

## Sierra Club Zero Waste Committee

### Zero Waste Cradle-to-Cradle Principles for the 21<sup>st</sup> Century Municipal Solid Waste Landfills

#### Advisory

Lined municipal solid waste (MSW)<sup>1</sup> landfills, like their open dump predecessors, are a failed technology for handling the discards of our society. Burying unsorted garbage in these facilities takes an unacceptable toll on public health, safety, and our environment, not only because of damage landfills cause when they are built, operated and abandoned, but because landfilling removes products from circulation so that virgin resources have to be mined or harvested to replace them.

Nevertheless, landfills continue to be built or expanded. This Advisory addresses the reality of landfills during the transition to Zero Waste, that is, to a “cradle-to-cradle” future in which products are designed to be cycled back into products, organics are cycled safely back into soil, toxins that cannot be safely recycled are banned, and discards that cannot be recycled are specially treated and buried in ever-diminishing landfills.

Section 1—Overarching Considerations, *climate change, depletion of material and energy resources, threats to public health and the environment*

Section 2—Guidelines: Phasing Out Landfilling of MSW

Section 3—Guidelines: Siting New Landfills, *site and design, Environmental Justice*

#### 1. Overarching Considerations

##### *Climate change*

Many climatologists feel we are approaching a tipping point in global warming after which severe climate changes may occur beyond our capacity to control them. Methane is a greenhouse gas that is 23 to 103 times more heat-trapping than carbon dioxide, depending on the time frame considered. This gas is generated in the airless environment of landfills from the decomposition of organic materials such as food scraps, yard trimmings, paper, cardboard and other plant-based products. (In 2005, 96% of food scraps were landfilled according to US EPA.) Methane that is not captured by gas collection systems escapes to the atmosphere. According to the EPA, landfills represent the largest man-caused source of methane released to the atmosphere in North America.

##### *Depletion of material and energy resources*

Garbage is not a renewable resource. Though some of the materials in garbage, such as wood fibers, are theoretically renewable, almost all manufacture and transportation of products and packaging involve petroleum or other diminishing, finite resources. To assess the full impact of landfilling we must consider the entire lifecycle of products deposited in landfills, including the materials and energy that went into their extraction, manufacture and distribution. When products are landfilled these “embodied” resources are lost for future generations.

For example, an aluminum can starts as the ore *bauxite*, which is strip-mined. The manufacturing process of the can wastes three-quarters of the excavated raw material. Also, aluminum is sometimes called “congealed electricity;” it takes 20 times more energy to turn aluminum ore into a new can than it does to recycle a used one.

Another example of wasted resources are polyethylene terephthalates (PET) beverage containers, made from byproducts of petroleum refining. The energy price escalation of 2008 heralds the future shortage of petroleum and

---

<sup>1</sup> The US EPA definition of “municipal solid waste” does not include sewage sludge and industrial sludges, and these categories are not considered in this document. Also “MSW” and “garbage” are used here synonymously, but without implying that management of all discards is the responsibility of a municipality.

petroleum-based products, but in 2007, despite a good market for recycled PET, 80% of PET bottles were sent to landfills, where they will never be reused or recycled.

In MSW landfills, products are mixed in with methane-producing organics. Because the embodied energy and materials in landfilled products is wasted, any energy production salvaged from the methane in landfill gas is a net loss. Our rate of production and disposal is not sustainable, particularly as world population grows and more countries adopt US customs and consumer patterns. One of the drivers of our “disposable” culture is the option of landfilling, which is deceptively inexpensive because costs relating to pollution are postponed.

### ***Threats to public health and the environment***

MSW landfills also threaten air quality and private and public water supplies. Our waste becomes more toxic every year as more compounds are introduced into commerce and thus into the waste stream. The health effects of many chemicals in landfills are undetermined; many others are known toxins.

Hazardous air pollutants (HAPs), such as vinyl chloride, benzene and dimethyl mercury, which affect the central nervous system and cause cancers, are generated in landfills. Some landfill gas escapes capture by the gas collection system and rises from the landfill into the air along with methane. Studies indicate that populations within several miles of landfills, especially children, have an increased risk of multiple diseases.

Similarly, mechanisms to protect water supplies from waste only postpone, and do not prevent, pollution. Landfills generate leachate, a toxic liquid mix of chemicals in the waste mass. All landfill liners leak leachate, even initially from pinholes in the manufacturing process. Eventually liners and leachate collection systems will fail, causing large-scale groundwater contamination that cannot be remediated. Meanwhile, during the years of waste intake and, theoretically, for a period of years after a landfill is capped, leachate is collected via pipes in the landfill, trucked to sewage treatment plants--where the treatment leaves some chemicals unaffected--and finally released into rivers.

Even the most updated design and equipment cannot eliminate landfill impacts. As problems arise, required interventions only mitigate harm, so that environment is progressively degraded.

## **2. Recommendations: Phasing Out Landfilling of MSW**

- To curtail methane release, organic materials—food scraps, yard trimmings, soiled paper-- should be banned from landfills (as in the European Union and in many North American municipalities), and diverted to local, controlled composting operations or controlled anaerobic digestion facilities that maximize greenhouse gas capture and energy production from wastes that contain organics.
- Other waste should receive mechanical/ biological treatment (MBT) so that any organic portion is biologically inert when landfilled.
- As MSW landfilling is phased out, landfill disposal bans should be implemented, enforced, and expanded. Local bans should include a recommendation for state Extended Producer Responsibility legislation that prohibits the use of certain toxins and holds brand-owners responsible for collection and safe recycling of their products as a condition of sale in the state. Disposal bans should be implemented in the following order of priority:
  1. Organic (methane-producing) material—yard trimmings, food scraps, soiled paper and other plant-based products.
  2. Electronics and other toxic products.
  3. Materials such as paper, glass, metal, most plastic, and other material and products for which there are recycling or producer take-back programs.
  4. Other products for which recycling programs may be lacking, including toxic products, certain plastics and other products.
- The jurisdiction should manage materials and energy according to this order of priority: reduce waste of energy and materials and use of toxins; repair and reuse products and materials; recycle, conserving as

much embodied value as possible. All discards should be put to their highest and best use. For example, it is better to compost yard trimmings locally than use them as alternative daily cover on a landfill.

- All materials entering the landfill should be inspected, and monitored.
- Waste disposal should be “pay-as-you-throw.” If bags are used they should be translucent so banned materials can be readily visible to waste handling personnel and inspectors.
- No provisions in agreements or contracts should encourage wasting, i.e. no “put or pay” contracts, or free disposal for residents of the host community.
- A gas collection system should be utilized as soon as possible and operated to capture and burn as much gas as possible.<sup>2</sup> While the EPA requires gas collection systems to be utilized within five years of initial waste deposit, this practice allows considerable gas release before the system is operational.
- Cells should be capped with a final cover as soon as they are filled, to minimize methane generation and maximize gas collection efficiency.
- Alternative fuel vehicles should be required for all collection and long haul transport trucks and landfill tractors, to reduce climate change impacts.
- An engineering firm with no connections to the waste company should monitor and audit landfill operations and report to public health authorities and a community landfill oversight committee. Audits and all required reports should be on the Web and copies available for free or for a minimal copy charge in the host community.
- Landfill owners (both municipal and private) should be required to properly account on their financial ledgers for the long-term liability the landfill represents.
- Landfills should be required to establish an insurance fund, with no relationship to the waste company, to provide for perpetual preventive maintenance and corrective action/cleanup costs, adequate to reflect major site failure beyond the post-closure period.

### **3. Recommendations: Siting New Landfills**

Concerned citizens may not be able to marshal the resources to participate meaningfully in landfill decisions in the designated time periods. The goal of this section is to suggest some salient points for advocacy.

#### ***Site and design***

Some considerations for the site are soil type; height of the water table; distance from aquifers and surface water bodies; geological stability; access roads; and substantial buffers for neighborhoods. If the waste is unprocessed MSW, the nearness of other polluting facilities must be considered. Also, MSW attracts gulls, causing a danger from bird strikes on aircraft using nearby airports.

Clauses in state regulations allow engineering solutions to leap over established site suitability criteria. For example, in the case of a proposed site over an aquifer that supplies public wells, the regulatory authorities may decide that a double liner with leak detection adequately addresses the threat to water supply. Unless these escape clauses are repealed, citizens have little recourse but to protest and publicize a dangerous site and the need for waste policy reform.

The main reasons for not siting landfills in undeveloped, natural areas are (1) because of inevitable environmental degradation and destruction of habitat, and (2) because sites should be in close proximity to where waste is generated to minimize fuel and emissions associated with garbage transport.

On the other hand, if organics are not banned as recommended, a number of facts argue for landfill sites remote from human habitation and activity: (1) Escaped landfill gas can travel for miles. (2) MSW waste presents a threat from methane explosions and fires. (3) “Nuisance conditions” associated with MSW landfills include odor, noise, dust, litter, rats, and gulls. (4) Garbage truck traffic contributes additional noise, dust, and fumes, and also poses a safety threat. (5) Capped landfills containing unsorted refuse will remain hazardous for the foreseeable future.

---

<sup>2</sup> A Sierra Club policy document on landfill-gas-to-energy is forthcoming.  
Sierra Club Zero Waste  
Municipal Solid Waste Landfill Advisory

While the site should be landscaped to approximate natural conditions, public access must be restricted to prevent damage to the landfill cover and bodily harm from fugitive emissions or methane explosions.

Therefore, the best way to preserve close-in landfill capacity is to require that discards be source separated and waste processed before it is landfilled.

- No new landfills should be sited if there are five or more years of capacity in the existing landfill. Instead, phase in bans as recommended in section (2) and charge a lower fee--or no fee--for source separated materials that are sent to reuse, recycling or composting markets. (Using these approaches and others, a landfill in San Jose, CA that was projected to have five more years of capacity, extended the capacity an additional 35 years.)
- Jurisdictions should not site new MSW landfills, expand existing MSW landfills, or convert construction & demolition landfills to MSW landfills, unless all jurisdictions using the MSW landfill also have a Zero Waste implementation plan--either in place or under development—that includes mandatory diversion of organic material from landfills and a progressive reduction of all other discard streams.
- A qualified consultant should evaluate a proposed site and make site-specific recommendations regarding landfill design. The consultant should not have worked for the landfill owner or operator and should sign an agreement not to do so in the future.
- Local governments should be allowed to impose higher standards for landfills than required by state and federal regulations.

### ***Environmental justice***

For a variety of reasons, the burdens of living near a landfill fall disproportionately on people who are already coping with poverty, pollution, lack of fluency in English, or minority status. (See <http://www.sierraclub.org/policy/conservation/justice.asp>)

Often affected residents have good reasons to feel isolated and powerless in this situation. The regulatory authorities, who are responsible for finding garbage space, may not be responsive to complaints. The current environmental protection system fails to provide equal protection to people of color and low-income communities. The mission of the United States Environmental Protection Agency (EPA) was never to address environmental policies and practices that result in unfair, unjust and inequitable outcomes. The impetus for change came from grassroots mobilization that views environmental protection as a basic right, not a privilege reserved for those who can “vote with their feet” and escape from or fend off locally undesirable land uses—such as landfills, incinerators, chemical plants, refineries and other polluting facilities.

In addition, local officials whose real estate is financially impacted by a landfill cannot vote on many decisions relating to the facility because of this conflict of interest. Furthermore, while fees or gifts from the waste company (e.g. uniforms for sports teams, ice cream for the town fair) do not necessarily benefit or compensate those most impacted by the facility, this largess often engenders loyalty of residents living farther away. The community may become divided over the landfill.

Host community agreements often include provisions that may be seen as addressing environmental injustice, such as buy-out programs for real estate. It should be noted that when landfill owners or operators buy devalued property and the residents relocate, not only does the company then own more of the community; they have also eliminated the most aggrieved and sometimes the most vocal critics of their operation. Also, while local officials and residents alike welcome fees paid to the local jurisdiction, they tend to overlook long-term hidden costs relating to the landfill such as monitoring, legal disputes, road maintenance and repair, and additional administrative duties, as well as diminished quality of life.

- Public notices and regulatory documents regarding the landfill should be translated into the languages spoken in the area that may be affected by the facility.

- Fees paid to the host community should not go into general funds but should be set aside for long-term needs related to the landfill, or to promote source reduction, reuse, recycle, or composting projects and “green” economic development.
- A landfill oversight committee should have broad representation from the community and a stated mission of advocacy for residents and the environment. The committee should not rely on the owner or operator for information about solid waste issues, but should also consult environmentalists and independent scientific studies, and work directly with the firm that monitors and audits the landfill.
- Hours of operation should be appropriate for the neighborhood, and landfill truck traffic should follow designated routes to avoid residential neighborhoods.

\* \* \*

Note that the problems outlined in this document all spring from the mistaken assumption that “the trash has to go somewhere.” For information on ways to replace landfilling (as well as incineration and high-heat conversion technologies) with safe, sustainable approaches to waste reduction and discard management, please see the Sierra Club’s Zero Waste Policy and the supporting framework document. (<http://www.sierraclub.org/policy/conservation/municipalsolidwaste.pdf>.)