Unnecessary Dangers:
Emergency Chemical Release Hazards at Power Plants

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Table of Contents **Page**

Tables and Figures

Executive Summary

Across the country, some 3.5 million people live near any of 225 power plants (other than nuclear) that could suddenly release extremely hazardous chemicals and cause serious injury or death. Power plants could all but eliminate these hazards by using safer chemicals.

Ammonia poses the principal emergency chemical release danger to workers and communities at these power plants. Power plants use ammonia in air pollution control equipment. Chlorine gas, used in cooling water systems at power plants, can also endanger communities in the event of a sudden release.

Under certain conditions, both ammonia and chlorine gas can form toxic and lethal clouds if released in large quantities. Frequent industrial accidents involving ammonia or chlorine and the threat that terrorists could use stored chemicals as weapons demonstrate the need to use safer alternatives at power plants and other industrial facilities. Gaseous ammonia and gaseous chlorine can both burn the eyes and lungs; high levels can cause fluid in the lungs, leading to death.

Power companies' choice of technology determines the danger to communities:

- Some 166 power plants report using anhydrous ammonia, endangering an average of 21,506 people around each facility.
- An additional 69 power plants report using aqueous ammonia, endangering an average of 205 people off-site.
- Forty power plants report chlorine gas as their greatest emergency release hazard, endangering an average of 4,618 nearby residents.
- Power plants can readily substitute safer chemicals that work just as well to control pollution. The simplest changes are to substitute aqueous ammonia or urea for anhydrous ammonia, and chlorine bleach or bromine for chlorine gas. Under development are other alternatives that do not rely on ammonia or chlorine gas.

The data in this report also show that:

- Just two-dozen power plants account for two-thirds of the people in danger. By using readily available safer chemicals these two-dozen plants could all but eliminate the danger to 2.4 million people.
- In ten states more than 100,000 people live in danger of emergency chemical releases from power plants. These states are California, Texas, Florida, Illinois, Minnesota, Pennsylvania, Missouri, Rhode Island, Virginia, and New Jersey.

Community members, regulators, news reporters, power plant managers, and employees all have a role in investigating or addressing chemical hazards in our communities. We urge readers to use this report and its recommendations to seek changes at high hazard power plants that eliminate the possibility of a catastrophic chemical release.

Scope and Limitations

This report examines 275 current and 36 deregistered power plants that reported using extremely hazardous substances under the Environmental Protection Agency's Risk Management Planning program as of September 2003. Most of these power plants burn coal or other fossil fuels, and a few burn solid waste or produce electricity from cogeneration or other sources. Not included are nuclear power plants or power distribution and transmission facilities. This report addresses the potential for sudden chemical releases rather than routine pollution and stack emissions that include mercury (a potent nerve toxin), cancer-causing substances, fine particles, smog-forming nitrogen oxides, and acid-rain from sulfur dioxide. Power plants are just one industry with vulnerabilities to chemical release hazards and terrorism.[1]

II. Background

The Clean Air Act Cleans Up Dirty Power Plants

Since its inception, the Clean Air Act has required states to reduce emissions that form smog – the brownish haze that hangs over cities and whole regions, especially in the summertime. The primary component of smog is ground-level ozone, a gas that forms when oxides of nitrogen (NOx) react with other air pollutants. Ozone is a potent respiratory irritant that can burn the lungs and cause breathing problems that range from chest pain and coughing to asthma attacks and pulmonary inflammation.[2] Nationwide, power plants are the second-largest source of ozone-creating NOx emissions (after automobiles).[3, 4]

The Clean Air Act requires all new power plants and some older plants to control NOx emissions. These pollution controls are important for healthy air. However, power plants often use ammonia in pollution control equipment to react with and control NOx emissions. The most hazardous forms of ammonia can pose unnecessary dangers to workers and communities.

Power plants can prevent NOx formation during combustion or can control NOx emissions with add-on equipment.[5] Control technologies most commonly include selective catalytic or non-catalytic reduction systems that rely on ammonia.[6] These control technologies are used at hundreds of power plants and are generally the most effective commercially widespread method of controlling NOx emissions. Pollution controls that rely on alternatives to anhydrous ammonia are generally just as effective at cleaning up NOx pollution, and some developing technologies may prove more effective.

Pollution Control Chemicals Pose Unnecessary Dangers

Hundreds of fossil fuel power plants in the U.S. use chemicals that are dangerous to transport and store. In particular, anhydrous ammonia and chlorine gas are extremely hazardous chemicals that can form lethal toxic clouds in an emergency release. For this reason, many power plants already use readily available safer alternatives that effectively control pollution without posing the same dangers to workers and nearby communities.

Anhydrous Ammonia – Many power plants use hazardous anhydrous ammonia to remove NOx in smokestack pollution control systems. Available alternatives to anhydrous ammonia do not pose the same dangers. Dilute aqueous ammonia presents lower health and safety hazards, but does not eliminate the danger entirely, because aqueous ammonia retains limited ability to form a toxic cloud. Solid urea poses less danger because it allows utilities to generate ammonia for pollution control systems on-demand. Power plants can easily convert from anhydrous to aqueous ammonia or urea. Under development are pollution prevention and control technologies that do not rely on ammonia at all.

Chlorine Gas – Some power plants use chlorine gas as a biocide to prevent fouling of water used in cooling or to generate steam. Fouling can be in the form of algae and slime in cooling towers or mussels and clams in intake water pipes. Such fouling can aggravate corrosion, increase mineral deposition, and reduce heat transfer. Common alternatives to chlorine gas at power plants include chlorine bleach or bromine. Additional approaches include ultraviolet light, pulsed electric power, filtration, and anti-fouling surface coatings. Power plants frequently use more than one method to filter or treat water.

Ammonia is Hazardous to Health

Ammonia is a corrosive colorless gas with a strong odor. While used safely most of the time, ammonia can endanger workers and surrounding communities by forming a lethal toxic cloud in the event of an emergency release. Acute ammonia exposure can irritate the skin, burn the eyes, cause temporary or permanent blindness, and cause headaches, nausea, and vomiting. High levels can cause fluid in the respiratory system (pulmonary or laryngeal edema), which may lead to death. Chronic exposure damages the lungs; repeated exposure can lead to bronchitis with coughing or shortness of breath.

Aqueous ammonia solution (ammonia in water) is inherently safer than anhydrous ammonia (without water) because it is less capable of forming a dense ground-hugging plume that can drift downwind. Urea is a solid form of ammonia that releases ammonia slowly; it is inherently safer than either anhydrous or aqueous ammonia because it does not form toxic plumes under normal conditions of use.[7]

Ammonia's danger depends on its form:

- Anhydrous ammonia is a *gas* that poses significant hazards to workers and communities in the event of an emergency release.
- Aqueous ammonia is a *solution* of ammonia mixed with water at concentrations of typically 19 percent or 29 percent ammonia. The lower concentration of ammonia poses lesser hazards but requires more volume and shipments when compared to anhydrous ammonia.

- Urea is a *solid* that can be used to form ammonia as needed on-site. Producing ammonia on-site from urea reduces transportation and storage dangers associated with anhydrous or aqueous ammonia.

Chlorine Gas is Hazardous to Health

Chlorine gas is greenish-yellow with a strong, irritating odor. Chlorine gas can form a dangerous toxic plume in an emergency release. Chlorine in water harms fish and other marine life. Acute human exposure can cause permanent damage by severely burning the eyes and skin, and can cause throat irritation, tearing, coughing, nose bleeds, chest pain, fluid build-up in the lungs (pulmonary edema), and even death. Chronic exposure can damage the teeth and irritate the lungs, causing bronchitis, coughing, and shortness of breath. A single high exposure can permanently damage the lungs. Chlorine's danger depends on its form; chlorine bleach is a solution that does not have the potential of chlorine gas to form a dangerous toxic cloud.[8]

Emergency Releases Occur Repeatedly

National data show frequent ammonia and chlorine spills at industrial facilities. The National Response Center received reports of 6,400 ammonia spills over the 10 years ending March 1, 2004, and 2,200 releases involving chlorine gas.[9] Spills reported to the National Response Center range from minor to very large.[10]

Ammonia and chlorine were the first and second most commonly reported extremely hazardous substances involved in serious non-transportation industrial accidents – those involving death, injury, or evacuation – from 1994 to 1999. Some 656 of these serious incidents involved ammonia and 518 involved chlorine gas.[11]

A sampling of recent serious accidents illustrates ammonia dangers and underscores the desirability of substituting safer alternatives where feasible:

- On January 18, 2002, a train derailment leaked a large anhydrous ammonia plume over portions of Minot, North Dakota, killing one person, hospitalizing 15, and sending over 1,600 to hospitals and emergency medical centers.[12]

- In July 2002, an ammonia spill killed at least 13 people when a pipe burst at a fertilizer factory in Shandong province, China.[13]

- In July 2002, a planned release of ammonia to water from a power plant inadvertently killed 100,000 fish along ten miles of the Vermillion and Salt Fork Rivers near Urbana, Illinois.[14]

III. Findings

The Technology Determines the Hazard

Across the country, some 275 power plants report that they use large amounts of ammonia or chlorine gas. These power plants report the information under the Environmental Protection Agency's Risk Management Planning (RMP) program. Each facility's Risk Management Plan indicates among other things how many nearby residents live in danger of exposure to a worst-case chemical release. **Power plant RMP reports indicate that 225 of these 275 plants could harm people off-site in an emergency chemical release. These 225 power plants use enough ammonia or chlorine gas to collectively endanger any of 3,568,658 people who live in nearby communities.[15] Just two-dozen power plants are responsible for two-thirds of the population in danger.**

By switching to readily available and inherently safer pollution control options these power plants could eliminate or significantly reduce dangers that accidents or acts of terrorism pose to surrounding communities. Safer alternatives to anhydrous ammonia and chlorine gas are commercially available for use at power plants. Aqueous ammonia can replace anhydrous ammonia, and chlorine bleach or bromine can replace chlorine gas. Diverse technologies are available or under development that do not rely on ammonia or chlorine. The population figures do not include potential accidents during transport of the hazardous materials to the power plants. Safer technologies can reduce transportation hazards as well.

Out of the 275 power plants that submit RMPs:

- Some 166 power plants report *anhydrous ammonia* as their most dangerous chemical in the event of an emergency release. These 166 power plants endanger an average of 21,506 people per facility. All but one of these facilities endanger people off-site.

- An additional 69 power plants report *aqueous ammonia* (at concentrations of 20 percent or more) as the most serious emergency release hazard. These 69 plants endanger an average of 205 people per facility. Only one-third of these facilities, or 23 plants, endanger people off-site.

- Forty power plants report *chlorine gas* as their greatest emergency release hazard. These 40 plants endanger an average of 4,618 people per facility. All but three of these facilities endanger the surrounding community.

- Just two-dozen power plants in 11 states account for two-thirds of the people in danger. These two-dozen power plants are in California, Texas, Florida, Illinois, Minnesota, Pennsylvania, Missouri, Rhode Island, Virginia, New Jersey, and Delaware.

Table 1. Average Residents in Danger Near Power Plants, by Technology in Use

Technology in use	RMP power plants	Avg. residents in danger[16]	Avg. vulnerability in miles[17]
Anhydrous ammonia	166	21,506	3.56
Aqueous ammonia	69	205	0.35
Chlorine gas	40	4,618	2.22

In a worst-case release, ammonia or chlorine gas would drift downwind in a ground-level toxic plume. Such a release would generally endanger only a portion of the people who live in the downwind "vulnerability zone" because the wind generally only blows in one direction. The figures are not forecasts of potential casualties.

In ten states more than 100,000 people live in danger of emergency releases from power plants (Table 2).[18]

Table 2. The Ten States With Over 100,000 Residents in Danger Near Power Plants

State	Number of RMP power plants	Residential population in danger
California	75	803,311
Texas	23	607,067
Florida	17	438,655
Illinois	10	220,728
Minnesota	3	215,075
Pennsylvania	17	206,833
Missouri	4	173,000
Rhode Island	3	152,500
Virginia	8	126,258
New Jersey	5	107,646

Risk Management Program Tracks Hazard Reduction

The EPA's RMP program enables people to identify industrial facilities that switch to safer chemicals and processes, in particular when the facilities "deregister" from the program. At least three-dozen power plants have deregistered from the RMP program since 1999. These 36 power plants in some cases no longer use extremely hazardous substances and in other cases no longer use the chemicals above RMP threshold amounts. Before they deregistered, these 36 facilities collectively endangered any of 1,337,144 people from potential emergency chemical releases.

The RMP program requires industrial facilities that use extremely hazardous substances to carefully examine and describe the hazards they pose. The process can prompt facilities to select safer technologies, but nothing in the program *requires* facilities to use or even review available safer alternatives. Communities can track facilities' progress in reducing chemical hazards by reviewing RMP information through designated federal "reading rooms" (see endnote).[19]

The RMP planning process and other safety concerns have helped prompt a number of power plants to switch to safer chemicals, including:

- GWF Power Systems switched from anhydrous ammonia to aqueous ammonia at a half-dozen California power plants, eliminating potential dangers to thousands of nearby residents.

- Central and South West Corporation switched several power plants in Texas and Oklahoma from chlorine gas to safer chlorine bleach for cooling water treatment. The change reduces hazards to workers as well as people off-site.

- Wisconsin Power's Pulliam Plant (Green Bay, Wis.) switched from liquid anhydrous sulfur dioxide, used to capture particulates in pollution control equipment, to a safer solid form of the chemical. The change eliminated potential off-site injury to 180,000 people.

Public Pressure Prompts Safer Practices

Where neighbors have insisted on safer alternatives, some power plants have responded by substituting safer technologies that reduce the possibility of a lethal toxic cloud. The utility industry generally only spends money for safer alternatives, even if barely more costly, when there is a pressing need – such as public pressure or regulation.

- Constellation Power Source's Brandon Shores Power Plant near Baltimore agreed to use aqueous ammonia after four months of protests by local residents over the possible use of anhydrous ammonia.[20] Aqueous ammonia poses lesser dangers to the community from both storage and truck transportation.

- American Electric Power's Gavin power plant in Cheshire, Ohio selected a urea-based pollution control technology after residents raised concerns about the dangers of an emergency ammonia release. "Our neighbors in and around Cheshire told us they were very concerned about the impact of a serious accident involving a major release of anhydrous ammonia," said John Norris, senior vice president of operations and technical services, in a press release. "We took those concerns to heart."[21] Subsequently, however, larger pollution conflicts lead the company to buy out and relocate the entire immediate Cheshire community.

IV. Safer Alternatives Are Available

"If we make fewer toxic products, use milder manufacturing conditions, and produce less toxic waste, we reduce the opportunities for terrorists." – *National Research Council, Making the Nation Safer: The Role of Science and Technology in Countering Terrorism, 2002.*

Safer Technologies Reduce Hazards – Anhydrous Ammonia

Power plants have readily available alternatives to significantly reduce or eliminate the danger that ammonia poses to workers and nearby communities.

- At least 69 U.S. power plants use aqueous ammonia (at concentrations of 20 percent or more) rather than anhydrous ammonia, which significantly reduces but does not eliminate ammonia dangers (see Table 1, page 8). Switching from anhydrous to aqueous ammonia is a straightforward conversion that does not require significant new equipment.

- Ammonia-on-demand technology provides ammonia from urea as needed for pollution control systems, eliminating off-site emergency release hazards. Urea based pollution control systems have recently proven effective at large power plants. As of 2003, more than a dozen units had been installed at five commercial power stations.[22]

Power plants address NOx emissions with a combination of approaches.[23] The effectiveness of each technology depends on the combustion unit, the fuel, and operating requirements. Performance and cost-effectiveness are rapidly improving and changing as power plants gain experience with new technologies.[24]

Newer technologies are in various stages of commercial application. A sampling is listed below. Each has advantages and disadvantages in terms of pollution and cost, but all avoid the dangerous use of anhydrous ammonia. These technologies include:

- Goal Line Environmental Technology's $SCONO_X$™ (also EmeraChem EMx™) system uses a catalyst to remove NOx and other pollutants without the use of ammonia as an additional reagent. This technology is used commercially at natural gas-fired power plants in California and Massachusetts.[25] It is more expensive than selective catalytic reduction systems.

- Catalytica Combustion Systems' XONON™ technology uses a catalyst in natural gas combustion at temperatures below which most NOx emissions form. Since the lower temperatures do not generate NOx, this system does not require add-on, ammonia-based pollution control equipment; it prevents rather than controls pollution.[26] XONON™ is used at one plant in California. Catalytica is adapting the technology to more types of natural gas turbines.

- EnviroScrub Corporation's Pahlman™ Process is an emerging add-on technology that captures almost all NOx, sulfur, and mercury from coal-fired plants. This technology uses an oxide of manganese sorbent to capture these pollutants reducing air emissions to very low levels. EnviroScrub is currently bidding on large-scale commercial power projects.[27]

- PowerSpan Corporation's Electro-Catalytic Oxidation™ system uses ultra-violet light and conventional pollution equipment to control multiple pollutants, including NOx emissions. The system works with aqueous ammonia. PowerSpan is testing the system for commercial application.[28]

Safer Technologies Reduce Hazards – Chlorine Gas

Chlorine gas is only one commercially available treatment to prevent biological fouling of cooling water. In fact, while still widely used, gaseous chlorine is less used than previously due to its safety hazards.[29] There are safer substitutes for chlorine gas that do not form dangerous chemical plumes if inadvertently or deliberately released. These options include:

- Switching from chlorine gas to chlorine bleach at power plants would all but eliminate catastrophic release dangers. However, this would not resolve certain workplace hazards and environmental problems associated with routine discharge of chlorine.

- Bromine is another anti-fouling biocide that is widely used in power plants, most commonly in the form of dry bromine tablets. Dry bromine nonetheless poses hazards to workers, although it is thought to be somewhat less residually toxic than chlorine.[30]

Additional technologies can be used at power plants, or are in limited use, whether alone or in combination:

- Clearwater Systems' Dolphin™ pulsed power device has successfully limited scaling, biological activity, and corrosion in some smaller gas turbine plants that recirculate water, eliminating the need for chemicals on-site.[31]

- Trojan Technologies™ markets ultraviolet light systems that limit fouling of cooling water, as does LightStream Technologies™, which uses mercury-free pulsed ultraviolet light. Ultraviolet light is an emerging application for power plant turbines and cooling water, and may be more suitable for smaller plants that recirculate water (rather than once through water use).

- Potassium permanganate controls zebra mussels and algae in water intake pipes. It is widely used to pre-treat water at drinking water treatment plants. It does pose some hazards to workers, but not catastrophic emergency release hazards.[32]

Another strategy to address mussels is "non-stick" fouling release coatings. However, some antifouling coatings harm the environment. For example tributylin is a persistent toxic chemical that bioaccumulates in the food chain; it has been banned from use as hull paint on many ships, but remains registered for use in cooling towers.[33] Also toxic are products that contain other biocides such as atrazine. Copper-based anti-fouling paints also harm the marine environment. Some environmentally safer fouling release products include:

- SealCoat™ protects against corrosion and barnacles without poisons by providing a slippery micro fiber surface that imitates how marine mammals such as seals naturally protect themselves from barnacles.[34]

- The Department of Defense has validated environmentally safer silicon-based anti-fouling coatings through testing on boats and utility water intakes.[35]

More restrictive chlorine discharge standards will increase the use of alternate anti-fouling methods.

Strict Pollution Requirements Improve Technologies

In addition to emergency release hazards, some ammonia from pollution control escapes via the smokestack, contributing to routine air pollution. This smokestack ammonia that does not combine with nitrogen oxides can contribute to the release of fine particulate matter. Communities close to power plants have complained about sore throats, breathing problems, and other local health issues.[36]

Selective catalytic reduction (SCR) systems may not meet future restrictions on stack emissions. For example, regulators in Massachusetts and California are proposing stricter pollution requirements that may in effect limit the use of SCR and thereby force the development of non-ammonia pollution control or prevention alternatives (sometimes called Zero Ammonia Technology). Several non-ammonia pollution technologies listed above are under development or in early commercialization at power plants that burn natural gas. These technologies are designed not only to control or prevent NOx emissions, but also avoid release of added ammonia as a routine pollutant in stack emissions.

V. Despite Warnings, Prevention is Not Required

Terrorism Warnings Abound

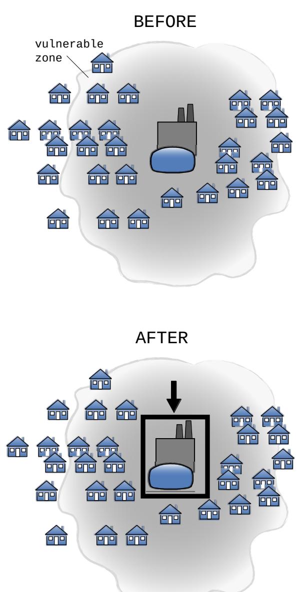
Government agencies and other experts have warned that terrorists can target facilities that use extremely hazardous substances. Agencies that have issued such warnings include the Department of Homeland Security,[37] Department of Justice,[38] Environmental Protection Agency,[39] General Accounting Office,[40] Congressional Research Service,[41] Agency for Toxic Substances and Disease Registry,[42] Naval Research Laboratory,[43] and

Army Surgeon General.[44] The chemical industry has also warned about these dangers in its report, "The Terrorist Threat in America."[45] The non-governmental Brookings Institute,[46] Rand Corporation,[47] and Center for Strategic and International Studies[48] have described the threat. Public interest groups including Environmental Defense, The Safe Hometowns Initiative, and U.S. Public Interest Research Group have documented industrial chemical hazards and safer alternatives to those unnecessary dangers.[49]

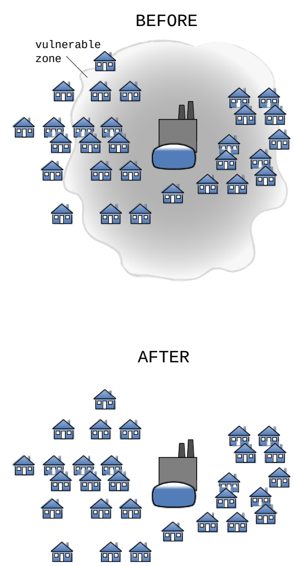
Site Security Alone is Insufficient

Add-on physical site security measures such as barriers, lights, and guards do not help utilities produce power, and because they leave communities vulnerable may ultimately fail to address terrorism (figure 1, left). Indeed, investigative reporters have walked into dozens of chemical facilities, finding open gates, holes in fences, and other lax security.[50] To more fully address the threat of terrorism, safer technologies reduce or altogether remove chemical dangers to workers and communities (figure 1, right).

Figure 1. Enhancing Security: Barriers to Access vs. Safer Chemicals



Before and after improving barriers to access – the community is still vulnerable



Before and after using safer chemicals – the community is no longer in danger.

No Federal Rules Protect Power Plants

More than two and a half years after September 11, 2001, there are still no substantial federal security standards for industries that use extremely hazardous substances. No federal standards require power plants and other industries to protect dangerous chemicals from theft or release by potential intruders. Nor does federal law require such companies to consider safer chemicals and processes that can reduce or eliminate chemical dangers.

The Clean Air Act, section 112(r) requires industrial facilities that use large amounts of certain extremely hazardous substances to disclose the dangers to workers and communities and to document measures that prevent a catastrophic chemical release. This law prevents pollution, saves lives, and protects property by stimulating safety steps *before* there is ever a major chemical release. As noted, under this law some 275 power plants report Risk Management Plans. These plans tell how the power plants will manage the risks of using anhydrous ammonia, chlorine gas, or aqueous ammonia – but the plans do not directly address chemical security.

The White House Blocks EPA Action

The Environmental Protection Agency (EPA) arguably has authority under the Clean Air Act section 112(r) general duty clause to compel companies to reduce chemical hazards in order to prevent accidents and improve security. Companies that reduce chemical dangers have less need for add-on safety controls (monitors, alarms, containment) and add-on physical security (guards, fences, lights). However, EPA has not used this authority and has not established any other systematic program to make communities safer by reducing chemical hazards at industrial plants.

In June 2002 EPA prepared options for an active chemical security program, including a draft press release and talking points, but the White House blocked these steps and transferred emphasis to the Department of Homeland Security, which is not a regulatory agency.[51] Nonetheless, lack of clear federal authority prompted both EPA and the Department of Homeland Security to call for legislation addressing chemical site security.[52]

Congress Fails to Act

To remedy these deficiencies, Senator Corzine (D-N.J.) and Congressman Pallone (D-N.J.) introduced the Chemical Security Act (S.157, H.R.1861). These bills require high priority chemical facilities to consider safer technologies and use them where practicable. Where safer technologies are not available, these bills set appropriate federal security standards.

Senator Corzine's bill unanimously passed the Senate Environment and Public Works Committee in July 2002. However, chemical manufacturers quickly organized opposition. As a result, seven Senators who had voted for the bill in committee raised objections that effectively scuttled chemical security legislation for the remainder of 2002.[53]

In 2003, Senator Inhofe (R-Okla.) introduced a very limited bill, the Chemical Facilities Security Act (S.994). This bill directs the Department of Homeland Security to endorse voluntary industry security initiatives rather than requiring industries to meet strict federal standards. This bill passed the Senate Environment and Public Works Committee on October 23, 2003 with a few strengthening amendments. These amendments require covered facilities to review safer chemicals and processes, and to report vulnerabilities to the federal government.

VI. Conclusion and Recommendations

Some power plants that use anhydrous ammonia or chlorine gas pose significant dangers to workers and communities. Just two-dozen power plants that use anhydrous ammonia impose two-thirds of the danger in terms of residential population at risk. Safer alternatives to anhydrous ammonia and chlorine gas are readily available for use at power plants, and new technologies are emerging. Power plants that use anhydrous ammonia or chlorine gas in populated areas pose unnecessary dangers.

Recommendations

The **power industry** should curtail unnecessary dangers by: converting high hazard power plants in populated areas to readily available safer alternatives to anhydrous ammonia and chlorine gas.

Community members should investigate solutions to local hazards by: contacting high hazard power plants with basic questions, including 1) has the facility explored alternatives to dangerous chemicals, and 2) when will the facility implement changes that eliminate catastrophic release dangers?

The **U.S. Environmental Protection Agency** should address power plant pollution and chemical hazards by: 1) using Clean Air Act general duty authority to reduce chemical dangers to communities around high hazard power plants, and 2) requiring new power plants and those that significantly upgrade to use safer control technologies.

Supporting Recommendations

Lawmakers should improve homeland security by: enacting an aggressive program of hazard reduction at high priority power plants and other facilities that endanger communities with extremely hazardous substances.

The **U.S. Department of Homeland Security** should reduce terrorism opportunities by: 1) developing a standard methodology for high hazard facilities to identify and switch to safer technologies that do not endanger workers and surrounding communities in the event of a terrorist-caused chemical release, and 2) allocating homeland security funding to convert high hazard facilities to safer technologies.

The **U.S. Chemical Safety Board** should reduce chemical hazards by: 1) working with federal agencies for comprehensive national public reporting and verification of chemical spills and emergencies, and 2) including safer technology conversion opportunities as a standard element in Board recommendations to industry and government.

The **U.S. Department of Labor** should improve worker safety by: developing training grants to non-profit organizations, through the National Institute for Environmental Health Sciences, to train and educate employees and first responders on preventing chemical vulnerabilities by means of inherently safer technologies.

State and local pollution prevention programs should leverage existing resources by: incorporating technology options analyses for inherent safety into pollution prevention technical assistance and site visits, and involving workers in site inspections.

Appendix A: Power Plants That Submit Risk Management Plans, by State

Power Plant Name	City	State	County	Toxic Chemicals*
Tenaska Central Alabama Generating Station	Billingsley	AL	Autauga	Ammonia (anhydrous)
Tenaska Lindsay Hill Generation Station	Billingsley	AL	Autauga	Ammonia (anhydrous)
E. B. Harris Electric Generating Plant	Prattville	AL	Autauga	Ammonia (anhydrous)
James A. Vann, Jr. Power Plant	Gantt	AL	Covington	Ammonia (aqueous)
TVA - Widows Creek Fossil Plant	Stevenson	AL	Jackson	Ammonia (anhydrous)
J. H. Miller Electric Generating Plant	Quinton	AL	Jefferson	Chlorine
Plant Franklin Combined Cycle Units	Smiths	AL	Lee	Ammonia (anhydrous)
Barry Combined Cycle Electric Generating Facility	Bucks	AL	Mobile	Ammonia (anhydrous)
Theodore Cogeneration Plant	Theodore	AL	Mobile	Ammonia (anhydrous)
Hog Bayou Energy Center	Mobile	AL	Mobile	Ammonia (aqueous)
Decatur Energy Center	Decatur	AL	Morgan	Ammonia (anhydrous)
Calpine Morgan Energy LLC	Decatur	AL	Morgan	Ammonia (anhydrous)
E. C. Gaston Electric Generating Plant	Wilsonville	AL	Shelby	Chlorine
Gorgas Electric Generating Plant	Parrish	AL	Walker	Ammonia (anhydrous)
Hot Spring Power	Malverne	AR	Hot Spring	Ammonia (aqueous)
Coronado Generating Station	St. Johns	AZ	Apache	Chlorine
APS West Phoenix Power Plant	Phoenix	AZ	Maricopa	Ammonia (aqueous)
Mesquite Generating Station	Arlington	AZ	Maricopa	Ammonia (anhydrous)
Pinnacle West Energy Redhawk Power Plant	Arlington	AZ	Maricopa	Ammonia (aqueous)
Griffith Energy	Golden Valley	AZ	Mohave	Ammonia (anhydrous)
South Point Energy Center	Mohave Valley	AZ	Mohave	Ammonia (anhydrous)

Pacific Oroville Power, Inc.	Oroville	CA	Butte	Chlorine
Contra Costa Power Plant	Antioch	CA	Contra Costa	Ammonia (aqueous)
Calpine Pittsburg	Pittsburg	CA	Contra Costa	Ammonia (anhydrous)
Delta Energy Center	Pittsburg	CA	Contra Costa	Ammonia (anhydrous)
Los Medanos Energy Center	Pittsburg	CA	Contra Costa	Ammonia (aqueous)
Pittsburg Power Plant	Pittsburg	CA	Contra Costa	Ammonia (aqueous)
Coalinga Cogeneration Company	Coalinga	CA	Fresno	Ammonia (anhydrous)
Kingsburg Cogeneration Facility	Kingsburg	CA	Fresno	Ammonia (anhydrous)
AES Mendota, L.P.	Mendota	CA	Fresno	Ammonia (anhydrous)
Rio Bravo Fresno	Fresno	CA	Fresno	Ammonia (anhydrous)
Heber Geothermal Company	Heber	CA	Imperial	Chlorine
Second Imperial Geothermal Company	Heber	CA	Imperial	Chlorine
AES Delano, Inc.	Delano	CA	Kern	Ammonia (anhydrous)
Mid-Set Cogeneration Company	Fellows	CA	Kern	Ammonia (anhydrous)
Sunrise Power Company, LLC	Fellows	CA	Kern	Ammonia (anhydrous)
Berry Cogen-18 Facility	Maricopa	CA	Kern	Ammonia (anhydrous)
Berry Cogen-38 Facility	Taft	CA	Kern	Ammonia (anhydrous)
DAI Oildale, Inc.	Bakersfield	CA	Kern	Ammonia (anhydrous)
Rio Bravo Poso	Bakersfield	CA	Kern	Ammonia (anhydrous)
Rio Bravo Jasmin	Bakersfield	CA	Kern	Ammonia (anhydrous)
Mt. Poso Cogeneration Company	Bakersfield	CA	Kern	Ammonia (anhydrous)
Texaco South East Kern River Cogeneration Facility	Bakersfield	CA	Kern	Ammonia (anhydrous)
Mojave Cogeneration Company	Boron	CA	Kern	Ammonia (anhydrous)
HL POWER COMPANY	Wendel	CA	Lassen	Ammonia (anhydrous), Chlorine
El Segundo Generating Station	El Segundo	CA	Los Angeles	Ammonia (aqueous)
AES Redondo Beach, L.L.C.	Redondo Beach	CA	Los Angeles	Ammonia (aqueous)
Scattergood Generating Station	Playa Del Rey	CA	Los Angeles	Ammonia (aqueous)
Praxair - Wilmington, CA	Wilmington	CA	Los Angeles	Ammonia (anhydrous)
Harbor Cogeneration Company Wilmington Plant	Wilmington	CA	Los Angeles	Ammonia (anhydrous)
Harbor Generating Station	Wilmington	CA	Los Angeles	Ammonia (aqueous)
AES Alamitos, L.L.C.	Long Beach	CA	Los Angeles	Ammonia (aqueous)
Haynes Generating Station	Long Beach	CA	Los Angeles	Ammonia (aqueous)
Pasadena Water & Power Broadway Power Plant	Pasadena	CA	Los Angeles	Ammonia (aqueous)
Grayson Power Plant	Glendale	CA	Los Angeles	Chlorine
Berry Cogen-42 Facility	Sant Clarita	CA	Los Angeles	Ammonia (anhydrous)
Valley Generating Station	Sun Valley	CA	Los Angeles	Ammonia (aqueous)
City of Burbank Public Service Department	Burbank	CA	Los Angeles	Chlorine
Sargent Canyon Cogeneration Company	San Ardo	CA	Monterey	Ammonia (anhydrous)
Salinas River Cogeneration Company	San Ardo	CA	Monterey	Ammonia (anhydrous)
King City Power Plant	King City	CA	Monterey	Ammonia (anhydrous)
SOLEDAD ENERGY LLC	Soledad	CA	Monterey	Ammonia (anhydrous)
Moss Landing Power Plant	Moss Landing	CA	Monterey	Ammonia (aqueous)
Rio Bravo Rocklin	Lincoln	CA	Placer	Ammonia (anhydrous)
Blythe Energy Project	Blythe	CA	Riverside	Ammonia (anhydrous), Ammonia (aqueous)
Colmac Energy, Inc.	Mecca	CA	Riverside	Ammonia (anhydrous)

Carson Energy Cogeneration Plant	Sacramento	CA	Sacramento	Ammonia (anhydrous)
SCA Congeneration Plant II	Sacramento	CA	Sacramento	Ammonia (aqueous)
OLS Energy-Chino Cogeneration Facility	Chino	CA	San Bernardino	Ammonia (anhydrous)
Colton Plant	Colton	CA	San Bernardino	Ammonia (aqueous)
High Desert Power Plant	Victorville	CA	San Bernardino	Ammonia (aqueous)
ACE Cogeneration Facility	Trona	CA	San Bernardino	Ammonia (anhydrous)
South Bay Power Plant	Chula Vista	CA	San Diego	Ammonia (aqueous)
Goal Line, LP	Escondido	CA	San Diego	Ammonia (aqueous)
University of California, San Francisco	San Francisco	CA	San Francisco	Ammonia (aqueous)
POSDEF Power Company L.P.	Stockton	CA	San Joaquin	Ammonia (anhydrous)
Stockton Cogen Company, Inc.	Stockton	CA	San Joaquin	Ammonia (anhydrous), Chlorine
Northern California Power Agency	Lodi	CA	San Joaquin	Ammonia (anhydrous)
Ripon Cogeneration, Inc.	Ripon	CA	San Joaquin	Ammonia (anhydrous)
OLS Energy Agnews	San Jose	CA	Santa Clara	Ammonia (anhydrous)
Wheelabrator Shasta Inc	Anderson	CA	Shasta	Ammonia (anhydrous)
Burney Forest Power Cogeneration Plant	Burney	CA	Shasta	Ammonia (anhydrous)
Stanislaus County Resource Recovery Facilty	Crows Landing	CA	Stanislaus	Ammonia (anhydrous)
Turlock Irrigation District	Ceres	CA	Stanislaus	Ammonia (anhydrous), Chlorine
Modesto Energy Limited Partnership	Westley	CA	Stanislaus	Ammonia (anhydrous)
Greenleaf 2 Power Plant	Yuba City	CA	Sutter	Ammonia (anhydrous)
Sutter Energy Center	Yuba City	CA	Sutter	Ammonia (anhydrous)
Pacific-Ultrapower Chinese Station	Jamestown	CA	Tuolumne	Ammonia (anhydrous)
OLS Energy-Camarillo Cogeneration Facility	Camarillo	CA	Ventura	Ammonia (anhydrous)
E. F. Oxnard, Inc.	Oxnard	CA	Ventura	Ammonia (anhydrous)
Ormond Beach Generating Station	Oxnard	CA	Ventura	Ammonia (aqueous)
Mandalay Generating Station	Oxnard	CA	Ventura	Ammonia (aqueous)
Woodland Biomass Power Ltd.	Woodland	CA	Yolo	Ammonia (anhydrous)
Craig Station	Craig	CO	Moffat	Chlorine
Nucla Station	Montrose County	CO	Montrose	Chlorine
Fort St. Vrain Station	Platteville	CO	Weld	Chlorine, Ammonia (aqueous)
Bridgeport Energy LLC	Bridgeport	CT	Fairfield	Ammonia (aqueous)
Conectiv - Hay Road Power Complex	Wilmington	DE	New Castle	Ammonia (anhydrous)
Gulf Power Co. Lansing Smith Elec Generating Plant	Southport	FL	Bay	Chlorine
FPL-Cape Cavaneral	Cocoa	FL	Brevard	Chlorine
Cedar Bay Generating Facility	Jacksonville	FL	Duval	Ammonia (aqueous)
St. Johns River Power Park	Jacksonville	FL	Duval	Chlorine
Payne Creek Generating Station	Bowling Green	FL	Hardee	Ammonia (aqueous)
Bayside Power Station	Tampa	FL	Hillsborough	Ammonia (anhydrous)
Lee County Solid Waste Resource Recovery Facility	Fort Myers	FL	Lee	Ammonia (anhydrous)
Indiantown Cogeneration Company, L.P.	Indiantown	FL	Martin	Ammonia (aqueous)
Stanton Energy Center	Orlando	FL	Orange	Ammonia (anhydrous), Chlorine
Curtis H. Stanton Energy Center Unit A	Orlando	FL	Orange	Chlorine, Ammonia (anhydrous)

Riviera Power Plant	Riviera Beach	FL	Palm Beach	Chlorine
Pinellas County Waste to Energy Facility Facility	St. Petersburg	FL	Pinellas	Chlorine
McIntosh Power Plant/Northside WWTP	Lakeland	FL	Polk	Ammonia (anhydrous)
Mulberry Cogeneration Facility	Bartow	FL	Polk	Chlorine
Orange Cogeneration Facility	Bartow	FL	Polk	Chlorine
Hines Energy Complex	Bartow	FL	Polk	Ammonia (aqueous)
Plant Bowen	Cartersville	GA	Bartow	Ammonia (anhydrous)
Plant Hammond	Rome	GA	Floyd	Ammonia (anhydrous)
Plant Wansley Combined Cycle Units	Franklin	GA	Heard	Ammonia (anhydrous)
Chattahoochee Energy Facility	Franklin	GA	Heard	Ammonia (aqueous)
Mid-Georgia Cogeneration Facility	Kathleen	GA	Houston	Ammonia (aqueous)
Plant Scherer	Juliette	GA	Monroe	Chlorine
Hamakua Energy Partners	Honokaa	HI	Hawaii	Ammonia (anhydrous)
AES Hawaii Inc.	Kapolei	HI	Honolulu	Ammonia (anhydrous)
Power Generation Station	Muscatine	IA	Muscatine	Chlorine, Sulfur dioxide (anhydrous)
Kincaid Generation, L.L.C.	Kincaid	IL	Christian	Ammonia (anhydrous)
Ameren Energy Generating Newton Plant	Newton	IL	Jasper	Chlorine
Kendall County Generating Facility	Minooka	IL	Kendall	Ammonia (aqueous)
AEG Coffeen Power Station	Coffeen	IL	Montgomery	Ammonia (anhydrous), Chlorine
Ameren CILCo Edwards Power Plant	Bartonville	IL	Peoria	Ammonia (anhydrous)
Dynegy Midwest Generation, Baldwin Complex	Baldwin	IL	Randolph	Ammonia (anhydrous), Chlorine
Cordova Energy Company, LLC	Cordova	IL	Rock Island	Ammonia (aqueous)
CWLP's Dallman Power Station	Springfield	IL	Sangamon	Ammonia (anhydrous)
Holland Energy LLC	Beecher City	IL	Shelby	Ammonia (anhydrous)
Marion Generating Station	Marion	IL	Williamson	Ammonia (anhydrous), Chlorine
Tanners Creek Plant	Lawrenceburg	IN	Dearborn	Ammonia (anhydrous)
PSI Energy Gibson Generating Station	Owensville	IN	Gibson	Ammonia (anhydrous)
Whiting Clean Energy Cogeneration Facility	Whiting	IN	Lake	Ammonia (anhydrous)
Merom Generating Station	Sullivan	IN	Sullivan	Ammonia (anhydrous)
East Bend Generating Station	Rabbit Hash	KY	Boone	Ammonia (anhydrous)
Owensboro Municipal Utilities	Owensboro	KY	Daviess	Chlorine
Mill Creek Station	Louisville	KY	Jefferson	Ammonia (anhydrous)
Spurlock Power Station	Maysville	KY	Mason	Ammonia (anhydrous)
Kentucky Utilities-E.W. Brown Station	Burgin	KY	Mercer	Ammonia (anhydrous)
TVA - Paradise Fossil Plant	Drakesboro	KY	Muhlenberg	Ammonia (anhydrous)
Western Kentucky Energy - D. B. Wilson Station	Centertown	KY	Ohio	Ammonia (anhydrous), Chlorine
Trimble County Station	Bedford	KY	Trimble	Ammonia (anhydrous)
Western Kentucky Energy-Reid/Henderson/Green	Sebree	KY	Webster	Chlorine
Acadia Power Station	Eunice	LA	Acadia	Ammonia (anhydrous)

AEP-Plaquemine Cogeneration Facility	Plaquemine	LA	Iberville	Ammonia (anhydrous), Chlorine
Perryville Power Station	Sterlington	LA	Ouachita	Ammonia (anhydrous)
Big Cajun 2	New Roads	LA	Pointe Coupee	Chlorine
AES Warrior Run	Cumberland	MD	Allegany	Ammonia (anhydrous)
Brandon Shores Power Plant	Baltimore	MD	Anne Arundel	Ammonia (aqueous)
Montgomery County Resource Recovery Facility	Dickerson	MD	Montgomery	Ammonia (anhydrous)
Westbrook Energy Center	Westbrook	ME	Cumberland	Ammonia (anhydrous), Ammonia (aqueous)
Androscoggin Energy Center	Jay	ME	Franklin	Ammonia (aqueous)
Rumford Power Associates	Rumford	ME	Oxford	Ammonia (anhydrous), Ammonia (aqueous)
Maine Independence Station	Veazie	ME	Penobscot	Ammonia (aqueous)
Erickson Station	Lansing	MI	Eaton	Chlorine
J. B. Sims Generating Station	Grand Haven	MI	Ottawa	Chlorine
Zeeland Generating Plant	Zeeland	MI	Ottawa	Ammonia (aqueous)
Black Dog Generating Plant	Burnsville	MN	Dakota	Ammonia (aqueous)
Covanta Hennepin Energy Resource Company	Minneapolis	MN	Hennepin	Ammonia (anhydrous)
Rochester Meat Co.	Rochester	MN	Olmsted	Ammonia (anhydrous)
Aries Power Plant	Pleasant Hill	MO	Cass	Ammonia (anhydrous)
Sibley Generating Station	Sibley	MO	Jackson	Ammonia (aqueous)
KCPL - Hawthorn Generating Facility	Kansas City	MO	Jackson	Ammonia (anhydrous)
New Madrid Power Plant	Marston	MO	New Madrid	Ammonia (anhydrous)
Choctaw County Generation Station	French Camp	MS	Choctaw	Ammonia (aqueous)
Daniel Electric Generating Plant	Escatawpa	MS	Jackson	Ammonia (anhydrous)
PPL Montana	Colstrip	MT	Rosebud	Chlorine
Butler Warner GPlant	Fayetteville	NC	Cumberland	Ammonia (anhydrous)
Roxboro Steam Electric Plant	Semora	NC	Person	Ammonia (anhydrous)
Cliffside Steam Station	Cliffside	NC	Rutherford	Ammonia (anhydrous)
Belews Creek Steam Station	Belews Creek	NC	Stokes	Ammonia (anhydrous)
Coal Creek Station	Underwood	ND	Mclean	Chlorine
Salt Valley Generating Station	Lincoln	NE	Lancaster	Ammonia (anhydrous)
Lincoln Electric System Rokeby Station	Lincoln	NE	Lancaster	Ammonia (anhydrous)
PSNH Merrimack Generating Station	Bow	NH	Merrimack	Ammonia (anhydrous)
Newington Energy	Newington	NH	Rockingham	Ammonia (anhydrous)
American Reffuel of Essex County	Newark	NJ	Essex	Ammonia (aqueous)
Logan Generating Co., L.P.	Swedesboro	NJ	Gloucester	Ammonia (aqueous)

Bayonne Plant Holding, L.L.C.	Bayonne	NJ	Hudson	Ammonia (anhydrous)
Carneys Point Generating Co., L.P.	Carneys Point	NJ	Salem	Ammonia (aqueous)
Cogen Technologies Linden Venture, LP	Linden	NJ	Union	Ammonia (aqueous)
Plains Escalante Generating Station	Prewitt	NM	Mckinley	Chlorine
El Dorado Energy, L.L.C.	Boulder City	NV	Clark	Ammonia (aqueous)
Saguaro Power Company	Henderson	NV	Clark	Ammonia (anhydrous)
Bighorn Electric Generating Station	Primm	NV	Clark	Ammonia (aqueous)
Apex Generating Station	North Las Vegas	NV	Clark	Ammonia (anhydrous)
TRI-Center Power Plant	Mccarran	NV	Storey	Ammonia (anhydrous)
Saranac Power Partners, L.P.	Plattsburgh	NY	Clinton	Ammonia (aqueous)
CH Resources, Beaver Falls	Beaver Falls	NY	Lewis	Ammonia (aqueous)
AES Somerset L.L.C.	Barker	NY	Niagara	Ammonia (anhydrous)
Onondaga County Resource Recovery Facility	Jamesville	NY	Onondaga	Ammonia (anhydrous)
Onondaga Cogeneration Facility	Syracuse	NY	Onondaga	Ammonia (aqueous)
CH Resources, Syracuse	Solvay	NY	Onondaga	Ammonia (aqueous)
Massena Energy Facility	Massena	NY	St. Lawrence	Ammonia (anhydrous)
Ogdensburg Energy Facility	Ogdensburg	NY	St. Lawrence	Ammonia (aqueous)
AES Cayuga LLC	Lansing	NY	Tompkins	Ammonia (anhydrous)
DP&L - J.M. Stuart Generating Station	Manchester	OH	Adams	Ammonia (anhydrous)
Conesville Power Plant	Conesville	OH	Coshocton	Ammonia (anhydrous)
Grand River Dam Authority Coal Fired Complex	Chouteau	OK	Mayes	Chlorine
AECI CC Power Plant -- Chouteau Power Plant	Pryor	OK	Mayes	Ammonia (anhydrous)
PSO Northeastern Station	Oologah	OK	Rogers	Chlorine
PSO Riverside Power Station	Jenks	OK	Tulsa	Chlorine
Klamath Cogeneration Project	Klamath Falls	OR	Klamath	Ammonia (anhydrous)
Coyote Springs Plant	Boardman	OR	Morrow	Ammonia (anhydrous)
Hermiston Power Project	Hermiston	OR	Umatilla	Ammonia (anhydrous)
Hermiston Generating Plant	Hermiston	OR	Umatilla	Ammonia (aqueous)
Hunterstown Combined-Cycle Power Plant	Gettysburg	PA	Adams	Ammonia (aqueous)
Keystone Station	Shelocta	PA	Armstrong	Ammonia (anhydrous), Ammonia (aqueous)
FirstEnergy Bruce Mansfield Plant	Shippingport	PA	Beaver	Ammonia (aqueous)
Ontelaunee Energy Center	Reading	PA	Berks	Ammonia (anhydrous)
Colver Power Project	Colver	PA	Cambria	Ammonia (anhydrous)
Air Products, Cambria Cogen Company	Ebensburg	PA	Cambria	Ammonia (aqueous)
Panther Creek Energy Facility	Nesquehoning	PA	Carbon	Ammonia (anhydrous)
Shawville Station	Shawville	PA	Clearfield	Ammonia (anhydrous)
NorCon Power Partners, L.P.	North East	PA	Erie	Ammonia (anhydrous)
EME Homer City Generating, L.P.	Homer City	PA	Indiana	Ammonia (anhydrous)
Conemaugh Station	New Florence	PA	Indiana	Ammonia (anhydrous)

Seward Station	New Florence	PA	Indiana	Ammonia (aqueous)
Montour Steam Electric Station	Washingtonville	PA	Montour	Ammonia (anhydrous)
Conectiv Bethlehem Plant	Bethlehem	PA	Northampton	Ammonia (anhydrous)
Northampton Generating Company, LP	Northampton	PA	Northampton	Ammonia (aqueous)
Shamokin-Coal Township Joint Sewer Authority	Shamokin	PA	Northumberland	Chlorine
Ecoelectrica, L.P.	Penuelas	PR	Penuelas	Ammonia (anhydrous)
Tiverton Power Associates	Tiverton	RI	Newport	Ammonia (anhydrous)
Ocean State Power	Harrisville	RI	Providence	Ammonia (aqueous)
Pawtucket Power	Pawtucket	RI	Providence	Ammonia (anhydrous), Ammonia (aqueous)
Santee Cooper Cross Generating Station	Pineville	SC	Berkeley	Ammonia (anhydrous)
South Carolina Electric and Gas, Wateree Station	Eastover	SC	Richland	Ammonia (anhydrous)
TVA - Allen Fossil Plant	Memphis	TN	Shelby	Ammonia (anhydrous)
TVA - Cumberland Fossil Plant	Cumberland City	TN	Stewart	Ammonia (anhydrous)
Lost Pines 1 Power Plant	Bastrop	TX	Bastrop	Ammonia (anhydrous)
CPL La Palma Power Station	San Benito	TX	Cameron	Chlorine
Baytown Energy Center	Baytown	TX	Chambers	Ammonia (anhydrous)
Cedar Bayou Electric Generating Station	Eldon	TX	Chambers	Ammonia (aqueous)
W. A. Parish Electric Generating Station	Thompsons	TX	Fort Bend	Ammonia (aqueous)
P. H. Robinson Electric Generating Station	Bacliff	TX	Galveston	Ammonia (aqueous)
CPL Coleto Creek Power Plant	Fannin	TX	Goliad	Chlorine
Channel Energy Center	Houston	TX	Harris	Ammonia (anhydrous)
AES Deepwater Cogeneration Plant	Pasadena	TX	Harris	Ammonia (anhydrous)
Pasadena Cogeneration, L.P.	Pasadena	TX	Harris	Ammonia (anhydrous)
Pasadena P2 Power Plant	Pasadena	TX	Harris	Ammonia (anhydrous)
Reliant Energy Channelview, L.P.	Channelview	TX	Harris	Ammonia (aqueous)
Magic Valley Generation	Edinburg	TX	Hidalgo	Ammonia (anhydrous)
AES Wolf Hollow, L.P.	Granbury	TX	Hood	Ammonia (aqueous)
Blackhawk Station	Borger	TX	Hutchinson	Ammonia (anhydrous)
Tenaska IV Texas Partners, LTD.	Cleburne	TX	Johnson	Ammonia (anhydrous)
Lewis Creek Plant	Willis	TX	Montgomery	Ammonia (anhydrous)
CPL Lon C. Hill Power Station	Corpus Christi	TX	Nueces	Chlorine
SRW Cogeneration Limited Partnership - SRWCLP	Orange	TX	Orange	Ammonia (aqueous)
Monticello Steam Electric Station	Mt. Pleasant	TX	Titus	Ammonia (anhydrous)
WTU San Angelo Power Station	San Angelo	TX	Tom Green	Chlorine
CPL Victoria Power Station	Victoria	TX	Victoria	Chlorine
Intermountain Generating Station	Delta	UT	Millard	Chlorine
Altavista Power Station	Altavista	VA	Campbell	Ammonia (anhydrous)
Chesapeake Energy Center	Chesapeake	VA	Chesapeake (City)	Ammonia (anhydrous), Chlorine
Chesterfield Power Station	Chester	VA	Chesterfield	Ammonia (anhydrous)

Doswell Combined Cycle Facility	Ashland	VA	Hanover	Ammonia (anhydrous)
Birchwood Power Facility	King George	VA	King George	Ammonia (anhydrous)
Gordonsville Energy L.P.	Gordonsville	VA	Louisa	Ammonia (aqueous)
Hopewell Power Station	Hopewell	VA	Prince George	Ammonia (anhydrous)
Bellemeade Power Station	Richmond	VA	Richmond (City)	Ammonia (anhydrous)
Moses Lake Generating	Moses Lake	WA	Grant	Ammonia (aqueous)
Frederickson Power LP	Tacoma	WA	Pierce	Ammonia (aqueous)
March Point Cogeneration Company	Anacortes	WA	Skagit	Ammonia (anhydrous)
Spokane Regional Waste-to-Energy Facility	Spokane	WA	Spokane	Ammonia (anhydrous)
Encogen Northwest Cogeneration Plant	Bellingham	WA	Whatcom	Ammonia (anhydrous)
Tenaska Washington Partners, LP	Ferndale	WA	Whatcom	Ammonia (anhydrous)
Sumas Cogeneration L.P.	Sumas	WA	Whatcom	Ammonia (anhydrous)
Pleasant Prairie Power Plant	Pleasant Prairie	WI	Kenosha	Ammonia (aqueous)
WEPCO Germantown Turbine Inlet Cooling System	Germantown	WI	Washington	Ammonia (anhydrous)
Mt. Storm Power Station	Mt. Storm	WV	Grant	Ammonia (anhydrous)
Wygen 1	Gillette	WY	Campbell	Ammonia (anhydrous)

Endnotes

[1] Industries other than power plants with significant chemical release dangers include some chemical manufacturers, oil refineries, and drinking water and wastewater treatment plants, among others.
[2] American Lung Association, State of the Air: 2004, April 2004.
[3] U.S. Environmental Protection Agency 1986 National Air Pollution Emission Estimates, 1940-1984, EPA-450/4-85-014 (January), Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency (Research Triangle Park, North Carolina).
[4] Fossil fuel-fired power plants produce NOx emissions, regardless of whether coal, oil, or natural gas is burned to generate power.
[5] Prevention technologies include low NOx burners, flue gas recirculation, fuel reburning, and steam or water injection. These technologies may, however, decrease combustion efficiency or increase particulate pollution.
[6] NOx Control White Paper, Plant Automation Services, 2001.
[7] Information sources include: New Jersey Hazardous Substance Fact Sheets (www.state.nj.us/health/eoh/rtkweb/rtkhsfs.htm) and National Library of Medicine Hazardous Substance Data Bank (www.toxnet.nlm.nih.gov).
[8] Ibid.
[9] These figures exclude transportation. National Response Center, www.nrc.uscg.mil/foia.html.
[10] A cursory review of chemical spills reported to the National Response Center found 32 incidents involving chlorine gas at power plants.
[11] Belke, James C., Chemical accident risks in U.S. industry – A preliminary analysis of accident risk data from U.S. hazardous chemical facilities, U.S. Environmental Protection Agency, September 25, 2000.
[12] Radig, Scott, Catastrophic Anhydrous Ammonia Release, Minot, North Dakota, North Dakota Department of Health, Division of Water Quality, 2002.
[13] World Watch: Deadly Chemical Spill, St. Petersburg Times, July 9, 2002.
[14] River back to normal after summer ammonia spill, The Daily Illini, August 29, 2002.
[15] Where two or more power plant vulnerability zones overlapped we eliminated the lesser of the vulnerability zones when calculating residential population in danger.

[16] "Residents in danger" indicates the residential population within the vulnerability distance. Others may work, travel, or go to school within the vulnerability distance.
[17] "Vulnerability in miles" indicates the distance within which exposure to the high chemical concentration of a toxic cloud may lead to severe health effects or death for people who are unable to readily escape.
[18] Where two or more power plant vulnerability zones overlapped we eliminated the lesser of the vulnerability zones when calculating residential population in danger.
[19] For a list of federal reading rooms that hold Risk Management Plan information see http://yosemite.epa.gov/oswer/ceppoweb.nsf/content/readingroom.htm or call the Environmental Protection Agency at 800-424-9346 or the Department of Justice at 888-442-9267.
[20] "Power company changes plan after local outcry," *Baltimore Sun*, October 7, 2000.
[21] Public statement, American Electric Power, December 19, 2000.
[22] Walker, Hamilton G., James J. Ferrigan, Ammonia-on-Demand™ Installations at American Electric Power's Clifty Creek and Kyger Creek Plants Provide 100% Availability and Safe Operation, Hera LLC, undated.
[23] EPA cites six general methods of reducing NOx: reducing combustion temperatures, reducing time at peak temperatures, chemical reduction, oxidation, removing nitrogen from combustion, and sorption. Technical Bulletin: Nitrogen Oxides (NOx), Why and How They Are Controlled, Clean Air Technology Center, U.S. Environmental Protection Agency, EPA-456/F-99-006R, November 1999.
[24] Bitler, John R., Alternatives to Ammonia Dependent NOx Control Technologies for Cogeneration and DHC Applications, Levitan & Associates, undated.
[25] Slocomb, Stephen H., and Dale T. Raczynski, Comparison of the Cost Effectiveness of New NOx Control Technologies and Conventional Selective Catalytic Reduction for Combined Cycle Combustion Turbine Power Plants, Epsilon Associates, Inc., 2001.
[26] Slocomb and Raczynski, op. cit.
[27] EnviroScrub Homepage, www.enviroscrub.com, accessed April 2004, and communication with EnviroScrub's Curt Steinbergs, March 15, 2004.
[28] PowerSpan website (www.powerspancorp.com) and communication with PowerSpan's Chris McLarnon, April 16, 2004.
[29] Technifax: Cooling Water Chlorination, Nalco Chemical Company, 1998.
[30] Technical Topic 030-0898: Testing and Control of Bromine-Based Biocides, and Technical Topic 029-0798: Bromine Safety, International Chemtex Corporation, 1998.
[31] Lane, John and Gerald Kutner, A Non-Chemical Water Treatment for Cooling Towers, February 2000, and personal communication with John Lane, April 12, 2004.
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[35] Advanced Nontoxic Anti-Fouling Coatings, Environmental Security Technology Certification Program, Department of Defense, www.estcp.org/projects/pollution/199502v.cfm.
[36] National Response Center, Incident Report 575686, report taken August 7, 2001.
[37] Press Release: Statement by the Department of Homeland Security on Continued Al-Quada Threats, Department of Homeland Security, November 21, 2003.
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[41] CRS Report to Congress: Chemical Plant Security, Congressional Research Service, January 2003.
[42] Industrial Chemicals and Terrorism: Human Health Threat Analysis, Mitigation and Prevention, Agency for Toxic Substances and Disease Registry, 1999; and, Terrorist Use of Expedient Chemical Agents: Health Risk Assessment and Las Vegas Case Study, Agency for Toxic Substances and Disease Registry, undated.
[43] Testimony of Dr. Jay Boris of the Naval Research Laboratory before the Committee on Public Works and the Environment of the Council of the District of Columbia, January 23, 2004.
[44] Study Assesses Risk of Attack on Chemical Plant, *Washington Post*, March 12,2002.

[45] The Terrorist Threat in America, Chemical Manufacturers Association (American Chemistry Council), April 1998.

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