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Standard Guide for Corrective Action for Petroleum Releases[1]

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1. Scope

1.1 This guide covers corrective action for petroleum releases. It describes the approach for assessment and remediation of releases to protect human health, safety, and the environment. It is intended to complement but not supersede federal, state, and local regulations, as well as complement other recommended practices on this subject (for example, NFPA 329 and API 1628).

1.2 The approach described in this guide is not the only way that a corrective action could be conducted, but experience has shown that following these guidelines will help ensure cost effective and timely remediation.

1.3 This guide is not intended to address field and site specific contractor health and safety issues. For guidance concerning contractor health and safety issues appropriate OSHA and other industry standards should be consulted. This guide does not address specific details of sample preparation or preservation or sampling quality assurance/quality control practices. For guidance concerning sampling practices see Appendix X1.

1.4 As shown in Fig. 1, assessment and remedial activities occur at many points in the corrective action process. Each round of assessment and remediation may result in additional steps until the corrective action goal has been achieved. The precise sequence and timing of these activities will depend on the site and the techniques that are used. However, the assessment and remedial activities shown in Fig. 1 may be conducted concurrently.

1.5 Once sufficient information has been gathered, remedial action can begin prior to defining the full extent of contamination. In many cases, an interim remedial action may be appropriate when contaminants are mobile. The ultimate effectiveness and the cost of remediation are often related to the migration of the contamination. Timely action will improve the effectiveness of the remediation and minimize its cost.

1.6 Regulators, consultants, contractors, owners, operators, insurance companies, and the public all need to have good communication throughout the corrective action process. Some of the forms that this communication can take are:

1.6.1 Site visits,
1.6.2 Telephone conversations,
1.6.3 Notification forms,
1.6.4 Progress reports, and
1.6.5 Project plans.

1.7 It is important to note that a report in and of itself is not communication; someone has to read and understand it for there to be communication. Reports must be complete, presenting pertinent information that is necessary to lead to an appropriate corrective action decision.

1.8 Progress reports play a key role in the communication. These reports should be clear and sufficient so that all parties involved in the remediation can understand them.

1.9 This guide is organized as follows: Section 2 lists referenced documents, Section 3 defines terminology used in this guide, Section 5 discusses how indicator compounds can be used in the corrective action process, Section 6 discusses interim remedial actions, Section 7 describes site assessments, Section 8 discusses remedial actions, Section 9 describes operation, maintenance, and monitoring requirements for remedial actions, Section 10 discusses completion of the corrective action process, Section 11 discusses a pre-excavation evaluation (PEE) option that can help identify and plan for contaminated materials that may be encountered during construction activities at UST sites, Section 12 discusses assessments associated with tank removal or abandonment, Sections 11 and 12 are specific to underground storage tank (UST) system closures. When a release is discovered and confirmed to have been caused by other means, the activities or portions of the activities described in Sections 11 and 12 may not be needed. Finally, Appendix X1 identifies additional documents related to assessment and remediation activities.

1.10 The values stated in inch-pound units are to be regarded as the standard. The SI units given in parentheses are for information only.

1.11 *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 and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *EPA Standards:*

SW 846, USEPA Recommended Analytical Procedures,

[1] This guide is under the jurisdiction of ASTM Committee E50 on Environmental Assessment and is the direct responsibility of Subcommittee E50.04 on Performance Standards Related to Environmental Regulatory Programs.

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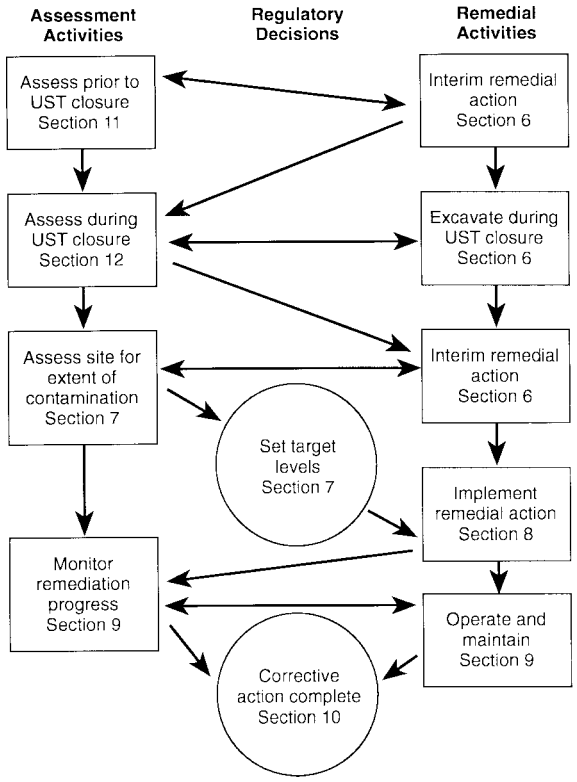

FIG. 1 Corrective Action Activities

Test Methods for Evaluating Solid Waste—Physical/Chemical Methods[2]

USEPA Publication No. USGPO 055-000-00368-8, Field Measurement Technics: Dependable Data When You Need It[2]

2.2 *API Standards:*

RP 1628, A Guide to the Assessment and Remediation of Underground Petroleum Releases[3]

RP 1629, A Guide for Assessing and Remediating Petroleum Hydrocarbons in Soil[3]

2.3 *NFPA Standard:*

NFPA 329, Leakage and Repair Safeguards for Flammable and Combustible Liquids[4]

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *corrective action*—actions taken to identify and clean up a release of petroleum. These activities include site assessment, interim remedial action, remedial action, operation and maintenance of equipment, monitoring of progress, and termination of the remedial action.

3.1.2 *corrective action goal*—the corrective action goal is to reduce levels of contamination to protect human health, safety, and the environment.

3.1.3 *natural cycle*—normally one annual fluctuation of the ground water levels. This time may differ depending on site specific and climatic conditions.

3.1.4 *pre-excavation evaluation (PEE)*—an assessment of the potential for contamination and its relative extent prior to an excavation at an UST site. A typical PEE could include the sampling of soil and ground water in the area of the UST excavation and the product dispensers.

3.1.5 *petroleum*—including crude oil or any fraction thereof that is liquid at standard conditions of temperature and pressure (60°F (16°C) and 14.7 psia (101.3 kPa)). The term includes petroleum-based substances comprised of a complex blend of hydrocarbons derived from crude oil through processes of separation, conversion, upgrading, and finishing, such as motor fuels, jet oils, lubricants, petroleum solvents, and used oils.

3.1.6 *receptors*—persons, structures, utilities, surface waters, and water supply wells that are or may be adversely affected by a release.

3.1.7 *regulatory agency*—USEPA or the designated state and local agencies responsible for carrying out the UST or other corrective action program.

3.1.8 *release*—a discharge of petroleum to the environment.

3.1.9 *remediation/remedial action*—activities conducted to protect human health, safety, and the environment. These activities include evaluating risk, making no further action determinations, monitoring, and designing and operating cleanup equipment.

3.1.10 *site assessment*—an evaluation of subsurface geology, hydrology, and surface characteristics to determine if a release has occurred, the levels of contamination, and the extent of contaminant migration. The site assessment generates information to support remedial action decisions.

3.1.11 *source area*—the source area is defined as either the location of liquid hydrocarbons or the location of highest soil and ground water contamination levels.

3.1.12 *UST closure*—the removal from the ground or decommissioning in place of an UST system, including the evaluation of the surrounding soil to determine if a release has occurred.

3.1.13 *UST system*—a storage tank and underground piping connected to the tank, that has at least 10 % of its volume below the ground.

4. Significance and Use

4.1 The purpose of this guide is to provide a logical, timely, economical framework and general sequence for site assessment and remediation activities for petroleum releases that contaminate the subsurface. However, this guide does not recommend particular techniques. Where state and local regulations exist, the intent is to provide a model to enable streamlining of the regulatory processes and to allow the corrective action to proceed in an effective manner. The corrective action goal is to reduce levels of contamination to protect human health, safety, and the environment, and to demonstrate that the impacts of the contamination have been addressed.

NOTE 1—Activities described in this guide should be conducted by a person familiar with assessment and remediation techniques.

[2] Available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

[3] Available from American Petroleum Institute, 1801 K Street N.W., Washington, DC 20226.

[4] Available from National Fire Protection Assoc., Batterymarch Park, Quincy, MA 02269.

5. Corrective Action Indicators

5.1 *Selection and Use of Indicator Compounds*:

5.1.1 Indicator compounds for sampling and analysis are easy to select when the released product is known. If, however, the type of product is unknown or more than one type of hydrocarbon product is suspected to have been released, the initial sampling and analysis should include indicator compounds for all suspected products. Once the compounds of concern have been identified, then further analysis can be limited to the identified compounds. When gasoline is the suspected release, benzene, toluene, ethylbenzene, and xylenes (BTEX) may be indicator compounds of concern. Other possible indicator compounds may be methyl tertiary butyl ether (MTBE) and tertiary butyl alcohol (TBA). When diesel, other distillates, or an unknown mixture of petroleum products is the suspected released hydrocarbon, indicator compounds may include naphthalenes and other semi-volatiles.

5.1.2 Indicator compounds in ground water and soil can be used to confirm the extent of contamination, defining the remedial action target levels discussed in 8.5, monitoring progress of the remedial action, and identifying the termination point of the remedial action.

5.2 *Field Screening Indicators*—Field screening techniques may be a cost-effective and timely assessment methodology. Field screening utilized during the assessment process may use one or more of a wide variety of qualitative or quantitative measurement techniques. The screening process includes defining the likely sources of contamination, the possible direction of contamination movement, and the likely extent of contamination. Some examples of field screening indicators are dissolved oxygen anomalies (O_2), carbon dioxide anomalies (CO_2), and volatile organics. For further information on field measurement techniques see USEPA Publication No. 055-000-00368-8.

5.3 *Indicator Compound Analysis*—The analysis of specific indicator compounds can occur in both soil and ground water. In general, analysis in soil should be limited to those compounds that are adversely affecting or are expected to adversely affect the ground water or other receptors. Unless specifically outlined by the regulatory agency, when investigating a petroleum release, the following analytical methodologies in Table 1 are commonly used and are recommended. Other methodologies or protocols that provide comparable results may be used.

6. Interim Remedial Action

6.1 *Introduction*:

6.1.1 The primary goals of interim remedial action are to mitigate fire and safety hazards and to prevent further migration of hydrocarbons in their vapor, dissolved, or liquid phase. Interim remedial action is most effective when the regulatory agency limits its oversight to being notified of the activities taken. From initial assessment through actual remediation, interim remedial action may be warranted or desired. Situations that warrant interim remedial action include the following:

6.1.1.1 Hydrocarbon vapors in occupied buildings or subsurface structures,

6.1.1.2 Dissolved hydrocarbons in drinking water wells,

6.1.1.3 Liquid hydrocarbons floating on ground water, and

6.1.1.4 Hydrocarbons apparently confined to the soils immediately adjacent to a recent release.

6.1.1.5 In addition, interim remedial action should be used in situations where it will be timely and cost effective and will not adversely affect the final remedial action plan.

6.1.2 *General Methods*—The following methods are the most common alternatives used in handling hydrocarbon-contaminated soils. Other methods may be locally competitive in both cost effectiveness and environmental compatibility. The methods may be used alone or together. (**Warning**—See Note 2.)

6.1.2.1 Liquid hydrocarbon recovery can be accomplished either by control of the ground water (ground water depression through pumping) or by passive recovery methods not requiring ground water pumping.

NOTE 2—**Warning:** Pumping ground water, pumping free product from the ground water, or sparging air into the ground water should only be used when sufficient understanding of the hydrogeologic impact of a method has been acquired or in an emergency situation. If done improperly, the plume may spread into previously uncontaminated areas.

6.1.2.2 Hydrocarbon vapor abatement can be accomplished through vapor extraction or limited source excavation.

6.1.2.3 Dissolved hydrocarbon recovery can be accomplished through ground water pump-and-treat methods or air sparging.

7. Site Assessment

7.1 *Introduction*:

7.1.1 The goals of site assessment are to determine the

TABLE 1 Recommended Analytical Methodologies

	Soil	Water
Gasoline	volatile organic aromatics using SW846 Method 8020	volatile organic aromatics using SW846 Method 8020 modified to detect MTBE and TBA
Middle distillates (for example, No. 2 fuel oil, JP4, diesel)	volatile organic aromatics using SW846 Method 8020 poly-nuclear aromatics (PNAs) using SW846 8100 (Naphthalenes)	volatile organic aromatics using SW846 Method 8020 poly-nuclear aromatics (PNAs) using SW846 8100 (Naphthalenes)
Heavier fuel oils and lubricating oil or unknown (for example, motor oil, used oil, No. 6 oil)	volatile organic aromatics using SW846 Method 8240 semi-volatile organics using SW846 Method 8270	volatile organic aromatics using SW846 Method 8240 semi-volatile organics using SW846 Method 8270