

1 Introduction

Capping is a commonly selected approach for the remediation of subaqueous contaminated sediments. Capping involves placing clean layers of sand, sediments, and/or other material over contaminated sediments to mitigate risks posed by those sediments. Capping can be used as a stand-alone remedy or in combination with other remedial technologies (e.g., removal monitored natural recovery). Caps are primarily designed to isolate contaminants in the underlying sediments from the overlying aquatic system to reduce bioavailability, mobility, and/or toxicity of contaminants, and are effective in the long term if they are physically stable, provide sufficient physical separation between underlying contaminated sediments and potential receptors, and maintain long-term chemical isolation of contaminants to achieve the target remedy objectives. Several previous guidance documents (United States Environmental Protection Agency [USEPA] 2005; Interstate Technology and Regulatory Council [ITRC] 2014; M. Palermo, Maynard, et al. 1998) have identified the following performance objectives or functions for caps depending upon the cause of exposure and the associated risk at a site:

- *Stabilization* of contaminated sediments to prevent resuspension and transport of contaminants to other sites. To avoid confusion with in situ stabilization/solidification of sediments, this guidance refers to this function as physical stabilization or physical stability.
- *Chemical isolation* of contaminated sediments to reduce migration and release of contaminants from interstitial waters of the underlying sediment.
- *Protection of the benthic community* to prevent it from interacting with and processing the underlying contaminated sediments.

The ITRC's 2014 Contaminated Sediments Remediation guidance document (ITRC 2014) presents a contaminated sediment remedy selection framework intended to assess whether capping may be appropriate for meeting the targeted remedy objectives at a given site. The guidance in this document supplements the 2014 Contaminated Sediments Remediation guidance document (ITRC 2014) by providing more details regarding the design, construction, and long-term monitoring of the chemical isolation function of caps. Although other factors, such as physical stability and habitat protection, are important considerations in the cap design, these factors are not the subject of this guidance, except in instances where they may directly affect the chemical isolation performance.

This guidance is organized into the following sections:

- Section 2 (Capping Overview) provides additional details on the objectives of capping, particularly the chemical isolation function of the cap. This section summarizes the typical cap layers and configurations that can be used for the contaminated sediment sites. Additionally, this section presents a recommended process for chemical isolation design, construction, and post-remediation monitoring and maintenance.
- Section 3 (Performance Objectives and Design Concepts) discusses a framework for selection of chemical isolation performance targets, describes chemical characteristics and transport mechanisms in sediment, and discusses the establishment of design life objectives and design criteria based on the site characteristics and conceptual site model (CSM). This section also summarizes the typical design constraints and advises the user to consider construction and monitoring aspects of the remedy in the chemical isolation design process.
- Section 4 (Chemical Isolation Design Data Needs) presents a list of key data requirements for designing and evaluating the chemical isolation layer (CIL) of a sediment cap.
- Section 5 (Chemical Isolation Layer Modeling) summarizes the use of models in the sediment cap design, lists the models that are currently available for chemical isolation evaluation, and discusses the functionality of these models, including uncertainty and sensitivity analyses.
- Section 6 (Chemical Isolation Construction Considerations) presents an overview of currently available placement methods and tolerances, the key factors that should be considered during the chemical isolation construction, and the quality assurance (QA) and quality control (QC) measures that should be implemented during construction to verify proper placement of CIL per the design requirements.
- Section 7 (Monitoring and Maintenance Objectives and Approaches) discusses the monitoring and maintenance objectives to be used when evaluating the performance of sediment cap for chemical isolation. This section summarizes the recommendations for monitoring methods, timeframes, and interpretation of the data collected during the long-term monitoring.
- Section 8 (References) lists the references cited in this document.

Appendices A through F present supporting information to aid the chemical isolation design, construction, and/or monitoring approach selection.