

# **Groundwater, Surface Water, and Sediment Assessments Required by EPA/World Bank/Equator Principles: Findings from US and International Projects**

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**Background/Objectives.** The authors were retained either to help assess and remediate international industrial sites or alternatively to serve as third party reviewers to verify compliance with the applicable protocols and regulatory guidance. The objective of our paper is to discuss what some refer to as “international standards” that are typically based on EPA Brownfield guidance, World Bank standards, or Equator Principle protocols. An overview and summary of the best practice for characterizing the ground water sediment surface water interactions and selecting a remedial strategy are given based on two previous projects. The focus is on the technical aspects of the guidance and standards and their importance, and the lessons learned from both their misapplication and their successful utilization in the case studies.

**Approach/Activities.** The evolution of international guidance is summarized with a focus on recent updates, relevant to deep water blowouts. The Deep Water Horizon impact on shoreline and wetland sediments and their impact on ground water are compared with a refinery plume impact on ground water, coastal sediments and bay surface water quality and the ecological end points for evaluating the impacts. These two case studies are presented in more detail to illustrate the steps involved, the type of field data gathered and the limitations of some historical practices, the benefits of current technologies, and the importance of adequate sediment water interface interactions, including the scientific principles of the advanced site investigation technologies applied, based on the migration and exposure pathways associated with each project as well as best remedial strategies. An illustration of the newer protocols is also given in the context of redevelopment of former PEMEX properties.

**Results/Lessons Learned.** For each of the case studies presented, the results from the utilized investigation, risk assessment and remediation technologies are presented. Results are also presented for “before” and “after” (initial) remediation. The data are from publicly available sources and reflect the authors’ experience and illustrate the utility of the latest technologies available.