Designation: D5745 – 23

Standard Guide for Developing and Implementing Interim and Early Actions for Waste Contamination Site Remediation[1]

This standard is issued under the fixed designation D5745; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope*

1.1 The purpose of this guide is to assist practitioners in the development, selection, design, and implementation of interim, short-term, or early action remedies undertaken at sites of waste contamination for the purpose of managing, controlling, or reducing risk posed by environmental site contamination. Early action remedies and strategies are applicable to the management of other regulatory processes (for example, state underground storage tank (UST) programs are equally applicable) in addition to the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)/ National Oil and Hazardous Substances Pollution Contigency Plan (NCP) process. This guide identifies and describes a standard process, technical requirements, information needs, benefits, and strategy for early actions.

1.2 This guide is applicable to both nonhazardous and hazardous sites of contamination as defined by CERCLA as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA) and the Resource Conservation and Recovery Act (RCRA) as amended by the Hazardous and Solid Waste Amendments (HSWA) of 1986.

1.3 To the extent that this guide may be used for hazardous materials operations, it does not address the applicability of regulatory limitations and local requirements.

1.4 *This guide offers an organized collection of information or a series of options and does not recommend a specific course of action. This document cannot replace education or experience and should be used in conjunction with professional judgment. Not all aspects of this guide may be applicable in all circumstances. This ASTM standard is not intended to represent or replace the standard of care by which the adequacy of a given professional service must be judged, nor should this document be applied without consideration of a project's many unique aspects. The word "Standard" in the title of this document means only that the document has been approved through the ASTM consensus process.*

1.5 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.6 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D653 Terminology Relating to Soil, Rock, and Contained Fluids

D3740 Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction

D6235 Practice for Expedited Site Characterization of Vadose Zone and Groundwater Contamination at Hazardous Waste Contaminated Sites

E1689 Guide for Developing Conceptual Site Models for Contaminated Sites

E1739 Guide for Risk-Based Corrective Action Applied at Petroleum Release Sites

E2081 Guide for Risk-Based Corrective Action

E2616 Guide for Remedy Selection Integrating Risk-Based Corrective Action and Non-Risk Considerations

2.2 *USEPA DocumentsAvailable from United States Environmental Protection Agency (EPA), William Jefferson Clinton Bldg., 1200 Pennsylvania Ave., NW, Washington, DC 20460, http://www.epa.gov.*

Guidance for Performing Preliminary Assessments under CERCLA, September 1991, EPA/9345.0-01A

Guidance for Performing Site Inspections under CERCLA, September 1992, EPA/9345.1-05

[1] This guide is under the jurisdiction of ASTM Committee D18 on Soil and Rock and is the direct responsibility of Subcommittee D18.21 on Groundwater and Vadose Zone Investigations.

Current edition approved July 1, 2023. Published July 2023. Originally approved in 1995. Last previous approved in 2015 as D5745 – 15. DOI: 10.1520/D5745-23.

[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

***A Summary of Changes section appears at the end of this standard**

Data Quality Objectives for Remedial Response Activities: Development Process, EPA/540/G-87/003

RCRA Corrective Action Interim Measures Guidance, Interim Final, June 1988, EPA/9902.4

RCRA Corrective Action Plan (Final), May 1994, EPA/9902.3-2A

3. Terminology

3.1 *Definitions*—For definitions of common technical terms in this standard, refer to Terminology D653.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *applicable or relevant and appropriate requirements (ARAR)*—those requirements, cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that show either a direct correspondence or address problems or situations sufficiently similar at a site to show that they are well suited for application.

3.2.2 *conceptual site model (CSM), n*—a written or pictorial representation of the physical system and the iterative characterization of the physical and chemical processes and conditions that affect the transport of contaminants from sources through environmental media to receptors or potential receptors (see Guide E1689).

3.2.3 *contaminant, n*—any substance potentially hazardous to human health or the environment present in the environmental media of concern, and for which there exist regulatory limits.

3.2.4 *early action, n*—a remedial plan initiated in advance of a complete or final characterization of a contaminated site.

3.2.5 *final remedy, n*—complete site restoration.

3.2.6 *interim action, n*—a remedial action that implements a partial solution prior to the selection of a final remedy.

3.2.7 *migration, n*—the movement of contaminant(s) away from a source through permeable subsurface media (such as the movement of a groundwater plume of contamination) or the movement of contaminant(s) by a combination of surficial and subsurface processes.

3.2.8 *potential migration pathway, n*—the route that may be taken by contaminants in the environment as they move or are transported from the source(s), usually in a downgradient direction.

3.2.9 *receptor, n*—humans or other species potentially at risk from exposure to contaminant(s) at the point(s) of exposure.

3.2.10 *release, n*—any spilling, leaking, pumping, emitting, emptying, discharging, injecting, escaping, leaching, dumping, and disposing into the environment (including the abandonment or discarding of barrels, containers, and other closed receptacles) of any hazardous substance.

3.2.11 *removal, n*—immediate, short-term measures intended to protect people from immediate threats posed by contaminants.

3.2.11.1 *Discussion*—Examples are handling, transport, and off-site disposal of sources or potential sources.

3.2.12 *size characterization, n*—the process by which information relating to the nature, extent, potential migration pathways, and receptors of environmental contaminants is gathered, interpreted, and documented.

3.2.12.1 *Discussion*—Site characterization efforts to provide a basis for the following: (*1*) the development of a conceptual site model (CSM), (*2*) the selection and design of a site remediation plan, or (*3*) the measuring point against which the effectiveness of a remedy can be evaluated, or some combination thereof (see Practice D6235).

3.2.13 *site remediation, n*—those actions taken in the event of a release or threatened release of a hazardous substance into the environment, to prevent or minimize the impact of the release, or to mitigate a substantial hazard to present or future environmental conditions.

3.2.13.1 *Discussion*—This early action may or may not lead to ultimate restoration of the site.

3.2.14 *source, n*—the location at which contamination has entered the natural environment.

4. Summary of Guide

4.1 The basic activities associated with implementing an interim or early action are as follows: (*1*) construction of a CSM and estimation of risk(s); (*2*) identification of exposure control pathways amenable to engineered control; (*3*) development of partial solutions, estimation of engineered risk, and identification and negotiation of required action levels; (*4*) selection of the desired solution(s); (*5*) attainment of legal authority for implementation of the planned solution(s); (*6*) design and execution of the selected solution(s); and (*7*) post-implementation monitoring of the conceptual site model.

4.2 Five common objectives for an early action are to achieve the following: (*1*) minimize the human or environmental risk exposure, or both; (*2*) minimize the time required to implement a final remedy; (*3*) protect resources (for example, financial, mineral, and ecological); (*4*) minimize the complexity of a final remedy; or (*5*) provide a solution-oriented project focus, or combination thereof.

4.3 There are three basic types of interim or early action remedies: (*1*) source control remedies, (*2*) pathway control remedies, and (*3*) receptor control remedies. Early actions are commonly categorized as source or receptor control since pathway controls usually require a sophisticated understanding of the conceptual site model dynamics.

NOTE 1—Some examples of interim and early action remedies include: fences; site access controls; warning signs; physical security; covers; barriers; underground barrier walls; drainage controls; runoff diversion barriers; berms; dikes; impoundment areas; capping; neutralizing chemicals; removal of debris; removal of drums, tanks, containers; removal of soil or solid materials; removal of liquids; in-situ treatments; bioremediation; alternate water treatment process; provision of alternate potable water sources or supplies; and provision of alternate habitat.

4.4 The development of a final remedy is often an iterative process that evolves frequently with the compilation of new data in the CSM. Prompt development and implementation of early actions increases attainment of a project's remediation objectives.

4.5 Early actions or interim remedial measures are effective risk management tools when designed and executed properly. Some common benefits derived from early actions include: (*1*) human, ecological, and financial resources are protected; (*2*) the time required to remediate an unacceptable environmental condition is minimized or reduced; (*3*) decreased geometric magnitude or scale of an unacceptable environmental condition; (*4*) minimized complexity and scope of a final remedial solution; and (*5*) environmental projects become "solution" oriented.

4.6 A successful strategy for the application of early actions has been developed. The strategy consists of phases or steps that include:

4.6.1 Development of a potential proactive early action remedies list.

4.6.2 Identification of early action candidate sites.

4.6.3 Selection of site-specific and easily definable CSM component(s).

4.6.3.1 Establishment and prioritization of early action objectives for each CSM component.

4.6.3.2 Identification of early action alternatives to addressing each objective, anticipated or expected results and their impact on final regulations and remedy.

4.6.3.3 Selection of regulatory and public comment, as appropriate.

4.6.4 Establishment of funding for early actions.

4.6.5 Prioritization of early action solutions consistent with the objectives, public response, expected results, and funding availability.

4.6.6 Selection and integration of early action solutions.

4.6.6.1 Determination of appropriate criteria for management of early action progress and results.

4.6.6.2 Establishment of documentation and record procedures for early action and effective final remedy implementation.

4.6.6.3 Analysis of the validation approach prior to the implementation of early action.

4.6.7 Preparation and finalization of the early action remedial plan.

4.6.8 Implementation and documentation of early action activities.

4.6.8.1 Frequent and periodic validation of early action results in comparison to the early action plan and the final remedial action frequently and periodically.

4.6.8.2 Frequent and periodic review of early action activities.

5. Significance and Use

5.1 This guide is intended to provide a systematic approach for the application and execution of early actions for purposes of remediating both hazardous and non-hazardous contamination. Iterative development of a CSM is fundamental to the use of this guide.

5.2 Anticipated users of this guide are owners or operators at sites of environmental contamination; technical professionals involved in the field of environmental site characterization and remediation; environmental regulators, property owners, employees, and residents adjacent to sites of environmental contamination; and lenders, sureties, and persons of general interest within an affected community.

5.3 This guide is not intended to replace legal requirements for remediating sites of environmental contamination. This guide should be used to supplement existing regulatory guidance and to focus remedial efforts toward final remedy solutions.

NOTE 2—The quality of the result produced by this standard is dependent on the competence of the personnel performing it, and the suitability of the equipment and facilities used. Agencies that meet the criteria of Practice D3740 are generally considered capable of competent and objective testing/sampling/inspection/etc. Users of this standard are cautioned that compliance with Practice D3740 does not in itself assure reliable results. Reliable results depend on many factors; Practice D3740 provides a means of evaluating some of those factors.

6. Procedure

6.1 *Assembling Required Information*—Assemble all available information, including the following: historical records, interviews, previous studies, environmental analytical data, permits, regulatory guidance and requirements, maps, geologic cross sections, engineering infrastructure as-built plans, and drawings (see Practice D6235). At least one site visit by technical personnel tasked with the responsibility of designing and implementing an early action is required prior to the development of a remedial plan.

NOTE 3—For sites subject to USEPA CERCLA additional guidance is available by reviewing "Guidance for Performing Preliminary Assessments under CERCLA" and "Guidance for Performing Site Inspections under CERCLA."

6.2 *Development of the Conceptual Site Model*—An initial concept of the site(s) CSM should be developed using all assembled information (see Guide E1689). The quality and accuracy of all information should be assessed both quantitatively and qualitatively, and the use of the information should be focused on the following:

6.2.1 *Identification of Contaminants*—Identify the environmental contaminants for all pathways of a CSM. Particular emphasis should be placed on identifying the contaminants for any suspected exposure pathways of concern.

6.2.2 *Characterization of Background Conditions*—The natural and secondary (modified) background concentration of contaminants in all CSM pathways must be characterized or estimated in order to design a useful early action. This information is necessary in order to develop appropriate action levels, identify possible synergism, estimate environmental risk, and identify and design remedial solutions.

6.2.3 *Contaminant Source Characterization*—An understanding of contaminant source characteristics is essential in developing a successful early action remedy. At a minimum, the following source characteristics should be measured or estimated for a site:

6.2.3.1 Source location, boundaries, volume, and mass;

6.2.3.2 Hazardous constituents and their concentration at a source;

6.2.3.3 Time, duration, rate of contaminant release (both volume and mass) from a source; and

6.2.3.4 Suspected areas (three dimensional) of contaminant migration within a pathway from a point or source release.

6.2.4 *Potential Migration Pathway Characterization*—Potential migration pathways through the soil, surface water, air, and ground water must be identified and characterized primarily for each source of contamination at a site. The minimum information or characterization requirements for developing an early action for each migration pathway type is as follows: (*1*) an evaluation and estimate of the contaminant mass released and its release mechanism to a pathway, (*2*) identification of the transport mechanism and an estimate of contaminant transport rate or dispersion within a pathway, or both; and (*3*) identification of the human and ecological receptors at potential points of exposure above levels of acceptable risk on a contaminant migration pathway.

6.2.5 *Contaminant Mass Estimate*—An estimate of contaminant mass and contaminant distribution is required for developing successfully focused early action remedies.

6.2.6 *Receptor Exposure Characterization*—Estimates of the concentration and duration of both human and ecological contaminant exposure should be developed for each exposure point within a migration pathway.

6.2.7 *Estimation of Human and Ecological and Other Risk*—Early actions are engineered risk management solutions. An estimate or perception of unacceptable risk should exist before an early action is considered and developed. There are many categories of environmental risks; some examples are human and ecological risk, financial risk, community relations, etc.

NOTE 4—For site subject to USEPA RCRA additional guidance is available by reviewing "RCRA Corrective Action Plan (Final)."

6.3 *Identification of Early Action Strategy*—Most successful early actions or interim remedial measures incorporate a strategy that emphasize a technical approach that expediously balances and expedites the technical requirements and needs of a project risk and available resources (see Guides E1739 and E2081). The elements of a proven strategy for developing and implementing early actions, as summarized in 4.6, are discussed as follows.

6.3.1 *Proactive Development of Early Action Remedies*—It is important for all affected parties to provide input within the framework of a "positive" forum to identify their concerns, risks, resources, and objectives for an early action. The development and implementation of an optimum early action will be delayed unless a proactive and technically focused environment of cooperation is developed among the parties affected by environmental contamination concerns. It is especially important for time and resource critical projects to foster proactive interaction on technical issues. ASTM advocates the early solicitation and consideration of community concerns.

6.3.2 *Identification of Early Action Candidate Sites*—Not all sites of environmental contamination are appropriate candidates for early action. Sites that are dynamic and contain complex migration pathways commonly require sophisticated and detailed site characterization before sufficient technical information is available to design an appropriate interim remedy.

6.3.3 *Identification of Manageable CSM Components and Early Action Solution Alternatives:*

6.3.3.1 Each site of environmental contamination has a CSM component appropriate to manage for the control of human or ecological risk. Example of these components include: (*1*) surface water diversion and runoff control from a contaminated release area may be a useful CSM component in pathway control; (*2*) source control or removal of a contaminant release to the environment may prevent migration of contaminant mass through a pathway to a receptor; and (*3*) fencing or warning signs of hazardous contaminants. Identification of the CSM components appropriate for engineered risk management is often the most critical element for developing a successful early action. Regulatory agency involvement is recommended to communicate the evaluation of the CSM components. Early agreement to the strategy by the regulatory agencies is essential.

NOTE 5—For sites subject to USEPA RCRA additional guidance is available by reviewing "RCRA Corrective Action Interim Measures Guidance, Interim Final."

6.3.3.2 Each CSM component identified should have well-defined risk management and mitigation objectives, each with associated desired and anticipated results from the potential early action solutions. These CSM components and objectives should be prioritized as the primary basis for evaluating alternatives and desired results. To the extent practical at this stage in the strategy, the possible impact on projected final remedies should be considered while the CSM components, objectives, and expected results are being identified and prioritized.

6.3.3.3 Public participation should be solicited and evaluated whether or not legally required. Early public/citizen participation may reveal objectives and concerns in addition to technical and site issues that could jeopardize the future success of the early action unless considered in all phases of the strategy.

6.3.3.4 At many sites where early actions have been implemented, often only one potential technical remedy was considered. The identification of multiple potential technical solutions *targeted at the most appropriate CSM components* is essential if the most flexible, timely, and technically responsive remedy(ies) is to be developed for that site (see Guide E2616).

6.3.4 *Funding of Early Actions*—Few sites have been remediated successfully using early actions alone and seldom are all contaminant migration pathways and risks understood at the early stages of a remedial project, the time when many early actions are performed. For these reasons, it is advisable to identify and allocate (budget) only a reasonable portion of the available funding for early action, which is balanced between cost and risk management benefits. The available funding levels should be used to guide and focus the following steps toward a realistic early action solution. If the human or ecological risks identified in the CSM component(s) cannot be addressed adequately by available funding, other or additional funding alternatives should be considered.

6.3.5 *Prioritization of Early Action Solutions*—The alternative elements, including desired results and technical components, of a proposed early action should be prioritized by the affected parties. It is important that the prioritization be performed in a proactive fashion to ensure that most critical