It's Smarter to Separate:

How Houston's Trash Proposal Would Waste Our Resources, Pollute Our Air and Harm Our Community's Health

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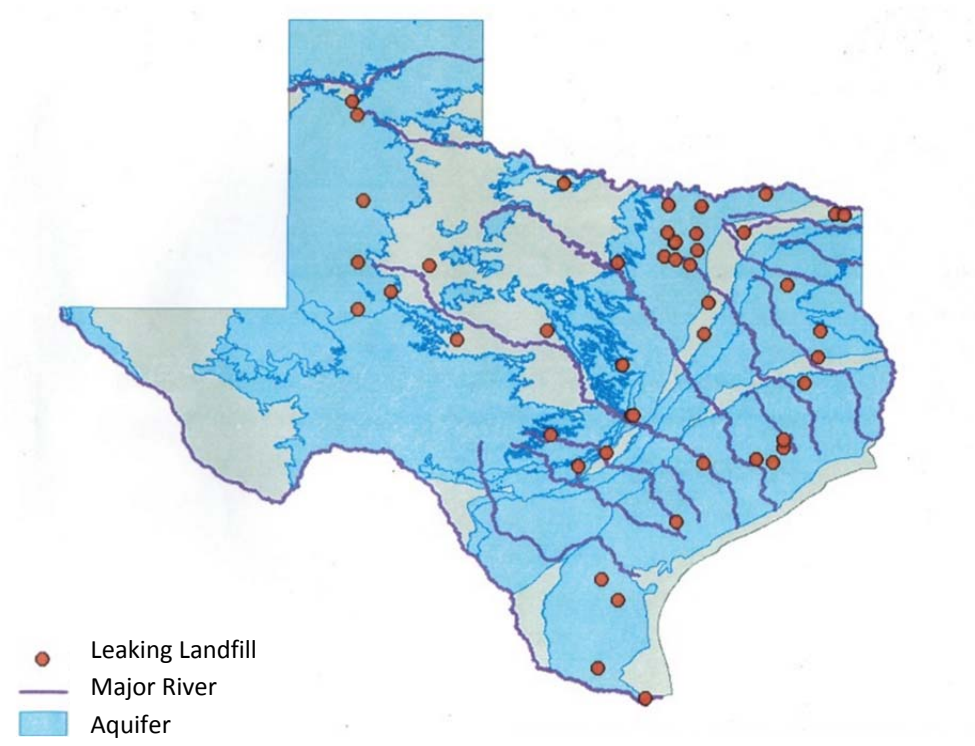
TEXAS CAMPAIGN FOR THE ENVIRONMENT FUND

Zero Waste Houston Coalition

1. Executive Summary

As communities across the United States seek ways to protect their environment, conserve raw materials and lower the cost of waste disposal, innovations that keep waste out of landfills are increasingly attractive. Even in Texas, where low costs have created one of the largest landfilling economies in the world, the case for landfill diversion is a no-brainer: every 10,000 tons of municipal solid waste (MSW) that goes to the landfill creates 1 job, while recycling the same amount of waste creates 20-100 jobs. Reuse or remanufacture from 10,000 tons of waste creates on average over 180 jobs.[1]



2012 Data "Joint Groundwater Monitoring and Contamination Report 2012" www.tceq.texas.gov

Recycling, reuse, and remanufacture also generate revenue for governments and firms that collect the materials, while landfilling creates potential financial and environmental liability: in Texas in 2012, 66 of nearly 200 active landfills reported they leaked toxins underground.[2] Landfills also account for 18% of U.S. methane emissions, a potent greenhouse gas.[3]

Public demands for action on climate justice, job creation and fiscal responsibility are often seen as competing interests—but waste reduction and recycling work on all accounts.

However, not all landfill diversion methods result in equivalent jobs, conservation and cost efficiency. In recent years, a number of firms have proposed technologies such as refuse derived fuel (RDF), gasification and other incineration methods that environmentalists and recycling advocates find to be destructive—especially when paired with "mixed waste processing" or facilities that encourage residents to throw all trash and recycling into one bin for subsequent separation. Traditional source-separated recycling operations are known as Materials Recovery Facilities or "MRFs," and so these mixed waste operations are known as "dirty MRFs." The technologies addressed in this report—dirty MRFs and incineration—are known to be ineffective and polluting, yet they are still promoted by waves of opportunist salespeople.

This report examines the problems of dirty MRFs and incineration technologies and concludes that both pose threats to public health and the environment. They also undermine effective waste reduction and recycling efforts.

Throughout this report, we reference a recent proposal to build a dirty MRF paired with new incineration methods in Houston, TX. The City of Houston is currently evaluating a potential overhaul of its solid waste program through a proposal called "One Bin for All." Mayor Annise Parker and the City's Office of Sustainability are advocating that Houston abandon source-separated curbside recycling and have citizens combine trash and recycling into the same bin. The City's announcement in March 2013 called the idea "innovative" and "the next revolution in recycling."[4]

- If the proposal passes, the City could offer tax incentives for a $100+ million dirty MRF to sort and process mixed municipal solid waste. The Request for Qualification issued in June 2013 calls for incineration technologies examined in this report, including gasification and catalytic conversion.
- The City's stated goal is to divert 75% of waste from landfills in two years, but dirty MRF and incineration technologies cannot meet this goal.[5] **Meanwhile, Austin, Dallas and San Antonio already have long-term solid waste plans in place to reach 90%, 85% and 60% diversion, respectively, through source-separated recycling, composting and waste reduction efforts** over the next few decades.

Houston is the perfect example of a city at a crossroads, like many cities in the U.S. and especially in Texas, where there are so many unexplored opportunities to reduce, reuse and recycle, but the infrastructure has not yet existed. In 2013, fewer than half of the neighborhoods serviced by the City of Houston Solid Waste Management Department had curbside recycling. Members of the Zero Waste Houston coalition were thrilled when in 2013, Mayor Annise Parker recommitted to expanding curbside recycling to every home serviced by the City. This would be the first time many Houstonians ever had the opportunity to recycle at the curb. Unfortunately, the "One Bin for All" proposal would undo all that progress and the community education that has been accomplished.

Houston, like many cities, has also implemented policies aimed at climate protection and reducing greenhouse gas emissions. The City has argued that a dirty MRF and a gasification facility would reduce greenhouse gases by diverting trash from landfills and eliminating truck routes needed to collect materials if they are combined into one bin. To the contrary, the climate benefits of landfill diversion through Zero Waste, real recycling and organics separation are exponentially greater than what the City proposes.

"Advanced disposal technologies" such as dirty MRFs and incineration are bad for the climate because they compete with recycling, waste prevention and reuse while encouraging a wasteful consumption cycle to continue:

- According to the EPA 36.7% of the greenhouse gas emissions produced in the U.S. are produced by the materials production, consumption and disposal cycle.[6]
- **A study by the Institute for Local Self-Reliance found that diverting 90% of our waste from landfills and incinerators through reduction, recycling and composting would be the equivalent of closing one-fifth of the country's coal-fired power plants.[7]**

Zero Waste is a proven policy. Hundreds of governments and many businesses have adopted Zero Waste principles, including the entire country of New Zealand, GM, Anheuser-Busch, Epson, Apple, Hewlett-Packard, Xerox and Pillsbury.[8]

Houston is the fourth largest city in the United States, and what Houston chooses to do with its trash will have repercussions throughout the Houston-Galveston region, which boasted over 14,000 jobs in recycling and re-manufacture in 2013.[9] If it chooses to adopt Zero Waste goals that seek to reach the highest and best use for all discards, the City of Houston could contribute to resource recovery infrastructure that will benefit the entire region and inspire other cities to follow Houston's lead.

It's smarter to separate. Any community starting on a path to divert waste from landfills in order to achieve cost savings, reduction in greenhouse gases, job creation and environmental justice should avoid dirty MRFs and incineration technologies. Real recycling, landfill diversion, job creation and other benefits will be the result of long-term planning to achieve Zero Waste through comprehensive programs based on separating at the source, incentives to reduce waste and education accomplished through genuine efforts to engage with members of the community.

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2. What is a Dirty MRF? Definitions and Challenges

Dirty MRF is short for "dirty materials recovery facility," which is an operation that attempts to sort recyclable and organic materials from household trash. This is also known as "mixed waste processing." According to the U.S. EPA, "the sorted recyclable materials may undergo further processing required to meet technical specifications established by end-markets (such as SRF [Solid Refuse Fuel] manufacture) while the balance of the mixed waste stream is sent to a disposal facility such as a landfill."[10] **Dirty MRFs also direct waste to phased incineration facilities such as gasification, pyrolysis or catalytic conversion plants while sending organic material to in-vessel composting or anaerobic digestion systems.**[11]

The term "dirty MRF" is considered pejorative by those promoting the technology. They will call these facilities "mixed materials recovery facilities," and the collection systems which feed them will be called "one bin" programs, "mixed waste processing," or even—in the case of the current Houston proposal—"One Bin for All." The defining characteristic of the technology is that one stream comes in the front of the facility with all discards—trash, recycling and organics—and multiple streams come out of the back, which could include materials destined for landfills, anaerobic digestion, recycling or incineration.

"Dirty MRF" refers to a "dirty materials recovery facility," that sorts commingled trash in an effort to remove recyclable and organic materials.

Diversion vs. Recycling

Proponents of dirty MRFs often tout high landfill diversion rates when comparing their operations to single-stream, source separated recycling, which requires customers to sort recyclable materials into a separate container that are sent to a traditional "clean" MRF and diverted from landfills through recycling. However, the touted diversion percentages for dirty MRFs invariably include materials that are incinerated, processed in anaerobic digestion or used as a daily landfill cover.[12] When recycling diversion alone is considered, the record for these facilities is consistently much lower than achieved with source-separated, single-stream recycling:

- **Chicago's Blue Bag dirty MRF operation found that even after ten years of operation, only 10% of Chicago's waste stream was being recycled into new products.** No composting facility would purchase yard waste processed through the facility due to contamination. In comparison, a 2005 single-stream recycling pilot program in Chicago had 80% participation and more than doubled the recycling rate seen with the dirty MRF.[13]
- A dirty MRF currently operating in Western Placer County, California claims a 50% diversion rate, but half of that number is actually wasted glass used as a daily landfill cover. In other words, half of the material they claim as "diverted" from the landfill was actually spread on top of the landfill.

- A dirty MRF in Roscoe, Illinois that went bankrupt in 2013 had a 10% recycling rate for collections from Rockford, Illinois, and a 17% recycling rate for collections from southern Wisconsin, while touting landfill diversion rates of 30% or higher in each location.[14]
- One dirty MRF still operating in Seville, Ohio reports a diversion rate of 17% even when they include "engineered fuel" in the diversion total. Without including this incineration technology, the recycling rate is 6-15%.[15]

Dirty MRFs Decrease Recycling

Diversion rates from dirty MRFs have a high level of variability depending on what sort of waste is being introduced. Office buildings produce mostly paper, cardboard and some containers. A dirty MRF has less food waste contamination to deal with when processing office waste streams, resulting in higher diversion rates. With household waste (or municipal solid waste, MSW), which contains large quantities of food scraps and complex consumer products, dirty MRFs produce a higher level of contamination and residual waste, and so overall diversion is low. The obvious problem with dirty MRFs is the fact that combining wet materials such as food waste with recycling commodities that are most marketable when dry—such as paper and cardboard—contaminates the dry materials.

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- At least one former staffer of the Western Placer County, California dirty MRF admits that **"food waste deteriorates rapidly, contaminating paper products and damaging machinery."**[16]
- At a failed dirty MRF in Crisp County, Georgia, the combination of machinery and workers **sorting by hand still couldn't separate enough of the wet garbage to extract enough high-quality recyclables** to make the plant profitable.[17]

The Royal Society of Chemistry's *Issues in Environmental Science and Technology* reported in 2002 that diversion rates for dirty MRFs are typically between 10%-30%.[19] For all of their arguments about big improvements possible with 100% participation, even proponents of dirty MRFs cannot ignore the fact that contamination and other sorting difficulties make dirty MRFs less effective and efficient than source-separated recycling. The landfill diversion gains claimed by dirty MRFs are always a result of the "energy production" end of these facilities.[20] Without incineration technologies, the diversion rates for dirty MRFs can be expected to be low.[21]

This problem has become even more significant in the last year with the announcement of "Operation Green Fence" in China. China is the largest market for secondary materials and "Operation Green Fence" is an attempt to ensure cleaner commodities are being sent to the country.

- "(N)ervous traders are refusing to ship consignments of recyclables that might contain unacceptably large amounts of unrecyclable materials (anything from unwashed items to the wrong kind of plastic to random bits and pieces of garbage that get mixed in with the recyclables). And cities and towns across the U.S. and Europe are finding there is no longer a ready market in China for their poorly sorted and often impure bales of plastics, paper, and other waste." [22]
- Plastics have been especially hard hit, with a 5.5 percent drop in plastic waste imports this year, "a significant change for a country long-used to double-digit increases in recycled materials flowing in."[23]

The contamination problem has become even more significant in the last year with the announcement of "Operation Green Fence" in China.

With end markets for materials increasingly interested in cleanliness and quality, the contamination problems identified with dirty MRFs have become even more concerning. **This strongly suggests that dirty MRFs may not be intended primarily for recycling, but rather as a means to process heterogeneous, mixed household trash into a more homogenous, uniform feedstock for incineration technologies such as refuse derived fuel (RDF), gasification, pyrolysis or waste-to-biofuels production**. According to the Steel Recycling Institute in a letter opposing Houston's proposal, dirty MRFs even contaminate metals by, "producing a variety of steel chemistries which would alter the consistent metallurgy of steel can bundles in the marketplace, which purchasers can expect."[24] Other recyclable and carbonaceous materials—namely, paper and cardboard—would be considered more fuel for the fire.

Dirty MRFs Historically Fail to Meet Expectations

Dirty MRFs have been abandoned in recent years across the U.S. for a variety of reasons including high costs, disappointing diversion rates, and lawsuits.

- In New Hanover County, North Carolina **a $20 million project[25] to build a dirty MRF there fell apart in 2011** after the contracting company was unable to secure funding.[26]
- In 2010, dirty MRF projects in North Carolina and Georgia failed. One facility is now a single-stream clean MRF; another was shuttered for good.[27] A **Fayetteville, NC facility that has since been shut down promised 80% diversion with state-of-the-art technology back in the 1990s**.[28] It never operated successfully[29] and ended with litigation[30].
- A dirty MRF operated by Total Waste Recycling in Roscoe, Illinois failed in 2012 after the company filed for bankruptcy[31].

There are potential legal risks associated with dirty MRFs. Some dirty MRFs require "flow control" to be successful, as is the case with the dirty MRF in Roseville, CA.[32] These policies which "designate the places

where municipal solid waste (MSW) is taken for processing, treatment, or disposal" have been "hotly debated"[33] and have led to lawsuits in Texas, New York, New Jersey, Kentucky, Pennsylvania, Ohio, Arkansas, Florida and elsewhere[34].

For example, in the fall of 2011 dirty MRF promoters **Organic Energy Company (OEC) of California** convinced the City of Dallas to pass a flow control ordinance in which all waste haulers in the city would be forced to take the waste to the city-owned McCommas Bluff landfill. OEC expected to build a dirty MRF at the site**. In response, the National Solid Waste Management Association filed a federal lawsuit against the City of Dallas**, and a permanent injunction was leveled against the City, which cancelled the ordinance[35]. OEC abandoned the project at that point, and they are currently bidding on "One Bin for All."[36]

Dirty MRFs Threaten Worker Safety

Dirty MRFs make an already unsafe job even more dangerous. Despite all the technology touted, **dirty MRFs rely heavily on low wage labor hand-sorting garbage**. The report from a dirty MRF in Roseville, California warns "One of the most surprising aspects of operating a mixed waste facility has been observing the large amounts of hazardous, Universal and e-waste recovered off the sorting lines."

- Workers are exposed to these hazardous waste, and also "**potentially explosive devices such as aerosol cans, propane cylinders and the occasional mortar, flare, or hand grenade**."
- One dirty MRF employee from a now-defunct facility in Chicago said,

  "There are so many **smells** that you come across, the make your stomach queasy. Yet before we went to work, they showed us a safety film where all the stuff was really clean… They told us that it was going to be a clean environment. They said fresh air was going to be pumped through there every 15 minutes, so it wouldn't smell, and stuff like that, but it wasn't. It was a little different than they had described it. **One time they had a dead dog… go through there**. There was all garbage, you know (not just recyclables). At first we thought they were only talking about plastic bottles and cans going through there. But that was plain garbage, everything, you know? Dirty diapers, cleaning products, stuff like that."[37]

In the Houston "One Bin for All" dirty MRF proposal, the proposed facility also threatens workers' labor rights. The City of Houston wants to implement a public-private partnership that will potentially privatize City jobs, stripping City employees of their union status. Former "One Bin" Program Manager Don

Pagel told Texas Campaign for the Environment in August 2013 that Houston's "One Bin" Local Government Corporation (LGC) would mean taking away sanitation worker benefits.[38]

3. What is Incineration? New Technologies, Same Problems

"Waste-to-energy" is an industry term for incineration, and even the newest "waste-to-energy" technologies –gasification, catalytic conversion, plasma arc pyrolysis—are still forms of incineration. Houston's proposal is no exception to the trend that mixed waste processing facilities will eventually incorporate incineration. As the former "One Bin for All" program manager has expressed, "Houston is an energy capitol of the world, and if this city cannot make waste-to-energy work, perhaps no one can."[39]

- **There has not been a single instance of a gasification plant processing household trash being constructed or successfully implemented in the U.S. at a commercial scale.** In other countries, however, these technologies have proven to be expensive and produce toxic emissions and byproducts, much like traditional mass burn incinerators.

In the U.S., gasification, catalytic conversion and pyrolysis of municipal solid waste are regulated by the Environmental Protection Agency as incineration as is reflected in the EPA Code of Federal Regulations:

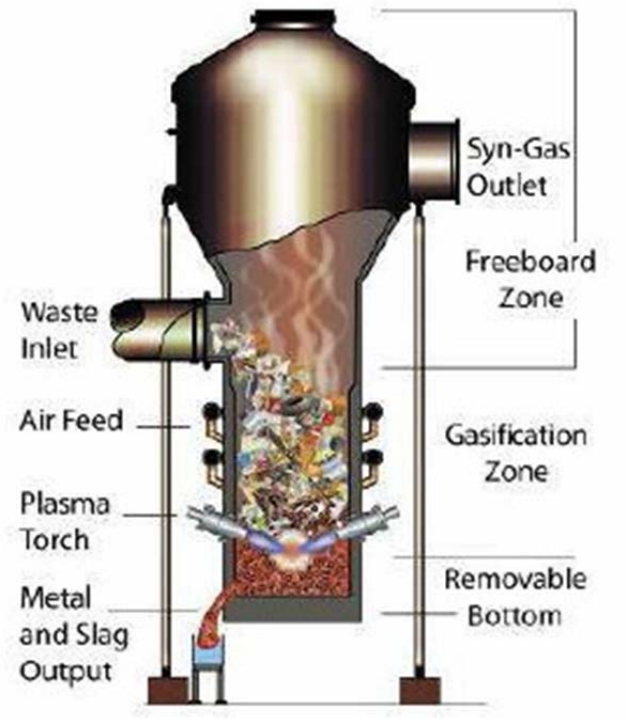
> Municipal waste combustor, MWC, or municipal waste combustor unit: (1) Means any setting or equipment that combusts solid, liquid, or gasified MSW [municipal solid waste] including, but not limited to, field-erected incinerators (with or without heat recovery), modular incinerators (starved-air or excess-air), boilers (i.e., steam-generating units), furnaces (whether suspension-fired, grate-fired, mass-fired, air curtain incinerators, or fluidized bed-fired), and pyrolysis/combustion units. Municipal waste combustors do not include pyrolysis/combustion units located at plastics/ rubber recycling units (as specified in § 60.50a(k) of this section). Municipal waste combustors do not include internal combustion engines, gas turbines, or other combustion devices that combust landfill gases collected by landfill gas collection systems. **Pyrolysis/combustion unit means a unit that produces gases, liquids, or solids through the heating of MSW, and the gases, liquids, or solids produced are combusted and emissions vented to the atmosphere.**[40] Incinerator means any enclosed device that: (1) Uses controlled flame combustion and neither meets the criteria for classification as a boiler, sludge dryer, or carbon regeneration unit, nor is listed as an industrial furnace; or (2) Meets the definition of infrared incinerator or plasma arc incinerator… Plasma arc incinerator means any enclosed device using a high intensity electrical discharge or arc as a source of heat followed by an afterburner using controlled flame combustion and which is not listed as an industrial furnace.[41]

A 2012 letter from the EPA to the Ohio Environmental Protection Agency reviewed a draft permit for a dirty MRF paired with gasification with the following air emissions: **"194 tons per year (tpy) of nitrogen oxides (NO_x), 0.25 tpy of lead, 7 tpy of total hazardous air pollutants (HAP), 78 tpy of particulate matter (PM),**

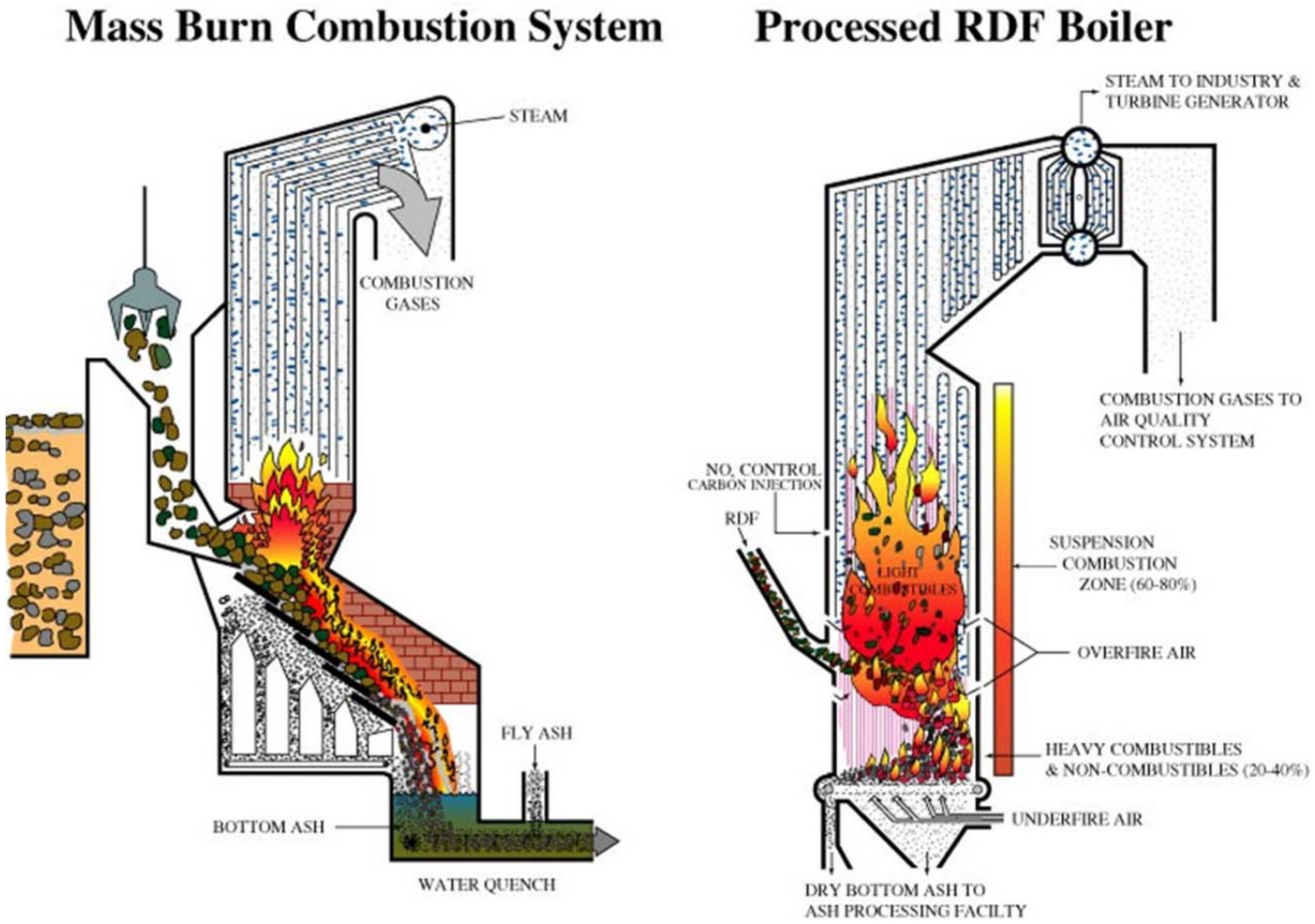
78 tpy of sulfur dioxide, 26 tpy of volatile organic compounds (VOC), 88 tpy of carbon monoxide, and 7 tpy of sulfuric acid." The letter then states, "EPA finds this source meets the criteria of 'municipal incinerators capable of charging more than fifty tons of refuse per day' provided for in Section 169(1) of the Clean Air Act."[42]

Supporters of phased incineration technologies such as gasification, pyrolysis or plasma arc will argue that their preferred system is not actually a waste incineration technology. These statements are clearly in conflict with the EPA's own rulings and definitions. Not only are gasification and pyrolysis methods regulated as incineration technologies when used for municipal solid waste, common sense and a simple look at the processes clarifies that these technologies pose the same problems as traditional incineration. Phased incinerators use high temperatures to reduce solid waste into gases and ash and then use boilers to burn the gases for energy.

Gasification/Pyrolysis/Plasma Arc[43]



Mass Burn and Refuse Derived Fuel (RDF)[44]



Incineration Competes with Recycling

Because dirty MRFs produce so much residual, contaminated waste that is not valuable as recycling or compost, they are often paired with waste-to-energy methods.[45] Incineration technologies further lower recycling rates. In fact, the European countries that have promoted waste incineration—such as Finland and Norway—have some of the continent's lowest recycling rates.[46]

- **Incineration technologies discourage recycling because the materials with the highest calorific (energy) value, such as plastics, are also recyclable.**[47] The European Commission noted that "Market mechanisms may favour inclusion in RDF [refuse derived fuel] of fractions that could be recycled in favourable environmental and economic conditions,"[48] meaning that RDF production shifts market forces to discourage the highest and best use[49] for some of our most recyclable resources. This same phenomenon holds true for other waste-to-energy incineration processes besides RDF production.
- In Denmark, studies show that areas of the country with expanded incineration saw drops in recycling; when incineration was discouraged, recycling improved[50].

Incineration Harms Air Quality

E.U. regulations—like U.S. regulations—recognize gasification, pyrolysis and plasma arc as forms of incineration,[51] and they stipulate that "emissions levels for releases to air from the combustion stages of such (gasification and pyrolysis) installations are the same as those established for incineration installations."[52]

Every form of waste incineration poses significant air quality threats. As a result, trash incineration has faced not only strong opposition from environmentalists, but has also posed significant political problems in terms of siting, operational costs and the long-term obligations typically involved in permitting a mass burn incinerator.[53] Refuse derived fuel production offers a loophole to these political challenges, as it sends trash "away" to be burned elsewhere in facilities such as cement kilns.[54] Other forms of incineration offer policy-makers "deniability." Houston officials, for example, have insisted that gasification is not incineration, and their proposed dirty MRF would likely be paired with a gasification facility.[55]

"Don't Burn Our Future"
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Environmental advocates and environmental justice groups are right to be concerned about "One Bin for All" for a variety of potential pollution concerns. Among the most significant of these concerns is dioxin and furan pollution.

- According to the U.S. EPA:
  "Dioxins and furans can cause a number of health effects. The most well-known member of the dioxins/furans family is 2,3,7,8 TCDD. The U.S. Environmental Protection Agency (EPA) has said that it is likely to be a cancer causing substance to humans. In addition, people exposed to dioxins and furans have experienced changes in hormone levels. High doses of dioxin have caused a skin disease called chloracne. Animal studies show that animals exposed to dioxins and furans experienced changes in their hormone systems, changes in the development of the fetus, decreased ability to reproduce and suppressed immune system."[56]
- **A report made to the State of Massachusetts in 2008** noted:
  "Pyrolysis produces low levels of air emissions containing particulate matter, volatile organic compounds, heavy metals, dioxins, sulfur dioxide, hydrochloric acid, mercury, and furans. (The types of emissions produced are similar to those from conventional incinerators.) … **Air emissions are the paramount environmental concern with regard to gasification, and the emissions are very similar to those from pyrolysis (emphasis added)."**[57]

Dioxin and furans are also produced by RDF burning facilities,[58] which also produce heavy metals such as mercury.[59] The European Commission found that burning RDF produced significantly more smog than burning coal.[60] Gasification and pyrolysis utilize filters of various sorts, but these filters themselves must eventually be replaced, and they contain high concentrations of toxins.[61] Furthermore, these pollution control mechanisms only remove pollutants as dictated by state and federal law. Some of the most

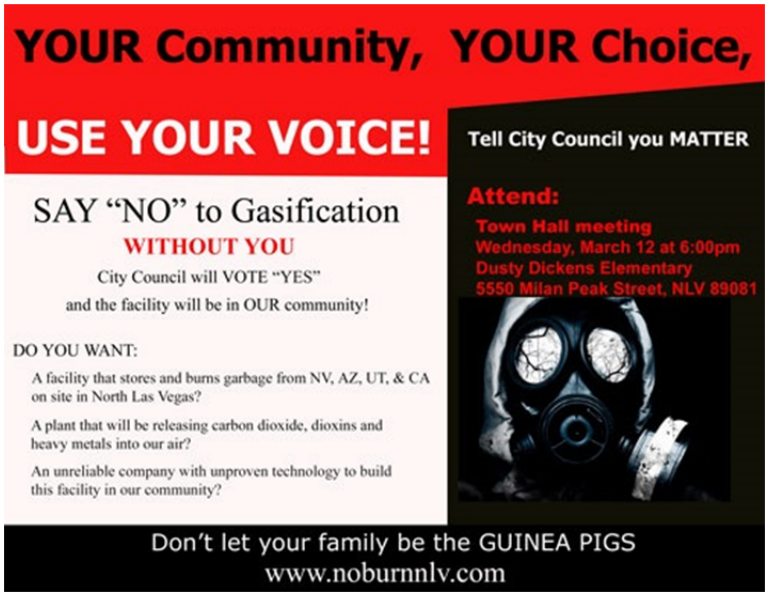
dangerous pollutants, such as ultrafine particles, are not currently regulated even at the federal level, meaning this pollution is not controlled by these facilities.[62]

"Ever Evolving," but Still Ever Failing

Despite the fact that they are processes which use high temperatures to turn solid waste into ash and gases (a process normally known as "burning"), "waste-to-energy" advocates argue that gasification, pyrolysis and plasma arc are technically different from incineration. Gasification and pyrolysis plants in practice, however, have had serious pollution and operating problems akin to those associated with traditional mass burn incineration.[63]

- **A "state of the art" gasification plant in Dumfries, Scotland opened in 2010 had over 200 breaches of emissions limits and 100 "short-term exceedances" in its three-year lifetime.** The Scottish EPA revoked their permit in August 2013, stating that the facility had consistently "failed to meet any reasonable expectation of environmental performance and the predicted level of energy recovery at approximately 3% is particularly disappointing and unsatisfactory."[64]
- Also in the UK, multiple dioxin violations led officials to shut down a gasification plant on the Isle of Wight in 2010[65].
- A gasification pilot plant in Ottawa, Canada had 29 "emission incidents" and 13 spills while only operational 25% of the time during the three years it was open[66].

In the U.S., these technologies have not been operated beyond the pilot stage, but even these small-scale facilities have had significant operational problems.



- One pyrolysis pilot plant in Romoland, California was reported in 2006 to have actually emitted more dioxins, nitrogen oxides, volatile organic compounds and particulate matter than two mass burn incinerators in Los Angeles[67].
- Taunton, Massachusetts spent at least $5 million between 2007 and 2010 on land, consultants and lawyers for a proposed gasification plant which was never designed or built and whose owners decided to move to another city[68]. In at least 24 other communities gasification in particular has been proposed, and every single proposal has failed.
- **Over 100 proposals have been made in various U.S. communities for commercial-scale incineration proposals of all sorts over the last 20 years. Every one of these proposals has failed due to community opposition and/or operational failures.**

Part of the reason for the operational failures of these facilities is due to the inconsistent nature of municipal solid waste. The solution to this problem, from the industry's standpoint, is the dirty MRF, which can extract metals for recycling and then process the rest of the materials into a more consistent feedstock for these incineration processes. There are also examples of combining household trash and sewage sludge to produce a more homogenous and calorific feedstock.[69] While this may or may not solve the operational problems these facilities have faced, there is no reason to believe that they would eliminate the pollution for which these facilities are notorious.

Incineration By-Products are Toxic When Reused or Landfilled

Waste burning facilities (including gasification, pyrolysis and plasma arc facilities) produce ash which is highly toxic, containing dioxins, furans, and high concentrations of heavy metals—lead, cadmium, copper and zinc. There are two types of ash: fly ash and bottom ash. According to Dr. Paul Connett, Executive Director of the American Environmental Health Studies Project (AEHSP):

- "Ideally, this fly ash is captured in the boilers, the heat exchangers, and the air pollution control devices, however, inevitably a small fraction escapes into the atmosphere. As far as toxic metals are concerned, it is a chemical truism to state that the better the air pollution control the more toxic the fly ash becomes. The bottom ash is also toxic… If handled properly, ash makes incineration prohibitively expensive (especially when the bottom ash is found to be toxic) for all but the wealthiest communities. If handled improperly, it poses both short- and long-term health and environmental dangers."[70]

All reuse and disposal options for the toxic ash produced by incineration facilities are problematic. Bottom ash from mass burn incinerators, RDF-burning kilns, gasification units and pyrolysis facilities is often sold to be used in asphalt, concrete, and cement products, spreading the toxicity. In the UK, use of bottom ash from waste incineration in foam concrete has been banned as it has been linked to explosions caused by a buildup of hydrogen gas in the ash.[71] **The toxic materials in the incinerator bottom ash (IBA) have been known to leach out when reused and when disposed of in landfills, polluting groundwater and land with toxic heavy metals, PCBs, dioxins, and furans.**[72]

- A Swedish study monitored leachate from a road built with asphalt containing incinerator ash, and found that the toxins contained in the ash leaked out from the road into the environment.[73]
- Dioxin leaking from roads turned the town of Times Beach, Missouri into an EPA Superfund site and the entire community had to be permanently evacuated from their homes in 1982.[74]

Communities along the San Jacinto River in Houston are already affected by toxic cancer-causing dioxins and PCBs leaching into the water and soil from the San Jacinto Waste Pits Superfund site, where waste from a local paper mill was dumped for decades.[75] While advocates claim that gasification and pyrolysis are not

incineration technologies, both produce these dioxin-containing byproducts and ashes—typically only the product of burning.[76,77]

- **A 2012 study led by a Finnish researcher published in the academic journal *Waste Management* found that "gasification ash leachate was acutely toxic."**[78]
- Chicken farms next to a "pyrolytic waste oxidizer" (pyrolysis incinerator) opened in 2003 in Barangay Aguado, Phillipines produced eggs with **dioxin levels 3 times higher than EU standards**, as well as dangerously high levels of PCBs and PBDEs, two dioxin-like compounds believed to cause hormonal problems, cancer and birth defects.[79] Both are bio-accumulative, meaning that a small amount of pollution over time can build up in the bodies of nearby residents, leading to health problems in the long run or in future generations.[80]

Newer incineration facilities use ultrahigh temperatures to turn the ash into "slag," a glass-like substance which gasification, pyrolysis and other phased incineration advocates claim to be "inert." Other research suggests otherwise**. The Florida Department of Environmental Protection has said that "there is considerable uncertainty about the quality of the 'slag'," and went on to note that an industry-performed test indicated arsenic and cadmium leaching above legal levels.**[81]

- One Italian study found that 73% of the dioxin produced at an incinerator in that country was concentrated in the slag.[82]

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…Houston would produce 53,000 tons of "acutely toxic" ash or slag annually. This is the equivalent of 138 fully loaded Boeing 777s.

If Houston were to send all its trash and recycling to a dirty MRF and incineration plant (excluding all yard and tree waste)[83], and if this facility were to meet the best diversion rate predicted by the Royal Society of Chemistry (30%)[84] and produce the least amount of ash indicated by the EPA (15% of household waste),[85] then Houston would produce 53,000 tons of "acutely toxic" ash or slag annually. This is the equivalent of 138 fully loaded Boeing 777s.

Most Expensive Form of Energy Production

"Waste-to-energy" is an expensive process, and the facilities dependent on dirty MRF treatment are particularly costly. According to the Energy Information Administration, producing electricity from municipal solid waste is the most expensive form of energy production both in terms of startup and operating costs—even more expensive than nuclear.[92]

- Envision Waste Services' dirty MRF in Seville, Ohio charges $61 per ton of waste processed with refuse derived fuel production.
- The consulting firm **SAIC (now Leidos, previously RW Beck) performed a feasibility study for San Antonio considering various incineration technologies; they estimated that gasification or pyrolysis systems would cost $120-160 per ton in Texas**, even including offsets for fuel or energy sales.[93]

The upfront costs are potentially excessive as well. **While Ecolution (OEC) originally said that their dirty MRF/waste-to-energy plant in Lancaster, California would cost $100 million, the headline announcing the deal's collapse called it a $200 million facility.**[94] A similar facility proposed in Arecibo, Puerto Rico had an estimated price tag of $500 million for a capacity of 2,000 tons per day – which is the same as that proposed by Houston's "One Bin for All."[95]

Most incineration contracts include what is known as a "put or pay" clause where cities agree to guarantee delivery of a certain amount of material or pay the price for that material.

Waste incineration poses significant financial risk over and on top of this. Most incineration contracts include what is known as a "put or pay" clause where cities agree to guarantee delivery of a certain amount of material or pay the price for that material.[96] Incineration operations need a certain amount of material to operate efficiently and profitably. Put or pay contracts ensure that cities will guarantee the trash or pay punitive rates designed to ensure the material.[97] Not only do these contracts discourage recycling and true waste diversion, they can leave cities with significant new financial burdens.

- Harrisburg, PA was the largest municipal bankruptcy in U.S. history in 2011; this bankruptcy was directly caused by debts under a put or pay incinerator contract.[98]
- Two years later Detroit became the largest municipal bankruptcy in U.S. history, and among the city's major debts were $1.2 billion incurred for its incinerator.[99]

Incinerators are bad investments because agreements such as put or pay, flow control or some other financial mandate, ensure that customers are coerced into feeding it even when cheaper alternatives exist.

Waste *of* Energy

"Waste-to-energy" is also a waste *of* energy. It proposes a linear system in which we expend energy extracting raw materials from the earth, refining these materials, turning these materials into consumer products, distributing them and collecting products for disposal only to then burn them for a tiny fraction of the total energy expended in the process. Alternatively, source reduction and recycling minimizes or eliminates energy expenditures prior to consumption and disposal at rates much greater than those produced by combustion. **Recycling saves 3-5 times the energy produced by mass burn incineration,**[100]

and gasification, pyrolysis and other phased incineration technologies produce less than 20% of the energy from mass burn.[101]

If only non-recyclable materials were burned, this would be less of a problem: we could save energy by recycling and produce energy from non-recyclables. The best materials for combustion, however, are also among the most easily recycled, meaning that incineration competes with recycling for materials.[102] Not only do incineration technologies waste energy, they materially discourage activities which save the most energy.

Recycling saves 15-25 times the energy produced by gasification, pyrolysis and other phased incineration technologies.

Anaerobic Digestion is an Unproven and Expensive Technology for Mixed Municipal Solid Waste

Anaerobic Digestion (AD) is a "waste-to-energy" process which would not be considered incineration, but is frequently paired with dirty MRFs and is one of the technologies under consideration in Houston. Anaerobic digestion is "a series of biological processes in which microorganisms break down material in the absence of oxygen."[103] This offers an important disposal opportunity for organic waste and livestock manure[104] to produce soil amendments which reduce the need for fertilizers and create a substitute for fossil fuels.[105].

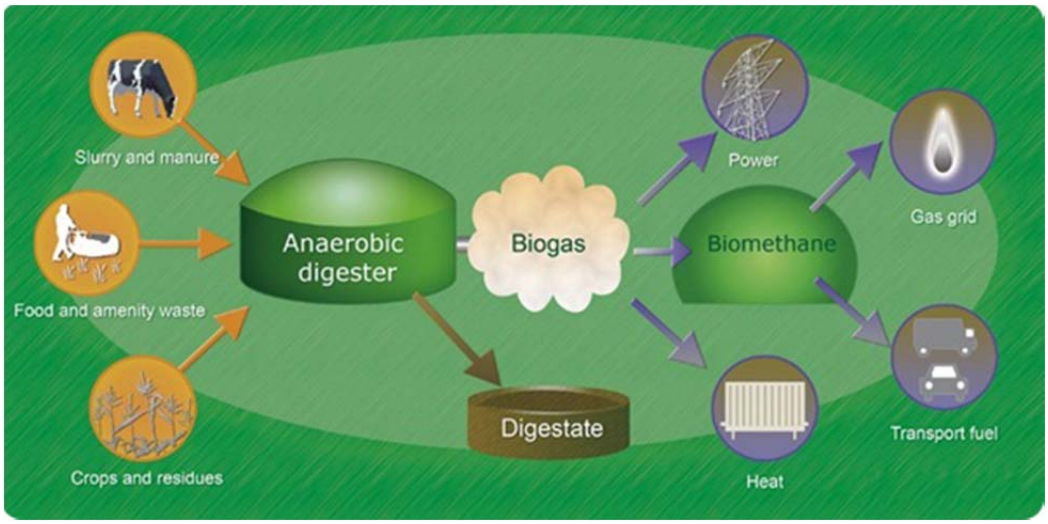

Diagram showing anaerobic digestion. www.leogroupuk.net

However, particular challenges exist when using anaerobic digestion to process municipal solid waste (MSW). According to one study, "anaerobic digestion (AD) systems are extremely sensitive to changes in environmental variables" and variable waste streams, like MSW, can mean total system failures[106]. The City of Austin places anaerobic digestion on the waste hierarchy just above landfilling as a "final end-use disposal option" and recommends composting as a better use of leftover organics.[107]

Even those systems used for manure can be challenging to operate on a consistent basis, with failure rates as high as 70%.[108] While new technological developments offer hope that this technology will be increasingly viable, evidence does not exist to suggest that it is ready to handle the level of variability in

household trash and uncertainties exist "over the economics and practical applications of [anaerobic digestion] to treat [municipal solid waste]."[109]

- Houston was home to a high profile failure for anaerobic digestion of household trash when startup Terrabon was forced to declare bankruptcy.[110] Their multi-million effort attracted investment from the State of Texas and Waste Management, Inc., but the effort collapsed when Waste Management pulled out after buying 18% of the firm.[111]

Anaerobic digestion alone would not be able to reach the diversion rates the City of Houston and other dirty MRF supporters have claimed, and without source separation this would be less than viable, create lower quality compost and a higher amount of residuals.

The better option would be to implement source-separated organics collection which could be processed through anaerobic digestion with the residual organics becoming compost soil amendments. Source-separated organics, like source-separated recyclables, are less contaminated and more viable for reuse.

"One Bin for All" Threatens Environmental Justice

Holmes Rd. incinerator, early 1970s.

Waste facilities in general tend to be sited in low income, predominately minority communities. This is especially true in Houston, where **a 1979 study tracked the siting locations of City-owned waste facilities and found that nearly all of City's landfills and incinerators were in African American neighborhoods.** The study conducted by Robert Bullard, Ph.D and his graduate students at Texas Southern University led to the first lawsuit charging environmental racism in the siting of a waste permitted facility, Bean vs. Southwestern Waste Management.[112] Bullard's study paved the way for many studies that have identified similar patterns of polluting and harmful industrial facilities located in communities that are predominately minority and/or low income.[113]

- In Houston, city-owned waste facilities were built in majority-minority districts following a pattern that Dr. Bullard described as the **"path of least resistance"** since predominantly white districts would not want landfills or incinerators in their neighborhoods, afflicting their schools and property values. Privately owned facilities continued the same pattern established by city-owned landfills and incinerators.

In 1972, the City of Houston invested $1.9 million in Houston Natural Gas Company to build "mini-incinerators" that the industry touted as "pollution free." Bullard writes in his 1987 book *Invisible Houston*,

> "The mini-incinerators did not meet the pollution standards of the Houston Air Quality Control Board and were shut down after a short period of operation in the mid-1970s… Four (80 percent) of the five Houston-owned incinerators were located in black neighborhoods, while one incinerator (20 percent) was located in a nonblack neighborhood (i.e., it was located in a Hispanic neighborhood); two (66.7 percent) of the three mini-incinerators Houston operated under its pilot program were located in black neighborhoods, while the third site was near a nonblack neighborhood. The location of Houston's landfill sites revealed that all five sites (100 percent) were operated in predominantly black neighborhoods."[114]

The potential locations suggested for the "One Bin for All" dirty MRF and incineration plant in Houston are no exception to the pattern of environmental injustice. For permitting and operational reasons, the facilities would likely be built at an existing landfill or transfer station. The proposal documents from the city even provide tax incentives if the facilities are built within the city limits.[115] Although demographics have shifted substantially, Houston's transfer stations and landfills are still located in communities of color. The following table uses census tract data to show the demographic population of the neighborhoods surrounding landfills and transfer stations where the City of Houston sends its trash, and where the new facilities would most likely be constructed.

FACILITY	AFRICAN-AMERICAN POPULATION (CENSUS TRACT 2010)	LATINO POPULATION (CENSUS TRACT 2010)	CITY COUNCIL DISTRICT (Percent Minority)
Blue Ridge	54.02%	22.18%	N/A
McCarty Road	18.56%	67.27%	B (93%)
Hardy Road Transfer Station	36.2%	53.1%	B (93%)
Waste Management Humble	33.6%	41.32%	N/A
Southeast Transfer Station	2.51%	85.47%	I (92%)
Southwest Transfer Station	10.78%	71.17%	F (85%)
Northwest Transfer Station	18.48%	66.34%	A (76%)

Despite the fact that Houston dumps waste in communities of color, the City's appointed advisory board for the "One Bin for All" project is 80% White, with no Latinos or African Americans—the most commonly affected populations. [116]

The "One Bin for All" project would continue the City of Houston's systemic legacy of environmental oppression of its minority residents by placing yet another polluting trash facility in a predominantly African American or Latino neighborhood. The systematic exclusion of Latino and African-American voices from the decision-making on the issue only heightens this likelihood. The current dirty MRF threat to communities of color is not limited to Houston.

- **Montgomery, Alabama has recently constructed a dirty MRF in a disproportionately African American neighborhood** with plans to implement incineration technologies in a few years.[117] According to census data, the facility will be built in a neighborhood that is 29% less White than the surrounding county.[118]
- Community activism defeated a proposed **dirty MRF in New Orleans** in 2011 after local environmentalists and civil rights activists raised the specter of environmental racism.[119] The facility was proposed for a neighborhood which was 95.4% African-American, New Orleans' historic Lower Ninth Ward.[120]

Dr. Bullard wrote in a 2014 article in Rice Design Alliance's *Cite Magazine*, "As I pointed out 25 years ago in *Invisible Houston*, illegal dumping will only end when the residents in the targeted neighborhoods and council districts 'take back' their communities."[121] Targeted areas are indeed starting to "take back" their communities. Environmental justice groups and networks are strengthening around industrial siting concerns such as "One Bin for All" and other pollution problems in Houston.[122] Greater public participation and inclusion of these groups by City officials will be necessary for equitable solutions to be reached.

4. The Real Solution: Zero Waste

Dirty MRFs do not address a fundamental problem: the culture of disposability.

Even when dirty MRFs are not intended for coupling with incineration technologies, the effect on resource management is negative. Dirty MRFs do not address a fundamental problem: the culture of disposability. **The notion that products can simply be thrown "away" indicates a lack of responsibility for the resources one consumes.** Conversely, source-separation raises individuals' awareness about what can be recycled and what cannot under the present systems. Zero Waste is partially about "guid(ing) people in changing their lifestyles and practices."[123] Dirty MRF systems do the opposite.

Defining Zero Waste

This big picture, long-term goal—90% diversion or higher—is often called Zero Waste. The **Zero Waste International Alliance** has developed the only peer-reviewed definition for the term:

> Zero Waste is a goal that is ethical, economical, efficient and visionary, to guide people in changing their lifestyles and practices to emulate sustainable natural cycles, where all discarded materials are designed to become resources for others to use.
>
> Zero Waste means designing and managing products and processes to systematically avoid and eliminate the volume and toxicity of waste and materials, conserve and recover all resources, and not burn or bury them.
>
> Implementing Zero Waste will eliminate all discharges to land, water or air that are a threat to planetary, human, animal or plant health.[124]

Note that this definition specifically excludes burning-based technologies such as gasification. In practice, local and commercial Zero Waste standards vary, with at least 90% diversion from landfills and incinerators being a common goal. Both Dallas[125] and Austin[126] have such goals, and San Antonio has a short-term goal to divert 60% of its waste by 2020.[127]

While the numbers and the complexity of the issue can seem daunting, the fact remains that Zero Waste breaks down into choices and policies that are less complicated, less risky and cheaper over time than dirty MRF and incineration proposals such as the "One Bin for All" proposal in Houston today. A simple Zero Waste policy statement for cities could be articulated as:

> Comprehensive and consistent recycling, comprehensive and consistent organics collection, policies which incentivize recycling and composting, full-scale public education efforts, producer responsibility and single-use product bans.

Zero Waste policies combine to eliminate most of our discards to landfills without the need for incineration technologies. Unlike unproven technologies like gasification of solid waste, Zero Waste relies on proven technologies such as source-separated recycling and organics collection.

Comprehensive and Consistent Recycling

The first step for any meaningful Zero Waste effort is curbside recycling. The first curbside recycling program in the US began in 1973,[128] and since then more than 9,800 communities offer some curbside recycling pick up.[129] According to the EPA, national waste composition studies indicate that 53.6% of materials discarded

in the U.S. are recyclable—paper, cardboard, plastic, metal and glass.[130] At least some of the remaining materials are also likely recyclable—such as textiles—but are not typically included in most curbside recycling programs. Any curbside program should include at least the most commonly collected materials—glass, plastic, paper, cardboard, aluminum and ferrous metals—and expanding to rigid plastics as well as gable-top cartons[131] will reduce residuals even further.

www.austinrecycles.com

One great debate in the recycling world has been between single-stream and dual-stream or multi-stream recycling. **Houston dirty MRF promoters have benefitted from confusion over the term single-stream, as residents who hope for "the big, green bins" mistakenly identify this with the proposed dirty MRF or "One Bin for All" program.** Historically, most communities lucky enough to have curbside recycling in the City of Houston had dual-stream or multi-stream recycling, where different recyclable materials had to be sorted in separate containers.[132] Most commonly, cans and bottles (glass, plastic and aluminum) were kept separate from paper and cardboard products. This reduced glass fine contamination of the paper, but experience also indicates that absent strong requirements or other incentives, fewer residents participate in dual-stream programs than single-stream.[133] **In Houston the difference has been stark—participation in single-stream recycling, where all recyclables go into the same big, green bin, is nearly 3 times the participation rate for dual-stream.[134]**

Each community should determine what works best for their residents, but the most important factor is consistency. Having dual-stream in some areas and single-stream in others (as in Houston right now) makes public education and community buy-in far more difficult, if not impossible. Recycling should be consistent and comprehensively offered to have at the best chance of diverting most of the materials currently discarded.

Comprehensive and Consistent Organics Collection

More than 40% of the total materials discarded in the U.S. are organic or compostable materials, comprising almost three-quarters of the materials left after recycling is removed.[135] **A growing number of communities are offering curbside collection for composting as well as for recycling.**[136] Organics break down in landfills to produce methane and other greenhouse gases (GHGs), meaning that diverting organics from landfills is crucial for reducing the climate impacts of waste.[137] Compost can also be used to facilitate and improve local agriculture,[138] reducing the distance between farm and table, the energy expended and

GHGs produced in feeding our community. While recycling is the most basic element of Zero Waste, organics collection has some of the biggest bang for the buck. Even dirty MRF operators have supported separate organics collection in order to reduce the problems of contamination.[139]

The most significant obstacle to organics collection is participation, and what is known as the "yuck" factor.[140] Food scraps can begin to stink, draw insects and other vermin and can generally gross out residents. A variety of solutions have been developed, however, from lining compost containers with paper bags,[141] using smaller bins, different bin designs which keep out insects or even putting compost in the freezer until collection day.[142] Garbage can be disgusting as well, but over the years people have found ways to handle it without creating problems for themselves. There is no reason the same couldn't be true for compost.

Unlike recycling, composting does not necessarily need to be collected at the curb. Residents can also compost on their own property and reduce the need to purchase fertilizers for yard and indoor plants alike. The City of Austin has developed a backyard composting program where residents can receive training in composting, request a smaller trash can and receive a rebate voucher for a 75% discount on a home composting system.[143] Cities interested in Zero Waste should provide curbside composting and strong incentives for at home composting.

www.greatergreaterwashington.org

Incentives for Recycling and Organics Collection

Between recycling and composting, at least 90% of material can be diverted from disposal, not including textiles, rubber and other recyclable materials not normally collected in most cities. After offering the services, the next challenge becomes encouraging participation. The two most effective means of ensuring participation are SMaRT waste pricing and mandatory recycling for pickup.

In countries such as Scotland and Germany, mandatory curbside recycling and composting programs can be controversial, but they are very effective at increasing participation. These are ordinances which designate that the City will not collect any waste if either recycling or composting are not also present, or if there is recycling or composting present in the waste. Customers are still free to self-haul their discards to a landfill and pay gate fees there, but City collection crews will not throw valuable commodities into the landfill themselves. Such policies are best implemented after all other incentives, education and programs have gone into effect to capture the last chunks of material after recycling, composting and other programs have become widely accepted.

SMaRT (Save Money and Reduce Trash) is where "residents are charged for the collection of municipal solid waste—ordinary household trash—based on the amount they throw away. This creates a direct economic incentive to recycle more and to generate less waste."[144] While some communities may determine this through metering, where each load of trash set out at the curb is weighed, this is unnecessary and often unpopular.

- An easy solution is to offer different sized trash cans—24 gallon, 36 gallon, 64 gallon and 96 gallon—and to charge customers more for bigger cans. Another solution is to require that trash be disposed in special bags and to sell the bags at grocery stores. The more trash, the more bags, the more customers pay**.**
- In general SMaRT pricing can reduce waste disposal by up to 50%[145] and increase recycling by up to 40%.[146] EPA estimates that SMaRT (also known as "Pay-as-you-throw or PAYT) policies in 2006—which covered only 25% of the U.S. population—diverted about 6.5 million tons of waste which would have otherwise been thrown away.[147] They estimated t hen that the policies reduced disposal by an average of 17%.

In general SMaRT pricing can reduce waste disposal by up to 50% and increase recycling by up to 40%.

However, it is important to keep in mind that not all communities have waste fees. Designated waste fees are not necessary to achieve successful recycling and landfill diversion rates. Some, like the City of Houston, pay for waste disposal from general funds. Several large cities without waste fees have better than average diversion rates. Toronto, for example, has no waste fee and boasts a 49% diversion rate—about 3 times that of Houston.[148] Part of their success is likely due to their curbside food waste collection and a commitment to strong education programs.

Full-scale Public Education

Participation rates are highest when people understand the recycling, composting and the Zero Waste goals set by their community. Full-scale education means providing information for residents through multiple methods—from mass media campaigns reaching as wide an audience as possible, to targeted media tailored to specific populations, to grassroots community education with small groups and civic organizations to individual communication door-to-door. Some billboards or a few radio ads will likely not suffice.

Door-to-door efforts in particular can be very valuable at increasing participation and reducing contamination in recognized "hot spots" where diversion is not being done well or at all. City employees, community partners or volunteers can take time to explain to residents what works and what does not, express the importance of recycling and composting and make sure that residents understand the incentives in place.

Producer Responsibility and Product Bans

At least 90% of waste is recyclable or compostable, and at least some of the remainder could be with better residential programs. Assuming 90% of the materials are now accepted and 90% of residents participate, 81% of materials should be diverted. How do we get to the rest? A combination of producer responsibility and single-use product bans can close the gap by encouraging manufacturers to design products that are recyclable or compostable. **Better product design is the solution to the portions of the waste stream**

that should not exist in the first place, the disposable products and packaging that is "designed for the dump" or "born to be buried or burned". Getting there requires time and successful implementation of an emerging framework called "extended producer responsibility" (EPR).

Extended producer responsibility "entails making manufacturers responsible for the entire lifecycle of the products and packaging they produce."[149] In practice, this has been adopted in the form of "producer takeback" recycling—programs whereby manufacturers take back their products when consumers are ready to discard them. This has been adopted most widely with electronic waste.[150]

- **Almost half the states in the U.S. now have laws requiring electronics manufacturers to take back their products for recycling**, or those manufacturers are not allowed to market their products in that state.[151] This has reduced the amount of electronic waste in landfills by more than half a billion pounds.[152]
- Other states have passed EPR laws for batteries, paint, mattresses, fluorescent lighting and other products.[153] Alameda County, California has passed a local ordinance requiring EPR for pharmaceuticals,[154] and stakeholders have begun discussing the possibility of national EPR policies for packaging.[155] Such a system entails big product manufacturers paying local governments to collect materials, or setting up their own drop-offs for customers.
- Adopted as a principle for all products, EPR could recover most of the materials remaining after curbside recycling and composting. By requiring manufacturers to handle these materials' end-of-life—physically and/or fiscally— it also encourages them to design simpler, more recyclable, less wasteful products in the future.

Better product design is the solution to the portions of the waste stream that should not exist in the first place, the disposable products and packaging that is "designed for the dump" or "born to be buried or burned".

Dallas, TX passed a bag ordinance in March 2014

Single-use product bans are most appropriate for disposable products that create environmental or property harms, are not easily diverted and for which reasonable alternatives exist. Single-use checkout bags and Styrofoam (a brand name for expanded polystyrene, or EPS) are two of the most common products banned or restricted at the municipal level.

- Single-use bags pose harms to recycling machinery, with at least one Sacramento area facility forced to shut down operations six times a day just to clear away bags.[156] Under normal circumstances most communities do not want these bags included in with recycling, making diversion significantly more difficult. Stryrofoam has few markets for remanufacture, and it contaminates the recycling stream when it breaks down.[157]
- There are, of course, many more sustainable alternatives to these products, and so bans have few negative impacts overall. Bans not only increase diversion by switching to more recyclable products, they can also reduce the overall amount of waste by eliminating disposable products and replacing them with reusable products.
- With a few exceptions, any product which cannot be recycled or composted curbside and which has no producer takeback option should be considered eligible for a ban. Local governments have the opportunity to lead on these efforts as well.[158]

5. Conclusion: Landfill Diversion Impacts Globally and Locally

Diversion is important not just to communities concerned about the long-term availability of landfill space or the local impacts of waste pollution; keeping trash out of landfills responsibly means reducing the global climate impacts of materials management and so many other impacts of how we consume and produce waste.

- **For every ton of household garbage, there are as many as 71 tons of materials discarded upstream during the extraction, refining, manufacturing and distribution of those materials.[159]**
- Incineration does nothing to change the upstream production of waste, which accounts for a larger quantity of greenhouse gas emissions than landfilling. To rely on waste burning without addressing waste reduction is ill-advised, and Denmark missed their climate change goals because of their reliance on phased incineration.[160]

Dirty MRFs optimally reach about 10-30% diversion, while gasification and other phased incineration technologies have shown repeated failures with household waste. Promoters of these technologies believe that combining them will solve their respective problems, by giving dirty MRFs a place to put their residual waste and by producing a more uniform fuel for the gasification units. Just because the discards are not going to landfills, however, does not mean that we consider these materials to have achieved their highest and best use.

www.flickr.com/photos/dazzlemedia/2827938617

Recycling and reuse allow our economy to eliminate some of our trash. Prevention and reduction allow us to conserve even further. **Recycling, composting, and waste reduction are all higher and better uses for**

these materials than incineration, according to the EPA.[161] Some local governments even define "conversion" technologies as disposal techniques, not diversion.[162]

The facts show that it's smarter to separate. Cities and states can establish comprehensive and consistent recycling, comprehensive and consistent organics collection, incentives for recycling and composting, full-scale public education efforts, producer responsibility and product bans in order to be Zero Waste in a matter of decades. Innovation will be necessary; problems will arise that will require solving, and most importantly political will is necessary to see these processes through. Regardless, communities large and small, conservative and liberal, urban, rural and suburban, rich and less than rich have all found ways to reduce waste, recover valuable resources, save money and improve their impact on the Earth.

Communities considering dirty MRFs or other incineration facilities should stop and consider that 20 years from now they will wish they had begun their Zero Waste efforts this year. For communities with their sights set higher and policy makers looking towards the future, dirty MRFs and incinerator proposals are a trap. Zero Waste is an opportunity.

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