

Three R's Managed Garbage Protects Groundwater Quality

G. Fred Lee, Ph.D, P.E., D.E.E. and Anne Jones-Lee, Ph.D.
G. Fred Lee & Associates
El Macero, CA 95618

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The June 30, 1996 *New York Times Magazine* carried an article by John Tierney entitled "Recycling is Garbage." As professionals who have been concerned with municipal landfill pollution of groundwaters for over 30 years and who spent 30 years teaching and conducting university graduate-level research on a variety of environmental issues including solid waste management and groundwater pollution control, we find that Mr. Tierney has grossly misrepresented the value of waste reduction and recycling as it relates to protecting the groundwater resources that will be available to future generations. Mr. Tierney states,

"Believing that there was no more room in landfills, Americans concluded that recycling was their only option. Their intentions were good and their conclusions seemed plausible. Recycling does sometimes make sense--for some materials in some places at some times. But the simplest and cheapest option is usually to bury garbage in an environmentally safe landfill. And since there's no shortage of landfill space (the crisis of 1987 was a false alarm), there's no reason to make recycling a legal or moral imperative."

Mr. Tierney goes on to state that recycling diverts money from other, more significant environmental problems and that,

"Recycling may be the most wasteful activity in modern America: a waste of time and money, a waste of human and natural resources."

* * *

"Today's landfills for municipal trash are filled mostly with innocuous materials like paper, yard waste and construction debris. They contain small amounts of hazardous wastes, like lead and mercury, but studies have found that these poisons stay trapped inside the mass of garbage even in the old, unlined dumps that were built before today's stringent regulations. So there's little reason to worry about modern landfills, which by Federal law must be lined with clay and plastic, equipped with drainage and

gas-collection systems, covered daily with soil and monitored regularly for underground leaks."

We find that Mr. Tierney's statement of "facts" is not valid in many aspects. While there are many valid reasons to criticize the highly inaccurate information that Mr. Tierney has presented on the benefits of recycling, the area that we wish to address is the one that the senior author has worked on for over 30 years: namely, the pollution of groundwaters by municipal landfill leachate. Those knowledgeable of today's landfilling practices know that today's landfills, at best, in most situations only postpone for from a few years to a few decades the pollution of groundwaters by municipal solid waste (MSW) leachate. We also address, to a lesser extent, the other impacts of today's Subtitle D landfills and the factors that need to be considered in evaluating the true costs of landfilling MSW.

Long-term Reliability of Landfill Liner Systems

The landfilling approach adopted in this country in the early 1980s involves what has been appropriately termed "dry-tomb" landfilling. This approach involves placing garbage in plastic sheeting- and compacted soil-lined landfills. These liners were chosen not because they had been demonstrated to have properties that would prevent leachate (garbage juice) generation within the landfill and the collection of leachate for as long as the waste in the landfill would be a threat. They were selected because they were the next-cheapest thing to nothing (i.e. an unlined sanitary landfill of the type that was used prior to the adoption of the dry-tomb landfilling approach).

In the early 1980s, when the current landfilling approach began to evolve, environmental groups and legislators teamed up to dictate to the US EPA how they should design and monitor landfills to prevent leachate generation and/or to collect it once generated. Basically, the environmental groups and some members of Congress did not trust the US EPA to develop landfilling regulations that would carry out the congressionally defined mandate of protecting public health, the environment and groundwater resources from pollution by landfill-derived leachate for as long as the wastes in the landfill represent a threat. Congress instead adopted regulations that told the US EPA the details of how to design a landfill, with plastic sheeting and compacted clay liners. While the inability of compacted clay to prevent leachate from passing through it for as long as the wastes in the landfill represent a threat was fairly well understood at that time, the ability of the plastic sheeting (principally high density polyethylene) to prevent leachate from passing through it for as long as the wastes represent a threat was poorly understood.

It was known then that compacted clay layers would only postpone when leachate passed through them and, therefore, compacted clay liners of the type being used

would not be effective barriers in preventing leachate from passing through the liner for as long as the wastes in the landfill would be a threat. In a "dry-tomb" type landfill, where there is limited moisture to interact with the waste, many of the components of the waste will be in a form that represents a threat to groundwater quality, effectively forever.

With respect to plastic sheeting liners, it was not but a few years until information began to accumulate which showed that the plastic sheeting used as landfill liners had a finite period of time during which it could be expected to function effectively as a barrier to moisture entering the landfill, which generates leachate, and as an effective system for collecting leachate so that it could be removed in order to prevent groundwater pollution. By the late 1980s, it was clear that the "dry-tomb" landfilling approach for hazardous waste and MSW was a fundamentally flawed technology that, at best, only postponed when groundwater pollution occurred.

The US EPA Solid Waste Disposal Criteria (1988a) state,

"First, even the best liner and leachate collection system will ultimately fail due to natural deterioration, and recent improvements in MSWLF (municipal solid waste landfill) containment technologies suggest that releases may be delayed by many decades at some landfills."

The US EPA Criteria for Municipal Solid Waste Landfills (1988b) state,

"Once the unit is closed, the bottom layer of the landfill will deteriorate over time and, consequently, will not prevent leachate transport out of the unit."

These statements, while published by the US EPA in 1988, are valid today. While no one can predict how long a particular landfill liner system will function to prevent moisture from entering the landfill through the cover or collect the leachate within the landfill once moisture enters, there is no debatable issue about the fact that today's hazardous waste and MSW landfills' cover and liner systems will, under the current approach for landfilling, ultimately fail to protect groundwaters from pollution by landfill leachate.

Lee and Jones-Lee (1997a,b) have recently summarized the deficiencies in the US EPA's Subtitle D regulations and Subtitle D landfills as being developed under these regulations. They have developed a set of questions that should be asked of any landfill applicant and regulatory agency that proposes to approve a minimum Subtitle D landfill. These questions, if reliably answered, will demonstrate that many of the sites where Subtitle D landfills are being developed are not suitable sites for this type of landfill. The minimum MSW Subtitle D landfill cover and single composite liner

required by the US EPA or the double composite liner and landfill cover used in some states such as New York, Michigan, New Jersey, etc. will fail to prevent moisture from entering the landfill, which generates leachate and will ultimately lead to pollution of groundwaters in the vicinity of the landfill. Contrary to the statements made by Tierney, today's landfills are not "safe." The regulatory approach adopted in the 1980s for hazardous waste and municipal solid waste landfilling for which Congress dictated landfill design is now a significant impediment toward revising landfilling regulations to consider what is known today about the ability of "dry-tomb" type landfills to protect groundwater resources from pollution by landfill leachate for as long as the wastes in the landfill represent a threat, i.e. effectively forever.

Impacts of MSW Leachate Pollution of Groundwaters

Mr. Tierney implies that there are only a few components of MSW that represent threats to groundwater quality. He does not understand domestic water supply water quality issues or the composition of leachates produced by today's MSW landfills. Jones Lee and Lee (1993) have provided a discussion of the potential impacts of today's MSW leachate on public health, groundwater resources, the environment and the interests of those within the sphere of influence of the landfill. Today's MSW landfills, even with 50% diversion of the waste as it is practiced today, including extensive household hazardous waste collection/diversion, contains a wide variety of hazardous and deleterious chemicals that can render a groundwater unusable for domestic and many other purposes. The current groundwater quality protection regulations do not adequately or reliably address the wide variety of constituents in MSW leachate that can impair the use of a groundwater for domestic water supply purposes.

There is no doubt that, even with a highly effective household hazardous waste collection program and no illegal industrial and commercial hazardous waste disposal, MSW leachate would still be highly hazardous to individuals who use groundwaters polluted by leachate. There is no way to totally divert all hazardous and deleterious chemicals from MSW. Contrary to the statement made by Tierney, the "poisons" inside MSW are not trapped inside the garbage. Part of the hazardous chemicals, as well as a variety of highly deleterious chemicals, leave a landfill through the liner system and pollute groundwaters, rendering them unusable for domestic water supply purposes.

Therefore, the basic approach that must be used in managing solid waste is to reduce the magnitude of solid waste that must be disposed of to the maximum extent possible and to site landfills where the inevitable pollution of groundwaters is of little or no

consequence to the public, who at some time in the future may wish to use groundwaters in the region for domestic water supply purposes.

Reliability of Groundwater Monitoring to Detect Pollution

A key component of the landfilling regulations adopted in the early 1990s was the requirement for groundwater monitoring. The basic premise was that the groundwaters downgradient from the landfill should be monitored near the landfill in order to detect liner failure. In principle, the near-landfill detection of liner failure (i.e. leachate polluted groundwaters), would occur sufficiently early so that the amount of groundwaters polluted by leachate would be small and would not trespass under adjacent properties. The basic approach for monitoring the new lined landfills was to require a series of vertical monitoring wells spaced hundreds to a thousand or more feet apart along the downgradient edge of the landfill.

Cherry (1990) first pointed out that the groundwater monitoring system developed for unlined landfills of a few wells spaced hundreds of feet apart down groundwater gradient from the landfill is an unreliable approach for monitoring lined landfills. Lined landfills will initially leak leachate through the liner through limited size holes, rips, tears and points of deterioration that will produce finger-like plumes of leachate of limited lateral dimensions. Each of the monitoring wells used has a zone of sampling of about one foot on each side. Therefore, the finger-like plumes of leachate can readily pass between the monitoring wells without being detected. Lee and Jones-Lee (1994a) have discussed a groundwater protection strategy that involves the use of a double composite liner of the type used by the state of Michigan. The lower composite liner serves as the base of a leak detection system. When leachate is found in this system between the two composite liners, it is clear that the upper composite liner has failed and action must be taken to prevent groundwater pollution that will occur when the lower composite liner fails.

Lee and Jones-Lee (1996) have recently discussed the detection of landfill liner system failures. They point out that while often landfill proponents claim that there are no recorded instances of a Subtitle D landfill polluting groundwaters, they fail to point out that one of the primary reasons for this is the unreliability of the groundwater monitoring systems to detect the pollution of groundwaters by landfill leachate. Further, the wide-spread groundwater pollution that will ultimately occur from today's Subtitle D landfills would not be expected to be detected today because of the short time that Subtitle D landfills have been used.

It is appropriate to question whether today's landfills, with their plastic sheeting and compacted soil liners and monitoring systems that depend on vertical monitoring wells placed hundreds to a thousand or more feet apart, are significantly better than

the classical unlined landfills that were used before the "dry-tomb" landfilling approach was implemented. At least with the classical sanitary landfills, the leakage of leachate to groundwater occurred at all locations under the landfill; therefore, it was relatively easy to detect, through monitoring, pollution of groundwaters by landfill leachate. With today's lined landfills and the finger-like plumes of polluted groundwater that are generated from them, the public, and some individuals such as Mr. Tierney, are lulled into believing that they are "safe" landfills, when in fact they are basically time bombs that will ultimately be significantly detrimental to future generations' health, groundwater resources and interests. The "dry-tomb" landfilling approach gives the public a false sense of safety that something permanent in groundwater quality protection is being done in managing solid wastes when it is not.

Flawed Technological Approach

It is obvious that the "dry-tomb" type of landfilling is fundamentally flawed if the purpose of landfilling is to manage MSW while protecting groundwater resources from pollution by hazardous and deleterious chemicals that render groundwaters unusable for domestic water supply purposes. It is important to note that several countries such as some parts of Canada and western Europe will not allow the construction of "dry-tomb" type landfills for managing municipal solid wastes because of their inevitable failure to protect public health, groundwater resources and the interests of those who own or use properties near a landfill.

With respect to Mr. Tierney's statement about "safe landfills," it is quite clear that there is no such thing as a safe landfill of the type being developed today, where the landfill is sited in an area where there are groundwaters that are or could at any time in the future be used for domestic water supply purposes. With few exceptions associated with landfills sited at locations where there is no useable groundwater associated with the landfill, today's landfills will not prevent groundwater pollution and therefore are not safe.

Only 30 Years of Post-closure Care is Required

Yet another significant deficiency with the original and current landfilling regulations for both hazardous and municipal solid wastes is that RCRA only requires 30 years of mandated post-closure care funding. With very few exceptions, today's landfills will be threats to groundwater quality effectively forever, certainly for many hundreds to thousands of years. With only 30 years of mandated funding after closure of the landfill for monitoring and maintenance, there certainly will be significant funding deficiencies in maintaining the cover, collecting leachate and eventually addressing the groundwater pollution that will occur at most of today's landfills. Lee and Jones-Lee (1993a, 1994b, 1995) provide additional information on the significant

deficiencies in the post closure care funding for Subtitle D landfills. The situation in the future will be similar to that today where there will be inadequate funds available to stop further groundwater pollution by today's minimum Subtitle D landfills when this pollution is eventually discovered. This is one of the most significant deficiencies of the current Subtitle D regulations.

Justified NIMBY

Mr. Tierney states in his article that,

"Landfills are scarce in just a few places, notably the Northeast, partly because of local economic realities (open land is expensive near cities) but mainly because of local politics. Environmentalists have prevented new landfills from opening by propounding another myth...Our garbage will poison us."

Once again, Mr. Tierney has not reliably discussed the issues of justified concern to those who own or use properties near existing or proposed landfills. Anyone who has ever spent any time around a municipal landfill knows that, with very few exceptions, today's landfills are poor neighbors. In addition to polluting groundwaters, today's landfills that meet current regulatory requirements release a wide variety of hazardous and obnoxious materials that are significantly detrimental to those within the sphere of influence of the landfill.

As discussed by Lee and Jones-Lee (1993b, 1994c), the direct sphere of influence of many municipal landfills for such problems as odors, dust, blowing trash, birds, truck traffic and decreased property value is often several miles from the landfill. Current regulatory requirements do not require that those who develop landfills control these releases from the landfill so they do not trespass onto adjacent property owners' lands. Landfill owners/operators are able to construct a landfill within a very short distance of the landfill-adjacent property owners' property line. There is, therefore, inadequate distance between where wastes are deposited and constituents are released from the deposited wastes and the properties of adjacent property owners/users. This leads to a highly justified NIMBY ("Not In My Back Yard").

The authors have yet to find a single person who would welcome having an MSW landfill sited within a few hundred yards of their property line. This NIMBY is justified. Until such time as effective regulatory requirements are developed and, most importantly, implemented-enforced where adequate bufferlands between where the wastes are deposited and the adjacent property line occur (a mile or more) there will be significant justified opposition to siting landfills in a region. The issue is not just "poisons" as Mr. Tierney states; the issue that must be addressed in eliminating a

justified NIMBY is the control of all of the hazardous and obnoxious impacts of landfills on the landfill owners' properties.

Importance of Recycling in Preventing Groundwater Pollution

The deficiencies in Subtitle D landfills have significant implications for the importance of recycling/diversion of wastes from the landfill through reuse, reduction and recycling. It is generally found that it is relatively easy for communities to divert 25% of the MSW stream through recycling, reduction and reuse of waste components. It is also fairly well established that, with aggressive use of the 3 R's, it is possible to achieve a 50% reduction/diversion of the MSW stream. This means that, since each landfill has a finite capacity for accepting waste, if the rate of filling of today's landfills is reduced by 50%, there will therefore be 50% less need for new landfills. With each new landfill there is a certain inevitable groundwater pollution, except for the few landfills sited at locations where there are no useful groundwaters hydraulically connected to the base of the landfill. Such situations are indeed rare. Most landfills sited today are located where groundwater pollution is inevitable, i.e. it is only a matter of time.

Since the groundwater resources of an area are crucial to future generations' water supplies, it is essential that their quality be protected. This is especially important in light of the fact that there is no cleanup of MSW leachate-polluted groundwaters to acceptable drinking water quality once they have been polluted by MSW leachate. Such groundwaters and the associated aquifer areas must be considered permanently damaged and lost effectively forever as a domestic water supply.

Economics of Recycling

Mr. Tierney devotes considerable space to a discussion of the economics of recycling, where he claims that recycling is not cost-effective in terms of benefit to society. Mr. Tierney's analysis of the economics of recycling is fundamentally flawed in that he fails to consider the true perpetual monitoring and maintenance costs as well as the Superfund costs of cleaning up the groundwater pollution associated with landfill liner systems that at best only delay when groundwater pollution occurs. Further, he fails to address the significant costs associated with the adverse impacts of landfills on those who own or use properties within the sphere of influence of the landfill. Today's society has been able to force landfills and their impacts on nearby property owners.

As discussed by Lee and Jones-Lee (1993b, 1994c), with the exception of a few impacts such as altered viewshed, truck traffic, etc. it is possible to develop landfills with sufficient bufferlands and control systems to eliminate most of the justified NIMBY. However, the development of such landfills would require a significant

increase in the cost of landfill management of wastes. These costs are now being passed on to nearby owners and users of properties near landfills. This is one of the major reasons for justified NIMBY.

A proper economic analysis considers not only the short-term active life issues of concern to today's public, but also the long-term issues of concern to the health, welfare and interest of future generations. Fundamentally, today's landfills enable the current society to dispose of their garbage by landfilling at far less than the real cost of landfilling. These costs and the associated detriments are being passed on to future generations. It is possible to develop appropriate landfills today that can manage the non-recyclable components of waste at a cost of about 10 cents per person per day more than is currently being paid for MSW management under Subtitle D regulations.

A fundamentally flawed premise in Mr. Tierney's discussion is that the cost of recycling MSW components is not justified. The facts are that a proper economic analysis would likely show that it is prudent public policy to subsidize 3 R activities in order to reduce the magnitude of the true costs of the landfilling of MSW. It is inappropriate to assume that the costs of landfilling are properly reflected in the tipping fees being paid at today's minimum Subtitle D landfills. These tipping fees are kept artificially low by failing to address the true active life costs to those within the sphere of influence of the landfill as well as the true long term costs to groundwater resources, public health and the environment.

Need for Federal Landfilling Regulation (RCRA) Revisions

A critical review of today's MSW and hazardous waste landfilling situations shows that there is an urgent need to revise RCRA (federal regulations governing landfilling of wastes) to address the well known, highly significant deficiencies in both hazardous waste and MSW landfilling approaches. While, as discussed in our publications (see Lee and Jones-Lee, 1995b), "dry-tomb" landfilling can be made to work if significantly different approaches are taken toward design, closure and long-term funding of these landfills, it is unlikely that today's and future generations will, in fact, provide the funds necessary to properly operate and maintain "dry-tomb" landfills for as long as the wastes represent a threat. For this reason, there is growing recognition that the "dry-tomb" landfilling approach must be abandoned as soon as possible.

Those landfills that have been constructed under current regulations, with the plastic sheeting and compacted clay liners, should be recognized as eventual polluters of groundwaters similar to the classical unlined sanitary landfills. Funds should be set aside from disposal fees, while the landfills actively receiving waste, to face the inevitable groundwater pollution problems that will have to be addressed.

Today's landfilling regulations should be changed so that it will be possible to construct landfills as biological and chemical reactors, where shredded MSWs are placed in double composite-lined landfills in which leachate, and then eventually clean water, is added to the landfill while the liner system is still effective in collecting leachate, in order to remove those components of the waste that will inevitably be leachable as precipitation enters the landfill in the future. This "wet cell" approach for landfilling is readily implementable, and its costs, while initially somewhat higher, in the long-term are far cheaper than the "dry-tomb" approach (Lee and Jones-Lee, 1993c). The components of the waste that represent long-term threats are removed by this approach through deliberate fermentation and leaching of the waste under controlled conditions.

Today's landfilling regulations are badly out-of-date and represent an early 1980s understanding of the ability of landfill liner systems and groundwater monitoring systems being used to prevent pollution of groundwaters by landfill leachate for as long as the wastes in the landfill represent a threat. Specifically, there is need to change RCRA and/or state regulations:

- require that a double-composite liner be used for both Subtitle C and D landfills where the lower composite liner is a leak detection system for the upper liner.
- require that, when the landfill owner/operator cannot stop leachate from occurring in the leak detection system between the two composite liners, the wastes in the landfill must be removed (mined) from the landfill.
- require the closure of Subtitle C and D landfills with leak detectable covers that are operated and maintained for as long as the landfill exists.
- eliminate the minimum 30-year post-closure care and maintenance period and require that post-closure care be provided for as long as the wastes in the landfill represent a threat, which is understood in a "dry-tomb" type landfill to be forever.
- require that an adequate dedicated trust fund be developed from disposal fees to ensure that funds will in fact be available when needed for perpetual monitoring and maintenance in order to meet any plausible worst-case contingencies that could occur at a landfill, including waste exhumation and groundwater cleanup, to the extent possible.
- allow *in situ* treatment (fermentation and leaching) initially utilizing leachate recycle followed by clean water leaching of shredded wastes in double composite-lined landfills.
- RCRA also needs to be changed to ensure that all justifiable NIMBY impacts associated with landfills (such as odor, dust, fugitive trash, gull impacts, etc.) are controlled within the property boundaries of the landfill owner.

Because of the very high perpetual, *ad infinitum* costs associated with "dry-tomb" landfilling that provide for true protection of public health, groundwater resources and the environment, it is recommended that the "dry-tomb" landfilling approach be abandoned as soon as possible in favor of a waste treatment approach that produces residues that do not represent long-term threats to groundwater quality, public health and the environment.

Adoption of the recommended approach for MSW management which maximizes the use of 3 R's will significantly change the economics of the 3 R's. As long as the myth that Tierny attempted to support continues to exist that the landfilling of MSW can be safely done in a minimum Subtitle D landfill at that costs that are being paid today, society will continue to fail to properly support MSW waste stream component reduction, recycling and reuse. There is an urgent need to stop the current trend of reducing the magnitude of 3 R waste diversions arising out of the flawed economic analyses that are being used today to evaluate the benefits of the practice of the 3 R's in MSW management.

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Presentation Slides follow:

3 R's and Groundwater Quality Protection

G. Fred Lee, PhD, PE, DEE Anne Jones-Lee, PhD

G. Fred Lee & Associates
El Macero, California
Phone: 916-753-9630
e-mail: gfredlee33@gmail.com
Web Site: www.gfredlee.com

Characteristics of Subtitle D Landfills
Only Postpone Groundwater Pollution
True Cost of Landfilling Greater Than Today's Tipping Fees

Importance of 3 R's in Reducing Need for New Landfills

Recommended Approach for MSW Management

*Presented at California Resource Recovery Association's 1997 Annual Conference,
June 1-4, Monterey, California*

Tierney's Folly

J. Tierney Stated in June 30, 1996, *New York Times Magazine* Article, "Recycling is Garbage":

"Recycling may be the most wasteful activity in modern America: a waste of time and money, a waste of human and natural resources."

"Today's landfills for municipal trash are filled mostly with innocuous materials like paper, yard waste and construction debris. They contain small amounts of hazardous wastes, like lead and mercury, but studies have found that these poisons stay trapped inside the mass of garbage even in the old, unlined dumps that were built before today's stringent regulations. So there's little reason to worry about modern landfills, which by Federal law must be lined with clay and plastic, equipped with drainage and gas-collection systems, covered daily with soil and monitored for underground leaks."

Potential Impacts of Subtitle D Landfills

- Groundwater and Surface Water Quality - *Public Health, Economics, Aesthetics*
 - Migration of Methane and VOCs - *Public Health, Explosions, Toxicity to Plants and Animals*
 - Illegal Roadside Dumping and Litter near Landfill - *Aesthetics, Public Health, Economics*
 - Truck Traffic - *Highway Safety*
 - Noise - *Nuisance, Public Health*
 - Odors - *Nuisance, Public Health*
 - Dust - *Nuisance, Public Health*
 - Wind-Blown Litter - *Aesthetics, Public Health*
 - Vectors, Insects, Rodents, Birds - *Nuisance, Public Health*
 - Condemnation of Adjacent Properties for Many Future Uses
 - Impaired View
 - Decreased Property Values
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Deficiencies in Subtitle D Landfills in Protecting Groundwaters from Pollution by Landfill Leachate

In 1988, as Part of Promulgating Subtitle D Regulations, the US EPA Recognized the Deficiencies in Subtitle D Composite Liner

The US EPA Solid Waste Disposal Criteria (August 30, 1988) Stated,

"First, even the best liner and leachate collection system will ultimately fail due to natural deterioration, and recent improvements in MSWLF (municipal solid waste landfill) containment technologies suggest that releases may be delayed by many decades at some landfills."

The US EPA Criteria for Municipal Solid Waste Landfills (July 1988) Stated,

"Once the unit is closed, the bottom layer of the landfill will deteriorate over time and, consequently, will not prevent leachate transport out of the unit."

Situation Today Has Not Changed - Subtitle D Landfills Only Postpone Groundwater Pollution

Inadequate Regulatory Approaches

Permitting of Subtitle D Landfills Only Considers Short-Term Groundwater Protection

Misleads Public and Regulatory Agencies Regarding Long-Term Protection Provided by Subtitle D Landfills

Does Not Address Protection of Public Health, Groundwater Resources, and Environment for as Long as Wastes Will Be a Threat

Subtitle D Regulations Were a Compromise Forced by Litigation

Long-Term Characteristics of Subtitle D Landfills

- Municipal Solid Wastes Contain a Variety of Hazardous, So-Called Non-Hazardous Conventional Pollutants and Hazardous and Non-Hazardous Unregulated Pollutants That Are Significant Threats to Groundwater Quality

Must Consider More Than Just a Few Hazardous Chemicals in Evaluating Potential Impacts of MSW Leachate on Groundwater Quality

- MSW in a Subtitle D "Dry Tomb" Type Landfill Will Be a Threat to Groundwater Quality Forever

The 30-Year Minimum Post-Closure Care Period Set Forth in RCRA Represents a Small Part of the Total Time That the Post-Closure Care Monitoring, Maintenance and Remediation Will Be Needed

- Single-Composite Liner Will Not Serve as a Suitable Base for a Leachate Collection System That Will Collect All Leachate Generated in the Landfill for as Long as the Wastes Will Be a Threat.
- Minimum Subtitle D Landfill Covers Will Not Prevent Moisture from Entering the Landfill, Which Will Generate Leachate for as Long as the Wastes in the Landfill Will Be a Threat

Cannot Inspect Low-Permeability Layer of the Cover

- The Typical Subtitle D Groundwater Monitoring Approach Involving Monitoring Wells Spaced Hundreds or More Feet Apart Is Highly Unreliable in

Detecting Leachate Polluted Groundwaters at the Point of Compliance for Groundwater Monitoring

Liner Leakage Will Likely First Be Detected in Off-Site Groundwater Production Water Supply Wells

- Inadequate Post-Closure Care Funding Required to Meet the Minimum 30-Year Needs for Monitoring and Maintenance

No Assurance That Funds Will Be Available from Post-Closure Year 31 to the Effectively Infinite Time That the Wastes Will Be a Threat

Fundamentally, Subtitle D Landfills Are a Flawed Technological Approach for MSW Management That Allows Today's Society to Dispose of Its MSW at Cheaper-Than-Real Costs

Costs Passed on to Future Generations in Terms of:

Damage to Public Health and the Environment

Lost Water Resources

"Superfund" Clean-Up of Polluted Groundwaters

Adverse Impacts to Those Who Own or Use Properties within the Sphere of Influence of the Landfill

True Cost Issues of Landfilling of MSW

Landfilling without Justified NIMBY

- Bufferlands to Dissipate Active-Life Releases, Emissions and Impacts

At Least One Mile

- Compensation of Those within the Sphere of Influence for Non-Controllable Impacts

Damaged Viewshed

Loss of Property Value - Stigma

- Truck Traffic - Road Repair, Congestion, Air Quality
- Consumption of Non-Renewable Resources

Land and Other Resources

Not Available to Future Generations

- Landfill Active-Life Disposal Life

Collection and Disposal

Control of Emissions Releases and Other Impacts

Odors, Windblown Litter, Roadside Dumping, Etc.

- Develop Post-Closure Monitoring, Maintenance and Contingency Funding

Dedicated Trust Developed from Disposal Fees of Sufficient Magnitude to Fund:

Perpetual Monitoring and Cover Maintenance

Plausible Worst-Case Failures

Groundwater Remediation

Replacement of Water Supply

Waste Exhumation and Appropriate Management

A Proper Economic Analysis Could Readily Show That Even Subsidized 3 R's Is Justified from an Economic Perspective

Must Properly Evaluate True Costs of Landfilling Relative to Cost of 3 R's

Recommended Approach for MSW Management

Zero Waste Is Appropriate Goal

Maximize 3 R's

Landfill Non-3 R Manageable Materials in Waste (Resource) Stream

Landfill Characteristics

Consider Short-Term (Active-Life) and Long-Term (Post-Closure) Impacts

- Adequate Bufferlands to Dissipate Active-Life Impacts

At Least One Mile of Landfill Owner-Owned Property

- Use Double-Composite Liner with Leak Detection System between Two Liners

When Leakage of Leachate into the Leak Detection System Cannot Be Stopped, Must Exhume (Mine) Wastes to Prevent Groundwater Pollution

- Use Leak-Detectible Cover That Is Operated and Maintained for as Long as the Wastes Represent a Threat - Forever
- Develop Dedicated Trust Fund from Disposal Fees That Will Provide for Protection of Public Health, Groundwater Resources, and Environment

Protect the Interests of Those Within the Sphere of Influence of the Landfill

Consider Plausible Worst-Case Scenario Failures Including Need to Remediate Contaminated Groundwaters and Exhume Waste

Conclusion

Tierney Grossly Misrepresented the Ability of Today's Subtitle D Landfills to Protect Public Health, Groundwater Resources, the Environment, and the Interests of Those within the Sphere of Influence of the Landfill

Tierney Also Grossly Underestimated the True Costs of Landfilling of Municipal Solid Waste

MSW Landfilling in Today's Minimum Subtitle D Landfills Is Being Practiced at Far Less Than the Real Long-Term Cost of MSW Management

Maximizing 3 R's Is Prudent Public Policy for MSW Management Since It Will Provide for a Reduced Number of Landfills and Thereby Reduce the Adverse Impacts of the Landfills

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