

PPC 9476.1991(01)

CLOSURE STANDARDS FOR HAZARDOUS WASTE LAND TREATMENT  
UNITS

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

MAY 2- 1991

MEMORANDUM

SUBJECT: Closure Standards for Hazardous Waste Land Treatment Units

FROM: Devereaux Barnes, Director  
Permits and State Programs Division  
Office of Solid Waste (OS-340)

TO: Doug McCurry, Chief  
Waste Engineering Section  
RCRA Branch, Region IV

You previously raised a series of questions regarding the closure of hazardous waste land treatment units to my staff and to the ORD laboratory in Ada (RSKERL-Ada). These are important questions since many land treatment facilities are beginning to close in response to the November 8, 1990 prohibition of the land disposal of the petroleum refining wastes (KO48-52). After consulting with RSKERL-ADA, as well as internally, we are providing you with the answers you sought. It is important to keep in mind that of the four major types of land disposal units, the land treatment unit is the most difficult for which to define generic technical closure procedures. This is due to the fact that the characteristics of the soils affecting the closure are by nature site-specific, and that the wastes are to be transformed, degraded, or immobilized during the closure process by the soil, biologic, and climatic conditions unique to each site. With this constraint in mind, we have addressed your questions as specifically as possible:

1. Q. Is soil sampling required during closure/post closure?
  - A. Section 265.280(d)(1) requires that during the closure period the owner or operator of an interim status land treatment facility continue unsaturated zone monitoring in a manner and frequency specified in the closure plan, except that soil-pore liquid monitoring may be terminated 90 days after the last application of waste to the treatment zone. Unsaturated zone monitoring consists of both soil-pore

liquid monitoring and analysis of soil cores (see Sections 265.278(a) and (b)).

In addition, Section 265.280(f) requires that during the post-closure care period the owner or operator of an interim status land treatment unit must continue soil-core monitoring (soil sampling) in the manner and frequency specified in the post-closure plan.

Similarly, permitted units must continue unsaturated zone monitoring during closure and post-closure care periods, as specified in the permit (see Sections 264.280 (a) (7) and (c)(7)).

Given the language of Sections 264.280 and 265.280, we expect that in most cases unsaturated zone monitoring (particularly soil-core) will be necessary during the closure and post-closure care periods of a land treatment unit. There are, however, limited instances where soilcore monitoring may not be required by the closure and/or post-closure plan. For example, in the case where the treatment zone is removed as a part of clean closure soil-core monitoring may be suspended at the completion of the closure period. (See. Sections 264.112(e); 264.280(c); 265.280(d) and (f)(i)).

2. Q. At what intervals and for how long?

A. General guidance pertaining to soil sampling intervals and duration during land treatment site closure/postclosure is provided in several land treatment guidance documents:

Guidance Manual on Hazardous Waste Land Treatment Closure/Post-Closure (OSWER Directive 9476.00-9)

Permit Guidance Manual on Unsaturated Zone Monitoring for Hazardous Waste Land Treatment Units (EPA/530-SW-86-040)

RCRA Guidance Document: Land Treatment (NTIS-PB155065)

Permit Guidance Manual on Hazardous Waste Land Treatment Demonstrations (July, 1986)

Although the guidance provides a general framework for soil sampling, the geographic, spatial, and temporal variabilities

between different land treatment units (as well as within any individual unit) necessitate that site-specific considerations be evaluated when establishing the sampling intervals and duration required during closure/post closure of a given land treatment unit.

Data from the reconnaissance survey is used- as the primary basis for establishing site-specific sampling requirements. If this survey reveals that the facility has been well managed, with no apparent significant buildup or downward migration of hazardous constituents, the general guidance provided in the above-referenced guidance documents can be used to establish soil sampling intervals and duration. We recommended that, at a minimum, samples should be collected quarterly during the closure period and during the first year of the postclosure period. Periods between sampling events may be gradually extended after the first year of post-closure.

If data from the reconnaissance survey reveals an apparent significant buildup and/or downward migration of hazardous constituents, the general guidance alone will not be sufficient to establish soil sampling intervals and duration. Under such a scenario, soil pore liquid samples should continue to be collected as recommended in the Permit Guidance Manual on Unsaturated Zone Monitoring for Hazardous Waste Land Treatment Units (EPA/530-SW-86-040). The soil pore liquid monitoring should continue until there is no longer potential for vertical migration of fast-moving hazardous constituents from the waste-soil matrix. Additionally, it is important to collect soil cores downward through the treatment zone into the unsaturated zone for analysis at selected intervals along the core in order to determine the extent of degradation and immobilization within the treatment zone, as well as the migration of less mobile waste constituents into the unsaturated zone. Under this scenario, actual degradation rate data under the closure conditions may be deemed important. If such is the case, sampling intervals should be shorter than specified in the guidance.

Two recent land treatment research studies, sponsored by RSKERL-Ada, provide useful guidance because they involve a determination of degradation rates under field conditions. These studies used the following sampling schedule: 0, 2, 4, and 8 weeks, and continued at 4-week intervals throughout the study. Under a closure scenario, the sampling schedule should use these same intervals, or other type of appropriate sampling interval,

until a minimum of 6 data points are obtained or until an asymptotic constituent level is approached. Any time degradation rates are to be calculated, a minimum of 3 replicate sample analyses are recommended for each sampling date in order to establish a 95% confidence interval for the degradation rates and half-lives of the waste and its constituents. After you determine that degradation is proceeding at an acceptable rate and that downward migration is not occurring, quarterly sampling (as recommended in the general guidance) can be initiated.

3. Q. Does EPA recognize approved methods for determining degradation rates?
  - A. There are no EPA-approved methods for determining degradation rates, although methods for determining degradation rates are discussed in the Permit Guidance Manual on Hazardous Waste Land Treatment Demonstrations (LTD). These are based on methods used in the land treatment research program at RSKERL-Ada and documented in the lab's publications. (See Attachment)

The need and approach for determining degradation rates will depend to a great degree on the results of the reconnaissance survey discussed under Question 2. Under the well-managed scenario, we can see little need to undertake this task unless the final loading rate is significantly greater than that used during normal operation. Under the poorly managed scenario, we would consider this task a necessity. The actual approach for determining degradation rates would vary somewhat depending on the degree of the problem as well as waste and site-specific characteristics. In addition to the treatability study approach discussed in the LTD Guidance Manual, the RSKERL-Ada publication Mobility and Degradation of Residues at Hazardous Waste Land Treatment Sites at closure (See Attachment) specifically provides information pertaining to the quantitative evaluation of mobility and persistence of organic and inorganic waste constituents which have accumulated in soil treatment systems under various closure scenarios.

4. Q. Can continued operations under closure last indefinitely? At what concentration is closure complete? At what concentration, degradation rate, or point in time does operational closure cease and a RCRA cap become a requirement?
  - A. As Sections 264.113 and 265.113 layout, closure is expected to be

completed within 180 days after receiving the final volume of hazardous waste, but a longer period may be approved if the owner or operator can demonstrate that closure activities will, necessarily, take longer than 180 days (see Sections 264.113(b) (1) (i) and 265.113 (b) (1) (i)). In the case of a land treatment unit, more than 180 days may be required to maximize degradation, transformation, or immobilization of hazardous constituents within the treatment zone. This period cannot be defined by regulation in that each site will require a time period specific to that site. The duration of the closure period is primarily dependent on the waste loading rate at closure as well as the potential waste degradation rate. Each owner or operator should, however, be able to estimate that time in advance, based on the treatment data already established during operation. For the large majority of well-managed land treatment units, the duration of the closure period will vary between 90 and 360 days.

Because land treatment closure is a continuing process rather than a set of distinct engineering procedures (as in landfill closure), the concentrations of hazardous constituents remaining in the treatment zone after closure may vary and will continue to change during the post-closure care period. Post-closure care at a land treatment facility is different from practices at other closed or closing land disposal facilities in that active management will frequently continue to enhance degradation and transformation and sustain immobilization. Complete degradation of organics to background levels before closure has been completed is not necessarily required. Concentrations of organics should, however, be to the point that the application of a final cover and the reduced level of active site management will prevent the post-closure escape of hazardous constituents from the treatment zone. Similarly inorganics should be immobilized during closure to provide the same level of protection over the long term.

In the case where closure activities fail to immobilize or degrade hazardous constituents, an impermeable cap may be required or clean closure may be appropriate. (Changes to the closure plan will require approval by the Regional Administrator (Sections 264.112(c) and 265.112(c)). The determination of the rate of immobilization and degradation is site specific; however, escape of constituents from the treatment zone at concentrations above health-based levels indicates that the rate of immobilization or degradation is unacceptable.

5. Q. What closure standards are required where migration of hazardous constituents has occurred?

A. The general closure performance standard remains the same whether or not migration of hazardous constituents has occurred. That is, the owner or operator must close the facility in a manner that minimizes the need for further maintenance; and that controls, minimizes, or eliminates to the extent necessary to protect human health and the environment, the post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated run-off, or hazardous waste decomposition products to the ground or surface water or to the atmosphere. (Sections 264.111 and 265.111).

Where hazardous constituents have migrated beyond the treatment zone above health-based levels, successful immobilization, degradation, or transformation during closure may be subject to question. In this case additional closure and post-closure activities may be required that go beyond disking, adding soil amendments, and installation of a vegetative cover. Obviously, the additional activities will vary from site to site; however, some of these activities may include, but are not limited to, removal of some or all of the treatment zone and installation of a low permeability cap. In addition, cleanup of the contaminated media, e.g., ground-water removal and treatment, may be appropriate. Cleanup of these media is a corrective action decision.

Whatever program of additional activities is selected, it must be consistent with the goals specified in the general closure performance standard.

6. Q. What closure standards are required where ground-water contamination exists but where levels of contaminants are within the ACL's established by the permit?

A. At units where ground-water contamination exists but where that contamination is below the established ACL, corrective action under Section 264.100 may not be required. The decision as to whether ground-water cleanup is required is site-specific, generally based on the principles described in EPA's proposed corrective action rule (55 FR 30798). At the same time, the closure standard to be applied remains the same (see previous

discussion).

Furthermore, having an ACL does not negate the treatment demonstration requirement of Section 264.272. If it is found during closure that constituents are migrating below the treatment zone above health-based levels, additional steps may be required, such as treatment zone removal or installation of a low permeability final cover. The determination of what steps are required will depend primarily upon whether the hazardous constituents. The owner or operator should be aware that the postclosure care period cannot be terminated until the owner or operator successfully demonstrates that all the ground water at the site is safe for all potential receptors (Alternate Concentration Limit Guidance, EPA/530\_SW-87017).

7. Q. At what point in the life of the unit do closure activities become in-situ remediation under corrective action? At what concentrations and frequencies for soil, pore-water, surface water and ground water? What permit modifications are required?
- A. Most actions taken to remedy migration of constituents of concern outside the treatment zone (into ground water, surface water, or soil adjacent to the treatment zone) at closing units can be accomplished as a part of closure.

At a permitted facility, methods for preventing such migration should be outlined in the permit (see Sections 264.270-264.283). If, during closure, migratory constituent concentrations are found to exceed levels specified in the permit, a corrective action program must be initiated (see Sections 264.90-264.101). The addition of a corrective action program requires a permittee to initiate a Class 3 permit modification, although some limited remediation activities, such as a change in the number of ground-water monitoring wells at a regulated unit, may require only a Class 2 permit modification (see Appendix I to Section 270.42). Such modifications may receive temporary authorization provided they meet the test of Section 270.42(e)(2). (Of course, Class 2 or 3 modifications would not be used in states authorized for ground-water corrective action, but not authorized for EPA's new permit modification procedures. In authorized States, permit modifications must be made according to state modification procedures.) In the alternative, the Agency may take unilateral action to modify a permit to require corrective action (see Section 270.41).

At an interim status facility, certain requirements designed to prevent migration of constituents of concern are specified in Sections 265.270-265.282 and 265.90265.94. Unlike permitted facilities, at present there are no regulatory provisions requiring corrective action when migratory constituent concentrations exceed regulatory levels of concern. Instead, the Agency may compel corrective action at an interim status facility through the issuance of an administrative order pursuant to RCRA, Section 3008(h). In addition, as an alternative, the Agency may expedite the issuance of a permit to an interim status facility, with the result that the corrective action provisions referenced above would be applicable.

Completion of remedial activities may exceed 180 days. As mentioned previously, this is a legitimate basis for granting an extension of the closure period. In addition, long-term remediation activities at regulated units, such as ground-water counterpumping, may be performed during the post-closure care period.

8. Q. At what point in time, and to what standards does a facility certify closure?
- A. This question is directly related to question 4 in your letter. You will note in Sections 264.115 and 265.115 that closure is to be certified when the unit has been closed in accordance with the specifications in the approved closure plan. Closure will be complete when closure activities have immobilized, degraded, or transformed hazardous constituents in the treatment zone to levels agreed upon in the closure plan and when a vegetative cover has been established. In the case where the treatment zone is ineffective, closure may be certified after the treatment zone is removed or after a low permeability cap is installed. Other long-term activities such as ground-water remediation will normally be completed during the post-closure care period and after closure certification.

We hope these responses are useful. Please feel free to call Chris Rhyne (FTS 382-4695) to discuss other technical aspects of land treatment closure.

Attachment

cc: Sylvia Lowrance, OSW

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