

Landfilling of Drinking Water ABRs

For

Workshop on Arsenic-Bearing Drinking Water
Treatment Residuals

February 13-14, 2006

Tucson, Arizona

Gregory Helms

USEPA Office of Solid Waste

RCRA Background

- EPA regulates waste management under the Resource Conservation and Recovery Act (RCRA)
- Under RCRA we define:
 - What is a waste?
 - What is a hazardous waste?
 - Safe handling, treatment, and disposal for hazardous waste, and some other wastes

RCRA Background

- Groundwater contamination is a key waste management concern
- Leach testing has been used in regulatory programs to help determine:
 - What waste is hazardous: listings, delistings, Toxicity Characteristic (TC) regulation
 - What treatment is adequate: Land Disposal Restriction (LDR) treatment requirements
- TCLP is the most used leaching test.

TC Regulation

- The Toxicity Characteristic (TC) regulation (40 CFR 261.24) is risk-based and directed at groundwater protection.
- The TC follows a basic risk assessment format, estimating in turn:
 - Release (TCLP)
 - Transport and transformation (DAF)
 - Exposure (water ingestion)
 - Toxicity (from human and/or animal studies)

TC Regulation

- Toxicity Characteristic Leaching Procedure (TCLP) estimates contaminant release
- TCLP is a screening test that considers conditions that may be present in a MSW landfill that contains decomposing garbage.
 - Acetic acid buffered to pH 5 (initial); 20:1 liquid/solid ratio; particle size reduction to 9.5 mm; equilibrium.
- Co-disposal of industrial solid waste with MSW is considered plausible “worst case” waste management.

TC Regulation

- A dilution and attenuation factor (DAF) estimates transport from the landfill to a well.
 - EPA CMTP groundwater model used (unlined landfill).
 - Generic DAF of 100 was applied to leachate concentrations for the 1990 TC rule.
 - DAF 100 was estimated to be protective at 85% of sites (85% of sites at or below endpoint).
 - Modeling has been updated and improved since promulgation of the TC rule; can now do constituent specific DAF; finite source modeling.

TC Regulation

- Preventing well water contamination is the regulatory end-point.
 - MCLs were used where available.
 - For constituents without an MCL, 10^{-5} lifetime cancer risk level, or HQ1 was used.
- For arsenic, the MCL was used.
 - TC value is based on arsenic MCL of 50 ug/l.
 - At the new MCL, 90th percentile population exposed to $1.3-6.1 \times 10^{-4}$ cancer risk.
 - EPA understands the need to update, but does not currently have the resources to do so.

Waste Management Under RCRA

- Hazardous waste is managed under RCRA Subtitle C requirements:
 - Generator, storage and transport requirements
 - Treatment to LDR levels before landfilling
 - Landfilling in hazardous waste landfills (listed wastes) or non-hazardous landfills (fully treated characteristic waste).

Waste Management Under RCRA

- Non-Hazardous industrial wastes must go to Municipal Solid Waste (MSW) or Industrial non-hazardous landfills (unless reused):
 - RCRA bans the open dumping of industrial waste— including non-hazardous waste (40 CFR 257.1(a); open dumps defined at 40 CFR 257.2)
 - Construction and Demolition (C&D) landfills cannot accept ABRs (40 CRF 257.2)

Waste Management Under RCRA

- MSW landfills have national design and operation requirements (as of 1991) and state requirements:
 - MSW Landfills must have a liner and leachate collection system, or do a no-migration demonstration. 40 CFR 258.40
 - MSW Landfills must install a groundwater monitoring system and do corrective action if leachate causes MCL exceedences beyond 150 meters from unit boundary. 40 CFR 258.50

Waste Management Under RCRA

- Industrial non-hazardous landfills regulated at the national and state level (40 CFR 257):
 - National requirements are general, and include prohibitions on causing groundwater or surface water contamination, compliance with safety standards, and a ban on open burning.
 - State requirements may include liners, leachate collection, and monitoring (e.g., New Mexico applies the MSW design regulations to industrial landfills).
 - EPA has technical guidance for landfill design, including the IWEM model (<http://www.epa.gov/epaoswer/non-hw/industd/tools.htm>).

ABR Management Under RCRA

- ABRs do not fail the TC regulatory value so are not regulated as hazardous waste.
 - ABRs can go to MSW or industrial non-hazardous waste landfills
 - ABRs cannot go to C&D landfills
 - ABRs cannot be dumped in the open

Arsenic in Landfill Leachate

- In 2000 EPA collected landfill leachate data to better understand landfill conditions and problems.
- Some As was found in leachate from all types of landfills.

Arsenic in Landfill Leachate

- For MSW landfills (200 landfills):
 - Number of data points (N)=2444
 - Percent detects: 71%
 - 5th percentile: 4 ug/l
 - Median: 20 ug/l
 - Mean: 441 ug/l
 - 95th percentile: 260 ug/l

Arsenic in Landfill Leachate

- For industrial non-hazardous waste landfills (21 landfills):
 - Number of data points (N)=189
 - Percent detects: 74%
 - 5th percentile: 3.5 ug/l
 - Median: 40 ug/l
 - Mean: 212 ug/l
 - 95th percentile: 830 ug/l

Arsenic in Landfill Leachate

- For Subtitle C landfills (17 landfills):
 - Number of data points (N)=463
 - Percent detects: 91%
 - 5th percentile: 9 ug/l
 - Median: 1500 ug/l
 - Mean: 42,806 ug/l
 - 95th percentile: 173,000 ug/l

Will ABR Disposal Cause GW Contamination Even Though it is Not RCRA Hazardous?

- Indicators that it may:
 - TCLP appears to under predict As leaching from ABRs:
 - Leachate from mature landfill used in Ghosh, et.al (2004) had higher pH, more reducing conditions than TCLP.
 - Reduced ABR will release As from the Fe, and some As will reduce to As III.
 - As seems to leach more at higher pHs.
 - TC regulation out of sync with new MCL

Will ABR Disposal Cause GW Contamination Even Though it is Not RCRA Hazardous?

- Indicators that it may not:
 - ABRs are a very low volume waste; low mass of As added to any one landfill.
 - ABRs must be landfilled.
 - MSW landfills have liners/leachate collection.
 - Industrial landfills may have liners.
 - Industrial landfills may not have the same reducing conditions present in MSW landfills.
 - Do not know frequency of Fe use for water treatment.

Will ABR Disposal Cause GW Contamination Even Though it is Not RCRA Hazardous?

- No absolute, categorical answer.
 - Projected contamination at one or two landfills would not be considered a national problem.
- Leaching from waste does not mean that GW contamination will occur— only that it may occur.
- Risk assessment modeling provides estimates.
 - Try to be sure models are conservative, so we err on the side of protection.
- Models can help identify conditions most likely to result in releases that can contaminate GW.