

**GENERAL PROTOCOL  
FOR  
DEMONSTRATION  
OF  
IN SITU BIOREMEDIATION TECHNOLOGIES**

previously released as  
**Protocol Binder and Resource Document  
of ITRC's  
In Situ Bioremediation  
Technology Specific Task Group**

**- Revised FINAL -**

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## EXECUTIVE SUMMARY

*In situ* technologies rely on the capabilities of indigenous or introduced microorganisms to degrade, destroy or otherwise alter objectionable chemicals in soils or ground water. These technologies can be applied to soils or deep sediments and in arid or wet regions. *In situ* bioremediation is a class of technologies as variable as the subsurface itself. The In Situ Bioremediation Technology Specific Task Group (ISB Group), a subgroup of the ITRC, recognized that given appropriate conditions, *in situ* technologies can remediate contaminants more cost effectively than conventional technologies.

The ISB Group developed a General Protocol and Outline for the general class of *in situ* bioremediation technologies plus conducted detailed literature reviews of technology-specific protocols for “Natural Attenuation” and “Bioventing” of petroleum hydrocarbons. These protocols have been developed by Federal agencies, contractors and industry. The use of this document is intended to offer the proponent of the demonstration multi-state and tribal (regulatory) acceptance of the data generated during the demonstration project. It also offers an early opportunity for tribal and stakeholders to understand the intent of the demonstration and discuss their concerns and sensitivities with the proponent before the demonstration is in its final design.

The ISB Group knows, through experience, that acceptance of a technology by multiple states and state agencies, tribes (as regulators or stakeholders), and local communities requires an organized collective process. In the “General Protocol” the ISB Group defined categories of responsibilities for participants in a multi-state demonstration. These participants might include the state or tribal regulatory agency hosting the demonstration, other states interested in the technology, the proponent, other tribal governments and stakeholders. Each have identified responsibilities during three phases of the technology demonstration process. Phase One identifies the specific parties by name, Phase Two designs the demonstration and Phase Three implements the demonstration and reports the results. These responsibilities are clearly defined in Table 1 of the General Protocol.

The “General Outline” to the General Protocol contains the essential elements of an *in situ* bioremediation (ISB) demonstration. It provides guidance to the proponent during the development of the initial demonstration proposal. While following this guidance, the proponent of the demonstration project should include enough detail that the states or tribal regulatory agency (host and participating) can identify; the applicable regulatory requirements for the project, the innovative nature of the project, and the advantage this project might have over other conventional technologies. It should also contain enough information so that stakeholders, tribal governments and states can identify any sensitivities they may have with this technology.

The ISB Group is comprised of representatives from 15 states, the Federal government, industry, and representatives from an environmental and other non-profit groups. Members of the larger ITRC working group, which include community and tribal representatives, offered comments and guidance throughout the development of the General Protocol. Thus, the “Protocol Binder and Resource Document” reflects the input of many sectors of our society interested in site cleanup.

Through its collective experience, and depth of representation, the ISB Group found several issues pertinent to *in situ* bioremediation. These issues, as summarized by the ISB Group, are as follows.

- ◆ Cleanup levels, and the approaches used by various jurisdictions to derive those numerical criteria, vary among state and federal agencies. Although a single set of concentration based cleanup levels cannot be developed to apply to all jurisdictions, it is recommended that a work group be established to formulate policy recommendations for changes that encourage consistency in approach, if not numerical criteria.
- ◆ Factors beyond the jurisdiction of the state regulatory agencies often dictate the type of remedial technology that is deployed. These factors include addressing the concerns of participants in real estate transactions and the financial institutions lending on such transactions and the public's opposition and fear of a technology. These pressures often discourage the deployment of cost-effective techniques and technologies, particularly natural attenuation and bioventing, and thus reduce the potential market for affordable remedial measures. The governors need to consider means of addressing the concerns of these non-regulatory entities in order to broaden market acceptance of many affordable remedial options, as well as encourage the free market to continue to develop remediation techniques and technologies.
- ◆ Natural attenuation for petroleum hydrocarbons, particularly benzene, toluene, ethyl benzene and xylene, is well demonstrated as a remedial option for groundwater. Governors should require that for all sites where remediation is deemed necessary, particularly fuel tank sites, the appropriate agencies should evaluate natural attenuation as a remedy, referencing their agencies to consider the ITRC work-product concerning this topic and the various technical guidance documents and references now available in the literature.
- ◆ Bioventing is a cost-effective *in situ* technology which reduces petroleum hydrocarbon contamination by accelerating natural biological conversion processes. Where remediation of soils is deemed necessary, particularly for leaking underground fuel sites overseen by state agencies, the use of bioventing should be encouraged as a remedial measure.