UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

DEC 27 2000

OFFICE OF
SOLID WASTE AND EMERGENCY
RESPONSE

Roger Kennett and Brian J. Sogorka
Interstate Technology & Regulatory
Cooperation Work Group
444 North Capitol St.
Suite 305
Washington, D.C. 20001

Dear Mr. Kennett and Mr. Sogorka:

I am pleased to provide you a copy of an EPA guidance memorandum, which I recently signed, on the applicability of RCRA section 3020 to in-situ ground-water remediation. We recognize and appreciate the long-term interest of the Interstate Technology and Regulatory Cooperation Work Group in innovative ground-water cleanup technologies. As you know, we developed this guidance memorandum partially in response to your study, *Regulatory and Technical Guidance for In Situ Bioremediation of Chlorinated Solvents in Groundwater*, and your letter to me of September 9, 1999.

In your September letter, you asked three specific questions. The attached guidance answers your questions. For your convenience, I've summarized the answers below, but for more detail you should refer to the policy memorandum.

1. Question: Is injection of contaminated ground water back into the contaminant plume without substantially reducing the concentrations in the injected fluid covered by RCRA section 3020(b) exemption for cleanup sites?

   Answer: EPA interprets section 3020(b)(2) to require that the treatment be intended to "substantially reduce" hazardous constituents in the ground water. But the "substantial reduction" may occur either before or after reinjection. The reduction may occur "in-situ" after reinjection of the ground water into the aquifer . As long as the reinjection meets these conditions (and the other conditions of section 3020(b)), it may occur without triggering the section 3020(a) prohibition on underground injection of hazardous wastes or the RCRA land disposal restrictions.

2. Question: If injection of contaminated ground water is covered by RCRA section 3020(b), does the exemption extend to state programs?

   Answer: The guidance memorandum states that RCRA sections 3020(b)(1)(A) and 3020(b)(1)(B) limits the section 3020(b) exemption to "response actions" taken under CERCLA section 104 or 106 and to "corrective action" required under RCRA. The exemption applies to any CERCLA action under section 104 or 106, including actions where federal agencies other than EPA are the lead agency. Second, the exemption would apply to any actions taken at RCRA treatment, storage, or disposal facilities (TSDs) under RCRA "corrective action" authorities, including (but not limited to) sections 3004(u), 3004(v), and 3008(h). It would also apply to injections that occur as part of a remedy under an authorized state corrective action program.

3. Question: Is injection of amendments alone prohibited under RCRA?

   Answer: As explained in the policy memorandum, RCRA subtitle C, including section 3020, does not prohibit the injection of amendments alone into ground water during in-situ treatment if the amendments are not hazardous waste.

If you have any questions or would like to discuss these issues in more detail please contact Robert Hall, Deputy Director, Permits and State Programs Division, at 703-308-8432.

Sincerely,

Elizabeth A. Cotsworth, Director
Office of Solid Waste

cc: Tom Kennedy, Association of State and Territorial Solid Waste Management Officials

Attachments

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MEMORANDUM

**SUBJECT:** Applicability of RCRA Section 3020 to In-Situ Treatment of Ground Water

**FROM:** Elizabeth A. Cotsworth, Director
Office of Solid Waste

**TO:** RCRA Senior Policy Advisors
RCRA Enforcement Managers
Superfund Regional Policy Managers

We have recently received several questions on how the Resource Conservation and Recovery Act (RCRA) applies to the reinjection of ground water contaminated with hazardous waste during cleanups, and particularly on the applicability of section 3020(b) of RCRA to ground-water remedies involving in-situ bioremediation and other forms of in-situ treatment. This memorandum clarifies that reinjection of treated ground water to promote in-situ treatment is allowed under section 3020(b) as long as certain conditions are met. Specifically, the ground water must be treated prior to reinjection; the treatment must be intended to substantially reduce hazardous constituents in the ground water – either before or after reinjection; the cleanup must be protective of human health and the environment; and the injection must be part of a response action under CERCLA section 104 or 106 or a RCRA corrective action intended to clean up the contamination.

**Background**

Section 3020 of RCRA addresses the underground injection of hazardous waste in the context of RCRA and CERCLA cleanups. RCRA section 3020(a) bans hazardous waste disposal by underground injection into a formation which contains an underground source of drinking water (within one-quarter mile of the well), or above such a formation. However, RCRA section 3020(b) exempts from the ban reinjection of treated contaminated ground water withdrawn from an aquifer, if the following criteria are met: (1) the reinjection is a CERCLA section 104 or 106 response action or part of a RCRA corrective action intended to clean up the contamination, (2) the contaminated ground water is treated to substantially reduce hazardous constituents prior to

such reinjection, and (3) the response action or corrective action is sufficient to protect human health and the environment upon completion.[1]

In the past, EPA and state regulators have expressed concern that the RCRA land disposal restrictions (LDRs) might add further limitations on ground-water reinjection conducted as part of a RCRA or CERCLA action. The LDR requirements, found in RCRA sections 3004(f), (g), and (m) and codified at 40 CFR Part 268, establish specific treatment standards that *restricted* hazardous waste must meet before it may be disposed of in a *land disposal* unit. Ground water being reinjected may contain a restricted waste, and injection of hazardous waste into underground injection wells is land disposal under LDR. To address concerns that these treatment requirements might limit the scope of the section 3020(b) exemption, EPA issued a clarifying memorandum on December 27, 1989. The memorandum stated that contaminated ground water reinjected during the course of RCRA or CERCLA cleanups in a manner consistent with the RCRA section 3020(b) exemption is not subject to RCRA land disposal restrictions. As the memorandum summarized, "EPA construes the provisions of RCRA section 3020 to be applicable <u>instead</u> of the LDR provisions at RCRA sections 3004(f), (g), and (m), to reinjections of contaminated ground water into an underground source of drinking water (USDW), which are part of a CERCLA response action or RCRA corrective action." (emphasis added) (See Don R. Clay, Assistant Administrator for Solid Waste and Emergency Response, to EPA Waste Management Division Directors and Regional Counsels, OSWER Directive #9234.1-06; a copy of the memorandum is attached.)[2]

EPA's December 27, 1989 memorandum, therefore, clarified the relationship between RCRA section 3020 and the LDR requirements. Since that memorandum, EPA has received additional inquiries on the scope of section 3020, particularly as it applies to ground-water remedies involving in-situ bioremediation and other in-situ treatment. The remainder of this memorandum addresses those inquiries.

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[1]Prior to the 1984 amendments to RCRA that included section 3020, EPA promulgated very similar requirements in the implementing regulations for the Underground Injection Control (UIC) Program at 40 CFR 144.13. Additional clarification for injection wells at section 144.13(d) provides exemptions from the prohibition on Class IV wells (wells involving the injection of hazardous waste) in cases where the aquifer has been exempted pursuant to specific criteria, or where no underground source of drinking water (USDW) source exists within one quarter mile of the injection well.

[2]Questions have been raised as to whether the Corrective Action Management Unit (CAMU) rule superseded this 1989 directive. EPA emphasizes that the CAMU requirements do not supercede the 1989 memo. In addition, questions have been raised as to whether Minimum Technological Requirements (MTRs) apply to reinjection. MTRs apply to landfills, surface impoundments, and waste piles and therefore are not relevant to reinjection.

**Application of Section 3020(b) to In-situ Treatment**

As the December 27, 1989 memorandum stated, the RCRA section 3020(b) exemption from the ban on hazardous waste injection applies to reinjected ground water only if the ground water "is treated to substantially reduce hazardous constituents prior to such injection", and the injection meets the other requirements for exemption. The memorandum further stated that "steps necessary to 'substantially reduce' hazardous constituents should be decided on a case-by-case basis," until further guidance is developed. Today's memorandum clarifies one element of the requirement for substantial treatment.[3]

EPA interprets section 3020(b)(2) to require that contaminated ground water withdrawn from an aquifer be treated prior to reinjection and that the treatment be intended to "substantially reduce" hazardous constituents in the ground water. But the "substantial reduction" may occur either before or after reinjection. To be more specific, the reduction may occur "in-situ" after reinjection of the ground water into the aquifer (that is, within the formation that is the target zone for the injected fluid). The intended treatment must reasonably be expected to reduce levels of contamination and must be part of a legitimate effort to achieve cleanup of such contamination. As long as the reinjection meets these conditions (and the other conditions of section 3020(b)), it may occur without triggering the section 3020(a) prohibition on underground injection of hazardous wastes or the RCRA land disposal restrictions.

This clarification is particularly relevant to in-situ ground-water bioremediation. Over the last decade, government, academic, and industrial researchers have investigated and piloted remedial systems that rely on "enhanced" or "engineered" in-situ bioremediation of contaminated ground water to promote treatment or increase biodegradation of hazardous constituents. These remedial systems can be used to clean up ground water contaminated with petroleum hydrocarbons, chlorinated aromatics, chlorinated solvents, and other common pollutants. In these systems, remediators stimulate the biodegradation of pollutants by manipulating subsurface conditions (for example, by adding nutrients) and in some cases by adding naturally-occurring or nonindigenous microorganisms. In many cases, contaminated ground water is extracted during the course of the remedy, amended to promote in-situ bioremediation, and reinjected. These "amendments" or "treatment agents" might include addition of microorganisms ("bioaugmentation"), nutrients (for example, phosphate or ammonium nitrate), electron donors (for example, oxygen, hydrogen peroxide, or specifically-designed commercial products), or substrates to promote microbial growth (for example, lactic acid, various alcohols, propane, or other chemical products). Amending the extracted contaminated ground water in any of these ways clearly constitutes "treatment" under RCRA (see section 1004(34)). Therefore, EPA considers these systems to be consistent with RCRA section 3020(b)(2) treatment requirement, as long as extracted ground water contaminated with hazardous waste is amended (or otherwise

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[3]This memorandum also does not address what degree of treatment would be considered "substantial", which is a determination made on a case-by-case basis.

"treated") before reinjection, and as long as the treatment is intended to achieve a substantial reduction of hazardous constituents after reinjection.[4]

EPA emphasizes that the general principle described above – that under section 3020(b)(2) "treatment" must occur prior to reinjection, but the "substantial reduction" of hazardous constituents in the ground water may occur after reinjection – applies to other in-situ treatment systems besides biotreatment, as long as they too comply with the conditions of section 3020(b). For example, it would potentially apply where ground water contaminated with hazardous waste is reinjected in the course of in-situ flushing or in-situ chemical oxidation. In-situ flushing is a ground-water cleanup method that involves the injection or infiltration of a flushing solution into a zone of contaminated soil and ground water, followed by downgradient extraction of ground water and elutriate (flushing solution mixed with contaminants). Flushing solutions typically include plain water, augmented by surfactants, co-solvents, or other treatment agents. The extracted ground water/elutriate mixture is treated above-ground to remove most of the contaminant, and then reinjected to repeat the flushing procedure.

In-situ chemical oxidation is another subsurface treatment method, involving the introduction of oxidizing agents into contaminated aquifers. Typical oxidants include hydrogen peroxide, potassium permanganate, and ozone. Delivery methods vary, but the oxidants are sometimes mixed with extracted ground water, which is then reinjected and recirculated. This method potentially can destroy or degrade an extensive variety of hazardous wastes, including volatile organic compounds (such as trichloroethylene and benzene) and semivolatile organic contaminants (such as certain pesticides, polycyclic aromatic hydrocarbons, and polychlorinated biphenyls) in ground water, sediment, and soil. These advanced technologies show great promise in addressing ground-water contamination.

In both of the systems described above, the addition of treatment agents to extracted contaminated ground water prior to reinjection constitutes "treatment," and therefore the reinjection would be allowable under section 3020(b), as long as the other conditions of that section were met.

EPA has occasionally been asked how RCRA applies to a commercial chemical or chemical product that is injected into ground water for in-situ treatment where no ground water is withdrawn and reinjected. RCRA subtitle C, including section 3020 (a), does not regulate material that is not a hazardous waste and thus does not prohibit the injection of a material into ground water during in-situ treatment if the material is not a hazardous waste. Therefore, as long as the injected materials are not hazardous wastes, the exemption in 3020(b) is not needed to allow the injection into ground water of flushing solution, oxidants, or other treatment agents without mixing with extracted ground water. If any of these substances qualify as a "hazardous waste," then its injection is subject to RCRA subtitle C regulation, and, if that injection is into or

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[4]Similarly, EPA considers these systems consistent with the UIC regulations at 40 CFR section 144.13.

above a formation that contains an underground source of drinking water, it is prohibited by RCRA section 3020(a).

Under RCRA, a material is regulated under RCRA subtitle C only if it is a "hazardous waste" as defined in 40 CFR. section 261.3, and a material is only a "hazardous waste" if it meets the definition of "solid waste" in 40 CFR. section 261.2. A "solid waste" is defined in section 261.2 as a "discarded material." Commercial chemicals or chemical products generally are not "discarded," even when their use results in deposit on the land, if they are being used for their ordinary or original intended purpose. See section 261.2(c) (ii) (commercial chemical products are not solid wastes when applied to the land and that is "their ordinary manner of use") and section 261.33 introduction (enumerated commercial chemical products are solid wastes when "applied to the land in lieu of their original intended use"). For example, a pesticide applied on the land for the purpose of killing pests is not considered "discarded," and thus is not solid or hazardous waste subject to RCRA regulatory requirements. Similarly a commercial chemical or chemical product that is specially formulated to treat contamination and then is injected into ground water to treat that type of contamination is not considered discarded and is not subject to RCRA regulatory requirements.

A commercial chemical or chemical product injected into ground water also would not be subject to RCRA subtitle C regulations when it is injected into ground water to treat a type of contamination if it had been proved successful elsewhere in treating such contamination, or if it had been commonly used in other forms of treatment of such contamination, or if it had chemical properties that could legitimately be expected to promote in-situ treatment of that contamination. See Self v. United States, 2 F. 3d 1071, 1079-81 (10th Cir. 1993) (broadly construing ordinary manner of use/original intended purpose test to include uses furthering a generic rather than highly specific activity).

**Eligible Cleanup Authorities**

RCRA sections 3020(b)(1)(A) and 3020(b)(1)(B) limit the section 3020(b) exemption to "response actions" taken under CERCLA section 104 or 106 and to "corrective action" required under RCRA. EPA has frequently been asked to clarify its views on the scope of this limitation. First, the exemption of course applies to any CERCLA action under section 104 or 106, including actions where federal agencies other than EPA are the lead agency. Second, the exemption would apply to any actions taken at RCRA treatment, storage, or disposal facilities (TSDs) under RCRA "corrective action" authorities, including (but not limited to) sections 3004(u), 3004(v), and 3008(h). It would also apply to injections that occur as part of a remedy under an authorized state corrective action program, as long as these injections met the other exemption requirements of RCRA section 3020(b).[5]

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[5]Simply qualifying for the eligible cleanup authorities under section 3020(b) does not affect other regulatory obligations, whether federal, state, or local. For example, it does not obviate the need for operators of these injection systems to provide inventory information, or

**Other Considerations When Selecting Groundwater Reinjection as a Cleanup Remedy**

EPA supports the types of activities described in this memorandum because they can often provide effective treatment in otherwise intractable situations. In approving ground-water remedies, regulators should consider the current and potential beneficial uses of the ground water, and the time it will take different remedies to achieve remedial goals, including whether the "substantial treatment" consistent with section 3020(b)(2) will occur within a reasonable period of time. The treatment timeframe should be consistent with the remedial goals for the site. Regulators should also be careful when selecting ground-water reinjection remedies to ensure that activities intended to remediate contamination, such as flushing, do not inadvertently result in any unacceptable migration of contaminants or treatment agents beyond the zone of treatment. To assure the action is sufficiently protective of human health and the environment, regulators should review methods for monitoring the proposed ground-water reinjection, and may want to consider hydraulic containment measures.

**Conclusion**

I trust these clarifications will facilitate the use of enhanced in-situ bioremediation and other ground-water remedies at sites where ground water is contaminated with RCRA hazardous waste. If you have any specific questions about these issues, contact Robert Hall, Deputy Director, Permits and State Programs Division, at 703-308-8432.

cc: Bruce Kobelski, OW
Larry Reed, OERR
Walter Kovalick, TIO
Barry Breen, OSRE
Betsy Devlin, ORE/RED
Tom Kennedy, ASTSWMO

Attachments

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meet other specific requirements imposed by the UIC Program Director in direct implementation or primacy programs. Therefore, operators should coordinate with their state regulators to obtain, as necessary, variances, waivers, construction permits, approvals, etc., prior to reinjection under 3020(b) of the federal RCRA statute.