

Chapter 2 RCRA Closure and Corrective Action Program

2.0 Introduction

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This chapter presents guidance from the Indiana Department of Environmental Management (IDEM) Office of Land Quality (OLQ) for preparing Resource Conservation and Recovery Act (RCRA) closure plans, cleanup plans, and corrective action work plans to meet the requirements of [329 Indiana Administrative Code \(IAC\) 3.1](#).

Although the RISC Technical Resource Guidance Document offers a flexible generic framework for remedial activities in Indiana, certain hazardous waste rules preclude the sole use of the RISC Technical Guide as a directive in achieving RCRA closure and corrective action requirements. This chapter is intended to provide default options for achieving RCRA closure, “No Further Action” (NFA) status for corrective action solid waste management units and areas of concern, and RCRA Corrective Action Completion Determinations. RCRA Corrective Action requirements (Hazardous and Solid Waste Amendments [HSWA] of 1984) pertain to RCRA Subtitle C permitted treatment, storage or disposal (TSD) facilities, facilities that at any time had RCRA interim status, and facilities that operated without a RCRA permit when they should have had one. An owner or operator of a facility regulated under HSWA is responsible for instituting corrective action as necessary to protect human health or the environment from releases of hazardous wastes or hazardous constituents.

This chapter is not intended to be all-inclusive in the discussion of requirements and responsibilities, or to limit the use of site-specific options that may differ from the default. The RISC Technical Resource Guidance Document establishes a framework for developing a non-default approach for RCRA closure or corrective action cleanup. Environmental requirements implemented by other programs (such as the Superfund Program and the Voluntary Remediation Program [VRP]) may still apply to a site or facility both before and after certification of RCRA closure.

Indiana is authorized to administer its hazardous waste management program in place of the federal program. To develop the hazardous waste program, the State has (with few exceptions and deletions) incorporated by reference the federal hazardous waste regulations in [Title 40 of the Code of Federal Regulations \(CFR\), Parts 260 through 270](#). These federal regulations are mandated by Subtitle C of RCRA. For convenience, federal regulations (when appropriate) are cited in this chapter. In addition, the acronym “RCRA” is used throughout this chapter as a general term for hazardous waste regulatory requirements.

Questions that arise and requests for other guidance should be directed to the site-specific OLQ or Office of Enforcement (OE) contact. The procedures outlined in this chapter are intended to clarify and standardize the RCRA closure and corrective action process. Owners or operators are encouraged to meet with IDEM staff as needed to develop plans for remediation, ground water monitoring, and decontamination.

IDEM recognizes that the costs of closure and remediation may be significant and intends to minimize these costs wherever possible. Therefore, obtaining OLQ approval of a closure or cleanup plan is strongly recommended before any closure or cleanup activity is implemented. Closure or cleanup activities conducted prior to OLQ approval may need to be altered or even repeated if the closure or cleanup activities do not conform with applicable regulations or fail to protect human health and the environment.

This guidance replaces the Non-rule Policy Document entitled Hazardous Waste Management Unit Closure Guidance, (identification number WASTE-0013-NPD).

2.1 Definitions

Many terms used in this non-rule policy document are defined in [329 IAC 3.1](#) and [40 CFR 260.10](#). The following additional definitions apply to facilities subject to regulation for RCRA hazardous waste permitting, corrective action, and closure only. These terms replace or supplement those in the [Glossary](#) of the RISC Technical Manual.

Active portion means the portion of a facility where TSD operations are being or have been conducted after the effective date of [40 CFR Part 261](#) and that is not a *closed portion* (see also *closed portion* and *inactive portion*).

Aquifer means a geologic formation, group of formations, or part of a formation capable of yielding a significant amount of ground water to wells or springs.

Area of concern (AOC) means a unit or area that does not meet the definition of a *solid waste management unit* (SWMU) but that merits further investigation to determine the presence or absence of releases.

Certification means a statement of professional opinion based upon knowledge and belief.

Closed portion means the portion of a facility that an owner or operator has closed in accordance with the approved facility closure plan and all applicable closure requirements (see also *active portion* and *inactive portion*).

Closure of a hazardous waste (RCRA) facility means action taken to secure the hazardous waste management facility or unit(s) in a manner that will protect human health and the environment in accordance with the closure plan requirements of [40 CFR 265, Subpart G](#), and [40 CFR 264, Subpart G](#). Closure of a SWMU or AOC means that the owner or operator has demonstrated, either through investigation or remediation, that the unit or area does not warrant further action.

Closure by removal or decontamination means the decontamination, treatment, or removal of the following: all hazardous waste, hazardous waste constituents, hazardous constituents, leachate, contaminated run-on and runoff, waste decomposition products, liners, and contaminated soil (including ground water) that pose a substantial present or potential threat to human health or the environment. This standard is achieved by demonstrating attainment with one of the following closure levels.

- Estimated quantitation levels (EQL) for organic constituents, or the mean plus one standard deviation of background for non-organics. This type of closure is a “clean closure”.
- Default or non-default residential levels. This type of closure is a “residential closure”.
- Default or non-default industrial levels if the owner files an environmental restrictive covenant which limits the land use of the property and certain activities that can occur at the property (i.e. prohibition on drinking untreated groundwater) in accordance with the approved risk assessment. This type of closure is an “industrial closure”.

Closure in-place means leaving either waste in place (e.g. a landfill) or contamination in place after closure when contamination cannot be practicably removed during closure, and post-closure care of engineered structures or other facilities is needed. Closure in-place must comply with the applicable requirements for removing or stabilizing the waste, capping the hazardous waste management unit or utilizing other appropriate engineering controls, developing and

implementing a ground water monitoring plan, and providing a written post-closure care plan subject to IDEM approval.

Compliance point is a vertical surface located at the hydraulically down-gradient limit of the waste management area that extends down into the uppermost aquifer underlying the regulated unit(s). The waste management area can encompass more than one regulated unit (see [40 CFR 264.95](#)).

Directed sampling is the term for using professional judgment and prior site knowledge to choose sampling locations. It is synonymous with the term “judgmental sampling”.

Disposal means the discharge, deposit, injection, dumping, spilling, leak, or placement of any solid or hazardous waste into or on any land or water so that such solid or hazardous waste or any constituent thereof can enter the environment, be emitted into the air, or be discharged into any water, including ground water.

Disposal facility means a facility or part of a facility at which hazardous waste is intentionally placed into or on any land or water and at which waste will remain after closure. The term *disposal facility* does not include corrective action management units (CAMU) into which remediation wastes are placed.

Facility is defined as follows:

1. All contiguous land, structures, other appurtenances, and improvements on the land used for TSD of hazardous waste. A facility can consist of several TSD operational units (for example, one or more landfills, surface impoundments, or combinations of such units).
2. For the purposes of implementing corrective action under [40 CFR 264.101](#), all contiguous property under the control of the owner or operator seeking a hazardous waste management permit. This definition also applies to facilities implementing corrective action under Indiana Code ([IC](#)) [13-22-13](#).

Final closure or *total closure* means the closure of all hazardous waste management units at the facility in accordance with all applicable closure requirements so that hazardous waste management activities under [40 CFR, Parts 264 and 265](#), are no longer conducted at the facility unless subject to the provisions in [40 CFR 262.34](#).

Generator means any person, by site, whose actions or processes produce hazardous waste identified or listed in [40 CFR, Part 261](#), or whose actions first cause a hazardous waste to become subject to regulation.

Ground water means water located below the ground surface in interconnected voids and pore spaces in the zone of saturation.

Ground water protection standard means a concentration limit (as defined in [40 CFR 264.94](#)) established by the Commissioner in a facility permit for hazardous constituents (as defined in [40 CFR 264.93](#)) detected in ground water from the regulated unit in the uppermost aquifer at the *compliance point* (as defined in [40 CFR 264.95](#)) during the compliance period (as defined in [40 CFR 264.96](#)). To establish this concentration limit, the Commissioner must consider which hazardous constituents are from the regulated unit and their potential to harm human health and the environment.

Hazardous constituent means any constituent identified in [Appendix VIII of 40 CFR, Part 261](#).

Hazardous waste is defined in [40 CFR 261.3](#). For Corrective Action purposes, this term includes any chemical that poses or may pose a threat to human health or the environment (See IC 13-11-2-99).

Hazardous waste management unit is a contiguous area of land on or in which hazardous waste is placed, or the largest area in which there is significant likelihood of hazardous waste constituents mixing in the same area. Examples of hazardous waste management units include a surface impoundment, waste pile, land treatment area, landfill cell, incinerator, tank and its associated piping and underlying containment system, and container storage area. A container alone does not constitute a unit. The unit includes the containers and the land or pad upon which the containers are placed.

Industrial closure includes the decontamination, treatment, or removal from a unit of all hazardous waste, hazardous waste constituents, hazardous constituents, leachate, contaminated run-on and run-off, waste decomposition products, liners, and contaminated soil (including ground water) that pose a substantial present or potential threat to human health or the environment at closure levels exceeding default or non-default residential levels but below industrial levels.

In operation refers to a facility that is treating, storing, or disposing of hazardous waste.

Inactive portion means the portion of a facility that is not operated after the effective date of [40 CFR Part 261](#) (see also *active portion* and *closed portion*).

Inner liner means a continuous layer of material placed inside a tank or container that protects the construction materials of the tank or container from the contained waste or reagents used to treat the waste.

Leachate means any liquid, including any suspended components in the liquid, that has percolated through or drained from hazardous waste.

Liner means a continuous layer of natural or man-made materials beneath or on the sides of a surface impoundment, landfill, or landfill cell that restricts the downward or lateral escape of *hazardous waste*, *hazardous waste constituents*, or *leachate*.

Management or *hazardous waste management* means the systematic control of the collection, source separation, storage, transportation, processing, treatment, recovery, and disposal of hazardous waste.

No further action may be used in two slightly different ways in the corrective action process.

1. “No Further Action” status can be a determination used for individual SWMUs or AOCs. Once all activities required are completed at individual units at a facility, a “No Further Action” status may be granted to that specific SWMU or AOC.
2. “No Further Action” can also be used to describe a site-wide selected remedy. For example, if the RCRA Facility Investigation reveals that both the soil and ground water at all SWMUs and/or AOCs at a facility are below the RISC default residential levels for all COCs, and there are no ecological exposures of concern, the facility owner or operator may propose “No Further Action” as the final remedy for the entire facility.

On-site means the same or geographically contiguous property which may be divided by public or private right-of-way, provided the entrance and exit between the properties is at a crossroads intersection,

and access is by crossing as opposed to going along the right-of-way. Non-contiguous properties owned by the same person but connected by a right-of-way, which he controls and to which the public does not have access, is also considered on-site property.

Operator means the person responsible for the overall operation of a facility.

Owner means the person who owns a facility or part of a facility.

Partial closure means the closure of a hazardous waste management unit in accordance with applicable closure requirements in [40 CFR, Parts 264 and 265](#), at a facility that contains other active hazardous waste management units. For example, partial closure may include the closure of a tank (including its associated piping and underlying containment systems), landfill cell, surface impoundment, waste pile, or other hazardous waste management unit while other units of the same facility continue to operate.

Personnel or facility personnel means all persons who work at or oversee the operations of a hazardous waste facility and whose actions or failure to act may result in noncompliance with the requirements of [40 CFR, Part 264 or 265](#).

Point of compliance is a term used in RCRA but not in this User's Guide. To avoid confusion with similar terms, this chapter uses the term *compliance point*. The terms *point of compliance* and *compliance point* can be used interchangeably in RCRA.

Release means any spill, leak, pouring, emission, emptying, discharge, injection, pumping, escape, leaching, dumping, or disposal of hazardous wastes (including hazardous constituents) into the environment (including the abandonment or discarding of barrels, containers, and other closed receptacles containing hazardous wastes or hazardous constituents).

Remediation waste means all solid and hazardous wastes, all media (including ground water, surface water, soil, and sediment), and debris that contain listed hazardous wastes or hazardous constituents, or that themselves exhibit a hazardous waste characteristic and which is managed for the purpose of implementing Corrective Action requirements under [40 CFR 264.101](#) and [RCRA Sections 3004\(u\), 3004\(v\), and 3008\(h\)](#).

Representative sample means a sample of a universe or whole (for example, a waste pile, lagoon, or ground water) that can be expected to exhibit the average properties of the universe or whole.

Screening is a RISC term that refers to the initial sampling event of site characterization to determine the need for a broader investigation of the nature and extent of contamination.

Soil means unconsolidated earth material composing the superficial geologic strata (material overlying bedrock) consisting of clay, silt, sand, or gravel particles as classified by the U.S. Department of Agriculture (USDA) Soil Conservation Service (SCS) or a mixture of such materials with liquids, sludges, or solids that is inseparable by simple mechanical removal processes and that is primarily composed of soil by volume based on visual inspection.

Solid waste is defined in [40 CFR 261.2](#).

Solid waste management unit (SWMU) means any discernable existing or historical unit (permitted or unpermitted) at which solid wastes have been placed at any time, irrespective of whether the unit was intended for the management of solid or hazardous waste. Such units include any area at a facility where hazardous constituents have been routinely and systematically released.

Storage means the holding of hazardous waste for a temporary period at the end of which the hazardous waste is treated, stored, or disposed of elsewhere.

Treatment means any method, technique, or process, including neutralization, that achieves the following:

- Changes the physical, chemical, or biological character or composition of any hazardous waste so as to neutralize such waste, recover energy or material resources from the waste, or render such waste non-hazardous or less hazardous,
- Makes the waste safer to transport, store, or dispose of, or
- Makes the waste amenable for recovery or storage or reduces the volume of the waste.

Unit means either a *hazardous waste management unit* or a *SWMU* unless otherwise specified.

Unsaturated zone or zone of aeration means the zone between the land surface and the water table.

Uppermost aquifer means the geologic formation nearest the natural ground surface that is an aquifer, as well as lower aquifers that are hydraulically interconnected with this aquifer within the facility's property boundary.

2.2 Closure Overview

Closure levels, regulations, and agency review and public notice of closure plans are discussed below.

2.2.1 Closure Levels

Closure in this chapter is used to describe the process of taking a RCRA hazardous waste management unit (i.e. a treatment, storage, or disposal [TSD] unit) out of service. Closure is required for all hazardous waste management units following termination of interim status, after denial of an operating permit, or after facility closure.

With the development of the RISC Technical Guide, default closure levels have been established using conservative exposure assumptions. These levels have been determined to be protective of human health and the environment and are presented in Table A of [Appendix 1](#) of the RISC Technical Guide. The table provides constituent closure levels based on residential exposure assumptions and on industrial exposure assumptions.

There are two general types of closure:

1. closure by removal or decontamination, and
2. closure with waste or contamination remaining in place.

The premise of closure by removal or decontamination (hereafter referred to as "closure by removal") is that all hazardous waste has been removed from a RCRA TSD unit and any releases at or from the unit have been remediated so that further regulatory control under RCRA Subtitle C is no longer necessary to protect human health and the environment. Closure by removal is accomplished either by demonstrating that:

1. constituent levels in soil do not exceed the analytical method's EQL for organics and the mean plus one standard deviation of background levels for inorganics, or
2. constituent levels remaining in soil do not exceed default or non-default residential closure levels, or
3. constituent levels remaining in soil do not exceed default or non-default industrial levels if an environmental restrictive covenant has been placed on the property which limits the use of the property to land uses and/or activities consistent with the approved risk assessment.

Closure levels for ground water may be: the constituent concentrations listed in [40 CFR 264.94\(a\)](#); the Maximum Contaminant Limit (MCL) in [40 CFR 141](#); the alternate concentration limits (ACL) established in accordance with [40 CFR 264.94\(a\)\(3\)](#); or background levels for each constituent as specified in the permit, if applicable. A facility that meets industrial closure levels would not be subject to post-closure requirements.

However, an environmental restrictive covenant that limits the activities and/or land use consistent with the approved risk assessment must be established.

Industrial cleanup levels must be achieved throughout the closed unit and in any areas affected by releases from the unit. This scenario cannot be used at units where waste remains in place (such as land disposal units that closed in-place). Further information relating to industrial closure is presented in [Section 2.6.2](#) of this User's Guide.

Closure in-place involves leaving waste in place or leaving contamination exceeding industrial closure levels in place. This category includes all land disposal units and other units where contaminants in excess of industrial closure levels remain in place and engineering controls are needed to achieve the closure performance standard. Land disposal units require capping and maintenance (along with ground water monitoring) for the post-closure period. At other units where waste has been removed, but contamination remains, there is a need for some continuing engineering controls or other structures to insure that the exposure and land use assumptions remain valid. These units may be eligible for more limited post-closure care than land disposal units, depending on the circumstances. More information is provided in [Section 2.6.3.1](#) of this Guide.

2.2.2 Closure Regulations

IDEM regulates the management of hazardous waste under the authority of the Environmental Management Act, [IC 13](#), and the Indiana hazardous waste rules, [329 IAC 3.1 et seq.](#) These rules incorporate, by reference, [40 CFR Parts 260 through 270](#). Closure of hazardous waste facilities under interim status is regulated under [40 CFR 265, Subpart G](#), and [329 IAC 3.1-10 and 14](#). Closure of facilities that have Part B permits is regulated under [40 CFR 264, Subpart G](#); [40 CFR 270.1\(c\)\(5\)](#); and [329 IAC 3.1-9 and 15](#). Copies of [329 IAC 3.1 et seq.](#) can be obtained by calling the Legislative Services Agency at (317) 232-9581. Copies of [40 CFR Parts 260 through 299](#) can be obtained by writing to the following address:

U.S. Government Printing Office
Superintendent of Documents
Mail Stop: SSOP
Washington, DC 20402-9328

2.3 Corrective Action Overview

Corrective Action's goal is to evaluate the potential for release of hazardous constituents and remediate releases as necessary to protect human health and the environment. Corrective Action requirements pertain to any facility that is operating or had operated as a TSD facility. This includes facilities that had interim status at any time, as well as facilities that operated without a permit when they should have had one. Corrective Action can be initiated through either a permit, if applicable, or an order. Facilities can attempt to close hazardous waste management units at the same time they are addressing releases from SWMUs and AOCs. Under this situation, the facility can request to complete closure of the hazardous waste management unit through the RCRA corrective action process.

The RCRA Corrective Action process consists of five key elements:

- Potential source identification,
- Release assessment,
- Release investigation,

- Evaluation and selection of an appropriate remediation technology or technologies, and
- Remediation of the release(s).

Not all five elements need to be performed at all facilities. However, each facility subject to corrective action will be evaluated for its potential to release hazardous constituents. If the potential exists, the facility must perform a release assessment. The decision to proceed to subsequent elements depends on the level and type of hazardous constituent present. In order to achieve a “no further action at this time” determination for the facility, it must be demonstrated that either hazardous constituent levels do not exceed background levels or EQLs or that hazardous constituents do not pose unacceptable risks to human health or the environment. This determination can be performed either after the release assessment or the release investigation, or upon completion of remediation activities.

2.4 Closure Plan Preparation

In accordance with [40 CFR 264.112](#) and [265.112](#), the closure plan must identify steps necessary to perform partial or final closure of the facility at any point during its active life. To this end, the following sections detail the type of information that must be included in the closure plan.

2.4.1 Facility Description

A facility description must be provided that includes the following information:

1. Description of the type of industry,
2. Standard Industrial Code (SIC),
3. Products,
4. Location,
5. Size,
6. Other permitted activities occurring on site (for example, a discharge using a National Pollutant Discharge Elimination System [NPDES] permit), and

7. Other general summarized information.

2.4.2 Description of Waste Management Units

The closure plan should describe each container storage area, tank system, incinerator, land treatment unit, landfill, surface impoundment, waste pile, or other hazardous waste management unit that is to be addressed. For each unit, the following information must be provided:

1. A discussion of the types of waste management activities that occurred at the unit, including the capacity and the maximum inventory of the unit and the process code and unit of measure from the Part A permit application (if applicable),
2. Descriptions of each waste in the unit, including the common name(s) and U.S. EPA hazardous waste code(s),
3. A discussion of the time period of use, dimensions, capacity, topography, soil types (as appropriate), copies of past spill reports, and any other relevant information, and
4. A copy of the most recent Part A permit application, if applicable.

Plans for total closure must address all units at the facility. Plans for partial closure should indicate which units are to remain active. This information should also be indicated on the facility's Part A permit application.

The closure plan should state *verbatim* the Closure Performance Standard in [40 CFR 265.111](#) or [264.111](#).

2.4.3 Maps and Drawings

The closure plan should provide a topographic or county map indicating the location of the facility without obscuring the features. The topographic or county map should include features within 1,000 feet of each property line of the facility. The closure plan should provide detailed maps or diagrams of the facility itself; detailed drawings of each unit to be closed; and cross sectional drawings of secondary containment systems, landfills, and surface impoundments. Topographic features, well locations, and surface water run-on and

run-off directions should be discussed or included on the detailed maps, drawings, and diagrams.

Detailed maps or diagrams of the facility itself should also include, but not be limited to, the following information:

1. Map scale and date,
2. Orientation of the map (north arrow),
3. Legal boundaries of the facility,
4. Access control (fences and gates),
5. Surrounding land uses (residential, commercial, agricultural, and recreational),
6. On-site buildings and structures, including the entrances and exits of each,
7. Locations of each on-site hazardous waste management unit, including clear identification of units undergoing closure, and
8. The USDA SCS soils survey map of the area surrounding the units.

Detailed drawings of each unit to be closed should also include, but not be limited to, the following information:

1. Drawing scale and date,
2. Orientation of the drawing (north arrow),
3. Dimensions, entrances, and exits of buildings or structures located adjacent to the unit undergoing closure,
4. Unit dimensions,
5. Appurtenant structures or equipment of the unit, and
6. Relationship of the unit to other points or structures on the facility property.

Additional maps and drawings are discussed in [Section 2.9](#), RCRA Soil Sampling, for soil investigation.

2.4.4 Containment Description

The closure plan should provide a detailed description of the containment of each unit undergoing closure. The closure plan should describe how the unit, including the containment, was designed and operated to prevent the migration or escape of hazardous waste, hazardous constituents, leachate, and runoff from the unit.

For container and tank storage units and incinerators, the discussion should focus on secondary containment structure features (such as walls, berms, and slope), if any, for the entire unit, including ancillary equipment, if applicable. The discussion should include items such as capacity, dimensions, age, integrity, materials of construction, joints, fittings, coatings or sealants applied to the structure, and chemically resistant water stops used at joints.

For waste piles, landfills, surface impoundments, and land treatment units, the description should provide information on the liner and the cover system (if applicable). Specifically, information should include the following:

- Liner type, composition, manufacturer, dimensions, thickness, and age,
- Brief description of the original liner installation procedures, including seaming and quality assurance/quality control (QA/QC) checks,
- Brief description of any liner maintenance and inspection performed after installation, and
- Description of the structural condition of the unit, including cracks, tears, leaks, punctures, holes, or unsealed joints or seams of the secondary containment system, liner, or cover system.

If containment structures are not present or are inadequate, the closure plan should discuss the drainage features of the unit and its surroundings and where spilled waste would flow. This discussion should also describe the facility setting, including the attenuative properties of the soil between the unit, ground water, and surface

water and any other factors that would influence the mobility of hazardous waste or hazardous waste constituents and their potential to migrate to ground water and surface water.

2.4.5 Hazardous Waste List

The closure plan must provide a complete, detailed list of all hazardous wastes (chemical name and the U.S. EPA hazardous waste number) treated, stored, or disposed of at each unit. Common names or trade names should not be used when generic chemical names are available. For each unit, the closure plan should indicate the total volume or weight of each hazardous waste managed on site over the active life of the facility.

2.4.6 Air Emissions

When applicable, the closure plan should specify that air emissions problems related to closure will be eliminated or minimized, including nuisance problems such as dust or odors. Example problems include solvent emissions during remediation, transfers, and decontamination operations and dust problems related to decontamination, soil excavation, and solidification activities.

2.4.7 Personnel Safety and Fire Prevention

The closure plan should indicate that Occupational Safety and Health Administration (OSHA) and other government regulations will be followed to protect all personnel (including contractors and visitors) involved in the closure project and those who could be possibly exposed to hazardous waste by the closure activities.

2.4.8 Closure Schedule

According to [40 CFR 264.113\(a\)](#) and [265.113\(a\)](#), all hazardous waste must be treated, removed, or disposed of in accordance with the approved closure plan within 90 days after approval of the closure plan by IDEM or after receipt of the final volume of hazardous wastes for permitted units. Closure activities must also be completed in accordance with the approved closure plan within 180 days after approval of the closure plan or 180 days after receipt of the final volume of hazardous wastes for permitted units.

The plan should contain a timetable that shows all critical closure dates, including dates for waste removal, sampling, soil removal,

critical times for the independent engineer or his or her representative to be present on site, site restoration, times for survey plat (if applicable), independent engineer's certification, and other relevant activities. This timetable should generally start at the point of closure plan approval or some other definable date and should not be based on calendar dates.

IDEM may require that the owner or operator contact OLQ before conducting certain critical activities (such as soil sampling or removal, ground water monitoring well installation, or well sampling) to allow an inspector to be present to observe these activities.

Closure time periods longer than those listed above may be granted if detailed justification is provided that meets the requirements of [40 CFR 264.113\(a\)](#) or [40 CFR 265.113\(a\)](#). Extensions of the closure period are discussed in [40 CFR 264.112\(c\)\(2\)\(ii\)](#) and [265.112\(c\)\(2\)\(ii\)](#), which reference the permit modifications of [40 CFR 270.42](#). It should be noted that the time period for closure by removal should not exceed 3 years. If closure by removal cannot be achieved, a post-closure plan must be submitted for approval. Closure certification is due 60 days after closure completion.

2.4.9 Closure and Post-Closure Cost Estimates

The closure plan should include a closure cost estimate calculated in current dollars in accordance with [329 IAC 3.1-14-3](#) or [329 IAC 3.1-15-3](#). Closure costs should, at a minimum, include estimates for removal of inventory, decontamination, sampling and analysis, and closure certification. The costs should be based on a third party closing the facility. Closure costs should also include a contingency fee based on a percent of total costs to compensate for errors of omission and unforeseeable circumstances. For facilities that require post-closure, a separate post-closure cost estimate must also be provided in accordance with [329 IAC 3.1-14-13](#) and [329 IAC 3.1-15-5](#).

2.4.10 Financial Assurance

Financial assurance must be established for closure and post-closure based on the closure and post-closure cost estimates. Several options are available under [329 IAC 3.1-14](#) and [329 IAC 3.1-15](#) for establishing the appropriate financial mechanism. For enforcement-driven closure plans, the administration of this requirement is handled

by the OLQ through the Office of Enforcement. For other closure plans, the administration of this requirement is handled solely by OLQ.

2.5 Administrative Closure Procedures

The general process for, and exceptions to, closure activities are discussed below.

2.5.1 Agency Review and Public Notice of Closure Plans

When IDEM receives a closure plan, the closure plan is logged in and assigned to a reviewer. The closure plan is reviewed for completeness and technical adequacy. If the plan is inadequate, the owner or operator is sent a Notice of Deficiency (NOD) that specifies the plan's inadequacies. The plan must be revised to address the items in the NOD and resubmitted to IDEM. When IDEM receives a complete and technically adequate plan, IDEM will approve or modify the closure plan in accordance with [40 CFR 265.112 and 264.112](#). The number of copies of the closure plan required for review depends on the unit type undergoing closure. Guidance on the number of copies to be submitted will be given prior to closure plan submittal.

A Public Notice is then filed in a local newspaper, and the public will be given a 30-day opportunity to submit written comments and request modifications of the closure plan. A public hearing may be conducted at IDEM's discretion.

2.5.2 Request for Administrative Review

If the owner or operator wishes to challenge a closure plan modification that has been made by IDEM for the purpose of closure plan approval, a Petition for Administrative Review and a Petition for a Stay of Effectiveness must be submitted to the Office of Environmental Adjudication within 15 days of the date of receipt of the closure plan approval letter. The petition must include facts demonstrating that one is either the applicant, a person aggrieved or adversely affected by the decision, or likewise entitled to review by law. The petition must specifically identify the portions or conditions of the modified closure plan for which a stay or administrative review is being requested. Further information on this issue is presented in [IC 13-15-6 and IC 4-21.5-3](#).

2.5.3 Time Extensions During the Closure Period

Under [40 CFR 264.113 and 265.113](#), the Commissioner may approve an extension of the 180-day closure period if the owner or operator can demonstrate, among other things, that:

1. Closure activities will necessarily take longer than 180 days to complete, and
2. The owner or operator has taken and will continue to take all steps to prevent threats to human health and the environment from the unclosed but inactive facility.

For closures under interim status requirements, [40 CFR 265.113 \(b\) and \(c\)](#) state that an extension of the 180-day closure period must be requested at least 30 days prior to the expiration of the 180-day period. Justification for the time extension must be provided. For permitted facilities undergoing closure, [40 CFR 264.113\(d\)](#) requires that the permit be modified in accordance with [40 CFR 270.42](#).

As previously noted, the closure by removal time period should generally not exceed 3 years. If the facility is attempting a plume stability assessment according to RISC Appendix 3, or if the risk assessment requires longer than 3 years to complete, the closure period may be extended. If closure by removal cannot be achieved in the approved period, a post-closure plan must be submitted for approval.

2.5.4 Closure Plan Modifications

An owner or operator with an approved closure plan must submit a written request to IDEM to authorize a change to the approved closure plan. The written request must include a copy of the amended closure plan for approval by IDEM. The closure plan must be modified whenever unexpected events require changes to the plan.

The closure plan must be amended at least 60 days after an unexpected event has occurred that affects the closure plan. If an unexpected event occurs during the partial or final closure period, the owner or operator must amend the closure plan no later than 30 days after the unexpected event. These provisions also apply to owners or operators of surface impoundments and waste piles who intended to remove all hazardous wastes upon closure but who are required to close as landfills in accordance with [40 CFR 265.310](#). If the amendment to the

plan is a Class 2 or 3 modification according to the criteria in [40 CFR 270.42](#), the modification to the plan will be approved in accordance with the procedures in [40 CFR 265.112\(d\)\(4\)](#).

2.5.5 Closure Certification Procedures

Closure certification procedures and requirements are discussed below.

2.5.5.1 Submittal of Closure Plan and Certifications

All copies of the closure plan, certification, and any revisions (one with original signatures) should be submitted to the address below.

Section Chief
Hazardous Waste Permit Section
Office of Land Quality
Indiana Department of Environmental Management
100 North Senate Avenue
P. O. Box 6015
Indianapolis, IN 46206-6015

2.5.5.2 Signatory Requirements

The closure plan application, revisions, and reports are subject to the signatory requirements of [40 CFR 270.11](#). The application must be signed as follows:

1. For a corporation, by a responsible corporate officer defined as follows:
 - a. A president, vice president, treasurer, or secretary of the corporation in charge of a principal business function or any other person that performs a similar policy or decision-making function for the corporation, or
 - b. The manager of one or more manufacturing, production, or operating facilities employing more than 250 persons or having gross annual sales or expenditures exceeding \$25 million if authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures

2. For a partnership or sole proprietorship, by a general partner or the proprietor, respectively
3. For a municipality, state, federal, or other public agency by either a principal executive officer or ranking elected official defined as follows:
 - a. The chief executive officer of the agency, or
 - b. A senior executive officer having responsibility for the overall operations of a principal geographic unit of the agency (for example, U.S. EPA regional administrators).

A duly authorized representative can also sign the application, but a written authorization must be signed by the appropriate officer as defined above, and the authorization must be on file with IDEM.

The Closure Plan Certification Statement in [Appendix 2.1](#) should be signed. At least one of the copies of the certification submitted to IDEM must have original signatures. Certification of closure constitutes a report as defined by [40 CFR 270.11\(b\)](#). Therefore, the certification must conform to the associated signatory requirements. The certification must be signed by the officer described in this section as well as a registered professional engineer (see “Certification of Closure” below).

2.5.5.3 Certification of Closure

All partial or total closures of hazardous waste management units must be certified by both the owner and operator and an independent registered professional engineer in accordance with [40 CFR 264.115](#) and [265.115](#). Certification is due 60 days after completion of closure activities and no more than 240 days from the date of closure plan approval (unless otherwise approved).

The independent engineer should be present during all critical, major closure activities. The independent engineer or the facility owner or operator may be required to notify IDEM in advance of any critical closure activity. These activities can include soil sampling, remediation, final cover placement, and other events. The frequency of inspections by the independent engineer should be sufficient to determine the adequacy of each critical activity. The responsibilities of the certifying engineer during closure are discussed in the preamble

of the [May 2, 1986, Federal Register](#) amending the closure and post-closure requirements of [40 CFR Parts 264 and 265](#).

A closure report should be submitted with the Closure Certification Statement (see [Appendix 1.4](#)). This report should include, but not be limited to, the following information:

1. Volume or weight of waste and waste residue removed,
2. Method of waste handling and transport,
3. Waste manifest numbers or copies of manifests from waste removal and waste residues,
4. Sampling and analytical methods used,
5. Chronological summary of closure activities,
6. Closure costs,
7. Photographic documentation of closure, and
8. Analytical results.

All analytical results must include the information listed in [Section 2.8.3](#) in order to be validated by IDEM. For partial closures, revised cost estimates for remaining closure activities and any affected financial assurance instruments should be submitted with the closure certification documents. If the certification is for total closure, the certification documents should include a request for release from financial assurance.

A completed Closure Certification Statement ([Appendix 2.2](#)) should be included with the certification report.

2.5.5.4 Status of Facility after Closure

The closure report and Closure Certification Statement should clearly state the status of the hazardous waste facility after closure is completed. For example, the report and certification should state if a storage facility is to be operated as a generator (less than 90-day accumulation). The report should also describe whether closure is partial or total. If closure is partial, the report or certification should name both the units covered by the closure report or certification as

well as units remaining in operation or covered by the permit. The report or certification should indicate whether the facility will continue to be permitted or if the facility status would be changed to a generator or transporter (if applicable).

The report or statement should also indicate which of the statements presented below describes the intended use of the facility.

1. The facility will continue to be permitted.
2. No TSD activities will occur at the facility.
3. The facility will continue to treat or store hazardous wastes under interim status requirements.
4. The facility will be a small-quantity generator of less than 1,000 kilograms per month of hazardous waste and accumulate the hazardous waste on site for less than 90 days.
5. The facility will generate more than 1,000 kilograms per month and will accumulate the hazardous waste on site for less than 90 days.
6. The facility will generate more than 100 kilograms per month, but less than 1,000 kilograms per month and accumulate the hazardous waste on site for less than 180 days (or 270 days, if applicable).
7. The facility will be exempt from TSD regulation under RCRA.
8. The facility will be a transporter of hazardous waste.

2.5.5.5 Part A Permit Modification and Withdrawals

This discussion applies only to facilities with permits or interim status. This discussion does not apply to facilities that are required to close by an enforcement action or other means and that did not have interim status.

The facility's Part A permit application must be revised in accordance with [40 CFR 270.71](#) when closure certification is submitted. Responsibility for a closed unit cannot be terminated completely upon closure. In the case of total closure that requires no post-closure care, the owner/operator should submit a letter requesting withdrawal of the

Part A permit application to the IDEM, along with their closure certification.

For partial closure, a revised Part A permit application must be submitted to include only the remaining units and, if necessary, corrected copies of the existing Part A permit. A cover letter discussing the closure and explaining the changes should also be included. Facilities should modify Part B permits in accordance with the requirements specified in [40 CFR 270.42](#).

2.6 Closure Options

Closure can be achieved in two ways:

1. by removal or decontamination, or
2. in-place.

Closure by removal or decontamination can be achieved in two ways:

1. clean closure, or
2. risk-based closure.

Clean closure levels are established as background levels or EQLs for the constituents set forth in [40 CFR 261, Appendix VIII](#). Risk-based closure is based on a default or non-default risk assessment that uses exposure assumptions consistent with the land use (i.e. residential or industrial). Table 2-1 below summarizes closure options.

Table 2-1. Summary of Closure Options

<i>Closure Types</i>	<i>Removal or Decontamination</i>			<i>Closure In-Place</i>	
	<i>Clean</i>	<i>Residential</i>	<i>Industrial</i>	<i>Contamination in Place (waste removed)</i>	<i>Land Disposal Units (waste remains)</i>
<i>Closure Levels</i>	<i>Background or EQL</i>	<i>RISC Default or Non-default</i>	<i>RISC Default or Non-default</i>	<i>Site Specific</i>	<i>NA</i>
<i>Post Closure Activities</i>	<i>None</i>	<i>None</i>	<i>None*</i>	<i>See Section 2.6.3.1</i>	<i>See Section 2.6.3.2</i>

* A restrictive covenant with land use and/or activity controls required

2.6.1 Closure by Removal or Decontamination

2.6.1.1 Decontamination Procedures

Before decontamination, all paved areas, concrete pads, containment systems, structures, and sumps should be visually inspected to identify any cracks, gaps, spills, stains, or damaged areas that may be present. This visual inspection should be documented in the closure certification report with notations of any identified problems. Any cracks, gaps, or damaged areas should be repaired by grouting or sealing before decontamination is performed in order to prevent the further release of contamination into underlying soil.

Decontamination of paved areas, containment systems, and sumps should include the following:

- Visual inspection,
- Waste removal,
- Mechanical cleaning (scraping or sweeping),
- Repair of damaged or unsealed areas,
- Low-volume, high-pressure washing (can include steam or detergent for more effective cleaning),

- Three successive low-pressure ambient-temperature water rinses, and
- Sampling and analysis of final rinsate to confirm decontamination.

The first two water rinses described above should remove both residual wastes and any detergents used during washing. The third or final rinse should provide the source of verification samples. Verification of decontamination must be provided to confirm that closure levels have been met.

At least two samples of the final rinsate from each unit undergoing closure should be analyzed for the hazardous constituents identified in the waste as defined in [40 CFR 261, Appendix VIII](#), or for hazardous waste constituents as defined in [40 CFR 260.10](#). The two rinsate samples are field duplicates for the rinsate. The final rinsate samples should be representative of the entire final rinse. Rinsate samples to be analyzed for metals should be filtered to remove solid particles prior to sample preservation. Whenever applicable, procedures for minimizing loss of volatile organic compounds (VOC) during sampling should be described in the closure plan.

Minimum closure levels for the rinsate that should be achieved for closure by removal are discussed further in [Section 2.9.1.2](#) below. Decontamination procedures will be repeated until closure levels are met. If closure levels are not met after two iterations of decontamination procedures, IDEM will provide further guidance. Specific decontamination procedures for typical closure by removal projects are discussed below.

Decontamination of Equipment, Structures, and Pads

In accordance with [40 CFR 264.114](#) and [265.114](#), the closure plan should describe all efforts to (1) remove hazardous waste, its residues, and hazardous waste constituents from tanks or (2) decontaminate paved areas, concrete pads, containment systems, equipment, structures, pipes, pumps, sumps, and any other appurtenances to the hazardous waste management unit. IDEM may request the owner or operator to use any reasonable means to clean or decontaminate the unit and its ancillary equipment, including scraping, pressure washing, solvent washing, and other means. Any equipment, including heavy earth-movers or small tools, should be scraped and washed to remove waste residues. These residues should be managed as hazardous

waste, and the procedure for cleaning and managing them should be described in detail in the closure plan.

Storage pads should be decontaminated in accordance with the procedures specified in [40 CFR 264.112\(b\)\(4\)](#). A typical pad decontamination procedure is presented below.

1. All wastes are removed from the pad and appropriately disposed of.
2. The pad is mechanically cleaned by scraping, sweeping, or other methods to remove all physical contamination.
3. The pad is inspected for cracks. If cracks are detected, items 10 and 11 may be performed at this point.
4. The cracks are sealed.
5. The pad is washed using a high-pressure steam cleaner with detergent or appropriate solvent to remove previously stored waste materials.
6. The pad is rinsed three times with water. Low-pressure, ambient-temperature rinses should be used.
7. The third (final) rinsate is collected separately, and two samples are analyzed to show that the pad's surface meets closure levels. For inorganic and certain organic parameters, closure levels will be based on the MCLs of the National Primary Drinking Water Regulations ([40 CFR 141](#)) in the rinsate. For organic parameters without MCLs, the closure levels of the rinsate will be based on the EQLs of the analytical methods as defined in SW-846. Analytical parameters will be based on wastes previously stored in the area.
8. Care is taken to prevent the migration of cleaning liquids from the pad area.
9. All residues and rinsates are collected and disposed of as hazardous waste unless the residues and rinsates are analyzed and determined to be non-hazardous.
10. Soil underlying cracks discovered during visual inspection is sampled for contamination. If contamination is found, the

vertical and horizontal extent of the contamination should be determined. Closure levels for soil are based on background levels for inorganic parameters and the EQLs of the analytical methods as defined in SW-846 for organic parameters, or the RISC closure levels. Background levels for inorganics are determined by sampling soil borings in four locations known to be located in an area unaffected by facility operations. Each boring will be sampled at the same depth intervals as the soil samples collected from under the pads. The 95% upper confidence limit (UCL) of the mean is calculated to be the cleanup level for each inorganic parameter for each pad depth interval.

11. Soil that does not meet cleanup levels is remediated or removed.
12. The pad is cleaned until closure levels have been met.

Tank Decontamination Procedures

Tanks containing hazardous waste are subject to all reasonable means of decontamination in order to meet closure levels. Procedures for decontamination include manual sludge removal, pressure or solvent washes, rinses, and other procedures. An independent, registered professional engineer should certify the methods used and that the level of decontamination is appropriate for each tank's final disposition (for example, disposal as a hazardous waste or storage of product). Tanks that will be reused after closure for product storage or storage of a different hazardous waste, and tanks to be dismantled for scrap metal, require decontamination. Tanks to be dismantled and disposed of as hazardous waste may not require decontamination but are subject to Land Disposal Restrictions ([40 CFR 268](#)). Some tank closures require a contingent post-closure care plan (see [40 CFR 264, Subpart J](#), and [40 CFR 265, Subpart J](#)).

Tanks that will be used for accumulation (not to exceed 90 days) of the same hazardous waste following closure should be drained, all visible contamination removed, and the tank inspected. Owners and operators of existing tank systems that will be used to accumulate hazardous waste should be aware of the assessment requirements in [40 CFR 262 and 265.191](#).

Underground tanks containing ignitable wastes should be removed in accordance with State Fire Marshall regulations, and underlying soil

should be sampled for the hazardous waste constituents stored in the tank. Tanks containing non-ignitable hazardous waste can be abandoned in-place if they are properly decontaminated, filled, and capped, and soil testing verifies the absence of soil contamination. Soil sampling requirements are discussed in [Section 2.9](#).

Sampling and analysis of the final rinse is required in order to confirm that closure levels have been met for tanks that are to be used after closure to store product or different hazardous waste. At least two samples of the final rinse should be analyzed for the hazardous constituents or hazardous waste constituents identified in the stored waste. The two rinsate samples are field duplicates for the rinsate. The final rinsate samples should be representative of the entire final rinse. When applicable, procedures for minimizing loss of VOCs during sampling should be described in the closure plan.

Decontamination procedures should be repeated until closure levels are met.

Care should be taken to prevent the migration of cleaning liquids from the containment area. All wash and rinse waters should be collected and managed as hazardous waste unless analysis shows that they are non-hazardous. The closure plan should describe how decontamination waste material (rinse water, decontamination equipment, personal protective equipment, and other materials) will be managed. An estimate of the volume of waste material to be generated should also be provided. Residues from listed hazardous waste must be managed as hazardous waste unless they are de-listed under the provisions of [40 CFR 260.22](#) or covered by the exemption of [40 CFR 261.4](#).

The tanks should be decontaminated in accordance with the procedures specified in [40 CFR 264.112\(b\)\(4\)](#). A typical tank decontamination procedure is presented below:

1. All wastes are removed from the tank.
2. The tank is mechanically cleaned by scraping, sweeping, or other methods to remove all physical contamination.
3. The tank is washed using a high-pressure steam cleaner with detergent or appropriate solvent to remove previously stored waste materials.

4. The tank is rinsed three times with water.
5. The third (final) rinsate from each tank is collected separately, and two samples are analyzed to show that the tank meets closure levels. For inorganic and certain organic parameters, closure levels will be based on the MCLs of the National Primary Drinking Water Regulations (40 CFR 141). For organic parameters without MCLs, the closure levels will be based on the EQLs of the analytical methods as defined in SW-846. Analytical parameters should be based on wastes previously stored in the tank.
6. Care is taken to prevent the migration of cleaning liquids from the tank area.
7. All residues and rinsates are collected and disposed of as hazardous waste unless the residues and rinsates are analyzed and determined to be nonhazardous.
8. The tank is cleaned until closure levels are met.

2.6.1.2 Soil Remediation

The closure plan for any facility attempting closure by removal must fully describe (1) each step taken to remove waste from the units and contaminated soil from the surrounding areas or (2) each method proposed for remediation of contaminated soil.

For removal, the plan should include a description of solidification/stabilization, accumulation of waste or reagents, equipment used, the soil removal pattern and excavation depth increments, loading areas, and any other information critical to soil removal. The plan should clearly discuss how soil will be removed, accumulated, loaded, and managed once it leaves the site. Covered and lined roll-off containers are recommended for accumulating and removing hazardous wastes. Accumulating contaminated soils on the ground is ill-advised, as this may constitute an illegal hazardous waste pile. The plan should describe backfill materials to be used. Analysis of backfill material should document that the backfill does not exceed land-use specific closure levels or otherwise violate the assumptions of the risk assessment.

Alternatively, soil containing certain hazardous waste constituents can be remediated to closure levels and allowed to remain in the unit or be

placed back into the unit. Bio-remediation and soil vapor extraction of organic constituents are examples of soil remediation processes. A complete remediation plan is required to be submitted for IDEM review as a proposed modification to the approved closure plan.

The remediation plan should include the following:

- Detailed description of treatment process(es),
- Justification of applicability and feasibility of this process to this site (including discussion of site conditions and contaminants),
- Schedule of activities,
- Expected timeframe to meet closure levels,
- Periodic testing to verify progress,
- Periodic status reports indicating progress made,
- Sampling (locations and depths) and analysis procedures for periodic and final verification, and
- Final verification sampling and analysis to confirm complete remediation to closure levels.

In addition, the remediation plan should discuss efforts to minimize air emissions, including volatiles and dust, when applicable.

A registered professional engineer should certify engineering studies and design drawings related to the remediation plan.

2.6.2 Industrial Closure

In order to provide consistency across program areas and to implement the principles of RISC, OLQ will use the approach discussed below to accept closure certification for hazardous waste management units, or to determine that no further action is required for SWMUs and AOCs. This approach is to be used at facilities where the owner or operator chooses to close to industrial levels through a risk-based decision process.

As the name implies, Industrial Closure is to be used only in locations which have been, and will remain, industrial. As addressed in the RISC Technical Guide, closure plans may use non-default risk assessments to determine site-specific industrial closure levels. Future land use and exposure assumptions must be made in the preparation of the risk assessment. Industrial areas will allow higher closure levels than residential areas, therefore, a specific set of criteria must be met to ensure that future land use and exposure assumptions used in the risk assessment remain valid.

Engineering controls are not allowed for industrial closure.

2.6.2.1 Industrial Closure Requirements

After the removal of all waste and liners, a risk assessment based on closure levels for an industrial facility can be conducted. The risk assessment evaluates the levels of hazardous constituents that remain in the soil and groundwater, and insures that the default or non-default land-use appropriate closure levels are achieved. After approval of the risk assessment, the facility can certify closure. In order for the closure certification to be accepted, the facility must maintain land use or activity restrictions, consistent with the approved risk assessment, through either an environmental restrictive covenant or other approved mechanism (see [Appendix 5](#) of the RISC Technical Guide). Once the site restrictions have been implemented and other elements of the approved closure plan have been successfully accomplished, the closure certification will be accepted.

The nature and extent of contamination in soil and ground water must be determined for all facilities using industrial closure levels. Facilities with multiple sources may follow the closure procedures described in [Chapter 5](#) of the RISC Technical Guide. In addition, ground water contamination associated with the facility must be below the default or approved non-default industrial levels at the perimeter of compliance and below the default residential levels at areas beyond the point of property control. This can be demonstrated by proving plume stability. Compliance schedules associated with these requirements will be determined in the closure plan. If at any time land-use specific closure levels are exceeded, remediation or corrective action must occur. Failure to remediate or implement corrective actions could result in an enforcement action.

If any waste or liners remain in place, or if waste and liners have been removed but contamination in excess of industrial closure levels remains in-place, remediation, corrective action and/or appropriate engineering controls will be required. The unit is not eligible for industrial closure and must be closed in-place. A hazardous waste management post-closure permit or other enforceable document is then required. The presence of hazardous constituents at levels below the land-use appropriate closure levels does not constitute waste or contamination remaining in place.

Industrial closure can be obtained by performing remediation (for example, excavation and hauling, soil vapor extraction, or other form of remediation) for areas exceeding industrial closure levels. Once the industrial levels are met (again, based on the additional confirmation sampling and analysis plan [SAP]), the owner/operator may certify that the unit meets the industrial closure scenario.

The only restriction that must remain in effect after achieving industrial closure is to file an environmental restrictive covenant consistent with the approved risk assessment. Such an environmental restrictive covenant might include (1) a land use restriction (e.g. the property cannot be used for residential purposes), and/or (2) activity restrictions, if applicable (e.g. groundwater at the site cannot be consumed). In these cases, the facility must record in the local recorder's office an environmental restrictive covenant that provides the appropriate land use and activity restrictions. No post-closure requirements, such as those applicable to land disposal units, would apply.

Future use of property subject to an industrial closure must be consistent with the exposure assumptions underlying the risk assessment. Property subject to industrial closure can be used for any legitimate future industrial use so long as the land use and exposure potential are consistent with the land use and exposure assumptions approved in the risk assessment.

2.6.2.2 Summary of Requirements for Industrial Closure

1. The approved closure plan must be successfully completed.
2. The owner or operator performing the industrial closure must record an appropriate environmental restrictive covenant on the property deed concerning the industrial land-use restriction. A title reference must be provided. The portion of the property

covered by the deed restriction must be clearly delineated on a survey plat.

3. Owners of the property after the restrictive covenant is recorded must:
 - a. comply with the terms of the covenant, and
 - b. notify future buyers that the facility's use is limited and must be consistent with the terms of the environmental restrictive covenant.

4. Before the land use can change, the owner or operator at the time the change is proposed must demonstrate that the remaining constituents meet levels consistent with the proposed use of the property. If IDEM agrees with the demonstration, the environmental restrictive covenant may be amended or terminated to reflect current conditions. In the case of termination, only the restriction is terminated. The fact that the deed was once restricted and then modified remains on the deed.

If an owner/operator does not comply with the terms of the environmental restrictive covenant, that owner/operator is subject to enforcement action in accordance with IC 13-14-2-6.

2.6.2.3 Notices

Sites that are closed to industrial levels are required to record an ***environmental restrictive covenant*** in the local recorder's office. This recorded document notifies future landowners that the property meets industrial health-protective levels but is not suitable for residential use and residential activities.

Within 60 days of certification of closure of the hazardous waste management unit, the owner or operator must record, in accordance with State law, an environmental restrictive covenant that will notify any potential future purchaser of the property that the property has been used to manage hazardous wastes and that certain restrictions apply to its use. The owner or operator must also submit to IDEM a certification signed by the owner or operator that the notation has been recorded, including a copy of the document in which the notation has been placed (See [40 CFR 264.119](#) and [265.119](#)).

If in the future the owner/operator wishes to demonstrate that the levels of constituents left in place meet the residential closure levels, a supplemental sampling and analysis plan for verification sampling must be sent to the IDEM for approval. A separate closure certification must then be submitted, stating that the verification sampling now indicates that the site meets residential closure levels. Following IDEM acceptance of the revised closure certification, the environmental restrictive covenant may be amended or terminated. As stated above, only the restriction can be terminated.

2.6.3 Closure in Place

2.6.3.1 Closure with Contamination in Place

In some cases, after the waste or liners are removed, contaminants may remain which exceed land-use specific closure levels. In these cases, the closure is not considered a closure by removal or decontamination, but is considered a closure in place. Where engineering controls or physical barriers (i.e. something more than an environmental restrictive covenant) are needed to meet the land use specific closure levels, an enforceable document is needed to ensure that the engineering control or physical barrier remains in place.

Limited post-closure care may be warranted, dependent upon the facts and circumstances of each case. In some cases, physical engineering controls (e.g. caps, fences, buildings) must be maintained to ensure that the land use and exposure assumptions made in the approved risk assessment remain valid. In other cases, appropriate groundwater monitoring schedules may need to be established. In these cases, the details and duration of the facility's post-closure requirements (stipulated in an order or post-closure permit) could be tailored to the specific facts and engineering controls being utilized. In some situations, it may be appropriate to combine monitoring or other features with other closure or corrective action activities at the facility. For example, the monitoring of a particular unit may be combined in some circumstances with an overall program in corrective action.

Facilities utilizing engineering controls to prevent exposure will require an order or post-closure permit which will include the stipulation that the control must be maintained appropriately and if damaged or rendered ineffective, must be repaired or replaced with other effective controls. The engineered control must also be described in the environmental restrictive covenant.

2.6.3.2 Closure In-Place - Land Disposal

Any unit where waste is to be left in place (such as landfills, tanks unable to achieve clean closure, waste piles, and surface impoundments to be closed as landfills) has several additional important considerations beyond those required for closure by removal or decontamination. These considerations include liners, final cap cover, vegetation, ground water monitoring, post-closure care, and permit requirements.

Full descriptions and detailed engineering drawings are required for each unit undergoing closure in-place. Details of liners, drainage layers, covers, vegetation, wells, final contours, construction QA, or any relevant structures or practices should be provided. A registered professional engineer should certify engineering studies and design drawings and specifications.

Several additional regulatory requirements for closed disposal units are specified in [40 CFR 265.197](#), [265.228](#), [265.280](#), and [265.310](#) for facilities. The requirements concern ground water monitoring, post-closure plans, post-closure care, notice to local land authority, and notice in the deed to property. More information on groundwater monitoring requirements is presented in [40 CFR 264 Subpart F](#) and [265 Subpart F](#), and more information on post-closure care and notices is presented below.

2.6.3.3 Post-Closure Care

The closure plan for any disposal unit must include a post-closure care plan in accordance with [40 CFR 265.117](#). For land disposal units that close after May 19, 1981, an application for a post-closure care permit must be submitted upon request from IDEM. Tank systems that do not have secondary containment must follow the procedures for post-closure care outlined in [40 CFR 265.197](#).

2.6.3.4 Location Documentation for Disposal Units

There are three notification requirements for facilities that close units in place with post-closure care. First, [40 CFR 265.116](#) states that at no later than the submission of the certification of closure of each hazardous waste disposal unit, an owner or operator must submit to the local zoning authority or county land-use authority and the IDEM Commissioner a survey plat indicating the locations and dimensions of landfill cells or other hazardous waste disposal units with respect to

permanently surveyed benchmarks. This plat must contain a note indicating the owner's or operator's obligation to restrict disturbance of the hazardous waste disposal unit in accordance with [40 CFR Part 265, Subpart G](#), regulations.

A copy of the survey plat and a copy of the document with the notation required by [40 CFR 265.116](#) must also be provided to the IDEM along with the closure certification.

Second, [40 CFR Part 265.119\(a\)](#) states that within 60 days of certification of each hazardous waste disposal unit, the owner or operator must submit to the zoning authority or county land-use authority and the IDEM a record of the types, locations, and amounts of hazardous wastes disposed of within each cell.

Third, [40 CFR Part 265.119\(b\)](#) states that within 60 days of certification of closure of the first and last hazardous waste disposal units, the owner or operator must record a notice in deed that the land was used to manage hazardous waste and must not be disturbed, and certify that this information was recorded and a copy of the information sent to the IDEM.

2.6.3.5 Certification of Completion of Post-Closure Care

Within 60 days after the completion of the established post-closure care period for each hazardous waste management unit, a certification must be submitted to IDEM that the post-closure care period for the hazardous waste unit was performed in accordance with specifications in the approved post-closure plan. The certification must be signed by the owner or operator and an independent, registered professional engineer. Documentation supporting the independent registered professional engineer's certification must be furnished to IDEM upon request until the owner or operator is released from the financial assurance requirements for post-closure care under [329 IAC 3.1-14 or 15](#).

2.7 RCRA Corrective Action Process

Facilities seeking a TSD permit and facilities that formerly operated as TSDs, that released hazardous constituents, must fulfill certain Corrective Action requirements in accordance with [IC 13-22-2-5\(6\)](#) and [IC 13-22-13-1](#). IDEM may initiate Corrective Action either through the RCRA permit, if applicable, or through an order. Alternatively, facilities may choose to address Corrective Action

obligations voluntarily (for example, through either an agreed order or the VRP with accompanying order). Regardless of how a facility enters corrective action, the goals are the same—facility-wide assessment for the presence of released hazardous waste and/or hazardous constituents followed by a demonstration that any such release at or from the facility does not pose unacceptable risks to human health or the environment.

The Corrective Action process consists of five basic elements:

- Potential source identification,
- Release assessment,
- Release investigation,
- Evaluation and selection of appropriate remediation technology or technologies, and
- Remediation of release(s).

These elements typically occur, to some degree, during most cleanups. They should be viewed as evaluations needed to make good cleanup decisions, not necessarily individual steps through the process. All five elements are briefly described below. Specific details are provided in the “Corrective Action Scope of Work,” which is available from IDEM.

Either a default or non-default risk assessment can be performed after either the release assessment or the release investigation, or upon completion of remediation activities. Upon satisfactory completion of corrective action requirements, IDEM will issue an acknowledgment that no further action (NFA) is required for the unit. Closure under the RISC Technical Guide can be used to demonstrate that the unit has attained no further action status.

IDEM recognizes recent reforms by the U.S. EPA to “streamline” Corrective Action. For facilities that meet EPA’s qualifying criteria, the IDEM will incorporate a streamlined Corrective Action process into permits and orders. In accordance with the streamlined approach, IDEM emphasizes that the details contained in the Corrective Action Scopes of Work referred to above should not be considered boilerplate provisions applicable to every site, but rather a menu of possible activities that may be appropriate for a particular facility or corrective action evaluation. Similarly, facility owners and operators are

encouraged to pursue interim corrective measures and presumptive remedies to accelerate the process of environmental improvement.

2.7.1 Potential Source Identification

During this stage of the process, the entire facility is evaluated for its potential to release hazardous wastes and hazardous constituents into the environment. The potential source identification is similar to the pre-sampling discussed in [Chapter 2](#) of the RISC Technical Guide. This evaluation is commonly referred to as the RCRA facility assessment (RFA). If the RFA reveals that the potential for releases exists or existed, a current conditions report is required for the facility that includes the following information:

- A summary of the facility's background, including the historical use of the facility and all known locations where solid or hazardous wastes were managed, regardless of when they were in use,
- A description of the known nature and extent of any contamination, including available monitoring data, potential migration pathways, and potential receptors, and
- A description of any measure that was or is being undertaken to mitigate any risks to human health or the environment.

2.7.2 Release Assessment

Release assessment is the first of two steps in the Corrective Action RCRA facility investigation (RFI) process. The default procedures for this assessment follow the screening procedures described in [Chapter 3](#) of the RISC Technical Guide. This assessment normally requires a work plan submitted for IDEM approval, unless IDEM has approved an alternate approach. Two additional requirements apply to the release assessment beyond those presented in [Chapter 3](#). First, the owner/operator must submit a community relations plan (CRP). The CRP will describe how the community will be kept apprised of conditions and ongoing work at the facility. Secondly, if an imminent threat to human health or the environment is discovered during the release assessment, interim measures are required to abate the threat.

2.7.3 Release Investigation

Release investigation is the second of two steps in the RFI process. It is similar to characterization of the nature and extent of contamination discussed in [Chapter 4](#) of the RISC Technical Guide. However, the owner/operator should refer to this chapter's Sample Quality Assurance and Analytical Requirements, RCRA Soil Sampling, and RCRA Ground Water Evaluation sections for additional requirements applicable to the RCRA program. All RISC requirements must be followed as well. Results of the release investigation and release assessment are usually presented in an RFI report.

2.7.4 Evaluation and Selection of Appropriate Remediation Technology

Upon IDEM's approval of the results of the release investigation, IDEM may require the evaluation of remediation technology alternatives. This evaluation is commonly referred to as a corrective measures study (CMS). The CMS's objective is to ensure that any technology ultimately selected will be capable of effectively achieving timely closure. The technology or technologies will also be evaluated for cost-effectiveness. It is important to note that "cost-effective" does not necessarily mean the least costly.

Evaluation of appropriate remediation technologies need not be a lengthy process. A presumed remedy (that is, a known, proven remedy) that meets the effectiveness and timeliness criteria can be proposed to IDEM. Regardless of how the potential remedy is chosen, its proposal must be made available for public comment.

2.7.5 Remediation of Releases

Upon termination of the public comment period, IDEM will select the remedy or combination of remedies to be implemented. Under the Corrective Action process, this element is called "Corrective Measures Implementation" (CMI). Once the remedy is selected, the owner or operator must submit a CMI work plan for approval that includes a remedial cost estimate and demonstrates financial assurance through one or more of the options listed in [40 CFR 264, Subpart H \(329 IAC 3.1-15-4\)](#). The following mechanisms are preferred by IDEM:

- Trust fund,
- Surety bond guaranteeing performance, or

- Letter of credit.

Insurance and surety bonds guaranteeing payment into a standby trust fund are not acceptable mechanisms (See [55 FR 30856, July 27, 1990](#)).

2.7.6 Corrective Action Completion Determinations

2.7.6.1 Introduction

This section provides guidance on acknowledging the completion of corrective action activities for Solid Waste Management Units and Areas of Concern, at RCRA treatment, storage, and disposal facilities (TSDs). It describes two types of completion determinations, “Corrective Action Complete Without Controls” and “Corrective Action Complete With Controls.” It also provides guidance on when each type of completion determination is appropriate, and discusses completion determinations for less than an entire facility. Finally, it provides procedures for making completion determinations for both permitted and non-permitted facilities, and sets out how IDEM intends to implement the statutory and regulatory provisions of Indiana’s authorized RCRA Corrective Action Program.

For Solid Waste Management Units (SWMUs) and Areas of Concern (AOCs), there are two potential ways of achieving a Corrective Action Complete determination: 1) the owner/operator may demonstrate the remediation of any releases to naturally occurring background concentrations or 2) the owner/operator may make a demonstration that the concentrations of hazardous constituents remaining are protective of human health and the environment.

Regarding the first potential corrective action completion determination, when demonstrating that the hazardous constituents are naturally occurring at levels normally found in that area (background concentrations), the owner or operator must use the methods specified in [Chapter 3](#) of the RISC Technical Guide for determining site-specific background concentrations. Regarding the second potential determination, the owner or operator may use risk assessments to verify that no affected environmental media at the facility present a threat to neither human health nor the environment.

Remediation of the affected media may or may not be necessary to meet the protective concentrations established by the risk assessment,

to eliminate sources of ongoing or potential future releases, or to restore natural resources to productive use (such as groundwater in wellhead protection areas). For any remedy that relies on industrial land use exposure assumptions or activity restrictions at the site to protect human health or the environment, the owner or operator must record an environmental restrictive covenant to the property's deed. An environmental restrictive covenant, whether for specific activity restrictions or land use restrictions, is an example of an institutional control. Institutional controls are legal or administrative measures that limit human exposure to contaminants. Other examples of institutional controls include use control areas, easements, and zoning ordinances. Additional requirements for environmental restrictive covenants are discussed in [Appendix 5](#) of the RISC Technical Guide.

A site may be closed using engineering controls, which are physical measures such as landfill capping, waste containment, groundwater slurry walls, extraction wells, or treatment methods. Engineering controls are capable of managing environmental and health risks by reducing contamination levels or limiting exposure pathways, and encompass a variety of engineered remedies to contain or reduce exposure to contamination, and/or provide physical barriers intended to limit access to the property or the contaminants. In contrast, institutional controls are a variety of administrative or legal devices imposed to ensure that the engineered controls stay in place or, where there are no engineered controls, to ensure the restrictions on activities or land use stay in place. "Corrective Action Complete With Controls" implies that engineering and/or institutional controls were used to close the SWMUs or AOCs.

It is important to note, that [Section 2.7.6](#) does not address the corrective action requirements of [40 CFR 264.100](#) for regulated hazardous waste land disposal units, which is conducted in lieu of [40 CFR 264.101](#). Section 101 addresses SWMUs, AOCs, and potentially hazardous waste management units that were closed by decontamination and removal if new information reveals that unacceptable exposures exist. When corrective action is terminated under [40 CFR 264.100](#), as adopted by reference in [Title 329 of the Indiana Administrative Code \(IAC\) Article 3.1, Rule 1, Section 7, and Rules 9 and 13, \(329 IAC 3.1-1-7, 329 IAC 3.1-9 and 329 IAC 3.1-13\)](#), the owner or operator is required to return to the facility's groundwater monitoring and response program, and other ongoing permit requirements remain in force.

2.7.6.2 Background

IDEM and the United States Environmental Protection Agency (U. S. EPA) recognize the importance of an official acknowledgment that RCRA corrective action activities have been completed. An official completion determination, made through appropriate procedures, benefits the owner or operator of a facility, IDEM and the general public as well. Official recognition that corrective action activities are complete can, among other things, promote transfer of ownership of the property and, in some cases; help return previously used commercial and industrial properties, known as “Brownfields” back to productive use. Further, once IDEM makes a determination that corrective action activities are complete, it can focus agency resources on other facilities. Finally, because completion determinations are made through a process that provides for adequate public involvement, the public is assured an opportunity to review and comment on the proposed cleanup methods, the level of cleanup to be achieved, and any remaining activities that will be required. The public participation process also assures the community the opportunity to pursue available administrative and/or judicial challenges to any of IDEM’s decisions.

For these reasons as well as those listed below, IDEM and U. S. EPA entered into a Memorandum of Understanding (MOU) on December 17, 2001, which memorialized our agreement on the management and coordination of our RCRA Subtitle C corrective action activities. Of particular note, the MOU enhanced IDEM’s ability to bring idled hazardous waste management facilities into the Indiana Brownfields Program through the use of the various legal authorities of its remedial action programs.

IDEM received authorization for the RCRA Corrective Action Program from U. S. EPA on October 21, 1996. The remedial activities of Indiana’s authorized RCRA Corrective Action Program are administered by the Hazardous Waste Permits Section of the Permits Branch in IDEM’s Office of Land Quality (OLQ). OLQ’s Remediation Services Branch includes: the Indiana Brownfields Program, which was created by a merger of IDEM’s Brownfields Section and a portion of the Indiana Finance Authority in 2006; the Federal Programs Section, which oversees state lead Superfund National Priorities List sites and Department of Defense base closures, the State Cleanup Section, which uses state CERCLA-like authorities under [IC 13-25](#) to address hazardous substance releases and includes the authority to address petroleum contamination under [IC 13-24](#); the Leaking Underground Storage Tank Section, which closes sites under

[IC 13-23](#) and the Underground Storage Tank Rule [329 IAC 9](#); the Site Assessment Section, which scores sites for prioritization under [329 IAC 7-1](#), the Indiana Scoring Model; and the Voluntary Remediation Program, which has the authority to address both hazardous substances and petroleum under [IC 13-25-5](#).

The U. S. EPA, through the MOU, supports the option provided by IDEM for RCRA treatment, storage or disposal (TSD) facilities to address their corrective action obligations through IDEM's Voluntary Remediation Program. Corrective action activities may also be conducted through oversight by one or more of the other Remediation Services Branch programs. The MOU acknowledged EPA's agreement to generally not take federal RCRA corrective action enforcement actions against RCRA Subtitle C TSD facilities that successfully remediate their facilities through Indiana's various remediation programs. This was made possible by all of IDEM's remediation programs use of the RISC Technical and User's guides as their cleanup standard.

In 2004, the MOU was modified to provide the same protection for facilities addressing their RCRA corrective action obligations under the oversight of the U. S. EPA. The 2004 MOU added that IDEM will generally not take enforcement actions against TSD facilities that address corrective action under federal oversight. The MOU lists the conditions that facilities must meet in order to be protected by it, and the conditions under which IDEM and the U. S. EPA are not bound by it. A copy of the signed 2004 MOU is located in [Section 2.3 of Appendix 2](#). Pursuant to the MOU, U. S. EPA and IDEM have agreed to honor, to the extent possible, each other's completion determinations. Therefore, IDEM will accept completeness determinations made by U. S. EPA, Region 5, and U. S. EPA, Region 5 will accept completion determinations made by IDEM, barring any of the listed conditions in the MOU.

Under [40 CFR section 264.101](#), as adopted by reference in [329 IAC 3.1-1-7](#), [329 IAC 3.1-9](#), and [329 IAC 3.1-13](#), owners and operators seeking a permit for the treatment, storage or disposal of hazardous waste pursuant to [IC 13-15](#) and [IC 13-22](#), must conduct corrective action for any and all releases of hazardous constituents at or from their facility "as necessary to protect human health and the environment." This portion of the RCRA Corrective Action Program is carried out under the authorities of the Hazardous Waste Permit Section, through the issuance of operating and post-closure hazardous waste permits. RCRA corrective action is also an obligation of owners

and operators of facilities that have or once had “interim status,” and are thereby subject to corrective action as required by orders under IC 13-22-13. This portion of the RCRA Corrective Action Program is also carried out under the authority of the Hazardous Waste Permit Section. Regardless of the legal authority imposing these requirements, the requirements are the same and the ultimate goal of the RCRA Corrective Action Program is to satisfy the “protection of human health and the environment” standard. Thus, a determination by IDEM that corrective action activities are complete is an announcement that the “protection of human health and the environment” standard has been achieved. The universe of facilities subject to the corrective action requirements includes facilities that vary widely in complexity, extent of contamination, and the level of risk presented at the facility. To address this wide variation among corrective action facilities, multiple approaches have been developed to achieve the “protection of human health and the environment” standard.

Regardless of the implementing program, when conducting corrective action, one of the key distinctions among remedies is the extent to which they rely upon controls (engineering and/or institutional) to ensure that they remain protective. In some cases, a facility may propose a remedy that requires treatment and/or removal of waste and all contaminated media to levels that allow the facility to be used in an unrestricted manner. At these facilities, no additional oversight or activity is required following cleanup. When implementation of the remedy is completed successfully, protection of human health and the environment is achieved. These remedies are also referred to as “residential” cleanups; (i.e. residential exposure assumptions are used when calculating the cleanup levels). In other cases, a facility may propose a remedy that allows contamination to remain on-site with the requirement of ongoing obligations such as operation and maintenance of engineered controls (e.g., a landfill cap), and compliance with institutional controls (e.g., a restriction on the property’s deed that the land be used for industrial purposes only and that the cap not be disturbed). Thus, in this situation, the standard is achieved through use of an engineered remedy (i.e. containment), that allows some contamination to remain in place, and requires institutional controls (i.e. land use and activity restrictions), at the facility to prevent or limit the risk of exposure to the contamination that remains after cleanup activities are completed.

Following the remedy implementation (CMI) at RCRA corrective action facilities, maintenance of controls and continued corrective

action related activities are essential to meet the standard of “protection of human health and the environment.” An example of a situation where IDEM typically would approve a proposed remedy that relies on controls is a facility for which the reasonably foreseeable future land use is industrial. At those facilities, IDEM may allow the facility the option of achieving long-term protection of human health and the environment by selecting a remedy that allows higher levels of hazardous constituents to remain at the facility, but requires the use of controls to limit the risk of unacceptable exposure. This remedy is considered to be a final remedy; however, protection of human health and the environment at the facility is dependent on the maintenance of these controls.

2.7.6.3 Corrective Action Complete Without Controls Determination

As discussed above, a determination by IDEM that corrective action activities are complete is a statement by IDEM that protection of human health and the environment has been achieved at a facility. IDEM will consider different approaches to achieving protection of human health and the environment at facilities, depending on the site-specific circumstances. IDEM believes that it is appropriate to make the determination that Corrective Action is Complete Without Controls where the facility owner or operator has satisfied all corrective action obligations. This determination indicates that either there was no need for corrective action at the facility or, where corrective action was necessary, the remedy has been implemented successfully, and no further activity or controls are necessary to protect human health and the environment. Thus, the corrective action requirements can be eliminated. The facility will be eligible for release from financial assurance for corrective action, as no funds will be needed for future corrective action-related activities. In addition, because there are no longer any RCRA corrective action required activities at the facility, IDEM will have no concerns associated with transfer of the property, nor any reason to want to be informed of or take any action regarding that transfer.

2.7.6.4 Corrective Action Complete With Controls Determination

IDEM will generally make a Corrective Action Complete With Controls determination at a facility where each of the following has been demonstrated to IDEM’s satisfaction:

1. A full set of corrective measures has been defined,
2. The facility has completed construction and installation of all required remedial actions,
3. Site specific media cleanup objectives have been met, and
4. All that remains is performance of required operation and maintenance, monitoring actions, and/or compliance with and maintenance of any controls.

A Corrective Action Complete With Controls determination provides the owner or operator with recognition that protection of human health and the environment has been achieved, and will continue as long as the necessary operation and maintenance actions are performed, and any institutional controls are maintained and followed. An enforceable mechanism must be in place to ensure there is compliance with and maintenance of all controls.

Several enforcement mechanisms are available to require the necessary operation and maintenance activities associated with engineered controls. Operating permits, post-closure permits, remedial action permits and enforceable orders are examples of enforceable mechanisms. An environmental restrictive covenant will also be required for all engineered controls.

In addition to the enforcement mechanisms above, another enforceable mechanism is appropriate for implementing institutional controls alone in some instances, which are environmental restrictive covenants. [IC 13-14-2-6](#) gives IDEM the authority to enforce compliance with institutional controls in the form of environmental restrictive covenants. For the purposes of [IC 13-14-2-6](#), environmental restrictive covenants are defined in [IC 13-11-2-193.5](#), as any deed restriction, environmental covenant, environmental notice, or other restriction or obligation that: (1) limits the use of the land or the activities that may be performed on or at the land, or requires the maintenance of any engineering control on the land designed to protect human health or the environment; (2) by its terms is intended to run with the land and be binding on successors; (3) is recorded with the county recorders office in the county in which the land is located; and (4) explains how it can be modified. The mechanism referenced in [IC 13-14-2-6](#) is only appropriate for environmental restrictive covenants.

A permit or order will be required for engineering controls.

This is an approach that is supported by U.S. EPA; however, the decision as to which mechanism is appropriate for each hazardous waste facility rests with IDEM's Hazardous Waste Permit Section ([See Federal Register 68 FR 8757, February 25, 2003](#)). In addition, where necessary (e.g. Corrective Action Management Units (CAMUs) used for disposal), adequate financial assurance for corrective action will be required.

IDEM will periodically review facilities for compliance with all controls, and require notification in advance of any transfer of ownership of any portion or all of the facility. This will allow an opportunity for IDEM to assure that compliance with all corrective action requirements continue. (For more information, a copy of "Institutional Controls: A Site Manager's Guide to Identifying, Evaluating and Selecting Institutional Controls at Superfund and RCRA Corrective Action Cleanups", U. S. EPA 540BFB00B005, OSWER 9355.0B74FSBP, September 2000, can be found at <http://www.epa.gov/superfund/action/ic/guide/guide.pdf>).

It should be noted that some facilities that obtain a Corrective Action Complete With Controls determination, or subsequent facility owners, might later wish to obtain a Corrective Action Complete Without Controls determination if circumstances were to change. For example, the owner or operator at a facility cleaned up to industrial exposure levels could decide to conduct additional cleanup because of a desire to change the land use to unrestricted use levels, and/or because they no longer wish to maintain any engineering controls. Should a facility later seek a Corrective Action Complete Without Controls determination, IDEM will process that determination through the procedures described below. Whenever a Corrective Action Complete Without Controls determination is subsequently justified, it would be appropriate to remove whatever enforceable restrictions are in place and release the facility from financial assurance for corrective action, so long as there are no additional RCRA activities at the facility subject to the CAMU Rule or any permitting requirements.

2.7.6.5 No Further Action

The term "No Further Action" may be used in two slightly different ways in the corrective action process. First, "No Further Action" status can be a determination used for individual SWMUs or AOCs. Once all activities required are completed at individual units at a

facility, a “No Further Action” status may be granted to that specific SWMU or AOC, while work may continue at other areas of the facility.

Second, “No Further Action” (NFA), can also be used to describe a site-wide selected remedy. For example, if the RFA or the RFI reveals that both the soil and ground water at all SWMUs and/or AOCs at a facility are below the RISC default residential levels for all COCs, and there are no ecological exposures of concern, the facility owner or operator may propose “No Further Action” as the final remedy for the facility. If IDEM agrees with this proposal, this final remedy would be public noticed and the public participation process would begin.

2.7.6.6 Completion Determinations for a Portion of a Facility

IDEM may develop a number of distinct and separate remedies to address different areas of a facility or different media. This approach may be necessary because a facility includes areas and media that present a wide range of environmental risks. For example, an industrial facility may include areas that have never been used for industrial purposes or have never been otherwise contaminated. Alternatively, a facility may have contaminated groundwater undergoing corrective action years after the source of contamination has been removed and the soil has been cleaned up to unrestricted use levels. To ensure that a range of appropriate cleanup and land use options is available to the facility owner or operator, IDEM will consider, when appropriate, allowing a facility to legally subdivide a parcel from the remainder of the facility, consistent with the goals and objectives of the RCRA Corrective Action Program. In these situations, IDEM may select or approve a cleanup approach based on unrestricted use at parts of the facility, while cleanup at other parts of the facility may be based on restricted use assumptions, which would rely on engineering and/or institutional controls to maintain the protectiveness of the corrective action.

Alternatively, IDEM may select or approve a cleanup approach based on unrestricted use for the entire facility, with some parcels requiring a longer time period to achieve the same cleanup goals. Under this approach, a Corrective Action Complete Without Controls determination could be made for a portion of a facility when it qualifies for unrestricted use. A Corrective Action Complete Without Controls or a Corrective Action Complete With Controls

determination, as appropriate, could be made for remaining portions of the facility when those cleanup goals are achieved, and any necessary controls would then be implemented under an appropriate mechanism.

In some situations, following a Corrective Action Complete Without Controls determination for a portion of a facility, the owner would be allowed to subdivide and/or sell the portion that is no longer subject to corrective action. In these situations, IDEM will consider the long-term plan for the facility, the effect of the Corrective Action Complete Without Controls determination, and the effect of the sale of the property on the financial assurance established for corrective action. IDEM will require that adequate financial assurance remains available to address corrective action obligations at the remainder of the facility.

2.7.6.7 Procedures for Completion Determinations for the Entire Facility

The federal regulations in [40 CFR 260 through 270](#), as adopted by reference in [329 IAC 3.1](#), do not provide explicit procedures for recognizing completion of corrective action activities. Therefore, the U. S. EPA and IDEM have considerable flexibility in making completion determinations, and feel that it is important to provide meaningful opportunities for public participation as part of the completion determination process. Coordinated community planning and input are key components to these determinations.

It should be noted that if the Voluntary Remediation Program (VRP) is the program under which the facility wishes to address its corrective action obligations, the VRP does not dictate the scope of remedial activities proposed by the applicant. Because the VRP is voluntary, applicants to a certain extent are free to conduct whatever activities in whichever areas they choose. However, the scope of the environmental investigations conducted at RCRA TSDs under corrective action is crucial when making completion determinations. The MOU in [Section 2.3 of Appendix 2](#) sets out the scope, conditions and requirements for facilities that wish to carry out their RCRA corrective action obligations in the VRP. The Hazardous Waste Permits Section will be responsible for making completion determinations at all TSD facilities after the facility has received a Certificate of Completion from the VRP and a Covenant Not to Sue from the Office of the Governor of the State of Indiana. The Certificate of Completion and Covenant Not to Sue is very specific as to what constituents were investigated and in which areas confirmation samples were taken.

Pursuant to Indiana Code 13-25-5-1, participation in the Voluntary Remediation Program does not affect a person's RCRA obligations set forth in 42 USC 6901.

It is recommended that the facility coordinate their activities in the VRP with the Hazardous Waste Permit Section if they wish to carry out their RCRA Corrective Action Program obligations at the same time.

The procedures for processing completion determinations are dependent on various factors including: the status of the facility (permitted or interim status); the resulting future land use and proposed method of eliminating exposure pathways; and whether the determination applies to a portion of the facility or the entire facility.

2.7.6.7.1 Procedures for Determinations Without Controls

Procedures for Permitted Facilities

At permitted facilities, the Hazardous Waste Permits Section will use permit modification procedures to reflect the determination that corrective action is complete. In cases where no other permit conditions remain, the permit will be modified not only to reflect the completion determination, but also to change the expiration date of the permit to allow earlier permit expiration ([See 40 CFR 270.42 \(Appendix I\(A\)\(6\)\)](#)). The current regulations in [40 CFR 270.42](#), as adopted by reference in [329 IAC 3.1-1-7](#) and [329 IAC 3.1-13](#), provide procedural requirements for permit modifications.

In most cases, completion of corrective action will likely be a Class 3 permit modification, and IDEM will follow those procedures, including the procedures for public participation. However, Class 3 procedures may not be appropriate in all circumstances, and IDEM will evaluate each situation to determine whether a less extensive procedure would be adequate. For example, where IDEM has made extensive efforts throughout the corrective action process to involve the public and has received little or no interest, and/or the environmental problems at the facility were limited or nonexistent, more tailored public participation may be appropriate.

Procedures for Non-permitted Facilities

At non-permitted (interim status) facilities where facility-wide corrective action is complete, and all other RCRA obligations at the facility have been satisfied, the Hazardous Waste Permit Section will acknowledge completion of corrective action without controls by the following procedures. The written bases for IDEM's decision will be stated clearly and specifically include that:

1. There are no current treatment, storage, or disposal activities that require a hazardous waste permit,
2. All closure and post-closure requirements applicable at the regulated units have been fulfilled,
3. All potential sources of environmental contamination at the facility have been sufficiently investigated to determine the level of threat to human health and the environment, and have been appropriately remediated where necessary, and
4. All corrective action obligations have been met.

The following public involvement procedures set out the requirements for making corrective action completion determinations at non-permitted facilities.

1. IDEM will notice local officials, the county health department and any local environmental agency, and publish a public notice in a news paper of local distribution of the proposed completion determination. The notices will generally include the following:
 - a. Name,
 - b. Location,
 - c. Property legal description,
 - d. Current owners and/or operators,
 - e. Property ownership,
 - f. Operation history, and
 - g. A comprehensive summary that includes:

- (1) the current site conditions; and
 - (2) an explanation that these current site conditions do not pose a significant environmental concern.
2. IDEM will solicit correspondence regarding the proposed facility completion determination from:
 - a. local officials,
 - b. the county health department; and
 - c. any local environmental agency.
3. IDEM will provide the following as necessary:
 - a. responses to any comments received from the public or local officials, and
 - b. a forum for public meetings.
4. If a public hearing is requested, IDEM will conduct a hearing in a public forum to receive comments.
5. IDEM will consider all comments received.
6. After receipt of all comments, IDEM will notify all interested parties of the completion determination.
7. If IDEM determines that appropriate completion has been attained, a Notice of Completion of Corrective Action Without Controls will be issued to the owner/operator.

More detailed guidance on RCRA public participation can be found on U. S. EPA's website at:

<http://www.epa.gov/epaoswer/hazwaste/permit/pubpart/manual.htm>.

A copy of IDEM's Guide for Citizen Participation is located on our website at:

http://www.in.gov/idem/your_environment/community_involvement/publicparticipation/index.html.

2.7.6.7.2 Procedures for Completion Determinations With Controls

To process a Corrective Action Complete With Controls determination, IDEM will consider the regulatory status of the facility, among other factors. As stated above, permits and orders will continue to be used as enforceable mechanism options to assure compliance with any and all remaining engineering controls. IDEM's authority to enforce environmental restrictive covenants pursuant to [IC 13-14-2-6](#), may be sufficient to assure compliance with institutional controls, however, the decision as to which mechanism is appropriate for each facility rests with IDEM's Hazardous Waste Permits Section.

Procedures for Permitted Facilities

At permitted facilities, IDEM's permit modification procedures will be required for operating facilities, and an option for post-closure facilities. This determination generally will be made at facilities where the four conditions stated at the beginning of [Section 2.7.6.7.1](#) have been met.

For operating permitted facilities where engineering controls are used to eliminate or limit exposure to remaining contaminants, the specific requirements for operation and maintenance of such controls and any other associated required activities, will be specified in the operating permit as a Class 3 permit modification. For post-closure facilities, these requirements may be specified in a post-closure agreed order or a post-closure permit. Engineering controls will also require the use of one or more of the financial assurance mechanisms listed above under [Section 2.7.5](#).

For permitted facilities where institutional controls alone are used to limit exposure by land use or activity restrictions, the permit may be modified to simply reflect the completion determination. In cases where no engineering controls are used to limit exposure to contaminants, all land use specific cleanup objectives for each medium have been obtained, and no other permit conditions remain, the permit will be modified not only to reflect the completion determination, but also to change the expiration date of the permit to allow earlier permit expiration ([See 40 CFR 270.42 \(Appendix I \(A\)\(6\)\)](#)).

In all cases where the final remedy uses engineering controls, activity restrictions or land use restrictions to ensure compliance with the "protection of human health and the environment" standard, all such

restrictions and controls shall be recorded on the deed(s) to all of the property(ies) originally listed on the facility's Part A application.

Procedures for Non-permitted Facilities

For non-permitted facilities, the procedures for making the determination are the same as for Corrective Action Complete Without Controls for non-permitted facilities. This determination generally will be made at facilities where the four conditions in [Section 2.7.6.7.1](#) have been met.

For facilities where engineering controls are used to eliminate or limit exposure to remaining contaminants, the specific requirements for operation and maintenance of all such controls must be specified in an enforceable order or Remedial Action Permit (RAP), for as long as the controls are necessary to ensure the protection of human health and the environment. At facilities where engineering controls are implemented, the use of one or more of the financial assurance mechanisms listed in [Section 2.7.5](#), must be specified in the order or RAP for the operation and maintenance of all the controls used.

In cases where no engineering controls are used to limit exposure to hazardous constituents, and all site-specific media cleanup objectives have been met, the use of an environmental restrictive covenant on the property deed may be the only control to maintain.

In cases where the final remedy uses engineering controls, activity restrictions or land use restrictions to meet the "protection of human health and the environment" standard, all such restrictions and controls shall be recorded on the deed to the property, or deeds to all of the parcels of property originally listed on the facility's Part A application.

2.7.6.8 Procedures for Determinations for Less than the Entire Facility

As discussed above in [Section 2.7.6.6](#), IDEM may make a Corrective Action Complete determination for a portion of a facility, when corrective action activities are still required at the remaining portion. When IDEM makes this determination for a portion of the facility (with or without controls), it will do so using procedures that will not affect portions of the facility where corrective action requirements remain. For example, at a permitted facility, IDEM may make a Corrective Action Complete determination for a portion of the facility by modifying the permit following the procedures in [40 CFR 270.42](#),

as adopted by reference in [329 IAC 3.1-1-7](#) and [329 IAC 3.1-13](#). However, IDEM will not eliminate the permit if corrective action responsibilities (and possibly other RCRA responsibilities) remain at the facility.

At non-permitted facilities, the procedures for making the determination for a portion of the facility are the same as for Corrective Action Complete Without Controls for non-permitted facilities. However, it is important to note that interim status is not terminated by completion determinations made by IDEM. If the corrective action was implemented through an agreed order or final order, the order will remain in force until the facility satisfies all corrective action obligations required and ensures that any required controls will be maintained.

2.8 Sample Quality Assurance and Analytical Requirements

The sample QA and analytical requirements apply to the soil and ground water sampling discussed in [Sections 2.9 and 2.10](#) of this User's Guide. Sampling and analysis plans (SAPs), sampling QA, and analytical requirements are discussed below.

2.8.1 Sampling and Analysis Plans

An adequate SAP should include, at a minimum, the following information:

1. Media to be sampled,
2. Parameters to be analyzed,
3. Sampling locations and depths,
4. Background boring locations and depths for inorganic parameters (if applicable),
5. Soil boring methods, sample collection methods, and sampling equipment,
6. Procedures and equipment used to minimize volatilization in samples submitted for organic analysis,
7. Sample preservation techniques and containers,

8. Equipment decontamination procedures,
9. Analytical procedures used to achieve EQLs,
10. Statement indicating closure levels,
11. Sample chain-of-custody control procedures, including shipping procedures, and
12. A copy of the form that will be used to record and document soil descriptions and sampling information in the field.

The form identified under item 12 above should include the following information:

1. Facility or unit,
2. Purpose of sampling,
3. Sampling date and time,
4. Weather conditions,
5. Field personnel,
6. Sampling method and equipment,
7. Boring, test pit, or well location and identification (ID) number,
8. Soil mapping unit determined from the appropriate county soil survey published by USDA's SCS,
9. Sample number,
10. Sampling interval and depth,

11. Monitoring well static water level,
12. Monitoring well purging procedure,
13. Ground water field measurements (such as pH, specific conductance, and temperature),
14. USDA soil textural classification from the following reference:
USDA. 1962. *Soil Survey Manual*. Handbook No. 18. U.S. Government Printing Office. Washington, DC.,
15. Lithology,
16. Munsell soil color from the following reference:
Munsell Color. 1975. *Munsell Soil Color Charts*. Baltimore, MD.,
17. Sedimentologic features,
18. Miscellaneous observations, and
19. Evidence of contamination (such as discoloration, odor, or field instrument results).

Facilities are strongly advised to perform continuous soil borings and record descriptions in accordance with IDEM's Unconsolidated Descriptive Requirements.

2.8.2 Sampling Quality Assurance

Sampling methods and equipment used should follow guidance in U.S. EPA's "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods" (SW-846) and U.S. EPA's "RCRA Ground-Water Monitoring Technical Enforcement Guidance Document" (OSWER Directive No. 9950.1, Final, 1986). Field sampling methods not included in SW-846; [40 CFR 261, Appendix I](#); or the technical enforcement guidance document must be approved by OLQ before use. These methods include drilling, boring, and other sampling methods. When available, standard procedures as defined by U.S.EPA, IDEM, or the American Society for Testing and Materials (ASTM) should be followed.

IDEM recommends using the Data Quality Objective (DQO) process for all sampling and analysis performed in support of RISC. DQOs

establish the type, quality and quantity of data required to make and defend a particular decision. See [Appendix 4](#) of the Technical Guide for information on the DQO process. IDEM highly recommends collecting the various types of quality assurance samples. Each QA sample documents specific aspects and provides information about accuracy or precision throughout the sampling process. Proper decisions cannot be made without appropriate QA samples, and analytical results will be considered to be estimated, attributed to the sample, or may not meet the project DQO.

For each batch of 20 samples or less, IDEM recommends at least one field duplicate per matrix type must be collected. Control samples such as trip blanks (when VOC's are chemicals of concern) or equipment blanks (to demonstrate field decontamination procedures) should be collected for each day that samples are collected. In addition, for each batch, sufficient sample amounts must be collected of each matrix to allow the laboratory to prepare one matrix spike and either one matrix duplicate analysis or one matrix spike duplicate per analytical batch when appropriate for the method. The purpose of matrix spikes is to determine bias resulting from the sample matrix. Therefore, the spiked sample must be from the same project as the field samples. If the spiked sample is not from the same project, analytical results must be flagged as estimated. Samples identified as blanks do not meet the purpose of a spike and must not be spiked.

Samples collected for VOC analyses require specialized sampling and handling procedures. Soil samples should be collected with a split-spoon sampler or a sampler that uses removable liners made of stainless steel or some other material acceptable to the laboratory. IDEM recommends Method 5035A for collecting soil samples for VOC analysis. Preparation, decontamination, and sampling procedures should be performed in accordance with SW-846 and U.S. EPA's technical enforcement guidance document. Under no circumstances should soil samples for VOC analysis be mixed, composited, or otherwise aerated.

2.8.3 Analytical Requirements

A complete quality assurance project plan (QAPP) should be prepared to document sampling and analytical requirements. Guidelines for developing a QAPP are presented in [Appendix 4](#) of the RISC Technical Guide as well as SW-846, Chapter 1. [Appendix 4](#) of the RISC Technical Guide also details the data quality objectives (DQO) process. One project objective is that the analytical methods' EQLs

meet closure levels. [Appendix 2](#) of the RISC Technical Guide contains guidance on choosing analytical methods that will meet project objectives.

The QAPP should also specify analytical methods for each parameter, sample preparation and extraction methods, and EQLs for each analyte. Guidance for establishing EQLs, which are highly matrix-dependent, is provided in SW-846. The analytical methods in SW-846 should be used whenever possible. Other official U.S. EPA methods applicable for the sample matrix can be used, but any modification to these methods or the use of any other methods will require the submittal of the complete method for OLQ approval. The QA requirements specified in the individual methods must be performed by the laboratory to produce data of acceptable quality.

The use of common field screening instruments, such as combustible gas indicators, colorimetric indicator tubes, and photo-ionization detectors (such as the HNu™ or TIP™), is not an acceptable substitute for SW-846 methods. These screening tools can be used to determine the presence (but not the absence) of hazardous constituents. They are only appropriate and acceptable for screening samples. If portable field instruments are used, the results should be confirmed by laboratory analysis of the samples using SW-846 methods.

2.9 RCRA Soil Sampling

This section discusses soil sampling under the RCRA program, including the following:

- Soil sampling requirements,
- Background sampling,
- Sampling considerations,
- Sampling to determine the nature and extend of contamination,
- Closure or verification sampling, and
- Industrial closure soil sampling.

2.9.1 Soil Sampling Requirements

Hazardous waste management units having any evidence or possibility of a release or the potential for migration of a hazardous waste or hazardous constituent (see 40 CFR 261, Appendix VIII) at any time during the life of the unit must be investigated before closure. Soil, and potentially ground water, should be investigated to determine the presence of hazardous constituents. For Corrective Action purposes, the investigation must evaluate for the presence and concentrations of hazardous constituents. Investigation is required for container or tank storage areas located on soil, gravel, paved pads, or concrete pads. However, IDEM may, on a case-by-case basis, determine that alternate sampling is appropriate. Sampling should be performed in accordance with the sampling methods listed in 40 CFR 261, Appendix I, or SW-846, Chapter 9.

If soil is found to be contaminated, the closure plan, post-closure care plan, or corrective action provisions, if applicable, may require ground water monitoring to determine the nature and extent of contamination. Ground water monitoring applicable by regulation (40 CFR 264.90 and 40 CFR 265.90) has specific standards, and the closure plan must account for these standards (see [Section 2.10](#) for ground water monitoring requirements).

Constituent evaluation, closure levels, and screening sample locations are discussed below.

2.9.1.1 Constituent Evaluation

Parameters for soil analysis should include elements or compounds of the hazardous wastes, hazardous constituents (40 CFR 261, Appendix VIII), or hazardous waste constituents (as defined in 40 CFR 260.10). The owner or operator or IDEM can propose parameters. For Corrective Action purposes, the initial parameter list is comprised of any hazardous constituent used at the facility, as well as any breakdown product or by-product of a hazardous constituent used at the facility. With sufficient justification, parameters can be eliminated during SAP preparation. Parameters can also be eliminated depending on sampling results (see [Chapter 3](#) of the RISC Technical Guide).

Parameters should be determined not only based on knowledge of wastes or byproducts managed at the unit, but also on other potential elements such as raw materials, feed stocks and products used at the facility. These considerations are similar to those used by U.S. EPA for waste de-listings. For example, soil underlying a surface impoundment containing F006, electroplating wastewater treatment

sludge, could also be analyzed for 1,1,1-trichloroethane and trichloroethylene, solvents likely to be used at a metal plating facility. For purposes of corrective action investigations, product storage tanks, valves and pumping equipment are also potential source areas for routine and systematic releases. IDEM may also require additional parameters for analysis, such as breakdown products from chlorinated hydrocarbons.

2.9.1.2 Closure Levels

Closure requires analysis of final rinsates from the decontamination of pads, tanks, or structures to determine if the waste has been removed. Rinsate analytical results must meet (1) the MCLs of the National Primary Drinking Water Regulations ([40 CFR 141](#) and [40 CFR 264.94\[a\]\[2\]](#)) for inorganic and certain organic parameters with MCLs and (2) estimated quantitation limits (EQLs) as defined by SW-846 for the organic parameters without MCLs. RISC default closure levels are not appropriate for rinsates because the decontamination demonstration is not based on exposure.

Default closure levels for soil and ground water are listed in the RISC Technical Guide, [Appendix 1 Table A](#). These closure levels are based on appropriate land use.

Closure levels for soil can also be established using the non-default procedures presented in [Chapter 6](#) of the RISC Technical Guide. The alternate cleanup level proposal must document that the constituents left in soil will not adversely impact any other environmental medium (ground water, surface water, or atmosphere) and that direct contact through dermal exposure, inhalation, or ingestion will not result in threats to human health or the environment.

Closure levels for soil can be the analytical methods' EQLs for organic compounds and background levels for inorganic compounds. Background levels for inorganic compounds are calculated as the mean plus one standard deviation. If the coefficient of variation for the background samples exceeds 1.2, additional sampling may be necessary. (See [Chapter 3](#) of the Technical Guide).

2.9.1.3 Screening Sample Locations

Locations of screening soil borings and samples should be selected to determine with a high level of confidence whether any of the identified constituents are present. Random sampling can be performed using a

grid system. Directed sampling using the default screening procedures specified in [Chapter 3](#) of the RISC Technical Guide should be performed in areas of suspected contamination (such as cracked areas of a containment structure, areas of known spills, and suspected downslope, downwind, or runoff areas of a containment structure). As noted in the Technical Guide, screening in areas of known contamination is not recommended. If an area is known to be, or can be reasonably expected to be contaminated, screening should be skipped and you should proceed directly to a nature and extent of contamination investigation (See [Chapter 4](#) of the Technical Guide).

Other directed or systematic methods (such as sampling at uniform intervals) can be used if warranted on a site-specific basis. These methods may include a circular pattern of sampling around a central point or linear sampling along the drainage way, boundary, or perimeter of a container storage area. Grid sampling and directed sampling can both be used in the same closure plan. [Chapter 3](#) of the RISC Technical Guide discusses procedures for choosing sampling locations based on a random grid pattern for screening purposes.

2.9.2 Background Sampling

Determination of background concentrations is only necessary to establish closure levels (for example, when natural soil concentrations exceed closure levels) or to determine the vertical extent of contamination for organics. [Chapter 3](#) of the RISC Technical Guide provides details and requirements on background sampling.

All background boring locations should be adequately justified and are subject to approval and modification. Background samples must be taken in areas unimpacted by the facility, or other sources of contamination. Proposed background boring locations must be shown on a detailed map or diagram of the facility. Any deviations from the SAP resulting from problems encountered in the soil or based on knowledge of the area should be adequately justified and will be subject to review. Background soil sample results may also be subject to approval if the concentrations are not typical of local Indiana soil.

2.9.3 Sampling Considerations

The risk assessment process requires developing an overall project goal, developing a conception of the facility (a “conceptual site model”), collecting data (research or analytical) to support or enhance the conceptual site model, and evaluating the results. Physical

sampling of the facility is only part of the process. Sampling results may indicate the need to collect further data. The sampling process may go through several rounds requiring planning, data collection, and evaluation. It is possible that the project goal may change when more information becomes available during this iterative process. Throughout the process, the owner or operator should consider what types of sampling will be required to collect the data needed to make a final evaluation.

The RISC site evaluation process is summarized in Table 2-2 below.

Table 2-2. RISC Three-Step Site Evaluation Process

Step	Purpose	Comment
Screening	To determine if additional investigation is needed	Can include judgmental (directed) or random soil sampling as well as ground water screening
Determining Nature and Extent of Contamination	To identify contamination boundaries and amounts	May indicate that remaining constituents pose acceptable risks or that remediation is necessary
Verification of Closure Sampling	To confirm that remediation is complete	Must be repeated until closure levels are met

As stated above, area screening is optional. If an area is known to be contaminated, the owner or operator should proceed to determining the nature and extent of contamination or to remediation (for example, excavation of the area). Remediation requires adequate closure verification sampling results.

The owner or operator should consider all media when developing the conceptual site model. The SAP should detail the sampling strategy for each medium and consider several factors such as the waste and its constituents, site conditions, environmentally sensitive areas, soil types, possible preferential pathways to ground water or surface water, depth to ground water, and analytical methods required. The SAP must also consider both surface and subsurface soils as well as

possible ground water investigation. Area classification, random and directed sampling, and sampling at specific units are discussed below.

2.9.3.1 Area Classification

Areas are classified as unlikely to be contaminated, known to be contaminated, and possibly contaminated (See [Chapter 3](#) of the RISC Technical Guide for details on proper area classification). The sampling strategy may vary based on the investigative area classification.

RISC procedures limit a default risk assessment to a maximum source area of 0.5 acre for subsurface soil. This is the largest area for which default values were calculated. Subsurface source areas larger than 0.5 acre cannot be subdivided and require a non-default risk assessment. The simplest non-default risk assessment procedure for larger source areas is to use a smaller dilution attenuation factor in the equation to calculate a non-default closure level (see [Chapter 6](#) of the RISC Technical Guide). In all cases, both surface and subsurface soils must be investigated.

2.9.3.2 Random and Directed Sampling

The two basic options for soil screening to determine if a site will meet closure levels are random and directed sampling. Random sampling is used to determine if an area that may be contaminated is in fact contaminated and if the contamination exceeds default closure values. Directed sampling is used to determine if areas known to be impacted exceed default closure values. [Chapter 3](#) of the RISC Technical Guide discusses these sampling procedures.

The SAP can propose a combination of random and directed sampling and should describe the sampling strategy, which is subject to IDEM review and approval. Again, the owner or operator may choose not to screen and proceed to the nature and extent determination and/or remediation (with adequate verification sampling).

All soil analytical results, regardless of whether sampling is random or directed, must be evaluated against the lower of the direct exposure (surface soil) or migration to ground water (subsurface soil) default value. The entire soil column must meet the lower of the two values. The higher value can be used only if the owner or operator can validly demonstrate that its use will not result in an unacceptable exposure.

Random Sampling

Random sampling can be used in areas classified as “may be contaminated.” Sampling locations can be chosen using a random grid method if there is no evidence of releases. Random samples can be collected based on soil stratigraphy similar to the method discussed in [Chapter 3](#) of the RISC Technical Guide. Each soil stratum must be sampled because random sample results confirm the presence or absence of contamination.

Random sampling results should be statistically evaluated to determine if enough samples have been collected by following the procedures in [Chapter 3](#) of the RISC Technical Guide. The 95% UCL for each constituent is calculated and compared to the closure level. If the evaluation of random sample results exceeds appropriate closure levels, the nature and extent of contamination must be determined.

Directed Sampling

Generally, directed sampling should be performed at areas known or suspected to be impacted, such as in areas of cracks, runoff areas of a containment structure, or areas of known spills. The default procedures discussed in [Chapter 6](#) of the RISC Technical Guide should be used during directed sampling. The three borings sampled should be in the area of highest contamination (that is, all three results should be reasonably similar). Anomalous or “outlier” results should also be explained.

For volatile constituents, the average of each constituent of the three soil boring samples is calculated. This value is the “exposure point concentration” (EPC) for that constituent. For nonvolatile constituents, use only analytical results from strata that have constituents detected. Calculate the average of each constituent within each boring. This is the EPC. EPCs (for both volatile and non volatile constituents) are compared to closure levels. (See [Chapter 3](#) of the Technical Guide.) If all EPCs for a source area are less than closure levels, the source area is not considered to present an exposure risk for human health. Closure can be certified in this case at this point (assuming there are no groundwater issues). If any EPC exceeds the appropriate closure level, the nature and extent of contamination must be determined. (See [Chapter 4](#) of the Technical Guide.)

2.9.3.3 Sampling at Specific Units

Investigative soil sampling is required for storage areas or tanks located on soil or gravel. Sampling locations can be chosen using the random grid sampling strategy if no areas have evidence of releases. If evidence of a release exists, the default direct sampling procedures can be used. The paved or concrete pads of storage areas or tanks must be decontaminated and soils sampled (using default procedures) at areas of cracks, gaps or other damaged areas. Soil sampling at the edge of the pad is also required. Sample results are evaluated using the directed strategy (that is, all strata must be below closure levels) unless there is evidence of a release.

Sampling may not be required for storage areas or tanks in secondary containment. Default procedure sampling is only required if cracks, gaps, or damaged areas of the containment system existed. The secondary containment requires decontamination.

For closure of units other than aboveground tank systems, angled soil borings should be performed, with samples taken at the sides and below the bottom of the tank, and as close to the tank as possible. Additional borings should be located and oriented to allow sampling beneath the tank system. Soil below the bottom of the tank must be sampled in accordance with the procedures in [Chapter 3](#) of the RISC Technical Guide. However, if the tank is removed, soil verification samples only are required unless contamination is detected above closure levels.

Closure of waste piles and surface impoundments require the complete removal of waste, liners, leachate, and materials contaminated with waste or leachate. Soil sampling should be conducted on a random grid based on the assumption that the waste was homogeneous and evenly distributed. If the waste was not homogenous, directed default procedures can be used. These units also require Subpart F ground water monitoring, which is discussed in [Section 2.10](#).

2.9.4 Sampling to Determine the Nature and Extent of Contamination

If soil screening results indicate that EPCs exceed closure levels, a SAP to determine the complete nature and extent of soil contamination is required. The owner or operator should contact IDEM prior to submittal of such a SAP. Not only must the contamination boundaries (vertical and horizontal extent) be determined, a concentration gradient across the contaminated zone (the nature) must also be determined. This gradient will allow a more detailed estimate of risk.

(An accurate estimate of risk cannot be made unless it is known how much contamination is present and the location of the contamination.) [Chapter 4](#) of the RISC Technical Guide describes nature and extent determination requirements.

Once the nature and extent of contamination have been determined, a second set of EPCs is calculated based on the nature and extent determination results. These EPC values are compared with closure levels. If the EPCs are below closure levels, the unit is eligible for closure. Otherwise, options include either a non-default risk assessment or soil remediation. If a risk assessment is not feasible or remediation is not practicable (waste removal and decontamination to an appropriate standard), the unit must be closed in-place.

2.9.5 Closure or Verification Sampling

The RISC Technical Guide requires closure or verification sampling of surface and subsurface soils to demonstrate that contaminant concentrations are below closure levels for each impacted medium. [Chapter 6](#) of the RISC Technical Guide describes the minimum number of samples, sampling locations, and decision criteria for closure sampling.

2.9.6 Industrial Closure Soil Sampling

For industrial closures, it is assumed that the soil or ground water contaminant concentrations exceed residential closure levels. Unless the unit was closed through screening as provided in [Chapter 3](#) of the RISC Technical Manual, the nature and extent of contamination in soil must be determined for all units using industrial closure levels because it is necessary to define the extent of the soil contamination that might impact ground water above residential values. For facilities with multiple sources, the procedures in [Chapter 4](#) of the RISC Technical Guide may be followed. Ground water must be below default residential values at the boundary of property control.

2.10 RCRA Ground Water Sampling

As stated in [Subpart G of 40 CFR 264 and 265](#), closure is required at all contiguous areas of land on or in which hazardous waste is placed or the largest area in which there is significant likelihood of mixing hazardous waste constituents in the same area. Subpart G of the regulations requires the consideration of ground water when determining clean closure standards (See [53 FR 8705](#)). Therefore, the

owner or operator must demonstrate either that there is no evidence of release of hazardous constituents to ground water or that ground water does not pose potential harm to human health or the environment as a result of facility-related contamination. Ground water sampling refers to the sampling needed to determine the extent of decontamination necessary to satisfy closure performance standards.

Ground water protection is a major concern in regulatory strategy for hazardous waste land disposal. Therefore, in addition to ground water sampling to meet closure levels, ground water monitoring is required at surface impoundments, waste piles, and land treatment units or landfills (hereafter referred to as “Subpart F units”) that received hazardous wastes after July 26, 1982. Subpart F units must comply with Subpart F requirements for detecting, characterizing, and responding to releases to the uppermost aquifer and any hydraulically interconnected underlying aquifers.

This section clarifies the application of RISC Technical Guide procedures to the RCRA program and presents a discussion of how the procedures either comply with RCRA federal rules, or may necessarily be more stringent than RISC Technical Guide procedures. Within this chapter, ground water monitoring refers to the collection of samples required by [Subpart F of 40 CFR 264 and 265](#).

Ground water is dynamic and can have temporal and spatial contaminant changes. The possibility of missing a plume of ground water contamination is very likely if the site-specific hydrogeology is unknown. In addition, without significant sampling control, sampling techniques may not ensure the collection of samples representative of ground water within the media. Therefore, valid conclusions based solely on ground water data require strict sample collection control at pre-determined points in time and space based on knowledge of the characteristics of the ground water flow, and capability of obtaining representative samples.

This section discusses the following:

- SAP requirements,
- Ground water screening,
- Characterization of the nature and extent of contamination,
- Ground water closure sampling, and

- Ground water monitoring.

Where applicable, the discussion for each of these topics first addresses Subpart F unit requirements, followed by non-Subpart F unit guidelines.

2.10.1 Sampling and Analysis Plan Requirements

2.10.1.1 Subpart F Unit Requirements

Hazardous constituents under the RCRA program for ground water monitoring include those listed in [40 CFR 264, Appendix IX](#). The list of hazardous constituents to be analyzed for is based (1) on their presence in ground water ([40 CFR 270.14 \[c\]\[4\]\[ii\]](#)) and (2) their capability for harming human health or the environment ([40 CFR 264.93 \[b\]](#)). A hazardous constituent can be removed from the list of constituents to be analyzed if it can be demonstrated that the constituent is not present in ground water or is not present at concentrations that can pose a substantial present or potential future hazard to human health or the environment. This can be simply demonstrated by determining the total list of constituents in ground water samples. Otherwise, a hazardous constituent can be removed from the list of contaminants of concern if it is demonstrated that the constituent is not capable of posing a substantial present or potential future hazard to human health or the environment (See [40 CFR 264.93 \[b\]](#)).

2.10.1.2 Non-Subpart F Unit Requirements

Units not subject to Subpart F monitoring requirements must be sampled and analyzed using consistent procedures as described in [Chapter 4](#) of the RISC Technical Guide. DQOs must be achieved.

Parameters for ground water analysis should include elements or compounds of the hazardous waste, hazardous constituents (as defined in [40 CFR 261, Appendix VIII](#)), or hazardous waste constituents (as defined in [40 CFR 260.10](#)). Parameters can be proposed by the owner or operator or IDEM. For corrective action purposes, the initial parameter list is comprised of any hazardous waste or hazardous constituent used at the facility, as well as any breakdown products or by-product of a hazardous waste or hazardous constituent used at the facility. With sufficient justification, parameters can be eliminated

from the list during SAP preparation. Parameters can also be eliminated depending on sampling results. Parameters should be selected based on knowledge of wastes managed at each unit and may include other potential elements or compounds related to facility operations (such as breakdown products). This strategy is similar to U.S. EPA considerations for waste de-listing.

2.10.2 Ground Water Screening

2.10.2.1 Subpart F Unit Requirements

Screening under the RCRA ground water monitoring program is based on determining if a release has occurred from a unit to the uppermost aquifer at the compliance point. Subpart F units that meet the requirements of the indicator monitoring program of [40 CFR 265](#) and of the detection monitoring program of [40 CFR 264](#) satisfy the objectives of the screening process discussed in [Chapter 3](#) of the RISC Technical Guide. The nature and extent of ground water contamination does not have to be characterized to satisfy the requirements discussed in [Chapter 4](#) of the RISC Technical Guide if both of the situations below apply.

1. An adequate monitoring program at the unit has not yielded results that indicate a statistically significant indication of release during the unit's operation (including closure period).
2. Soil screening results indicate that hazardous constituents have not migrated from the unit to the uppermost aquifer.

If ground water monitoring results indicate detection of the presence of hazardous constituents from a Subpart F unit, an appropriate ground water monitoring program (that is, ground water quality assessment under [40 CFR 265](#) or compliance monitoring under [40 CFR 264](#)) must be implemented at the compliance point. Detection is defined by statistically significant evidence that contamination exists, determined by comparing data collected at the compliance point(s) to the background water quality data.

Subpart F requirements do not apply after closure if all waste, waste residues, contaminated containment system components, and contaminated subsoil including ground water are removed or decontaminated to land use appropriate levels at closure. [Chapter 6](#) of the RISC Technical Guide presents a methodology for demonstrating

that a unit meets the closure performance standards and presents no potential harm to human health or the environment.

The groundwater sampling requirements for closure by removal and in-place closure are discussed further in the following sections.

2.10.2.2 Non-Subpart F Unit Requirements

Ground water screening at units not subject to Subpart F can consist of the method for screening presented in [Chapter 3](#) of the RISC Technical Guide. In accordance with the strategy for ground water monitoring, as evidence increases that a release has occurred, additional sampling and analysis of ground water is needed to demonstrate that closure performance standards are not exceeded. Examples of situations that may require additional sampling of ground water include the following:

1. Detection of a hazardous constituent during ground water screening,
2. Detection of a VOC hazardous constituent at concentrations exceeding the residential level in a preferential pathway to ground water,
3. Detection of a VOC hazardous constituent at a concentration exceeding the residential level within the first sedimentary layer of similar texture and material above the saturated zone in soil screening,
4. Subsurface soil sampling results indicate the presence of a non-VOC hazardous constituent at a concentration exceeding the residential level and the constituent is detected within the first sedimentary layer of similar texture and material above the saturated zone, and
5. Subsurface soil sampling results indicate the presence of a non-VOC hazardous constituent at a concentration exceeding the residential level and the constituent is detected in saturated soil.

If ground water samples are collected, it may be beneficial to also collect saturated soil samples in order to describe the saturated soil as was done for other soil samples.

If no constituent levels exceed closure levels, no other aspects of the nature and extent determination described in [Chapter 4](#) of the RISC Technical Guide are necessary. If the closure performance standard for ground water is exceeded, characterization of the nature and extent of contamination (See [Section 2.10.3](#) below) is necessary to determine the extent of remediation necessary ([40 CFR 264.112 \[b\]\[4\]](#)).

2.10.3 Characterization of the Nature and Extent of Contamination

2.10.3.1 Subpart F Unit Requirements

To meet the requirements of a ground water quality assessment under [40 CFR, Part 265](#), or compliance monitoring under [40 CFR, Parts 264 and 270.14\(c\)\(3\) and \(4\)](#), ground water monitoring must continue at least until the compliance period is completed (See [40 CFR 264.92](#)). The compliance period is the number of years equal to the active life of the waste management area, including any waste management activities conducted prior to permitting and closure.

An adequate ground water quality assessment plan or compliance monitoring program should satisfy the objectives of the nature and extent determination outside the compliance point as discussed in [Chapter 4](#) of the RISC Technical Guide. However, to satisfy closure performance standards, it may be necessary to determine the nature and extent of contamination for the plume within the compliance point.

If the assessment of the quality of the ground water shows that the unit has released hazardous constituents to the uppermost aquifer, post-closure care is required unless there is an adequate closure by removal.

If the owner or operator can demonstrate that a source other than a regulated unit caused the release to the ground water or if the detection was an artifact caused by an error in sampling, analysis, statistical evaluation or natural variation in the ground water, they are released from the requirements of ground water quality assessment under [40 CFR 265](#) or compliance monitoring under [40 CFR 264](#).

Characterizing the contamination also requires knowledge of the hydrogeology of the area. The uppermost aquifer unit and any hydraulically interconnected underlying aquifers (that is, all likely subsurface flow paths for hazardous constituents that could be released

from the unit) should be identified. The hydrogeologic properties (for example, hydraulic gradient, ground water flow, rate, and direction), beneath the facility should be known and the supporting data used to identify this information (such as hydrogeologic investigation reports for the facility area) should be provided in the SAP. This information should be included in a report written by a qualified hydrogeologist on the hydrogeologic characteristics of the facility property supported by drilling logs for on-site borings and wells and available professional literature. A description of the regional geologic and hydrogeologic setting should also be included in the report. Guidance for establishing an adequate hydrogeology study is presented in U.S. EPA's 1986 "RCRA Ground-Water Monitoring Technical Enforcement Guidance Document" (OSWER Directive No. 9950.1) or 1992 "RCRA Ground-Water Monitoring: Draft Technical Guidance Document" (EPA/530-R-93-001).

2.10.3.2 Non-Subpart F Unit Requirements

For units not subject to Subpart F requirements, the guidance in [Chapter 4](#) of the RISC Technical Guide can be used to determine the extent of remediation necessary to meet the closure performance standards. One sampling event may not be adequate to define the characteristics of the nature and extent of contamination. Many times the investigation should proceed in phases, until the three-dimensional limit of the contaminant plume is defined. The final phase consists of conducting a controlled sampling program to determine the concentrations and movement of the contaminants within the plume. If the nature and extent procedure has shown that the unit released a listed hazardous waste into the ground water, the boundary between waste and contaminated media must be determined.

Groundwater containing one or more hazardous constituents may not constitute a "waste", but may be considered a contaminated medium.

The owner or operator may submit a justification of the distinction between hazardous waste and contaminated media. The use of U. S. EPA's "contained-in" policy will set out the requirements for this demonstration. For closure by removal or decontamination, the hazardous waste must be removed and affected media must meet the land-use specific closure performance standard.

2.10.4 Ground Water Closure Sampling

2.10.4.1 Subpart F Unit Requirements

This section clarifies the procedures necessary to ensure that closure activities are in compliance with RCRA Subpart F requirements and satisfy closure performance standards. If hazardous constituents are not detected in the uppermost aquifer at the compliance point for a Subpart F unit, a detection monitoring program in accordance with [40 CFR 264.98](#) must be established to demonstrate that applicable closure standards have been met. If hazardous constituents are detected from a Subpart F unit at the compliance point during ground water monitoring, a compliance monitoring program must be implemented. Under the RCRA ground water monitoring program, the point of initial discovery is the compliance point. The ground water protection standard for Subpart F units must be met at the compliance point until completion of the compliance period as described in [40 CFR 264.95](#).

Upon demonstration of closure by removal or decontamination, a closure certification must be submitted to verify that the approved closure plan has been followed and to document that the Subpart F unit is compliant with the requirements of Subpart F. Subpart F requirements no longer apply after IDEM accepts the closure certification.

Within the compliance point, it must be demonstrated that there has not been a release to ground water beneath the waste management boundary. When a release has occurred or there is a potential release that exceeds the residential ground water level, additional ground water sampling is required as described below for units not subject to Subpart F requirements. Any deviations from the SAP resulting from problems encountered in obtaining representative ground water samples or from knowledge of the area should be adequately justified and discussed with IDEM.

2.10.4.2 Non-Subpart F Unit Requirements

For hazardous waste management units, SWMUs, and AOCs not subject to [40 CFR 264.91](#) through [264.100](#), it may have to be demonstrated that ground water beneath the units does not have a plume containing hazardous wastes or hazardous constituents, or that the plume will not present potential harm to human health or the environment. Obviously, if all hazardous waste is contained in a material that is removed, the closure performance standard has been achieved. However, if contaminated media are left in place exceeding land use specific closure levels, the potential for ground water

degradation from soil leaching, or present ground water migration must also be determined.

When a hazardous waste or hazardous constituent from the unit is detected in ground water, the closure performance standard can be achieved by demonstrating maximum concentrations within the plume are below land use specific levels, and below residential levels at the point of property control. In addition, the owner or operator must demonstrate that the closure has controlled or minimized to the extent necessary to protect human health and the environment, post-closure escape of hazardous constituents or hazardous waste decomposition products to the groundwater.

Where there are multiple potential sources of particular hazardous wastes or hazardous constituents, or for large sites, the overall control of the groundwater plume may be consolidated into one monitoring program. The Office of Land Quality has a non-rule policy document that addressed the issue of multiple sources (WASTE-0015-NPD).

Maximum concentrations detected when determining the nature and extent of the plume in ground water may determine the length of time needed to demonstrate closure. In order to demonstrate that concentrations within the plume do not exceed land-use specific closure levels throughout the plume and residential levels at the point of property control, a sampling program must be established to demonstrate plume stability. The MAROS software program is used to demonstrate plume stability and is detailed in [Appendix 3](#) of the RISC Technical Guide.

If the statistical evaluation indicates that the land-use specific closure performance standard is achieved, the unit is eligible for closure by removal. If statistical evaluation indicates closure performance standards are exceeded, post-closure care (that is, post-closure permitting or corrective action) is required.

2.10.5 Contaminated Ground Water In-Place

When land-use specific levels are exceeded, additional sampling may be needed to demonstrate that the plume is controlled or minimized to the extent necessary to protect human health or the environment from hazardous constituents, or hazardous waste, or their decomposition products to the groundwater that may escape after closure. To satisfy the closure standard, it must be shown that the residential levels at the point of property control will not be exceeded and the land-use

specific levels will not be exceeded beyond the perimeter of compliance (compliance point). This can also be demonstrated by plume stability as described in [Appendix 3](#) of the RISC Technical Guide.