Center for American Progress

Toxic Trains and the Terrorist Threat

How Water Utilities Can Get Chlorine Gas Off the Rails and Out of American Communities

Paul Orum

Progressive Ideas for a Strong, Just, and Free America

TOXIC TRAINS AND THE TERRORIST THREAT

How Water Utilities Can Get Chlorine Gas Off the Rails and Out of American Communities

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Executive Summary

Each year, thousands of tons of highly toxic chlorine gas travel by rail in the United States to drinking water and wastewater treatment facilities and other industries. These massive railcars traverse some 300,000 miles of freight railways, passing through almost all major American cities and towns. A rupture of one of these railcars could release a dense, lethal plume for miles downwind, potentially killing or injuring thousands of people.

The Department of Homeland Security and numerous security experts have repeatedly warned that terrorists could use industrial chemicals as improvised weapons of mass destruction—and indeed, terrorists recently attacked and blew up several trucks carrying chlorine in Iraq. In this respect, railcars of chlorine gas represent a distinct national security vulnerability. Yet Congress and the Bush administration have not acted to eliminate unnecessary uses of chlorine gas railcars even where undeniably affordable and practical alternatives exist.

To examine this vulnerability and encourage action, the Center for American Progress surveyed water utilities that still receive chlorine gas by rail, as well as utilities that since 1999 have eliminated chlorine railcars by switching to a less hazardous disinfectant. Our major findings are shown in the box on page 3.

Just 37 drinking water and wastewater treatment facilities still receive chlorine gas by rail. More than 25 million Americans live in harm's way near these facilities,[1] while millions more live in cities and towns along the rail delivery routes.

The good news is this vulnerability can be removed. Since 1999, some 25 water utilities that formerly received chlorine gas by rail have switched to safer and more secure water treatment options, such as liquid bleach or ultraviolet light. These alternative treatment options eliminate the danger of a catastrophic toxic gas cloud. As a result, more than 26 million Americans who live near these facilities are safer and more secure.

These conversions also remove the threat to communities along rail delivery routes. Railroads, by their nature, are wide open and largely insecure, providing easy access to railcars—as evidenced by the graffiti that frequently marks them (see photo on page 15). This makes it practically impossible to provide security commensurate with the risk presented by railcars of chlorine gas.

The only way to truly protect communities is to get unnecessary toxic cargoes off the tracks. Converting to safer alternatives for water treatment does that.

There continues to be some progress in this direction. At least six water utilities that now use chlorine-gas railcars are in the process of converting operations. Nonetheless, many others contacted by this survey have no plans to change.

Cost was a frequently cited reason for not converting. But the survey found such conversions are affordable even at large facilities, costing no more than $1.50 per person served each year—or the price of a bag of potato chips—and often much less. Put another way, a single day's expenditures on the war in Iraq could cover construction costs of converting the remaining U.S. water utilities off chlorine gas railcars. Cost is not a sufficient justification to continue to jeopardize American communities with massive railcars of chlorine gas.

State and local governments may provide incentives for water utilities to switch from chlorine gas. But communities along the rails have little or no local control over toxic trains that pass by homes, workplaces, and schools. The plant conversions identified in this report are positive, but without a national strategy, these communities will be much less secure than they should be.

Washington, D.C., for example, quickly converted its sewage treatment plant from chlorine gas railcars to liquid bleach in the aftermath of the Sept. 11, 2001, terrorist attacks. But hazardous chemicals, including chlorine gas, are still being transported by rail through the District just a few city blocks from the U.S. Capitol building—an intended target on 9/11.

In response, the city government sought to reroute toxic trains around the city. The Bush administration, however, has backed a lawsuit to block local control, arguing that local governments lack legal authority to protect citizens by rerouting trains.

The story is the same in other cities that have converted water utilities from chlorine-gas railcars, such as Cleveland and Indianapolis. Despite converting, these cities are still at risk from chlorine-gas railcars headed to other cities that have not converted, such as Minneapolis and Nashville.

A comprehensive solution can only come from the federal level. In fact, judges in the ongoing litigation over rerouting in Washington, D.C., have encouraged the Bush administration to develop a national strategy to address the security and safety dangers involved in the manufacture, use, and transportation of chlorine gas and other hazardous chemicals. Unfortunately, the administration and Congress have largely ignored this advice.

After years of inaction, and under growing public pressure, temporary and cosmetic chemical security legislation was enacted in October 2006 requiring the Department of Homeland Security to promulgate chemical-plant security regulations by April 4, 2007. But the legislation exempts water utilities, does not address transportation security concerns, and neglects safer and more secure technologies. Thus, among other shortcomings, DHS's new regulations will do nothing to address the risk posed to tens of millions of Americans by unnecessary rail shipments of chlorine gas to water utilities.

To address this danger and other chemical hazards, Congress must create meaningful national incentives. Among other actions, federal security standards should:

- Require chemical facilities to review and use available, cost-effective technologies that significantly reduce or eliminate serious emergency chemical release hazards;
- Target assistance to help water utilities convert from chlorine gas, including facilities that discontinued chlorine gas after Sept. 11, 2001;
- Give the Department of Homeland Security full authority to safeguard chemical infrastructure and the public, with appropriate roles for other governmental agencies; and
- Require chemical facilities to account for transportation risks—including the possibility of a catastrophic chemical release—in developing security assessments and plans.

Taking these actions would remove unnecessary toxic cargoes from the nation's railways and communities. The danger is immense and the solutions are clear. What we need now is action.

Major Findings

The Center for American Progress surveyed 62 water facilities that receive chlorine gas by rail or previously received chlorine gas by rail. These facilities treat an average of five billion gallons of drinking water and four billion gallons of wastewater each day, and serve more than 45 million people in two dozen states and the District of Columbia.[2] The survey identified facilities that have eliminated chlorine gas railcars, but also found others that have no plans to do so. Major survey findings include:

- **Only 24 drinking water and 13 wastewater facilities still use *rail shipments* of chlorine gas.** These facilities are found in California, Florida, Kansas, Kentucky, Louisiana, Michigan, Minnesota, Missouri, Nebraska, South Carolina, Tennessee, Texas, Utah, and Virginia. These facilities endanger more than 25 million Americans who live nearby, and millions more near railways that deliver the chlorine gas.
- **At least six drinking water and 19 wastewater facilities have eliminated *rail shipments* of chlorine gas since 1999 by switching to a less hazardous disinfectant.** These facilities are found in California, the District of Columbia, Florida, Georgia, Indiana, Kentucky, Louisiana, Maryland, Michigan, Minnesota, New Jersey, New York, Ohio, Oregon, Pennsylvania, and Washington. Some 26 million people in nearby communities and millions more along rail delivery routes are no longer threatened by chlorine gas from these facilities. Additional water utilities eliminated chlorine gas rail shipments prior to 1999.[3]
- **Of facilities that still receive *rail shipments* of chlorine gas, at least four drinking water and two wastewater plants have definite plans to convert from chlorine gas to a safer, more secure disinfectant.** These facilities are found in Colorado, Florida, Kentucky, Louisiana, South Carolina, and Virginia. By converting, they will remove the threat to more than five million people living nearby, and millions more along their rail delivery routes. Several more such facilities are planning to convert within a few years, and others are evaluating alternatives.[4]
- **Chlorine gas rail shipments travel long distances through populated areas.** Some 16 chlorine production sites sell chlorine by rail to the merchant market. The profusion of freight rail lines precludes identifying specific routes between producers and water utilities. The locations of producers and chlorine-gas-using water utilities, however, make clear that rail shipments often cover hundreds or even thousands of miles.
- **General cost estimates provided by 20 water facilities indicate that switching from chlorine gas to a safer, more secure disinfectant is affordable.** Conversions at these facilities cost no more than $1.50 per person served each year—or the price of a bag of potato chips—and often cost much less. A single day's expenditures on the war in Iraq could easily have paid to convert these 20 facilities off chlorine gas.

Dangerous State of Play

Chemical Railcars Pose Serious Hazards

Exposure to chlorine gas can severely burn the eyes, skin, and lungs, and can be fatal. When released from a railcar, compressed chlorine expands rapidly into a ground-hugging poison gas cloud. A single ruptured railcar of chlorine gas can release a dense, lethal plume from 14 miles to 25 miles downwind in worst-case conditions.[5] In large urban areas, thousands of people could be killed or seriously injured in these conditions.

The Department of Homeland Security estimates that a major chlorine railcar spill could kill 17,500 people.[6] A Naval research lab likewise found that such a spill could quickly cause 100,000 serious injuries or deaths under a scenario involving large holiday crowds.[7]

This risk is especially worrisome given the vulnerability of railcars. A RAND Corp. database of worldwide terrorist incidents recorded over 250 attacks against rail targets from 1995 to 2005.[8] Insurgents in Iraq have recently targeted trucks carrying chlorine gas with several deliberate attacks.[9]

The graffiti on many railcars attests to their vulnerability. A survey of rail workers reported widespread lax security at rail yards.[10] Investigative news reports repeatedly show easy access to chemical facilities and rail cargoes.[11] A *Pittsburgh Tribune* reporter recently found so little security he could leave his business card on dozens of railcars and locations.[12]

Railcars may travel or sit near schools, hospitals, homes, and downtowns with only nominal security, if any. The railroad carrier may simply park the chlorine railcar outside the water utility fence on an unpredictable schedule, leaving it for the facility to retrieve. Rail security regulations are minimal, yet because federal rules preempt state and local requirements, chemical railcars passing through communities are largely exempt from local control.

Major chlorine rail spills are infrequent but can be deadly. Chlorine rail spills killed eight people in Youngstown, Fla., in 1978; 17 people in Montanas, Mexico in 1981; three people near San Antonio, Texas in 2004; and nine people in Graniteville, S.C., in 2005. Since 1990, the National Response Center has recorded over 160 mostly-minor spill reports involving railroads and chlorine, or more than one every six weeks.[13]

Such spills reveal the overall vulnerability of the system. But a calculated terrorist rupture of a single chlorine-gas-filled railcar could have far worse consequences, potentially poisoning an entire community.

New Interim Chemical Security Rules Won't Fix the Problem

Many federal agencies and others have warned that terrorists could use chemical facilities as pre-positioned weapons of mass destruction.[14] Yet there are almost no federal chemical security requirements. Congress enacted temporary legislation in October 2006 that requires the Department of Homeland Security to promulgate interim, stopgap chemical security requirements by April 4, 2007.[15]

But this new law is seen as an incomplete measure that will ultimately be replaced by comprehensive legislation. It has significant shortcomings that leave millions of Americans vulnerable. In particular, the new regulations:

"We are happy not to have the chlorine gas there. In the end it was a no-brainer to switch."

Bill McKeon, Chief-Wastewater, Philadelphia Water Department, Philadelphia, Pa.

- Exempt drinking water and wastewater plants and other types of facilities;
- Do not require facilities to address the dangers, security costs, and potential liabilities of transporting extremely hazardous materials to or from their facilities; and
- Ignore cost-effective safer technologies that are the most effective way to reduce the attractiveness of chemical facilities as terrorist targets.

These regulations are too focused on physical security at facilities and do not do enough to emphasize supply chain security. Better fencing, lighting, and access controls are important, but insufficient—particularly if the delivery of hazardous materials to or from a facility travels by rail through a major urban center.

In 2006, the Transportation Security Administration released draft voluntary action items for securing rail transportation of toxic inhalation materials such as chlorine gas. Yet the voluntary recommendations lack enforcement, are vague on key elements (such as protecting railcars in transit), and are silent on feasible opportunities to take hazardous cargoes off the rails.

The Bioterrorism Act of 2002 provided substantial federal funding to drinking water facilities to conduct vulnerability assessments, but did not require these facilities to reduce any hazards or otherwise improve security. Similarly, there are no significant federal security standards for wastewater plants.

Homeland Security Presidential Directive 7 designated the U.S. Environmental Protection Agency as the lead agency to oversee security at drinking water and wastewater facilities.[17] The EPA could require preventive security at water utilities under the general duty clause of the Clean Air Act. The Bush administration, however, blocked a specific proposal developed by EPA and the then Office of Homeland Security (now DHS) to use this authority to establish federal chemical security standards.[18]

Less Hazardous Alternatives Are Available

In 2006 the National Research Council reported that "the most desirable solution to preventing chemical releases is to reduce or eliminate the hazard where possible," including by modifying processes or replacing hazardous materials with less hazardous substitutes.[19] Two years ago, the Center for American Progress recommended an action plan for safeguarding hazardous chemical facilities using these techniques,[20] and one year ago released survey findings that documented some 284 facilities across diverse industries that had switched to less acutely hazardous options.[21]

The Association of American Railroads supports development of less hazardous products and technologies as substitutes for highly hazardous materials. In congressional testimony, the association explained that chlorine gas and other "toxic inhalation hazard," or TIH, chemicals comprise just 0.3 percent of all rail shipments, but railroads face potentially ruinous liability from hauling these chemicals (which they are required to carry). For this reason, the railroads "strongly support efforts aimed at finding and utilizing 'inherently safer technologies' as substitutes for hazardous materials, especially TIH" that are shipped by rail.[22]

Roughly two-thirds of large U.S. wastewater utilities already use a disinfectant chemical other than chlorine gas, or

plan to stop using chlorine gas.[23] At least 160 large U.S. public drinking water systems already use liquid bleach.[24] In last year's survey, the Center for American Progress identified more than 200 drinking water or wastewater facilities that had eliminated chlorine gas since 1999—a sample of similar changes at many water utilities nationwide.[25] Most of these water facilities switched to liquid bleach, while others use ultraviolet light.

Last year's report noted that approximately 1,700 drinking water plants and 1,150 wastewater facilities report extremely hazardous substances, primarily chlorine gas, under EPA's Risk Management Planning program. This year's survey report focuses on just those water utilities that recently have received chlorine gas by rail.

Utilities that eliminate chlorine gas may replace other hazardous chemicals. Some wastewater facilities remove chlorine from effluent by using anhydrous sulfur dioxide, a dangerous toxic gas. These facilities frequently replace anhydrous sulfur dioxide with less hazardous sodium bisulfite. Similarly, some drinking water facilities replace anhydrous ammonia, a toxic gas, with aqueous ammonia, a less hazardous alternative.

Replacement Chemicals Can Be More Safely Produced

Water utilities can buy concentrated bleach in bulk as sodium hypochlorite, or generate dilute bleach on-site from salt and electricity. Recent high prices for chlorine make on-site generation increasingly attractive even for larger water utilities. Several facilities surveyed in this report are considering or adopting on-site bleach, while others are considering or adopting ultraviolet light. Both options eliminate bulk transportation of extremely hazardous substances and greatly reduce overall transportation needs.

In our survey for this report, we found many utilities that eliminated chlorine gas now buy bulk sodium hypochlorite bleach. One argument against converting water utilities to bleach is that it simply shifts the danger to bleach manufacturing facilities,

A freight train derailed on Jan. 6, 2005, in Graniteville, S.C., rupturing a railcar of chlorine gas. The leaking gas visible in the photo above killed nine people, sent 500 to the hospital with breathing problems, and caused more than 5,000 to evacuate for several days. (U.S. EPA)

which typically make hypochlorite from bulk rail shipments of chlorine gas. Producers, however, can manufacture hypochlorite using "just-in-time" technology, in which chlorine gas is created and promptly used only in small amounts, eliminating the danger of a catastrophic gas release.

This process is used in Asia, Australia, Europe, and a few U.S. locations.[26] Further industrial-scale production is under development in the United States.[27] Currently, some 94 manufacturers across the country produce sodium hypochlorite for use in industrial or household products.[28] Full conversion to producing hypochlorite without bulk chlorine gas would eliminate thousands of rail shipments each year and take millions of Americans out of harms way.

"We are very glad the chlorine gas is gone. It's an achievement. It used to be our number one employee concern."

Ray Flasco, Water Supply Division Manager, Akron Water Supply Plant, Kent, Ohio

Producing hypochlorite bleach from bulk chlorine gas is currently marginally cheaper than using safer and more secure methods—but only insofar as companies do not pay the full costs of security and liability insurance for a potential catastrophic chlorine release. Requiring producers that use bulk chlorine gas to internalize these costs would immediately make large-scale production using safer and more secure methods cost-competitive.

Major Survey Findings

Few Water Utilities Still Use Chlorine Gas Railcars

Only 24 drinking water and 13 wastewater facilities still use *rail shipments* of chlorine gas. Yet because of these few facilities, thousands of tons of deadly chlorine gas pass through major American cities. Some 25 million Americans live within range of a worst-case toxic gas release around these facilities, and millions more live along rail delivery routes. Among these 37 facilities are:

- St. Paul Regional Water Services-McCarron, Maplewood, Minn., 1.3 million people at risk
- Kansas City, Missouri Water Treatment Plant, 720,000 people at risk
- Omohundro Water Treatment Plant, Nashville, Tenn., 973,663 people at risk
- East Bank Wastewater Treatment Plant, New Orleans, La., 726,185 people at risk*
- Central Regional Wastewater System, Grand Prairie (Dallas), Texas, 3.9 million people at risk

For a complete list see Appendix A on page 16 and the map on page 11.

Many Water Utilities Have Switched to Safer, More Secure Alternatives

At least six drinking water and 19 wastewater facilities have eliminated *rail shipments* of chlorine gas by switching to a less hazardous disinfectant since 1999. As a result, more than 26 million people no longer live within range of a chlorine gas release from these facilities, and additional millions are no longer in danger from rail shipments to these facilities. Among these 25 facilities are:

- Wyandotte Wastewater Treatment Facility, Wyandotte, Mich., 1.1 million people no longer at risk
- Baldwin Water Treatment Plant, Cleveland, Ohio, 1.4 million people no longer at risk

* Population before hurricane Katrina. Facility intends to convert to liquid bleach but lacks dedicated funding amid extensive post-Katrina needs.

- Metropolitan Wastewater Treatment Plant, St. Paul, Minn., 520,000 people no longer at risk
- Joint Water Pollution Control Plant, Carson, Calif. (Los Angeles County), 210,000 people no longer at risk
- White River Water Treatment Plant, Indianapolis, Ind., 968,579 people no longer at risk

For a complete list see Appendix B on page 18 and the map on page 11. Additional water utilities eliminated chlorine gas rail shipments prior to 1999.[29]

Some Additional Water Utilities Are Eliminating Chlorine Gas

Of the 37 water facilities that still use chlorine railcars, at least four drinking water and two wastewater plants are currently converting to a safer, more secure disinfectant with at least partial construction planned by 2008. Completing these conversions will cut chemical hazards for five million people who live nearby and many others along freight railways. Facilities with well-developed plans to convert include:

- Metro Wastewater Reclamation District, Denver, Colo., 925,000 people at risk
- City of Richmond Water Purification Plant, Richmond, Va., 704,630 people at risk
- Carrollton Water Purification Plant, New Orleans, La., 892,320 people at risk**

Several other facilities may convert within a few years, and others are evaluating alternatives. Two other facilities (in Stockton and San Jose, Calif.) occasionally use liquid bleach as an available backup, but are evaluating more serviceable long-term solutions such as ultraviolet light.

Chlorine Gas Railcars Travel Over Long Distances

Each year, approximately 45,000 shipments of chlorine gas travel by rail in the United States. These shipments may travel over more than 300,000 miles of freight railways across the country.[30] Rail lines pass through almost all major American cities and towns.

The 16 chlorine production sites listed in Appendix C reportedly sell chlorine by rail to water utilities through the merchant market. Usually, a distributor company moves the chlorine gas from the original manufacturer to the water utility. These rail shipments may travel long distances—hundreds or even thousands of miles—passing through densely populated cities and towns. There is no legal requirement to use the closest supplier or the safest route.

The large water utilities covered by this report account for only a small portion of the chlorine on the rails—but are by their nature located in or near large cities or towns. Producers also ship to chlorine packaging locations and sodium hypochlorite bleach production facilities. Additional destinations include PVC plastics producers, some paper mills, and chemical manufacturers. Roughly two-thirds of chlorine is never shipped, but rather is used on-site in chemical manufacturing or is moved by pipeline to nearby facilities. For this very reason, chemical manufacturers may co-locate to avoid shipping chlorine gas.[31]

The profusion of freight rail lines precludes identifying specific routes between producers and water utilities. However, the map on page 11 illustrates the long distances that rail shipments must travel between manufacturers and the few water utilities that still receive chlorine gas by rail.

"As a plant operator it's a weight off your shoulders if you don't have that risk of chlorine gas."

Nick Frankos, Plant Manager, Back River Wastewater Plant, Baltimore, Md.

** Population before hurricane Katrina.

Utilities Cited a Number of Reasons for Switching

Personnel at water facilities that eliminated chlorine gas were generally relieved to be rid of it and considered the change an achievement. Reasons and advantages for switching included: improving safety and security; meeting discharge requirements; reducing liability exposure; cutting costs of preventive maintenance, training, emergency planning, and regulatory compliance; mitigating on-site security costs associated with chlorine gas; and previous experience with chlorine leaks.

Most surveyed facilities that have not converted are evaluating disinfectant options. These facilities cited as potential obstacles: costs of capital and replacement chemicals; the large size of the utility and needed chemical volumes; storage space and shelf life of liquid bleach; requirements to maintain backup disinfection capability; and the need for reliable information on alternatives.

Some facilities also noted investments in chlorine-gas security, such as containment buildings, sensors, and scrubbers. Such sunk costs may create a disincentive to further change yet do nothing to protect incoming rail shipments.

"Maintenance cost… priceless! No special training or emergency repair kits to keep on hand. We do all our repairs in-house where chlorine required an outside contractor. The Fire Department loves us. No more emergency drills and training."

John Garvin, Operation and Maintenance Manager, Regional Water Resource Agency, Owensboro, Ky.

Conversion Costs Are Manageable

Twenty facilities provided general information on the construction and operating costs of converting off chlorine gas railcars. Switching these facilities to a safer, more secure disinfectant is affordable, costing no more than $1.50 per year per person served—the price of a bag of potato chips—even without accounting for important cost savings. Many facilities are spending well less than that amount. Examples are described in the box on pages 12–13.

Cost figures varied widely depending on facilities' specific circumstances and the information available to respondents. Some facilities, for example, needed to upgrade aging infrastructure; others did not. While many respondents were able to estimate construction and chemical costs, most found it difficult to compile information on *avoided* costs from readily available sources. Some facilities, however, identified important savings in preventive maintenance, emergency planning, employee training, regulatory compliance, future site security, or other factors.

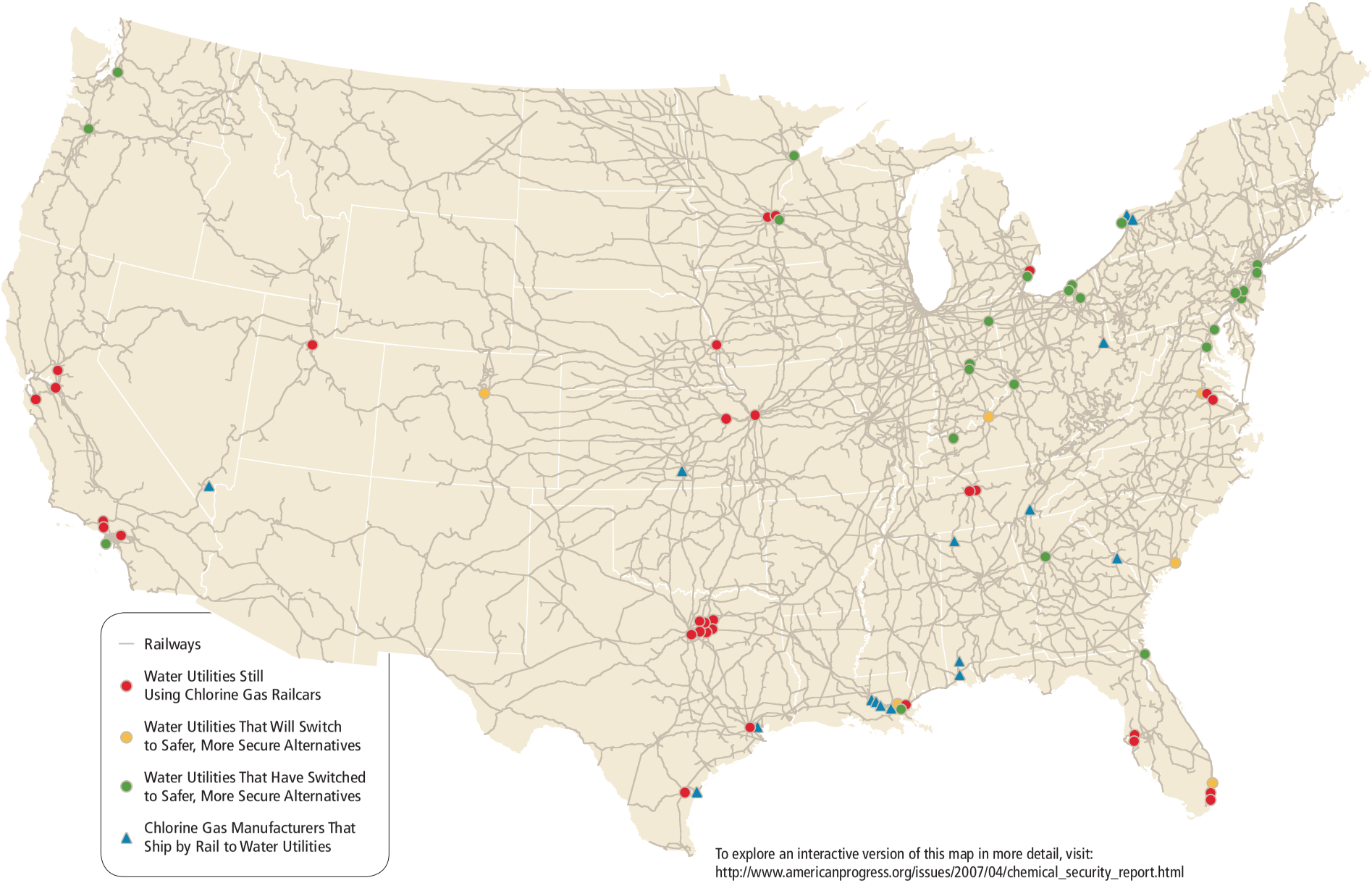
Facilities using chlorine gas face new demands to upgrade physical security to protect against a possible terrorist attack. Current practices include at best such meager physical security measures as better fences, vehicle gates, lights, employee identification, and cameras. Some facilities may also have enclosures and gas scrubbers that attempt to contain an emergency release. Converting from chlorine gas mitigates these costs while providing superior protection to employees and surrounding populations.

After all, there is little reason to believe that current security practices would be able to withstand a well-executed attack by an armed intruder. Nor does enhanced physical security do anything to protect railcars in transit to the facility.

The Government Accountability Office is currently conducting a review of costs associated with conversion of water utilities to less hazardous chemicals. This GAO report is expected in spring 2007.

Unnecessary Rail Shipments of Chlorine Gas Endanger Millions

Shown are 37 water utilities that still receive chlorine gas by rail. Distributors ship railcars of chlorine gas from 16 manufacturers to these utilities—frequently over long distances and through densely populated areas. Also shown are 25 water utilities that since 1999 have eliminated railcar shipments of chlorine gas by converting to safer, more secure alternatives for water treatment. Millions of people along railroads are no longer endangered by chlorine gas shipments to these utilities. Of utilities that still receive chlorine gas by rail, at least six more have firm plans to convert from chlorine gas within two years.



To explore an interactive version of this map in more detail, visit:
http://www.americanprogress.org/issues/2007/04/chemical_security_report.html

Conversion Costs at Specific Facilities

These 20 water utilities were able to convert from chlorine gas railcars to effective alternatives at a reasonable cost.[32] A single day's expenditures on the war in Iraq could have easily paid for all these conversions.

- **The Metropolitan Wastewater Treatment Plant in St. Paul, Minn.,** switched from chlorine gas railcars to liquid bleach in late 2005. The aging plant required upgrades that were projected to cost about the same whether staying with chlorine gas or switching to liquid bleach. Actual construction cost $7.8 million, and chemical costs increased $85,000 per year. Annual operating costs of preventive maintenance, energy, and emergency preparedness decreased about $65,000, while in-plant security decreased an estimated $35,000. The entire metropolitan wastewater system serves about 2.4 million people; annual conversion costs, including otherwise necessary construction, are about 20 cents per person served.

- **The Columbia Boulevard Wastewater Treatment Plant in Portland, Ore.,** switched from chlorine gas railcars to liquid bleach in 2005. Construction cost $4.4 million, and increased chemical costs are more than offset by operating savings anticipated from reduced need for maintenance, electric power, training, labor, and emergency planning. The facility serves some 550,000 people, who will benefit from the offset of operating costs in the long term.

- **The Akron Water Supply Plant in Kent, Ohio,** switched from chlorine gas railcars to liquid bleach in 2004. Construction cost about $1.1 million (or one-fourth the cost of a new chemical building) and operating costs increased about $65,000 per year, primarily to cover chemicals. The facility, however, avoided over $1.2 million in construction costs by eliminating chlorine gas. By switching, the facility avoided constructing a containment building to enclose railcars ($308,000), installing an emergency gas scrubber ($598,000), and upgrading certain process equipment such as a chlorine gas evaporator ($369,000). Even without considering avoided costs, the facility's 280,000 customers pay only approximately 50 cents more each year.

- **The Edward P. Decher Secondary Wastewater Plant in Elizabeth, N.J.,** switched from chlorine gas to liquid bleach in 2003. Construction upgrades cost $750,000 and chemical costs increased $291,000 from 2002 to 2004, while maintenance and training costs decreased an estimated $70,000 per year. The facility serves about 500,000 people; annual conversion costs are about 55 cents per person served.

- **The South Treatment Plant in Renton, Wash.,** switched from chlorine gas to liquid bleach in 2003. Construction cost $2.4 million, and chemical costs increased about $350,000 per year. The entire wastewater system serves about 1.4 million people; without accounting for any operating savings, annual conversion costs are less than 40 cents per person served.

- **The Western Lake Superior Sanitary District in Duluth, Minn.,** switched from chlorine gas to liquid bleach in 2006. Construction cost $1.6 million. Operating costs initially remained about the same, with increased chemical costs offset by decreased demurrage charges that resulted from keeping a chlorine railcar on-site. A newly revised discharge permit will likely lengthen the disinfection season and increase chemical costs in the future. The facility serves 110,000 people; annual conversion costs are thus far about a dollar per person served.

- **Crescent Hill Water Treatment Plant in Louisville, Ky.,** is building an on-site generating facility for bleach disinfectant at an estimated capital cost of roughly $10 million. Accounting for depreciation, the facility estimates the cost of switching over from chlorine gas at about $500,000 annually. The entire water system serves about 850,000 people; estimated annual conversion costs are about 60 cents per person served.

- **The City of Richmond Water Purification Plant in Richmond, Va.,** is switching from chlorine gas railcars to liquid bleach in early 2007. Construction cost $11 million for a new building, about one-third directly linked to storage of liquid bleach. Chemical costs are anticipated to increase $450,000 per year. The facility serves about 500,000 people;

without accounting for any operating savings, annual conversion costs are about $1.50 per person served.

- **Blue Plains Sewage Treatment Plant in Washington, D.C.,** switched from chlorine gas railcars to liquid bleach immediately after September 11, 2001. According to the plant's chief engineer at the time, the change adds about 25 cents per month to the average household customer's utility bill.[33]

- **The Nottingham and Baldwin drinking water treatment plants in Cleveland, Ohio** completed conversion from chlorine gas to liquid bleach in late 2002 and 2005, respectively. Construction cost an estimated $2,475,000 for both plants, and chemical costs increased about $208,000 per year. The Cleveland division of water serves some 1.5 million people; without accounting for any operating savings, annual conversion costs are less than 25 cents per person served.

- **The Buckman Water Reclamation Facility in Jacksonville, Fla.,** switched from chlorine gas railcars to ultraviolet light in 2001. Construction cost $6 million, including about $1 million for unrelated upgrades. Electricity costs increased about $150,000 per year over the previous cost of chlorine gas, but only if not considering recent dramatic chlorine price increases. The entire wastewater system serves about 575,000 people; annual conversion costs are about 80 cents per person served.

- **The Wyandotte Wastewater Treatment Facility in Wyandotte, Mich.,** switched from chlorine gas railcars to ultraviolet light in 2000. Construction cost $8 million, and operating costs increased from about $320,000 to $350,000 each year. The wastewater system serves about 415,000 people; annual conversion costs are about $1.30 per person served.

- **The Mill Creek Wastewater Treatment Plant in Cincinnati, Ohio,** switched from chlorine gas railcars to liquid bleach in 2001. Constructing a temporary conversion cost less than $40,000; planned permanent construction is projected to cost less than $3 million. Chemical costs increased about $290,000 per year. The entire metropolitan sewer district serves about 800,000 people; without accounting for any operating savings, annual conversion costs are about 60 cents per person served.

- **The City of Philadelphia** converted its Northeast, Southeast, and Southwest water pollution control plants from chlorine gas to liquid bleach. Capital costs for conversion were $5.9 million for all three plants, and chemical costs increased about $275,000 per year. After converting to liquid bleach, these facilities jointly save roughly $75,000 each year in reduced labor and risk management planning costs. The entire wastewater system serves about 2.2 million people; annual conversion costs are about 25 cents per person served.

- **Samuel S. Baxter Water Treatment Plant in Philadelphia, Pa.,** converted to liquid bleach in 2005. Construction costs were about $2 million, and chemical costs increased about $670,000 in 2006. Estimated savings on labor and emergency planning are at least $25,000 per year. The entire drinking water system serves about 1.6 million people; annual conversion costs are less than 50 cents per person served.

- **The Middlesex County Utilities Authority wastewater plant in Sayreville, N.J.,** switched from chlorine gas railcars to liquid bleach in 2001. Construction cost $1.3 million, and chemical costs increased from 2002 to 2006 about $1.5 million, as chlorine prices more than tripled. The wastewater system serves some 800,000 people. Discounting two-thirds of increased chemical costs for price change, and not accounting for any operating savings, annual conversion costs are still less than a dollar per person served.

- **The Back River Wastewater Treatment Facility in Baltimore, Md.,** switched from chlorine gas railcars to liquid bleach in 2004. Construction cost $2.6 million, and chemical costs increased from 2003 to 2008 about $2.4 million, during which time chlorine prices more than doubled. For this and other reasons the facility is planning further conversion to generating bleach on-site. The entire wastewater system serves 1.3 million people. Discounting one-half of increased chemical costs for price change, and not accounting for any operating savings, annual conversion costs are still less than a dollar per person served.

Conclusion and Recommendations

More than five years after 9/11 and despite many credible warnings, the U.S. government has yet to enact policies that seriously reduce unnecessary chemical hazards. The Center for American Progress surveyed water utilities that still use chlorine gas railcars to examine systematic shortcomings in current federal chemical security policies, and to encourage Congress to enact policies that swiftly and efficiently remove unnecessary chemical hazards.

The survey shows that many large water utilities have converted from chlorine gas railcars to safer and more secure alternatives. These conversions remove terrorist targets at the facilities and on the rails, and make millions of Americans safer and more secure. Facility operators are relieved when the gas is gone and often proud of helping to bring about the change.

The roughly three dozen water utilities that still receive chlorine gas railcars can also convert to safer alternatives, but many are not acting. At the same time, recently enacted interim chemical security legislation exempts water utilities, neglects transportation hazards, and ignores safer technologies. Millions of Americans remain unnecessarily at risk from a catastrophic chemical release.

To address this threat, Congress, the administration, and industry must make chemical security an urgent national priority, with the goal of transitioning to safer, more secure technologies. Specifically:

- Water utilities that still use railcars of chlorine gas or anhydrous sulfur dioxide should shift to safer and more secure treatment alternatives.

- Congress should require chemical facilities to review and use available, cost-effective technologies that significantly reduce or eliminate serious emergency chemical release hazards.

- Congress should target grants, loans, and other incentives to help water utilities convert from chlorine gas, including facilities that discontinued chlorine gas after September 11, 2001. Such assistance should not cover containment buildings and other physical security measures that are inherently incapable of protecting chlorine gas railcars at water utilities and in transit.

- The Department of Homeland Security should go back to Congress for full authority to safeguard chemical infrastructure and the public, with appropriate roles for other governmental agencies.

- Congress should require chemical facilities to account for transportation risks—including the possibility of a catastrophic chemical release—in developing security alternatives, assessments, and plans.

- Congress should require chemical facilities to involve appropriate employees when developing security alternatives, assessments, and plans.

- The Department of Homeland Security should develop methodologies to account for the impact of safer, more secure technologies on facility security, including the costs, avoided costs, and feasibility of alternatives.

- Manufacturers of liquid bleach should adopt production methods that do not require bulk transportation or storage of chlorine gas. Congress should require these facilities to carry sufficient liability insurance to cover a catastrophic chemical release.

These policy recommendations are reasonable and obtainable. They would impose only insignificant burdens on consumers, while delivering measurable improvements in safety and security. Indeed, many water utilities have already abandoned chlorine gas at affordable cost with effective results. Congress and the Department of Homeland Security have the responsibility to compel the swift conversion of the remaining water utilities that still receive chlorine gas by rail. The reasons to do so are self-evident in this report. Congress and DHS need only act.

A graffiti-covered rail tanker passes within blocks of the National Mall in Washington, D.C. (Jim Dougherty/Sierra Club)

Appendix A

WATER UTILITIES USING CHLORINE GAS RAILCARS

FACILITY NAME	CITY	STATE	FACILITY TYPE	APPROXIMATE FACILITY SIZE—MILLION GALLONS PER DAY (MGD)	CONVERSION STATUS	VULNERABILITY ZONE POPULATION*
Joseph Jensen Filtration Plant	Granada Hills	CA	Drinking water plant	750 MGD	Evaluating alternatives; no active plans to convert	1,700,000
F. E. Weymouth Water Treatment Plant	La Verne	CA	Drinking water plant	520 MGD	Evaluating alternatives; no active plans to convert	304,873
Los Angeles Aqueduct Filtration Plant	Sylmar	CA	Drinking water plant	600 MGD	Have looked at alternatives; no change forecast	290,000
Sacramento Regional Wastewater Treatment Plant	Elk Grove	CA	Wastewater plant	165 MGD	No apparent plans to convert	18,000**
San Jose/Santa Clara Water Pollution Control Plant	San Jose	CA	Wastewater plant	115 MGD	Evaluating alternatives including ultraviolet light; liquid bleach is available backup	245,000
City of Stockton Tertiary Treatment Plant	Stockton	CA	Wastewater plant	35 MGD	Occasionally using liquid bleach as backup; considering other alternatives including ultraviolet light	430,200
Metro Wastewater Reclamation District	Denver	CO	Wastewater plant	160 MGD	Switching to liquid bleach by end of 2007	925,000
Fiveash Water Treatment Plant	Fort Lauderdale	FL	Drinking water plant	70 MGD	Switching to generating bleach on-site or other alternative by about 2008	1,526,000
John E. Preston Water Treatment Plant	Hialeah	FL	Drinking water plant	86 MGD	Developing plans to convert, possibly to on-site bleach; conversion likely within a few years	1,893,169
Alexander Orr Water Treatment Plant	Miami	FL	Drinking water plant	175 MGD	Developing plans to convert, possibly to on-site bleach; conversion likely within a few years	1,643,691
Hillsborough River Water Treatment Plant-Tampa, FL	Tampa	FL	Drinking water plant	85 MGD	Alternatives under consideration; conversion not imminent or planned	508,760
City of Tampa-Howard F. Curren AWTP	Tampa	FL	Wastewater plant	96 MGD	Has studied feasibility; no specific plans to convert	1,042,000
Topeka Water Treatment Plant	Topeka	KS	Drinking water plant	22 MGD	No plans to convert	173,925
Crescent Hill Water Treatment Plant	Louisville	KY	Drinking water plant	100 MGD	Switching to generating bleach on-site by about 2008–2009	675,100
Carrollton Water Purification Plant	New Orleans	LA	Drinking water plant	120 MGD	Switching to liquid bleach, likely in 2007	892,320
East Bank Wastewater Treatment Plant	New Orleans	LA	Wastewater plant	108 MGD (pre-Katrina)	Planning to convert eventually; timeline uncertain given major capital needs post-Katrina	726,185
Detroit WWTP-Chlorination/ Dechlorination Facility	Detroit	MI	Wastewater plant	700 MGD	No plans to convert	2,100,000

* Vulnerability zone figures, submitted by facilities to EPA, indicate residential populations within range of a worst-case toxic chemical release. These figures are not forecasts of potential casualties.
** This figure most likely significantly understates the facility's vulnerability zone population.

Appendix A, continued

WATER UTILITIES USING CHLORINE GAS RAILCARS, CONTINUED

FACILITY NAME	CITY	STATE	FACILITY TYPE	APPROXIMATE FACILITY SIZE—MILLION GALLONS PER DAY (MGD)	CONVERSION STATUS	VULNERABILITY ZONE POPULATION*
St. Paul Regional Water Services-McCarron	Maplewood	MN	Drinking water plant	50 MGD	No plans to convert	1,300,000
Fridley Filter Plant	Minneapolis	MN	Drinking water plant	85 MGD	No plans to convert	337,000
Kansas City, Missouri Water Treatment Plant	Kansas City	MO	Drinking water plant	115 MGD	No plans to convert	720,000
Florence Water Treatment Plant	Omaha	NE	Drinking water plant	64 MGD	No plans to convert	390,000
North Charleston Sewer District WWTP Herbert Site	Charleston	SC	Wastewater plant	17 MGD	Switching to ultraviolet light, expected completion about summer 2007	365,213
Omohundro Water Treatment Plant	Nashville	TN	Drinking water plant	90 MGD	Evaluating options; no finalized plan to convert	973,663
Central Wastewater Treatment Plant	Nashville	TN	Wastewater plant	288 MGD	Evaluating options; no finalized plan to convert	965,468
O.N. Stevens Water Treatment Plant	Corpus Christi	TX	Drinking water plant	80 MGD	No plans to convert	360,000
Elm Fork Water Treatment Plant	Carrollton	TX	Drinking water plant	330 MGD	Evaluating alternatives; no specific plan to convert	790,000
Bachman Water Treatment Plant	Dallas	TX	Drinking water plant	150 MGD	Evaluating alternatives; no specific plan to convert	2,000,000
Eastside Water Treatment Plant	Sunnyvale	TX	Drinking water plant	440 MGD	Evaluating alternatives; no specific plan to convert	1,800,000
NTMWD Regional Water Treatment Plant	Wylie	TX	Drinking water plant	265 MGD	No plans to convert; evaluating options	137,517
Central Wastewater Treatment Plant	Dallas	TX	Wastewater plant	120 MGD	No plans to convert; preliminary cost analysis of alternatives	930,000
Central Regional Wastewater System	Grand Prairie	TX	Wastewater plant	150 MGD	No plans to convert	3,931,692
Rolling Hills Water Treatment Plant	Fort Worth	TX	Drinking water plant	100 MGD	Under review; investigating on-site generation of bleach	428,447
East Water Purification Plant	Houston	TX	Drinking water plant	225 MGD	No plans to convert; alternatives evaluation ongoing	1,300,000
Central Valley Water Reclamation Facility	Salt Lake City	UT	Wastewater plant	56 MGD	Evaluating options as part of facility upgrade	1,334,000
Hopewell Water Treatment Plant	Hopewell	VA	Drinking water plant	10 MGD	Currently under review; no apparent plans to convert	91,000
City of Richmond Water Purification Plant	Richmond	VA	Drinking water plant	132 MGD	Switching to liquid bleach; completing conversion early 2007	704,630
City of Richmond Wastewater Treatment Plant	Richmond	VA	Wastewater plant	60 MGD	Evaluating and testing alternatives; no clear timeline to convert	722,769

* Vulnerability zone figures, submitted by facilities to EPA, indicate residential populations within range of a worst-case toxic chemical release. These figures are not forecasts of potential casualties.

Appendix B

WATER UTILITIES NO LONGER USING CHLORINE GAS RAILCARS*

FACILITY NAME	CITY	STATE	FACILITY TYPE	APPROXIMATE FACILITY SIZE—MILLION GALLONS PER DAY (MGD)	CONVERSION STATUS	CONVERSION YEAR	FORMER VULNERABILITY ZONE POPULATION**
Joint Water Pollution Control Plant	Carson	CA	Wastewater plant	330 MGD	Switched to liquid bleach	2004	210,000
Blue Plains Wastewater Treatment Plant	Washington	DC	Wastewater plant	370 MGD	Switched to liquid bleach	2001	1,700,000
Buckman Water Reclamation Facility	Jacksonville	FL	Wastewater plant	41 MGD	Switched to ultraviolet light	2001	360,000
R. M. Clayton WRC	Atlanta	GA	Wastewater plant	80 MGD	Switched to ultraviolet light	2000	1,151,993
Fall Creek Water Treatment Plant	Indianapolis	IN	Drinking water plant	20 MGD	Switched to liquid bleach	2000	771,633
White River Water Treatment Plant	Indianapolis	IN	Drinking water plant	70 MGD	Switched to liquid bleach	2003	968,579
Water Pollution Control Plant	Fort Wayne	IN	Wastewater plant	50 MGD	Switched to liquid bleach	2006	330,000
Waste Water Treatment Plant, West	Owensboro	KY	Wastewater plant	8 MGD	Switched to liquid bleach	2001	90,000
Jefferson Parish East Bank WWTP	Harahan	LA	Wastewater plant	40 MGD (pre-Katrina)	Switched to liquid bleach	2003	790,000
Back River Wastewater Treatment Facility	Baltimore	MD	Wastewater plant	150 MGD	Switched to liquid bleach	2004	1,470,000
Wyandotte Wastewater Treatment Facility	Wyandotte	MI	Wastewater plant	45 MGD	Switched to ultraviolet light	2000	1,100,000
Metropolitan Wastewater Treatment Plant	St. Paul	MN	Wastewater plant	222 MGD	Switched to liquid bleach	2005	520,000
Western Lake Superior Sanitary District	Duluth	MN	Wastewater plant	43 MGD	Switched to liquid bleach	2006	128,293
Middlesex County Utilities Authority	Sayreville	NJ	Wastewater plant	120 MGD	Switched to liquid bleach	2001	10,740,000
Edward P. Decher Secondary Wastewater Trmt. Plant	Elizabeth	NJ	Wastewater plant	65 MGD	Switched to liquid bleach	2003	50,000
City of Niagara Falls Wastewater Treatment Plant	Niagara Falls	NY	Wastewater plant	32 MGD	Switched to liquid bleach	2003	1,100,000
Mill Creek WWTP	Cincinnati	OH	Wastewater plant	130 MGD	Switched to liquid bleach	2001	860,000
Nottingham Water Treatment Plant	Cleveland	OH	Drinking water plant	70 MGD	Switched to liquid bleach	2002	1,100,000
Baldwin Water Treatment Plant	Cleveland	OH	Drinking water plant	60 MGD	Switched to liquid bleach	2005	1,400,000
Akron Water Supply Plant	Kent	OH	Drinking water plant	38 MGD	Switched to liquid bleach	2004	411,356
Columbia Boulevard Wastewater Treatment Plant	Portland	OR	Wastewater plant	70 MGD	Switched to liquid bleach	2005	157,500
Southeast Water Pollution Control Plant	Philadelphia	PA	Wastewater plant	90 MGD	Switched to liquid bleach	2002	1,182,741
Northeast Water Pollution Control Plant	Philadelphia	PA	Wastewater plant	190 MGD	Switched to liquid bleach	2003	1,575,971
Samuel S. Baxter Water Treatment Plant	Philadelphia	PA	Drinking water plant	165 MGD	Switched to liquid bleach	2005	787,271
South Treatment Plant	Renton	WA	Wastewater plant	80 MGD	Switched to liquid bleach	2003	650,000

* Facility converted since 1999 and fully eliminated chlorine gas.
** Vulnerability zone figures, submitted by facilities to EPA, indicate residential populations within range of a worst-case toxic chemical release. These figures are not forecasts of potential casualties.

Appendix C

PRODUCERS OF CHLORINE GAS SHIPPED BY RAIL TO WATER UTILITIES				
FACILITY NAME	CITY	STATE	FACILITY TYPE	VULNERABILITY ZONE POPULATION*
Olin Corp. McIntosh, Alabama Plant	McIntosh	AL	Chlorine producer	42,750
Occidental Chemical Corporation, Mobile Plant	Mobile	AL	Chlorine producer	334,000
Occidental Chemical Corp., Muscle Shoals Facility	Muscle Shoals	AL	Chlorine producer	115,282
Olin Corporation Augusta, Georgia Plant	Augusta	GA	Chlorine producer	440,000
Occidental Chemical (formerly Vulcan Chemicals)	Wichita	KS	Chlorine producer	500,831
Occidental Chemical Corporation Convent Plant	Convent	LA	Chlorine producer	250,000
Occidental Chemical (formerly Vulcan Chemicals)	Geismar	LA	Chlorine producer	490,000
Occidental Chemical Taft Plant	Hahnville	LA	Chlorine producer	830,000
Pioneer Americas LLC	St. Gabriel	LA	Chlorine producer	408,000
Pioneer Americas LLC	Henderson	NV	Chlorine producer	1,100,000
Olin Corporation-Niagara Falls, New York Plant	Niagara Falls	NY	Chlorine producer	998,200
Occidental Chemical Corporation-Niagara Plant	Niagara Falls	NY	Chlorine producer	1,100,000
Olin Chlor-Alkali, Charleston Plant	Charleston	TN	Chlorine producer	258,000
Occidental Chemical Corporation Ingleside Plant	Gregory	TX	Chlorine producer	362,031
Oxy Vinyls, LP-Battleground Chlor-Alkali Plant	La Porte	TX	Chlorine producer	2,300,000
PPG Industries, Inc., Natrium	New Martinsville	WV	Chlorine producer	97,585

* Vulnerability zone figures, submitted by facilities to EPA, indicate residential populations within range of a worst-case toxic chemical release. These figures are not forecasts of potential casualties.

Appendix D: Methodology

After the Center for American Progress released survey findings last year that documented 284 facilities in diverse industries that have switched to less acutely hazardous chemicals or processes, we decided to conduct a follow-up survey of water utilities that receive rail shipments of chlorine gas. We undertook this survey for four primary reasons. First, 90-ton railcars of chlorine gas pose a distinct danger of a major chemical release. Second, large water utilities are typically located near major cities and thus endanger large numbers of people. Third, rail shipments of chlorine gas travel many miles through populated areas, putting even more people at risk. And finally, there are clear, readily available alternatives to chlorine gas, which means this vulnerability can be quickly addressed.

This survey shows where progress has been made, drawing attention to successful, cost-effective plant conversions, and where we still have security vulnerabilities, giving particular attention to rail vulnerabilities, which are too frequently left out of the chemical-security conversation.

The survey included drinking water or wastewater facilities that reported railcar amounts of chlorine gas under EPA's Risk Management Planning, or RMP, program at some time since the program began in June 1999. Several water utilities that discontinued chlorine gas railcars prior to 1999 were also surveyed. The survey consisted of telephone interviews and in some cases follow-up email communication.

For water utilities that still report chlorine gas in railcar amounts, the survey used unstructured questions about the facility's timeline and plans, if any, to convert to a safer and more secure disinfectant, as well as about facility size, population served, and potential obstacles to conversion. For facilities that had already switched or where conversion is underway, the survey also covered conversion costs. In some cases facility size and population figures are from facility Websites or EPA's Clean Watersheds Needs Survey.[34]

This survey report uses publicly available rail maps and population density figures to illustrate transportation concerns in shipping chlorine gas from manufacturing sites through distributors to water utilities. Chlorine production sites were identified through industry publications and EPA regulatory analysis documents covering the chlorine industry.[35] Given the complexity and variability of suppliers and railways, the survey report does not link suppliers, distributors, and water utilities over specific rail routes.

Acknowledgments

Paul Orum wrote this survey report and interviewed personnel at the facilities it covers. Mr. Orum previously authored "Preventing Toxic Terrorism: How Some Chemical Facilities are Removing Danger to American Communities," published by the Center for American Progress in April 2006. He is the former director of the Working Group on Community Right-to-Know and currently works as an independent consultant on chemical safety and security issues.

Reece Rushing, director of regulatory and information policy at the Center for American Progress, provided editorial oversight and assisted in preparing the report. P.J. Crowley, senior fellow and director of national defense and homeland security at the Center for American Progress, also provided input and guidance on the report.

The photo on the cover is courtesy of Jim Dougherty/Sierra Club. The author and the Center for American Progress also thank Carol Andress of Environmental Defense for providing helpful comments, and greatly appreciate the cooperation of survey respondents at water utilities across the country.

Endnotes

1 Summary population at risk figures used in this report factor in overlapping vulnerability zones.

2 Summary water treatment figures used in this report factor in overlapping service areas.

3 The survey did not attempt to identify facilities that converted from chlorine gas railcars to a less hazardous disinfectant prior to 1999, but noted several wastewater facilities that had done so—the Southwest Wastewater plant in Philadelphia, Pa., and the Southerly and Westerly plants in Cleveland, Ohio. In addition, the Dalecarlia water plant in Washington, D.C. eliminated chlorine gas railcars in the 1980s and is planning long-term conversion to a less hazardous disinfectant. The survey identified three additional facilities that eliminated rail shipments of chlorine gas since 1999, but that still use smaller containers while planning long-term conversion to a safer and more secure disinfectant—the 23rd Avenue wastewater plant in Phoenix, Ariz., and the Crown water plant and Morgan water plant in Cleveland, Ohio. Other water utilities in Wheeling, W.V., Erie, Pa., and St. Louis, Mo., eliminated chlorine railcars since 1999, but have no current plans to fully convert to a less hazardous disinfectant.

4 Two additional wastewater facilities, in San Jose and Stockton, Calif., occasionally use less hazardous liquid bleach as a backup disinfectant.

5 These dispersion distances are found in RMP*Comp, developed by the Computer Aided Management of Emergency Operations (CAMEO) team of the National Oceanic and Atmospheric Administration and the U.S. Environmental Protection Agency. The Chlorine Institute, Pamphlet 74, "Estimating the Area Affected by a Chlorine Release" (1998) states that a chlorine gas plume from a railcar can remain at 14.8 miles "immediately dangerous to life or health." This is the level from which a healthy person must escape within 30 minutes or risk irreversible harm or death.

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27 KIK Custom Products, letter to the Honorable Ed Markey, Member of Congress (July 26, 2006).

28 Chlorine Institute, Pamphlet 10, North American Chlor-Alkali Industry Plants and Production Data Report 2005 (August 2006).

29 The survey did not attempt to identify facilities that converted prior to 1999, but noted three additional wastewater facilities that had done so. These facilities are the Southwest Wastewater plant in Philadelphia, Pa., and the Southerly and Westerly plants in Cleveland, Ohio. In addition, the Dalecarlia water plant in Washington, D.C. eliminated chlorine gas railcars in the 1980s and is planning long-term conversion to a less hazardous disinfectant.

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