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To: <secy@nrc.gov>
Date: Mon, Jun 30, 2003 7:33 PM
Subject: Re: Proposed 10 CFR PART 20 -- GRRN In Opposition to Proposed Rule

Secretary
US Nuclear Regulatory Commission
Att: Rulemaking and Adjudications Staff
Washington, DC 20555

Re: Proposed 10 CFR Part 20
Comments by the Grassroots Recycling Network In Opposition to Proposed Rule

Sir,

Attached are comments from the GrassRoots Recycling Network, as a Word document and as unformatted text. Please enter our comments into the record.

Sincerely,
Bill Sheehan

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June 30, 2003

Secretary
US Nuclear Regulatory Commission
Attn: Rulemaking and Adjudications Staff
Washington, DC 20555

Re: Proposed 10 CFR PART 20: Comments by the Grassroots Recycling Network In Opposition to Proposed Rule

To Whom It May Concern:

The Grassroots Recycling Network submits these comments in opposition to the proposed rule, 10 C.F.R PART 20, that would permit low level radioactive waste to enter general commerce and/or be disposed of in municipal solid waste landfills.

We are opposed to low level radioactive waste (LLRW) entering general commerce to be lawful for use in recycled products, or to be permissibly disposed of in Resource Conservation Recovery Act (RCRA) Subtitle D landfills for municipal solid waste (MSW).

Many other commentors are already dealing in detail with the use of such material in recycled products, so these comments will be focused on their disposal in Subtitle D landfills.

In summary, and as documented later in this set of comments, the standards set by the Environmental Protection Agency for the design, operation and closure of municipal solid waste landfills under RCRA are demonstrably inadequate to protect public health or the environment from any hazardous material, such as low level radioactive waste, that either is volatile or not short-lived.

Volatile or semi-volatile compounds will tend to volatize as a gas and be emitted. Yet 95% of the MSW landfills have no active landfill gas control systems, and, of those that do, in aggregate they control less than 25% of total emissions. Consolidating both those with and those without suggests that the combined efficiency is only between 10% and 15%.

Other low level radioactive compounds will, in the presence of the organic fraction of municipal solid waste (MSW) tend to be chelated and be mobilized into the leachate that, in the future, will be released into surface waters or the underlying aquifer.

Therefore, any analysis of whether public health or safety is protected would have to assume that the LLRW would be released to the environment. Yet, at this point, there

has been no adequate showing that such releases into the environment would be of such low levels as to be safe. Moreover, cost considerations that are driving this process improperly exclude future costs and external costs from the calculation.

The Statutory Standard Under RCRA

The Resource Conservation and Recovery Act provides that any regulations developed by EPA shall "at a minimum" insure that "there is *no reasonable probability of adverse effects* on health or the environment from disposal of solid waste."[1]

As shown below, EPA's present landfill rules demonstrably fail to achieve that statutory requirement even before the addition of LLRW in MSW landfills.

Groundwater Discharges

The "Subtitle D," or so-called "dry tomb," rules promulgated in 1991 were intended to keep the landfill dry in order to stabilize the waste load, thereby preventing uncontrolled discharges of toxics-laden leachate into surface or groundwater (the "Landfill Groundwater Rule").[2]

The bedrock foundation for the rules was the requirement for an elaborate system of barriers intended to isolate the waste from liquids and remove any liquids that did accumulate.[3]

Also, the rule had many other location and operational provisions intended to complement the liner requirements, imposing restrictions on where a landfill could be located, limitations on hazardous substances, monitoring and financial assurance.[4]

Unfortunately, although this approach seemed comprehensive, in fact, the Landfill Groundwater Rule was fatally flawed from its inception. For one thing, throughout the rule's development EPA's technical staff repeatedly rejected industry claims that the liners and leachate collection lines – the foundation upon which the final standards were erected – would achieve their intended purpose:

> "No liner, however, can keep all liquids out of the ground for all time. Eventually liners will either degrade, tear, or crack and will allow liquids to migrate out of the unit. Some have argued that liners are devices that provide a perpetual seal against

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1 42 U.S.C §6944(a). Italics added.

2 56 FEDERAL REGISTER 50978 (October 9, 1991); 40 C.F.R. PART 258.

3 Composite liners: 40 C.F.R. §258.40(b); leachate collection system: 40 C.F.R. §258.40(a)(2); and outside liquid restriction: 40 C.F.R. §258.28.

4 Location restriction: 40 C.F.R. §§258.11 to 258.13; co-disposal ban: 40 C.F.R. §258.20; daily cover: 40 C.F.R. §258.21; monitoring systems: 40 C.F.R. §§258.51 to 258.55; and financial assurance: 40 C.F.R. §§258.61 and 258.72.

any migration from a waste management unit. EPA has concluded that the more reasonable assumption, based on what is known about the pressures placed on liners over time, is that *any liner will begin to leak eventually.*"[5] (emphasis added.) More recently, the EPA Inspector General concluded that:

"EPA officials have stated that based on current data and scientific prediction, the release of contaminants may eventually occur, even with the application of best available land disposal technology. There is concern that *these barriers will merely postpone the inevitable release of contaminants until after the 30-year liability has expired.* As previously stated, some sites contain materials which are highly resistant to decomposition or which remain toxic forever. There have been several studies to determine the expected life span of landfill liners, and opinions on this issue vary widely. The bottom line is that not even the manufacturers claim that their liners will last forever.

"Many liners are only warrantied for a period of 20 years, and landfill caps are only expected to last for 20 years. Leachate collection systems have a finite life, as drains clog, and pumping capacity declines with time. Some of the older systems, which will be the first sites to end their 30-year post-closure care period, were constructed without liners, double liner protections, or leachate collection systems that are required under today's regulations. Potential failures at landfills include:

- leachate collection systems clogging,
- leaks/ pinholes/ seams/ stress cracking/ brittle fractures/ deterioration/ chemicals passing through liners,
- erosion of the cap by natural weathering, vegetation roots penetrating cover, burrowing by soil-dwelling mammals, cave-ins by settling of wastes,
- seismic and general instability of the landfill, and
- rainfall creating more leachate that migrates into groundwater (bathtub effect).
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"In our sample, we found several examples of barriers failing during the first 30 years. Most of the states in our sample reported animal or weather-related damage at their sites. Repairs were required at one facility after wild pigs rooting in the near surface soil caused erosion of the landfill cap. In another state, black bears have been a problem. We found other examples of landfill caps eroding, damage to caps due to animal burrows, and a drainage channel being destroyed after heavy downpours. Other sites needed maintenance due to vegetation growth. Additionally, unexpected events other than natural erosion occurred at other sites which required maintenance activities. For example, at one site an automobile drove through the fence surrounding the facility, destroying the leachate treatment system. Another landfill site required repairs after children dug under a fence into the landfill site in order to skateboard on an old truck ramp. Officials in one state speculated that all post-closure facilities will need continuous surface and fence maintenance in perpetuity."[6]

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5 47 FEDERAL REGISTER 32285 (July 26, 1982).

6 Inspector General, *RCRA: RCRA Financial Assurance for Closure and Post-Closure* (2001), at p. 34.

What appeared to be an elaborate regulatory edifice of defense-in-depth actually turned out to be a house of cards that only delayed, rather than prevented, pollution. It most certainly did not keep the garbage dry and stabilized for the centuries in the future that the waste load remained a threat to the environment.[7]

Possibly, this made the "dry-tomb" misnomer the worst thing to have done. For, in addition to its failure to prevent harm to our progeny, liners deferred the occurrence of the inevitable harm until the very worst time – namely until after the responsible parties are relieved of their legal responsibility for the illegal discharges, and the remediation and monitoring systems are no longer functional. That can only act to increase the prospect that the threats to our grandchildren's drinking water will go uncorrected.

There are also many other major flaws in the Landfill Groundwater Rule, among them are the fact that the mission critical leachate collection systems are likely to clog,[8] and critical monitoring function to provide early detection of leaks before the entire aquifer is contaminated are spaced so far apart as to be useless.[9] Also, the equally important financial assurance rules intended to insure that there are funds available to clean up pollution wound up not accounting for clean up costs that are anticipated but have not already occurred, and did not provide assurance that any funds will actually be available for anything.[10]

These conclusion are no longer controversial, and have become the industry consensus. For example, here are the comments of the Solid Waste Management Association of North America –

> "The problem with the dry-tomb approach to landfill design is that it leaves the waste in an active state for a very long period of time. If in the future there is a breach in the cap or a break in the liner and liquids enter the landfill, degradation would start and leachate and gas would be generated. Therefore, dry-tomb landfills need to be monitored and maintained for very long periods of time (some say perpetually), and someone needs to be responsible for stepping in and taking corrective action when a problem is detected. The federal Subtitle D rules require

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7 Commission of the European Communities, *Management and Composition of Leachate from Landfills* (No. B4-3040/013665/92), at p. 7 TABLE 1.2.

8 Kerry Rowe, "Particle Size and Clogging in Granular Media Permeated with Leachate," 126 JOURNAL OF GEOTECHNICAL AND GEOENVIRONMENTAL ENGINEERING 9 (September 2000).

9 40 C.F.R.§258.51. Cherry; Haitjema; Lee. "A Groundwater Protection Strategy for Lined Landfills."

10 E.P.A. Inspector General, *supra,* at p. 31.

only 30 years of post-closure monitoring by the landfill operator, however, and do not require the operator to set aside funds for future corrective action. Given the many difficulties of ensuring and funding perpetual care by the landfill operator, the responsibility of responding to long-term problems at dry-tomb landfills will fall on future generations, and the funding requirements could quite likely fall on state and local governments."[11]

Similarly, a wide range of landfill engineers have published similar comments–

"...The dry containment method of operating a landfill has been described as long-term storage of waste rather than waste treatment or waste disposal, and does have some significant drawbacks. There will always be pockets of moisture within waste, and it is generally accepted that all lining and capping systems will eventually leak so rain and/or groundwater will eventually enter the site. Thus, the decomposition of the organic fraction of the waste will eventually occur, with resulting emissions of landfill gas and leachate. Since pipes and pumps buried within the waste eventually clog up and fail, there will be less chance of collecting and treating these emissions if they occur in the distant future."[12]

"The containment provided by these landfills offers environmental protection initially; however, at some point beyond the 30-year [postclosure] period, there may be partial failure(s) of the containment lining system (underlying and overlying the waste). The primary environmental issue associated with partial containment system failure and moisture infiltration is the potential associated increase in gas and leachate production and the resulting impact of uncontrolled leachate and/or landfill gas releases to the environment. The nature and magnitude of the releases exiting the landfill and their resulting impacts is directly related to the amounts of organic waste not yet decomposed."[13]

The fact that dry tomb based landfills will fail and are a fatally flawed technology is now conventional wisdom. The question, then, is why EPA nonetheless went on to promulgate liner based standards predicated upon those barriers lasting forever. For RCRA

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11 John Skinner, "Composting and Bioreactors," *MSW Management* (July/August 2001), at p. 16.

12 Peter White, et. al., *Integrated Solid Waste Management: A Lifecycle Inventory* (Aspen Pub. 1999), at p. 275.

13 John Pacey, et. al., *The Bioreactor Landfill - An Innovation in Solid Waste Management*, Monograph (2001), at p. 2. *See, also,* Lee, G.F. and Jones-Lee, A., "Assessing the Potential of Minimum Subtitle D Lined Landfills to Pollute: Alternative Landfilling Approaches," *Proc. Air and Waste Management Assoc.* 91st Annual Meeting, San Diego, CA. Lanier Hickman, "Ticking Time Bombs," *Municipal Solid Waste News* (SWANA) (March 1995). Abraham Michaels, "Solid Waste Forum on Landfills," *Public Works* (April 1995). D.P. Komilis, R.K. Ham, R. Stegmann, "The Effect of Landfill Design and Operation Practices on Waste Degradation Behavior: A Review," 17 *Waste Management and Research* 20-26. (1999).

required that the rules insure that there will be no leakages "for as long as the wastes remain hazardous," while EPA acknowledged that "thousands of years" was the length of time it expected a waste load containing decomposable and hazardous material to remain a threat to the environment.[14]

According to the EPA's Inspector General, the answer involved a political decision to keep disposal costs artificially low that was imposed on the technical staff without any scientific support–

> "Landfill design requirements and post-closure maintenance for both Subtitle C and Subtitle D facilities are expected to prevent leakage in the short term; however, their long-term effectiveness in controlling releases of contaminants is unknown. EPA and others have stated that it is likely that some disposal facilities will leak at some period after they close. ...
> "EPA officials *acknowledge the lack of criteria or scientific basis* for establishing the 30-year post-closure time frame. ... EPA made the decision to establish the time frame at 30 years, seemingly *based on a compromise of these competing interests*. EPA officials we spoke to agreed that the 30-year time frame was *not based on specific scientific criteria or research studies*."[15]

For these reasons, compounds whose toxicity extends for decades and centuries and that are either soluble or can be mobilized will eventually leak into surface or ground waters at some point in the future when the barriers and liquid removal systems degrade and fail, probably shortly after the end of the 30 year post-closure period, if the Inspector General's projections are accurate.

Please note, too, that MSW landfills were never designed to safely manage hazardous type materials. "Owners or operators of all MSWLF units must implement a program at the facility for detecting and preventing the disposal of regulated hazardous wastes."[16]

Many of the radioactive isotopes involved in the docket would be potentially soluble in a MSW landfill, especially because, unlike Europe, landfills in the U.S. are not precluded from accepting decomposable matter. The chelating agents from the organic fraction of the waste stream would mobilize the isotopes whose half-lives would keep them hazardous beyond the time they would leak out of the landfill into surface or sub-surface

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14 46 FEDERAL REGISTER 28328 (May 26, 1981). *See, also,* **Commission of the European Communities**, *Management and Composition of Leachate from Landfills* (No. B4-3040/013665/92), at p. 7.

15 E.P.A. Inspector General, *RCRA: RCRA Financial Assurance for Closure and Post-Closure* (2001), at p. 31 (emphasis added).

16 40 C.F.R. §258.20(a).

waters, as shown on the following table:

TABLE 1
Examples of Low Level Radioactive Wastes
That Are Potentially Soluble

Radioactive Isotopes	Half Life (years)
Plutonium-239	24,000
Strontium-90	29
Americium-241	432.2
Cesium-135	2,300,000

Recent testing of the leachate from California landfills graphically demonstrates that radioactivity does not adhere in the waste mass but instead does leach out of the landfill.[17] In that case, the leachate in which radioactivity was measured was in the leachate captured by the leachate collection system. Even if the systems do not clog up or break down in the near term, the landfill owner is not required to keep the leachate collection system operating after the end of the post-closure period, 30 years following closure.[18] At some point in time after the end of the post-closure period, the leachate will no longer be contained and will be released.

Therefore, any reasonable analysis of the issues would have to start from the predicate that some of the LLRW disposed of in MSW landfills would, in many instances, contaminate drinking water supplies about 30 or 40 years in the future. The remaining issue for public health and safety is whether the levels that would leak would be so low as to pose no threat – no claim could be made, however, that the radioactive wastes would remain isolated for longer than the isotopes active lives.

In addition, these comments would apply with equal vigor to disposal in Subtitle C

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17 California State Water Resources Control Board, *Summary of Radioactivity Measurements in Leachate and Groundwater at Selected California Municipal Landfills* (March 2003).

18 40 C.F.R. §258.40(a)(2) contains the Subtitle D requirement for MSW landfills to install leachate collection systems. 40 C.F.R. §258.61(a) limits the time that the systems much be maintained and operated to 30 years following closure of the landfill. After the end of that post-closure period, the Subtitle D rules permit the owner to terminate all of the abatement systems and sell or abandon the site. Although that section of the code does permit an approved state to increase (or decrease) the length of the post-closure period on a case-by-case basis, 40 C.F.R. §258.61(b)(2), the EPA Inspector General has correctly noted that the structure of the rule precludes its practical exercise. This is because the time that decision is made is prior to the occurrence of the liner or leachate collection system failures. *Id.*, at p. 35. In any event, EPA is actively in the process of reducing the post-closure period.

(hazardous waste) landfills. Although hazwaste landfills have more rigorous liner requirements such as double liner/leachate collection systems,[19] those incremental enhancements suffer from the same infirmity as the single composite liners in Subtitle D landfills. Eventually, they will deteriorate and fail, too. It will just take longer.

Consequently, the only substantive difference between landfilling radioactive waste in Subtitle C vs. Subtitle D landfills is that, in Subtitle C facilities, there may be radioactive isotopes with sufficiently short half-lives to be no longer be of concern by the time the more redundant barriers ultimately fail further in the future than with Subtitle D sites. Also, the monetized cost of the attendant injury will be discounted back to the present for that many more years, to the extent that discounting is considered appropriate in these circumstances, something that is extremely controversial.

Air Emissions

Groundwater concerns lie mostly in the future. Air emissions are current issues.

For one thing, unlike the Landfill Groundwater Rule that applies to almost all MSW landfills,[20] the Landfill Air Rule[21] only applies to a very small proportion of the sites.

The Landfill Air Rule does not apply to all MSW landfills. Instead it has a size cutoff for coverage that only applies its requirements to new landfills that began construction or received waste after May 30, 1991, and that meets one of two cutoffs –

- Have a design capacity of more than 2.76 million tons (or 3.3 million cubic yards); and, if so, also,
- Have a calculated emission rate for non-methane organic gases of 55 or more tons per year.[22]

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19 40 C.F.R. PART 261.

20 The only minor exception is in 40 C.R.F. §258.1(d). With regard to certain small landfills, first and foremost, the extremely limited exception only applies to truly small facilities less than 20 tons per day, as contrasted with 650 tpd under the air rule. In addition, even for landfills that were that small, they also had to ① show there was no evidence of existing groundwater contamination, and ② be in an area that, like Alaska, has interrupted transportation for 3 months each year or is in the desert where no aquifers underlie the site that might be impacted. Even then, the exemption only extends to a part of the regulations, namely those dealing with liners and monitoring, but not siting, operating criteria, closure, post-closure and financial assurance. 40 C.F.R. §258.1(f)(1).

21 40 C.F.R. PART 60 SUBPART WWW.

22 40 C.F.R. §60.752.

EPA's own data base of 931 landfills, shows that the size and emission cutoff exempted 95% of all MSW landfills, unweighted by size of the landfills. On a weighted basis by size, 61% of the methane emissions and 47% of the non-methane emissions were excused,[23] or an average of 54% of all landfill gases were exempted.[24]

Second, these extraction systems are not actually installed and operated for the entire extended period of time that gases are emitted. They are not put in place until several years after the landfill begins accepting waste, or are put into place but under conditions in which the systems function poorly, and are removed from service before major gas production resumes later down the road.

Whenever the collection systems are not in place, of course, nothing is captured and all of the gases emitted, but not oxidized, are released into the atmosphere. Similarly, for the period that they operate at substandard operating conditions, overall recovery falters. The times like these when there is either no operational gas collection, or the system is operating at subpar levels, must be averaged with the periods when gas collection is installed and operating at its peak performance in order to determine an average rate that reflects lifetime performance.

Using measurement methodology from EPA, including their assumptions, 23% of the gas generated would be severely underperforming in the early years of a landfill's life. Another 50% of lifetime gas emissions are probably slated for release in the future after the cover fails when there is no functioning gas collection system.

Also, even when the systems are functioning, an extensive literature search done by two international scientists with Procter & Gamble as part of a life cycle analysis concluded that—

> "Estimates of [gas] collection efficiencies vary, 20-25% (De Baere et al., 1987); 40% (RCEP, 1993); 40-70% (Carra and Cossu, 1990); 40-90% (Augenstein and Pacey, 1991), and will depend on size, shape and engineering design of the landfill site."

After reviewing each of the studies, the authors decided that "[f]or the purposes of the L[ife] C[ycle] I[nventory] model in this book, a figure of 40% will be assumed,"[25] only slightly more than half of EPA's biased anecdotal estimate for an instantaneous rate. Forty percent is also the generally applied level for the typical instantaneous capture rate in Europe.[26]

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[23] 61 FEDERAL REGISTER 9911 (March 12, 1996).

[24] 61 FEDERAL REGISTER 9914 and 9916 (March 12, 1996).

[25] White, at pp. 283-284.

[26] European Commission, at p. 143. [INSERT NORWAY CITE.]

Overall, after considering each of these factors, only between 10% and 15% of lifetime gas emissions are captured by active collection systems. The vast majority of landfill gases from compounds that volatize will be released into the atmosphere currently.

From the more common LLRW materials, the following table shows those of greatest concern for air emissions:

TABLE 2
Examples of Low Level Radioactive Wastes
That Are Volatile or Semi-Volatile

Radioactive Isotopes	Half-Life (years)
Tritium	12.3
Iodine-129	15,900,000

Therefore, even more the case than with regard to groundwater contamination, any responsible analysis must consider that most of the radioactive isotopes that are volatile or semi-volatile must be expected to be released uncontrolled into the atmosphere.

Link Between Air and Water Releases and Human Exposure

The only reasonable operating assumption is that many of the radionuclides, which would be permitted in Subtitle D landfills by the proposed rule, would be emitted uncontrolled into the atmosphere and contaminate drinking water supplies.

The next question is whether those releases would be a threat to public health or safety. To make that determination, an analysis must be made to determine human dose exposure to those isotopes.

Such an analysis, of sorts, was done of disposal in industrial landfills, but, to our knowledge,[27] nothing has yet been done for MSW facilities. Nothing has been put forward to establish what is the worst case volume of radioactive material that will be discarded at each landfill near nuclear and medical facilities, whatever dilution effects are claimed, and pathways into the environment are set forth. Since the abatement systems in MSW landfills are flawed, until that exposure analysis has been done, there is no way to assert that the public health and safety can be protected by changing the rules to permit more hazardous wastes in MSW landfills never intended for that purpose.

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[27] Cohen & Associates, *Technical Support Document: Potential Recycling of Scrap Metal from Nuclear Facilities* (2003).

Cost Comparison Must Be Done on Life-Cycle Basis

The present discussion of the cost implications of permitting disposal of LLRW in MSW landfills has focused exclusively on the short term and excluded non-market costs currently born by landfill neighbors.

The NRC's notice states that:

> "A principal comment regarding Alternative 5 is that requiring all material, even that which has no, or very small amounts of, radioactivity but which has some economic value, to be sent to NRC/AS-licensed LLW disposal sites would be costly to licensees, in particular smaller entities like hospitals, without an accompanying health and safety benefit. However, a regulation limiting disposal of these materials to an EPA-regulated landfill would have much smaller costs than disposal at a licensed LLW disposal site and place much smaller economic burden on licensees for controlling the disposition of solid materials."[28]

This represents unsound and invalid economics. It is junk science at its most indefensible. Proper economic analysis by any reputable entity demands that life-cycle costs be accounted for. These include both those occurring in the future and not accounted for in current pricing, and also those external costs not reflected in present market prices.

When both the EPA technical staff and its own Inspector General conclude that the barrier systems will deteriorate, there is no permissible basis for failing to consider the consequent costs in Superfund remediation that will eventually ensue.

Similarly, when there is substantial, albeit not yet conclusive, concern about current health impacts among those living near to landfills, that, too, must be factored into the cost analysis, even before turning to the future groundwater contamination issues that are anticipated later.[29]

It may be noted in that regard that even before the introduction of radioactive wastes, EPA notes that among the more than 100 non-methane organic compounds in landfill gas are 13 recognized hazardous air pollutants (HAP), such as vinyl chloride, toluene, tri-chloroethene, xylene, and benzene that are thought to cause various forms of cancer, including leukemia, non-Hodgkin's lymphoma, and liver, lung, kidney, bladder and brain cancer.[30] In addition, twelve compounds, such as benzene, chloroform and ethylene

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28 68 FEDERAL REGISTER 9600 (February 28, 2003). Similar, see: National Research Council, *The Disposition Dilemma: Controlling the Release of Solid Materials from Nuclear Regulatory Commission-Licensed Facilities* (National Academy Press, 2002), at p. 6

29 State of New York Department of Health, *Investigation of Cancer Incidence and Residence Near 38 Landfills With Soil Gas Migration Conditions, New York State, 1980-1989* (1998). *See, also,* Paul Elliot, "Risk of adverse birth outcomes in populations living near landfill sites," 323 *British Medical Journal* 363 (Aug. 2001).

30 E.P.A., *Air Emissions from Municipal Solid Waste Landfills*, at p. 1-3; 61 FEDERAL REGISTER 9917 (March 12, 1996); 56 FEDERAL REGISTER 24473 (May 30, 1991).

dichloride, have the potential to produce non-cancer health effects, including effects on the kidneys, liver and central nervous system.[31]

Conclusion

For these reasons, we strongly oppose permitting the introduction of low level radioactive waste into Subtitle D landfills.

Sincerely,

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[31] 56 FEDERAL REGISTER 24474 (May 30, 1991).