivation of cleanup levels is accomplished by analyzing sites to determine which fraction(s) is present and applying the appropriate fate, transport and toxicity factors.

The method developed by this group to determine TPH Fraction specific toxicity criteria is a surrogate approach intended to supplement the indicator approach. Indicators are single, carcinogenic hydrocarbon compounds which are evaluated/regulated individually at either the federal or state level. The TPHCWG surrogate approach utilized all appropriate fraction specific toxicity data (single compound and mixture/product), minus the carcinogenic indicator compounds, to derive the fraction specific RfDs and RfCs. This hazard assessment method for petroleum contaminated sites would be utilized where indicator compounds are not present or are below/remediated to regulatory action levels. Toxicity RfDs/RfCs for all of the model fate and transport based fractions were presented in the group's findings.

From 1999 to 2013 most states and Canada adopted some variation of the risk based approach to regulating petroleum releases. Early adopters were Massachusetts, Washington, Oregon, and Alaska. Many other states have referenced these state's methods or calculators.

### Regulatory Approach to Cleanup Levels



Source: ADEC 2011 Draft Report

In 2011 the Alaska Department of Environmental Conservation (ADEC) surveyed all 50 states and Canada to determine how other states were regulating petroleum releases at contaminated sites. An Internet survey was followed up by individual phone contacts with regulators, and identified three basic approaches to the establishment of regulatory cleanup levels for petroleum hydrocarbons. Approximately 67% of those surveyed established cleanup levels using a Risk-Based Corrective Action (RBCA) methodology, 13% percent directly assigned cleanup levels by regulation (Assigned), and 8% established cleanup levels determined solely on a case-by-case basis (Case-by-Case). A fourth category of 'Other' is established to include those states whose cleanup level approach is not replicated by other states (10%). The problem of inconsistent regulatory levels was readily apparent in the individual state's "Tier 1" approaches, which apply to most smaller releases:

- TPH cleanup levels ranged from 50 mg/kg (OK) to 4,100 mg/kg (AZ)
- GRO cleanup levels ranged from 3.1 mg/kg (OH) to 1,500 mg/kg (UT)
- DRO cleanup levels ranged from 2.7 mg/kg (OH) to 5,000 mg/kg (UT)
- RRO (ORO) cleanup levels ranged from 99 mg/kg (TX) to 10,000 mg/kg (UT)

In 2009 EPA released provisional peer reviewed toxicity values (PPRTV) for several types of petroleum fractions. These were published through their risk assessment databases. These values are significantly different from the values published by the TPHCWG in 1999. Some fractions of petroleum compounds are now considered to be an order of magnitude more toxic than they were in 1999, resulting in possible risk based cleanup levels that are 1/10 current levels. As states consult this information guidance is needed on how to apply it.

An ITRC project to revisit the work of the TPHCWG will help states develop consistent methodology for establishing risk based tiered cleanup levels and for establishing and approving methods for risk based corrective actions.

The project team will require integration and discussion by the following disciplines:

- Risk Assessors
- Toxicologists
- Analytical Chemists
- Site Investigation, Sampling, and Remediation professionals and engineers
- Hydrogeologists
- Regulatory Agencies

Individuals representing each of these disciplines have indicated interest in serving on the working group. Several of these individuals were involved in the 1993 – 1999 TPHCWG effort.

The following technical areas and regulatory barriers will be addressed by this project:

- Evaluate RBCA as currently implemented in ASTM and various other standards organizations.
- Fractionation approach (revisit petroleum fractions used to determine risk)
- Oxygenated Compounds in weathered petroleum contaminated sites (fractions & breakdown products/polar compounds), impact on Toxicity Values used, Impact on Analytical Methods.
- Revisit TPHCWG (and MADEP) Analytical Methods (EPH/VPH)

- Appropriate Toxicity Values for Each Fraction using updated studies
- Indicator Compounds and Surrogate Compounds used to evaluate risk
- Evaluating the Risk of Mixtures using current risk assessment methodology
- Compounds dissolved in fuel releases (e.g. TCE, etc)
- Metals commonly associated with petroleum releases
- Risk Drivers (Cleanup Decisions to target specific compounds or mixtures)
- Cumulative Risk Calculations – revisit equations & factors for mixtures and combinations of compounds
- Modeling Techniques (Bioscreen, Sesoil, Modflow & Others, fate & transport, etc.) for mixtures in Soil and Groundwater
- Modeling Techniques for Indoor & Outdoor Air (Build on PVI Guidance)

The 3 year schedule below would be a reasonable approach:

- 2014 – Team-building, collecting data and information using surveys, case studies, and literature review to identify and evaluate regulatory approaches, technology used for characterizing risk of petroleum, and real site practices at petroleum contaminated sites. Several states have generated information similar to the ADEC report described above. A summary of regulatory approaches and a list of issues similar to those described above will help direct the development of guidance documents.
- 2015 –Use this information and data to evaluate and provide an overview of technologies required for risk based decisions, including but not limited to, project planning, sampling soil, sampling groundwater, characterizing source areas and dissolved phase contaminated areas, monitoring attenuation, statistical analysis, determining toxicity and assessing risk.
- 2016 – Develop a Tech-Reg guidance document and associated Internet-based training curriculum that describes a defensible approach to determining risk at petroleum contaminated sites.

## Proposed Personnel

**Team Leaders:** (TBD), John Mennati (UT) and Roger Brewer (HI) have indicated interest,

**States indicating interest:**

AK – Fred Vreeman (POC and regulatory manager for Federal Sites); CA – Tom Booze (published a review of petroleum range toxicity values); WA – Hun Seak Park (ECY - developed the Washington 4 phase calculator); OR – TBD (Mike Poulsen helped develop Oregon RBDM Calculator) UT – John Mennati (worked on PVI tox issues). Many other states have interest in the topic as well.

**DoD components:**

USAF funded implementation of Alaska’s risk based decision making calculator by paying for consultant training and other development costs. ACOE has a significant interest in development of this guidance as well. DLA (Defense Logistics Agency) has indicated interest but does not have a funding mechanism for it. US Army originally funded the 4 phase modeling research in Alaska and will be interested in this effort.

## **Federal Agencies:**

FAA (Dept of Transportation) funded development of a series of papers for the “Statement of Cooperation” working group in Alaska. These documents update the TPHCWG information. This effort led to development of a “Hydrocarbon Risk Calculator” approved in 2011.

USGS worked with various parties in 2002 to attempt characterization of risk in contaminated aquifers.

Dept of Interior (BLM, USFWS & NPS) are involved in numerous cleanups, and Dept of Agriculture (USFS & others) also has an extensive cleanup program.

EPA offices that should be involved are the RSL group in several regions.

## **Industry:**

API, and the individual Petroleum industry companies, are keenly interested in developing risk based approaches to remediation at petroleum sites.

## **Summary of Deliverables (primary project product(s))**

This guidance will provide:

- A consistent framework based on RBCA for risk based decision-making at a typical petroleum contaminated site, covering conceptual site model, investigation and sampling, characterization of contaminated areas and media, characterizing concentrations, assessing human health and ecological risk, and developing cleanup objectives
- Identify appropriate technologies and important data to collect so that defensible risk based decisions can be made.
- Discuss and provide sources of information on toxicity values and appropriate methods to assess the risk of petroleum mixtures found at contaminated sites.
- Improved State technical oversight based on detailed requirements for application of an acceptable risk assessment strategy at petroleum sites.

## **Targeted Users**

- Regulatory staff, staff and managers from all state environmental, public health, and remediation programs
- Regulatory staff and managers from Federal environmental, public health, and remediation
- Site owners and “Responsible Parties”
- Federal Agencies cleaning up Petroleum Contaminated Sites owned by the Federal Government
- Remediation and Cleanup consultants and Engineers
- Public stakeholders at the local, tribal, and community level
- Academics interested in using or developing science-based approaches to assess risk of petroleum contamination