



**SUSTAINABLE AND SAFE RECYCLING:
PROTECTING WORKERS WHO
PROTECT THE PLANET**

GAIA

Partnership for Working Families

MassCOSH

National Council for
Occupational Safety and Health

| 2015 |

THE FOLLOWING SPECIALISTS CONTRIBUTED TO THE RESEARCH, WRITING AND PREPARATION OF THIS REPORT:

Tolle Graham, *Labor and Environment Coordinator, Massachusetts Coalition for Occupational Safety and Health (MassCOSH)*

Jamie Tessler, MPH, *Health and Safety Consultant to the Massachusetts Coalition for Occupational Safety and Health (MassCOSH)*

Peter Orris, MD, MPH, *Professor & Chief, Occupational and Environmental Medicine, University of Illinois, Hospital and Health Sciences System*

Joanna Shimek, PhD, MS, *Clinical Assistant Professor, University of Indiana School of Public Health*

Monica Wilson, *U.S. and Canada Program Director, GAIA*

Hays Witt, *Transforming Trash Program Director, Partnership for Working Families*

ACKNOWLEDGEMENTS:

This report was developed with assistance from Randy Rabinowitz, Occupational Safety and Health Law Project; Garrett Brown; Ben Beach, Legal Director, Partnership for Working Families, and many others who shared their expertise on this topic.

ACHIEVING SUSTAINABLE AND SAFE RECYCLING

Zero waste is the future. Growth in the recycling economy has the potential to not only conserve the environment, but also create 1.5 million new jobs. But research indicates that recycling work can be dangerous, with injury rates more than double the national average. By addressing this problem, local governments have an opportunity to secure the sustainability and health of their cities while ensuring that recycling jobs are good jobs. Recyclers deserve safe working conditions, as they protect public health and the planet from waste, pollution, and resource depletion.

The environmental necessity of recycling is well-established: achieving a 75% recycling rate would yield greenhouse gas emission reductions equivalent to shutting down one-fifth of all U.S. coal power plants (Tellus 2011). A growing number of cities recognize recycling as a key component of their local climate action plans (West Coast Climate and Materials Management Forum 2012). In short, recycling provides proven benefits for clean air and waste reduction, and along with other zero waste strategies it can offer a critical pathway for municipalities to achieve sustainable growth.

Recycling can also play a key role in urban job creation strategies. At our current national recycling rate of 34.5%, the U.S. recycling industry employs nearly 1 million people and generates billions of dollars of economic activity annually (Tellus 2011, USEPA 2012). Studies have shown that recycling creates at least 10 times as many jobs per ton of waste as disposal in either incinerators or landfills, and that investments in recycling, composting, and recycling reliant manufacturing could produce 1.5 million more jobs across the country.

But recycling workers face serious hazards on the job. In too many cities across the country, sorters work in loud and dusty facilities where they are often exposed to extreme temperatures. Working long hours, they lean over conveyor belts sorting materials – pulling out things that don't belong, ensuring the best quality materials are bundled together for the highest value. They work with heavy equipment in dangerous situations – climbing onto and into massive conveyor belts and balers to clean them. They maneuver past huge front-end loaders and forklifts, and walk by heavy bales of material that, when unsafely managed, can fall on workers who are in the wrong place at the wrong time. Moreover, they deal with an array of inherently unsafe materials that should not be on the recycling line – used needles, chemicals, dead animals and broken glass. As a result of these un-

safe conditions, recycling workers face above-average injury rates and are sometimes even killed on the job. Many recycling sorters are employed by temp agencies, further increasing the likelihood that they won't have the training or experience needed to do their job safely.

But it doesn't have to be this way. Occupational hazards can be mitigated, and in some cases eliminated, with a combination of engineering controls, improved safety systems, work practices, and extensive training. There are important actions and best management practices that cities can and should take to improve recycling jobs. Cities that offer curbside recycling service generally contract with private companies to process recyclable materials collected from households. To ensure safe and dignified recycling jobs, municipal governments must require rigorous health and safety standards in recycling contracts.

This report offers a unique inside look at the working conditions faced by recycling workers across the United States, as well as a series of specific policy recommendations that municipal decision makers should follow to improve industry accountability and health and safety outcomes. It also includes practical recommendations for public education programs that can prevent dangerous materials from entering the recycling stream. Our analysis is based on occupational health studies, OSHA reports about health and safety violations, articles from news media and industry trade publications, interviews with recycling workers, and first-hand observation of recycling work.

Our findings underscore the need for urgent action to improve health and safety conditions for recycling workers. Improving the recycling sector overall is not only possible – it's imperative for averting today's ecological crises, and protecting the health and well-being of this important group of climate workers who protect us all.



Bulldozer moving collected recyclables

RECYCLING WORK: ESSENTIAL BUT HIGH-RISK

Across the United States, there are approximately 21,000 workers who process recyclable materials after they've been collected by city or private waste collection crews and taken to the local Materials Recovery Facility (MRF) (U.S. Census 2014). At the MRF, glass, paper and metals are sorted into different materials streams by machines and by hand, with recycling workers pulling items off conveyor belts for sorting as they pass by.

MRFs are dependent on hand sorting to ensure that the highest quality and cleanest recyclable materials are extracted. Workers also sort out mistakes (non-recyclable or hazardous materials), which are removed and sent to waste disposal facilities. Hand sorting ensures that materials collected for recycling can be most efficiently turned into high-grade feedstock that fetches the best prices in the marketplace for recyclable material. Depending on the contract terms between cities and recycling providers, profit-sharing arrangements can bring in additional revenue to cities from the sale of recycled materials.

The work that recycling sorters do is essential to the overall functioning of the system. Yet their work is also dangerous. The combination of repetitive motion in awkward positions, exposure to extreme heat and cold, working around heavy machinery and moving vehicles, and the unpredictable nature of the materials that come into recycling facilities means that recycling workers face high workplace injury rates.

The following sections review occupational health studies, reports from news media and industry trade publications, OSHA reports about health and safety violations, interviews with recycling workersⁱ and first-hand observation of recycling work to document the kinds of injuries, hazards, and even fatalities that MRF workers experience.

For recycling workers, going to work can be fatal

Seventeen workers were killed on the job at recycling MRFs between 2011 and 2013 (OSHA 2015a). OSHA accident reports and fatality records as well as news media reports illustrate the range of hazards that

News Reports Describe Recycling Worker Tragedies

St. Louis Co. man dies after getting caught in compactor
St. Louis Post-Dispatch, Kim Bell, June 13, 2011 (Bell 2011)

Northampton recycling plant worker injured on the job dies
The Morning Call, Tracy Jordan, October 3, 2011 (Jordan 2011)

Horror as worker is crushed by trash compactor in Brooklyn
New York Post, Georgett Roberts, March 16, 2013 (Roberts 2013)

Fayette man fatally crushed by bales of paper
The Tribune-Review, December 20, 2011 (Tribune-Review 2011)

Amputation at Recycling Plant Prompts OSHA Action in New Jersey
Waste Management World, Ben Messenger, March 20, 2013 (Messenger 2013)

Man run over at recycling center in North Bay
ABC7 News, March 12, 2013 (ABC7 News 2013)

contributed to these fatal incidents, including being struck by moving vehicles at MRFs (such as forklifts, bulldozers, and trucks), being caught or crushed in balers and other heavy machinery during maintenance or while attempting to clear jams, being crushed by falling bales, and being buried under tons of materials (OSHA 2011a, OSHA 2011b, OSHA 2012a, OSHA 2015b).

Excerpt from OSHA Accident Investigation (OSHA 2012a)

“Employee is Struck and Asphyxiated by Paper Load, Later Dies”

Republic Services, North Las Vegas, Nevada

At approximately 11:00 a.m. on June 8, 2012, Employee #1 was sorting and loading paper material onto a conveyor belt. The conveyor carried the paper into a processing area, where it was compacted and baled. At the beginning of the operation, the material was hand sorted to remove non-paper items, after which it was deposited into a holding bay.

As material filled the holding bay, it was released onto the conveyor belt. On June 8, 2012, the amount of paper in the holding bay was significantly more than an average day's amount. Furthermore, the operation was delayed for approximately two hours because the paper was jammed in the holding bay due to its weight and compaction. Employee #1 was standing on the conveyor belt and pulling material from the holding bay by hand to break up the pile and move the material onto the conveyor more efficiently. While removing the jammed paper, he was struck and engulfed in a mound of paper, which was estimated to weigh approximately 2.5 tons. Coworkers discovered Employee #1 laying on the baler feed conveyor in the supine position covered by the paper load. Emergency medical personnel were summoned. They arrived and had an employee at the facility use a front loader to lift the material off of him. Employee #1 was transported to a medical center. At approximately 4:49 a.m. on June 14, 2012, he was pronounced dead after being removed from life support.

Recycling workers are injured at higher rates than other workers, and injuries can be severe

Fatality rates only paint a partial picture of the dangers MRF workers face. MRF workers are also injured on the job at high rates, and when they are, the consequences can be severe. The rate of nonfatal injury incidents in MRFs was 8.5 per 100 workers in 2012 (BLS 2014). This is much higher than the rate for all industries (3.5 per 100 workers) and higher than the average for all waste management and remediation services (5.1 per 100 workers) (BLS 2014).

Our review of OSHA citations found these examples to illustrate how unsafe conditions put MRF workers at risk.

- OSHA cited Eagle Recycling in North Bergen, New Jersey for multiple violations following the amputation of an employee's fingers. OSHA cited the company with a serious violation for failing to implement a lockout/tagout program to control potentially hazardous energy, among other violations (OSHA 2013a).
- An employee's leg was caught in a machine and severed at the Taft Recycling Center in Orlando,

Florida (Orlando Sentinel 2010). OSHA cited the facility operator Smurfit Stone for hazards including lack of lockout/tagout procedures and permit-required confined spaces (OSHA 2012b).

- The California Department of Industrial Relations' Division of Occupational Safety and Health (Cal/OSHA) cited American Reclamation, Inc., its subsidiary, South Coast Fibers, Inc. and their staffing agency, Steno Employment Services, Inc., with 36 safety violations the agency alleges put more than 60 sorters, drivers, helpers and mechanics at risk while on the job. Cal/OSHA issued five serious violations, including: a failure to follow a written program to prevent workers' entry into machinery before the energy is shut off, an unsafe work platform raised on a forklift, and various unguarded pieces of machinery that could lead to amputations and other serious injuries (California Department of Industrial Relations 2012).
- Old Atlanta Recycling in Atlanta, Georgia was cited for 15 serious safety violations. The multiple violations included failing to provide an energy control program for workers maintaining and servicing equipment to keep machines from accidentally starting up, to formally train powered industrial truck operators, and to guard a conveyor belt (OSHA 2012c).
- EDCO Waste and Recycling Services, Inc. of San Marcos, California, was cited by OSHA for an incident when an employee's hand was crushed inside a baler while the employee was performing maintenance (OSHA 2011c).
- The leg of an employee was caught by the moving ram of a baler at the Tonghua Materials Recovery Facility in Salinas, California (OSHA 2013b). The employee was hospitalized and treated for a fractured leg, and Cal/OSHA cited the facility for multiple violations, including violations related to moving machinery/equipment (OSHA 2013b).

Health and safety violations from these and other incidents described hazards including insufficient lockout/tagout procedures to protect workers cleaning heavy machinery, falling objects injuring workers, vehi-

cle operation hazards, and a lack of protective gear (2010a, 2011c, 2012b, 2012d, 2013a).

Because OSHA investigates so few workplaces in the first place (GAO 2009), this may only be the tip of the iceberg in terms of actual incidents. Additionally, frequent reliance on temporary workers and staffing agencies means that injuries are likely under-reported (see the “Temporary Workers in MRFs” sidebar on page 6 for more information).

Occupational health and safety studies and interviews found additional common hazards:

- In interviews, recycling workers reported injuries such as fingers caught in machinery, needle sticks, being struck by flying objects, and cuts from sharp materials. Workers also reported a range of ergonomic risks in their work.ⁱ
- 70% of recycling workers in a 2013 survey experienced an injury or illness from job exposures (Jamison 2013). The most common injuries identified were musculoskeletal disorders such as injuries to the back and knees (reported by 57% of workers), and scrapes and cuts (reported by 43% of workers).
- Another survey of recycling workers found health risks including dust, noise and smell, exposure to hazardous materials, facility hygiene, cuts, falls, repetitive motion, and stress (Espino and Kissinger 2011). Dust was the most frequent concern identified. Workers said that despite wearing a protective mask, it was difficult to breathe because of the amount of dust in the air. Stress was another major concern, and workers described “constant pressure from supervisors to work fast so as to not get fired.” Workers also described opening large bags passing by on the conveyer belt, even though they couldn’t see the contents of the bags before opening them to prepare themselves for possible hazards (Espino and Kissinger 2011).
- A study of temporary worker conditions in Massachusetts found MRF workers who had not been informed that vaccinations were required or that workers directly employed by the recycling company underwent routine medical examinations (Freeman and Gonos 2009).



Forklift operator moving bales of paper

Temporary workers in recycling MRFs

Many waste and recycling companies rely heavily on temporary labor, and labor brokers and staffing agencies cater specifically to these industries. Elite Staffing, a major staffing agency, boasts that it provides staff to 90% of facilities run by “the largest provider of waste and environmental services in North America, servicing nearly 20 million municipal, commercial, industrial and residential customers” (Elite Staffing 2015).

The use of temporary labor is an important component of the industry’s staffing practices. Even though the National Waste & Recycling Association (NWRA) usually does not weigh in on matters before the National Labor Relations Board, it filed an amicus brief in an ongoing NLRB case involving a temp agency supplying workers to a recycling MRF. In describing the issue, NWRA General Counsel David Biderman stated, “This case is very important to all employers, including waste and recycling companies. This is the first time we have filed with the NLRB in my 17 years at the Association” (National Waste & Recycling Association 2014).

Problems with the use of temp labor are well documented across a range of industries. Across all industries, temporary workers earn 22% less than their counterparts with regular jobs and suffer more frequent injury rates (Smith and McKenna 2014). A 2013 analysis of millions of workers’ compensation claims from many industries found that temporary workers are at a significantly greater risk of being injured on the job than permanent employees (Grabell, Pierce and Larson 2013). Temp workers are often reluctant to raise health and safety concerns or report injuries to their employers, because temp workers have little or no protection from firing or retaliation (APHA 2014). Temporary workers often receive insufficient safety training. It is often unclear to these workers who their employer is and how to address or resolve concerns about hazardous exposure or injuries (Smith and McKenna 2014).

Reliance on temporary staffing agencies has allowed companies to distance themselves from responsibility for worker health and safety (Freeman and Gonos 2011). Among employers who use temporary labor, failure to properly train and orient workers who are new to the job, or have been brought on as temporary labor, is a common practice and a serious concern (Smith and McKenna 2014). Research about work-related injuries for low-wage workers shows that workers who have received health and safety training are more likely to seek medical attention and to notify employers of injuries than workers who have not received health and safety training (Riley and Morier 2015).

According to a report from ProPublica, after an employee was crushed to death by three 800-pound bales of cardboard at Sonoco Recycling in North Carolina in 2010, a company representative told an OSHA inspector, “We don’t train temps” (Grabell, Pierce and Larson 2013).

Dirty MRFs: Sorting through the garbage

This report looks at conditions for workers sorting recyclables in MRFs that handle recyclables already separated by the public into recycling bins (so-called “clean MRFs”). In facilities called “Dirty MRFs,” workers sort through mixed waste—including garbage, food waste, and mixed recyclables—that is all thrown together in the same bins by the public. Substances that contaminate the recycling stream—such as rotten meat and broken light bulbs—are commonplace in a system that intentionally mixes garbage with recyclables. This means that work in a Dirty MRF is particularly dangerous, with a greater proportion of hazardous materials on the sort line (Texas Campaign for the Environment Fund 2014). In order to protect worker safety, cities should not pursue Dirty MRF schemes like “One Bin For All,” which was proposed in Houston. Instead, cities should ensure that the public is properly source separating discarded materials into garbage, compost, and recycling bins. More details on this can be found in the recommendations.

It doesn't have to be this way

Occupational injuries and fatalities are preventable. These events are not random or unforeseeable “accidents;” they are predictable incidents that result from exposure to recognized hazards. Hazards can be mitigated, and in some cases eliminated, with a combination of engineering controls, improved safety systems, work practices, and extensive training. As discussed further below, cities should also educate consumers to reduce the entry of hazards into the recycling stream. An incumbent workforce working at a facility with a comprehensive safety program is best equipped to tackle the challenges presented by contaminants in the recycling stream, and proactive education of the public supports safer conditions.

Municipal governments have the power and responsibility to increase industry accountability and improve recycling worker health and safety

As municipalities expand their recycling programs, they can and should use their power to hold industry accountable to high health and safety standards and outcomes. Because they contract with recycling companies to manage the municipal recycling stream, city governments create and shape local waste management and recycling markets in significant ways that can be leveraged to improve recycling worker health and safety.

Specifically, cities can use their contracts, franchises, land and facility leases or public-private partnerships with private sector recycling companies as points of intervention to address health and safety issues. For example, when entering into new recycling contracts, cities can and should consider the company's safety record, the caliber of the company's health and safety program, whether the company pays its employees a family-supporting wage, and whether the company provides opportunities for stable, full-time employment and career advancement.

Cities also have the power to prevent harm to recycling workers through public education and outreach pro-



Worker throws cardboard boxes into an industrial compactor

grams. The public needs to be informed that some materials threaten the health and safety of people working in recycling facilities. These materials include hypodermic needles (which can carry life-threatening illnesses) and plastic bags (which can clog machinery and require workers to climb more frequently into heavy equipment in order to remove the plastic). Strong “source separation” programs – the proper separation of recyclable materials at homes, businesses and elsewhere – are also critical to ensuring recycling worker safety and in achieving high recycling success. The “Public Education” text box on page 13 suggests practical steps cities can take to improve worker safety through source separation.

Together, these are best management practices for cities to implement.

WHAT MAKES RECYCLING DANGEROUS? THE TOP NINE HAZARDS RECYCLING WORKERS FACE

The previous cases paint a compelling picture of what can go wrong for workers in a MRF. The occupational health and safety analysis below looks systematically at MRF work, and describes the major hazards found in Material Recovery Facilities. These hazards can be mitigated by careful facility and work station design, proper equipment, comprehensive health and safety plans, thorough training, and implementation of systems that include workers in managing health and safety.

1. Risk of being struck by vehicles, falling bales, or materials

Material Recovery Facilities are dynamic work environments. Trucks, forklifts, front-end loaders, and other types of vehicles are continuously used to deliver unsorted materials, move materials to different positions, and move heavy bales.

Falling materials are another hazard in MRFs. Bales of recently compacted plastic, aluminum, or paper can weigh as much as 2,000 pounds and can shift or fall, crushing workers below.

The majority of injuries for the combined waste and recycling sectors between 2003 and 2009 resulted from contact with objects and equipment (NIOSH/CDC 2012). OSHA fatality data shows that eight MRF recycling workers died on the job between 2011-2013 from being struck by vehicles or crushed by falling bales or other objects (OSHA 2015a, OSHA 2015b, OSHA 2012a, OSHA 2012e).

2. Working with moving machinery

Contaminants such as plastic bags can jam the sorting lines and other heavy sorting machinery. The steps required to remove contaminants from machinery, such as climbing inside to cut off plastic bags, place the employee at risk if OSHA Lockout/Tagout (LO/TO) training or procedures are lacking.

Machine guarding rules and the OSHA LO/TO standards provide clear protocols to protect workers who op-

erate, maintain, or work adjacent to moving machinery such as compactors, conveyer belts, and sorting machinery. These rules and protocols require that machinery be de-energized (and not able to be turned on) while a worker is cleaning, servicing, or adjusting the machinery. Workers need training and sufficient time to complete tasks in order to comply with these protocols.

Bales of recycling exit a compactor



3. Exposure to dangerous materials

Materials Recovery Facility work is inherently unpredictable. Recycling sorting workers are required to visually inspect and sort different categories of recyclable materials. Unlike a factory or manufacturing setting, where upstream inputs are known, the recycling stream is influenced by the misconceptions or errors of millions of consumers who place inappropriate and potentially dangerous objects or substances into the municipal recycling stream. Recycling workers have to quickly identify hazards as they pass by on the sort line and respond appropriately to the hazard.

Workers interviewed for this project¹ reported having contact with the following hazards while working on the sorting lines:

- Used *hypodermic needles/syringes* discarded incorrectly by individuals who use them for home medication or by intravenous drug users; often these arrive in glass jars which are crushed during material transfer.
- *Laceration hazards* from nails, sharp metal, broken glass, and wood shards.
- *Dead and rotting animals*, such as squirrels, cats, and dogs, which had climbed into the bins in search of food scraps and later died.

“There are dead animals. Squirrels, cats and dogs. They climb in the bins looking for food and can’t get out.”ⁱ

- *Hazardous chemicals* such as household solvents, mercury-containing thermometers, industrial solvent containers, motor oil, open or leaking containers of hazardous household cleaners, batteries with

hazardous components such as lead or cadmium, fluorescent bulbs, and printer toners. Workers said that they were shown safety videos but did not have any formal training for hazardous waste management.

- *Biohazards* such as rotting food waste, used diapers, pet feces, and everyday garbage present infectious disease risks.
- *Respiratory hazards* from the inhalation of dusts, potentially infectious aerosols, chemical vapors, and from the inhalation of odor-masking mists used in some MRFs.

4. Working in awkward postures all day

MRF workers who sort material from a fixed-paced conveyor belt work in awkward postures that lead to work-related musculoskeletal disorders, such as repetitive stress injuries of the back, shoulder, knees, hands, and fingers. Even in the best circumstances, their backs are bent in a forward angle for hours at a time. The conveyor belts are at a fixed height and do not accommodate the height and reach of short workers without an ability to adjust the platforms they stand on. One study found that workers below 5’ 4” were at a distinct disadvantage in working the sorting lines (Lavoie and Guertin 2001).

With arms extended, shoulders reaching, hands constantly clasping objects that are moving at a set pace on a vibrating conveyor belt, many workers are twisting, reaching or jumping to toss or place materials into the proper bin or chute. In one study most of the physical complaints of MRF workers were associated with the awkward physical postures (Lavoie and Guertin 2001).

The number of workers positioned on a sorting line, sorting line speed, and width of the conveyor belt contribute greatly to the frequency, intensity, and severity of awkward and repetitive postures on the line.

During interviews, some workers described how they had created their own personal hand tools (sticks with bent nails or hooks) to assist them with line sorting jobs and to attempt to relieve the stress of continuous forward reaching. Handmade tools like this indicate that the height and width of conveyor belts and other machines are not well designed.

“When I started working as sorter over 10 years ago, they had eight people on a sorting line, now there are only four, but the company expects us to work as if there are eight people on the line.”
(Clarke and Martinez 2010)

5. Dealing with extreme temperatures and fatigue

Recycling workers are exposed to outdoor temperatures by working in close proximity to the massive, open facility doors that trucks use to deliver materials. Extreme cold is a risk factor for back, shoulder, knee, hand and wrist injuries and can contribute to a loss of manual precision and dexterity (IHSA n.d.), a big problem for a job that relies on grasping and sorting a new object every few seconds. Extreme heat conditions contribute to fatigue, fatigue-related cognitive effects, heat exhaustion, and possibly heat stroke (OSHA Occupational Heat Exposure, n.d.). The fixed pace of conveyor belts limits the ease and frequency with which workers can take breaks to rehydrate or warm up. Moreover, the use of needed personal protective gear can become intolerable in the heat resulting in additional exposures. Overheated workers might remove the gear to breathe, which leaves them unprotected. Planning for and preparing

against temperature extremes and fatigue are essential parts of a good safety program (OSHA Occupational Heat Exposure, n.d.; Olorunnishola et al 2010).

“The doors open with the truck delivery. I wear two pairs of pants, two jackets, but the cold just comes right in ... My fingers are always red from the cold.”ⁱ

6. Respiratory hazards: Dust and other airborne contaminants

Dust is created by nearly every phase of the material recovery process and may contain minute particles of plastics and glass, biohazards, toxic substances, and other respiratory irritants. Dust hazards can be especially hard to mitigate in high heat because even the best-fitting and properly assigned respirator can become too physically uncomfortable to wear for extended periods of time.

Animal feces, rotting food and organic waste that are mistakenly placed in recycling bins may expose workers to biological hazards. Biological toxins that become airborne through dust are called “bioaerosols.” Endotoxins are a type of bioaerosol known to cause serious respiratory illness and health effects in workers who are exposed to them. Numerous studies of composting, recycling and garbage workers have documented the exposures and illnesses associated with inhaling endotoxins (Lavoie and Guertin 2001, Sigsgaard et al 1994, Malmros et al 1991, Domingo and Nadal 2009). The same rotting food and waste are also found in MRFs, albeit at lower levels. Formal scientific studies of endotoxin and bioaerosol exposures in MRFs are lacking; the presence of unrelenting rotting food odors and dust, however, suggests that a precautionary approach is warranted that would recognize and control for bioaerosol exposures.

7. Exposure to noise and vibration

Continuous noise exposure can contribute to physical and psychological stress and hearing loss, reduce productivity and contribute to workplace accidents and injuries by making it difficult to communicate and to hear warning signals. In a study of recycling facilities, recorded noise levels exceeded levels determined safe by federal standards (Lavoie and Guerin, 2001). Occupational noise exposure is also associated with hearing loss, tinnitus, insomnia, increased blood pressure, and a long list of stress related hormonal changes and health effects (OSHA Noise Factsheet).

8. Slips, trips, and falls

Unsafe conditions can contribute to slips, trips, and falls which may result in a variety of injuries. Unsafe conditions may include spills, obstacles, floor mats,

slippery floors, moving from a wet to a dry surface, uneven or unlevel floors, inadequate footwear, lack of handrails, and poor lighting.

9. Occupational stress and other hazards

A large and growing body of scientific research has documented the negative health effects of job stress (APA 2015, Schnall et al 2009, NIOSH 2002). For MRF workers, sources of job stress can include (1) fear of injury or illness from uncontrolled hazards, (2) the inability to communicate safety concerns with supervisors due to language barriers, (3) fear of asking questions if job status is contingent or temporary, (4) threats or harassment from co-workers or supervisors, (5) production quotas, and (6) line speed (Jamison 2011, Espino and Kissinger 2011, worker interviews).ⁱ

The union difference: Best practices at work

Employees in unionized workplaces can participate in, and improve health and safety programs in unique ways. The company-wide employee handbook for one large recycling facility where workers are represented by a union specifically encourages employee participation in the workplace to identify hazards and improve work processes without fear of reprisal. Employees may provide suggestions “anonymously or not.” Furthermore, employees are explicitly requested to immediately report unsafe conditions or potential hazards, whether in a “product, facility, piece of equipment, process, or business practice.” In the event of serious health and safety concerns, the employees at this company can also follow the grievance procedure through their union representative to ensure that issues are properly addressed.

A study on the effects of unions in the workplace confirmed that unionized workers enjoy more effective enforcement of legislated labor protections such as safety, health, and overtime regulations (Mishel and Walters 2003). The study additionally found that “collective bargaining fuels innovations in... work practices that affect both unionized and nonunionized workers.”

Finally, it is important to note that where workers have a voice on the job, protection from retaliation, and formal structures for participating in health and safety management, they experience better health and safety outcomes. Studies have demonstrated that unionized workplaces are safer, have well-trained staff, and experience less turnover than nonunion workplaces (Mishel and Walters 2003; Zullo 2012; Frazis, Gittleman, et al. 1995).

MUNICIPAL BEST PRACTICES FOR MAKING MATERIAL RECOVERY FACILITIES SAFERⁱⁱ

Municipal governments can improve recycling worker health and safety by pursuing an active partnership with the recycling industry that creates direct accountability. Cities should use the best practices described below to ensure that their recycling contractors adhere to high standards for worker safety and health and create good jobs in their communities.

Municipalities should require entities with which they do business to meet health and safety standards that protect or advance the municipality's business interests. Engaging companies that promote health and safety in the workplace is good business for municipal governments. It can lower costs associated with turnover, missed work, and workplace injuries; ease the burden on the social safety net; reduce the risk of liability judgments and workers' compensation costs; and improve the quality of services provided to the city.

When doing business with recycling companies through contracts, franchises, land and facility leases or public-private partnerships, cities should take the following steps to set high standards for health and safety with respect to the work that is covered by the agreement with the city. A city should make findings that explain the way in which these measures advance the city's business interests.

- 1. Evaluate potential contractors, lessees and franchisees based on their health and safety practices.** Reward contractors with strong health and safety practices during the bidding process by awarding points for performance, and require proof that any past health and safety violations have been corrected.
- 2. Require contractors, lessees and franchisees to submit a written Illness and Injury Prevention Program (I2P2).** Following award of a contract or franchise, the I2P2 should be audited annually, and the company should be required to submit proof that any deficiencies will be corrected. The elements of the I2P2 should include:
 - a. Qualified, specialized safety staff as part of management team.
 - b. Programs that encourage the reporting of injuries, and provide protection for whistleblowers.
 - c. A program for regular identification and correc-

tion of safety hazards and health (noise, air quality, etc.) hazards. This should include employee engagement in identifying hazards.

- d. Policies that allow workers to refuse to complete a task that they believe is unsafe.
- e. Effective mechanisms for employee involvement in managing safety, such as joint employee-employer health and safety committees.
- f. Training and materials provided in the native language of the workforce.
- g. Procedures for thorough investigation of all incidents, including close calls.

In contrast to an I2P2, behavior safety programs are inadequate because such programs emphasize workers' behaviors rather than identifying and eliminating hazards and can artificially lower illness and injury rates. This makes it harder to enforce industry accountability for accurately identifying and addressing the hazards. Behavior safety programs discourage reporting work-related injuries and illnesses because workers "fear job loss or other disciplinary action, or fear jeopardizing rewards based on having low injury and illness rates." (GAO 2009)

- 3. Require contractors, lessees and franchisees to abate OSHA violations, within the abatement period required by OSHA, regardless of whether the company challenges the violation.** This prevents companies from delaying critical safety fixes while they work through what can be a lengthy administrative appeal process.

Given the additional health and safety risks involved in the use of temp labor, cities should restrict the use of temporary workers and staffing agencies on work covered by city contracts.

- 1. Prohibit the use of temporary and contingent workers by contractors, lessees and franchisees.** These provisions should be paired with policies that give existing temporary workers preference for hiring into permanent jobs.
- 2. Alternatively, require that a host, or principal employer, be considered a joint employer for purposes of compliance with all applicable**

workplace laws, including those relating to health and safety. Further require that all on-site employees within any job classification receive the same wages and benefits, training, and safety supervision and are rated the same for purposes of workers compensation.

City policies that protect and raise standards for workers can also improve health, and should be applied to the recycling industry.

1. **Seamless Service provisions allow experienced, well-trained workers to stay on the job in the event that a contract changes hands.** Seamless Service policies require a successor contractor to retain employees who worked for the terminated contractor, usually for at least 90 days.
2. **Workers who are protected by truly effective anti-retaliation measures are more likely to flag health and safety issues before those issues disrupt work or cause injuries.**
3. **Wage measures that require adequate pay levels have been shown to increase worker health (BARHII 2014).**
4. **Fair workweek policies that give employees certainty about their work schedules also reduce worker stress (Economic Policy Institute 2015).** Fair workweek policies require employers to post schedules two weeks in advance, and reasonably accommodate individual employees' needs for stable or flexible schedules that enable them to manage child care needs or a second job.

Cities should pair strong zero waste goals with smart source separation policies that ensure cleaner, safer streams of material entering the MRF (see sidebar on public education, source separation). In addition, cities should ensure that city contracts include strong environmental terms that protect worker and community health where such terms advance the city's business interests. In addition to strict compliance with federal, state, and local environmental regulations, recycling operators should be required to:

1. Implement appropriate dust-control measures to protect both workers and the surrounding communities.

Public education: Practical steps to prevent hazards for recycling workers

Enforcing rules around source separation of waste (making sure that residents are putting garbage, recyclables, and compost in separate bins) is more than an environmental issue. It also helps protect recycling workers from life-threatening hazards, including exposure to used hypodermic needles and rotten food. Clear rules around source separation should be accompanied by strategies such as:

- Providing recycling bins to all households.
- Establishing partnerships with community groups and schools to educate residents and encourage participation in source separation and zero waste plans.
- Distributing multilingual educational materials to residents to understand how to source separate their waste.
- Initiating public awareness campaigns with recycling workers as spokespeople for keeping hazardous items, such as hypodermic needles and toxic waste, out of the recycling stream.
- Educating the public to keep plastic bags out of MRF systems that do not accept them to reduce the need for manual cleaning of heavy machinery that can get clogged by bags.
- Providing online tools to answer residents' questions about how to source separate their waste (i.e. what kinds of materials belong in each bin).
- Making tours of MRFs available to the public.
- Establishing collection programs for hypodermic needles, either through door-to-door pick-up or through convenient drop-off locations.ⁱⁱⁱ

2. Utilize equipment, both stationary and mobile, that reduces vehicle and machine exhaust via engineering controls, alternative fuels, and electric or hybrid systems.
3. Comply with all vehicle idling laws.

Finally, in all of a city's dealings with recycling facilities, whether the relationship is contractual or regulatory (e.g. through licensing or other regulation), the city should require strong access and inspection rights for city personnel. Frequent access gives staff an opportunity to ensure that zero waste goals are being met and the facility is operating smoothly overall, and an opportunity to alert the appropriate agency if health and safety issues are suspected. It can also help create an overall more lawful, accountable environment in which all requirements, including those relating to health and safety, are taken seriously.

RECYCLING DOESN'T WORK UNLESS MRF WORKERS ARE SAFE ON THE JOB

In the last 30 years, recycling has become a widely accepted social practice. Many cities are approaching 70% recycling rates. Cities that are lagging behind are working hard to catch up, and planning for zero waste is a common plank in mayoral environmental agendas. Large consumer brands have joined in these efforts, and consumers have clearly shown their preference for recycled products. Recycling is popular because it's an expression of our values, an ecologically critical practice, and a smart economic move. Along with waste prevention, product redesign, reuse, and composting, recycling makes up a core component of zero waste programs. Fundamentally, it's about recovering resources for future generations and reducing the impacts of our consumption. To fully live those values, however, we must consider the human impacts of our waste management systems, and invest as much energy in improving recycling worker jobs as we do in raising diversion rates. We can convince millions of citizens to put the right container in the right bin. We can organize weekly collection from thousands of households and businesses, and move sorted commodities across global markets. We certainly have the capacity to honor the recycling workers that collect, sort, and process the material that keeps the zero waste economy humming with good, safe jobs. When we do, recycling can reach its highest and best potential.

APPENDIX: Select OSHA Standards and NIOSH Guidelines that apply to recycling contractors^{iv}

Federal OSHA General Industry (29 CFR 1910)

- 1910.94, Ventilation [related topic page]
- 1910.95, Occupational noise exposure [related topic page]
- 1910.120, Hazardous waste operations and emergency response [related topic page]
- 1910.132, General requirements (Personal protective equipment)
- 1910.133, Eye and face protection [related topic page]
- 1910.134, Respiratory protection [related topic page]
- 1910.135, Head protection
- 1910.136, Foot protection
- 1910.137, Electrical protective equipment
- 1910.138, Hand protection
- 1910 Subpart I - Appendix A, References for further information (Non-mandatory)
- 1910 Subpart I - Appendix B, Non-mandatory compliance guidelines for hazard assessment and personal protective equipment selection
- 1910.146, Permit-required confined spaces [related topic page]
- 1910.252, General requirements (Welding, cutting, and brazing) [related topic page]
- 1910 Subpart Z, Toxic and hazardous substances [related topic page]
- 1910.1030 OSHA Bloodborne Pathogen Standard
- 1910 Subpart D, Walking working surfaces.

NIOSH Revised NIOSH Lifting Guidelines

<http://www.cdc.gov/niosh/docs/94-110/>

NIOSH Ergonomic Guidelines for Manual Material Handling

<http://www.cdc.gov/niosh/docs/2007-131/pdfs/2007-131.pdf>

Endnotes

- i In conjunction with the research for this report, 20 recycling workers were interviewed in Spanish and English at one location in Southern California, one location in Northern California, and two locations in Eastern Massachusetts. Site visits in the MRFs where these workers were employed were conducted by occupational health researchers. We also draw on interviews by J. Tessler, an occupational health and safety partner. These first-hand accounts exemplify the larger trends that are documented in this report.
- ii This report on improving health and safety conditions at recycling facilities should not in any way be taken as a recommendation for landfills or incineration (also called “waste to energy” by the waste industry). These waste disposal methods are fraught with problems for communities and the environment, as well as serious health and safety dangers for workers.
- iii For example, in San Francisco, residents with medical conditions requiring the use of hypodermic needles may pick up a free Sharps Container at pharmacies in San Francisco. They can then drop it back off at any pharmacies. More information about the program is available at <http://www.sfrecycling.com/index.php/for-homes/household-hazardous-waste#needles>.
- iv Note: 25 states have state OSHA plans, some enforcing federal regulations but others with their own state regulations.

References

- ABC7 News. (2013, March 12). Man run over at recycling center in North Bay. Retrieved from <http://abc7news.com/archive/9024510/>. Accessed April 2015.
- ACGIH. (2009) Hand activity level: TLV® physical agents, 7th edition. *Cincinnati, Ohio: ACGIH*.
- American National Standards Institute. (May 2006). Guide for the Measurement and Evaluation of Human Exposure to Vibration Transmitted to the Hand. *New York, New York: ANSI S2.70-2006 (revision/replacement of ANSI S3.34-1986)*.
- American National Standards Institute. (1997). American national standard for equipment technology and operations for wastes and recyclable materials: baling equipment safety requirements. *New York, New York: American National Standards Institute (Z245.5)*.
- American National Standards Institute. (1997). American national standard for equipment technology and operations for wastes and recyclable materials: stationary compactors safety requirements. *New York, New York: American National Standards Institute (Z245.2)*.
- American Public Health Association. *Ensuring Workplace Protections for Temporary Workers*. Retrieved from <http://www.apha.org/policies-and-advocacy/public-health-policy-statements/policy-database/2015/01/28/14/43/ensuring-workplace-protections-for-temporary-workers> Accessed April 2015.
- APA (2015). Work, Stress and Health 2015: Sustainable Work, Sustainable Health, Sustainable Organizations. Retrieved from <http://www.apa.org/wsh/> Accessed April 2015.
- BARHII. (2014). The Minimum Wage and Health: A Bay Area Analysis. Retrieved from http://barhii.org/download/publications/barhii_2014_minimum_wage_health.pdf Accessed April 2015.
- Bell, K. (2011, June 13). St. Louis Co. man dies after getting caught in compactor. *St. Louis Post-Dispatch*. Retrieved from http://www.stltoday.com/news/local/crime-and-courts/st-louis-co-man-dies-after-getting-caught-in-compactors/article_0ee7a14c-95c7-11e0-a99f-0019bb30f31a.html. Accessed April 2015.
- Boston Zero Waste Task Force. (2014, March 11). *Don't Waste This Opportunity: Policy Recommendations for a Path to Zero Waste and Good Jobs for Boston*. Retrieved from http://www.cleanwater.org/files/TaskForce_Recommendations.pdf Accessed April 2015.
- Brownstein, B. & Matsumara, E. (2014, December 8). San Jose Contractor Flouting Multi-Million Dollar Wage Theft Violation. *The Left Hook*. Retrieved from <http://thelefthook.com/2014/12/08/san-jose-contractor-flouting-multi-million-dollar-wage-theft-violation/> Accessed April 2015.
- Bunn, TL., Slavonva, S., & Tang, M. (2011). Injuries among solid waste collectors in the private versus public sectors. *Waste Manag Res* 29(10):1043-1052. Retrieved from <http://wmr.sagepub.com/content/29/10/1043> Accessed April 2015.
- BLS (2010). TABLE A-1. Fatal occupational injuries by industry and event or exposure, All United States, 2010. *Census of Fatal Occupational Injuries*. Retrieved from <http://www.bls.gov/iif/oshwc/cfoi/cftb0250.pdf> Accessed April 2015.
- BLS (2014). Industry Injury and Illness Data – 2012. Supplemental News Release Table SNR05. Injury cases - rates, counts, and percent relative standard errors - detailed industry – 2012. Retrieved from <http://www.bls.gov/iif/oshwc/osh/os/ostb3573.pdf> Accessed April 2015.
- Bureau of Labor Statistics. Waste Management and Remediation Services: NAICS 562 *Industries at a Glance*. Retrieved from <http://www.bls.gov/iag/tgs/iag562.htm> Accessed April 2015.
- California Department of Industrial Relations (2012, May 3). Cal/OSHA cites Southern California Recycling Company for multiple safety violations. California Department of Industrial Relations News Release. Retrieved from <https://www.dir.ca.gov/DIRNews/2012/IR2012-21.html>. Accessed April 2015.
- CDC. (2001, April 27). Baler and Compactor-Related Deaths in the Workplace. United States, 1992-2000. *MMWR*.
- Clarke, C., & Martinez, M. (2008). Occupational Hazards of Waste and Recycling Workers. *Occupational Health and Safety Internship Program*. Los Angeles, CA. Unpublished manuscript.
- Domingo J., & Nadal, M. (2009). Domestic waste composting facilities: A review of human health risks. *Environment International*. 35: 382-389.

References

- Economic Policy Institute. (2015, April). Irregular Work Scheduling and Its Consequences. Briefing Paper #394. Retrieved from <http://www.epi.org/publication/irregular-work-scheduling-and-its-consequences/> Accessed April 2015.
- Elite Staffing. Waste Services Provider: Staffing Case Study. Retrieved from <http://www.elitestaffinginc.com/waste-services-case-study.php> Accessed April 2015.
- Espino K., & Kissinger A. (2011) Occupational Hazards of Waste Recycling Workers: LAANE's "Don't Waste L.A. Campaign." LAANE.
- Kehilla Community Synagogue. (2014, March 21). Economic Justice Committee Donates to Fired Undocumented Worker. Retrieved from <http://www.kehillasynagogue.org/2014/03/21/economic-justice-committee-donates-to-fired-undocumented-worker/> Accessed April 2015.
- GAO (United States Government Accountability Office). (2009, October). Workplace Safety and Health: Enhancing OSHA's Records Audit Process Could Improve the Accuracy of Worker Injury and Illness Data. *United States Government Accountability Office*.
- Grabell, M., Pierce, O., & Larson, J. (2013, December 18). Temporary Work, Lasting Harm. *ProPublica*. Retrieved from <http://www.propublica.org/article/temporary-work-lasting-harm> Accessed April 2015.
- Frazis, H., Gittleman, M., Horrigan, M., & Joyce, M. (1995, May). Employer-Provided Training: Results from a New Survey. *Monthly Labor Review* 3-17.
- Huren, A., Englehardt, JD., Fleming, LE., & Bean, JA. (1999). Occupational health and safety amongst municipal solid waste workers in Florida. *Waste Manage Res* 17(5): 369-377.
- IHSA (Infrastructure Health and Safety Association). Guide on the Prevention of Musculoskeletal Injuries. Retrieved from http://www.ihsa.ca/pdfs/msd/prevention_msi.pdf Accessed April 2015.
- International Labor Organization. (2012). Promoting Safety and Health in a Green Economy. Retrieved from http://www.ilo.org/safework/info/video/WCMS_175600/lang-en/index.htm Accessed April 2015.
- Jamison, J., & East Bay Alliance for a Sustainable Economy/EBASE. (2013). *Risks and Hazards for Recycling and Waste Workers in the Bay Area*. Retrieved from <http://lohp.org/wp-content/uploads/2013/09/EBASE.pdf> Accessed April 2015.
- Jordan, T. (2011, October 3). Northampton recycling plant worker injured on the job dies. *The Morning Call*. Retrieved from http://articles.mcall.com/2011-10-03/news/mc-northampton-greenstar-todd-heller-recycling-wor-20111003_1_northampton-recycling-plant-todd-heller-osharecords-show. Accessed April 2015.
- MassCOSH. (2010, April 28). Dying for Work in Massachusetts: Loss of Life and Limb in Massachusetts Workplaces. *Workers Memorial Day report*.
- LAANE. (2014). *From Waste to Resource: Restoring Our Economy with Recycling Careers*. Retrieved from http://www.laane.org/wp-content/uploads/2014/05/RecyclingJobsinLA_Report2014.pdf Accessed April 2015.
- Lavoie, J., & Guertin, S. (2001). Evaluation of Health and Safety Risks in Municipal Solid Waste Recycling Plants. *Journal of the Air and Waste Management Association*. 51(3): 352-360.
- Mishel, L., & Walters, M. (2003, August 26) How Unions Help All Workers, *Economic Policy Institute*. Retrieved from http://www.epi.org/publication/briefingpapers_bp143/ Accessed April 2015.
- Malmros, P., Sigsgaard, T., & Bach, B. (1992). Occupational Health Problems Due to Garbage Sorting. *Waste Management and Research* 10: 227 - 234.
- Messenger, B. (2013, March 20). Amputation at recycling plant prompts OSHA action in New Jersey. *Waste Management World*. Retrieved from <http://www.waste-management-world.com/articles/2013/03/amputation-recycling-plant-prompts-osharecords-show>. Accessed April 2015.
- National Waste & Recycling Association (2014). National Waste & Recycling Association Joins Other Groups in Opposing Changes to Labor Standards That Would Harm Waste & Recycling Industry. Retrieved from <https://wasterecycling.org/blog/2014/07/09/national-waste-recycling-association-joins-other-groups-in-opposing-changes-to-labor-standards-that-would-harm-waste-recycling-industry/> Accessed April 2015.
- NIOSH (1997). Musculoskeletal Disorders and Workplace Factors - A Critical Review of Epidemiologic Evidence for Work-Related Musculoskeletal Disorders of the Neck, Upper Extremity, and Low Back. Retrieved from <http://www.cdc.gov/niosh/docs/97-141/> Accessed April 2015.
- NIOSH (1999). Stress... At Work Booklet. DHHS (NIOSH) Publication No. 99-101
- NIOSH (1997). Control of scrap paper baler crushing hazards. Cincinnati, Ohio: US Department of Health and Human Services, Public Health Service; DHHS (NIOSH) publication no.97-107.
- NIOSH (2002). The Changing Organization of Work and the Safety and Health of Working People. Retrieved from <http://www.cdc.gov/niosh/docs/2002-116/pdfs/2002-116.pdf> Accessed April 2015.
- NIOSH, CDC (2012, March). Solid Waste Industry. NIOSH Fact Sheet. DHHS (NIOSH) Publication no. 2012-140.
- Olorunnishola, O. A., Kidd-Taylor, A & Byrd, L. (2010). Occupational injuries and illnesses in the solid waste industry: A call to action. *New Solutions*, 20:211-223.
- OSHA/Occupational Safety and Health Administration Regulations and Factsheets, Accessed April 2015:
- www.osha.gov, <https://www.osha.gov/SLTC/recycling/index.html>
https://www.osha.gov/SLTC/recycling/recycling_collection.html
https://www.osha.gov/SLTC/recycling/recycling_cardboard_baling.html
<https://www.osha.gov/SLTC/noisehearingconservation/healtheffects.html>
- OSHA. Occupational Heat Exposure. *United States Department of Labor*. Retrieved from <https://www.osha.gov/SLTC/heatstress/> Accessed April 2015.
- OSHA. (2007). Safeguarding Equipment and Protecting Employees from Amputation. *Small Business Safety and Health Management Series. OSHA 3170-02R*.
- OSHA (2010a). Inspection: 300751781. Retrieved from https://www.osha.gov/pls/imis/establishment.inspection_detail?id=300751781 Accessed April 2015.
- OSHA (2011a). US Department of Labor's OSHA cites Resource Management Cos. for 37 violations after worker fatality at Earth City, Mo., recycling plant. Region 5 News Release: 11-1736-KAN. Retrieved from https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=NEWS_RELEASES&p_id=21492 Accessed April 2015.
- OSHA (2011b). US Department of Labor's OSHA cites Marietta Industrial Enterprises in Marietta, Ohio, after worker's death at recycling facility. Region 5 News Release: 11-1367-CHI. Retrieved from

- https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=N EWS_RELEASES&p_id=20736 Accessed April 2015.
- OSHA (2011c). Inspection: 315340950. Retrieved from https://www.osha.gov/pls/imis/establishment.inspection_detail?id=315340950 Accessed April 2015.
- OSHA (2012a). Accident Investigation Summary: Employee Is Struck And Asphyxiated By Paper Load, Later Dies. Inspection: 316002914. Retrieved from https://www.osha.gov/pls/imis/establishment.inspection_detail?id=316002914 Accessed April 2015.
- OSHA (2012b). Inspection: 314912494 - Smurfit-Stone, Inc. Retrieved from https://www.osha.gov/pls/imis/establishment.inspection_detail?id=314912494 Accessed April 2015.
- OSHA (2012c). US Department of Labor's OSHA cites Olde Atlanta Recycling with 23 safety and health violations, proposes more than \$69,000 in fines. *OSHA Regional News Release*. Retrieved from https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=N EWS_RELEASES&p_id=21978 Accessed April 2015.
- OSHA (2012d). Inspection: 316210319. Retrieved from https://www.osha.gov/pls/imis/establishment.inspection_detail?id=316210319 Accessed April 2015.
- OSHA (2012e). Weekly Summary (Federal and State data tabulated week ending September 29, 2012). Retrieved from https://www.osha.gov/dep/fatcat/fatcat_weekly_rpt_09292012.html Accessed April 2015.
- OSHA (2013a). US Labor Department's OSHA cites Eagle Recycling in North Bergen, NJ, for safety violations following worker amputation. Region 2 News Release: 13-365-NEW (osha 13-022). Retrieved from https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=N EWS_RELEASES&p_id=23787 Accessed April 2015.
- OSHA (2013b). Accident Investigation Summary: Employee Fractures Leg In Baler. Inspection 316805407. Retrieved from https://www.osha.gov/pls/imis/accidentsearch.accident_detail?id=202654117 Accessed April 2015.
- OSHA (2015a). Fatal occupational injuries by selected worker characteristics and selected industry, Materials recovery facilities (NAICS 562920), 2011 – 2013.
- OSHA (2015b). Reports of Fatalities and Catastrophes, Archive from 2009 – 2013, https://www.osha.gov/dep/fatcat/dep_fatcat_archive.html Accessed April 2015.
- Partnership for Working Families. (2013). *Transforming Trash in Urban America*. Retrieved from <http://www.forworkingfamilies.org/sites/pwf/files/0313%20Recycling%20Report.final.pdf> Accessed April 2015.
- Punnett, L., & Wegman, DH. (2004). Work-related musculoskeletal disorders: the epidemiologic evidence and the debate. *Journal of Electromyography and Kinesiology* 14, no. 1: 13-23.
- Riley, K., Morier, D. (2015, March). Patterns of Work-Related Injury and Common Injury Experiences of Workers in the Low-Wage Labor Market. *Report to the Commission on Health and Safety and Workers' Compensation, California Department of Industrial Relations*. Retrieved from http://www.dir.ca.gov/CHSWC/Reports/2015/Patterns_Work_Related_Injury.pdf Accessed April 2015.
- Roberts, G. (2013, March 16). Horror as worker is crushed by trash compactor in Brooklyn. *New York Post*. Retrieved from <http://nypost.com/2013/03/16/horror-as-worker-is-crushed-by-trash-compactor-in-brooklyn/>. Accessed April 2015.
- Schnall PL, Dobson M, Rosskam E. (eds.). (2009). *Unhealthy Work: Causes, Consequences, Cures*. Baywood Publishing.
- Sigsgaard, T., Malmros, P., Nersting, L., & Peterse, C. (1994). Respiratory disorders and atopy in Danish refuse workers. *Am J Respir Crit Care Med* 149:1407-12.
- Smith, R., & McKenna, C. (2014). Temped Out: How the Domestic Outsourcing of Blue-Collar Jobs Harms America's Workers. *National Employment Law Project and the National Staffing Workers Alliance*.
- Tellus Institute and Sound Resource Management. (2011). *More Jobs, Less Pollution: Growing the Recycling Economy in the US*. Retrieved from <http://www.no-burn.org/downloads/MoreJobsLessPollutionFinal.pdf> Accessed April 2015.
- Texas Campaign for the Environment Fund and Zero Waste Houston Coalition (2014). It's Smarter to Separate: How Houston's Trash Proposal Would Waste our Resources, Pollute Our Air, and Harm Our Community's Health. Retrieved from http://zerowastehouston.org/wp-content/uploads/2014/07/ItsSmartertoSeparate_TCEF_ZeroWaste-HoustonReport_July20141.pdf Accessed April 2015.
- Townsend, T., Tolaymat, T., Leo, K., & Jambeck, J. (2004). Heavy metals in recovered fines from construction and demolition debris recycling facilities in Florida. *Science of the Total Environment*, 332, 1-11.
- Tribune-Review. (2011, December 20). Fayette man fatally crushed by bales of paper. Retrieved from http://triblive.com/x/pittsburghtrib/news/regional/fayette/s_772745.html/#axzz3XJxnC2lv. Accessed April 2015.
- Wasserman, Donald E. (2006). HAND-Arm Vibration Standards: The New Ansi S2.70 Standard. Retrieved from: http://www.public.navy.mil/comnavsafecen/Documents/acquisition/wasserman_HAV_stds_06.pdf Accessed April 2015.
- West Coast Climate and Materials Management Forum (2012). *Climate Action Toolkit*. Retrieved from <http://westcoastclimateforum.com/toolkit/homepage> Accessed April 2015.
- US Census Bureau. (2014, December). Economic Census Industry Series, 2012: Waste Management and Remediation Services. EC125611. Retrieved from http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ECN_2012_US_5611&prodType=table Accessed April 2015.
- USEPA. (2014). Municipal Solid Waste Generation, Recycling and Disposal in the United States: Facts and Figures for 2012. Retrieved from http://www.epa.gov/solidwaste/nonhaz/municipal/pubs/2012_msw_fs.pdf Accessed April 2015.
- Zullo, R. (2011). *Right-to-Work Laws and Fatalities in Construction*. Retrieved from <http://irlee.umich.edu/Publications/Docs/RightToWorkLawsAndFatalitiesInConstruction.pdf> Accessed April 2015.