S. HRG. 109–1044

INHERENTLY SAFER TECHNOLOGY IN THE CONTEXT OF CHEMICAL SITE SECURITY

HEARING

BEFORE THE

COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS UNITED STATES SENATE

ONE HUNDRED NINTH CONGRESS

SECOND SESSION

JUNE 21, 2006

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ONE HUNDRED NINTH CONGRESS
SECOND SESSION

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ADDITIONAL MATERIAL

INHERENTLY SAFER TECHNOLOGY IN THE CONTEXT OF CHEMICAL SITE SECURITY

WEDNESDAY, JUNE 21, 2006

U.S. SENATE,
COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS,
Washington, DC.

The committee met, pursuant to notice, at 9:30 a.m. in room 628, Dirksen Senate Office Building, Hon. James M. Inhofe (chairman of the committee) presiding.

Present: Senators Inhofe, Bond, Voinovich, Chafee, Thune, Jeffords, Carper, Lautenberg, and Obama.

Senator INHOFE. Consistent with our policy of starting on time, we will start on time, and Senator Jeffords is here on time.

[Laughter.]

OPENING STATEMENT OF HON. JAMES M. INHOFE, U.S. SENATOR FROM THE STATE OF OKLAHOMA

Senator INHOFE. Good morning. Today the committee will be examining a concept called Inherently Safer Technology and its relation, if any, to making chemical sites more secure against terrorist attacks. Last week the Homeland Security and Government Affairs Committee held a markup on S. 2145, a bill to require heightened security at our Nation's chemical sites. During that markup, the subject of IST was hotly debated. An amendment to require IST was wisely voted down by a bipartisan vote of 11 to 5. Despite this defeat, I am certain this environmental concept will continue to be debated in the context of security, thus our hearing today remains important.

IST is essentially the idea of giving the Federal Government authority to mandate that a private company change its manufacturing process or the chemicals that they use. We will hear today from witnesses about how IST applies in the real world, what it can do and what it cannot do.

In the wake of 9/11, there was a realization that chemical facilities, which are critical to our Nation's economy, could be targets for terrorism. Since then, the Bush Administration has made a determined effort to protect our Nation's critical infrastructure against terrorists who aim to harm us. Congress, too, has acted by enacting into law the Marine Transportation Security Act, the Bioterrorism Act, and a comprehensive nuclear security package that was passed out of this committee.

Congress also created the Department of Homeland Security vesting it with power and authority to protect the Nation's infrastructure. DHS has worked diligently and quickly to address the

Nation's security issues. In the chemical sector, they have deployed teams of counter-terrorism specialists to each identified high-risk chemical facility to work with management, local first responders and law enforcement, States and other Federal agencies to assess and address the security needs. DHS has also created several tools to help all chemical facilities, regardless of whether they represent high-risk locations. This all means that chemical facilities are more protected and we are all indeed safer than we were 5 years ago.

This committee has twice tried to move legislation to require certain chemical plans to upgrade their security against terrorist acts, a move strongly supported by the Administration and DHS. Each time, we have been sidetracked by the insistence of some that any such legislation must include allowing DHS to mandate IST. This is an idea that is not supported by DHS, the Nation's premier security experts.

The idea of IST predates 9/11. This is very important. We talk about IST and relationship with the security bill. IST was an effort by several environmentalist groups to put in their demands and dictates to business and industry long before 9/11 occurred. Then now they have taken advantage of the fact that 9/11 is there and we are taking security measures, they are trying to put this on. So this is what we are dealing with.

DHS Security Chertoff said, and this is a quote, "We have to be careful not to move from what is a security-based focus—into one that tries to broaden into achieving environmental ends that are unrelated to security." IST is not a "thing" that can be readily identified in legislation and then measured and regulated. It is a philosophy of safe manufacturing that translates into a complicated, interrelated set of site and community-specific decisions made by engineers and safety experts. We will hear from these very engineers today.

What the security experts at DHS have said that they support and need from Congress is a law requires facilities to achieve a level of security. They want a performance standard set by DHS that allows for industry to decide how to reach it.

Over the past 5 years, industry has also taken great strides to protect their facilities and they did this voluntarily, in absence of a mandate to do so. For example, the Center of American Progress, who is testifying today, recently noted that 284 facilities in 47 States examined their processes and made what the report characterized as IST-like changes. This proves my point; though I doubt that is what you had in mind. These companies did not operate under a Federal regulation when they made the changes. They made a business case decision.

You know, it is kind of the idea that these companies, as some would say, they want to have insecurity, they want to have the threat that faces them. They don't want that. That would cost them money. That would cost lives, that would destroy their property.

Consequently, they are concerned about it, and I think that if you want to pursue the IST thing, that is fine, go ahead and do it. But do it on some other bill. Don't do it in conjunction with security, because it has nothing to do with security.

Senator JEFFORDS.

[The prepared statement of Senator Inhofe follows:]

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IST is essentially the idea of giving the Federal Government authority to mandate that a private company change its manufacturing process or the chemicals that they use. We will hear today from witnesses about how IST applies in the real world. What it can do and what it cannot.

In the wake of 9-11, there was a realization that chemical facilities, which are critical to our Nation's economy, could be targets for terrorism. Since then, the Bush Administration has made a determined effort to protect our Nation's critical infrastructure against terrorists who aim to harm us. Congress, too, has acted by enacting into law the Marine Transportation Security Act, the Bioterrorism Act, and a comprehensive nuclear security package that was passed out of this committee. Congress also created the Department of Homeland Security vesting it with power and authority to protect the Nation's infrastructure. DHS has worked diligently and quickly to address the Nation's security issues. In the chemical sector, they have deployed teams of counter terrorism specialists to each identified high-risk chemical facility to work with management, local first responders and law enforcement, states and other Federal agencies to assess and address the security needs. DHS has also created several tools to help ALL chemical facilities regardless of whether they represent high-risk locations. This all means that chemical facilities are more protected and we are all indeed safer than we were 5 years ago.

This committee has twice tried to move legislation to require certain chemical plants to upgrade their security against terrorist acts—a move strongly supported by the Administration and DHS. Each time, we have been sidetracked by the insistence of some that any such legislation must include allowing DHS to mandate IST. This is an idea that is not supported by DHS, the Nation's premier security experts.

The idea of IST predates 9/11 and has never been about security. IST is an environmental concept that dates back more than a decade when the extremist environmental community, Greenpeace and others, were seeking bans on chlorine—the chemical that is used to purify our Nation's water. It was only after 9/11 that they decided to play upon the fears of the Nation and repackage IST as a panacea to all of our security problems.

Of course I do not view Greenpeace as any sort of authority on security issues—I prefer to stick to the real security experts. And the real security experts at DHS have been crystal clear that they do not support IST requirements. DHS Secretary Chertoff has said: "We have to be careful not to move from what is a security-based focus into one that tries to broaden into achieving environmental ends that are unrelated to security."

IST is not a "thing" that can be readily defined in legislation and then measured and regulated. It is a philosophy of safe manufacturing that translates into a complicated, interrelated set of site and community-specific decisions made by engineers and safety experts. We will hear from these very engineers today.

What the security experts at DHS have said that they support and need from Congress is a law that requires facilities to achieve a level of security. They want a performance standard set by DHS that allows for industry to decide how to reach it.

Over the past 5 years, industry has also taken great strides to protect their facilities and they did this voluntarily, in absence of a mandate to do so. For example, the Center of American Progress, who is testifying today, recently noted that 284 facilities in 47 states examined their processes and made what the report characterized as IST—like changes. This proves my point; though I doubt that is what you had in mind. These companies did not operate under a Federal regulation when they made the changes. They did a business case study of their operations and made their decisions weighing various factors. Despite what some interest groups would have us believe, chemical companies do not want an attack on their assets anymore than we do. They do not need the Federal Government coming in and telling them specifically how to manufacture products. Government's role is to direct them to make their facilities secure and help them by providing the guidance and tools to

do it but not stifle innovation and economic opportunity by dictating to them how to it.

I look forward to hearing from our witnesses.

OPENING STATEMENT OF HON. JAMES M. JEFFORDS, U.S. SENATOR FROM THE STATE OF VERMONT

Senator JEFFORDS. Thank you, Mr. Chairman.

Homeland security experts have referred to chemical plants as "pre-positioned weapons of mass destruction." Yet nearly 5 years since the September 11th attacks, the Bush Administration has done almost nothing to address this glaring vulnerability.

I am pleased that the Senate Homeland Security Committee unanimously adopted legislation last week to address the widespread risks posed by chemical facilities. Over 15,000 chemical facilities nationwide store sufficient quantities of hazardous chemicals to likely cause death or injury to the surrounding communities if released.

The chemical industry's own data indicates that it in a worst case release, toxic chemicals could threaten more than 1 million people at over 100 facilities across the Nation. More guards in higher fences are not enough to protect our communities from the dangers posed by chemical facilities. Rather, owners and operators of chemical plants need to take practical steps to reduce the inherent hazards posed by their facilities.

For example, swimming pool service companies have made their neighborhoods safer by switching from chlorine gas to bleach or chlorine tablets. Unfortunately, thousands of communities remain vulnerable because facilities in their towns have not chosen to implement such measures. For example, nearly 3,000 drinking water and wastewater treatment plants still use chlorine gas instead of liquid bleach or ultraviolet light.

Should implementation of inherently safer technology be mandatory for all chemical facilities? No. That has never been my position. Rather, when I chaired this committee in 2002, we unanimously adopted legislation that would have required consideration of the implementation of inherently safer technologies "when practicable."

Senator Inhofe's bill that passed out of committee during the last Congress also would have required implementation of alternative approaches "when practicable" in the judgment of the owner and operator. Likewise, Senator Lieberman's proposal last week would require implementation of inherently safer technology only when it would significantly reduce the risk of serious injuries and was practicable.

Some have suggested that inherently safer technologies merely shift the risk from one location to another. However, such technologies will be elevated on a case by case basis and implemented only if they would make the community safer.

Let me also mention two other elements that are critical for effective chemical security legislation. First, to ensure public accountability, citizens and local officials must be allowed to determine if a facility in their community is in compliance and to challenge the Department of Homeland Security actions or inactions if

necessary. Second, Congress should preserve the right of States to implement more stringent laws as needed to protect their citizens.

In conclusion, legislation addressed to the risks posed by chemical facilities is long overdue. I am looking forward to the hearing and will work to ensure that the Congress enacts a strong chemical security law.

Thank you, Mr. Chairman.

[The prepared statement of Senator Jeffords follows:]

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Second, Congress should preserve the right of states to implement more stringent laws as needed to protect their citizens.

In conclusion, legislation to address the risks posed by chemical facilities is long overdue.

I look forward to this hearing and will work to ensure that Congress enacts a strong chemical security law.

Senator INHOFE. Thank you, Senator Jeffords.

Senator BOND.

OPENING STATEMENT OF HON. CHRISTOPHER S. BOND, U.S. SENATOR FROM THE STATE OF MISSOURI

Senator BOND. Thank you very much, Mr. Chairman, for holding this hearing of the Environment Committee on Inherently Safer Technologies.

Attempting to change internal manufacturing processes to use and produce products that are less of a risk to the environment is a longstanding goal of environmental stakeholders. It is only natural that the Environment Committee reviews this latest reincarnation of its environmental issue. Proposals mandating so-called inherently safer technologies, in order to avoid risks to the environment, are not new. Bills have been around Congress, including those championed by our colleague from New Jersey, for a long time.

After the tragic events of 9/11, environmental stakeholders saw an opportunity to dust off their old IST bills. Indeed, earlier versions of legislation with IST mandates consisted of nothing more than these old environmental bills with the addition of the words "homeland security" sprinkled here and there. Well, it was a bad idea then, and it is a bad idea now. Not only is it bad policy, but it is most likely an impossible policy to implement in any successful way.

If I didn't make myself clear, I will go on and explain a little bit. [Laughter.]

Senator BOND. Advocates throw out casual examples as if there are only one or two simple examples that cover everything. It is just like getting rid of chlorine in water treatment plants, they say. It is simple and no big deal.

However, it is a big deal, if not an overwhelmingly impossible deal. Our modern life depends on hundreds of thousands of industrial processes to produce products we need for safety, health and prosperous lives. Medicines that save lives, fertilizers that help feed nations, even simple things such as laundry baskets and Tupperware don't just grow on trees. They are made with complex industrial processes, using chemicals that are sometimes dangerous or hazardous.

Manufacturing processes differ not only from sector to sector and product to product, but from plant to plant. How do we imagine the Government and the legal system would know how to operate these industrial plants better than plant managers themselves? Some proposals would include a review of alternatives using inherently safer technologies. Can you imagine that a Government bureaucrat would have the expertise to review these operations?

How could someone in Washington be able to review a report and say that product A made on line B in plant C in the middle American town of D should have been made a different way? Even if they could, how could they conduct thousands of those complex reviews and make thousands of those decisions across this massive economy? Even if they could do that, how could they know that the alternatives they might recommend as inherently safer technologies were affordable, or would not cause plant closures, lost jobs? Would they even care?

Other bills impose a general duty to employ inherently safer technologies. Is this something we want to leave up to attorneys to argue over and sue over? How many countless billions of dollars would be spent to avoid a legal liability, even if the risk of danger is remote? How many vital products would disappear from the market over liability fears, even if producers are fully complying with

the numerous health safety and security regulations already on the books?

Yes, we must examine IST calls in the context of regulations that are already on the books, already generating reports, already informing responders and already forcing security changes. Operators responsible for safety are already taking action. Local Governments charged with response are taking action. Organizations representing industries, Federal agencies, congressional committees are all taking action. In addition, the Government Affairs Homeland Security has just rejected IST mandates as untenable.

I am delighted, Mr. Chairman, that the committee will hear testimony on just how impossible an idea this is from a fellow Missourian. Charlie Cott was born and raised on a grain and livestock farm in Saline County, MO, where my grandparents grew up. Charlie is now with the Missouri Farmers Association, the regional farm cooperative, supply cooperative that represents 45,000 farmers in Missouri and surrounding States.

Charlie is here today representing the Agricultural Retailers Association. He is the face of our farmers who bring food to the market, food we find in our grocery stores, in our pantries and on our dinner plate. He has first-hand insight into how broadly and how deeply a fundamental and comprehensive mandate, such as IST, would affect all our daily lives.

You don't have to take my word for it, and you probably won't. But I ask you to listen to the people who are actually engaged in this field and make your judgment based on what they have to say. I thank Mr. Cott for joining us, and I thank my colleagues for their indulgence.

[The prepared statement of Senator Bond follows:]

STATEMENT OF HON. CHRISTOPHER S. BOND, U.S. SENATOR FROM THE STATE OF MISSOURI

Mr. Chairman, thank you for holding this hearing today in the Environment Committee on Inherently Safer Technologies. Attempting to change internal manufacturing processes to use and produce products that are less of a risk to the environment is a longstanding goal of environmental stakeholders. It is only natural that the Environment Committee review this latest reincarnation of this environmental issue.

Proposals mandating so-called inherently safer technologies (IST) in order to avoid risk to the environment are not new. Bills have been around for many Congresses, including those championed by our colleague from New Jersey.

After the tragic events of 9/11, environmental stakeholders saw an opportunity to dust off their IST bills. Indeed, earlier versions of legislation with IST mandates consisted of nothing more than those old environmental bills with the addition of the words "homeland security" sprinkled here and there.

It was a bad idea then and it is a bad idea now. Not only is it bad policy, but it is most likely an impossible policy to implement in any successful way.

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Manufacturing processes differ not only from sector to sector or product to product, but from plant to plant. How do we imagine that the government or legal sys-

tem would know how to operate these industrial plants better than the plant managers themselves?

Some proposals would include a review of alternatives using inherently safer technologies. How could we ever imagine that a government bureaucrat would have the expertise to review these operations. How could someone far away in Washington be able to review a report and say that product A made on line B in plant C in middle America town D should have been made a different way?

And even if they could, how would they conduct thousands of those complex reviews and make thousands of those decisions across our massive economy? And even if they could do that, how would they know that alternatives they might recommend as inherently safer technologies were affordable, or would not cause plant closures or lost jobs? Would they even care?

Other bills impose a general duty to employ inherently safer technologies. Is this something we want to leave up to attorneys to argue over, or sue over? How many countless billions would be forced to be spent to avoid such a legal liability, even if the risk of danger is remote? How many vital products would disappear from the market over liability fears? Even if producers are fully complying with the numerous health, safety, and security regulations already on the books?

Yes, we must examine IST calls in the context of regulations that are already on the books, already generating reports, already informing responders, and already forcing security changes.

Operators responsible for safety are already taking action.

Local governments charged with response are already taking action. Organizations representing industries are already taking action. Federal agencies are already taking action. Congressional committees are already taking action. Indeed, the Senate Committee charged with Homeland Security just rejected IST mandates as untenable.

I am delighted that the Committee will hear testimony on just how impossible this idea is from a fellow Missourian. Charlie Cotts was born and raised on a grain and livestock farm in Saline County, Missouri. Charlie is now with the Missouri Farmers Association,

a regional farm and supply cooperative representing 45,000 farmers in Missouri and surrounding states.

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I thank him for joining us here today and I thank my colleagues for their indulgence.

Senator INHOFE. Thank you, Senator Bond.

Senator LAUTENBERG.

OPENING STATEMENT OF HON. FRANK R. LAUTENBERG, U.S. SENATOR FROM THE STATE OF NEW JERSEY

Senator LAUTENBERG. Thanks very much, Mr. Chairman, for calling this hearing to show how impossible the task would be to have IST in place. I really appreciate this opportunity. Thank you, Senator Bond.

I have been involved with this issue for many years. I introduced the first chemical security bill in 1999. Since the terrorist attacks of 9/11/2001, I believe that it is even more important to improve security measures at facilities that manufacture or use dangerous chemicals.

Now, my State of New Jersey is particularly vulnerable. We have our own IST standard, and because of the number of chemical manufacturing and transporting facilities, warehousing, et cetera, we have a great deal of concern about the safest way to deal with chemical safety and security. I think IST is a common sense approach, and I have been pleased to work with my colleague, Senator Obama, on the issue. We introduced a bill that requires IST for facilities storing large amounts of chemicals where practicable.

The last qualifier is important: where practicable. I listened to our colleague, and listened to how the IST idea strikes, carries his attention. It is nice that we have a disbeliever here.

The question is, can it work? How can we bureaucrats, and I am only a junior bureaucrat, because I am only here a couple of years now, the fact is that how can we bureaucrats describe something to management? I think we did it with pesticides. I see Senator Biden here. I think we did it with pesticides, right? They were using pesticides and killing darned near everything in sight, not only animals, but humans as well.

We insisted, we bureaucrats insisted that the industry change its materials. They did it, and you know what? There is more wildlife in the skies, more birds have come back, people live healthier now, everybody is going to something called organic I guess organic is an IST, right, inherently safer technology? It works.

When we think about how difficult it is to enforce compliance, just think of IRS. How many of those returns are not examined, but violate the law in terms of necessity to file, necessity to be accurate? But we don't throw our hands up and say, oh, it is too hard to monitor this. We just go ahead and we do what we have to.

Now, even the chemical industry recognizes that IST can reduce risks. Again, remember the S is safety, that IST can reduce risks, and some facilities are voluntarily examining whether it will work for them. I am glad that these individual facilities are taking these voluntary steps. That is good corporate citizenship.

That doesn't mean that we can trust the entire industry to take prudent safety precautions. As public servants, our most important duty is the protection of the public. No physical security system at a chemical plant is foolproof. The best way to guarantee the safety of workers and nearby residents is to use safer materials and processes wherever we can in our chemical facilities.

The National Research Council conducted a study of this issue for the Department of Homeland Security. Their study concluded, "The most desirable solution to preventing chemical releases is to reduce or eliminate the hazard where possible, not to control them." This is a strong recommendation for inherently safer technology. I think to ignore that recommendation is at our peril.

Now, I look forward to hearing from today's witnesses. I especially want to welcome the Commissioner of New Jersey's Department of Environmental Protection, Lisa Jackson. She works for another long-time champion of strong chemical security measures, Governor John Corzine, whom you all know well. We thank you, Ms. Jackson, for traveling here today to testify on an issue that is of such critical importance to our State, and frankly, I believe to States across this country.

I thank you, Mr. Chairman.

Senator INHOFE. Thank you, Senator Lautenberg.

Senator VOINOVICH.

OPENING STATEMENT OF HON. GEORGE V. VOINOVICH, U.S. SENATOR FROM THE STATE OF OHIO

Senator VOINOVICH. Thank you, Mr. Chairman, for holding this hearing today. The chemical industry is a critical component of our

Nation's economic infrastructure. Securing it is of the utmost importance.

I compliment your attention to this matter over the years. Your commitment to the issue helped to lay the groundwork for the legislation that passed out of the Homeland Security and Governmental Affairs Committee last week. I look forward to working with you and all the other interested people to improve the legislation on the Senate floor and ensure that our Nation's chemical sector is secure from the threat of terrorist attacks.

The chemical industry contributes to our high quality of life, whether it is enhanced crop production, improved water chlorinization, effective household cleaners or advanced life-saving medications. However, these benefits do not come without risk. Where there is risk, we must assess that risk and take the appropriate action.

I think we also have to weigh the threat versus the cost in securing our homeland. I think we should acknowledge that we already have the Marine Transportation Safety Act that is regulating many of these facilities in the most vulnerable places.

We have to also recognize that the industry, through something called responsible care, is also doing everything that they can to secure their facilities. There is sometimes a tendency on the part of Members of Congress to not recognize the fact that if I own a chemical facility, I am going to do everything I can to protect the people who work in that facility, I am going to do everything I can to protect the investment in the facility, and I do care about my neighbors in the area where my facility is located.

The concept of inherently safer technology originated in an environmental protection and occupational safety context. Safety and environmental concerns are already regulated by the Occupational Safety and Health Administration and by the Environmental Protection Agency through their risk management program. It should be noted that while the EPA encourages consideration of IST it mandates neither analysis nor implementation of IST in its risk management program.

I must ask if the EPA does not see fit to even mandate the analysis or consideration of IST, then why should the Department of Homeland Security?

While the concept of IST may be appropriate in the context of worker safety and environmental protection, it is both unprecedented and ill-conceived as a security measure. The definition of security is broadly understood to include such measures as employee background, identification checks, the limitation and prevention of access to controls, perimeter protection, the installation of intrusion detector sensors and other measures to prevent, protect against or deter a terrorist incident. In short, security enhancements are primarily made outside the fence.

Furthermore, there is no precedent for including IST in a Federal security regulatory regime. The term is inconsistent with security precedent set by the Bioterrorism Act, the Maritime Transportation Act and the Atomic Energy Act, which regulates our 103 nuclear facilities in this country. These laws focus on enhancing physical security measures, not mandating private sector industrial process change.

The law most similar to the chemical facility security legislation that the Senate will be considering is MTSA, and MTSA requires security commensurate with risk, not the reduction or elimination of that risk. IST is largely defined as "the relocation, hardening of the storage or containment modification processing, substitution or reduction of substances of concern." I feel strongly the Federal Government should not direct industry practice or procedure; rather, it should be left to process safety experts.

The Homeland Security and Governmental Affairs Committee agrees with this position. An amendment that would have mandated IST for hundreds of chemical facilities was defeated on a bipartisan vote of 11 to 5. Additionally, I offered an amendment to ensure that no site security plan could be denied by DHS for the absence of a particular security measure. Therefore, no site security plan could be denied by DHS based solely on the absence of IST. That is in the law that passed out of the Homeland Security and Governmental Affairs Committee. That amendment was adopted by voice vote.

Mr. Chairman, I would like to remind my colleagues that the U.S. chemical industry is already experiencing economic hardship as a result of rising natural gas costs, which I believe this Congress is partly responsible for because of our unrealistic environmental policies. According to the American Chemistry Council, the U.S. chemical industry went from posting trade surpluses in excess of $20 billion in 1995 to becoming a net importer of chemicals with a $9 billion deficit in 2005. I want to tell you something, a lot of those jobs were lost in my State of Ohio.

So I am interested in hearing what the witnesses have to say about this. I do not believe IST belongs in this chemical security legislation.

[The prepared statement of Senator Voinovich follows:]

STATEMENT OF HON. GEORGE V. VOINOVICH, U.S. SENATOR FROM THE STATE OF OHIO

Mr. Chairman, thank you for holding this hearing today on Inherently Safer Technology and chemical security. The chemical industry is a critical component of our Nation's economic infrastructure, and securing it is of the utmost importance. I complement your attention to this matter over the years. Your commitment to the issue helped to lay the groundwork for the legislation that passed out of the Homeland Security and Governmental Affairs Committee last week. I look forward to working with you and all of our interested colleagues to improve the legislation on the Senate floor, and ensure that our nation's chemical sector is secure from the threat of terrorist attacks.

The chemical industry contributes to our high quality of life, whether it is enhanced crop production, improved water chlorination, effective household cleaners or advanced life-saving medications. However, these benefits do not come without risk. Where there is risk, we must assess that risk and take the appropriate action.

The concept of "inherently safer technology" originated in environmental protection and occupational safety contexts. Safety and environmental concerns are already regulated by the Occupational Safety and Health Administration and by the Environmental Protection Agency through the Risk Management Program. It should be noted that while the EPA encourages consideration of IST, it mandates neither analyses nor implementation of IST in its Risk Management Program. I must ask, if the EPA does not see fit to even mandate the analyses or consideration of IST, then why should the Department of Homeland Security?

While the concept of IST may be appropriate in the context of worker safety and environmental protection, is both unprecedented and ill-conceived as security measure. The definition of security is broadly understood to include such measures as employee background and identification checks; the limitation and prevention of ac-

cess to controls; perimeter protection; the installation and of intrusion detection sensors; and other measures to prevent, protect against, or deter a terrorist incident. In short, security enhancements are primarily made outside the fence.

Furthermore, there is no precedent for including IST in a Federal security regulatory regime. The term is inconsistent with security precedent set by the BioTerrorsim Act, the Maritime Transportation Security Act (MTSA), and the Atomic Energy Act. These laws focus on enhancing physical security measures, not mandating private sector industrial process change. The law most similar to the chemical facility security legislation that the Senate will be considering is MTSA, and MTSA requires security commensurate with risk — not the reduction or elimination of that risk.

IST is largely defined as "the relocation, hardening of the storage or containment, modification, processing, substitution, or reduction of substances of concern." I feel strongly that the Federal Government should not direct industry practice or procedure; rather, that should be left to process safety experts.

The Homeland Security and Governmental Affairs Committee agrees with this position. An amendment that would have mandated IST for hundreds of chemical facilities was defeated on a bipartisan 11-5 vote. Additionally, I offered an amendment to ensure that no site security plan could be denied by DHS for the absence of a particular security measure. Therefore, no site security plan could be denied by DHS based solely on the absence of IST. My amendment was adopted by the Committee by voice vote.

Mr. Chairman, I would remind my colleagues that the U.S. chemical industry is already experiencing economic hardship as a result of rising natural gas costs. According to the American Chemistry Council, U.S. chemical industry went from posting trade surpluses in excess of $20 billion in 1995 to becoming a net importer of chemicals, with a $9 billion deficit in 2005.

With more than 100,000 American jobs displaced, the industry can ill afford additional regulation that could add enormous costs and further diminish its competitiveness while adding little additional security value. IST is adequately regulated by the appropriate entities: EPA and OSHA. Efforts to push further IST or process change requirements in name of security should be rejected.

Mr. Chairman, I ask unanimous consent that this information paper from the ACC be included in the record.

Thank you, Mr. Chairman.

Senator INHOFE. Thank you, Senator Voinovich.

Senator OBAMA.

OPENING STATEMENT OF HON. BARACK OBAMA, U.S. SENATOR FROM THE STATE OF ILLINOIS

Senator OBAMA. Thank you very much, Mr. Chairman. I am looking forward to hearing from the witnesses.

Just to pick up on something that Senator Voinovich said, Illinois has one of the biggest chemical industries in the country. We have 900,000 people working directly in chemical facilities around the country, but 53,000 of them are in Illinois. So I have a great interest in seeing a strong and vibrant chemical industry.

My hope was that we could not prejudge these issues. The reason that we were having a hearing, hopefully, was to learn something new, as opposed to simply dig in on our previous positions. I do wish that we could have held this sooner, before this committee passed what I believe is an insufficient wastewater security bill, and before the Senate Homeland Security Committee passed chemical plant security legislation that did not include strong IST provisions.

I think that IST is an integral part of chemical plant security. I welcome a thorough debate of this issue, because I think that a lot of misleading arguments have been made about what IST is and isn't, and it is important to clear up some of these misconceptions.

For instance, we have heard that IST is in the early stages of development, even though it has been used in the chemical indus-

try itself for nearly 30 years. Saying IST is in its infancy is a little like saying the personal computer is in its infancy.

We have heard that IST is an environmental issue—that has been repeated already in some of the statements—not a security one despite the fact that the Departments of Justice and Homeland Security, and even though the American Chemical Council itself have embraced IST as part of chemical plant security in the past. Most recently, a National Academy of Sciences study commissioned by DHS endorsed the adoption of IST as "the most desirable solution to preventing chemical release from terrorist attack." Time and again, experts have agreed that IST is the most effective approach to eliminating terrorist threats to chemical facilities.

We have heard that IST is too expensive, but that does not have to be the case. A recent survey of nearly 300 facilities that switched to safer technologies since 1999 found that 87 percent spent less than $1 million and one half reported spending less than $100,000 in applying IST. Thirty-four percent of survey participants actually expected to save money or improve profitability in part because IST reduces the need for barriers, secondary containment, security training and liability concerns.

We have heard that IST merely shifts risks, rather than eliminates them. I understand that some of the witnesses today will base their arguments on the theoretical example of a facility that reduces its inventory of a dangerous chemical, but then has to make more frequent shipments, which in turn places more chemicals in the transportation system.

In fact, there are hundreds of real-world examples of wastewater facilities switching from chlorine gas to liquid bleach, or manufacturing plants using lower temperatures or simplified processes to reduce risks. If anything, the theoretical examples cited by these witnesses only highlights the need for DHS to play a role in the IST decision, making the process to ensure that individual facilities are not making short-sighted decisions, that merely shift risks elsewhere.

There is one thing that we can all agree on: any chemical plant security legislation should be comprehensive and rational. It should balance the need to keep us safe with the need to continue producing chemical products that are essential to our economy. I believe that the IST approach needs to be a part, not the whole, but a part of rational, comprehensive security legislation. Without it, we are leaving a huge gap in our ability to manage the risks that these facilities represent.

Mr. Chairman, I just think that it is important before we move on to emphasize the risks. There are 111 facilities in this country where chemical release could threaten more than 1 million people under the worst case scenarios. There are more than 750 additional facilities where such a release could threaten more than 100,000 people. These are not speculative. And every security expert that you talk to will tell you that in fact there are enormous potential risks.

I am glad that the chemical industry has taken some of the steps that it has done on its own. The question is whether or not we can provide some additional measures that would improve safety with-

out being an onerous burden on industry. That is what I am going to be interested in hearing today.

Thank you, Mr. Chairman.

Senator INHOFE. Thank you, Senator Obama.

Well, it has been the custom of this committee to allow any Senator who wants to be heard to testify before this committee. We have a request from the senior Senator from Delaware, Senator Biden. If you would take the bench and give us your testimony, we would appreciate it.

STATEMENT OF HON. JOSEPH BIDEN, U.S. SENATOR FROM THE STATE OF DELAWARE

Senator BIDEN. Thank you very much. Thank you, Mr. Chairman.

It reminds me of the good old days in the Judiciary Committee, we used to debate abortion. It is nice to be at a committee where it is so unified.

Maybe what I should do is direct my comments—I don't know which half of this outfit to direct it to. Folks, I would like to ask that my prepared statement be entered into the record in whole, if I may.

Senator INHOFE. Without objection, so ordered.

Senator BIDEN. Mr. Chairman, I just want to begin by pointing out that I come from what used to be called the chemical capital of the world, that was our logo. I am not representing any environmental group, I am not a subversive. The way sometimes we talk about this, it began as an environmental, this idea began with environmentalist, is a little bit like it came out of Mein Kampf or some subversive doctrine.

The only generic point I will make at the outset here is that initially, the reason why EPA didn't have these types of rules or suggestions that we are talking about that has taken on the acronym we are all referencing is because the chemical plants in my State were safe for the workers, as long as they didn't blow up. It wasn't that they were going to spontaneously blow up, the chlorine wasn't all of a sudden going to implode, or that the plant and the dangerous chemical there. So there was no need for, I say to my friend from Ohio, for environmental legislation relating to a facility that, absent some act of God and/or some terrorist act, could cause great damage.

So I would argue we are comparing apples and oranges when we say that, look, if you don't need this for the safety of the employees, why then do we need this for the safety of the community? They are fundamentally different questions. EPA looks at what is likely to occur if things are run as they are supposed to run, and to overstate it, it makes regulations related to those circumstances. It does not calculate if Osama bin Ladin and his boys climb across the fence in New Castle, Delaware and blow up a chemical plant that happens to be a chlorine plant.

So there are two different issues in my point. The issue of inherently safer technologies, in my view, is in fact critically important to homeland security. I commend you all here on this committee for focusing on the issue. I hope that what I am about to say will add

some content to the debate, because if we do this right, I think we can advance the ball to enhance the safety of millions of people.

I live in an area where there are 10 million people. Everybody looks at Delaware as a little, tiny State. We are a little, tiny State. We live in the Delaware Valley. Ten million people. We have more oil refineries and chemical plants in our general area than you do in any other place, including Houston or—add them all up. There are 10 million people in this area. So we are concerned about this issue.

I believe that we have a greater obligation to protect our hometowns and to protect against what has now become unfortunately not a reasonable but a, if not predictable, a probable threat. Anybody thinks that terrorists have gone out of business and are not going to be hanging around, and if you are sitting out there, a terrorist, you say, OK, where do I get my biggest bang for the buck—no pun intended? Where do you do that?

Well, I will tell you what, I would just take a 90 ton chlorine gas tanker, I would put some plastique underneath it, go, by the way, to any of the yards, you will see there are no cameras, there is no police, there is not much switching, not a hard thing to do. I would wait until it hit a populated area. I asked the Naval Research Center, what would happen if one of these tankers blew up in a populated area? They said, 100,000 people would die or be severely injured, 100,000 folks.

We had a little amendment that said, to make the point, this is not just about inherently safer technologies. It is about inconvenience. I introduced an amendment that a number of States wanted to allow cities and States to force these very dangerous commodities to be able to go around cities, and it got voted down. Why? Because it will cost more money to take it around. It would cost more money. It would cost more money.

I found that kind of amazing. If we simply require facilities that store and utilize large amounts of chlorine or other dangerous chemicals, to transition inherently safer technology wherever feasible, we could in fact completely or permanently eliminate known threats to our communities. This would allow us to focus our scarce resources on border security and other critical infrastructure.

By the way, the Marine Maritime Act, which I voted for, I took last recess and I went to, I started off in Charleston and went down the ports of Miami, then I went to New Orleans, then I went to California, then I went to Seattle to talk to these guys. They don't think this is secure. Talk to the people who have in fact had to implement the Act. We talk about this Act like it has done something. It has done something. But my, oh, my, you ought to go talk to the port directors in these ports as I did. Don't take my word for it, check it out.

So there is a whole lot of focus we need on greater resources on places which present threats which cost a lot more money to protect than if we in fact just were to make some of these changes. For example, in my little old State of Delaware, we had the Wilmington water pollution control facility, and it transitioned from gaseous chlorine to chlorine bleach. That decision eliminated a threat to 560,000 people, according to the security people. It cost $160,000 in capital investment.

Because the facility permanently eliminated the risk, it is no longer required to spend, I didn't even calculate the number, they don't need guards, they don't need fences, and they don't need security around the facility now. So I don't know what the net cost is, but it is less than $160,000. Not only should we be supporting this type of decision, we should require it wherever it is practicable. That is the important word this legislation says.

In my view, it is unacceptable that only 5 years after the attacks of September 11th, we haven't made a decision to reduce the dangers posed by these gaseous chemicals at chemical facilities and water treatment plants. It is not like this is some kind of burdensome requirement that will kill industry. It has been pointed out, hundreds of facilities have made this decision without Government intervention. These facilities seem to be operating just fine. In addition, every proposal that I have seen provides for a transition only if it is practicable and it would allow a facility, not the Government, to determine what the alternative process should be.

As always, another overriding concern for Government and for industry is the cost associated with the transition. According to the Department of Homeland Security, there are 300 chemical facilities that put over 50,000 citizens in danger. As a result, a report by the Center for American Progress, found 87 percent of these facilities reported that it would cost no less than $1 million, and one half of these—as my friend from Illinois—I am trying to get through this quickly—from Illinois pointed out, $100,000 was the cost to transfer these technologies.

If we were to provide $1 million, a top-end estimate, for every chemical facility to transfer to safer technologies, we could eliminate the risk for $300 million. To eliminate the threat posed by roughly 100 water treatment facilities that threaten over 100,000 individuals each, it would cost $125 million. This doesn't even require that. Thus, an investment of less than half a billion dollars would eliminate the threat to nearly 60 million people.

In contrast, we didn't have any problem with the $35 billion profits this year for the oil industry, and God bless them, I am glad they are making profits. We didn't have a problem giving an energy bill a $2 billion incentive. A $2 billion incentive. My dad used to say, and my friend Tom Carper knew him before he passed away, he used to say, hey, champ, if everything is equally important to you, nothing is important to you. If you don't prioritize, it doesn't matter.

Tell me that spending $2 million to encourage the oil industry and gas industry is a higher priority than spending $125 million to take every single water treatment facility in America and make it—even if we paid it all, just outright, just outright. Wow. I don't quite get that.

Because the transition to safer technologies will result in savings by reduction of guns, guards, gates and bureaucratic expense, it seems to me that costs would even be lower. Quite frankly, gentlemen, in my view, this is a good use of Federal resources. If industry officials will work with us, I think we could devise a system where we could help fund capital investment with facilities returning the savings that result in out years. In the process, we protect

millions of Americans and reduce the strain on local law enforcement and first responders.

In conclusion, Mr. Chairman, and I really do appreciate your giving me the time, I know at least on my committees, when I chaired Judiciary for 17 years and Foreign Relations, if a colleague says they want to testify, and you go, oh, God, why does he have to come and testify, we have enough to do? So I understand that, having been chairman longer than any one of you up there combined. I get it.

But let me conclude with this. The 9/11 Commission issued a report on their own nickel on December 15th of last year, 2005. It is just an interesting little sidelight, and I will get out of your hair. It says, part 1, homeland security emergency preparedness and response, it gives a recommendation and a grade. It is a category. Critical infrastructure risk and vulnerabilities assessment. Let me just read what it says and I will depart.

"A draft national infrastructure protection plan, November 2005, spells out a methodology and a process for critical infrastructure assessments." Continuing to quote: "No risk and vulnerability assessments actually made. No national priorities established. No recommendations on the allocation of scarce resources. All key decisions at least a year away."

Continuing to quote: "It's time we stopped talking about setting priorities and actually set some." Folks, take the worst case scenario in the cost of water treatment plants, you are talking $125 million. A hundred and twenty-five million bucks it seems to me is a higher priority here than it is for 50 things we could name, but I know resources are scarce and your time is scarce and you have real experts behind me here.

So unless you have questions for me, I will get out of your hair. I am happy to answer questions, or attempt to.

Senator INHOFE. No questions. Thank you very much, Senator Biden.

Senator BIDEN. Thank you very much.

Senator INHOFE. We would like to ask the second panel to come forward. Dennis Hendershot, with the American Institute of Chemical Engineers, Center for Chemical Process Safety; Philip Crowley, Director, National Defense and Homeland Security, Center for American Progress; David A. Moore, President and CEO of AcuTech Consulting Group; Lisa Jackson, Commissioner, New Jersey Department of Environmental Protection; Charlie Cott, Vice President of Plant Foods and Transportation, Missouri Farmers Association.

Also I would like to say at this time, we would like to note that some groups, including the Synthetic Organic Chemical Manufacturers Association and the National Association of Chemical Distributors were not invited to speak, but have submitted comments on our topic. Without objection, we will include their testimony in the record.

[The referenced testimony can be found on pages 97-109 and 84-94.]

Senator INHOFE. We will start over here, Mr. Hendershot, with you and work across. We would like to encourage you not to exceed

5 minutes in your opening statement. Your entire statement will be made a part of the record.

Mr. HENDERSHOT.

STATEMENT OF DENNIS C. HENDERSHOT, STAFF CONSULTANT, CENTER FOR CHEMICAL PROCESS SAFETY, AMERICAN INSTITUTE OF CHEMICAL ENGINEERS

Mr. HENDERSHOT. Thank you, Chairman Inhofe, Ranking Member Jeffords and members of the Environment and Public Works Committee. Thank you for the opportunity to discuss this important topic.

My name is Dennis Hendershot, and I represent the Center for Chemical Process Safety, which was formed in 1985 by the American Institute of Chemical Engineers in response to the toxic gas release tragedy in Bhopal, India. CCPS advances chemical process safety through research, collaboration, education and promotion of process safety as a key industry value.

I was a member of the committee which wrote the 1996 book, "Inherently Safer Chemical Processes: A Life Cycle Approach," and I wrote major sections of that book. Safety and security are good business. Incidents interfere with efficient manufacturing and good performance reduces risk and actual losses, increases productivity and improves community image for the company.

Inherently safer design is one tool for safety and security. It is a philosophy for the design and operation of any technology, including chemical processing. As a design philosophy, it cannot be effectively mandated by regulation. Inherently safer design continues to evolve and specific tools and techniques are in early stages of development. CCPS, which wrote the book on inherently safer design, believes that there have been major advances in the area since 1996 and we are working currently on an updated edition. This will certainly not be the final version.

But inherently safer design is only one of many tools for chemical process safety and security. The objectives of process safety and security vulnerability management are safety and security, not necessarily inherent safety, and inherent security. It is possible to have a safe and secure facility with inherent hazards. In fact, this is essential for a facility where there are no technologically feasible alternatives.

Also, the economic and societal benefits of the technology may be sufficient to justify safety and security management of a technology with inherent hazards. Air travel is neither inherently safe nor inherently secure, and cannot be made so. The benefits justify extensive safety and security activities to manage the well-known hazards. These activities are highly effective and flying is the safest way to travel, despite the inherent hazards.

Similarly, chemical hazards can be managed in a highly effective manner. Inherently safer processes only partially address security issues and will not reduce the need for traditional security measures. A chemical plant must consider all security issues: toxic material releases, fires and explosions, theft and diversion of material, contamination, damage to the plant. It is highly unlikely that any technology can eliminate all hazards and a plant will need traditional security measures for any remaining hazards.

The chemical industry is a complex, interconnected ecology, really. There are dependencies throughout the system, and any change will have cascading effects. It is possible that a change in technology that appears to be inherently safer locally will increase hazards somewhere else. Such changes need to be evaluated by people who understand the system to anticipate all of the implications.

In many cases, it may not be clear which technology option is inherently safer, and there may be disagreements. Chemical processes have multiple hazards. Different technologies will have different inherent safety characteristics with respect to each of those multiple hazards. For example, CFC refrigerants were thought to be inherently safer when first developed, and in fact they are, with regard to fire and acute toxicity hazards. But later information revealed environmental impacts which have resulted in the phase-out of many of these materials.

Inherently safer designs cannot be invented by legislation. There are thousands of chemical technologies, and these can be operated safely and security, using an appropriate blend of inherent engineered and management strategies. Is it an appropriate use of our national resources to replace these technologies with inherently safer technologies if they in fact exist, if the risks of the existing technology can be managed? Resources devoted to replacement of existing technology, including technical talent and creativity, as well as financial resources, will be diverted from creation of new products and new technology. Society will lose the benefits of those new technologies, which in some cases may render existing technology obsolete.

In summary, inherently safer processes are one tool for safety and security. They are not the only tool, and we must recognize that other approaches can be highly effective. Significant efforts on traditional security measures will still be required.

The chemical industry is complex, and includes thousands of technologies. Most are unique, and changes will take significant time and resources. We believe that a requirement for inherently safer technology is not a cost-effective component of security legislation. Future invention and implementation of inherently safer technologies to address both safety and security concerns is best promoted by enhancing understanding of the concepts in the industry. Inherently safer design should be a way of thinking, not a one time activity to comply with a regulation, done once and then forgotten.

Thank you for the opportunity.

Senator INHOFE. Thank you, Mr. Hendershot.

Mr. CROWLEY.

STATEMENT OF PHILIP J. CROWLEY, SENIOR FELLOW AND DIRECTOR OF NATIONAL DEFENSE AND HOMELAND SECURITY, CENTER FOR AMERICAN PROGRESS

Mr. CROWLEY. Mr. Chairman, thank you very much. I am P.J. Crowley, I direct the Homeland Security Program at the Center for American Progress. We are grateful for all the endorsements of our recent report here in your opening comments.

I should salute Paul Orum, who was the lead author of the report and is here in attendance today as well.

In our national chemical facility survey, the data demonstrate that inherently safer practices can reduce terrorism risks to millions of Americans. It also reveals that change is not occurring fast enough and that an appropriate role for Government in this area is to try to accelerate that pace of change before we are attacked again.

I view this issue from a security standpoint based on my experience over three decades as an Air Force officer, a member of the staff of the National Security Council. I was working for the insurance industry on September 11th, four blocks from the World Trade Center. So I understand how terrorism risk affects the private sector.

Almost 5 years after 9/11, the global jihadi movement is evolving. The Bush Administration's rhetoric, that we are fighting terrorists in Baghdad so we do not have to confront them here, is at odds with the reality of successful attacks in Madrid, London, and the plot recently discovered in Canada. The next attack, and we should be clear that there will be other attacks, is likely to involve self-starters, people inspired by Al Qaeda, but acting alone. Because as many of you have said, we cannot protect everything, our priority must be reducing the vulnerability of catastrophic terrorism.

This is not an arbitrary judgment, but is specific to the threat we face: that terrorists will attack where they can kill as many innocent civilians as possible and have the most significant economic and political impact on our country. As a result, we must take measures to protect our critical infrastructure and chemical facilities must be made more secure.

A risk-based chemical security strategy should include a number of items: better physical security and mitigation, but it must also emphasize risk elimination. The Secretary of Homeland Security is wrong to suggest, as he did in March, that inherently safer technology has little to do with security. Where more secure technologies are readily available, we have an obligation to remove these facilities and these communities from the terrorism target list.

In our report, we surveyed 1,800 facilities, de-registered from Risk Management Planning Program. Among our key findings, and Mr. Chairman, as you mentioned, 284 facilities have switched to less hazardous practices, reducing the terrorism threat to 38 million people. However, only 10 percent of those facilities represent the highest risk facilities in our Country.

Senator Obama mentioned that our report shows that this is cost-effective. In a range of areas, particularly drinking water and wastewater treatment, alternatives involve common technologies, not new innovations. There is a fairness issue. While many cities across the country, Ohio and other places, have eliminated threats to their people, they remain at risk, for example, because hazardous materials are still transported through those cities to other locations that have not taken this initiative.

I see a strategic double standard here. For example, the military, with support from Congress, is constantly exploring how to invest in new technologies that make us stronger around the world. Why would we not take the same approach to employ new technologies to make us more secure here at home?

We need a comprehensive national approach, not a series of disconnected local or regional actions. In my view, what needs to be done, the Department of Homeland Security should be granted authority to regulate chemical security. DHS should promulgate strong national standards regarding the manufacturer, use and in particular, the transportation of hazardous materials around the country.

DHS, in conjunction with EPA, should establish a center of excellence, they have done this in a number of priority areas, and promote the development and broad adoption of inherently safer technologies where practicable. Chemical facilities should be required to do comprehensive annual security risk assessments, which should include an evaluation of safer alternatives. These findings should be reported to DHS, the EPA, and in my view, to shareholders of publicly traded companies.

Finally, the Government should create incentives to encourage change, such as targeted grants, loans, and tax credits. To Senator Voinovich's point, I see that there should be caps on liability for facilities that adopt safer approaches if a terrorist attack does occur.

Our national security strategy must place greater emphasis on protecting the homeland. Since we cannot expect our security forces to intercept every attack, we must narrow the potential for terrorists to successfully exploit our critical infrastructure. Business as usual, in my view, is no longer an option.

Mr. Chairman, thank you very much.

Senator INHOFE. Thank you, Mr. Crowley.

Mr. MOORE.

STATEMENT OF DAVID A. MOORE, PE, CSP, PRESIDENT AND CEO, ACUTECH CONSULTING GROUP, CHEMETICA, INC.

Mr. MOORE. Good morning, Mr. Chairman and Senators, ladies and gentlemen. My name is David Moore. I am the president of a consulting group specializing in chemical process security and safety called the AcuTech Consulting Group. We are based here in Alexandria, VA.

I come to you with a practical background of over 25 years working in industry, first in Mobil Corporation and then as a private consultant, assisting companies in managing risk, and in particular, risks that we have identified could be solved or not solved through inherently safer technology.

In addition, I was selected by the American Institute of Chemical Engineers to prepare the chemical industry's leading guidelines on how to conduct a vulnerability assessment, which mentioned IST but also mentioned other options for reducing risk. Lately, I have been hired by the American Institute of Chemical Engineers, as well, for the IST book project update that Mr. Hendershot mentioned. So I am deeply involved in inherently safer studies, having conducted them in California, where there is a regulation in Contra Costa County for safety purposes, as well as recently the prescriptive order in the State of New Jersey for homeland security there. I am also deeply committed to homeland security and safety and public protection.

As a process safety professional, I have seen and witnessed many examples of inherent safety being applied and analyzed and stud-

ied for years. In fact, inherent safety is a philosophy which is ingrained in chemical security and safety professionals in everything they do. So in other words, there has already been a great deal of inherent safety considerations in the infrastructure that is presently built.

The problem seems to be an over-emphasis, in my mind, on the expectation of the value of inherent safety for regulation. There are several problems that I think regulation has caused in the States and examples that I have worked with, as well as anticipating a national regulatory framework involving inherent safety for the chemical sector. The first is that it is a vague concept that is not a singular technology, as it applies, nor is there a single best practice that solves all problems. In fact, there is a great deal of judgment that is required. That means that it can be rather subjective. And subjectively evaluated, which ultimately would be the challenge that any regulators would have to face as to judge how safe or how secure a process is, and the fairness to that, particularly at a societal risk level.

If inherent safety is forced onto industry as a mandate, I am expecting a great deal of questions and problems on the interpretation of it, technical judgments that would have to be made about various specific situations, the fairness of it to everyone involved, including society, and governmental liabilities that may develop, should Government interfere and force particular inherent safety technologies, at least in their mind.

So obviously an obstacle to clear-cut regulation is that we don't have, even as an industry, today in a voluntary sense, a very clear picture of inherent safety. Although it seems obvious, actually the book that Mr. Hendershot described has various strategies for inherent safety. The regulations that we have seen introduce more than just substitution of a technology. They look at minimization, substitution, simplification of processes and so forth.

If the regulation in future was to be performance based, you could only imagine that clear metrics would have to be available in order for this to be clearly evaluated and for decisions to be made. Value is a key problem. What is inherently safer to you, to the people right near the plant, is not necessarily what is inherently safer to the community, or to the community that is producing larger capacities of products miles away. Perhaps it could lead to redistribution of risks as it could with transportation, for example.

In fact, inherently safer is not even necessarily inherently more secure. I could imagine a great deal of effort invested in inherent safety in the interest of eliminating a technology, while the plant is not necessarily as secure as it may be. So my suggestion is to leave this to a voluntary process, and to encourage the voluntary understanding of inherent safety and make inherent safety far more clear for the future for the benefit of safety and security.

Thank you.

Senator INHOFE. Thank you, Mr. Moore.

Ms. JACKSON.

STATEMENT OF LISA P. JACKSON, COMMISSIONER, NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION

Ms. JACKSON. Thank you, Mr. Chairman. Good morning to you and members of the committee.

I am Lisa Jackson, I currently serve as the Commissioner for Environmental Protection in the State of New Jersey. A member of my staff is here, our inherently safer technology expert, Mr. Paul Komosinski. As we said on the train down this morning, I am a chemical engineer by training, as is he, I am an environmentalist by practice in my everyday work. So I come here today on behalf of Governor Corzine and the people of the State of New Jersey to tell this committee how important this issue is for us, the issue of security, especially, our chemical standards and our inherently safer technology standards, which we have now in place and which we are implementing are vitally important to Governor Corzine, vitally important to the people of New Jersey.

I would also like to say that our director of homeland security in New Jersey, Richard Canas, supports as well the idea of inherently safer technology as a vital part of homeland security for our State.

You mentioned, Mr. Chairman, that it is the implementation of inherently safer technology that is of concern. I heard it in most of the speakers this morning, and it is understandable and right that implementation would be a concern. So I thought I would speak just a few minutes this morning about what is happening in the State of New Jersey.

Our inherently safer technology program is a part of a proscriptive order that was issued to the facilities in our State that handle extraordinarily hazardous substances. So we have faith in the idea of inherently safer technology for new facilities as part of our Toxic Catastrophe Prevention Act. It is legislated for them in regulation as well.

But via an order, an executive order, essentially, from a domestic security task force for other facilities in our State, those facilities were required to do several things, one of which is a security vulnerability assessment. But that vulnerability assessment came along with a requirement to evaluate. I want to stress that it is an evaluation of inherently safer technology that we are requiring from certain of the facilities in our State, 157 facilities to be exact.

Those evaluations were scheduled to be done by March 21st of this year, pursuant to an order that was issued in November of 2005. We are now in the process, as regulators, as public officials, as public servants, of evaluating compliance with those orders. We expect that we will see all facilities and evaluate them by July and have already seen 100.

Compliance right now is excellent. And that includes the inherently safer technology part of the standard. I do agree with what I have heard this morning from some people that the chemical industry, the regulated industry as I see it from my perspective, from my chair, understands the importance of these standards and in fact has already, in our visits, embraced them, have for years. We are not mandating something, but we are putting the Government's stamp of approval and more important, urgency at this time, on ensuring that all facilities that handle extraordinarily hazardous sub-

stances meet the requirement to ask and evaluate inherently safer technology, to ask the right questions.

In our business, it is the asking of the questions right now that are so important. There are experts in the field and in Government who can help ask those questions. As Mr. Moore said, he certainly has been involved, not only in my State, but elsewhere in the country in helping responsible companies to meet their mandates or their voluntary choices, their choice to implement inherently safer technology at this point.

We go from here to looking at what we will do if and when we find companies who don't choose to meet the mandates of our proscriptive order. As I said, that includes more than inherently safer technology. To date, that has not been the issue of greatest concern for us.

I would like to sum up by saying that we see inherently safer technology as common sense, easy to implement, something that so far is a part of a regulatory and legislative program that makes perfect sense from a security and an environmental perspective. We would request that this committee maintain our ability to have more restrictive standards than those at the Federal level and would strenuously oppose any preemption in the area of homeland security.

Thank you.

Senator INHOFE. Thank you, Ms. Jackson.

Mr. COTT.

STATEMENT OF CHARLIE COTT, VICE PRESIDENT, PLANT FOODS AND TRANSPORTATION, MFA INC.

Mr. COTT. Thank you, Mr. Chairman, and members of this committee. Thank you for inviting me to testify today on behalf of the Agricultural Retailers Association, the ARA, concerning the issue of inherently safer technology and chemical site security.

I am Charlie Cott, vice president of Plant Foods and Transportation for MFA Incorporated, a regional farm supply cooperative headquartered and operating out of Columbia, MO. MFA was established in 1914 and has retail facilities in Missouri, Iowa, Kansas, Oklahoma and Arkansas. The goods and service provided by retail dealers include seed, crop protection chemicals, fertilizer, crop scouting, soil testing, custom application of pesticides and fertilizers, and development of comprehensive nutrient management plans and state-of-the-art IPM programs.

ARA represents a significant majority of America's agricultural retailers and distributors in Washington, DC.

From some views being expressed in Congress, the general public might think that products that have been designated as hazardous material, hazmat, have very little regulations governing their safe use, storage and handling. However, that could not be further from the truth. Even before the terrorist attacks on September 11, 2001, agriculture retailers have been one of the most heavily regulated industry segments in the country. We are also taking steps to improve onsite security and close any existing security gaps.

There are countless Federal, State and local laws and regulations currently related to the safe handling, transportation and storage of agricultural crop inputs. For example, many ag retail facilities

that handle and store a threshold amount of listed substances, such as anhydrous ammonia, are required to comply with the EPA's risk management program, RMPs. Because of the existing regulations that are working, ARA does not believe the Federal Government should be getting into the business of mandating inherently safer technology or alternative approaches for chemical processing, which is extremely complex and which differs from company to company.

We do strongly oppose efforts by uninformed anti-chemical activist groups that are attempting to tie the new IST mandates to chemical facility security legislation. We agree with the views expressed by DHS Secretary Chertoff and Senate Homeland Security Committee chairperson Susan Collins that DHS should stay focused on security and not move into broader environmental issues.

We are pleased that the Homeland Security Committee last week soundly defeated an amendment to the Chemical Facility Anti-Terrorism Act, S. 2145, designated to impose an inherently safer technology mandate on the industry, which would create new liabilities and financial burdens on many ARA members. It would be extremely difficult for a retailer or farmer to go through a costly analysis and demonstrate to DHS why certain crop input products should or should not be used. We believe that the Government agencies, such as the EPA, has already made determinations on product safety when they approve pesticide registrations.

The EPA already requires extensive product testing on agricultural pesticides and MFA, like most retailers, also conduct our own field trials to ensure pest management efficiency. An IST mandate imposed on U.S. agriculture could jeopardize the availability of lower cost sources of plant nutrient products or certain agricultural pesticides used by farmers and ranchers.

If MFA was forced to recommend less effective pest management products or plant nutrient products to our farmer customers, the net result would be lower yields, less quality, less farm revenue and potentially market shifts to foreign countries. Our Nation is making a strong effort to become more energy independent and less dependent on foreign sources of energy. ARA is a member of the 25 by 25 Ag Energy Working Group, whose goal is for farms, ranches, forests and other working lands to provide 25 percent of the United States' energy needs from renewable resources by 2025.

Corn is a major component in the manufacture of ethanol, a clean-burning, renewable, domestically produced fuel, and is Missouri's second largest crop in production, producing nearly 300 million bushels of corn annually. An IST mandate could force the use of less efficient fertilizer for corn crops, which in turn would directly impact crop yields. One bushel of corn yields about 2.8 gallons of ethanol. A reduction of one bushel per acre in corn production would reduce Missouri net farm income by $5 million, as well as less corn available to produce ethanol, which in turn would hinder the Nation's effort to become more energy independent.

America's agricultural industry is already faced with numerous regulations which add to the daily cost of doing business. We are also faced with high fuel, fertilizer and transportation costs. Ninety-six percent of the world's consumers reside outside the United States. With the current state of domestic and international agri-

cultural markets, now is not the time for Congress to place additional burdens and costs on farmers and ranchers by limiting their product choices, increasing their input costs, lowering their crop yields and opening them up to frivolous lawsuits.

An IST mandate imposed on chemical facilities in the name of security could drive many in agriculture out of business and increase our dependence on foreign sources of food and fiber, similar to what we now face with foreign oil.

Thank you for your consideration today.

Senator INHOFE. Thank you very much, Mr. Cott.

We are going to be having a series of votes coming up, it would be the desire of the Chair to take our questioning right up to the end of the first vote and that would have to conclude the meeting, because we will have a series of votes. So we will try to keep, and I will ask my colleagues to try to keep our times to the 5 minutes that we have allotted for questions.

I have to observe that, as I was listening to the testimony here, that I see similarities between this and what the President has been trying to do with Clear Skies. The President had the most ambitious reduction in pollutants, 70 percent reduction in the period of time, no Democrat or Republican administration before has done this. That is in pollutants, SO_x, NO_x and mercury. Yet it has been held hostage, because you won't include CO_2, which is not a pollutant.

I see the same thing happening here. We are losing opportunities to have good security measures and chemical security in saying, well, we can't do it unless we include IST. So this is something that I see that bothers me a little bit.

Let me ask you, Mr. Hendershot, to clarify something. Because I have a feeling it is going to be said again, and I have heard it many times, that you were an integral part of the committee that authored the National Research Council report. Many people use this report to justify a Federal policy mandating chemical facilities, that they use IST.

I would just ask you to answer the question, did the National Research Council recommend that IST should be mandated by the Federal Government?

Mr. HENDERSHOT. No. The report and the committee's charter was to provide DHS with guidance in making research development and technology assessments.

Senator INHOFE. It was my understanding also, and I think we are going to hear over and over again a misinterpretation of that National Research Council report.

Now, in your testimony you state that specific tools and techniques for application of inherently safer design are in the early stages of development. I have here a paper from Texas A&M, which I at this point would enter into the record without objection, that calls IST subjective and states, and I am quoting from it now, "a systematic methodology to measure inherent safety does not exist." Let me repeat that, I am quoting now: "a systematic methodology to measure inherent safety does not exist."

[The referenced report can be found on pages 77-83 .]

Senator INHOFE. I would say, don't you think it would be kind of rash and premature to impose some kind of a one size fits all definition if we don't have the tools we need?

Mr. HENDERSHOT. Yes, I believe it would be premature. There is no method for measuring the inherent safety of the process. Actually, I believe the one size fits all will never really be appropriate. Facility operators must be able to consider local factors in making these choices.

Senator INHOFE. Another problem that I have is, any time that we mandate something or suggests something and we have not a well defined definition, this bothers me, because it can be interpreted by anyone to mean any other thing. There has been a lot of discussion about the "mandatory" consideration of IST, saying that, well, we are just going to mandate that you consider IST. Now, if you decide not to do it, then that is fine.

But I would suggest to you, Mr. Moore, in your testimony, you talked about the problems of a value judgment when the regulator and the facility differ over what is safe and practicable. Would this not be a problem, then, for the consideration approach?

Mr. MOORE. Yes. First, as I mentioned in my testimony, there is no particular metric, as was just confirmed by Mr. Hendershot, and Texas A&M, I am familiar with that study and agree to that. In addition, since we are unclear on exactly what is inherent safety, it further confuses the issue. So simply considering it means that we are working in a fuzzy set.

Senator INHOFE. That bothers me. Ms. Jackson, what do you think about that, about a lack of definition? Or do you not see it that way?

Ms. JACKSON. I think, as I stated, that there is a need to evaluate. Certainly there needs to be a test. The test that we use in our State is a practicability test. We heard a lot about that this morning. Practicality is also in our regulations and our legislation. So we have an ability to look at costs. Those evaluations, I think, encourage and inspire a lot of technology transfer, which is vital to any industrial operation continuing to grow and work well.

So I think the role of many of our regulators is to encourage people to do the evaluation and then to share the information they have.

Senator INHOFE. Mr. Cott, from your perspective, since you would be perhaps one that would have to be required to comply with something, do you consider that to be ambiguous? Are you concerned?

Mr. COTT. Yes, sir. The ambiguity of a broad, sweeping document that is mandated like that would be difficult for us to deal with from a retailer's standpoint. The challenge we see is, in our business it is not so much the chemical process, but the result of using certain products in a fashion that is environmentally and economically sound for the customer.

Senator INHOFE. Yes. I thank you.

Senator JEFFORDS.

Senator JEFFORDS. Mr. Chairman, I ask that the report by the Center for American Progress and testimony submitted by the General Accountability Office be entered into the record.

Senator INHOFE. Without objection.

[The referenced report and testimony can be found on pages 151-192 and 112-135.]

Senator JEFFORDS. Thank you, Mr. Chair.

Ms. Jackson, we heard testimony today that inherently safer alternatives are just an engineering concept that cannot be applied in the regulatory context. Yet I understand that 45 facilities in New Jersey recently completed inherently safer technology analyses. Based on your Agency's initial review, is it feasible to require chemical facilities to consider safer alternatives?

Ms. JACKSON. Thank you, Senator. Absolutely, it is, Senator. It is being done. The result of our evaluation is, it is being done, it had been done in the past. The costs are not astronomical. We have not had people coming forward and saying that they could not meet the requirement to do these evaluations. In fact, they have already done them when we check on them. These are facilities that are quite well regulated in many other areas, so they know that they handle extremely hazardous substances. They know they operate in the most densely populated State in the country and I think they take that responsibility seriously, as do we.

Senator JEFFORDS. Mr. Crowley, some of the panelists have described inherently safer technologies as a concept rather than a practical tool. Yet the report issued by your group highlights hundreds of examples of facilities that have already implemented inherently safer technologies. Could you please describe some of the inherently safer alternatives that have already been implemented, making millions of Americans safer?

Mr. CROWLEY. Thank you, Senator. Three quick points, that in many cases, it is not significantly changing an existing process, it is changing the form of a chemical used within that process. Drinking water, wastewater treatment plants are a great example where in the majority of facilities highlighted in our report show that just by switching from chlorine gas, which if released, as Senator Biden said, has the ability to harm or kill 100,000 people in a relatively short period of time, switching to liquid bleach or to ultraviolet radiation in essence removes a terrorism threat.

I think also you can look at gaseous ammonia, switching to a liquid form, and sulfur dioxide as three examples of where you are not fundamentally changing a process, you are changing the form within a process.

Senator JEFFORDS. Mr. Cott, the Oklahoma City bombing and the recent arrests in Canada have reminded us about the potential impact of fertilizer as a weapon in the hands of terrorists. Does the Agricultural Retailers Association agree that fertilizer retailers that store thousands of pounds of potentially explosive ammonia nitrate are an attractive target for terrorists?

Mr. COTT. Well, I don't know if they are an attractive target. We are regulated with the product at this point to the point where we have to account for every pound that gets delivered and every pound that gets sold, or in most cases, we are already doing that. I don't think that I would consider the retail system for agriculture to be a particular target in that.

But there is a very high level of awareness, and we are, like I indicated, already documenting most of the transactions moving product in and out of any of our retail facilities.

Senator JEFFORDS. Mr. Moore, nearly 5 years after the September 11th attacks, almost 3,000 drinking water and wastewater treatment plants still use chlorine gas instead of liquid bleach or ultraviolet light. Why do you believe that voluntary measures are sufficient to address the risks posed by these facilities?

Mr. MOORE. Because they have other options, Senator, besides IST, is my answer without knowing all the specifics. Each site has to be evaluated individually, and I would say that they probably did address this. They are familiar no doubt with inherent safety and to the extent that it was feasible to them, perhaps they did entertain that option.

Senator JEFFORDS. Thank you, Mr. Chairman.

Senator INHOFE. Thank you, Senator Jeffords.

Senator VOINOVICH.

Senator VOINOVICH. Ms. Jackson, I am really interested in what you are doing in New Jersey. When did your law go into effect?

Ms. JACKSON. Our proscriptive order went into effect in November of last year. Our TCPA law is, the program goes back to in response to Bhopal. So I don't have the year, but I think it was the late 1980's.

Senator VOINOVICH. The order went out in November, and according to what I have here, the 45 facilities that have been required under the Act to conduct a review of the practicality and potential for adopting IST. From what you said to me, or what you said, it seems to me that these people are aware of the risks that they pose to the communities, and have tried to substitute chemicals. The reason I am asking the question is, they are also regulated under the EPA, and they are also regulated under OSHA. The OSHA regulations are made to protect their employees and the EPA in terms of their missions.

I guess the point is, how many of these facilities do you think you are going to have to go in and mandate them to change their processes or the materials that they use in the manufacture of whatever it is they are manufacturing?

Ms. JACKSON. Thank you, Senator. It is certainly my hope that it will be none of them. The information that we collect is confidential for the facility, because it includes process information. In fact, we leave it all at the facility when we visit, so that they don't have concerns about important information of theirs being given outside of the Government.

To date, I am happy to say that we haven't found any significant instances of compliance. The Domestic Security Preparedness Act in New Jersey gives the task force and the Governor sweeping powers to take action. That would have to be based on a belief that the sum total of all the requirements in that order, of which inherently safer technology is one very important piece, led to a situation where the safety of our citizens was at risk. I know Governor Corzine would act then, immediately.

Senator VOINOVICH. So in other words, are some of the facilities, are the 45 covered by MTSA, too?

Ms. JACKSON. I am sorry, covered by what, Senator?

Senator VOINOVICH. By the Maritime Transportation Safety Act?

Ms. JACKSON. I would assume they are, but I don't know the answer off the top of my head.

Senator VOINOVICH. Mr. Chairman, one of the things that I don't know when we are going to get this law passed, but from what I can tell here, we may not do anything this year. I think the New Jersey situation is one we should really look at, to see just how this is actually working out. So often, we legislate here and have no idea what it really means.

So I would be real interested in keeping track of how this is going in your State.

Second of all, and this is a subject that came up in the other committee that I am a member of, an issue of preemption. There is a lot of feeling that States should not be preempted. We have talked about alternatives, either one, silence, that is that we make no mention at all of preemption, and then let the Department of Homeland Security work it out with the respective jurisdictions, like for instance, the State of New Jersey. Or the alternative may be just grandfathering in States like yours that have things in place already.

Do you have any opinion on that?

Ms. JACKSON. Well, certainly I would like to see Federal legislation that mirrors what we do in New Jersey. But in the absence of that, I think it is very important, as you said, Senator, to allow States to learn as they go. I think this is very much an evolving field. As old as it is, people's knowledge and fear of it I think will be addressed as we move forward and demonstrate that these things can be done.

I also want to mention that our work was done cooperatively in our State with the New Jersey Chemistry Council. The best practices standards that we developed for the chemical industry and the oil industry were based on a cooperative process. They are now mandatory, but there was cooperation in the actual technical development of those standards. While I know we will have to go further, I think that is very important for us to remember as well.

So I would like to see us keep the flexibility for States to move beyond it and not be limited if they weren't grandfathered before.

Senator VOINOVICH. Thank you. I would like to ask this of all our witnesses. To your knowledge, has IST ever been defined as a security measure in any Federal law? In the EPA, when they did their risk management plan, they concluded that inherently safer processes is a developing concept and is not ready for general application. IST frequently displaces risk rather than reducing it. Even if a few examples of workable alternative approaches do exist, there is not a rational basis for imposing an additional industry-wide regulatory burden. Last but not least, the concept is normally considered when designing new processes, a time when changes can be implemented cost effectively.

So I guess the question is, has it been defined in any Federal law as a safety measure, IST?

Mr. HENDERSHOT. Not to my knowledge.

Mr. CROWLEY. I don't know.

Mr. MOORE. No, sir.

Ms. JACKSON. I don't know, sir.

Mr. COTT. No, sir.

Senator VOINOVICH. Thank you. Has my time expired, Mr. Chairman?

Senator INHOFE. Yes, your time has expired.

I think probably a better way to ask the question is, has it been defined at all.

Senator LAUTENBERG.

Senator LAUTENBERG. Thank you very much, Mr. Chairman.

Ms. Jackson, welcome again. I did mention that you would be here, and I was pleased that you are here to testify. I think our State of New Jersey kind of exemplifies what ought to be done. But we have done it on our own. We have established standards. Frankly, I don't think that jumping into a national standard would be a wise idea, unless it absolutely, well, grandfathering was suggested, I am an expert at that, anyway.

[Laughter.]

Senator LAUTENBERG. But the fact is, also, New Jersey was the first State to sign the Bill of Rights. So we are up there, we have longevity, man, have we got longevity. So grandfathering would be a step, a positive step. Frankly, I think that it ought to be the State's right. If its standards are going to be stricter than a Federal law, then I think we should be allowed to do it.

Very frankly, I am confused at times because people who are devout advocates of States rights here suddenly have a different view. So I just want to be sure that our situation is understood.

Have any of New Jersey's chemical security requirements caused any facilities to shut down or move out of State that you are aware of?

Ms. JACKSON. No, not at all, Senator.

Senator LAUTENBERG. No. As the Commissioner of the New Jersey, Department of Environmental Protection Security is also a part of your portfolio, is that right?

Ms. JACKSON. Yes, sir, I serve as the Governor's representative for chemical facilities, wastewater, water, on the task force, the Domestic Security Task Force, biotechnology, pharmaceutical.

Senator LAUTENBERG. So do you think that IST is only therefore an environmental issue and not a security issue?

Ms. JACKSON. Thank you, Senator. I don't see how you can separate them at all. I don't see why we would want to, frankly.

Senator LAUTENBERG. I agree. Do you think that the motivation behind the chemical industry's push for State preemption in Congress might, well, that is kind of a loaded question. You don't have to answer that. I know what the answer is.

Senator INHOFE. Well, I don't know the answer.

Senator LAUTENBERG. I would say, and I am sorry that our distinguished colleague from Ohio had to leave. Before we had a discussion there, I had a chance to challenge some of his views that the chemical industry is suffering because we have turned from a net exporter to a net importer. There is some small difference. But the growth of the industry has been terrific. It has grown with the GDP, of the country. If there are fewer people working, we don't know whether that is technology-caused or otherwise.

But the fact is that the volume of the business is far greater than it was. The one question that comes to my mind is whether or not chemical products may have brought, do they include employee protections in those facilities, or are they environmentally sound conditions in which they operate? For a long time, we have now dis-

cussed whether or not companies, countries that export to us ought to be compelled to observe our environmental conditions. It is never, it is there in part, but not fully.

We know that many countries are far less environmentally conscious than we are. So you can't, I don't think you can judge the success of the industry simply based on whether or not there is more tonnage one way or the other, because whatever they do to damage the environment gets to be our concern one way or the other. Whatever they do to damage the health and well-being of their employees is also inconsistent with the way America views its leadership in the world.

One of the things that was said, and I have to challenge, and that is, no one who owns or runs a chemical business wants to injure the health of their employees. I would concede that, but I would also remind everybody that asbestos, which was prominently manufactured in my home town of Patterson, NJ, and where a fellow that I went to high school with died prematurely, because they worked part-time in the asbestos factory, those owners knew what was going on. When the records were examined, it was detected inside the industry way before the public was aware of the dangers. We have example after example of unsafe products being used.

So I don't think we ought to rely on just the judgment of the employer. I think we ought to do what we can and I know our chairman very well, I have great respect, although we have great differences. We don't do things in small shots here. The fact is that no one wants to see employees' health damaged, and employees ought to be involved when they are considering a standard for operations within the industry.

So Mr. Chairman, thanks very much. I have questions that I will submit for the record.

Senator INHOFE. Thank you, Senator. Yes, we both know quite a bit about grandfathering.

I have two letters from some Oklahoma companies, one Rustoleum, one Dryvit, that I would like to submit for the record at this point.

[The referenced letters can be found on pages 95-96 and 110-111.]

Senator INHOFE. I was reminded by Senator Thune that he has a statement to submit.

Senator INHOFE. Also, I am sure there will be several members who will be submitting questions for the record. I want to thank all five of you for coming today and for your patience. I do apologize for the fact that we have votes that are starting right now, so we will have to draw this to a close.

Thank you very much for your input.

Senator JEFFORDS. Mr. Chairman, we do have some questions to add.

Senator INHOFE. Yes, they will all be included.

[The information to be submitted follows:]

[Whereupon, at 11:07 a.m., the committee was adjourned.]

[Additional statements submitted for the record follow:]

STATEMENT OF HON. JOSEPH R. BIDEN, U.S. SENATOR
FROM THE STATE OF DELEWARE

Mr. Chairman, Ranking Member Jeffords, and committee members, thank you for extending me the courtesy of making a statement this morning. The issue of inherently safer technologies is, in my view, critically important to our Nation's homeland security efforts. I commend all of you here in the Environment and Public Works Committee for focusing on this critical issue, and I hope that I can add to the debate and that we can advance the ball to enhance the safety for millions of Americans that are threatened by toxic chemicals.

Mr. Chairman I believe that we have no greater obligation than the protection of our home towns. In fact, I believe that this should be our number one priority here in Congress. Without security, little else we do here matters, and if we establish the right priorities, we can protect the homeland while preserving all that makes our nation great.

We all know the dangers posed by gaseous, toxic chemicals. These chemicals, such as chlorine, were used as weapons in World War II and security experts have told us that they pose a threat that is comparable in scope only to nuclear and biological weapons. Today, these chemicals are in common usage in facilities throughout the nation and are being transported in 90-ton rail tankers over unprotected rails in communities throughout the Nation.

If we simply required facilities that store or utilize large amounts of chlorine and other dangerous chemicals to transition to inherently safer technologies whenever it's feasible, we could completely and permanently eliminate known threats in our communities. This would allow us to focus our scarce resources on border security and other critical infrastructure targets as well as allow our Federal, State, and local law enforcement and first responders to focus on other vulnerabilities.

I realize that the focus on this hearing is on chemical facilities in general, but I want to highlight a decision made by officials in my home town. Last year, the Wilmington Water Pollution Control facility transitioned from gaseous chlorine to chlorine bleach. This decision eliminated the threat to 560,000 citizens in the community—my constituents, family members, and I might point out. It cost the Wilmington facility $160,000 in capital investment—and because the facility permanently eliminated the risk, it no longer has to protect the facility with guards, and gates. It also eliminated bureaucratic expenses because it no longer has to file a risk management plan with the Environmental Protection Agency.

Not only should we be supporting this type of decision, we should require it whenever it is practical. In my view, it is unacceptable that nearly five years after the attacks of September 11th, we haven't made the decision to reduce the dangers posed by these gaseous chemicals at chemical facilities and water treatment plants.

It is not like this is some over burdensome requirement that will kill industry. As has been pointed out, hundreds of facilities have made this decision without Government intervention. These facilities seem to be operating fine. In addition, every proposal that I have seen provides for a transition only if it is practicable and would allow the facility not the Government to determine what alternative processes should be used.

As always, another overriding concern for the Government and for industry is the costs associated with the transition. According to the Department of Homeland Security there are 300 chemical facilities that put over 50,000 citizens in danger. A recent report by the Center for American Progress found that 87 percent of facilities reported costs of less than $1 million and one-half of these spent less than $100,000 to transition to safer technologies.

If we were to provide $1 million—a top end estimate for every chemical facility to transition to safer technologies we could eliminate this risk for only $300 million. To eliminate the threat posed by the roughly the 100 water treatment facilities that threaten over 100,000 individuals it would cost $125 million. Thus, an investment of less than 1/2 billion dollars would eliminate the threat to nearly 60 million Americans. In contrast, last year we gave $2 billion in tax incentives to oil companies that posted record shattering profits. A few months ago, executives from these companies testified under oath at a Judiciary Committee hearing that they do not need these incentives. In my view, we are not focusing on the right priorities.

And, because the transition to safer technologies will result in savings by the reduction of guns, guards, gates, and bureaucratic expense, we can require—as the water facility protection bill that Senator Jeffords, Boxer and I have introduced would—facilities to return some of those savings to the Federal Government to help other facilities transition to safer technologies. This, in my view, is a good use of Federal resources, and if industry officials would work with us, I think that we could devise a system where we help fund capital investments with facilities return-

ing the savings that result in the out-years. In the process, we protect millions of Americans and reduce a strain on local law enforcement and first responders.

In conclusion, I would like to remind everyone of the 9-11 Commission report card issued last December. It found that with respect to our Nation's critical infrastructure the following: "no risk and vulnerability assessments actually made; no national priorities established; no recommendations made on allocations of scarce resources. All key decisions are at least a year away. It is time that we stop talking about priorities and actually set some." I believe that requiring chemical facilities to transition to safer technologies whenever it is practical should be a priority that we establish. Doing this would completely and permanently eliminate the threat to millions of Americans.

STATEMENT OF DENNIS C. HENDERSHOT, STAFF CONSULTANT, CENTER FOR CHEMICAL PROCESS SAFETY, AMERICAN INSTITUTE OF CHEMICAL ENGINEERS

The Center for Chemical Process Safety (CCPS) is sponsored by the American Institute of Chemical Engineers (AIChE), which represents the Chemical Engineering Professionals in technical matters in the United States. CCPS is dedicated to eliminating major incidents in chemical, petroleum, and related facilities by:

- Advancing state of the art process safety technology and management practices
- Serving as the premier resource for information on process safety
- Fostering process safety in engineering and science education
- Promoting process safety as a key industry value

CCPS was formed by AIChE in 1985 as the chemical engineering profession's response to the Bhopal, India chemical release tragedy. In the past 21 years, CCPS has defined the basic practices of process safety and supplemented this with a wide range of technologies, tools, guidelines, and informational texts and conferences. CCPS' output includes more than 70 guideline books, more than 90 university lectures, and a monthly e-mail process safety lesson delivered to more than 600,000 plant personnel around the world in 16 languages. The CCPS book "Guidelines for Analyzing and Managing the Security Vulnerabilities of Fixed Chemical Sites" (2002) has been used by thousands of plants around the world to evaluate chemical facility security. Today, CCPS has more than 80 member companies in the US and around the world, with an active program to continue to advancing the practices of process safety.

WHAT IS INHERENTLY SAFER DESIGN?

Inherently safer design is a philosophy for the design and operation of chemical plants, and the philosophy is actually generally applicable to any technology. Inherently safer design is not a specific technology or set of tools and activities at this point in its development. It continues to evolve, and specific tools and techniques for application of inherently safer design are in early stages of development. Current books and other literature on inherently safer design (for example, by the Center for Chemical Process Safety, Trevor Kletz, and others) describe a design philosophy and give examples of implementation, but do not describe a methodology. The Center for Chemical Process Safety has begun a project to update its 1996 book on inherently safer design, and one of the objectives for this second edition is to propose one or more specific methods for implementation.

What do we mean by inherently safer design? One dictionary definition of "inherent" which fits the concept very well is "existing in something as a permanent and inseparable element." This means that safety features are built into the process, not added on. Hazards are eliminated or significantly reduced rather than controlled and managed. The means by which the hazards are eliminated or reduced are so fundamental to the design of the process that they cannot be changed or defeated without changing the process. In many cases this will result in simpler and cheaper plants, because the extensive safety systems which may be required to control major hazards will introduce cost and complexity to a plant. The cost includes both the initial investment for safety equipment, and also the ongoing operating cost for maintenance and operation of safety systems through the life of the plant.

Chemical process safety strategies can be grouped in four categories:

- Inherent—as described in the previous paragraphs (for example, replacement of an oil based paint in a combustible solvent with a latex paint in a water carrier)
- Passive—safety features which do not require action by any device, they perform their intended function simply because they exist (for example, a blast resistant concrete bunker for an explosives plant)
- Active—safety shutdown systems to prevent accidents (for example, a high pressure switch which shuts down a reactor) or to mitigate the effects of accidents (for

example, a sprinkler system to extinguish a fire in a building). Active systems require detection of a hazardous condition and some kind of action to prevent or mitigate the accident.

• Procedural—Operating procedures, operator response to alarms, emergency response procedures

In general, inherent and passive strategies are the most robust and reliable, but elements of all strategies will be required for a comprehensive process safety management program when all hazards of a process and plant are considered.

Approaches to inherently safer design fall into these categories:

• Minimize—significantly reduce the quantity of hazardous material or energy in the system, or eliminate the hazard entirely if possible

• Substitute—replace a hazardous material with a less hazardous substance, or a hazardous chemistry with a less hazardous chemistry

• Moderate—reduce the hazards of a process by handling materials in a less hazardous form, or under less hazardous conditions, for example at lower temperatures and pressures

• Simplify—eliminate unnecessary complexity to make plants more "user friendly" and less prone to human error and incorrect operation

One important issue in the development of inherently safer chemical technologies is that the property of a material which makes it hazardous may be the same as the property which makes it useful. For example, gasoline is flammable, a well known hazard, but that flammability is also why gasoline is useful as a transportation fuel. Gasoline is a way to store a large amount of energy in a small quantity of material, so it is an efficient way of storing energy to operate a vehicle. As long as we use large amounts of gasoline for fuel, there will have to be large inventories of gasoline somewhere.

INHERENTLY SAFER DESIGN AND THE CHEMICAL INDUSTRY

While some people have criticized the chemical industry for resisting inherently safer design, we believe that history shows quite the opposite. The concept of inherently safer design was first proposed by an industrial chemist (Trevor Kletz, of ICI in the UK), and it has been publicized and promoted by many technologists from petrochemical and chemical companies—ICI, Dow, Rohm and Haas, ExxonMobil, and many others. The companies that these people work for have strongly supported efforts to promote the concept of inherently safer chemical technologies.

Center for Chemical Process Safety (CCPS) sponsors supported the publication of the CCPS book "Inherently Safer Chemical Processes: A Life Cycle Approach" in 1996, and several companies ordered large numbers of copies of the book for distribution to their chemists and chemical engineers. CCPS sponsors have recognized a need to update this book after 10 years, and there is a current project to write a second edition of the book, with active participation by many CCPS sponsor companies.

There has been some isolated academic activity on how to measure the inherent safety of a technology (and no consensus on how to do this), but we have seen little or no academic research on how to actually go about inventing inherently safer technology. All of the papers and publications that we have seen describing inherently safer technologies have either been written by people working for industry, or describe designs and technologies developed by industrial companies. And, we suspect that there are many more examples which have not been described because most industry engineers are too busy running plants, and managing process safety in those plants, to go all of the effort required to publish and share the information. We believe that industry has strongly advocated inherently safer design, supporting the writing of CCPS books on the subject, teaching the concept to their engineers (who most likely never heard of it during their college education), and incorporating it into internal process safety management programs. Nobody wants to spend time, money, and scarce technical resources managing hazards if there are viable alternatives which make this unnecessary.

INHERENTLY SAFER DESIGN AND SECURITY

Safety and security are good business. Safety and security incidents threaten the license to operate for a plant. Good performance in these areas results in an improved community image for the company and plant, reduced risk and actual losses, and increased productivity, as discussed in the CCPS publication "Business Case for Process Safety," which has been recently revised and updated.

A terrorist attack on a chemical plant that causes a toxic release can have the same kinds of potential consequences as accidental events resulting in loss of con-

tainment of a hazardous material or large amounts of energy from a plant. Clearly anything which reduces the amount of material, the hazard of the material, or the energy contained in the plant will also reduce the magnitude of this kind of potential security related event. The chemical industry recognizes this, and current security vulnerability analysis protocols require evaluation of the magnitude of consequences from a possible security related loss of containment, and encourage searching for feasible means of reducing these consequences. But inherently safer design is not a solution which will resolve all issues related to chemical plant security. It is one of the tools available to address concerns, and needs to be used in conjunction with other approaches, particularly when considering all potential security hazards.

In fact, inherently safer design will rarely avoid the need for implementing conventional security measures. To understand this, one must consider the four main elements of concern for security vulnerability in the chemical industry:

- Off-site consequences from toxic release, a fire, or an explosion
- Theft of material or diversion to other purposes, for example the ammonium nitrate used in the first attempt to destroy the World Trade Center in New York, or for the Oklahoma City bombing
- Contamination of products, particularly those destined for human consumption such as pharmaceuticals, food products, or drinking water
- Degradation of infrastructure such as the loss of communication ability from the second World Trade Center attacks

Inherently safer design of a process addresses the first bullet, but does not have any impact whatsoever on conventional security needs for the others. A company will still need to protect the site the same way, whether it uses inherently safer processes or not. Therefore, inherently safer design will not significantly reduce security requirements for a plant.

The objectives of process safety management and security vulnerability management in a chemical plant are safety and security, not necessarily inherent safety and inherent security. It is possible to have a safe and secure facility for a facility with inherent hazards. In fact this is essential for a facility for which there is no technologically feasible alternative—for example, we cannot envision any way of eliminating large inventories of flammable transportation fuels in the foreseeable future.

An example from another technology—one which much of us frequently use—may be useful in understanding that the true objective of safety and security management is safety and security, not inherent safety and security. Airlines are in the business of transporting people and things from one place to another. They are not really in the business of flying airplanes—that is just the technology they have selected to accomplish their real business purpose. Airplanes have many major hazards associated with their operation. One of them tragically demonstrated on 9-11 is that they can crash into buildings or people on the ground, either accidentally or from terrorist activity. In fact, essentially the entire population of the United States, or even the world, is potentially vulnerable to this hazard. Inherently safer technologies which completely eliminate this hazard are available—high speed rail transport is well developed in Europe and Japan. But we do not require airline companies to adopt this technology, or even to consider it and justify why they do not adopt it. We recognize that the true objective is "safety" and "security" not "inherent safety" or "inherent security." The passive, active, and procedural risk management features of the air transport system have resulted in an enviable, if not perfect, safety record, and nearly all of us are willing to travel in an airplane or allow them to fly over our houses.

SOME ISSUES AND CHALLENGES IN IMPLEMENTATION OF INHERENTLY SAFER DESIGN

- The chemical industry is a vast interconnected ecology of great complexity. There are dependencies throughout the system, and any change will have cascading effects throughout the chemical ecosystem. It is possible that making a change in technology that appears to be inherently safer locally at some point within this complex enterprise will actually increase hazards elsewhere once the entire system reaches a new equilibrium state. Such changes need to be carefully and thoughtfully evaluated to fully understand all of their implications.
- In many cases it will not be clear which of several potential technologies is really inherently safer, and there may be strong disagreements about this. Chemical processes and plants have multiple hazards, and different technologies will have different inherent safety characteristics with respect to each of those multiple hazards. Some examples of chemical substitutions which were thought to be safer when initially made, but were later found to introduce new hazards include:

- Chlorofluorcarbon (CFC) refrigerants—low acute toxicity, non-flammable, but later found to have long term environmental impacts
- PCB transformer fluids—non-flammable, but later determine to have serious toxicity and long term environmental impacts

• Who is to determine which alternative is inherently safer, and how are they make this determination? This decision requires consideration of the relative importance of different hazards, and there may not be agreement on this relative importance. This is particularly a problem with requiring the implementation of inherently safer technology—who determines what that technology is? There are tens of thousands of chemical products manufactured, most of them by unique and specialized processes. The real experts on these technologies, and on the hazards associated with the technology, are the people who invent the processes and run the plants. In many cases they have spent entire careers understanding the chemistry, hazards, and processes. They are in the best position to understand the best choices, rather than a regulator or bureaucrat with, at best, a passing knowledge of the technology. But, these chemists and engineers must understand the concept of inherently safer design, and its potential benefits—we need to educate those who are in the best position to invent and promote inherently safer alternatives.

• Development of new chemical technology is not easy, particularly if you want to fully understand all of the potential implications of large scale implementation of that technology. History is full of examples of changes that were made with good intentions that gave rise to serious issues which were not anticipated at the time of the change, such as the use of CFCs and PCBs mentioned above. Dennis Hendershot personally has published brief descriptions of an inherently safer design for a reactor in which a large batch reactor was replaced with a much smaller continuous reactor. This is easy to describe in a few paragraphs, but actually this change represents the results of several years of process research by a team of several chemists and engineers, followed by another year and millions of dollars to build the new plant, and get it to operate reliably. And, the design only applies to that particular product. Some of the knowledge might transfer to similar products, but an extensive research effort would still be required. Furthermore, Dennis Hendershot has also co-authored a paper which shows that the small reactor can be considered to be less inherently safe from the viewpoint of process dynamics—how the plant responds to changes in external conditions—for example, loss of power to a material feed pump. The point—these are not easy decisions and they require an intimate knowledge of the process.

• Extrapolate the example in the preceding paragraph to thousands of chemical technologies, which can be operated safely and securely using an appropriate blend of inherent, passive, active, and procedural strategies, and ask if this is an appropriate use of our national resources. Perhaps money for investment is a lesser concern—do we have enough engineers and chemists to be able to do this in any reasonable time frame? Do the inherently safer technologies for which they will be searching even exist?

• The answer to the question "which technology is inherently safer?" may not always the same—there is most likely not a single "best technology" for all situations. Consider this non-chemical example. Falling down the steps is a serious hazard in a house and causes many injuries. These injuries could be avoided by mandating inherently safer houses—we could require that all new houses be built with only one floor, and we could even mandate replacement of all existing multi-story houses. But would this be the best thing for everybody, even if we determined that it was worth the cost? Many people in New Orleans survived the flooding in the wake of Hurricane Katrina by fleeing to the upper floors or attics of their houses. Some were reportedly trapped there, but many were able to escape the flood waters in this way. So, single story houses are inherently safer with respect to falling down the steps, but multi story houses may be inherently safer for flood prone regions. We need to recognize that decision makers must be able to account for local conditions and concerns in their decision process.

• Some technology choices which are inherently safer locally may actually result in an increased hazard when considered more globally. A plant can enhance the inherent safety of its operation by replacing a large storage tank with a smaller one, but the result might be that shipments of the material need to be received by a large number of truck shipments instead of a smaller number of rail car shipments. Has safety really been enhanced, or has the risk been transferred from the plant site to the transportation system, where it might even be larger?

• We have a fear that regulations requiring implementation of inherently safer technology will make this a "one time and done" decision. You get through the technology selection and pick the inherently safer option, meet the regulation, and then you don't have to think about it any more. We want engineers to be thinking about

opportunities for implementation of inherently safer designs at all times in everything they do—it should be a way of life for those designing and operating chemical, and other, technologies. For example:

- Research chemists and engineers—inherently safer fundamental chemistries
- Process development engineers—inherently safer processes based on those chemistries
- Design engineers—inherently safer plant design using the selected technology and process
- Detailed design engineers—inherently safer equipment details—minimize the length and size of pipes, vessels, and other equipment, make the plant design "user friendly"
- Plant operation engineers and operators—develop inherently safer operating procedures, look for opportunities for enhancing inherent safety in existing facilities
- Operators—look for inherently safer ways to do all of the tasks involved in the day to day operation of a plant Inherently safer design and operation needs to be the way everybody involved in chemical technology thinks, not just a one time exercise to comply with a regulation.
- Inherently safer processes require innovation and creativity. How do you legislate a requirement to be creative? Inherently safer alternatives can not be invented by legislation.

WHAT SHOULD WE BE DOING TO ENCOURAGE INHERENTLY SAFER TECHNOLOGY?

Inherently safer design is primarily an environmental and process safety measure, and its potential benefits and concerns are better discussed in context of future environmental legislation, with full consideration of the concerns and issues discussed above. While consideration of inherently safer processes does have value in some areas of chemical plant security vulnerability—the concern about off site impact of releases of toxic materials—there are other approaches which can also effectively address these concerns, and industry needs to be able to utilize all of the tools in determining the appropriate security vulnerability strategy for a specific plant site. Some of the current proposals regarding inherently safer design in security regulations seem to drive plants to create significant paperwork to justify not using inherently safer approaches, and this does not improve security.

We believe that future invention and implementation of inherently safer technologies, to address both safety and security concerns, is best promoted by enhancing awareness and understanding of the concepts by everybody associated with the chemical enterprise. They should be applying this design philosophy in everything they do, from basic research through process development, plant design, and plant operation. Also, business management and corporate executives need to be aware of the philosophy, and its potential benefits to their operations, so they will encourage their organization to look for opportunities where implementing inherently safer technology makes sense.

We believe that the approach that the Environmental Protection Agency has taken to promote Green Chemistry provides a good example of how the Federal Government can promote the adoption of inherently safer technology in industry. EPA has been active in promoting the principals of green chemistry, promoting incorporation of green chemistry into the education of chemists, and in sponsoring conferences and technical meetings on the subject. Each year a number of awards are given to researchers and to companies for outstanding examples of implementation of green chemistry. An effort like this for inherently safer design will increase its visibility for all chemical industry technologists, promote sharing of ideas and information, recognize important contributions, and encourage others to understand and apply the inherently safer design principles.

RESPONSES BY DENNIS C. HENDERSHOT TO ADDITIONAL QUESTIONS FROM SENATOR INHOFE

Question 1. At the hearing, I entered into the record a copy of a letter from a company in OK called Dryvit. The letter expresses the belief that

"Every chemical process is unique. . . .Companies need to retain the direct authority to assess options and decide what is best for their business." I'm concerned about substituting the judgment of a Federal bureaucrat for the chemical plant engineer. In your experience, who is best suited to fully understand and make decisions about the complex nature of chemical processes?

Response. The people most qualified to make decisions about the optimal chemical process are the local experts working for the facility operating the process, who have the most extensive expertise on all of the many factors which impact on the decision. This is not just a "business" issue—these local experts are most familiar with local conditions and concerns which can impact a decision—they live in the community and understand specific local factors.

Question 2. Mr. Crowley argues that facilities that use chlorine for example, should be forced to switch to other alternatives, with stiff penalties for not complying. The city of Phoenix conducted a study on switching from chlorine to sodium hypochlorite, or liquid bleach. Because of the extreme temperatures in Phoenix, the city found that shipping the product in on a regular basis would not work because of the amount of product the City would need. Further, storing it onsite was also problematic because the city would need some means of cooling the sodium hypochlorite which loses potency in the heat and over time. Switching to liquid bleach is just not an option for the city. Under Mr. Crowley's proposal, Phoenix would be in violation of the law and will have to jeopardize the health of its citizens in order to comply. Isn't this why individual facilities are best equipped to make decisions about IST and security?

Response. This is a good example of the point in Question 1—local experts understand how local conditions impact the decision. As I stated at the hearing—I do not believe that there is a "one size fits all" for most chemical technologies.

Question 3. I also entered into the record a letter from Rust-Oleum, a manufacturer and employer in OK. This letter expresses concern about the effect of IST and the potential for quality consequence on downstream users of chemicals. Based on your experience in the chemical industry, can you elaborate on how IST affects the entire chemical supply chain?

Response. One could probably get an advanced degree in economics by studying this question in some detail. Some examples of these impacts include:

• Downstream Product impacts. The properties of many chemical products are significantly impacted by the manufacturing process and chemistry. This defines the spectrum of by-products and contaminants in the final product (nothing can ever be 100 percent pure). These contaminants and by-products are the result of chemical side reactions, impurities and contaminants in the raw materials, and other process characteristics. If a manufacturer changes the process or chemistry for making a product, it will also unavoidably change the composition of the final product, and perhaps other special characteristics of the product (length of polymer chains, branching of polymer chains, etc.). These changes may impact the performance of the product to consumers, industrial customers who use it to make other materials, and consumers of the products of those industrial customers. Sometimes these changes could even result in safety hazards—minor contaminants can catalyze chemical reactions which could cause reaction hazards or generate hazardous products. A chemical manufacturer must understand, as a part of its management of change process, what the impact of changes in a raw material will be. They may require extensive testing of "new" raw material to confirm that their product made with the new raw material can be manufactured safely and that its performance is not adversely impacted. This can cascade throughout the supply chain. This impact of manufacturing process on product characteristics is well known for products where there is potential direct human consumption—intentional for pharmaceuticals and food products, and potential for agricultural chemicals. The regulatory process for such materials includes consideration at an appropriate level for the manufacturing process, and it can be difficult to change a manufacturing process without extensive product testing and regulatory involvement. Finally, customers may reject the "inherently safer" product for quality or performance reasons. For example, many people do not believe that water based paints work as effectively for exterior applications, and prefer to use oil based paints.

• Large scale economic impacts. Changing the usage pattern for a major industrial chemical may have significant impacts on markets. Assume that Raw Material X is used as the feedstock for a major chemical Product P. A major manufacturer of Product P changes its manufacturing process to use Raw Material Y as a feedstock instead, perhaps because of improved technology or perhaps because somebody decides that the alternative process is inherently safer. If Product P is a large volume product, the process for manufacturing it may significantly impact the markets for Raw Materials X and Y. Following the laws of supply and demand, the price for Raw Material X, which will be in oversupply, will drop, and the price for Raw Material Y, which may be in shortage, will increase. Manufacturers, possibly overseas suppliers, using the old process (Raw Material X) may now find themselves with a cost advantage over those using the new process, even if it appeared that the new

process would have neutral or favorable economics based on costs before the change. Chemical companies have to deal with issues like this all the time, have expertise in chemical markets, and are able to predict these kinds of economic impacts and take them into account when making decisions. But it is highly unlikely that regulators will have the expertise or resources to properly consider these impacts.

Question 4. In his statement Senator Biden cited the Wilmington Water Pollution Control Facility that was able to switch to sodium hypochlorite for $160,000. However, I have heard of numerous cities that spent far more than that including DC which spent nearly

$13 million, a system in Pennsylvania spent $2 million; a third system in California spent $5 million to switch so indeed the cost to change technologies is significant.

Response. Your examples illustrate that it is not possible to extrapolate the experience of one facility in making a conversion to all facilities. The specific local characteristics of any plant will impact the economics of making a change, and cost range can be very broad. Your example is in reference to a single, very simple technology—I would expect an even wider range for a very complex, multi-step chemical technology. Changing the chemical process may require the complete replacement of a plant if the chemistry is very different—you might not be able to salvage anything but the steel structure of the plant and some storage tanks. Even some changes that appear simple at first glance may become complex. Dilution is an inherently safer design approach. So, is it necessarily simple to take a process which uses a hazardous material at 100 percent concentration and change it to a process that uses the same material at 25 percent concentration in water? Assuming the chemistry still works, perhaps this means that the reactor will have to be 3 or 4 times larger to hold all of the water which is now present. This will mean modifying a lot of piping because the reactor is a different shape and size. Or, perhaps the larger reactor will not fit in the building, or the building structural steel is not strong enough to support the larger and heavier reactor. So, you have to build a new building. You are now well along the road to completely replacing the plant. All decisions relative to that plant are now on the table. Perhaps the new plant should instead be located somewhere else, perhaps overseas. Perhaps the business does not have reinvestment economics—it makes money but does not earn sufficient return to justify investment of new capital, so the company decides to get out of the business entirely. In this example, another plant with a larger building or stronger structural steel might find this change relatively easy and cheap.

Question 5. Senator Biden goes on to comment that Wilmington no longer needs to spend money on other security enhancements "they don't need guards, they don't need fences, they don't need security around the facility now." Mr. Hendershot, you stated in your testimony that IST, if even feasible in a particular instance, will in fact not decrease the need for traditional means of security. Can you elaborate? Do you agree with those who say the costs to switch technologies are minimal and that essentially the only security risk at a facility is the chemicals it stores?

Response. I would assume that the Wilmington water treatment facility still has guards, fences, and security to protect the integrity of the water supply. Contamination and interruption of public water supplies is certainly a real concern with regard to potential terrorist attacks. Similarly, chemical facilities will always need guards, fences, and other security features. Plants must protect their equipment and infrastructure, they must protect products from contamination, and they must prevent theft and diversion of material for other purposes.

RESPONSE BY DENNIS C. HENDERSHOT TO AN ADDITIONAL QUESTION FROM SENATOR JEFFORDS

Question. Mr. Hendershot, you were a member of the National Research Council team that recently stated that "the most desirable solution to preventing chemical releases is to reduce or eliminate the hazard where possible, not to control it." Do you agree with this statement?

Response. I certainly cannot disagree with that statement since I signed off on the NRC report, and have made the statement myself many times. However, a chemical plant, like any other technology, must meet multiple objectives, and the optimum design must represent the best overall combination of characteristics to maximize the overall satisfaction with respect to all of the requirements. In most cases, that overall best option will not represent the "best" approach for any single objective, but rather the "best" option for ALL of the objectives taken together. This is the essence of all engineering—to understand the multiple requirements, understand how well various design options satisfy those requirements, and to be able to

select the best overall design. If the only objective of a chemical plant was to "prevent chemical releases" you would simply never build any chemical plants—there would never be any chemical releases from them. But then we would forgo all of the benefits associated with the plants—useful products, jobs, etc. I know how to build inherently safer automobiles—limit the engine size so no car could go more than about 5 mph. It would be very safe, but not very useful because I would have ignored all of the other requirements that automobile customers expect to have satisfied.

RESPONSES BY DENNIS C. HENDERSHOT TO ADDITIONAL QUESTIONS FROM SENATOR VOINOVICH

Question 1. Across the entire chemical manufacturing industry in the United States, how many of the chemicals listed on EPA's Risk Management Plan list have scientifically proven alternatives that increase safety, reduce risk, and operate at least as effectively, in terms of both cost and end product, as the chemical compound that is being replaced?

Response. It is not possible to provide a general answer to this question without extensive research. Most of the chemicals on the EPA RMP list are major, large volume industrial chemicals and they are used in many different applications. In my 35-year industrial career, I have probably seen 50 or so different uses of ammonia, for example. In some cases, there were alternatives—although the alternatives were not as "good" or they would have been selected to begin with. Chlorine is used for water disinfection, and this is probably the largest single use, but it is also used in thousands of chemical processes to make a wide range of products from plastics to pharmaceuticals. It would require a major study to understand the potential to replace chlorine in all of these applications, and to understand the economic consequences of such a change. In general, if a process existed that met the criteria of the Senator's question, and if investment and economics were not factors, chemical facilities would already be using it.

Question 2. Who or what body should determine what IST is? Should it be defined by Government, industry, or academia? If Government does define it, which agency should be responsible for that?

Response. I believe that the experts in a particular technology are best qualified to make judgments about the inherent safety characteristics of their process. They have the most knowledge of the process, and the multiple impacts of any change on safety and the environment throughout the chemical supply chain. It should not be defined by Government or academia. Who is better qualified to understand the safety of a chemical process—a group of engineers and operating personnel who have worked with the process for many years, or a Government regulator who, at best, spends a few weeks or months studying a process and likely no time at all actually operating the technology? I believe that the "hands on" operating experts are clearly best qualified.

I do not believe that there is any existing Government agency qualified to define inherently safer technology for the chemical industry. I am not sure this will ever be possible. I have worked for 36 years in the chemical industry, and, as a result of that, I am qualified to make inherently safer technology judgments for a limited number of technologies, those in which I have extensive experience. I am not qualified to make these judgments for most of the industry because I am not an expert in those technologies. I can offer ideas and suggestions for consideration by experts, but I am not qualified to make the decisions.

Question 3. To your knowledge has IST ever been defined as a security measure in federal law?

Response. To my knowledge IST has never been defined as a security measure in Federal law.

Question 4. The EPA has concluded that:

- "Inherently safer processes" is a developing concept and is not ready for general application;
- IST frequently displaces risk rather than reducing it
- Even if a few examples of workable alternative approaches do exist, there is not a rational basis for imposing an additional industry-wide regulatory burden; and
- The concept is normally considered when designing new processes, a time when changes can be implemented cost effectively.

Do you agree with the above assessments? In that context, do you believe that IST a concept that is ready for broad implementation as a regulatory requirement?

Response. Yes, I agree with the EPA statements. I do not believe that IST is ready for broad regulatory requirements. The philosophy of inherently safer design should be broadly taught to chemical engineers and chemists (and all other technologists—the philosophy applies to any technology, and is not something that only applies to the chemical industry). Because it is not possible to measure IST, or to objectively quantify it, it will be extremely difficult to regulate. I believe that a regulation could even be counter-productive, making inherent safety something that is done once to meet a regulation and then forgotten.

Question 5. Mr. Hendershot, I would argue that the reason that we are securing chemical facilities is to protect the processes and products that are produced there. For instance, there are some facilities that are so critical to the economic vitality or the national security of this nation, that any interruption in processing could be detrimental to the national economy and security. If it is the process and the product that we want to protect, why should Government mandate changing the process?

Response. For some products, the Government actually makes it difficult to change the process. For example, where the Government is the customer, product specifications may include specification of the manufacturing process, making changes very difficult, and any changes may have to be negotiated with the Government customer. For pharmaceuticals and products which may be consumed by people, process changes may be heavily regulated. In this case, even if you are able to use a completely inherently safe process (and, if you consider all hazards, I do not believe there is such a thing), you still need to secure the facility because the product or service produced is important.

Question 6. Mr. Hendershot, according to your testimony, "there has been some isolated academic activity on how to measure the inherent safety of a technology (and no consensus on how to do this), but we have seen little or no academic research on how to actually go about inventing IST." If this is the case, how would the Government mandate IST and measure compliance with IST?

Response. I do not believe there is currently an effective means for measuring IST, or for confirming compliance with any regulation. Any system for measuring IST will necessarily have to include somebody's judgment about the relative importance of different kinds of hazards. Which is the inherently safer refrigerant—CFCs, ammonia, or light hydrocarbons?

- CFCs—not acutely toxic, not flammable, long term environmental damage
- Ammonia—flammable, acutely toxic
- Light hydrocarbons—not acutely toxic, highly flammable

Any system to measure IST will have to be able to resolve issues like this, and, in fact, there is no "right" answer. The answer depends on the relative importance which is placed on the different hazards, and, even today, many people do not agree on the relative importance of different hazards associated with different materials for use as refrigerants. Anybody who attempts to measure inherent safety considering all potential hazards must incorporate this value judgment into the measuring system, and there must be some way to ensure that value judgments truly reflect the national sense of values.

Question 7. Mr. Hendershot, in your testimony you note that hazardous or abrasive chemicals are often the most useful. Gasoline is a good example of this. The very value of many chemical products is found in the complex processes that produce them, such as milk bottles, nylon seat belts, or military jet fuel. Are there currently alternative chemicals that can be used to make many of these specialty products without sacrificing quality or cost-effectiveness?

Response. I do not believe that it is possible to answer this question without significant investigation and research. There are tens of thousands of chemical products in commerce. I am sure that there are alternatives for most of them—the economy seems to get by when there are supply disruptions such as those caused by the Gulf coast storms in 2005. But these alternatives may not be inherently safer, and most likely would result in some sacrifice in quality or cost effectiveness. Over time the market will drive all users to the most cost effective technology, and this will change as technology evolves and improves.

I am not aware of any study which has ever been done to understand the answer to this question. I would say that it is not a good idea to make such a potentially far reaching change in the technology of the chemical industry in the United States without conducting a thorough study to understand the economic impacts.

RESPNOSES BY DENNIS C. HENDERSHOT TO ADDITIONAL QUESTIONS FROM SENATOR OBAMA

Question 1. Department of Homeland Security officials told EPW staffers in preparation for this hearing that if left to their own devices, individual facilities might make IST decisions that decrease risk at one plant, but increase risk system-wide. What are your thoughts on that assertion, and of DHS's potentially helpful role in coordinating IST at the most dangerous facilities?

Response. I believe that this is a possible outcome. Those making the decision for a single plant may not understand the system wide impacts, because they may not even have access to the information required to understand those impacts. These impacts may occur in other companies, in other industries, and in other parts of the company. DHS potentially can help an individual plant to understand these broader impacts.

This question leads me to think about an interesting conflict that a plant might have. Even if the plant understands that a change would increase risk to society as a whole, even though it would decrease the risk to that specific plant, why would they want to accept that additional risk locally even if the result is reduced overall risk to society as a whole? For example, if society thinks that it is better for a large inventory of hazardous material to be stored at Consumer Plant A, rather than Supplier Plant B, how do we convince Consumer Plant A that this is a good idea and make it attractive for Consumer Plant A to do this? DHS may have an important role here, with an opportunity to work with the parties involved and work out a solution, and perhaps back up the solution with financial or other incentives.

Question 2. In March of this year, Secretary Chertoff said he was open to the idea of requiring high-risk facilities to consider safer approaches. This is a position the industry opposes. What is your view on requiring high-risk facilities to consider IST?

Response. Of course we encourage every engineer to consider inherently safer approaches in the process of invention, development, and design, but I believe that it would be very difficult to write and enforce a meaningful regulation to require facilities to "consider" safer approaches. If you are a regulated facility, how do you know whether or not you have demonstrated "consideration" of safer approaches in a way that the regulator will accept? What does appropriate documentation of "consideration" consist of? Who is to evaluate the "sincerity" of the consideration? In the end I do not believe such a regulation will be effective in driving any change. For those regulated facilities that believe in the concept of inherently safer design—its value and effectiveness—they do not need a regulation and will be applying inherently safer design principles already. For those that do not believe in the concept, they will generate paperwork that shows that shows that they have considered inherent safety, perhaps demonstrate some relatively small improvements, and continue to operate the same way they did in the past. I suspect that any good lawyer would have no trouble "proving" compliance with such a vague and ill defined regulation. If the objective is real change in the chemical industry, we have two laboratories right now—Contra Costa County, CA, and the state of New Jersey. Perhaps we should wait a few years, then go back to these places and see what real impact the regulations have had—not just "how difficult it was to comply with the rules?", but rather, did the rules actually result in any real reduction of hazards?

Many of the leading chemical companies strongly encourage engineers and chemists to think about inherently safer, and look for opportunities to incorporate inherent safety features into plants. We need to encourage engineers and chemists at all companies to encourage this kind of thinking, but regulation is not an effective way to accomplish this. Inherently safer design is a creative activity, done in the mind of engineers and chemists who believe in the value of the philosophy, and not easily measured or regulated. In other areas the Government has developed policies and programs to encourage creative thinking—for example for pollution prevention (the Pollution Prevention Act of 1990, http://www.epa.gov/opptintr/p2home/p2policy/act1990.htm) and for "Green Chemistry". A useful approach might be statement of a policy, followed by creation of mechanisms to educate and provide incentives.

STATEMENT ON PHILIP J. CROWLEY, SENIOR FELLOW AND DIRECTOR OF NATIONAL DEFENSE AND HOMELAND SECURITY, CENTER FOR AMERICAN PROGRAMS

Good morning. I am P.J. Crowley. I direct the homeland security program at the Center for American Progress. I am grateful for the opportunity to discuss with you the challenge of chemical security and the opportunity—and indeed the security im-

perative—to employ inherently safer technology, materials and processes to make our society and economy less vulnerable to terrorism.

I will also briefly discuss the findings of a recent survey the Center for American Progress conducted of a wide range of chemical facilities across the country. The findings suggest both good news and bad news. The good news is that many facilities have successfully and economically switched to less acutely hazardous chemicals and processes. The survey data demonstrate that inherently safer technologies should be viewed as a viable and necessary component of chemical security. It reduces and in many cases eliminates terrorism risk to millions of Americans. It does not need to be studied. It needs to be embraced by the Department of Homeland Security and pursued as part of our national security strategy to protect the homeland. It should be specifically incorporated into legislation being considered by the Congress, because the bad news from our survey is that, while change is occurring, it is not happening fast enough.

At the outset, I should mention that I view this issue from a security vantage point, based on my experience over three decades as an Air Force officer, staff member of the National Security Council and national security analyst at the Center for the past two and a half years. I was working for the insurance industry in New York on September 11, four blocks from the World Trade Center. I understand the nature of terrorism risk and how it affects the private sector. From that experience, I do not view national security and economic productivity as competing priorities. We must do both.

We are approaching the fifth anniversary of 9-11. We can all be grateful that through the combined efforts of our military, our intelligence services and police, we have not been attacked again. In many respects, we are safer, but we are not safe. The threat to the United States is growing more dangerous and less predictable. There is equal risk that we as a country are losing our sense of urgency and becoming complacent. We need to use this intervening period before we are attacked again to make our society and economy as secure as they can be.

The Bush administration's rhetoric—that we are fighting terrorists in Baghdad so we do not have to confront them in my native Boston or Cleveland—is at odds with the reality that can be seen from successful attacks in Madrid and London and the plot that was recently foiled in Canada, employing common, yet critical infrastructure against us.

The global jihadi movement is evolving. The next attack—and we should be clear that there will be other attacks—is more likely to be perpetrated by individuals who are "self-starters"—inspired by al Qaeda, linked to the movement through the Internet, but acting on their own. These people are likely to be newly radicalized and will be extremely difficult to detect. They may well already be here in the United States. The people of Oklahoma understand all too well that terrorism involves both domestic and international threats.

We also recognize that we cannot protect everything. The United States is a target-rich environment. We have to set priorities, something the Department of Homeland Security has yet to effectively do. The emphasis should be to protect infrastructure that, if attacked, represents the greatest risk to human life or would generate the most significant economic loss to the United States. Chemical and petro-chemical facilities fit both of these criteria, particularly those in or near major metropolitan areas. The emphasis must be on preventing or reducing our vulnerability to catastrophic terrorism. This is not an arbitrary judgment. It is specific to the threat we face—that terrorists are most likely to attack where they can kill as many innocent civilians as possible and have the most significant economic and political impact on our country.

The Department of Homeland Security says it is pursuing a risk-based strategy. In that context, both DHS and the Congress are appropriately focused on security at chemical facilities across the country. But it was disappointing to hear Secretary of Homeland Security Chertoff, in comments in March to the American Chemistry Council, suggest that inherently safer technology is an environmental interest that has little to do with security.[1] He is wrong.

A risk-based chemical security strategy should be integrated and multi-dimensional. It requires better physical security, an area of particular emphasis with the Maritime Transportation Security Act (MTSA) and voluntary standards promoted by the American Chemistry Council. But physical security by itself is not enough. In some cases, it requires risk mitigation, which might involve changes in on-site storage and manufacture or facility relocation and consolidation. This too is not suffi-

[1]. Secretary of Homeland Security Michael Chertoff, Remarks at the American Chemistry Council National Chemical Security Forum, Washington, DC, March 21, 2006, available at http://www.dhs.gov/dhspublic/display?content=5494.

cient alone. We must also pursue risk elimination. Where safer and more secure technologies already exist and are readily available, we have an obligation to address these known vulnerabilities and in essence take as many chemical facilities and communities as possible off the terrorism target list. As a National Academy of Sciences report highlighted earlier this year, "The most desirable solution to preventing chemical releases is to reduce or eliminate the hazard where possible, not to control it."[2] This is the potential value of inherently safer technologies and manufacturing processes.

The Center for American Progress, with assistance from the National Association of State PIRGs and National Environmental Trust, conducted a survey of a wide range of facilities—1,800 in all—that deregistered from the Risk Management Planning (RMP) program. Among the key findings:

284 facilities in 47 states have dramatically reduced the danger of a chemical release into nearby communities by switching to less acutely hazardous processes or chemicals or moving to safer locations. This action reduces or eliminates a clear terrorism threat to at least 38 million people. For example, the Mill Creek Wastewater Treatment Plant in Cincinnati, Ohio eliminated the danger of an off-site chlorine gas release to an area encompassing 860,000 residents by switching to liquid bleach for disinfection. Likewise, the Water Pollution Control Facility in Wilmington, Delaware made a similar change, eliminating the danger to 560,000 nearby residents.

Change can be accomplished economically. Of respondents that provided cost estimates, 87 percent spent less than $1 million and roughly half reported spending less than $100,000 to switch to safer alternatives.

Our survey revealed that alternatives already exist in a range of applications: drinking water, wastewater, manufacturing, electric power production, hazardous waste management, and agriculture and oil refineries. In virtually all cases, change involved the adoption of common technologies, not new innovation: for water treatment, a shift from the use of chlorine gas to liquid bleach or ultraviolet radiation; in manufacturing, the use of liquid rather than gaseous ammonia; for electrical utilities, the use of aqueous rather than anhydrous ammonia or solid rather than anhydrous sulfur dioxide. These and other changes do not need to be studied. They are already in use and need to be more widely adopted.

The most common reasons cited for making changes included the security and safety of employees and nearby communities, as well as regulatory incentives and business opportunities. These facilities also saw opportunities to cut a variety of costs, requiring fewer physical security measures and hazardous material safety devices, making these operations more efficient and productive. This also took a significant burden off surrounding communities in terms of disaster planning and response.

While our survey results demonstrated that effective change can take place, it also revealed limitations in a purely market-driven response. For example, of the 284 facilities that adopted some form of inherently safer practices, only 10 percent represented the highest risk facilities—those that put 100,000 or more people at potential risk. At this pace, it would take another 45 years to eliminate this substantial risk to the American people. We do not have that much time to act.

There is also a fairness issue by relying on ad hoc local action rather than a national approach. Chemical security involves the transportation of hazardous materials, not just their manufacture and use. Many communities where change is taking place are also vital transportation hubs Wilmington, DE; Jacksonville, FL; Indianapolis, IN; Baltimore, MD; Omaha, NE; Cleveland and Cincinnati, OH; and Philadelphia, PA. They have taken the initiative to eliminate threats to their people, but potentially remain at risk because hazardous materials are still transported through these cities to neighboring states and communities that have not taken similar action.

With this in mind, what then is the proper role of Government to help promote change within communities and the private sector? As a security analyst, what is most important is to accelerate the pace of change and measurably reduce the risk of catastrophic terrorism to our society and economy. When it comes to our extraordinary military, we are constantly exploring how to invest in and employ new technologies that make us stronger. Why is it that we would not take the same approach to invest in and employ new technologies to make us more secure here at home? I think our citizens and our first responders deserve the same consideration that we rightly give our men and women in the military.

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[2] National Academy of Sciences, Board on Chemical Sciences and Technology (BCST) ,"Terrorism and the Chemical Infrastructure: Protecting People and Reducing Vulnerabilities (2006)", available at http://darwin.nap.edu/books/0309097215/html/9.html.

Voluntary actions should be encouraged, but the experience of the past 5 years shows that voluntary actions alone are not adequate to fully address this vulnerability. Government has the a responsibility to set strong safety and security standards, identify better alternatives, require needed security assessments and reporting, and create incentives for the private sector and cities and states to take action. We need a comprehensive national approach, not a series of disconnected local or regional actions.

To give one example of how this might work, consider the approximately 3,000 drinking water and wastewater treatment plants across the country that still use chlorine gas. DHS should identify the manufacture, transportation and use of chlorine gas for disinfection as posing an unacceptable risk to our society, when inherently safer alternatives clearly exist. But local officials and facility operators should determine how to best eliminate this risk, whether to convert to the use of liquid bleach, ultraviolet radiation or other process. Water treatment facilities represent an excellent starting point to implement a genuine risk-based approach to chemical security.

What needs to be done?

The Department of Homeland Security should be granted authority to regulate chemical security and move high-hazard facilities to inherently safer technologies where practicable.

With that authority, DHS should promulgate strong national standards to improve chemical security, including the manufacture, transportation and use of acutely hazardous materials. Particular emphasis should be given to the proximity of these acutely hazardous materials to major population centers across the United States that present the highest risk if successfully attacked by terrorists.

Chemical facilities should be required to do comprehensive annual security risk assessments and report those findings to DHS and EPA. These risk assessments should include a thorough evaluation of less acutely hazardous alternatives. In the case of publicly traded companies, an assessment of risk and summary of actions taken should also be reported to shareholders.

DHS, in conjunction with EPA, should embrace the adoption of inherently safer technology and processes as a key component of a risk-based national security strategy to protect the homeland. DHS should establish a Center of Excellence to promote the adoption of inherently safer technologies more broadly.

The Federal Government should create a variety of incentives to promote change. This might include a mix of targeted grants, loans and tax credits. Rewards for facilities that meet or exceed stronger national standards should also be explored, including caps on liability if a terrorist attack does occur. Aggressive DHS enforcement would also involve sticks for those entities that do not meet stronger security standards.

The course that we have followed in the first five years of the war on terror cannot be sustained indefinitely. There will always be a need to aggressively but judiciously employ military force to intercept terrorists before they can strike the United States. But as we have seen over the past couple of years, offensive action by itself is not enough. Over time, our national security strategy must place greater emphasis on homeland security. But again, as good as our intelligence and police forces may be, they cannot be expected to anticipate and intercept every attack.

We must adapt our society to this new security environment. We must reduce our vulnerability to terrorism and narrow the potential for terrorists to successfully attack us here. We cannot create a risk-free environment, but that should not be used an excuse for inaction. The security of the United States should not be subject to the lowest common private sector denominator. Business as usual is no longer acceptable.

RESPONSE BY PHILIP J. CROWLEY TO AN ADDITIONAL QUESTIONS FROM SENATOR INHOFE

Question. You have written about your concerns over the Nation's rail and transit security. However, one of the primary concerns in mandating IST, for example, is reduction of on-site inventories of chemicals. This would shift the security burden to rail and transit systems. How do you reconcile your support for IST which reduces inventories and requires more frequent shipments with your concerns about rail and transit security?

Respones. Senator Inhofe, you are absolutely correct to link the security of chemical facilities and security of our rail system, particularly the flow of hazardous materials through the center of many large and vital cities. We really do have to think of them together, which is why the matter of chemical security does not end at the

chemical facility fence line. Even if one could envision perfect security at a chemical manufacturing facility, for example, hazardous materials must be transported from the manufacturing facility to the user. This route will typically involve transit through one or more major cities. That combination—a hazardous material in a middle of an urban and economic center—creates a terrorism target of opportunity.

As you have pointed out, IST, or more accurately inherent risk reduction, is not one thing. It is a concept that offers a range of potential solutions to security challenges. It might include inventory reduction or separation, hardened storage, just-in-time manufacturing or materials substitution. Ideally, the Government would not be proscribing a specific solution, but it would mandate a process by which the Department of Homeland Security, Environmental Protection Agency, State agencies, industry groups and facility operators would collectively evaluate options that, if undertaken, would mitigate or eliminate the threat of terrorism.

So, in the scenario you highlight, the optimal solution would not be reducing the quantities of chlorine gas at a particular location—necessitating more frequent shipments of reduced quantities—but shifting from chlorine gas, which can be exploited by terrorists, to liquid bleach, which cannot. But in other cases where substitutes are not readily available, we cannot dismiss options that reduce our vulnerability to terrorism, even if they do not reduce the risk to zero.

RESPONSES BY PHILIP J. CROWLEY TO ADDITIONAL QUESTIONS FROM SENATOR JEFFORDS

Question 1. Why is physical security at a chemical facility not enough to protect against terrorist attacks?

Response. Physical security at the point of manufacture or use is important. Many facility operators are improving physical security, including fences, lighting, video cameras, guards and access controls. One of the reasons this is a homeland security issue is that, while a number of facility operators are taking concrete steps to improve security, too many are not.

However, physical plant security only addresses part of the security challenge. Security plans that Congress may require as part of chemical security legislation must take the transportation of applicable hazardous substances into account. It does not matter how secure the bank vault is if the Brinks truck never makes it to the bank—or if the bank's computer system is vulnerable to a hacker.

Terrorists watch what we do and consciously exploit vulnerabilities. Despite our best efforts, certain activities can be safe, but not secure. For example, a HAZMAT car on a rail siding may be considered safe. But if that HAZMAT car has graffiti on it, it is not secure because someone somewhere had unauthorized access to that car. If they can write on it, they can place an explosive device next to it. A HAZMAT car in the middle of Montana may well be safe and secure. A HAZMAT car in the middle of Washington, DC may be safe, but it is not secure because it presents an inviting target to a terrorist organization that attacked once and is determined to try again.

Question 2. As you know, members of Congress have debated for years whether all chemical facilities should consider and implement, where practicable, inherently safer alternatives to make their communities safer. One compromise approach to move passed this impasse would be to tailor the requirement to evaluate safer alternatives to the risk posed by the facility, so that facilities that DHS believes pose the highest risk would be required to undertake a more rigorous evaluation than facilities that pose less risk. Would you support such a compromise?

Response. Yes. Such an approach has two dimensions that I believe are important.

First, I support the concept of tiering where we devote increasing attention to security where the threat and consequence of an attack are most significant. We do not necessarily have to protect everything in society to the same standard. When looking at critical infrastructure, increased risk can be based on what a facility does, where it is or the value that our society places on it. This will vary among economic and industrial sectors or even within sectors. The emphasis must be preventing catastrophic terrorism. As the potential for catastrophic terrorism rises, security standards need to increase, including the need to evaluate more secure alternatives.

Second, I do not think that Government needs to mandate a specific solution to a security challenge. I agree with those who say that facility operators are in the best position to make decisions on how to change. But there needs to be a mandatory process where facility operators are informed about security risks and required to evaluate options that can reduce or hopefully eliminate those risks. So, to use the example of a wastewater treatment facility, it is an appropriate role for the Gov-

ernment to identify chlorine gas as a substance that poses an unacceptably high security risk, particularly if the facility is situated near a major population center or if the chlorine gas is transported through an urban center to that facility. The facility operator can determine whether a switch to liquid bleach, ultraviolet radiation or some other process is the most appropriate solution to the security challenge. What is important is that there is a process that encourages risk mitigation or elimination and mandates serious consideration of secure alternatives where they exist. As part of this process, there should also be Government incentives, such as tax credits, matching loans or grants, to accelerate the pace of change.

Question 3. There was not much discussion during the hearing on the security risks faced during transportation of chemicals. Yet I have heard horror stories about the potential consequences if a rail car full of chlorine gas were to explode near the US Capitol or near a major city. What is the risk of a terrorist attack during the transportation of chemicals and how does this influence our discussions of chemical facility security?

Response. We must continue to focus on the actual terrorist threat we face. The 9/11 perpetrators intended to attack the Capitol, Why should we give them another opportunity using a 90-ton HAZMAT car?

The U.S. Capitol is a great example of why chemical security needs to incorporate both physical security and transportation. I have no doubt that the CSX Corporation can safely operate on the freight rail line that flows through the heart of Washington, DC and in the immediate vicinity of the Capitol and other key Government structures, including the Pentagon. However, putting a 90-ton HAZMAT car next to the Capitol can never be made completely secure. Safety and security are fundamentally different concepts.

In recent weeks, whether these plots were mature or not, or feasible or not, those who identify with al Qaeda's radical ideology are focused on destructive acts in the heart of major cities—Toronto, Chicago, New York and so forth. Regardless of where the chemical facilities are actually located, our major freight rail lines pass through the heart of our urban and economic centers, creating targets of opportunity. If a HAZMAT car filled with chlorine gas ruptured due to an attack, it could potentially kill 100,000 people in 30 minutes. Rerouting may be an option in some cases, such as Washington, DC, but the best option is to get the hazardous material off these freight rail lines. The rail industry cannot do that; only the chemical industry and its customers can.

In fact, on June 13th Edward R. Hamberger, the CEO of the Association of American Railroads, told the House Transportation and Infrastructure Committee the "Railroads agree, and strongly support efforts aimed at finding and utilizing 'inherently safer technologies' as substitutes for hazardous materials, especially TIH."

RESPONSES BY PHILIP J. CROWLEY TO ADDITIONAL QUESTIONS FROM SENATOR VOINOVICH

Question 1. Across the entire chemical manufacturing industry in the U.S., how many of the chemicals listed on EPA's Risk Management Plan list have scientifically proven alternatives that increase safety reduce risk, and operate at least as effectively, in terms of both cost and end product, as the chemical compound that is being replaced?

Response. The member companies of the American Chemistry Council, the trade association of the chemical manufacturers only represent about 11 percent of the 14,000 facilities under the EPA's Risk Management Program (RMP). The large majority of chemical facilities that pose a threat to local communities are chemical users, not makers. Both chemical makers and users can convert to safer technologies. Our analysis of RMP data showed that chemical users are switching to safer technologies more quickly. However, chemical manufacturers are also innovating. Major manufacturers such as BASF, Dupont and Cargill are investing in vegetable based (PLA) plastics instead of chlorine based vinyl.

For the most part, the process change that would make us more secure involves not the hazardous substance, but its form. We could make significant progress if we start with just three toxic-by-inhalation (TIH) gases—anhydrous ammonia, chlorine and sulfur dioxide. According to the EPA, these account for more than 50 percent of all categories of chemical processes that threaten communities nationwide. A shift to aqueous ammonia, liquid bleach or ultraviolet light and solid sulfer dioxide or liquid sodium bisulfite (depending on the process) or other less hazardous forms would be significant.

Are there up front costs to such process changes? Yes, but as our report Preventing Toxic Terrorism shows, the costs are manageable—87 percent of respond-

ents reporting $1 million or less, the majority of those $100,000 or less. Additional savings were realized through the avoidance of a range of costs, including specialized protective gear, evacuation and response planning and training and compliance inspections.

Question 2. Who or what body should determine what IST is? Should it be defined by Government, industry, or academia? If Government does define it, which agency should be responsible for that? To you knowledge has IST ever been defined as a security measure in Federal law?

Response. The EPA routinely gives credit to facilities for hazard reduction techniques. That is why many facilities have been allowed to de-register under the EPA RMP program. Our survey of RMP data focused on the hundreds of facilities that have de-registered since 1999.

The adoption of secure alternatives would involve a process led by the Department of Homeland Security (DHS), with the participation of EPA, state and local authorities, industry and academia. The first step would be to identify substances (and forms of those substances, particularly gaseous forms) that have the potential if exploited by terrorists to kill or harm thousands of people. DHS would establish a Center of Excellence (as it has with other homeland security priorities) that would identify existing alternatives or promote research to develop viable and cost-effective alternatives where none currently exist. Even if IST initially evolved as an environmental rather than security concept, risk elimination, not just risk management or control, must be part of a viable chemical security strategy.

Question 3. The EPA has concluded that "inherently safer processes" is a developing concept and is not ready for general application; IST frequently displaces risk rather than reducing it; even if a few examples of workable alternative approaches do exist, there is not a rational basis for imposing an additional industry-wide regulator burden; and the concept is normally considered when designing new processes, a time when changes can be implemented cost effectively. Do you agree with the above assessments? In that context, do you believe that IST is a concept that is ready for broad implementation as a regulatory requirement?

Response. Over the years the EPA has had many opinions on this subject. In February of 2000 the EPA issued a security alert to the industry advising them that one of the ways they could reduce security hazards was through design changes at facilities. The EPA was reminding these facilities of their general duty under the Clean Air Act (Section 112r) to prevent a catastrophic release of regulated chemicals. In June of 2002 the EPA drafted guidance and regulations calling for hazard reduction through various techniques including the substitution hazardous substances. All of these actions are efforts by the EPA to advance inherently safer technologies, processes and plant designs to minimize the impact of a terrorist attack on a chemical facility.

Given the threat to our critical infrastructure, we need a comprehensive chemical security strategy. Such a strategy must incorporate the manufacture, use, physical security, storage and transportation of acutely hazardous materials. Risk elimination through the adoption of secure alternatives or inherently safer processes, whatever term one wants to use, should be an essential tool to reduce our vulnerability to terrorism.

IST is a concept, but it is a concept that belongs in our approach to chemical security.

Given the clear danger, and the mixed market-based response within the chemical sector, it is appropriate to grant the Department of Homeland Security regulatory authority. Obviously many within the chemical sector favor industry-wide security regulation to level an uneven playing field.

Promoting IST does not mean dictating one-size-fits-all solutions to every facility and every chemical. But regulation should establish a security framework where the adoption of inherently safer or more secure alternatives is a leading option. Facility operators, as is the case in New Jersey, should be required to evaluate alternatives and report those judgments to federal and state authorities. I do not believe that this places an arduous burden on the private sector. But if it does, then the Federal Government should not only regulate, but also provide incentives that help the private sector adapt more rapidly to this new security environment we face.

Question 4. Mr. Crowley, in the study Preventing Toxic Terrorism, how many of the 284 facilities referenced were actual chemical manufacturing facilities? How many of those chemical manufacturing facilities actually substituted or modified the chemical process? How many others relocated their facilities or modified the transport of the various chemicals? Given the small number of facilities that actually changed their processes, how can this study be viewed as a sweeping endorsement of IST for chemical manufacturing facilities?

Response. The vast majority of facilities cited in Preventing Toxic Terrorism involved chemical users rather than manufacturers, such as the drinking water and/or wastewater treatment facilities in Cleveland, Columbus and Cincinnati, Ohio that all switched from chlorine gas to liquid bleach disinfection, making millions of Ohioans more secure as a result. The Helena Chemical Company of Coldwater, OH switched from the use of anhydrous ammonia gas to alternative forms of fertilizers. Anhydrous ammonia is also a key ingredient used in illegal methamphetamine labs. Such a change improves both security and law enforcement.

Preventing Toxic Terrorism, using a sample of facilities from the Risk Management Program, proves the viability of the concept. Just like clinical studies, we can use a test sample to validate a concept for wider adoption. This is no different. What our report really showed was that market-based solutions are not viable absent a more aggressive federal role. An electric power producer uses anhydrous ammonia in air pollution control devices. The manufacturer sells it to them. The railroad is required to transport it—probably through a major city. At no time under the current system are the three of them required to jointly consider more secure alternatives. The federal Government needs to change this dynamic

Question 5. Mr. Crowley, I understand that the majority of the changes that occurred were the substitution of hypochlorite (otherwise known as bleach) for chlorine or other similar substitutes at water treatment facilities. Though the water treatment facilities will have less chlorine on site wouldn't the bleach manufacturers have increased amounts of chlorine on site, in order to keep up with the increased demand for bleach? Isn't this simply displacing risk to both the rail lines and the bleach manufacturing facilities? Have you considered the entire chemical industry supply chain in your analysis?

Response. Senator Voinovich, viewing chemical security in the context of the entire chemical industry supply chain is exactly how we should evaluate this issue. We must take a system-wide approach that looks at manufacturers, transporters and users collectively, not individually.

Security involves the management of risk. It will never be zero, particularly when we are talking about the presence of chemicals such as chlorine that our society does rely on every day. In the process of managing risk to reduce the threat of terrorism, there may be some displacement of risk as you say, but that displacement can mean a broad lowering of risk. For example, here in Washington, DC, CSX's current rerouting of HAZMAT cars away from the U.S. Capitol shifts that risk to a rail line that flows through, for example, Hagerstown, MD. That al Qaeda wishes to attack Washington, DC again is self-evident. It is unclear that an attack on Hagerstown, MD would achieve the same impact that their attack on 9/11 did. From a national security standpoint, this rerouting reduces the probability of an attack and is a prudent course of action.

A second legitimate security goal is to reduce the number of targets. Since there are at least two proven and reasonably economical alternatives to chlorine gas at water and wastewater treatment facilities, encouraging the shift to hypochlorite or better still ultraviolet radiation takes these facilities off al Qaeda's target list. The storage and transportation of liquid bleach does not remove all risk—there could still be environmental damage—but it eliminates the risk of catastrophic terrorism associated with the transportation and use of this hazardous substance (in its more dangerous form, gas).

The risk would still remain at the point of manufacture, but this is where the physical security measures come into play—better fencing, lighting, guards, access controls and other potential inherently safer processes, such as hardened storage, small storage quantities, just-in-time manufacture and so forth. By taking such a system-wide approach, looking at the entire process to include the manufacture, transportation and use—and incorporating more secure alternatives where they apply—we are able to significantly reduce the potential for terrorists to attack the United States using deadly chemicals such as chlorine as a weapon.

Question 6. Mr. Crowley, in your conclusions, you note that where safer alternative chemicals and processes are available, each chemical facility should make the appropriate modifications. You have also called for legislation that includes the use of IST. I am not aware of a list of currently approved IST substitutes for the chemicals found on the Risk Management Program (RMP) list. Could you please list the approved alternative technologies? Is this list approved by EPA? DHS? Academia?

Response. "The EPA's process of de-registering facilities that eliminate or reduce chemicals below RMP reporting thresholds recognizes the advantages of significantly reducing or eliminating the number of people at risk from a chemical release. Based on our survey of these facilities, those who switched to safer technologies since the 9/11 attacks, 45 percent told us they switched for security reasons.

As was stressed at the hearing, IST is an umbrella term to include many things—the substitution of one chemical compound for another safer alternative; a shift from one form of a chemical that can spread, endangering many, to another form that does not spread, endangering only a few; or changes in a manufacturing process, producing a chemical as it is required; the manner or volume of storage; or the location of the facility. For example, a facility is removed from the RMP program if it closes. This is not an action being advocated. If facilities adapt, they are less likely to be attacked. They are thus more likely to prosper. These are not competing priorities.

There are a range of proven and available alternatives to chemicals and processes that, if promoted and adopted, will make us less vulnerable to terrorism. I am not aware of an approved EPA list, but the application of the IST concept to homeland security would result in an overlapping, but not identical list. The central RMP criteria, such as volume of a substance in a particular location and the number of people in the surrounding area who are potentially threatened, are certainly valid in the security context as well.

For each segment of the chemical sector, I would expect a list of approved alternatives to be developed by DHS, working with the EPA, academia, chemical manufacturers, transporters, users, industry groups, environmental groups and other stakeholders.

RESPONSES BY PHILLIP J. CROWLEY TO ADDITIONAL QUESTIONS FROM SENATOR BOXER

Question 1. A document published in 2000, titled, "Chemical accident risks in U.S. Industry—A preliminary analysis of accident risk data from U.S. hazardous chemical facilities" demonstrates that four extremely hazardous chemicals (Anhydrous Ammonia, Chlorine, Sulfur Dioxide and Hydrogen Fluoride) account for 55 percent of the processes that threaten communities across the country. Please describe the processes that use these chemicals in wastewater and drinking water plants, refineries, and power plants.

Response. Chlorine gas continues to be widely used for disinfection at drinking and wastewater facilities. Anhydrous sulfur dioxide is used to remove chlorine after treating wastewater, as well as treat other industrial wastes. The same chemicals are used in electric power plants, anhydrous sulfur dioxide in air pollution control equipment and chlorine gas to prevent fouling of cooling towers. Anhydrous ammonia gas is used for fertilizer. Refineries employ hydrofluoric acid in the production of gasoline.

Question 2. Please describe the number of known substitutes for these chemicals when used in wastewater and drinking water plants, refineries, and power plants.

Response. The recent survey conducted by the Center for American Progress, Preventing Toxic Terrorism, provided several examples of common technologies that are viable and cost effective alternatives. Sodium hypochlorite (or liquid bleach) and calcium hypochlorite can be substituted for chlorine gas at drinking water and wastewater treatment facilities. Ultraviolet radiation provides additional advantages. Thousands of water utilities already use liquid bleach or ultraviolet light. Dozens of power plants already use aqueous ammonia rather than anhydrous ammonia in pollution control equipment; a few use even safer solid urea. The electric grid will always be a potential terrorism target, but use of a safer solid form of sulfur dioxide eliminates off-site risks at power plants if one is attacked. Liquid or granular fertilizers not only pose less risk than anhydrous ammonia, but eliminate a substance used in illegal methamphetamine labs as well. Some two-thirds of the Nation's refineries already use safer alternatives to hydrofluoric acid, primarily sulfuric acid. Newer solid acid catalysts are in the demonstration phase at refineries in Europe. Using sulfuric acid does not remove all hazards, but eliminates the potential for catastrophic terrorism.

Question 3. Please describe the number of communities and people that would have reduced or eliminated levels of risk as a result of the facilities described above using these substitutes.

Response. The Center for American Progress survey documented that 284 facilities in 47 States have adopted inherently safer practices, the vast majority involving these substitutes. As a result, at least 38 million people are at a lower level of risk of catastrophic terrorism. That is the good news. Of these facilities, only ten percent represent the highest risk facilities, those that put 100,000 or more people at risk. At this pace, it would take another 45 years to eliminate this vulnerability. The threat is much more urgent than that.

As of 2004, some 3.5 million Americans lived in danger of serious injury or death from 225 power plants that use extremely hazardous substances. Just two-dozen power plants account for two thirds of the people in danger. (Source: Unnecessary Dangers, Working Group on Community Right-to-Know, 2004.)

As of 2003, some 19 million Americans lived in danger of serious injury or death from extremely hazardous substances used at approximately 1,300 wastewater treatment facilities. Just 45 of these facilities each endangered any of more than 100,000 people. (Source: Eliminating Hometown Hazards, Environmental Defense, 2003.)

As of 2005, some 17 million Americans lived in danger of serious injury or death from extremely hazardous substances used at 50 refineries in 20 different States. (Source: Needless Risk, U.S. PIRG Education Fund, 2005.)

These power plants, wastewater facilities, and refineries could all but eliminate these hazards by using more secure chemicals or processes.

Question 4. Upgrading business infrastructure and modernizing management processes is commonplace in business. Particularly viewed against the backdrop of terrorist threats and community safety concerns, reducing a facility's risks by substituting dangerous chemicals or processes for safer alternative would appear to be a cost of doing business. Please provide me with a description of whether you believe that the costs of using alternative chemicals or processes can be amortized over times. Any case studies that you would have would be greatly appreciated.

Response. The Center for American Progress survey clearly demonstrated that chemical facilities can economically change to more secure alternatives. Of the 284 facilities documented in the Preventing Toxic Terrorism report, 195 reported cost data. Of those, 95 (49 percent) reported changes cost less than $100,000. Most of these were drinking water and wastewater treatment facilities. Another 75 (38 percent) reported costs between $100,000 and $1 million. Twenty facilities (10 percent) reported costs as high as $10 million. The remainder was higher than that. Facilities reporting higher costs in many cases incorporated alternative technologies and processes as part of major facility upgrades.

A previous study conducted at four facilities in Europe identified more than two-dozen opportunities to reduce chemical hazards, the majority with a payback period of less than two years. (Source: "The Feasibility of Encouraging Inherently Safer Production in Industrial Firms," by Gerard I.J.M. Zwetsloot and Nicholas Askounes Ashford, 2001.)

Question 5. Please provide me with a description of the types of costs to communities and individuals that cannot be amortized as a result of an uncontrolled release from a facility regulated by section 112 (r) of the Clean Air Act.

Response. The impacts of 1984 Union Carbide disaster in Bhopal, India are still being felt today. According to a June 2006 National Academy of Sciences report, 3,000 to 7,000 people were killed immediately with 20,000 cumulative deaths and 200,000 to 500,000 injuries as a result of the release of methyl isocyanate (MIC) gas. A similar U.S. plant in Victoria, Texas changed its processes so as to use up methyl isocyanate as soon as it is produced, all but eliminating potential for an off-site release.

A July 2004 Homeland Security Council report estimated that an attack on a chlorine facility in the United States could result in 17,500 fatalities, 10,000 severe injuries and 100,000 hospitalizations. They predicted, "An overall national economic downturn is possible in the wake of the attack due to a loss of consumer confidence."

The presence of acutely hazardous chemicals place significant burdens on citizens and Governments in surrounding communities. Those communities need to have specialized response capabilities. Local police may be burdened with additional duties monitoring high hazard facilities or frequent theft of anhydrous ammonia. Contingency plans need to be developed and publicized to local citizens. They in turn need to have their own personal plans in case an evacuation is required. All safety measures are subject to regulation, certification and compliance inspections. Many of these costs would be reduced or avoided entirely if facilities switched to more secure alternatives.

Facilities may not have insurance adequate to compensate the large number of people who could be harmed in a worst-case release. Indeed, the Association of American Railroads (AAR) recently called the current environment for rail transportation of extremely hazardous substances "untenable," stating that "The insurance industry is unwilling to insure railroads against the multi-billion-dollar risks associated with highly-hazardous shipments."

Question 6. Please provide me with a description of the types of costs to businesses that could result from an uncontrolled release from a facility regulated by section 112 (r) of the Clean Air Act.

Response. Given the on-going threat of terrorism to our society, the greatest potential cost to a acutely hazardous chemical manufacturer, user or transporter is the potential liability. For example, the release of chlorine gas from a HAZMAT car if ruptured because of a terrorist incident in the middle of Washington, DC could kill or harm 100,000 people within 30 minutes. Any business associated with such an attack risks bankruptcy, since such high-risk insurance is subject to limits and copayments. Shareholders of publicly traded companies that confront such risk and liability deserve to know how the company assesses the terrorism threat and a summary of actions taken to reduce the risk. Such a market-based approach would serve as a strong catalyst for change.

STATEMENT OF DAVID A. MOORE, PE, CSP PRESIDENT & CEO ACUTECH CONSULTING GROUP CHEMETICA, INC

INTRODUCTION

Good morning, Mr. Chairman. My name is David Moore and I am the President and CEO of the AcuTech Consulting Group, a security and safety consulting firm based in Alexandria, VA. I have an extensive background in chemical safety and security with a specialty in the application and regulation of inherent safety for chemical plant security.

I was the lead author of the American Institute of Chemical Engineers (AIChE) Center for Chemical Process Safety (CCPS®) "Guidelines for Managing and Analyzing the Security Vulnerabilities of Fixed Chemical Sites"[1] and the American Petroleum Institute (API)/National Petrochemical and Refiners Association (NPRA) Security Vulnerability Assessment Methodology[2]. These are the most highly used security vulnerability analysis guidelines in these industries.

I completed a project in January, 2006, as the Sector Coordinator for the petroleum refining, chemical manufacturing, and liquefied natural gas sub sectors for the Department of Homeland Security (DHS) initiative to develop a common strategic vulnerability analysis process called 'Risk Analysis and Management for Critical Asset Protection (RAMCAP)'. We currently have other efforts ongoing in support of industry and Government to reduce homeland security risks in the chemical sector including ongoing consultation to DHS for the chemical comprehensive review program.

My firm is actively involved in chemical process security consulting and training and in conducting Inherently Safer Technology (IST) studies for safety and security, some of which are done to address current regulations in effect in Contra Costa County, CA, and the State of New Jersey. I have been consulting in chemical process safety since 1981 and formally in inherent safety regulation since 1999. Prior to that time there wasn't a regulation that required IST, but I was practicing the principles of inherent safety routinely. I was formerly a Senior Engineer with Mobil Corporation, who condoned the principles of inherent safety in every decision we made, and before that I was a Research Engineer with the National Fire Protection Association.

In particular, I have assisted companies in understanding the concepts of inherent safety through our consulting and training assignments, and have conducted dedicated and integral inherent safety analyses on chemical facilities and other industrial facilities handling hazardous materials. I have published twelve papers on inherent safety, the regulation of inherent safety[3], and inherent safety consideration in chemical security. I have made numerous presentations on the topic at professional conferences, training forums, and Government venues.

Because of our experience we were selected by the AIChE CCPS® to update their classic book on inherent safety[4], which we are in process of at this time. For that I am working with the leading inherent safety specialists in the United States and internationally from industry and academia who serve as advisors to our team. I am a strong proponent of inherent safety, the ultimate goal being to see all compa-

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[1] Guidelines for Managing and Analyzing the Security Vulnerabilities of Fixed Chemical Sites, American Institute of Chemical Engineers, August 2002

[2] "Security Vulnerability Assessment for the Petroleum and Petrochemical Industries", American Petroleum Institute, August, 2004.

[3] Moore, David A., "Experiences in the Regulation of Inherent Safety", Mary Kay O'Connor Process Safety Center, Texas A&M University System, 2002 Annual Symposium, Beyond Regulatory Compliance, Making Safety Second Nature, October 29-30, 2002, College Station, Texas.

[4] Bollinger, R. E., D. G. Clark, A. M. Dowell, R. M. Ewbank, D. C. Hendershot, W. K. Lutz, S. I. Meszaros, D. E. Park, and E. D. Wixom (1996). Inherently Safer Chemical Processes: A Life Cycle Approach, ed. D. A. Crowl. New York: American Institute of Chemical Engineers.

nies applying inherently safer principles throughout the design and operating lifecycle of projects.

INHERENT SAFETY TECHNOLOGY BACKGROUND

Inherent Safety (IS) is emerging as a key process risk management issue. Process safety professionals have embraced the concepts voluntarily for years and it is an established method for addressing process risks. Any chemical company could point to inherent safety considerations they have implemented, whether for a regulation or not. This is because it is a general philosophy rather than a science, and it is imbedded in the thought process of chemical and safety engineers as they design and operate safe plants. They could also speak to many other process risk management techniques that are effective at risk reduction, including passive, active, and procedural layers of protection. They tend to employ a mixture of these strategies for optimal risk reduction as is appropriate.

Inherent Safety is a well recognized process safety concept; a collection of basic strategies focused on process safety improvement through the reduction of hazards. "Hazard" is defined as a physical or chemical characteristic that has the potential for causing harm to people, the environment, or property.[5] The IS concept is based on the belief that if one can eliminate or moderate the hazard, not only is the risk reduced, it may be possible to remove the risk altogether from consideration. Alternatively, an inherently safer system would make the hazard less likely to be realized and less intense if there is an accident.

It is a not necessarily a change in 'technology' that the term IS is referring to—it may involve less dramatic ideas than a change in technology such as a simplification of operating controls. I therefore refer to it as Inherent Safety (IS) to be inclusive of the full range of inherently safer strategies that were originally in mind. Technology may be mistaken to mean only process chemistry or the material used, rather than other aspects of IS.

IS includes four basic strategies for safety engineers to apply for process safety and risk management of chemical manufacturing plants, namely substitution, minimization, moderation, and simplification. These four strategies could be independent ideas or they may relate to one another, depending on the case by case situation. There is no defined and agreed upon way to consider them in a formal analysis methodology. Engineers are encouraged to consider them to the extent possible, but given the innumerable situations where they may be applied there cannot be a rule on what is an adequate consideration of IS.

In 1996 the AIChE CCPS® published the book "Inherently Safer Chemical Processes—A Concept Book", to clarify the concept and to help provide examples. Today it remains one of the leading practitioner's guides to understanding and applying inherent safety concepts. It is the leading reference mentioned in various regulatory actions and proposed actions.

ISSUES WITH INHERENT SAFETY

Inherent safety is a challenge for all parties—the owner, chemist, operator, design engineer, regulator, and the public. There are limitations of inherent safety and technical and business constraints to its usage. There are examples of where inherent safety has been very useful and where opportunities may exist, but since it is a concept the blanket requirement of inherent safety poses issues.

Undocumented considerations

IS is not new but regulation of IS is new. Most of industry is already practicing it but not formally documenting how they use inherent safety as a strategy for risk management. Engineers tend to make orderly, inherently safer decisions by practice for the most part. This has been expected of industry as a matter of principle, and there is evidence it is being practiced but without a degree of measurement of their actions or the benefits. One of the suspected reasons for this is the lack of formal and agreed IS analysis approaches, and the other is that these requirements simply haven't existed until recently to document the considerations.

Requires judgment and is potentially subjective

It is precisely because IS is vague and involves considerable judgment that it is very difficult to define and implement to any degree of uniformity and objectivity. This is particularly true in the chemical sector where the diversity of chemical uses

[5] Center for Chemical Process Safety, Inherently Safer Chemical Processes: A Life Cycle Approach, Center for Chemical Process Safety, AIChE, 1996. Collins Bill, Chemical Security Act of 2005,

and processes and site specific situations prevents clear characterization of the industry and a one-sized-fits-all solution.

IS can also be very subjective—how 'safe or secure' is 'safe or secure enough' is a decision of the analyst conducting the study. There are no clear and objective guidelines on how to make these decisions as it is considered both a concept to apply as one sees fit and as opportunities arise.

The CCPS® book itself is indeed a concept book and it does not provide a clear delineation of what is inherently safer or how to judge whether an inherent safety analysis is comprehensive and complete enough. The reason for this is that the topic is so diverse that it is, in some cases, even ambiguous. There is an entire section of the book explaining the numerous conflicts and risk: risk tradeoff problems of IS. Also the state of the practice is not perfectly clear on how it should be defined, conducted, analyzed, assessed, or judged as adequately performed. The book doesn't solve the classical problems with IS of trying to objectively decide 'what is inherently safer' and how to measure whether a process is safe enough. This sums the state of the practice with IS and is an underlying basis of the problems of attempting to regulate it and to apply it to security issues.

In actual practice this has proven to be problematic because IS, at this stage in its development, is more of a conceptual methodology rather than a codified procedure with a well established and understood framework for evaluation and implementation. This is somewhat a function of the state of the art of our understanding of IS.

Value and Perspective

What is inherently safer to one person is not necessarily inherently safer to another—it is a matter of perspective. If one takes an insular view of what is inherently safer, it may not be the most inherently safe decision for society as a whole. For example, if a plant decides to lower its risk at a given fixed chemical plant site by reducing inventory or making an alternative product, this could simply either transfer the risk to more of the public through increased shipments of hazardous materials in the community or move the same operation to another location which may be more problematic.

Companies may be unclear on the value of IS or may be unable to easily prove that IS is beneficial to employ. Methods to prove the value of IS and to quantitatively measure whether a given process is 'as inherently safe as is practicable' are generally unavailable or unproven. Case studies showing the economic and other benefits are not available for a wide array of industrial situations.

Depending on the goals, the perspective may be that it is safe or secure enough as it is. For example, the plant is designed to operate at a given capacity and has been optimized through careful engineering design to produce the product safely, efficiently, and cost-effectively. Many IS-type considerations have already gone into the design or operating philosophy of the plant. When confronted with the need to conduct an IS study, they often find that there are few opportunities to improve on that design, short of a complete change of 'technology', even if another technology exists that is inherently safer. If it does exist they find it troubling to consider changing the technology when the gains may be questionable for safety or security. As such the net change may be limited.

Safety and Security Conflicts

The need to introduce inherent safety as a strategy at all facilities subject to such a security regulation is questionable. This would result in a great deal of analysis to consider a single strategy has been applied, thereby causing a very large documentation problem and undoubtedly many technical and legal dilemmas. This is contrasted with a preferred approach of allowing industry to set security objectives to determine the relevant issues and vulnerabilities and make appropriate risk management decisions. It should be considered as a potential strategy rather than the first priority and allow the most effective homeland security strategies to be applied rather than force a particular one or a change in every technology.

In fact, what is inherently safer is not necessarily what is inherently more secure. For example:

- Moderation—a process that successfully applied an inherently safer technology may have changed a catalyst to end with a 'moderated' process—one that is operated at a lower pressure and temperature. This is commendable for safety, but may have little to do with security. The process may be disabled just the same, which is an issue of economic security, or it may release a flammable or toxic cloud which is just as significant.
- Minimization—In another case an owner may have reduced the inventory of a feedstock in a tank to reduce the consequences of an attack. The feedstock is a toxic

substance, so this appears sensible, but the material is also a 'dual purpose' chemical that could be used to make an improvised chemical weapon. In that case simply reducing the volume may not matter for the threat of theft of the materials—in fact smaller quantities may be more man-portable thereby accommodating theft. The plant may need for frequent deliveries of the material, which also increases the chance of theft.

• Simplification—An owner may invest considerable sums of capital to improve the simplicity of the control system, thereby lessening the chance of human error as a cause of an accident. This may result in a control system that is easier to compromise.

• Substitution—A petroleum refiner may substitute hydrogen fluoride catalyst with sulfuric acid for alkylation (along with substantial process changes). While the individual offsite impacts may be reduced from storage the opportunities for disruption of the transportation chain are increased due to the additional deliveries of acid that are required. Besides the number of additional volumes of materials transited throughout the community, the site has increased vulnerability each time a vehicle has to enter the perimeter. Generally speaking security professionals try to find ways to reduce penetrations through a secured perimeter.

IS REGULATORY PROPOSALS AND COMPLICATIONS

Inherent Safety is a common phrase from the chemical industry and is being considered and debated as a chemical process security concept for inclusion in proposed chemical security regulations[6]. IS is being considered by legislators as the first security strategy industry should use for reducing terrorist risk in the chemical sector. The newly appreciated concerns for terrorism have naturally highlighted the issue of the potential for attack on facilities handling hazardous materials. Out of this concern first sprung a potentially far-reaching proposed act titled the Chemical Security Act of 2001, S.1602. The Act was introduced on 10/31/2001 by Senators Corzine (D; NJ), Jeffords (D; VT), Boxer (D; CA), and Clinton (D; NY). Since then there have been several other proposals.

The proposed series of Chemical Security Act bills generally state that there are significant opportunities to prevent theft from, and criminal attack on, chemical sources and reduce the harm that such acts would produce by reducing usage and storage of chemicals by changing production methods and processes; and employing inherently safer technologies in the manufacture, transport, and use of chemicals;

These proposed regulations would have sweeping applicability and significant implications for design and operation of facilities handling hazardous materials. Many of the facilities mentioned to be included are from the USEPA Risk Management Planning regulated sources (40 CFR Part 68), which may not be either highly consequential or attractive to terrorists. Any new initiatives such as this have to be rational, measured, cost-effective, and fully justified.

The anticipated regulatory benefit seems to be that IS can remove the hazard entirely or reduce hazards to de minimis levels to where there is no interest in causing the attack. It is often expressed to be a possible strategy for security risk management, and sometimes is mistaken as a relatively obvious and simple approach to execute or regulate. Other proven security measures are often seemingly weighed as less effective or reliable.

These existing and proposed regulations typically end in a goal of IS consideration 'to the extent practicable' and sometimes allow cost or feasibility as a basis for justifying a change is 'practicable'. There is no standard measurement of what this means. While companies may believe they are moving toward inherently safer processes, they often find obstacles to the theoretically possible complete application of the four IS strategies.

Homeland security is not that simple and the implementation of IS is not that easily accomplished or even necessary for that purpose in all cases.

PROBLEMS WITH REGULATION OF IS

Holistic security v. singular issues

The problem is not IS, but the expectation of the value of regulation of IS. It forces industry to focus on a few safety strategies to the possible detriment of the complete approach to risk management. There seems to be an overemphasis of inherent safety as a singular strategy for security assurances in many of the proposed regulations.

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[6] Collins Bill, Chemical Security Act of 2005.

Inherent safety has to be considered in light of other security risk management approaches where one is not necessarily preferable over another. That decision should be made on a case by case basis rather than blanket regulatory requirements. Most security experts would agree that it is about providing sufficient layers of security, combined with an understanding of the threat and risk-based approaches to limiting access to possible assets of interest to adversaries that is the desired homeland security approach.

Both chemical process security and inherent safety are complex topics that are not easily mandated. To isolate inherent safety as a particularly necessary one is good practice but not necessarily good Government regulation. IST is not the panacea. It is not a "thing" that can be measured. It is a process towards safe manufacturing. It is a system of interdependent values and not something that can be distilled into a legislative definition and then regulated. Security management itself isn't a singular strategy. Furthermore, IS cannot be regarded as the sole design or operating criteria as it must be integrated with other considerations. The real issue is risk, whether safety or security risks, that IS can be applied to.

Degree of regulatory compliance effort

If IS is forced onto industrial facilities, there could be considerable dilemmas in interpretation, technical judgment, fairness, and liabilities. It isn't possible for everyone to fairly be dictated as to what is inherently safer. If the degree of inherent safety is left to discretion, there could be a very uneven treatment of the issue.

If the regulator was to make the judgment of what is practicable or the extent of practicality, there could be numerous issues develop. Do we want outside third parties to force changes in technology or operating philosophy on a company and to take on the liability of that decision when they may clearly lack the expertise for making this decision?

Since you can't measure it, how could you ever comply. . . how much IST is enough. . . what is compliance. . . how can you ever demonstrate that you adequately considered something so that it met some arbitrary definition. IST for every facility is not even feasible as there fewer options for some sites (where substitution of chemicals isn't possible since it is the only way or decidedly the best way or common practice for a given process).

No one is sure, therefore, of the degree of difficulty that requirements such are being proposed will cause but there will be, no doubt, considerable confusion due to the degree of ambiguity involved.

Diversion of scarce resources needed for homeland security

Regulatory impacts may cause a possible diversion of attention to the complete set of security measures available to the industry given the threat, consequences, and vulnerabilities. It provokes an enormous effort with possibly little to no additional gain, possibly at the detriment to security as resources are expended on less critical issues. It may not get at the heart of the matter—the degree of risk primarily caused by the degree of vulnerability of the industrial facilities.

This is process for chemical engineers together with safety experts to examine on a case-by-base basis, not in a sweeping edict from Congress. I am very concerned that rather than addressing true homeland security issues of the chemical sector, many hours of effort and resources would be diverted to proving the a process was already inherently safe as is practicable. The potential for litigation trying to "prove" you considered something is enormous.

Although a process or plant can be modified to increase IS at any time in its life cycle, the potential for major improvements is greatest at the earliest stages of process development. At these early stages, the process engineer has maximum degrees of freedom in the plant and process specification. The U.S. infrastructure that is being considered for chemical security regulation initially under any future regulation that requires IS is existing plant.

Judging adequacy and effectiveness

There is little guidance on how to judge effectiveness and completeness of inherent safety, particularly in a meaningful, fair and equitable way to all parties. This could prove to be a major dilemma for both industry and regulators as they try to justify that 'enough' inherent safety has been applied to be considered 'in compliance' with inherent safety requirements of security regulations. Experience has shown that regulators and industry have a difficult time interpreting inherent safety and agreeing on adequacy of efforts.

Given that inherent safety is a rather subjective concept, it makes the matter a difficult one to understand, implement, and regulate. Companies should be knowledgeable of inherent safety and actively encourage the use of it at every turn in a holistic approach to risk reduction.

EXPERIENCE WITH IS REGULATIONS

In actual practice IS implementation has proven to be problematic. The reason is that IS, at this time, is more of a theoretic concept rather than a codified procedure with a well established and understood framework for evaluation and implementation. Furthermore, it cannot be regarded as the sole design criteria as it must be integrated with other considerations. Industry

Today there is only one example of an implemented IS regulatory requirement for process safety and that is part of the Contra Costa County, CA, local Industrial Safety Ordinance (ISO) enacted in 1998 which effects only eight chemical sites. As for security, the only one that exists is in New Jersey where the Governor enacted a Prescriptive Order in November of 2005 which includes the need to consider IS for chemical security for certain sites in the state. Neither regulation goes so far as to require a change in technology due to the enormous challenges and liabilities associated with that move.

Contra Costa County, CA, Industrial Safety Ordinance

The Contra Costa County, CA, Industrial Safety Ordinance (ISO) became effective January 15, 1999. The ordinance applies to eight oil refineries and chemical plants that were required to submit a Risk Management Plan to the U.S. EPA[7] and are a program level 3 regulated stationary sources as defined by the California Accidental Release Prevention (CalARP) Program.

Part of the ISO requirements is the need for the regulated stationary sources to consider inherently safer systems when evaluating the recommendations from process hazard analyses for existing processes and to consider inherently safer systems in the development and analysis of mitigation items resulting from a review of new processes and facilities. Contra Costa Health Services completed and issued a Contra Costa County Safety Program Guidance Document on January 15, 2000. This document included a definition of inherent safety and some rules for implementation of the ordinance.

Lessons Learned from the Contra Costa County, CA, implementation of inherent safety requirements for their Industrial Safety Ordinance were presented in 2002 (Moore, 2002)[8].

- Companies found IS to be difficult if not infeasible to accomplish, particularly for existing processes;
- There are different perspectives on what is reasonable and what is feasible when it comes to decisions on the need for implementing IS;
- The guidance provided to ensure that IS was being considered consistently and fully was not informative enough, so there was some confusion and an education gap;
- The public and regulators often mistrust industry if anything less than a total technology change is implemented despite that IS includes a wide variety of ideas to meet the four strategies of minimization, substitution, simplification and moderation;
- Application of IS at only the most purely inherent level (first principles) is often at odds with practical and cost effective risk reduction, especially for existing construction;
- Guidance/training is needed for a team to know how to apply IS effectively.

New Jersey Prescriptive Order

On November 21, 2005, the State of New Jersey became the first State to require chemical plant security measures to protect against terrorist attacks. Acting Governor Richard J. Codey set new requirements for the 140 facilities that must comply with the Prescriptive Order, 43 of which are subject to the state's Toxic Catastrophe Prevention Act (TCPA) program. As part of the new requirements, these 43 facilities must review the potential for adopting inherently safer technology (IST) as part of their assessment.

This is very significant for three reasons—it sets precedent for State mandate of security of the chemical industry, it incorporates the need to evaluate IST more widely than any other regulation in the United States, and it forces industry to prove compliance to security 'best practices' they developed.

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[7] Environmental Protection Agency (EPA) (1996). "Accidental Release Prevention Requirements: Risk Management Programs Under Clean Air Act Section 112 (r) (7)." Federal Register 61, 120 (June 20), 31668-730.

[8] Moore, David A., "Experiences in the Regulation of Inherent Safety", Mary Kay O'Connor Process Safety Center, Texas A&M University System, 2002 Annual Symposium, Beyond Regulatory Compliance, Making Safety Second Nature, October 29-30, 2002, College Station, Texas

In 2003, the New Jersey Domestic Security Preparedness Task Force approved best security practices that were built upon the security code of the American Chemistry Council's responsible care program and the American Petroleum Institute's security guidelines, respectively. The best practices were developed by the Task Force and its Infrastructure Advisory Committee, which includes representatives of the State's chemical and petroleum industry. Many New Jersey-based facilities have voluntarily begun to implement these practices. The Prescriptive Order action clarifies that the best practices for chemical facilities are now mandatory.

The 43 chemical facilities in the TCPA program must analyze and report the feasibility of:

- reducing the amount of material that potentially may be released;
- substituting less hazardous materials;
- using materials in the least hazardous process conditions or form; and,
- designing equipment and processes to minimize the potential for equipment failure and human error.

Best practices included provisions for the facilities to prepare an emergency incident prevention, preparedness and response plan and outline the status of implementing other security practices. The State standards also now require worker participation in the development of the security assessments and prevention and response plans at each facility.

Under the new requirements, chemical facilities had 120 days to develop an assessment of facility vulnerabilities and hazards that might be exploited by potential terrorists. The assessments must include a critical review of:

- security systems and access to the facility grounds (including the regular testing and maintenance of security systems);
- existing or needed security measures outside the perimeter of the facility that would reduce vulnerabilities to an attack on the facility;
- storage and processing of potentially hazardous materials;
- employee and contractor background checks and other personnel security measures; and,
- information and cyber security;

The Prescriptive Order timing is critical as the nation struggles with how to more completely manage terrorism risks and to sort out the need for regulations for industries that are otherwise unregulated today. At this point the effectiveness of this rule is still in question. What is clear is the degree of change that most complex, existing plants will incur due to the identification of IS opportunities will be very limited based on personal experience.

RESEARCH ON THE EVALUATION OF INHERENT SAFETY

Some methods have been proposed to provide a benchmark for inherent safety. Most of these involve indices or fuzzy logic. While these are excellent developments in the right direction, they are not fully validated or comprehensive enough to assure that the aforementioned issues are satisfied.

There is a need for metrics and rules for how to evaluate inherent safety before regulations can be effective. Without a fair and legitimate way to measure the total risk balance created by changes in the name of inherent safety it will be subjective and possibly unfair.

Complex process systems, particularly with a long history of safe performance, cannot suddenly be dictated that a system is inherently safer without a great deal of individualized risk-risk tradeoff evaluation. Inherent safety is not fully understood, so regulating it and forcing change against typical engineering practices (with a strong empirical basis of success) is not recommended

There have been many experts recognize that this may be creating many other problems by overly relying on one strategy vs. a holistic approach. Facilities should be given that flexibility all the while bounded by appropriate layers of safety to reduce risk to an acceptable level.

PUBLIC PERCEPTION OF INHERENT SAFETY

Often inherent safety is seen as 'obvious' and 'common sense' when in reality the issue may not be that simple. Risk-risk tradeoffs can have unfortunate results if not properly evaluated. Priorities to inherent safety may mean compromises elsewhere.

Efforts to reduce risks often neglect the possibility that measures to reduce the "target risk" may introduce or enhance "countervailing risks."[1]

An important point is that we need to consider risk management interventions, not a single risk reduction strategy alone. Like medications, any intervention can have side effects. Instead industry and Government should advocate a proactive, holistic approach rather than heuristic, piecemeal reactions to homeland security.

BARRIERS IDENTIFIED FOR IMPLEMENTING IS

A workshop was held on the challenge of IS at the 17th Annual CCPS International Conference & Workshop on Risk, Reliability and Security in Jacksonville, Florida, on October 11, 2002, to address the concerns of implementing IS. Speakers from the USEPA, AIChE, Contra Costa County, and industry presented their experiences on the issue. In summary of that discussion, the audience agreed that there were barriers for effectively

implementing IS, and issues and challenges for any regulation of IS. Some of the constraints were reported to be as follows:

Adoption and implementation of IS by industry:

1. Existing facilities vs. new facilities—one dilemma is that the majority of the applications for IS are with the existing industrial installed base whereas the feasibility of applying IS to the fullest diminishes as the facility is actually built. This leaves many companies where new processes (and particularly new technologies) are rarely implemented resulting in few occasions to practice the methods.

> "Although a process or plant can be modified to increase IS at any time in its life cycle, the potential for major improvements is greatest at the earliest stages of process development. At these early stages, the process engineer has maximum degrees of freedom in the plant and process specification. The engineer is free to consider basic process alternatives such as fundamental technology and chemistry and the location of the plant. Imperial Chemical Industries (ICI) describes six stages of hazard studies, including three during the process design phase and three during construction, startup and routine plant operation. The identification of inherently safer process alternatives is most effectively accomplished between the first and second process design hazard studies (Preston and Turney 1991). At this stage the conceptual plant design meets the general rule for an optimization process—that a true optimum can be found only if all of the parameters are allowed to vary simultaneously (Gygax 1988)." (CCPS, "Guidelines for Engineering Design for Process Safety, 1993)"[9]

2. Unproven Value—Companies many be unclear on the value of IS or may be unable to easily prove that IS is cost-effective and worthwhile to employ, particularly for security. Methods to prove the value of IS and to quantitatively measure whether a given process is 'as inherently safe as is practicable' are generally unavailable or unproven. Agreed upon and practical tools for systematically conducting IS reviews under repeatable methodologies are not available with the exception of checklists or adaptation of safety analysis methodologies. Case studies showing the economic benefit are not available for a wide array of industrial situations.

3. Unclear vision of scope of IS—One can take a broad or a narrow view of IS. The narrow viewpoint only credits major changes in the degree of hazard whereas the broad viewpoint of inherent safety finds any change by the application of IS principles to be an advantage. All of the proposed regulations are very vague in their definition of inherent safety and industry experts themselves have mixed opinions on this point. Is reducing some inventory IS or is it only IS if the material hazards was substituted, which is the IS strategy that seems to be of most interest for the regulatory proposals reviewed?

REGULATION OF IS

The constraints to the regulation of IS include many of the concerns above plus:

1. Criteria for making compliance decisions—An obstacle to clear cut regulation is the lack of consensus on appropriate IS metrics. Assuming that the regulation is

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[1]Harvard Center for Risk Analysis, "Risk/Risk Tradeoffs in Pesticide Regulation: Evaluating the Public Health Effects of a Ban on Organophosphate and Carbamate Pesticides", George M. Gray and James K. Hammitt, Harvard Center for Risk Analysis And Department of Health Policy and Management, Harvard School of Public Health 718 Huntington Ave, Boston, MA 02115, August 6, 1999.

[9] Center for Chemical Process Safety (CCPS) (1993). Guidelines for Engineering Design for Process Safety. New York: American Institute of Chemical Engineers.

performance-based, there must be metrics for consistent regulation. These criteria are very hard to define with a broad conceptual topic such as IS for the wide variety of chemical processes to be regulated. This dilemma was recently described by the Mary Kay O'Connor Process Safety Center—"Regulation to improve inherent safety faces several difficulties. There is not presently a way to measure inherent safety. Process plant complexity essentially prevents any prescriptive rules that would be widely applicable. It would seem that legislation could explicitly require facilities to evaluate inherently safer design options as part of their process hazard analysis. But inherent safety would be almost impossible to enforce beyond evaluation because there are unavoidable technical and economic issues." (Mannan, et.al, 2003[10])

2. Need to consider risk rather than only hazard—There is little sense to the idea of imposing a requirement for 'change for the sake of change', i.e., requiring that every hazardous situation be made inherently safer. Industry is interested in referencing a measure of acceptable risk which limits the need for additional risk reduction since beyond that level resources may be better spent on other matters.

3. Unclear how to measure performance or compliance—Will regulations require only fundamental strategies to be employed, such as a site reports it reduced some materials onsite, or will it be based on vulnerability to the chemicals that remain? The factors and process to measure the effectiveness of IS regulations is not defined so it becomes very subjective.—Inherent safety regulations would have to show measurable benefit. If there was a reduction or increase in the number of incidents it could be incorrect to infer whether IS was the leading factor or whether other measures were involved. It is, therefore, difficult to measure the effectiveness of IS regulations.

The USEPA representatives at the workshop reported that the EPA intends to include IS in their analysis of the effectiveness of the Risk Management Plan (RMP) regulation (USEPA, 1996)[11] when they review the next submittals of registrations and hazard assessments. This is likely to be challenging given the state of implementation of IS and EPA's own admission on their expectation for inherent safety in the Risk Management Planning regulation. When EPA promulgated the RMP rule, some commenters asked EPA to require facilities to conduct "technology options analyses" to identify inherently safer approaches. EPA declined to do so, stating that "PHA teams regularly suggest viable, effective (and inherently safer) alternatives for risk reduction, which may include features such as inventory reduction, material substitution, and process control changes. These changes are made as opportunities arise, without regulation or adoption of completely new and unproven process technologies. EPA does not believe that a requirement that sources conduct searches or analyses of alternative processing technologies for new or existing processes will produce additional benefits beyond those accruing to the rule already. (FR, 1996[12])

4. IS means different things to different audiences—One person's opinion of IS is not another person's necessarily, and as a result risks could be simply transferred to others.

5. Macro v. Micro benefit—If IS regulations encourage individual plants to take the most inherently safe position to them, that is not necessarily the most inherently safe (or secure) position for the community they operate in thereby potentially increasing the societal risks. A common example is that of transportation risk, where the increased number of transits caused by lowering the onsite volume of a required feedstock increases the number of transits through the communities in the distribution chain. In addition, though, is the prospect that the total societal risk from a wide collection of inherently safer individual decisions leads to a redistribution of risk across the country—the analog of squeezing a balloon.

6. Economic Security—Another example of this concern is the possible lack of appreciation of the economic security of the chemical infrastructure in legislative discussions on inherent safety. At a national, State or local level, the economic impacts of an attack or disruption of the chemical infrastructure should be a key concern. If the plant is disabled for any reason, such as a distribution chain disruption, the lack of inventory may make the plant inoperative for a longer period of time than if it had accumulated and secured supplies necessary to function. It is more likely that plants will face supply issues due to natural or manmade disasters than be at-

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[10] Mannan, M.S., "Challenges in Implementing Inherent Safety Principles in New and Existing Chemical Processes," White Paper, Mary Kay O'Connor Process Safety Center, College Station, Texas, August 2002.

[11] Environmental Protection Agency (EPA) (1996). "Accidental Release Prevention Requirements: Risk Management Programs Under Clean Air Act Section 112 (r) (7)." Federal Register 61, 120 (June 20), 31668-730.

[12] 61 Fed. Reg. 31699 (June 20, 1996).

tacked and so the macro view of homeland security is compromised at the expense of a local viewpoint. These goals need to be balanced from a risk perspective with other hazard reduction goals.

RECOMMENDATIONS

Rather than attempt to regulate a vague and creative safety concept for chemical security, it should be left to industry and Government to work together to consider the full spectrum of available security risk management strategies and to meet performance standards for security based on site specific needs. Inherent safety should not be seen as the most important strategy to implement. Risk should be the measure of security preparedness given consequence, vulnerability, and threat considerations.

RESPONSES BY DAVID A. MOORE TO ADDITIONAL QUESTIONS FROM SENATOR INHOFE

Question 1. "As you may know, 2 years ago we has elevated levels of lead in Washington DC's drinking water. Subsequently studies indicate that the changing of chemicals switching from chlorine to chloramines was to blame. Isn't this one of the big problems if the Federal Government seeks to mandate IST? Unintended adverse consequences? What happens when the federal Government is wrong?"

Response. Government intervention on the design and operating practices of chemical facilities has a high potential to cause inadvertent safety or security consequences. History is ripe with past ideas which, in retrospect, didn't reduce risks as intended or caused other parties to be exposed to higher risks. At one time the following technologies were considered 'safer':

- Underground storage tanks (later found to cause environmental problems);
- Freons as a refrigerant gas (later found to contribute to ozone depletion, and then replaced primarily with anhydrous ammonia, the most popular chemical used prior to the introduction of freons);

The design of plants is based on years of experience in chemistry and engineering, and plant operating practices are established that are commensurate with the design and operating parameters of the plant. Change is not necessarily healthy for a plant especially abrupt changes after years of successful and safe operation. Most accidents occur during startup, shutdown, changes, and maintenance to a plant. If, in someone's opinion, a global change of technology would be inherently safer and this was to be mandated, it may be that arbitrarily forcing a change on a facility could have one of the following example effects:

- A plant that was forced to minimize feedstock inventory, such as a reagent, could result in less flexibility for operators to manage an emergency;
- A plant that was forced to use an alternative chemical may be less familiar with the technology resulting in a higher chance of an incident or less experience in control of the process in an excursion.
- A chemical could be 'inherently safer' from the perspective of toxicity or flammability, but be much more difficult to process leading to higher risk of incidents.

Inherently safer doesn't necessarily mean zero risk—it may be that the hazard is simply different. Efforts to reduce risks often neglect the possibility that measures to reduce the "target risk" may introduce or enhance "countervailing risks."[1]

An important point is that we need to consider risk management interventions, not a single risk reduction strategy alone. Like medications, any intervention can have side effects. Instead industry and Government should advocate a proactive, holistic approach rather than heuristic, piecemeal reactions to homeland security.

Question 2. "In his opening statement Senator Obama pointed to the need to process to "ensure that individual facilities are not making short-sighted decisions that merely shift risks elsewhere." You talked extensively about this dynamic in your testimony. Senator Obama also points to wastewater treatment facilities that have switched from chlorine gas to liquid bleach as an IST approach that has worked and is relatively easy too. Aside from the cost of such a change, one major utility spent $13 million, *liquid bleach*, or sodium hypochlorite has a very short shelf life. It must be produced within the vicinity of the treatment works. Further, gaseous chlorine

[1] Harvard Center for Risk Analysis, "Risk/Risk Tradeoffs in Pesticide Regulation: Evaluating the Public Health Effects of a Ban on Organophosphate and Carbamate Pesticides", George M. Gray and James K. Hammitt, Harvard Center for Risk Analysis And Department of Health Policy and Management, Harvard School of Public Health 718 Huntington Ave, Boston, MA 02115, August 6, 1999.

is used to make sodium hypochlorite. While the treatment works may not be storing gaseous chlorine, another facility in the near community must be in order to supply the sodium hypochlorite. Therefore, isn't switching to liquid bleach essentially shifting some of the risk somewhere else?"

Response. That is correct. Sodium hypochlorite (NaOCl) is a solution made from reacting chlorine with a sodium hydroxide solution. Since the manufacturing of sodium hypochlorite depends on gaseous chlorine and if a plant was to supply a larger quantity of sodium hypochlorite to a wider market area, it is conceivable that the manufacturing plant could increase the frequency of transits and quantity of chlorine required in order to meet demand. This could increase the societal risk of the community near to the plant and the workers involved.

Also please note that sodium hypochlorite is not without hazards. People have been seriously injured as a result of the chlorine released when sodium hypochlorite solutions are accidentally mixed with acids or acidic materials. Sodium hypochlorite is incompatible with many acids, ethylene glycol, propane, metals such as copper and nickel, and reducing agents such as sodium sulfite, and hydrogen peroxide to name a few.

Question 3. "To follow-up on a question from Senator Jeffords about the use of chlorine by the nations water and wastewater utilities, in January 2005 report on security at wastewater utilities, the GAO estimated it would cost a utility $12.5 million to switch from chlorine to sodium hypochlorite. According to a March 2006 GAO report, after careful review of cost, technical feasibility and safety considerations, and without the presence of a federal mandate on technology, 116 of the 206 largest POTWs switched from gaseous chlorine to another technology, most likely sodium hypochlorite. In that same report, GAO found that another 20 plan to switch to a technology other than chlorine. Nearly two-thirds of the nations largest POTWs are not using chlorine. Those who continue to use chlorine have taken steps to ensure that chlorine is secure. In your view, have these utilities gone though the appropriate process and decided, without a federal IST mandate, to continue using chlorine based on their individual systems' needs and is this not the best way to make these decisions? In your experience developing site security plans and vulnerability assessments, so you believe companies will consider IST even if we don't create a mandatory federal IST program?"

Response. The water treating industry is well aware of the options for biocides. The GAO report you cite seems to be evidence of the fact that inherent safety is being practiced where practical and feasible. Industry has been using inherent safety philosophy for years before they coined the term 'inherent safety'. Engineers naturally optimize designs and strive to achieve performance with efficiency and safety.

The elimination of chlorine simply due to its inherent hazards is not always feasible or necessary. Chlorine is used due to the long history of success in achieving the end goal—the effective and safe disinfection of water. Chlorine chemistry is also important to the production of pharmaceuticals, medical devices, safety equipment, computers, automobiles, aircraft parts and crop protection chemicals in other processes.

Companies may balance their safety and security needs by a number of strategies besides inherent safety, so it is possible that even those that chose to keep chlorine have addressed security and safety in other ways. In addition, it may be that some of the facilities had lesser public consequences in the event of a release due to quantity stored or the density of population in the neighboring area.

Responses by David A. Moore to Additional Questions from Senator Voinovich

Question 1. "Across the entire chemical manufacturing industry in the U.S., how many of the chemicals listed on EPA's Risk Management Plan list have scientifically proven alternatives that increase safety, reduce risk, and operate at least as effectively, in terms of both cost and end product, as the chemical compound that is being replaced?

Who or what body should determine what IST is? Should it be defined by Government, industry, or academia? If Government does define it, which agency should be responsible for that? To your knowledge has IST ever been defined as a security measure in Federal law?

Response. Section 112(r) of the Clean Air Act (CAA) requires EPA to promulgate regulations for the prevention and mitigation of accidental releases of extremely hazardous substances. Under this rule, 77 specific toxic substances and 63 specific flammable substances were regulated. According to Mr. Jim Belke of EPA in a pres-

entation he gave in 2004[2], approximately 14,600 active RMPs were filed with EPA in 2004 involving some 20,000 processes including about 17,150 that contain toxic chemicals and 7,700 that contain flammable chemicals. These represent a wide variety of industry facility types from Food and Beverage, Energy, Water and Wastewater, Agriculture, and Chemical Manufacturing. Even for any given industry or chemical there it is difficult if not impossible to say that there is a single 'technology' substitution or inherently safer strategy that could be universally employed. Each process has a specific use for the chemical substance and it is far too complex to find a magic bullet solution, let alone risk reduction may not justify the action. The feasibility of an inherently safer strategy must be individually evaluated.

In most cases it is not feasible to substitute the basic chemicals manufacturing process. For example, anhydrous ammonia or chlorine manufacturing will have those chemicals involved as end products. These are fundamental building block chemicals that may not have substitutes depending on their case by case use.

Question 2. "Who or what body should determine what IST is? Should it be defined by Government, industry, or academia? If Government does define it, which agency should be responsible for that?

Response. I believe the definition of what is inherently safer for any given plant must be made by a site specific analysis. Industry is in the best position to make this judgment given their intimate knowledge of all of the risk factors that are involved in this determination.

Question 3. "To your knowledge has IST ever been defined as a security measure in federal law?

Response. I have not seen IST requirements in any Federal law regarding security. Security regulations address reducing vulnerabilities to threats through security strategies including deterrence, detection, delay, or response activities.

Question 4. "The EPA has concluded that:

- "Inherently safer processes" is a developing concept and is not ready for general application;
- IST frequently displaces risk rather than reducing it;
- Even if a few examples of workable alternative approaches do exist, there is not a rational basis for imposing an additional industry-wide regulatory burden; and
- The concept is normally considered when designing new processes, a time when changes can be implemented cost effectively.

Do you agree with the above assessments? In that context, do you believe that IST a concept that is ready for broad implementation as a regulatory requirement?"

Response. My testimony contained similar conclusions to the USEPA so I am in complete agreement with this statement. Also, as stated in my testimony, regulation of a concept is not credible as we lack objective measures of inherent safety's value. It is precisely because IS is vague and involves considerable judgment that it is very difficult to define and implement to any degree of uniformity and objectivity. This is particularly true in the chemical sector where the diversity of chemical uses and processes and site specific situations prevents clear characterization of the industry and a one-sized-fits-all solution.

IS can also be very subjective—how 'safe or secure' is 'safe or secure enough' is a decision of the analyst conducting the study. There are no clear and objective guidelines on how to make these decisions as it is considered both a concept to apply as one sees fit and as opportunities arise.

Question 5. Senator Voinovich asked: "Mr. Moore, you mention that "reduction of risk" may actually increase "countervailing risk." Can you explain this in greater detail?"

Response. A countervailing risk is one that is created (expectedly or unexpectedly) by the action of implementing an inherently safer strategy (minimize, substitute, simplify, or moderate) that has an opposing or neutralizing effect to the desired end goal (which was reduction of risk). Every action taken has the potential for this effect. For example, by decreasing onsite inventory a plant increases the amount and frequency of transportation of chemicals. If a chemical is substituted the new chemical may have other unexpected hazards to have to manage that may or may not be known. If a process is simplified, redundancy or reliability may be decreased rather than increased leading to the higher likelihood of a release.

Question 6. "Mr. Moore, I would gather from your statement that you feel that without incentives, the innovation and development of IST standards is too heavy a burden to place on industry. You seem to suggest that Government could be re-

[2] Belke, James, USEPA, RMP 2004 Update, AIChE CCPS Technical Steering Committee, November 9, 2004.

sponsible for researching and developing standards for IST. Could you please elaborate?"

Response. Government's role should be to fund research on fundamental challenges that implementation of IST faces today: 1) defining exactly what it is and isn't; 2) how to evaluate IST benefits v. risks gained 3) IST applications and examples 4) education of managers and engineers and Government officials on the appropriate use, expectations, and limitations of IST.

RESPONSES BY DAVID A. MOORE TO ADDITIONAL QUESTIONS FROM SENATOR OBAMA

Question 1. "Department of homeland Securities officials told EPW staffers in preparation for this hearing that if left to their own devices, individual facilities might make IST decisions that decrease risk at one plant, but increase risk systemwide. What are your thoughts on that assertion, and of DHS's potentially helpful role in coordination IST at the most dangerous facilities?

Response. While I am not familiar with the conversation involving DHS I would offer that DHS's role should be to participate in the suggested Government research and education needs mentioned in response to question No. 6 above and for investigating the security benefits of IST in particular. Also, I believe it would be extremely difficult if not impossible for DHS to make these judgments fairly and technically given their complexity. All of the reasons listed in my testimony as to why IST is a difficult regulatory scheme applies to the DHS as well.

Question 2. "In march of this year, Secretary Chertoff said he was open to the idea of requiring high-risk facilities to consider safer approaches. This is a position the industry opposes. What is your view on requiring high-risk facilities to consider IST?"

Response. I believe industry should be left to prove that security risks are adequately addressed in total rather than to digress into academic exercises proving a negative in many cases, i.e., that IST isn't feasible. This is especially true with security where the emphasis should be on security strategies rather than safety strategies and Government should prioritize reducing vulnerabilities rather than focusing on changing technology. To me this is equivalent to requiring the airline industry to handle less passengers, fly smaller aircraft, or to not fly over populated areas since the inherent hazards are that there could be an accident. Following 9/11 the airline industry implemented security measures and accommodated commercial needs for the conveniences and necessity of passenger travel.

STATEMENT OF LISA P. JACKSON, COMMISSIONER, NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION

Good morning Chairman Inhofe, ranking member Jeffords and Members of the Senate Committee on Environment and Public Works. I would like to thank the Committee for the opportunity to appear before you to discuss the role of inherently safer technology in United States chemical plant security legislation.

Chemical plant security is a subject that Governor Jon S. Corzine and every New Jersey resident regard with urgent concern. We view our Chemical Standards, including requirements for inherently safer technology evaluation, as vital to providing New Jersey with an accurate reflection of our current state of security preparedness, as I will further outline in my testimony.

Our residents live in the shadow of the attacks of September 11, 2001, which claimed the lives of 674 New Jerseyans and transformed our northern waterfront into an evacuation zone. New Jersey also was the launching site for the first major bio-terror attacks on United States soil resulting in fatalities, when a still-unknown terrorist mailed anthrax-laden letters that severely contaminated the United States Postal Service facility in Hamilton, NJ.

New Jersey's very strengths create particular vulnerability to acts of domestic terrorism. Our chemical, petroleum and other industrial plants that support the economy of the Nation are clustered around well- developed transportation infrastructure linking the New York and Philadelphia metropolitan regions. The Port of New Jersey and New York is the entry point for more than 4 million cargo containers and 55 million tons of bulk cargo valued at over $100 billion. New Jersey is home to Newark Liberty International Airport—one of the busiest airports in the country serving more than 30 million passengers annually. My state is well-known as the center of pharmaceutical, biotechnology, and other life science industries targeted by violent and extreme animal rights activists. All of these infrastructure sites and

more are potential targets for terrorists, and all lie in the most densely populated State in the Union.

I shall begin with a brief overview of New Jersey's domestic security preparedness activities, and then turn to the specific reasons why the evaluation of inherently safer technologies in the chemical industry is of vital importance.

Overview of New Jersey's Domestic Security Preparedness Effort

New Jersey's unique vulnerabilities have made us a leader among states in initiating and implementing measures to counter potential terrorist operatives, to reduce the risk of attack at critical infrastructure facilities, and to reduce the potential impacts to public health and safety if any such attacks should occur in the future. New Jersey undertakes these efforts through our Domestic Security Preparedness Task Force (Task Force), chaired by Director Richard L. Canas of our Office of Homeland Security and Preparedness (OHSP).

As Commissioner of the Department of Environmental Protection (DEP), I serve as the Task Force lead for the pharmaceutical and biotechnology, chemical, nuclear, petroleum, wastewater, and dam safety sectors of our critical infrastructure. I share responsibility for the water sector as well in cooperation with the New Jersey Board of Public Utilities. Through the Task Force and the OHSP, I also participate in New Jersey's preparedness and response effort for other sectors.

The Task Force has undertaken a comprehensive program to reduce terror risk, to ensure preparedness at critical infrastructure facilities, and to test the efficacy of both public agencies and the private sector in responding to acts of terrorism. Every Task Force agency and every sector of our critical infrastructure has developed, through a public-private collaboration, a series of "Best Practices" for domestic security. Each set of Best Practices was reviewed and approved by the Task Force and the Governor. Every Task Force agency and every sector of our critical infrastructure has also participated in appropriate exercises to test the strengths and limits of terror detection and response capability.

New Jersey's current challenge is to ensure full implementation of security "Best Practices" across all sectors, consistent with a policy of "Zero Tolerance" for noncompliance, and to identify those additional regulatory and other measures that are appropriate to contend with emerging threats and challenges. Throughout this process, DEP is working with OHSP, State Police, Attorney General's Office and private companies within our sectors to reduce or eliminate specific threats that we have identified on a case-by-case basis.

New Jersey's Toxic Catastrophe Prevention Act (TCPA) Program

The Toxic Catastrophe Prevention Act (TCPA) program was created in 1986 as a result of a chemical accident in Bhopal, India that killed thousands of nearby residents. Several chemical facilities in New Jersey had experienced minor accidents prior to this time, clearly indicating that a similar risk existed in New Jersey. The TCPA requires facilities that handle extraordinarily hazardous substances above certain inventory thresholds to prepare and implement risk management plans. The plans must include detailed procedures for safety reviews of design and operation, operating procedures, maintenance procedures, training activities, emergency response, process hazard analysis with risk assessment and self-auditing procedures. An extraordinarily hazardous substance is defined as a substance, which if released into the environment would result in a significant likelihood of causing death or permanent disability.

In 1998 the program adopted USEPA's 112(r) Accidental Release Prevention Program (40 CFR 68) by reference. This program included additional toxic substances and highly flammable substances. It also required each facility to complete a worst case scenario analysis. The worst case scenario models the resultant toxic cloud to a predetermined concentration. The USEPA end point concentrations are approximately one-tenth of the concentration that would cause death to persons exposed.

On August 4, 2003, the readoption of the TCPA rules added reactive hazards substances to the list of extraordinarily hazardous substances covered under the program. Industrial accidents in New Jersey resulting from reactive hazards demonstrated the need to include reactives under the TCPA program. Owners and operators having listed reactive hazard substances in quantities that meet or exceed thresholds are required to develop risk management plans to reduce the risk associated with these unstable substances. In addition, and the focus of this testimony, this readoption included a requirement that owners and operators evaluate inherently safer technology for newly designed and constructed covered processes.

Chemical Sector Best Practices Standards

New Jersey recognizes that facilities in the Chemical Sector are diverse in size, complexity, and potential for off site impacts to the community and therefore a blanket approach to addressing security concerns may not be practical. The Best Practices represent a risk-based approach to security consisting of a site-specific vulner-

ability assessment that evaluates threats to a facility's operation, its particular vulnerabilities and likely consequences of a chemical release, and the physical and procedural security measures already in place. The Chemical Sector Best Practices were predominantly derived from the Security Code of the American Chemistry Council's Responsible Care program.

Subsequently the Task Force determined that additional measures were necessary to ensure that appropriate prevention and response measures are implemented by the chemical sector to address emerging domestic security threats. As a result, Chemical Sector Best Practices Standards (Standards) were put in place on November 21, 2005.

The Standards require chemical sector facilities to, among other things:

- comply with the Chemical Sector Security Best Practices;
- conduct a terrorism-based security vulnerability assessment; and
- develop a prevention, preparedness, and response plan to minimize the risk of a terrorist attack.

In addition, chemical sector facilities subject to TCPA are required to conduct a review of practicability and potential for adopting inherently safer technology.

Inherently Safer Technology

Facilities required to conduct an inherently safer technology review must evaluate:

- reducing the amount of extraordinarily hazardous substances materials that potentially may be released;
- substituting less hazardous materials;
- using extraordinarily hazardous substances in the least hazardous process conditions or form;
- and, designing equipment and processes to minimize the potential for equipment failure and human error.

I must emphasize that the inherently safer technology requirement under the Standards represents a practicability test; it is not mandatory that a covered facility implement IST, only that they evaluate. The results of the evaluations are held at the facility site, and are made available to DEP inspectors during an on-site visit.

Compliance with the Standards was required within 120 days of the effective date, March 21, 2006. DEP staff are on schedule to complete inspections to evaluate compliance at all the 157 facilities subject to the Standards by July 31, 2006. Of the total 157 facilities, 45 are regulated TCPA facilities required to perform IST analysis. It is important to note that with the majority of the inspections completed to date, compliance with the Standards has been excellent with a small percentage of exceptions. To date, we have inspected about 100 facilities subject to compliance with the Standards and over half the TCPA universe. In all cases, facilities required under the Standards to conduct IST review have done so. It is expected that Task Force orders will be generated to address any cases where gross non-compliance is determined. I believe that our compliance results clearly indicate that the evaluation of inherently safer technology is not overly burdensome on industry and is an effective tool for critically evaluating the risk reduction opportunities available at a specific facility.

But these measures alone are merely a starting point. Our knowledge of both the threat and the appropriate response is evolving daily. As we implement the "Best Practices" and work with facilities on site-by-site review of security vulnerabilities, we also have begun a public process to review what additional regulatory measures may be appropriate to harden potential targets, to reduce risk to surrounding communities, and to involve workers and communities in the process.

While New Jersey is doing its part, we renew our call for federal standards and protections that will reinforce our work, ensure a level playing field for firms operating in New Jersey, and provide equivalent protection from facilities that operate near our borders. The Standards, including the inherently safer technology evaluations, are vital to providing New Jersey with an accurate picture of the current state of preparedness within the Chemical Sector and provide a foundation to move forward with the appropriate actions necessary to safeguard our citizens.

CONCLUSION

Added Federal safeguards in these areas would complement New Jersey's tradition of strict rules to ensure safety at major chemical facilities and to protect surrounding communities.

But we remain persuaded that both security and interstate fairness would be advanced significantly, and with far less economic impact, if State measures were coupled with a Federal framework of regulatory protections. New Jersey is prepared to work with all members of the committee to achieve appropriate legislation to es-

tablish that framework. Finally, I must emphasize that given New Jersey's demonstrated attractiveness as a target for terrorism our State must have the discretion to impose stricter requirements, when necessary, to adequately safeguard our citizens from potential acts of terrorism. Therefore, we strenuously oppose the prospect of Federal preemption in the area of homeland security.

RESPONSE BY LISA P. JACKSON TO AN ADDITIONAL QUESTION FROM SENATOR INHOFE

Question. Whose judgment prevails if the decision not to implement Inherently Safer Technology (IST) is made? How do you envision dealing with difference of opinion between a compliance inspector and a family about the decision that something is not practible?

Response. On November 21, 2005, the Governor approved Best Practices Standards for TPCA/DPCC Chemical Facilities, pursuant to the authority found in the New Jersey's Domestic Security Preparedness Act of October 4, 2001. These Best Practices require that an IST review must be conducted and must include an analysis of whether adoption of IST is practicable and the basis for any determination that implementation of IST is impractical. To interpret "practicable and the basis for any determination that implementation of 1ST is impractical," the Department of Environmental Protection intends to use a definition of "feasibility", which would include such factors as whether the implementation of IST is "capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, legal, social and technological factors."

Should the Department determine that the review/analysis required by the Standards did not appropriately incorporate the factors detailed above and a facility resists steps to remedy these deficiencies, the New Jersey Domestic Security Preparedness Act provides compliance and/or enforcement mechanisms. The New Jersey Office of Homeland Security & Preparedness would initiate steps aimed at requiring the recalcitrant entity to come into compliance with the Standards.

RESPONSE BY LISA P. JACKSON TO AN ADDITIONAL QUESTION FROM SENATOR JEFFORDS

Question. Why is it important for States like New Jersey to be able to implement their own chemical security programs?

Response. The residents of New Jersey live in the shadow of the attacks of September 11, 2001, which claimed the lives of 674 New Jerseyans and transformed our northern waterfront into an evacuation zone. New Jersey also was the launching site for the first major bio-terror attacks on U.S. soil resulting in fatalities, when a still-unknown terrorist mailed anthrax-laden letters that severely contaminated the U.S. Postal Service facility in Hamilton, NJ.

New Jersey's very strengths create particular vulnerability to acts of terrorism. Our chemical, petroleum and other industrial plants that support the economy of the Nation are clustered around well-developed transportation infrastructure linking the New York and Philadelphia metropolitan regions. The Port of New Jersey and New York is the entry point for more than 4 million cargo containers and 55 million tons of bulk cargo valued at over $100 billion. New Jersey is home to Newark Liberty International Airport—one of the busiest airports in the country serving more than 30 million passengers annually. Our State is well-known as the center of pharmaceutical, biotechnology, and other life science industries targeted by violent and extreme animal rights activists. All of these infrastructure sites and more are potential targets for terrorists, and all lie in the most densely populated state in the country.

The concentration of critical infrastructure and density of our population may have no comparison in the United States. Clearly, our circumstances are vastly different than those of most other States. A "one size fits all" standard can not work across our diverse Nation. New Jersey, and all States, need to retain the ability to go beyond any threshold Federal security standards to ensure that our preparedness is measured in line with our potential vulnerabilities.

RESPONSES BY LISA P. JACKSON TO ADDITIONAL QUESTIONS FROM SENATOR VOINOVICH

Question 1. How many of the chemicals listed in BPA's RMP rule have scientifically proven alternatives that Increase safety, reduce risk, and operate at least as

effectively, in terms of cost and end product, as the chemical compound that is being replaced?

Response. Information is not available to folly answer this question. However, examples of IST successes include substituting sodium hypochlorite for chlorine for wastewater disinfection, substituting anhydrous ammonia with aqueous ammonia in air pollution control systems, substituting broroochlorohydantoin for chlorine for treating cooling water. In addition, replacing a chemical compound, or substitution, is only one of the inherently safer technology principles or techniques. Other IST techniques include reducing the amount of hazardous material that potentially may be released, using extraordinarily hazardous substances (EHSs) in the least hazardous process conditions or form, and designing equipment and processes to minimize the potential for equipment failure and human error. For a particular process or chemical product being manufactured, substitution may not be a feasible alternative, but use of one or more of the other three IST techniques could provide a feasible reduction in risk.

Question 2. Who or what body should determine what IST is? Should It be defined by Government, industry, or academic? If Government does define it, which agency should be responsible for that?

Response. A generic definition of IST should be provided through Government regulation. In the New Jersey Toxic Catastrophe Prevention Act (TCPA) rule, the definition of 1ST is "the principles or techniques incorporated in a newly designed and constructed covered process to minimize or eliminate the potential for an Extraordinarily Hazardous Substance (EHS) accident that include, but are not limited to, the following: (1) reducing the amount of EHS material that potentially may be released; (2) substituting less hazardous materials; (3) using EHSs in the least hazardous process conditions or form; and 4) designing equipment and processes to minimize the potential for equipment failure and human error." In our country, this definition is widely recognized by industry and organizations such as the Center for Chemical Process Safety of the American Institute of Chemical Engineers.

It is difficult to provide a defined list of required specific inherently safer technologies or equipment because each chemical process must be evaluated individually. Also, many processes are proprietary. However, it is possible to provide guidance on technologies or equipment for consideration by facilities in their process. This guidance could be prepared with input and assistance from academia, Government, industry, and organizations such as CCPS, the American Chemistry Council, and the American Petroleum Institute.

We believe that the Federal Government should be the lead in establishing regulations, defining 1ST, and providing or coordinating guidance for IST. However, New Jersey, and all States, must retain the ability to go beyond any threshold Federal security standards to ensure that preparedness is measured in line with potential vulnerabilities.

Question 3. To your knowledge has IST ever been defined as a security measure in Federal law?

Response. To our knowledge IST has never been defined as a security measure in Federal law. However, in Guidelines for Analyzing and Managing the Security Vulnerabilities of Fixed Chemical Sites. August 2002, published by the CCPS of the American Institute of Chemical Engineers, CCPS states that security risk reduction at a site can include inherently safer systems, to the extent that they can be designed and installed practically, particularly for existing processes. CCPS further states that the concept of inherently safer approaches to chemical processing and the design of plants can be directly applied to the security of hazardous materials. If a process is run under more moderate conditions, or a chemical is used in lesser amounts, the risk associated with one of the four malicious acts (theft/diversion, release, use as a contaminant,

Question 4a. Do you agree with the following conclusions from the EPA: "Inherently safer processes" is a developing concept and Is not. ready for general application?

Response. The concept of IST was first introduced publicly by Dr. Trevor Kletz, a noted process safety expert, approximately 30 years ago. Since that time, IST studies have been widely performed by industry. In Inherently Safer Chemical Processes. A Life Cycle Approach. 1996, the CCPS discusses various methods and techniques on how to perform an IST study. In fact, Dennis Hendershot, who also gave testimony at the June 21 Hearing, has published several papers and case studies during his industry career detailing IST studies that he has conducted, the IST alternatives that were implemented as a result of those studies, and how the decision for feasibility to implement those IST alternatives was supported using risk assess-

ment techniques. Therefore, we strongly believe that IST evaluation is a well-established concept that is ready for general application.

Question 4b. Do you agree with the following conclusions from the EPA: IST frequently displaces risk rather than reducing it?

Response. We do not agree with this conclusion. It is true that for any change that is ever made to a chemical process, the change roust be evaluated carefully to ensure that a new, unintended, or unforeseen risk is not being introduced. We strongly believe that facilities should perform IST evaluations to search for feasible alternatives that will reduce the risk of a release to the surrounding community.

Question 4c. Do you agree with the following conclusions from the EPA: Even if a few examples of workable alternative approaches do exist, there is not a rational basis for Imposing an additional Industry-wide regulatory burden?

Response. We disagree with this statement. We reiterate that facilities should perform IST equations to search for feasible alternatives that will reduce the risk of a release to the surrounding community.

Question 4d. Do you agree with the following conclusions from the EPA: The concept Is normally considered when designing new processes, a time when changes can be implemented cost effectively?

Response. We disagree with this statement It is true that it is most cost effective to evaluate and implement IST during the design stages of a new process. However, CCPS states in its Inherently Safer Client Processes. A Life Cycle Approach on page 16, "It is never too late to consider inherently safer alternatives. Major enhancements to the inherent safety of plants which have been operating for many years have been reported (CCPS, 1993a; Wade, 1987; Camthers et al., 1996)." Also, continuing to perform IST evaluations in the later stages of a plants life cycle is valuable because new technologies may be available that were not available when the plant initially was designed and constructed.

Question 5. Do you believe that IST is a concept ready for broad Implementation as a regulatory requirement? Do you believe that IST is a mature process that can be cost-effectively Implemented across the broad range of chemicals used in this country?

Response. From the responses above and the responses to Senators Inhofe's and Jeffords' questions, we believe that IST evaluations can and should be broadly implemented as a regulatory requirement. We believe that the IST evaluations and determinations of feasibility of IST alternatives can be done cost-effectively. These IST evaluations should be performed by the facilities handling the most hazardous chemicals above specified threshold quantities, such as in New Jersey's TCPA rule or the EPA's Accidental Release Prevention rule, 40 CFR 68.

Question 6. Under New Jersey's Toxic Catastrophe Prevention Act, certain facilities are required to conduct a review of IST. Of the 45 facilities that have been required under the Act to conduct a review of practicability and potential for adopting IST, how many have actually implemented or intend to implement IST? Of that number, how many were actual chemical manufacturing facilities (as opposed to water treatment facilities)? How does New Jersey DEP measure the implementation of IST and compliance with the Act?

Response. The 45 facilities that are referred to are those that are subject to the Best Practices Standards, adopted November 21, 2005, under the authority of New Jersey's Domestic Security Preparedness Act of October 4, 2001. These 45 facilities, which are a subset of the total 102 regulated under New Jersey's TCPA rule, N.J.A.C. 7:31, are all chemical manufacturing facilities defined and selected by their North American Industry Classification System (NAICS) or Standard Industrial Classification (SIC) codes. Pursuant to the Best Practices Standards, these 45 facilities were required to complete an IST evaluation by March 21, 2006. During the course of our inspections at these facilities, they all have stated that they have implemented past IST or other risk reduction measures. Approximately one-third have provided a schedule to implement additional IST or risk reduction measures, and about one-third have identified additional IST or risk reduction measures but have not yet scheduled their completion. About one-third had no additional recommendations. It should be noted that these are facilities that have been regulated under our TCPA program for many years.

Question 7. Has your department or any other Agency of the New Jersey Government tried to assess the financial impact on the New Jersey chemical industry of studying and possibly implementing 1ST? If so, what was the conclusion? Is New Jersey concerned about losing chemical Industry Jobs? You Indicate that the evaluation of IST is not overly burdensome on Industry—who is making that Judgment?

Response. Our department has not performed a formal financial impact assessment on the New Jersey chemical industry of studying and possibly implementing IST, and we do not know of any other New Jersey Agency that has done so. In our experience so far under the Best Practices Standards, facilities primarily have completed the IST review with in-house personnel with backgrounds in chemistry, engineering, process controls and instrumentation, maintenance, production and operations, and chemical process safety. Some facilities have hired consultants to assist or lead the study. Facilities have not expressed to us that performing the IST review has been overly burdensome, and the extraordinary compliance record further supports this position.

RESPONSES BY LISA P. JACKSON TO ADDITIONAL QUESTIONS FROM SENATOR BOXER

Question 1. Please provide a description of how New Jerseys Toxic Catastrophe Prevention Act could provide an opportunity for businesses to have a more stable business plan as a result of using inherently safer technologies.

Response. Performing an IST review and implementing IST or other risk reduction measures provide several positive benefits resulting in a more stable business plan for a facility. First of all the reduction in risk of a release lowers the companies potential liabilities. This has the secondary benefit of increasing the surrounding community's perception, confidence, and acceptance of the facility. Many IST alternatives, which have an initial capital cost, have lower operating costs in areas such as maintenance, operations, and emergency response requirements. If the risk of release can be eliminated or substantially reduced, the facility would become less attractive to a terrorist and thus less likely as a terrorist target. Reducing or eliminating the risk of a release caused by a terrorist or occurring accidentally would avoid business losses from a production shutdown following the incident. All of these serve to provide the facility a more stable business plan.

Question 2. Please provide the type of economic impact analysis that your Agency conducts to determine whether a business should use inherently safer technology.

Response. The standards require that an IST review must be conducted and must include an analysis of whether adoption if IST is practicable and the basis for any determination that implementation of IST is impractical. To interpret "practicable and the basis for any determination that implementation of IST is impractical," the Department of Environmental Protection intends to use a definition of "feasibility", which would include such factors as whether the implementation of IST is "capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, legal, social, and technological factors."

Question 3. Will your Agency be tracking the economic benefits derived from business's use of any inherently safer technologies required to be used under New Jersey's Toxic Catastrophe Prevention Act? Please provide any such analysis that you currently possess.

Response. We do not currently possess any analysis tracking the economic benefits derived from business's use of any inherently safer technologies. However, our Department will be tracking the evaluation and implementation of IST alternatives to provide a valuable reference universe for the chemical industry. Documented IST success stories, if applicable, will serve as a valuable tool as facilities investigate available options.

STATEMENT OF CHARLIE COTT, VICE PRESIDENT, PLANT FOODS AND TRANSPORTATION MFA INC

INTRODUCTION

I would like to thank Chairman Inhofe and Senator Jeffords for holding this important hearing today. My name is Charlie Cott, Vice President, Plant Foods and Transportation, with MFA Incorporated, a regional farmer cooperative operating and headquartered in the state of Missouri. I am here today to testify on behalf of the Agricultural Retailers Association (ARA), which represents a significant majority of the Nation's retail dealers who provide essential agricultural pesticides, fertilizer, seed and other agronomic services to America's farmers. As the only national organization exclusively representing the interests of the agricultural retail and distribution industry, ARA is vitally interested in any Federal laws or regulations related to inherently safer technology (IST) requirements that may affect the oper-

ation of facilities and chemicals utilized in the Nation's agricultural sector. I appreciate the opportunity to testify today on this important issue.

MFA Incorporated is built upon a solid commitment to its farmer/owners to provide quality products and services, embracing honesty in business and offering professional advice that farmers can depend on. MFA Incorporated is a farm supply cooperative established in 1914, and has retail facilities in Missouri, Iowa, Kansas, Oklahoma, and Arkansas. We have approximately 150 full service retail facilities, both company owned and affiliates, and 100 bulk fertilizer plants. Our Board of Directors is made up of our farmer/owners, and they keep us in tune with the needs of our more than 45,000 members. The heart of our operations is our Agri Services Centers providing farmers and ranchers with the products and services they need to do business in today's complex farming environment. I grew up in north central Missouri in Saline County. I graduated from the University of Missouri, Columbia in 1976, and have worked for MFA Incorporated in various capacities since 1977.

OVERVIEW OF AG RETAIL/DISTRIBUTION INDUSTRY

In 2002, there were an estimated 10,586 farm retail outlets in the United States.[1] The overall number of retail outlets is even lower today and has been declining due to a number of factors taking place within the industry: consolidation, increased domestic and global competition, higher operating costs, and low profit margins. ARA members range in size from family-held businesses or farmer cooperatives to large companies with multiple outlets located in many states. A typical retail outlet may have 3 to 5 year-round employees with additional temporary employees added during the busy planting and harvesting seasons. Many of these facilities are located in small, rural communities.

The goods and services that we provide include: seed, crop protection chemicals, fertilizer, crop scouting, soil testing, custom application of pesticides and fertilizers and development of comprehensive nutrient management plans, and state of the art IPM programs. Certified crop advisors (CCA's) are retained on retailer's staff to provide professional guidance and crop input recommendations to farmers and consumers. Retail and distribution facilities are scattered throughout all 50 states and provide important jobs in rural and suburban communities. The food and agriculture production and processing industry contributes substantially to the American economy ? accounting for 13 percent of the U.S. gross domestic product and 18 percent of domestic employment.

EXISTING SAFETY REGULATIONS AND INHERENTLY SAFER TECHNOLOGY

Even before the terrorist attacks on September 11, 2001, agricultural retailers have been one of the most heavily regulated industry segments in the country. Many of the products used by the industry are hazardous materials, which are highly regulated and expensive materials. There are countless Federal and State laws and regulations related to the safe handling, transportation and storage of agricultural crop

inputs. For example, many agricultural retail facilities that handle and store a threshold amount of listed substances such as ammonia are required to comply with the U.S. Environmental Protection Agency's (EPA) Risk Management Program (RMP)[2]. Under the rule, covered facilities must develop an RMP that describes their chemical accident prevention programs and submit full updates and resubmissions to EPA at least once every 5 years. The RMP Rule divides regulated facilities into three program focuses according to the level of potential danger they may present to surrounding communities.

Most agricultural retailers fall under the RMP's Program 2 Requirements, which generally are processes of low complexity and do not typically involve chemical reactions. Program 2 RMP requirements for retailers include written operating and maintenance procedures; training; mechanical integrity, compliance audits, incidence investigations and employee participation. They also conduct hazard assessments, which include analyses of worst-case and alternative release scenarios; establish emergency response programs that include plans to inform the public and emergency response organizations about the chemicals onsite and their health effects and strategies to coordinate those plans with the community; and report steps taken to prevent incidents that can release dangerous chemicals. Program 2 RMP reporting requirements are less stringent than Program 3 RMP requirements, which are usually for higher risk chemical facilities and involve complex chemical proc-

[1] Doane's Ag Professional Magazine, Summer 2003, p.40-41

[2] Accidental Release Prevention Requirements: Risk Management Programs Under Clean Air Act Section 112(r)(7); Final Rule; 40 CFR Part 68

essing operations. The prevention program requirements for Program 3 are very similar to those of the OSHA Process Safety Management (PSM) requirements.

The Federal Insecticide Fungicide and Rodenticide Act[3] (FIFRA) continues to be the basis of EPA regulations covering agricultural pesticides. Sections of the code cover handling, labeling, crop tolerance requirements, precautionary statements, environmental protection issues, worker protection standards, storage requirements, transportation regulations and considerations, product use, and lots more issues designed to protect the public and all workers.

The Department of Transportation's (DOT) Pipeline and Hazardous Materials Safety Administration (PHMSA) formulates, issues and revises Hazardous Materials Regulations (HMR) under the Federal Hazardous Materials Transportation Laws. The HMR issued by the DOT cover hazardous materials definitions and classifications, hazard communications, shipper and carrier operations, training and security requirements, and packaging and container specifications. Agricultural retailers and distributors are required to comply with many of these DOT regulations.

As an industry, we have done a good job of educating and training employees to judiciously handle hazardous materials and to make sure they remain in the hands of authorized personnel. Employees of agricultural retailers and distributors complete numerous training and certification programs that help ensure hazardous materials are being stored and handled with proper care. An employer at an agricultural retail facility is responsible that their employees comply with several regulatory requirements such as: (1) Commercial Applicator Certification; (2) DOT Hazmat training for hauling hazardous materials such as anhydrous ammonia, ammonia nitrate and other certain agricultural chemicals; (3) Worker Protection Standard training; (4) OSHA Standards such as Worker Right to Know, Lockout/Tagout, Confined Space Entry, Personal Protective Equipment, etc.; (5) Random drug and alcohol testing; (6) Commercial Drivers Licenses and Hazardous Material Certification; and Restricted Use Pesticide recordkeeping.

Because existing regulations are working, ARA does not believe the Federal Government should mandate the use of ISTs or alternative approaches for chemical processing, which is extremely complex, and which differs from company to company. Our industry would support common-sense chemical security regulations that recognize the needs of America's agricultural industry. ARA is working closely with the U.S. Department of Homeland Security (DHS) and the Senate Homeland Security and Governmental Affairs Committee on this very matter. However, we do strongly oppose efforts by anti-chemical activist groups that are attempting to tie new IST mandates to chemical facility security legislation. If an IST mandate was put in place for the Nation's agricultural industry it could jeopardize the availability of lower-cost sources of plant nutrient products or certain agricultural pesticides used by farmers and ranchers. It will also hurt our ability to compete with growing threats from countries such as Brazil and China. It is estimated that 96 percent of the world's consumers reside outside the United States. According to the USDA Economic Research Service (ERS), the U.S. agricultural trade surplus for 2006 is estimated to be only $1 billion compared to a $21 billion surplus in 1997. This change is being caused by increased international competition and higher operating costs for our farmers and ranchers due to more regulations and higher input costs, primarily due to higher fuel and fertilizer costs.

ARA believes it is important for Congress to oppose legislative proposals such as S. 2486 sponsored by Senators Frank Lautenberg (D-NJ) and Barrack Obama (D-IL) that according to Senator Lautenberg would "require every chemical facility in the nation to adopt inherently safer technology." IST is not a security issue and relates to process safety decisions that should be left to the safety experts that help manage these facilities. We strongly agree with concerns expressed by DHS Secretary Chertoff that his agency not move from a security based focus into broader environmental objectives that are unrelated to security. We also agree with Senate Homeland Security and Governmental Affairs Committee Chairman Susan Collins that the Lautenberg-Obama approach "would impose costly, intrusive, and burdensome mandates that take the wrong approach to homeland security" and that "process engineering decisions are best left to the private sector." We appreciate Chairman Collins efforts to work with our industry on chemical site security issues where we have serious concerns such as the IST issue. We were pleased last week when an IST mandate amendment offered last week during committee consideration of the "Chemical Facilities Anti-Terrorism Act of 2005" (S. 2145) was soundly defeated.

Uninformed anti-chemical groups have been pushing for an IST mandate long before September 11, 2001. Congress should be very careful about how it handles this

[3] 7 U.S.C. s/s 136 et seq. (1996)

issue. A March 2003 General Accounting Office (GAO) report[4] found that ISTs could result in shifting, rather than reducing, the risk of terrorist attacks. In that report, GAO stated, "reducing the amount of chemicals stored may shift the risk onto the transportation sector as reliance on rail or truck shipments increases." Availability of lower-cost sources of plant nutrient products or certain pesticides used by farmers could be at risk under an IST or other alternative approaches mandate. As this committee should be aware, the EPA already monitors IST technologies when reviewing agricultural pesticides for new section 3 registrations and during the re-registration process. It also considers agricultural pesticides for fast track registration that it deems the product safer for use. A new IST approach or mandate would set up a duplicative effort that is not needed and potentially opens the door for anti-chemical groups to file lawsuits against the industry. Agricultural retailers and their farmer customers cannot afford the loss of essential crop input products, new expensive Federal mandates or defending against frivolous lawsuits.

If MFA was forced to recommend less effective pest management products or less efficient plant nutrient products to our farmer customers, the net results would be lower yields, less quality, less farm revenue, and markets shifting to foreign countries. Would you buy a wormy apple, a scared tomato, or rotten grapes? Of course not, and neither will other American consumers; but that is what you can expect if an IST mandate becomes law.

In addition, our nation is making a strong effort to become more energy independent and less dependent on foreign sources of energy. ARA is a supporter of Federal policies that promote the use of renewable fuels and serves as a member of the 25x25 Ag Energy Working group, whose goal is for farms, ranches, forests, and other working lands to provide 25 percent of the United States' energy needs from renewable sources by 2025. For example, corn is a major component in the manufacture of ethanol, a clean-burning, renewable, domestically produced fuel. According to the Renewable Fuels Association (RFA), ethanol production is the third largest use of U.S. corn, utilizing a record 1.43 billion bushels of corn in 2005. The state of Missouri ranks ninth in total corn production in the U.S. Corn is Missouri's second largest crop in production, producing nearly 300 million bushels of corn annually. If an IST mandate became law, it could force the use of less efficient fertilizer for corn crops, which in turn would directly impact crop yields. According to ethanolfacts.com, one bushel of corn yields about 2.8 gallons of ethanol. A reduction of one bushel per acre in corn production would reduce Missouri net farm income by $5 million. It would also mean that there would be less corn available to produce ethanol and hinder the Nation's efforts to become more energy independent.

ARA believes that Congress should not go to such extremes as actually picking winners and losers in the crop protection and plant nutrient industry. This is an issue best left up to the market place and consumers.

CONCLUSION

ARA and our members strongly support the war on terrorism and are committed to do our part to address security related concerns. As an industry we have already made great strides, but we believe it is important to have commonsense, workable regulations in effect that do not place unreasonable and unnecessary IST mandates on the industry. America's agricultural industry is currently faced with high fuel, fertilizer and transportation costs. It is also important to note that about 80 percent of U.S. counties were declared disaster or contiguous disaster counties last year due to devastating hurricanes, fires, floods, excessive moisture and severe drought. With the current state of the domestic and international agricultural markets and uncertainties facing America's agricultural industry, now is not the time for Congress to try to place further burdens on farmers and ranchers by limiting their product choices, increasing their input costs, and impacting their crop yields. This type of Federal policy could help further drive many within agriculture out of business and increase our dependence on foreign sources of food and fiber, similar to what we now face with foreign oil.

Thank you for considering ARA's views. We appreciate Chairman Inhofe's interest and support on this important issue. We welcome the opportunity to provide further input to the committee on the issue of IST and address any security gaps that may exist within the industry. ARA stands ready to work with Congress on the development of a chemical site security legislation that adequately reflects the needs of America's agricultural industry and our rural economy. As we face these challenges, we can only accomplish what needs to be done if we work together.

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[4] GAO-03-439 Homeland Security: Voluntary Initiatives Are Under Way at Chemical Facilities, but the Extent of Security Preparedness is Unknown, March 2003, p. 29

RESPONSES BY CHARLIE COTT TO ADDITIONAL QUESTIONS FROM SENATOR INHOFE

Question 1. Your company is a large distributor of ammonium nitrate based fertilizers. Based on events in Oklahoma City, I, more than anyone, understand how dangerous "A-N" can be. I am also concerned with your comments about effects on the food supply if other alternatives were forced upon agriculture. How are best management practices and current safety rules for distributors, farmers, and ranchers working?

Response. Retailers handle hazmat materials regularly in the production of American's food supply with out any incidents. We all realized after OK City and 9-11 that we need to be even more responsible and knowledgeable of issues surrounding terrorism. Before that time our focus was on accidents not intentional misuse. MFA has incorporated a number of new security measures that will help prevent ammonium nitrate or hazardous materials we handle from falling into the wrong hands, including registration and name/address of users (where required), no sales of bagged AN, no sales of AN to non-agricultural users, and no sales of bagged bulk fertilizer products sold. AN is still a very useful and economical farming tool, but can it be replaced? Anything can be replaced, but at a cost, most of those production programs that could switch from AN to other materials have already done so and the remaining users need AN just to remain productive and produce an economical crop. On certain crops, AN is still the recommended plant nutrient product of choice by the University of Missouri, the State's land grant college. Current alternatives to AN are not desirable to many of our farmer customers because they do not exhibit the same chemical characteristics and would not fit well in their crop production practices, or economic value.

Question 2. Are you concerned that DHS rules and regulations, including IST, could conflict with the Department of Transportation's regulations governing safety and security of the transit system?

Response. The agrichemical industry is the most regulated business segment in the entire United States and we are constantly trying to work in an environment when agency regulations conflict. Currently DHS has very limited regulatory authority but we believe that soon Congress will address this area and I hope that the new DHS will coordinate with other agencies on existing hazmat security rules. ARA supports the DOT maintaining their jurisdiction and oversight for the transportation of hazmat materials. The DOT already has security rules in effect related to the secure transportation of hazmat and they seem to be working well. I do however have concerns there will not be regulatory harmony and that conflicts over interpretation of IST's will be very confusing and bad for business. It is ARA's understanding that DOT and DHS have or are working on an interagency agreement that establishes the ground rules on how they will interact on these types of security regulations related to hazmat transportation.

RESPONSE BY CHARLIE COTT TO AN ADDITIONAL QUESTION FROM SENATOR JEFFORDS

Question. Your written testimony discusses a range of federal laws governing agricultural operations. Are any of these laws designed to address the unique risks posed by terrorism?

Response. It is my understanding that the DOT's hazmat transportation security laws and the fingerprint and background check requirements for applicants seeking a commercial drivers license (CDL) with a hazmat endorsement were implemented following 9/11 due to concerns of terrorists. I believe the same is true as it relates to the Coast Guard's MTSA rules. While I am not aware of any other direct federal laws that address terrorism or terrorist activities, I can assure you that MFA operates in an environment where we are carefully regulated as to the safety and security of our facilities by several federal agencies such as the EPA, DOT, OSHA and DHS as well as state and local agencies. Industry has initiated several programs to assist retailers and local authorities to do a better job of preventing criminal activities thus also stopping terrorist activities.

RESPONSES BY CHARLIE COTT TO ADDITIONAL QUESTIONS FROM SENATOR VOINOVICH

Question 1. Across the entire chemical manufacturing industry in the United States, how many of the chemicals listed on EPA's Risk Management Plan list have scientifically proven alternatives that increase safety, reduce risk, and operate at least as effectively, in terms of both cost and end product, as the chemical compound that is being replaced?

Response. I have not done a study nor am I aware of any study on the EPA's RMP's than determines which chemicals are good IST substitutes.

Question 2. Who or what body should determine what IST is? Should it be defined by Government, industry, or academia? If Government does define it, which agency should be responsible for that?

Response. In the agricultural pesticide segment the EPA has responsibility for chemical approvals and that process is extensive taking many years to complete, detailed in it's science, and very expensive for registrants. I do not see any reason to have another agency or organization duplicate or try to out guess what the EPA has done in regards to the approval of chemicals. MFA or any other agricultural retailer or farmers would have a hard time to determine what an IST is because we do not have the funds to conduct such a costly analysis.

Question 3. To your knowledge has IST ever been defined as a security measure in federal law?

Response. I am not aware of any regulation that defines IST as a security measure. I can not see how IST's can even be considered security measures, there appear to be more of a philosophy.

The EPA has concluded that:

- "Inherently safer processes" is a developing concept and is not ready for general application;
- IST frequently displaces risk rather than reducing it;
- Even if a few examples of workable alternative approaches do exist, there is not a rational basis for imposing an additional industry-wide regulatory burden; and
- The concept is normally considered when designing new processes, a time when changes can be implemented cost effectively.

Question 4. Do you agree with the above assessments? In that context, do you believe that IST a concept that is ready for broad implementation as a regulatory requirement?

Response. I agree with the above statements and do not believe that IST programs are ready for adoption for broad implementation as a regulatory requirement.

Challenges in Implementing Inherent Safety Principles in New and Existing Chemical Processes

White Paper

August 2002

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Abstract

This paper defines inherent safety and contrasts it with more traditional approaches to safety. It illustrates through analogies with common household examples the challenges faced in evaluating and implementing inherently safer designs. The first challenge is simply to measure the degree of inherent safety in a way that allows comparisons of alternative designs, which may or may not increase safety or may simply redistribute the risk. The second is that because inherent safety is an intrinsic feature of the design, it is best implemented early in the design of a process plant, while the US has a huge base of installed process plants and little new construction. Thirdly, in developing inherently safer designs, there are significant technical challenges that require research and development efforts with limited economic incentives. These challenges make regulation of inherent safety very difficult. We believe that a coordinated long-term effort involving government, industry, and academia is essential to develop and implement inherently safer designs. A similar approach has shown success in related areas such as green chemistry, energy conservation, and sustainable development.

Challenges in Implementing Inherent Safety Principles in New and Existing Chemical Processes

What is Inherent Safety?

Inherent safety is based on the use of technologies and chemicals with intrinsic properties that reduce or eliminate hazards. Inherent safety is based on concepts known for more than 100 years (Kletz, 1998) and is an approach to chemical incident and pollution prevention that is in some ways contrary to traditional accident prevention and mitigation methods. Traditional safety practices typically reduce risk by lowering the probability of an incident and/or mitigating the consequences of an incident. This approach alone, although extremely important and generally effective, does not reduce the hazards of serious chemical incidents because it attempts to control hazards rather than eliminate them. Inherent safety is especially important in today's world where terrorists may cause a chemical release by methods that bypass or defeat normal safety systems.

The concepts of inherent safety as applied to chemical process plant design has been discussed elsewhere (Mannan et al., 2002) and are summarized below:

Intensification or minimization consists of reduction of quantities of hazardous chemicals in the plant. "What you don't have can't leak".

Substitution is the use of a safer material in place of a more hazardous one. It may be possible to replace flammable substances with non-flammable ones or toxic substances with non-toxic ones. However, it is necessary to evaluate not only the substance but also the volumes required.

Attenuation or moderation is the use of a hazardous chemical under less severe conditions such as lower pressure or temperature. Thus chlorine and ammonia are stored as refrigerated liquids at atmospheric pressure rather than at high pressure at ambient temperature. The lower pressure results in lower leak rates and the lower temperature lowers the vaporization rate.

Limitation of effects, by changing designs or process conditions rather than by adding on protective equipment that may fail. For example, it is better to prevent overheating by using by using a fluid at a lower temperature rather than use a hotter fluid and relying on a control system.

Simplicity: Simpler plants are safer than complex plants as they provide fewer opportunities for error and contain less equipment that can fail.

Other principles such as, making assembly errors impossible, and avoiding knock-on effects are also inherently safer design concepts.

One of the most common accidents at home is falling on the stairs. A home without stairs, i.e. a one-story bungalow, is inherently safer with regard to falling on stairs than a two-story house. Even if the stairs are equipped with handrails, non-slip surfaces, good lighting, and gates for children, the hazard is still present (Kletz, 1998). Obviously the choice of an inherently safer house implies positive and negative consequences, which may include aesthetics, cost, and other types of hazards. An elevator could reduce the use of stairs but requires a large capital expense. During construction there would be significant hazards to the residents and construction workers and the stairs would still be necessary for emergency egress. Few families would conclude that installing an elevator is the best use of their resources.

Measuring Inherent Safety

While inherent safety is based on well-known principles, difficulties have been encountered in adopting the principles as a routine practice by industry. One of the first problems encountered during application of inherent safety principles is the subjectivity involved. The principles are descriptive rather that prescriptive, hence they are subject to interpretation based on previous experience, knowledge, and personal perception. A consequence of the subjectivity is that a systematic methodology to measure inherent safety does not exist, and it is not currently possible to know how inherently safe a plant or an equipment item is because it is not possible to evaluate how well the principles have been applied. If we cannot measure how inherently safer the one story condo is with respect the two-floor house, how can we choose the inherently safer option?

Several measurement and analysis tools have been proposed during the last few years, but in general they focus on specific aspects of the problem during a specific time in the plant lifecycle and are difficult to apply. Besides the lack of measurement methodology, inherent safety cannot be applied in the same way for existing productive plants as for new facilities during the design stage. Existing equipment and processes impose restrictions on changes towards inherently safer technologies that might be implemented in an operating facility. For instance it is not possible to turn a two-story house into a bungalow without an extremely expensive modification. However, other smaller changes can be implemented to obtain an inherently safer house even if not so safe as the bungalow. Some types of staircases are safer than others, e.g., short high steps are inherently more hazardous than long low steps. Very low single steps are easy to be undetected and cause accidents. Thus the possible solutions could be to avoid single small steps and to use staircases with low and long steps or (as suggested by Kletz) with frequent landings to reduce the distance and height of a possible fall.

Evaluating and Comparing Design Options

The cost of applying inherent safety to existing facilities may require significant financial resources but may also unintentionally cause an increase in risk if it is implemented without a holistic view of the plant. A chemical plant is a complex collection of intricate and interconnected equipment, pipes, vessels, and instruments containing a variety of chemicals. When a modification is made in one part of the plant, other areas will be affected, requiring other changes in other parts of the plant. If the safety impact of this cascade of changes into other areas is not understood during the evaluation of the original change toward an inherently safer plant, the final result could be a less safe plant! A common example is the possible substitution of a hazardous chemical substance, used in small amounts, by another one that is more benign but is required in much larger amounts. In this case it is difficult to evaluate which chemical is actually the inherently safer option, because aspects such as transportation, storage, and modification of the plant to work with the new chemical must be included in the evaluation. There must be a systematic assessment and minimization of all hazards together rather than one at a time to avoid the appearance of unidentified hazards. Application of inherent safety principles to operating plants is possible (Hendershot, 1997) but implementation is subject to constraints dictated by technical and economic factors.

The implementation of inherent safety for new plants is simpler and cheaper because the design exists only on paper since nothing has been built yet. However, since many inherently safer options may be available and because a systematic analytical methodology is not available, application of the inherent safety principles is still restricted. Also, inherent safety is not absolute, it is site and plant specific. For instance a two-story house may be safer than a bungalow when located in an area threatened by frequent flooding. Therefore, a solution that can be inherently safer for one plant may not be the best option for the same plant in another location with a different environment.

The application of inherent safety requires subjective judgment and tradeoffs among several factors. Furthermore, the selection and use of inherently safer technology does not guarantee by itself that a plant will result in safer operation among its complex and interrelated systems. For instance, a sick person with lung, heart, and digestive problems can take the best medicine for each sickness, however the interaction of those drugs may have catastrophic results rather than a positive therapeutic effect.

The objective of inherent safety is to remove or reduce hazards. The inherently safest case is the one with zero hazards, but this is a limiting and unachievable case. Everyday life is plagued with hazards that are intrinsic to our society. Removing all the hazards is not possible. The situation of a chemical plant is very similar, and therefore we can only aspire to design inherently safer plants. It will be necessary to apply other methods to control the remaining hazards. Therefore, it is still possible for incidents to occur but their consequences are reduced.

It may also be true that it is really not possible to judge which of two options is inherently safer. For instance solvent A is toxic but not flammable, solvent B is flammable but not toxic. There may be no "right" answer. Also, the answer may depend on one's point of view. A plant can use chlorine from 1-ton cylinders or from a 90-ton rail car. To the operator who has to connect and disconnect cylinders several times a day the rail car is inherently safer. To a neighbor several miles away the cylinders are safer, they do not contain enough material to affect him.

When new knowledge about chemical hazards or new technology is available, our understanding of the inherent safety of a specific plant can change. An example of this change is the adoption of CFC refrigerant gases (Hendershot, 1995) that are not flammable or toxic compared with ammonia, which was previously used. It has been theorized (and widely accepted) that they destroy the earth's ozone layer and our judgment of the inherent safety of CFC refrigerants relative to other materials are radically changed. Inherent safety is therefore a dynamic, subjective, and holistic concept that requires specific measurement and analytical tools to evaluate. However, these tools are under development and at present are not available for general use. Without these analytical tools it is very difficult if not impossible to impose restrictions, limits, and regulations to improve inherent safety.

Inherent Safety can also be misused when decisions are subjective and based on limited aspects without possibility of a methodical analysis. For instance, a plant requiring a specific raw material transported by rail can decide to improve the degree of inherent safety by reducing the inventory of that hazardous chemical. Changing the mode of transportation to truck results in a smaller shipment (and a smaller inventory) but it also triples the shipment frequency. Thus the total plant inventory is kept low but the remainder of the inventory is on wheels traveling from the supplier's plant to the user's plant. This example also shows an inherent safety complication that extends outside the plant boundaries and represents an incorrect application of inherent safety that cannot be detected without a measuring tool and without analyzing the plant as a global system. In this case it is inherently safer to maintain the large inventory inside the plant and, as suggested by Kletz (1998), keep it under control by using good design and operating practices that follow other concepts of inherent safety (e.g., keep the design simple to avoid errors).

Progress to Date

We believe that many chemical plants have adopted the easiest and most obvious improvements, such as reviewing chemical inventories and reducing them when it is practical. This improvement is a natural outcome of the Process Hazard Analysis that has been required of most major facilities for the last 10 years.

Less hazardous solvents have been developed and are in use in some processes (Crowl, 1996). Plants using hydrofluoric acid can now use an additive that reduces the dispersion of this chemical during a release. These developments however, required substantial time and cost to develop, test,

and implement. Many significant advances are possible but they too will require research, development, and implementation over a long time period. As shown above, the development of methods to measure the inherent safety of various process options is an essential first step to the widespread implementation of inherently safer designs. The Mary Kay O'Connor Process Safety Center is currently developing a method to measure inherent safety using fuzzy logic mathematics.

Moving Forward

Regulation to improve inherent safety faces several difficulties. One, there is not presently a way to measure inherent safety. Two, the complexity of process plants essentially prevents any prescriptive rules that would be widely applicable. At most it would seem that legislation could explicitly require facilities to evaluate inherently safer design options as part of their process hazard analysis, but inherent safety would be almost impossible to enforce beyond evaluation because of unavoidable technical and economic issues.

Government programs now support the research and development of concepts such as "green chemistry", "solvent substitution", "waste reduction" and "sustainable growth", which are related to inherent safety. A similar approach involving industry, government, and academia can enhance the discovery, development, and implementation of inherently safer chemical processes.

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TESTIMONY
OF
THE NATIONAL ASSOCIATION OF CHEMICAL DISTRIBUTORS

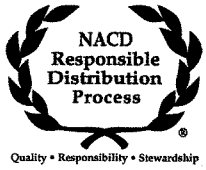
BEFORE THE

SENATE ENVIRONMENT AND PUBLIC WORKS COMMITTEE

ON

"INHERENTLY SAFER TECHNOLOGIES"

JUNE 21, 2006



Introduction

The National Association of Chemical Distributors (NACD) is an international trade association headquartered in Arlington, Virginia with more than 250 chemical distribution companies in the United States and Canada. These companies represent between 80% and 90% of the chemical distribution facilities in the nation and more than 90% of the industry's gross revenue. NACD member companies have established themselves as leaders in health, safety, security, and environmental performance through implementation of the Responsible Distribution Process℠ (RDP), established in 1991 as a condition of membership in NACD. RDP is a third-party verified management practice.

"Inherently Safer Technologies" and Chemical Distribution

We all share the ultimate goal of manufacturing, storing, handling, distributing and utilizing chemicals as safely as we reasonably can. Members of NACD certainly promote this goal through adherence with the Responsible Distribution Process℠ (RDP), which includes 12 Codes of Management Practice, including commitments to address risk management; compliance review and training; handling and storage, including site and transportation security; and product stewardship. A copy of the RDP Guiding Principles and Code of Management Practice is attached to the end of this testimony as an appendix.

The strongest incentive already exists for this industry to utilize the safest materials and processes possible in its operations—the fact that many of our employees and their families live, work, worship and play in the communities in which their chemical employment is based. Government oversight efforts include the Environmental Protection Agency's Risk Management Program and the Occupational Safety and Health Administration's Process Safety Management requirements, which already effectively govern how facilities manufacture, store, process, and otherwise use their chemicals in the safest manner possible to reduce the risk to employees, the environment, and their local communities. Market-based incentives include the ever-present goal of companies to avoid costly incidents and to minimize potential consequences of such incidents, and the desire of companies to do what is in the best interest of their employees, their communities, and their business reputations.

A government mandate to use "inherently safer technologies" without a thorough examination of the costs, benefits, potential public health effects, and unintended product substitution consequences would be a mistake. This nation has already experienced a similar situation with the requirement to use MTBE in gasoline. When this mandate was adopted, the consequences that arose were not anticipated earlier. As a result, today groundwater is contaminated, some watersheds in the country are severely damaged, gasoline availability is constrained, and lawsuits are consuming resources that would be more effectively used for other purposes. Lessons should be learned from this experience to thoroughly examine and study all possible consequences, including economic and public health benefits and risks of product substitutions.

A government mandate to adopt "inherently safer technologies" will not eliminate risk. The risk will still exist and will simply move to different stages in the process. Chemistry cannot be reinvented, and the molecules required to manufacture many necessary products will still exist at some point in the process.

Although product substitution in some cases is feasible and desirable, blanket mandates to do so are a poor policy choice. For example, while chlorine substitution may seem sensible in some cases, chlorine also demonstrates how a legislative "one size fits all" "inherently safer technologies" approach is likely to be counterproductive. Elemental chlorine is frequently used as a disinfectant at water and wastewater treatment facilities. A number of these facilities have switched or are considering switching from elemental chlorine to sodium hypochlorite solutions (a more concentrated version of laundry bleach). This requires a capitol investment in storage tanks and pumps. In addition, issues of stability and quality need to be addressed individually by each of these sites.

It takes between six to seven tank trucks of sodium hypochlorite solution to supply the same disinfecting power as one cargo tank of elemental chlorine. Therefore, switching from elemental chlorine to sodium hypochlorite increases the highway traffic by a factor more than six-fold. The increased use of sodium hypochlorite simply transfers the risk from end-user sites such as water treatment facilities to bleach production sites that use elemental chlorine to manufacture the bleach and to the trucks on the highways. The bleach manufacturing sites may be in the same areas as the water treatment plants. Therefore, all that is accomplished is to increase by nearly seven-fold the number of truck shipments to the water treatment plants. The end-user sites have a different risk, but the population may have an increased overall risk due to the additional truck shipments on the roads.

In addition, the accidental mixing of numerous other water and wastewater treatment chemicals with sodium hypochlorite solutions (i.e alum, ferric and ferrous chlorides and hydrochloric, phosphoric and sulfuric acids) can release chlorine gas from the sodium hypochlorite. Ammonia hydroxide solutions also react hazardously with this chemical. Therefore, risk reduction and counter measures are still necessary after the switching from elemental chlorine to sodium hypochlorite.

NACD members who have undergone U.S. Department of Homeland Security (DHS) security audits report that DHS has expressed concern about tank trucks on the roads. It is much more feasible to harden the security at a fixed facility than to secure numerous trucks on the road. Requiring substitution of certain raw materials for other raw materials perceived as "inherently safer" could require greater volumes to accomplish desired chemical outcomes. This, in turn, could easily result in more chemicals being transported on the roads, which could increase the overall risk of safety incidents as well as opportunities for terrorist incidents.

Chemical distributors must meet the needs of customers, who make purchasing decisions based on factors such as the laws of chemistry, cost, availability, functionality, and safety. In many cases, customers would have to expend significant resources to switch to different products. In many cases, no alternative substances exist that will serve the necessary purpose. Chemical distributors are not the final arbiters of what materials customers want and need; however, through practices adopted as part of the Responsible Distribution Process℠, NACD members assist customers in safely handling chemicals. This debate is focused on chemicals, but there are many other risks. The overall focus should be how products are stored and used, as well as making that storage and handling as safe as reasonably possible, not so much the product itself. To do otherwise would result in the proverbial "concrete airplane," which would be incredibly strong and safe, but would aerodynamically never be able to leave the ground, therefore never achieving its intended purpose.

The economic impacts of mandated use of ISTs must also be considered. Required product substitutions would impact many different industries ranging from pharmaceuticals to auto parts and supplies to water treatment and many more necessary and vital sectors of the economy. In a time of record high energy costs and trade deficits, the potential impacts on U.S. consumers, exports, and global competitiveness must be taken into account.

Conclusion

In conclusion, NACD appreciates the opportunity to provide testimony to the committee on this important issue. In the absence of a clear definition of the concept of "inherently safer technologies" and the difficulties in determining whether or not required measures would in fact reduce overall long term risk, NACD strongly recommends that Congress not impose its judgment about which product to utilize for a given task without more data that supports reasonable cost benefit and safety benchmarks.

Additional Details on the NACD Membership

NACD member companies process, formulate, blend, re-package, warehouse, transport, and market chemical products for an industrial customer base of approximately 750,000. Approximately $18 billion of U.S. chemical industry sales are through chemical distributors, who are also actively engaged in various phases of import/export trade. Chemical distributors' industrial customers use these materials to produce such everyday items as computers, detergents, cosmetics and toiletries, food flavorings, perfumes, automobile parts, water purifiers, fiberglass, plastics, pharmaceuticals, paints and coatings, and many other products.

To become a member of NACD, chemical distribution companies must take title to product and adhere to management practices related to health, safety, security, and the environment outlined in the Association's industry practice known as the Responsible Distribution Process℠ (RDP).

Before a company is admitted as a member, it must first be approved by successfully completing an independent, third-party verification of its written policies and procedures under RDP. To ensure continued compliance with RDP, every member must undergo an on-site verification by an independent third-party verifier once every three years. This mandatory practice has been in place since 1998, and members will begin their third on-site verification cycle later this year. NACD's Responsible Distribution Process℠ is the most comprehensive and rigorous industry practice of any in the chemical industry, primarily because of its requirement for independent third-party verification of health, safety, security, and environmental practices. Continued compliance with RDP is a condition of membership in NACD.

Although chemical distribution is a sector of the chemical industry, distribution facilities differ in numerous ways from chemical manufacturing facilities. One notable example is the low levels of release of toxic emissions from everyday operations. According to data compiled each year by the Environmental Protection Agency (EPA), chemical distribution is a minor source of environmental releases. Of all industrial sectors required to submit annual Toxic Release Inventory (TRI) reports, including the chemical industry, chemical distribution is by far the lowest emitter of toxic emissions. The average yearly release per distribution facility is just over 3,000 pounds over a 12-month period, whereas the average emissions of all TRI facilities is 179,000 pounds. While the

possibility of chemical releases exists at chemical distribution facilities, it is minimized because of several factors, not the least of which is adherence to the industry's environmental, health, safety, and security practice – the Responsible Distribution Process℠ – among NACD members.

Appendix A
NACD Testimony
Senate EPW 6-21-06

National Association of Chemical Distributors
The Responsible Distribution Process[SM]

Guiding Principles

As a member of the National Association of Chemical Distributors, this company is committed to continuous improvement in the chemical distribution industry's responsible management of chemicals. We pledge to manage our business according to these principles.

1. To recognize and respond to community concerns about chemicals, their handling, and transportation.

2. To make health, safety, security, and environmental considerations a priority in our planning for all existing and new operations, products, processes, and facilities.

3. To inform emergency response officials, employees, customers, and the public of manufacturer's information on chemical-related health or environmental hazards, and the manufacturer's recommendations on protective measures.

4. To work with customers, in accordance with manufacturer's recommendations, on product stewardship including handling, use, transportation, and disposal of chemical products.

5. To operate our plants and facilities in a manner that protects the health and safety of our employees, the public and the environment.

6. To cooperate in resolving problems created by past handling and disposal of hazardous chemicals.

7. To participate with government and others in creating responsible laws, regulations, and practices to help safeguard the community, workplace, and environment.

8. To promote the principles and practices of Responsible Distribution Process[SM] by sharing experiences and offering assistance to others who produce, handle, use, transport, or dispose of chemicals.

National Association of Chemical Distributors
The Responsible Distribution Process[SM]

Code of Management Practice

Each member company shall have an active program designed to continuously improve safety and reduce incidents. This Code does not impose upon member companies any obligation to guarantee compliance by third parties, i.e., parties over whom the member companies have no control. This program shall include:

I. Risk Management

A. Senior management commitment, through policy, communications, and resources, to on-going improvements in chemical distribution safety.

B. Regular review with suppliers of the hazards of materials.

C. Identification and implementation of risk reduction measures.

II. Compliance Review and Training

A. A process for monitoring regulations and industry practices for their application to chemical distribution activities.

B. A process for implementing applicable regulations and industry practices that apply to chemical distribution activities.

C. Training for all employees in the implementation of applicable regulations, as well as member company's specific requirements.

D. A process for review of employee compliance with applicable regulations and member company's specific requirements and review of outside contractor and re-seller compliance with member company's specific requirements.

III. Carrier Selection

A. A process for selecting carriers to transport chemicals that includes carrier safety and fitness, security, regulatory compliance, and performance review.

IV. Handling and Storage

A. Procedures for ensuring that containers are appropriate for the chemical being shipped, comply with regulatory requirements, and are free from leaks and visible defects.

B. Criteria for the cleaning and re-use of transportation equipment and chemical containers, and the proper disposal of cleaning residues.

C. Procedures for loading and unloading chemicals at the member company's facilities that result in protection of personnel, a reduction in emissions to the environment, and an increased awareness of hazards from inadvertent mixing of incompatible chemicals.

D. A process for providing manufacturer guidance and information to customers, warehouses, terminals and/or carriers on procedures for loading, unloading, and/or storing chemicals; and a process to increase awareness of hazards from inadvertent mixing of incompatible chemicals.

E. A process for selecting owned and contracted facilities and sites for chemical storage or handling that emphasizes safety, fitness and includes reviews.

F. Documentation of current operating procedures for handling and storing chemicals.

G. Facility design, construction, maintenance, inspection, and security practices that promote facility integrity, consistent with recognized codes and regulations

H. Develop a process for addressing chemical site and chemical transportation security, to include conducting a security vulnerability assessment.

I. Provisions for control of processes and equipment during emergencies resulting from natural events, utility disruptions, and other external conditions.

J. Procedures to properly label and mark packages and containers.

V. Job Procedures and Training

A. Identification of the skills and knowledge necessary to perform each job.

B. Establishment of procedures and work practices for safe operating and maintenance activities.

C. Training for all personnel to reach and maintain proficiency in safe work practices and the skills and knowledge necessary to perform their job, including confirmation of competence.

D. Programs designed to assure that personnel in safety critical jobs are fit for duty and are not compromised by external influences, including alcohol and drug abuse.

E. Outside Contractors: In areas where hazardous materials are present, members shall have a process in place to inform contractors of the known hazards and the emergency action plan.

VI. Waste Management and Conservation Practices

A. Procedures to ensure that all self-generated waste and empty containers are disposed of in a responsible manner, and in accordance with existing regulations.

B. A clear commitment by senior management through policy communications, resources, and programs to ongoing waste reductions and pollution prevention at each member facility.

C. A commitment to institute resource conservation measures.

VII. Emergency Response and Public Preparedness

A. A process for responding to, reporting on, and investigating chemical distribution incidents and releases involving the member company's chemicals, and implementation of appropriate preventive measures developed from that investigative process.

B. A system of internal investigation, reporting, appropriate corrective action, and follow-up for each incident and/or near miss that result or could have resulted in chemical incidents or releases.

C. Procedures for making emergency response information concerning the member company's chemicals available to response agencies.

D. Communication with state and/or local emergency planning commissions and response organizations on the potential hazards of the member company's chemicals.

E. Annual review, testing, and assessment of the operability of the member company's written emergency action and fire prevention plan and/or emergency response plan.

F. Facility tours for first responders to promote emergency preparedness and to provide current knowledge of facility operations.

G. Coordination of the written facility emergency response plan with the local emergency response team and other facilities. If no community plan exists, the facility should assist with efforts to create one.

H. Participation in the Local Emergency Planning Committee's process to develop and periodically test the local emergency response plan.

VIII. Community Outreach

A. Interaction with organizations, associations, government officials and/or the public on behalf of NACD's Responsible Distribution Process[SM].

B. Information and updates for employees on the Responsible Distribution Process[SM] to encourage key employees to become involved in community outreach efforts.

C. Advocacy of responsible public policies and regulations for chemical distribution.

IX. Product Stewardship

Customers

A. A process to qualify customers as prescribed by governmental regulation.

B. Member companies should work with customers to foster appropriate dissemination of information on the proper use, handling and disposal of products commensurate with product risk. A member may decide to cease doing business with customers whose practices are clearly inconsistent with the Responsible Distribution Process[SM].

X. Internal RDP Audits

A. Member companies shall establish documented procedures for regularly scheduled **INTERNAL AUDITS** to verify the implementation of policies and procedures supporting the RDP Code of Management Practice. The audits will be used to evaluate the effectiveness of the policies and procedures. Internal Audits shall be done on a yearly basis beginning with successful completion of the Interim Verification Process.

B. Audits shall be recorded and results brought to the attention of appropriate management personnel who must take timely corrective or preventive action. Annual audit results should be retained until the next Third-party On-Site Verification is completed.

XI. RDP Corrective and Preventive Action

A. Member companies shall establish a **CORRECTIVE AND PREVENTIVE ACTION** system for RDP related issues. This system should permit the identification and communication of inadequacies or improvements in each member company's implementation of RDP.

B. Member companies shall establish and maintain procedures for implementing corrective action and preventive actions arising from internal and external audits or other sources. Any corrective or preventive action taken to resolve the cause or RDP implementation inadequacy shall be appropriate, as determined by member company management, to the magnitude of the cause or inadequacy and commensurate with the risk involved.

XII. RDP Document and Data Control

A. Member companies shall establish and maintain a documented system to control all policies and procedures supporting RDP. In addition, member companies shall maintain a documented system to control the documents and data relating to RDP itself as issued by the National Association of Chemical Distributors (NACD).

B. Data includes any of the above that is electronically stored and utilized.

C. These documented procedures shall include provisions for review and approval of any new or revised policies and procedures by the authorized personnel within the member company.

D. A master list or functionally equivalent document control system identifying the current version of each document shall be established and be readily available to preclude the use of invalid and/or obsolete documents. The system shall ensure that:

Changes to documents and data shall be reviewed and approved by the same function/organization that performed the original review and approval, unless specifically designated otherwise. These functions/organizations shall have access to pertinent background information upon which to base their review and approval. Where practical, the nature of the change shall be identified in the document or appropriate attachments.

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RUST-OLEUM CORPORATION

June 21, 2006

The Honorable James M. Inhofe
Chairman
Senate Committee on Environment and Public Works
410 Dirksen Senate Office Building
Washington, DC 20510

Dear Chairman Inhofe:

As a manufacturer and employer in the state of Oklahoma, Rust-Oleum is writing to express its appreciation for your long-time support relative to the issue of Inherently Safer Technology (IST). As you are aware, the Senate Homeland Security and Governmental Affairs Committee completed its consideration of S. 2145, the Chemical Facility Anti-Terrorism Act of 2005, on June 15. Rust-Oleum remains opposed to the IST considerations which are included in the text of the legislation. We thank you for convening a hearing today to address this important issue and wish to express our views relative to the potential impact of an IST mandate on our business.

Created in 1921, Rust-Oleum Corporation is a worldwide leader in protective paints and coatings for both home and industry. Besides our famous rust-fighting paints, our products range from decorative American Accents® paints to durable industrial roof repair coatings. After 75 years, our founder's spirit of innovation, determination and commitment to quality lives on at Rust-Oleum.

As noted above, we strongly oppose the enactment of any provision which mandates the implementation of IST or that requires facilities to undertake a review of alternative substances and processes. Facility owners and operators work diligently every day to ensure the safety of their employees and operations. These individuals have the expertise and experience necessary to make sensitive decisions about substitutions and changes, which can significantly alter a product's performance. Government bureaucrats and regulators do not have the requisite experience or in-depth perspective of the company's products and markets to make these critical determinations. Most importantly, government-mandated changes and substitutions can yield adverse results and thereby leave companies vulnerable to significant liability.

It is also important to note that IST mandates and requirements would impact a far greater number of companies in the United States than most lawmakers would expect. These requirements would extend beyond the parameters of the traditional chemical industry and levy additional cost on thousands of other facilities and businesses. Rust-Oleum is not a chemical manufacturer; instead we purchase chemicals from outside suppliers and use them in our products. Yet, downstream blenders such as Rust-Oleum would also be required to significantly alter their processes and operations under many of the current proposals.

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RUST-OLEUM CORPORATION

Chairman, Rust-Oleum is already pursuing alternative options to increase the safety of its facilities and to improve its products. As an example, we cite Rust-Oleum's new Sierra Performance Coatings which have been introduced as the only high performance industrial and commercial coatings with zero volatile organic compounds (VOC). Sierra's coatings are also free of hazardous air pollutants (HAPs) and solvents, are non-flammable, and have no odour when applied. We have worked diligently to create these new products, which exceed the most stringent federal and state environmental VOC regulations, and our proud to offer them to our customers.

Chairman, we thank you for your consideration of our views on IST and for your staunch support of the manufacturers and employers in your state.

Please do not hesitate to contact us with any questions or concerns.

Sincerely,

Todd Bowen

Manager
Rust-Oleum Corporation
Tulsa, OK Facility

cc: Senate Environment & Public Works Committee
MaryAnne Dunlap – Professional Staff Member

SOCMA
SYNTHETIC ORGANIC CHEMICAL MANUFACTURERS ASSOCIATION

Testimony
of
the
Synthetic Organic Chemical Manufacturers Association

Submitted to the

Senate Committee on
Environment & Public Works

On

"Inherently Safer Technology"

Prepared by
James Cooper

June 21, 2006

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I. Introductory Comments

SOCMA appreciates the opportunity to submit this testimony regarding the engineering concept of inherently safer technology, or IST. Our goal is to describe the unique nature of the batch and specialty chemical manufacturing sector of the U.S. chemical industry and share with you how specialty chemical manufacturers use the principles of IST, pollution prevention (P2) and risk management when making business decisions.

SOCMA is the leading trade association representing specialty and batch chemical producers. Approximately 90 percent of SOCMA's members are small businesses, according to SBA definitions. While commodity chemicals make up most of the production volume in the global marketplace, specialty chemicals make up most of the diversity (the number of different chemicals) in commerce. As a condition of membership to SOCMA, chemical companies must subscribe to our environmental and security management system, called ChemStewards®. This self-imposed program requires companies to develop systematic approaches to environmental and chemical risk management.

SOCMA will focus its remarks today on five specific areas. First, this testimony will explain the nature of batch manufacturing and specialty chemistry. Second, the testimony will make the case that the concepts and principles associated with Inherently Safer Technology (IST) and Pollution Prevention (P2) are essentially the same. Third, the testimony will provide information on how SOCMA members use the concepts of IST and P2 when making business decisions. Fourth, the testimony will discuss the general nature of physics and chemistry and how it impacts our implementation of IST and P2. And finally, the testimony will explain SOCMA's perspective on why IST is an environmental and safety approach and not a panacea for security.

II. The Unique Nature and Role of the Batch and Specialty Chemical Manufacturing Sector

Specialty chemicals are essential ingredients and building blocks for the manufacture of almost everything made in the United States. Specialty chemicals perform very specific functions, based largely on their molecular structures, which give them unique physical and chemical properties. Without these substances, nylon would not be strong enough to use for seatbelts, medicine would revert back to what it was in the 1800s, and our armed forces would not have the equipment and supplies necessary to defend our country.

Because of their complex chemistries and narrowly focused applications, specialty chemicals are typically produced batch-by-batch in reaction vessels. Batch processes are very different from the 24 hours a day, 7 days a week continuous operations that produce commodity chemicals. Since continuous processes employ continuous feeds and yields, the production volume is usually far greater than for batch processes. The main difference, however, is that a batch process, which incorporates the chemical reaction (and yields the desired product), has a distinct beginning and end for each batch. As a result, the products that are stored onsite also change on a continual basis.

In addition to differences in processing and variable production schedules, another distinct feature among specialty chemical producers is the variability of risk at production and storage sites. Batch producers are necessarily flexible and they can make many different products during any given production year. Their business is driven by customer demand, and many chemicals are made on short notice. As a result, the types and quantities of chemicals onsite at a batch manufacturing facility often change from week to week or even day to day, leading to similarly frequent changes in the risk profile of the facility. This ever-changing risk profile can be a challenge for risk managers, but it also provides opportunities to continually review the chemistries for novel and safer approaches. Conveniently, it also makes it that much harder for a potential terrorist to

know what chemicals are on site and in what quantities at any one time. The inherent variability of batch manufacturing can actually make these sites less attractive as a target of terrorists.

III. The Concepts and Principles of IST and P2

Inherently safer technology is a chemical engineering philosophy that was launched by the industry in the late 70's. Its goal is to use traditional engineering, chemistry and other scientific concepts to reduce the risks associated with chemical processing. Risk and safety are often used in the same context, but the two actually have an inverse relationship: as risk is reduced, safety is increased. Since its inception, IST has been ingrained as a normal part of the engineering discipline in the chemical industry.

Pollution Prevention is a general philosophy that is broader in scope than IST and also got its start in the late 70's, when scientists and policy analysts in the U.S. and Europe saw the economic benefits of reducing pollution earlier in a chemical's life cycle, and not focusing only on disposal. P2 uses traditional engineering, chemistry and other scientific concepts to reduce the risks associated with the use of chemicals. While P2 may appear ill-defined, the principles upon which its concepts are founded are common throughout most environmental management system approaches.

The philosophies behind IST, P2 and most other environmental management systems are very similar. Each calls for systematically using engineering, chemistry and other scientific concepts to achieve the same ultimate goal of risk reduction. The main difference between IST and P2 is the scope of activities each is intended to cover. IST is mainly focused on chemical processing. P2, on the other hand, is very broad in scope and intended to go beyond chemical manufacturing and be applied to downstream uses of chemicals as well. If the scope of P2 was limited to chemical processing, it would very closely resemble the IST approach to risk reduction. The language may be different, but the principles and concepts are essentially the same.

IV. Using IST and P2 to Make Business Decisions

One of the fundamental principles in economics is understanding the main goal of business: to maximize profits. It is the primary principle from which most economic theory is derived. The U.S. chemicals business is very competitive with a large number of market players, which makes it prohibitively difficult to increase profits by raising prices. Therefore, the most feasible way to maximize profits in the U.S. chemical markets is by minimizing costs.

The main goal of IST is to reduce risks to health and the environment, similar to the goals of P2 and risk management in general. The idea is to tie risk reduction to lower operating costs, which is fairly straighforward in the chemical industry. The costs associated with handling materials classified as hazardous have increased substantially over the past 20 years. The economic incentives for reducing the use of hazardous chemicals include reduced likelihood of accidents among laboratory and processing workers, cheaper transportation and disposal costs, discounted insurance rates and fewer regulatory requirements. Obviously, it is in a chemical company's best financial interest to handle less hazardous substances; it helps reduce costs, which helps maximize profits. The concept of risk reduction, practiced through IST, P2 and other environmental management systems, is an important feature of the business model employed by chemical producers. The same principle applies for those who use, store or distribute chemicals, so in many ways IST is built into the chemical supply chain.

In commercial chemistry, costs are minimized by getting the best yield from raw materials, reducing the amount of waste from a particular reaction and by not having to pay additional costs associated with the handling of substances classified as hazardous. IST and P2 are employed from the very beginning, during R&D, when scientists study a particular chemical reaction, or series of reactions, to determine the best ways to maximize the yield. The scientists look at all raw materials, as well as the resulting products, including unintentional by-products and potential waste streams.

The next phase in R&D is typically the pilot phase, which attempts to replicate the bench-scale results at a slightly larger scale. The process (i.e., chemical reaction and necessary equipment) is again reviewed in detail and tweaked accordingly. The R&D phase may continue and include trial usage at the customer's site, to check product performance, ensure that the product can be used safely and make sure that there are no unaccounted risks. IST and P2 do not stop at the R&D phase, however. This approach is also applied when full-scale production begins, to double-check findings from earlier studies. If changes are made at some point in the future, the review process is conducted all over again to see what impacts the changes will make.

IST and P2 approaches are based on fundamental, long-standing engineering and chemistry principles. The concepts associated with IST and P2 work because they identify opportunities to maximize yields, reduce wastes and reduce risk, which, in turn, reduces cost and maximizes profit—the most powerful driver in business. Even if the conditions in the market place change, such as new regulations or restrictions, the fundamental driver for business decision-making will continue to be the maximization of profit. IST and P2 use fundamental engineering and chemistry principles that fit well into the chemicals business model.

V. Chemistry, IST and the Laws of Physics

Despite their fundamental importance, IST and P2 are two of the most misunderstood concepts in commercial chemistry. While it seems self-explanatory, the terms as used in chemistry and engineering may be misleading to non-scientists. Many non-scientists have been led to believe that the only way to ensure safe chemical manufacturing or achieve pollution prevention is by reducing the amount of hazardous substances used in chemical manufacturing and processing. Application of IST and P2, however, follow basic, scientific principles and are bound by the laws of physics; a simple reduction in the use of hazardous chemicals is rarely possible within the confines of a particular chemical reaction or process. When such reductions are possible, they often result in the transfer of risk to other points in a chemical process or the supply chain, without actually

reducing it. To place the current IST and P2 debate in context, this discussion will begin with an illustration of the limitations of substitution in the field of chemistry, then move to an explanation of why reducing a hazard in a process does not necessarily reduce the overall risk.

Like IST and P2, chemistry is also bound by the laws of physics. These physical laws place restrictions on what can and cannot be done when trying to make a chemical. For instance, a molecule (i.e., a chemical) is made up of atoms (e.g., sodium, carbon, chlorine, etc.) that are in specific locations or positions on the molecule. In organic chemistry, the goal is to take the atoms from one molecule and move them to locations on another, different molecule so that the target molecule takes on a specific function or behavior.

The laws of physics dictate if, how and when those atoms can be moved. To achieve certain critical structural changes, reactive chemicals must be used, and many are by their very nature hazardous, e.g., toxic, flammable, etc. In light of these constraints, scientists seeking to achieve certain chemical changes are often left with few alternatives. Where hazardous chemicals are used, they are highly regulated by EPA, OSHA, DOT and others, and appropriately managed by chemists in universities, government and industry. The fact of the matter is that scientists usually cannot produce the materials that make our standard of living possible without using very specific chemicals. Making medicine is a good example.

Often, it takes multiple steps to make medicine. Each step in the process carefully moves atoms from one molecule to locations on another molecule. Eventually, the scientist will obtain the desired chemical that performs a precise medicinal function. The movement of these atoms, from one molecule to another, is a chemical reaction and can only take place using certain materials. The chlorine atom, for instance, when it is located on a specific part of a molecule, allows these steps to take place. One common misconception, though, is that any chlorine atom will do. That is not the case. Chlorine

atoms take on different behaviors, or physical properties, depending on the atoms to which they are attached.

Table salt consists of the sodium (Na) and chlorine (Cl) atoms, which make up the chemical sodium chloride (NaCl). The chlorine atom used to make medicine, on the other hand, often comes from phosgene ($COCl_2$) or phosphorous trichloride (PCl_3). Phosgene, for example, has one carbon atom bonded to one oxygen atom and two chlorine atoms, giving the chlorine atoms very specific characteristics. The sodium atom that is attached to the chlorine atom in table salt, however, gives the chlorine a different nature. The very specific nature of the chlorine atom in phosgene is critical to its fundamental role in pharmaceutical manufacturing and minimizes the formation of potentially toxic by-products that would otherwise contaminate the medicine. By contrast, to use the chlorine in table salt in the drug manufacturing process would require the application of electrical energy to the salt, resulting in the formation of chlorine gas, which is corrosive and poisonous by inhalation. At that point, it is no longer table salt; it has been converted into a compound (chlorine) with similar hazards to the phosgene and achieving that conversion required the introduction of additional risks. The complex chemistry associated with making medicine has well-defined physical boundaries and requires the use of reactive chemicals. That is why, generally, medicine is not made from table salt.

IST is a conceptual and often complex framework that covers procedures, equipment, protection and, when feasible, the use of less hazardous chemicals. Its premise is that if a particular *hazard* can be reduced, the *overall risk* associated with a chemical process will also be reduced. In its simplicity, it is an elegant concept; however, reality is not always that simple. A reduction in hazard will reduce overall risk if, and only if, that hazard is not displaced to another time or location, or does not magnify another hazard. If the hazard is displaced, then the risk will be transferred or increased, not reduced. Here are several examples of how seemingly simple reductions in hazard may affect overall risk:

Reducing the amount of a chemical stored on site

A manufacturing plant is considering a reduction in the volume of a particular chemical stored on site. The chemical is used to manufacture a hazardous precursor to a critical nylon additive, which is sold to another company and used to make seat belts stronger. Because it is a critical component for nylon strength, and seatbelt production cannot be disrupted, the production schedule cannot change. If the amount stored on site is reduced, the only way to maintain the production schedule is to increase the number of shipments to the site. This leads to more deliveries (an increase in transportation risk), more transfers of chemical from one container to another (an increase in transfer risk) and, since there is now a greater chance that production could be disrupted by a late shipment, there is an increase in economic risk. This analysis only accounts for the risk to the manufacturer and does not include the risk to the customer making the seat belts or those using seat belts.

Substituting Sodium Hypochlorite for Chlorine

Some people point to the Blue Plains water treatment plant in Washington, DC, as a prime example of how easy it is to substitute sodium hypochlorite solution for chlorine gas as a wastewater disinfectant. Unfortunately, several important facts are usually missing from these explanations. First, the conversion was not an overnight process; in fact, the substitution began prior to September 11 and included costly retrofitting to the plant to accommodate the substitution. Second, the District of Columbia is in a different situation financially than other municipalities, in that it often receives federal funding to make such expensive changes possible. Also, it takes a large amount of sodium hypochlorite to achieve the same sanitizing effects as chlorine. But the most important fact that is missing from this story is that it takes chlorine to make sodium hypochlorite. The facilities producing the hypochlorite must now use and store vast quantities of chlorine in very few locations to keep up with the increased demand. There are only a handful of sodium

> hypochlorite producers in the United States, which means that more and more chlorine will have to be concentrated in a few locations to keep up with demand. The ultimate result of this is a huge increase in risk at chemical facilities that produce hypochlorite and, since water treatment plants typically use 1-ton cylinders, a somewhat modest reduction in overall risk.

In science, risk is dependent on the circumstances and surroundings of a hazard. A simple reduction in hazard will not necessarily result in a reduction of overall risk. IST decisions, therefore, are and should be based on overall risk, not simply on inherent hazards.

VI. IST: An Environmental and Safety Concept

As noted earlier, the philosophical movement of IST was born in the chemical industry during the late 70's and is routinely practiced by chemical engineers. It can be argued that this approach, along with the concept of P2, led to the establishment of environmental management systems, which provide a systematic way to manage environmental, health and safety risks. At no time during the evolution of IST were the founders thinking about applications in chemical site security. In fact, practitioners of IST, i.e., chemical engineers, to this day consider IST an environmental, health and safety approach.

Only recently have some people sought to connect the concept of IST to security; and, those proponents are typically not engineers, nor are they practitioners of IST. In fact, most do not have the technical background to fully grasp the concepts and principles that make up IST.

To SOCMA's knowledge, only one study has been conducted to try connect the concept of IST to security. In April of this year, the Center for American Progress published a report, *Preventing Toxic Terrorism, How Some Chemical Facilities are*

Removing Danger to American Communities, which claims that 284 chemical facilities have substituted hazardous materials for less hazardous products. It is easy to misinterpret this report. Just the title alone is misleading, because it uses the term "chemical facilities," when, in fact, approximately 90 percent of the study facilities are related to utilities, not chemical plants. Most of the facilities in the study are related to water treatment (about 75 percent), agriculture (almost 10 percent) and electricity (about 5 percent). Out of the 16 manufacturers that responded, only 6 were in the chemical or allied products industries. Most of those 6 make formulations, which are mixtures of chemicals, but those companies do not actually produce the chemicals. The IST methods applied were as follows:

- 3 moved operations or storage to another location
- 1 changed from rail shipments to pipeline distribution
- 1, a chemical wholesaler, provide no explanation of what was done
- Only 1 company actually implemented IST; but, in reality, it was an engineering and process change more than a chemical substitution

This study has little to do with chemistry or chemical manufacturing. It primarily concerns the substitution of products used by water and electricity providers, and farmers, all of which are critical infrastructure.

In most cases presented in the report, chlorine was substituted with sodium hypochlorite solution. As was previously pointed out, it takes chlorine to make hypochlorite bleach; therefore, the few bleach manufacturers will have to have much more chlorine on hand, concentrated in very few places, to keep up with the ever-increasing demand for hypochlorite solution. This not only transfers the risk, but concentrates it and magnifies it—due to more chlorine being needed at the bleach manufacturing sites. Also, commercial grade hypochlorite solutions present very well-known risks as well.

The prefix "hypo" indicates that the compound has as much chlorine as is physically possible and needs a specific substance to prevent the chlorine gas from being released

out of the hypochlorite solution. Hypochlorites by their very nature are unstable compounds, which is why we do not see a dry form of sodium hypochlorite, and will release copious amounts of chlorine gas under easy-to-achieve conditions. I would argue that there are more incidents involving the release of chlorine from hypochlorites than releases from actual chlorine vessels, such as rail cars and cylinders.

The only example in the report of IST being used at an actual chemical facility was the substitution of oleum with sulfur trioxide. Oleum, also known as fuming sulfuric acid, is simply sulfuric acid with an excess of sulfur trioxide added. The sulfur trioxide is the chemical consumed in the process, and is much more dangerous than the sulfuric acid. The company chose to manufacture and consume the sulfur trioxide on-site, rather than having it delivered in concentrated sulfuric acid. This is an excellent example of IST, because the transportation and transfer risks were reduced, and waste was minimized. These changes will probably pay for themselves and reduce overall costs for the company in the long run. In the context of security, however, is there a significant amount of risk reduction? It could be argued that the answer is no. Although oleum releases sulfur trioxide fumes, it does so at a rate that is much slower than a release of pure sulfur trioxide from a pressurized cylinder or rail car. Because of the slow release of sulfur trioxide gas from the oleum, a release would be fairly easy to control compared to a release of liquefied or pressurized sulfur trioxide.

VII. Conclusion

In essence, the concepts and principles that make up IST and P2 are the same. Like P2, IST uses chemistry and engineering principles to enhance safety and reduce risk. As you can tell, because chemistry and engineering must follow the laws of physics, significant risk reduction is very difficult to achieve, without transferring the risk to something—or someone—else.

Congress already created a law to ensure that full consideration is given to the same concepts and principles that make up IST: The Pollution Prevention Act. There are also components of IST built into the EPA's Risk Management Program, under the Clean Air

Act, and the Process Safety Management regulations at OSHA. IST is an environmental, health and safety approach, not a panacea for security.

Scientists support the concept of using inherently safer technologies whenever possible for more than economic reasons. They have a big motivating factor: their own safety. Scientists spend hours each day in laboratories and manufacturing facilities that use and produce chemicals. It is difficult to imagine that any scientist would not want to work under the safest conditions possible.

With all of these economic and safety incentives in place, the question becomes: Why do chemical companies still use hazardous materials? The simple fact is that the laws of physics are a much larger determining factor in selecting process materials than anything else. No federal program mandating IST or P2 will change how these processes are run in any significant way. Instead, such a program would result in government micromanagement of the decision-making process at individual facilities, would impose burdensome paperwork requirements on the regulated community, would duplicate certain key requirements of other federal and state regulatory programs, could slow chemical production activities, and could lead to manufacturers moving production overseas. Forcing implementation of IST and P2 could be quite costly. As the cost of doing business in the U.S. increases, manufacturers will seek opportunities to relocate to lower-cost regions, taking much needed manufacturing jobs with them.

Chairman Inhofe, members of the Committee, thank you for your consideration of SOCMA's perspective on these important issues. SOCMA is happy to answer any questions you may have about this testimony.

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June 21, 2006

The Honorable James M. Inhofe
Chairman
Senate Committee on Environment and Public Works
410 Dirksen Senate Office Building
Washington, DC 20510

Dear Chairman Inhofe:

On behalf of our facility in Sand Springs, Oklahoma, Dryvit Systems, Inc. wishes to convey its views relative to the issue of Inherently Safer Technology (IST). As you know, IST has been the source of much discussion and debate in the Senate over the past few years and has surfaced repeatedly in the negotiations surrounding chemical security legislation. As a downstream blender of chemicals, Dryvit opposes the adoption of any IST mandate or mandated review of alternative substances and processes. A mandate would impose a heavy cost burden on our facilities across the country and could adversely impact the performance and quality of our products.

Founded in 1969, Dryvit is the market leader in developing, manufacturing and marketing innovative Exterior Insulation and Finish Systems (EIFS) building materials and related products to industrial, commercial, institutional and residential markets. Dryvit has provided wall systems to more than 400,000 commercial and residential buildings throughout the world. The company operates four manufacturing plants in the U.S., including one at its headquarters in West Warwick, R.I. and three additional plants in OK, CA and GA. Dryvit is concerned that S. 2145, the Chemical Facility Anti-Terrorism Act of 2005, as reported by the Senate Homeland Security and Governmental Affairs Committee on June 15th contains language which would grant DHS the discretion to impose inherently safer technology requirements. We feel that this is an environmental issue and one which should not be included in a security bill.

As noted above, we strongly oppose the enactment of any provision which mandates the implementation of IST or that requires facilities to undertake a review of alternative substances and processes. Each chemical process is unique and can involve a multitude of factors and materials. Companies need to retain the direct authority to assess these options and to determine the best choice for their business. In addition, manufacturers are constantly striving to improve their products and the safety of their facilities. Consequently, many already consider alternatives and substitutions as part of their internal reviews.

We also wish to address the impact that an IST mandate could have on small and midsized businesses. The majority of Dryvit's facilities in the U.S. have less than 50 employees. The imposition of undue and costly requirements, to the tune of millions of dollars, could adversely impact their ability to compete in the domestic and global markets and could pose a significant risk to their operations in the U.S.

Chairman, we thank you for your long-time support on this critical issue and for your leadership in convening today's hearing. Please do not hesitate to contact us with any questions or concerns.

Sincerely,

Alex Winiecke
Manager
Dryvit Systems, Inc.
Sand Springs, OK Facility

cc: Senate Environment & Public Works Committee
MaryAnne Dunlap – Professional Staff Member

United States Government Accountability Office

GAO

Testimony
Before the Committee on Environment and Public Works, U.S. Senate

For Release on Delivery
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HOMELAND SECURITY

DHS Is Addressing Security at Chemical Facilities, but Additional Authority Is Needed

Statement for the Record by
John B. Stephenson, Director
Natural Resources and Environment

GAO-06-899T

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Highlights

Highlights of GAO-06-899T, testimony before the Senate Committee on Environment and Public Works

June 21, 2006

HOMELAND SECURITY

DHS Is Addressing Security at Chemical Facilities, but Additional Authority Is Needed

Why GAO Did This Study

Terrorist attacks on U.S. chemical facilities could damage public health and the economy. The Department of Homeland Security (DHS) coordinates federal efforts to protect these facilities from attacks.

GAO was asked to provide a statement for the record based on its report *Homeland Security: DHS Is Taking Steps to Enhance Security at Chemical Facilities, but Additional Authority Is Needed* (GAO-06-150, January 27, 2006). GAO reviewed (1) DHS's actions to develop a strategy to protect chemical plants, assist with the industry's security efforts, and coordinate with other federal agencies, (2) industry security initiatives, (3) DHS's authorities and the need for additional security legislation, and (4) stakeholders' views on any requirements to use safer technologies.

What GAO Recommends

GAO's report recommended that (1) the Congress consider giving DHS the authority to require the chemical industry to address plant security, (2) DHS complete its Chemical Sector-Specific Plan in a timely manner, and (3) DHS study, with the Environmental Protection Agency (EPA), the security benefits of using safer technologies. DHS agreed in substance with GAO's first two recommendations but expressed concerns about studying safer technologies. GAO continues to see merit in such a study. EPA had no comments on the report.

www.gao.gov/cgi-bin/getrpt?GAO-06-899T

To view the full product, including the scope and methodology, click on the link above. For more information, contact John Stephenson at (202) 512-3841 or stephensonj@gao.gov.

What GAO Found

DHS is developing a Chemical Sector-Specific Plan, which is intended to, among other things, describe DHS's ongoing efforts and future plans to coordinate with federal, state, and local agencies and the private sector; identify chemical facilities to include in the sector, assess their vulnerabilities, and prioritize them; and develop programs to prevent, deter, mitigate, and recover from attacks on chemical facilities. DHS officials told GAO that they now expect to complete and release the plan in the fall of 2006. In addition, DHS has taken a number of actions to protect the chemical sector from terrorist attacks. DHS identified 3,400 facilities that, if attacked, could pose the greatest hazard to human life and health and has initiated programs to assist the industry and local communities in protecting chemical plants. DHS also coordinates with the Chemical Sector Coordinating Council, an industry-led group that acts as a liaison for the chemical sector, and with EPA and other federal agencies.

The chemical industry is voluntarily addressing plant security, but faces challenges. Some industry associations require member companies to assess plants' vulnerabilities, develop and implement mitigation plans, and have a third party verify that security measures were implemented. Other associations have developed guidelines and other tools to encourage their members to address security. Industry officials said that high costs and limited guidance on how much security is adequate create challenges in preparing facilities against terrorism.

Because existing laws provide DHS with only limited authority to address security at chemical facilities, it has relied primarily on the industry's voluntary security efforts. However, the extent to which companies are addressing security is unclear. DHS does not have the authority to require chemical facilities to assess their vulnerabilities and implement security measures. Therefore, DHS cannot ensure that facilities are taking these actions. DHS has stated that its existing authorities do not permit it to effectively regulate the chemical industry, and that the Congress should enact federal requirements for chemical facilities. Many stakeholders agreed—as GAO concluded in 2003 and again in January 2006—that additional legislation placing federal security requirements on chemical facilities is needed.

Stakeholders had mixed views on whether any chemical security legislation should require plants to substitute safer chemicals and processes, which could lessen the potential consequences of an attack, but could be costly or infeasible for some plants. DHS has stated that safer practices may make facilities less attractive to terrorist attack, but may shift risks rather than eliminate them. Environmental groups told GAO that they favored including or considering inherently safer technologies in any federal requirements, but most industry officials GAO contacted opposed a requirement to use safer technologies because they may shift risks or be prohibitively expensive.

Mr. Chairman and Members of the Committee:

We are pleased to have the opportunity to present the results of our recent work on chemical facility security.[1] As we reported in January 2006, across the nation, approximately 15,000 facilities produce, use, or store more than specific maximum amounts of chemicals that the Environmental Protection Agency (EPA) has identified as posing the greatest risk to human health and the environment if accidentally released into the air. These facilities include chemical manufacturers, storage and distribution facilities, water and wastewater treatment facilities, and refineries, among others. Since September 11, 2001, government and other experts have recognized the potential threat that chemical facilities pose because many house toxic chemicals that could become airborne and drift to surrounding areas or be used to create a chemical weapon capable of causing harm. While these facilities potentially put large numbers of Americans at risk of injury or death in the event of a chemical release, the chemicals they produce, use, store, and distribute are critical to the nation's economy.

The Homeland Security Act of 2002 established the Department of Homeland Security (DHS) and set forth its mission to, among other things, prevent terrorist attacks in the United States and reduce the vulnerability of the nation to terrorism.[2] The President's February 2003 National Strategy for the Physical Protection of Critical Infrastructures and Key Assets sets forth the federal government's roles, objectives, and responsibilities in protecting the nation's critical infrastructure, including the chemical industry. In addition, a December 2003 presidential directive instructed DHS to produce a comprehensive integrated plan outlining national goals, objectives, milestones, and key initiatives for protecting critical infrastructure and key resources.[3] The directive also named DHS as the lead agency for the chemical sector. [4] Under an interim national plan released in February 2005, DHS is to identify and prioritize critical

[1]GAO, Homeland Security: DHS Is Taking Steps to Enhance Security at Chemical Facilities, but Additional Authority Is Needed, GAO-06-150 (Washington, D.C.: January 27, 2006).

[2]Pub. L. No. 107-296, § 101(b), 116 Stat. 2135, 2142 (2002).

[3]Homeland Security Presidential Directive Number 7, section 27 (Washington, D.C.: Dec. 17, 2003).

[4]Homeland Security Presidential Directive Number 7, section 15 (Washington, D.C.: Dec. 17, 2003).

chemical facilities, evaluate the chemical sector's vulnerabilities and risks, develop and implement protective programs for high-priority chemical facilities, identify regulatory options for protective measures, and maintain a relationship with all stakeholders.

The federal government's role in protecting chemical facilities from terrorist attacks has been much debated since September 11, 2001. Public debate has centered on whether the federal government should impose security requirements on chemical facilities or continue to work with the chemical industry to voluntarily address security concerns. Legislative proposals that would grant DHS or EPA, or one of these agencies in consultation with the other, the authority to require chemical facilities to take security steps were introduced in every Congress from 2001 to 2005. Provisions in legislative proposals that would require chemical facilities to implement or consider the substitution of safer chemicals and processes—referred to as "inherently safer technologies"—have also sparked debate. Appendix I provides an overview of key chemical security legislative proposals in the 109th Congress, two of which contain provisions relating to the use of inherently safer technologies.

My statement today is based on our January 2006 report, and will focus on (1) DHS' actions to develop a plan for protecting the chemical sector, assess facilities' vulnerabilities, and interact with the industry and other federal agencies; (2) chemical industry security initiatives and challenges; (3) DHS' existing authorities and whether additional legislative authority is needed; and (4) stakeholders' views on the inclusion of an inherently safer technologies requirement in any legislation. In conducting our work, we interviewed officials from DHS and EPA and reviewed pertinent federal legislation, EPA data, DHS documents, and other available reports. We also interviewed representatives of all 16 associations participating on the Chemical Sector Coordinating Council, a group of chemical sector associations that facilitate the sharing of industry views with DHS, and spoke with at least one member company belonging to 13 of the key

chemical industry associations.[5] We also interviewed other organizations with chemical industry expertise, including the American Society of Mechanical Engineers, the Center for Chemical Process Safety, Sandia National Laboratories, and the Working Group on Community Right-to-Know, among others. We conducted our work according to generally accepted government auditing standards.

Summary

In summary, we found the following:

- As of January 2006, when we issued our report, DHS was developing a Chemical Sector-Specific Plan as part of a national framework to reduce the overall vulnerability of the chemical sector. According to DHS, the plan will describe, among other things, the chemical industry; DHS' coordination with federal, state, and local agencies and with the private sector; DHS' efforts to identify and prioritize chemical facilities on the basis of risk; and DHS' development of protective programs to prevent, deter, mitigate, and recover from attacks on chemical facilities. In developing this plan, DHS initiated actions to identify the sector's critical assets, prioritize facilities, develop and implement programs, exchange information with the private sector, and coordinate efforts with EPA and other federal agencies. For example, DHS identified about 3,400 high-priority facilities and plans to use a new risk assessment methodology to compare and prioritize all critical infrastructure assets according to their level of threat, vulnerability to attack, and the consequences of an attack. DHS officials told us that they expect to complete and release the sector-specific plan in the fall of 2006.

- The chemical industry, led by its industry associations, has undertaken voluntary efforts to address plant security, but faces challenges in preparing facilities against terrorism. Some industry associations require their member companies to assess facilities' vulnerabilities and make

[5]As of November 2005, Chemical Sector Coordinating Council members included the Adhesive and Sealant Council; the American Chemistry Council; the American Forest & Paper Association; the Chemical Producers and Distributors Association; the Chlorine Chemistry Council; the Chlorine Institute; the Compressed Gas Association; CropLife America; the Fertilizer Institute; the Institute of Makers of Explosives; the International Institute of Ammonia Refrigeration; the National Association of Chemical Distributors; the National Paint and Coatings Association; the National Petrochemical and Refiners Association; the Society of the Plastics Industry, Inc.; and the Synthetic Organic Chemical Manufacturers Association. Three associations—the Adhesive and Sealant Council, the International Institute of Ammonia Refrigeration, and the National Paint and Coatings Association—were not able to identify a member company willing to speak with us.

security enhancements. For example, the American Chemistry Council, a chemical industry association, requires as a condition of membership that companies conduct vulnerability assessments, develop and implement plans to mitigate vulnerabilities, and have a third party verify that the security enhancements were implemented. The Council reports that its members have spent an estimated $2 billion on security improvements since September 11, 2001. Other industry associations have developed security guidelines, best practices, and other tools and a number of associations have developed security guidelines and vulnerability assessment methodologies tailored specifically to their member companies' unique security concerns. However, industry officials told us that they face a number of challenges in preparing facilities against a terrorist attack. They reported that the cost of security improvements can be a burden, particularly for smaller companies, and that determining the appropriate level of security for different facilities is difficult without guidance on what level of security is adequate.

- Existing laws provide DHS with only limited authority to address security concerns at U.S. chemical facilities. To require security improvements at these facilities, which pose significant risks to millions of Americans, DHS needs additional legislative authority. DHS lacks the authority to require chemical facilities to assess their vulnerabilities and implement security measures and cannot enter most chemical facilities without their permission to assess security or to enforce the implementation of any needed security improvements. In contrast to some other critical infrastructure facilities—such as nuclear and drinking water facilities—chemical plants generally are not subject to federal security requirements. Consequently, DHS has relied primarily on the private sector's voluntary participation to address facility security. As a result, DHS cannot ensure that all high-risk facilities are assessing their vulnerability to terrorist attacks and taking corrective actions, where necessary. On this basis, we concluded in 2003 and again in January 2006 that additional legislation is needed to place federal security requirements on chemical facilities.[6] In addition, DHS has concluded that its existing authorities do not permit it to effectively regulate the industry, and that the Congress should enact federal requirements for chemical facilities. Given that the nation's chemical facilities pose significant risks and the extent of their security preparedness is largely unknown, legislation giving DHS the authority to

[6]GAO, *Homeland Security: Voluntary Initiatives Are Under Way at Chemical Facilities, but the Extent of Security Preparedness Is Unknown*, GAO-03-439 (Washington, D.C.: Mar. 14, 2003).

require the chemical industry to address security at their plants is long overdue.

- While many of the stakeholders we contacted—including representatives from industry, research centers, and government—agreed on the need for additional legislation establishing federal security requirements, they had divergent views on whether facilities should be required to use safer chemicals and processes—referred to as "inherently safer technologies." Inherently safer technologies could lessen the potential consequences of an attack by reducing the risks present at these facilities, but could be costly or infeasible for some plants. The Department of Justice and DHS have recognized that safer practices, such as reducing the quantity of hazardous material on site may make facilities less attractive to terrorist attack or could prevent or delay a terrorist attack. However, DHS officials told us that the use of inherently safer technologies tends to shift risks rather than eliminate them, often with unintended consequences. Representatives from environmental groups, as well as process safety experts, told us that the inherently safer technologies should be included or considered in any federal chemical security requirements. In contrast, the majority of the industry officials we contacted opposed a requirement to use inherently safer technologies because their use may shift risks or be prohibitively expensive.

To ensure that chemical facilities take action to review and address security vulnerabilities, we recommended in January 2006 that

- the Congress consider providing DHS with the authority to require high-risk chemical facilities to assess their vulnerability to terrorist attacks and, where necessary, require these facilities to take corrective action, and
- DHS complete the Chemical Sector-Specific Plan in a timely manner and work with EPA to study the advantages and disadvantages of substituting safer chemicals and processes at some chemical facilities.

In comments responding to a draft of our January 2006 report, DHS agreed that the Congress should consider granting DHS the authority to require the chemical industry to address plant security and that completing and implementing the sector-specific plan is a priority. Legislation is before the Congress that, if enacted, would direct DHS to require high-risk chemical facilities to assess their vulnerability to terrorist attacks and take corrective action, where necessary. Furthermore, DHS officials expect to complete and release the sector-specific plan in the fall of 2006. However, DHS disagreed with our recommendation that the department work with EPA to study the security benefits of using safer technologies. As noted,

DHS believes that the use of safer technologies would not generally result in more secure chemical facilities and would shift risks rather than eliminate them. DHS also stated that it is unclear what role EPA would play in a study of the benefits of using safer technologies or how DHS's interaction with EPA might be perceived among DHS's private sector partners.

We continue to believe, however, that the use of safer technologies may have the potential to reduce security risks for at least some chemical facilities by making them less attractive to a terrorist attack and reducing the severity of the potential consequences of an attack and that studying the costs and security benefits of using safer technologies would be a worthwhile effort. While DHS should have the lead role in conducting such a study, EPA can provide valuable support. EPA has extensive expertise on toxic chemical data sources, U.S. hazardous materials facilities, and process safety issues, among other things, that the agency has developed through its oversight of a number of chemical safety programs. In particular, EPA maintains data on high-risk facilities' inventories of toxic and flammable chemicals and facility worst-case release scenarios, which could be useful to DHS in studying inherently safer technologies. Furthermore, we do not believe that a DHS-EPA partnership to study safer chemicals and technologies would necessarily bring the department into conflict with the industry, if the appropriate informational safeguards and assurances are built into the process. Through additional study, these two agencies can help to determine the appropriate role of inherently safer technologies in government and industry efforts to bolster chemical facility security and could identify alternative ways to reduce security, environmental, and health risks that could be shared with private industry.

Background

Experts agree that chemical facilities are among the most attractive targets for terrorists intent on causing massive damage. Despite the risk these facilities pose, no one has yet comprehensively assessed security at the nation's chemical facilities. EPA regulates about 15,000 facilities under the 1990 amendments to the Clean Air Act because they produce, use, or store more than certain threshold amounts of specific chemicals that would pose the greatest risk to human health and the environment if they were accidentally released into the air. These facilities must take a number of steps, including preparing a risk management plan (RMP), to prevent and prepare for an accidental release and, therefore, are referred to as RMP facilities. These facilities fall within a variety of industries and produce, use, or store a variety of products, including basic chemicals; specialty chemicals, such as solvents; life science chemicals, such as

pharmaceuticals and pesticides; and consumer products, such as cosmetics. Some of these facilities are part of critical infrastructure sectors other than the chemical sector. For example, about 2,000 of these facilities are community water systems that are part of the water infrastructure sector. In addition, other facilities that house hazardous chemicals that are listed under the RMP regulations are not subject to RMP requirements because the quantities stored or used are below threshold amounts. Through the RMP program, EPA has gained extensive expertise with chemical facilities and processes that could be useful in helping DHS assess security issues.

Federal requirements currently address security at some U.S. chemical facilities. For example, a small number of chemical facilities must comply with the Maritime Transportation Security Act of 2002 and its implementing regulations, which require maritime facility owners and operators to conduct assessments, develop security plans, and implement security measures. In addition, certain community water systems—while not specifically considered chemical facilities but which use and store large volumes of chemicals—are required by the Public Health Security and Bioterrorism Preparedness and Response Act of 2002 to conduct and submit a vulnerability assessment to EPA and prepare an emergency response plan that incorporates the results of the assessment. According to EPA, 1,928 drinking water facilities that are also subject to EPA's RMP program must comply with this act. Some states and localities have also created security requirements at chemical facilities.

In addition, the federal government imposes safety and emergency response requirements on chemical facilities that may incidentally reduce the likelihood and consequences of terrorist attacks. For example, Section 112(r) of the Clean Air Act includes a general duty clause directing owners and operators of facilities to identify hazards, design and maintain a safe facility to prevent releases, and minimize the consequences of any accidental releases that occur. [7] Under Section 112(r), RMP facilities must also implement a program to prevent accidental releases that includes safety precautions and maintenance, and monitoring and training measures, and they must have an emergency response plan. The Department of Labor's Occupational Safety and Health Administration's process safety management standard also requires facilities to conduct analyses of their chemical processes which must address hazards of the

[7]See 42 U.S.C. § 7412 (r)(1).

process, engineering and administrative controls applicable to the hazards, facilities siting, and evaluation of the possible health and safety effects of failures of controls on employees.

DHS Has Taken Actions to Develop a Plan for Protecting the Chemical Sector, Assess Facilities' Vulnerabilities, and Interact with the Industry and Other Federal Agencies

DHS is developing a plan for protecting the chemical sector that will establish a framework for reducing the overall vulnerability of the sector in partnership with the industry and state and local authorities. At the time of our review, DHS did not provide a specific date for completion of the Chemical Sector-Specific Plan. DHS completed a draft of the plan in July 2004 and has been working to revise it to accommodate changes to DHS's risk management strategy and comments from stakeholders. DHS officials told us that the final plan—which they now expect to complete and release in the fall of 2006—will reflect the basic principles and content described in the draft plan. On the basis of our review of the draft plan and discussions with DHS officials, the final plan will, among other things, (1) present background information on the sector; (2) describe the process DHS will use to develop an inventory of chemical sector assets; (3) describe DHS's efforts to identify and assess chemical facilities' vulnerabilities and plans to prioritize these efforts on the basis of the vulnerability assessments; (4) outline the protective programs that will be created to prevent, deter, mitigate, and recover from attacks on chemical facilities, and describe how DHS will work with private sector and government entities to implement these programs; (5) explain the performance metrics DHS will use to measure the effectiveness of DHS and industry security efforts; and (6) outline the department's challenges in coordinating the efforts of the chemical sector.[8]

DHS has also initiated actions to identify the chemical sector's critical assets, prioritize facilities, develop and implement protective programs, exchange information with the private sector, and coordinate efforts with EPA and other federal agencies. DHS is focusing its efforts for the chemical sector by identifying high-priority facilities. As a starting point, DHS has adapted EPA's RMP database of facilities with more than

[8]Our March 2003 report on chemical security recommended that DHS develop a comprehensive national chemical security strategy that is both practical and cost-effective. We recommended that the strategy identify high-risk facilities, collect information on industry security preparedness, specify the roles and responsibilities of each federal agency partnering with the chemical industry, and develop appropriate information-sharing mechanisms. If the final Chemical Sector-Specific Plan includes the elements DHS has described, it should meet the criteria set out in this recommendation.

threshold amounts of certain chemicals to develop an interim inventory of 3,400 chemical facilities that pose the greatest hazard to human life and health in the event of a terrorist attack. These are facilities where a worst-case scenario release potentially could affect over 1,000 people. According to DHS, 272 of these facilities could potentially affect more than 50,000 people.

DHS is also developing a new risk assessment methodology to compare and prioritize all critical infrastructure assets according to their level of threat, their vulnerability to attack, and the consequences of an attack on the facility. According to DHS, Risk Analysis Management for Critical Asset Protection (RAMCAP) will provide a common methodology, terminology, and framework for homeland security risk analysis and decision making that is intended to allow consistent risk management across all sectors. The RAMCAP process entails chemical facility owners/operators voluntarily completing a screening tool to identify the consequences of an attack. On the basis of the results of the screening tool, DHS will identify facilities of highest concern and ask them to voluntarily complete a security vulnerability assessment.

Finally, DHS has implemented a number of programs to assist the private sector and local communities in reducing vulnerabilities. For example, DHS works with local law enforcement officials and facility owners through the Buffer Zone Protection Program to improve the security of the area surrounding a facility. To assess and identify vulnerabilities at chemical facilities, DHS deploys teams of experts from both government and industry to conduct a site assistance visit. DHS had conducted 38 site assistance visits at chemical facilities as of June 15, 2005, and planned to conduct additional visits in fiscal year 2006 on the basis of need. DHS has also installed cameras at some high-consequence facilities, providing local law enforcement authorities with the ability to conduct remote surveillance and allowing state homeland security offices and DHS to monitor the facilities. In addition, DHS distributes threat information to the industry through various means and coordinates sector activities with the Chemical Sector Coordinating Council, an industry-led working group formed voluntarily by trade associations that acts as a liaison for the chemical sector. DHS also coordinates with EPA and other federal agencies through a government coordinating council. EPA officials believe that the agency could further assist DHS by providing analytical support in identifying high-risk facilities that should be targeted in DHS' chemical sector efforts, among other activities.

The Chemical Industry Continues Voluntary Efforts to Address Security, but Faces Challenges in Safeguarding Facilities

With few federal security requirements, industry associations have been active in promoting security among member companies. Some industry associations, including the American Chemistry Council (ACC), the Synthetic Organic Chemical Manufacturers Association, and the National Association of Chemical Distributors, require member companies to assess their facilities' vulnerabilities and make security enhancements, requiring as a condition of membership that they conduct security activities and verify that these actions have been taken. ACC, representing 135 chemical manufacturing companies with approximately 2,000 facilities, has led the industry's efforts to improve security at their facilities. ACC requires its members to adhere to a set of security management principles that include performing physical security vulnerability assessments using an approved methodology, developing plans to mitigate vulnerabilities, taking actions to implement the plans, and having an independent party such as insurance representatives or local law enforcement officials verify that the facilities implemented the identified physical security enhancements. These reviewers do not verify that a vulnerability assessment was conducted appropriately or that actions taken by a facility adequately address security risks. However, ACC requires member companies to periodically conduct independent third-party audits that include an assessment of their security programs and processes and their implementation of corrective actions. In addition, ACC members must take steps to secure cyber assets, such as computer systems that control chemical facility operations, and the distribution chain from suppliers to customers, including transportation.

Other industry associations have encouraged their members to address security by a variety of means. Most of the 16 associations we spoke to have developed security guidelines and best practices. For example, the International Institute of Ammonia Refrigeration, representing facilities such as food storage warehouses, developed site security guidelines tailored to ammonia refrigeration facilities and provides information about security resources to members. Several industry associations have also developed vulnerability assessment methodologies to assist their member companies in evaluating security needs. For example, the National Petrochemical and Refiners Association, in partnership with the American Petroleum Institute, developed a vulnerability assessment methodology tailored to refiners and petrochemical facilities. Despite industry associations' efforts to encourage or require members to voluntarily address security, the extent of participation in the industry's voluntary initiatives is unclear.

Chemical industry officials told us they face a number of challenges in preparing facilities against a terrorist attack. Most of the chemical associations we contacted stated that the cost of security improvements is a challenge for some chemical companies. For example, ACC reports that its members have spent an estimated $2 billion on security improvements since September 11, 2001. Representatives of the American Forest & Paper Association and the National Paint and Coatings Association told us that small companies, in particular, may struggle with the cost of security improvements or the cost of complying with any potential government security programs because they may lack the resources larger companies have to devote to security. Industry stakeholders also cited the need for guidance on what level of security is adequate. While DHS has issued guidance to state Homeland Security Offices and the Chemical Sector Coordinating Council on vulnerabilities and protective measures that are common to most chemical facilities, several stakeholders expressed a desire for guidance on specific security improvements. For example, representatives of the National Petrochemical and Refiners Association stated that one reason the association holds workshops and best practices sessions is to meet the challenge of determining the types of security measures that constitute a reasonable amount of security.

In addition, industry officials told us that the lack of threat information makes it difficult for companies to know how to protect facilities. A few industry officials also mentioned limited guidance on conducting vulnerability assessments and difficulty in conducting employee background checks as challenges. One industry association stated that it would like its members to receive guidance from DHS on how to conduct vulnerability assessments. Another association expressed frustration because none of the current vulnerability assessment tools address issues specific to their member facilities, which package and distribute chemicals, and it would like DHS to help develop or approve a methodology for this type of facility. Finally, a number of stakeholders we contacted told us that emergency response preparedness is a challenge for chemical companies. An official with an industry-affiliated research center asserted that emergency responders and communities in the United States are prepared to respond to a toxic release. However, other stakeholders we spoke with stated that many facilities have conducted security vulnerability assessments but may not have done enough emergency response planning and outreach to the responders and communities that would be involved in a release. A 2004 survey by a chemical workers union of workers at 189 RMP facilities found that only 38 percent of respondents indicated that their companies' actions in preparing to respond to a terrorist attack were effective, and 28 percent reported that no employees

at their facilities had received training about responding to a terrorist attack since September 11, 2001.[9] While environmental laws require emergency response planning for accidental chemical releases, several stakeholders told us facilities need to consider very different scenarios with consequences on different orders of magnitude when planning the emergency response for a terrorist incident.

DHS Needs Additional Authority to Ensure That Chemical Facilities Are Addressing Security Issues

Existing laws give DHS limited authority to address chemical sector security, but DHS currently lacks specific authority to require all high-risk facilities to assess their vulnerabilities and take corrective actions, where needed. A number of existing laws outline DHS's responsibilities for coordinating with the private sector and obtaining information on and protecting critical infrastructure, but these laws provide DHS with only limited authority to address security concerns at U.S. chemical facilities. For example, under the Homeland Security Act, the Secretary of DHS is responsible for coordinating homeland security issues with the private sector to ensure adequate planning, equipment, training, and exercise activities.[10] Furthermore, the Act gives DHS's Under Secretary for Information Analysis and Infrastructure Protection (IAIP) responsibilities related to protecting critical infrastructure, including

- accessing, receiving, analyzing, and integrating information from federal, state, and local governments and private sector entities to identify, detect, and assess the nature and scope of terrorist threats to the United States;
- carrying out comprehensive assessments of the vulnerabilities of the nation's key resources and critical infrastructure;
- developing a comprehensive national plan for securing the nation's key resources and critical infrastructure; and

[9]Paper, Allied-Industrial, Chemical, and Energy Workers International Union, *PACE International Union Survey: Workplace Incident Prevention and Response Since 9/11* (October 2004).

[10]All standards activities are to be conducted in conformance with section 12(d) of the National Technology Transfer Act of 1995, which states that federal agencies generally must use technical standards—performance-based or design-specific technical specifications and related management systems practices—developed or adopted by voluntary consensus standards bodies as a means to carry out policy objectives or activities, consulting and participating with such bodies in the development of technical standards when such participation is in the public interest and compatible with the agency's authorities and budget resources. See 6 U.S.C. §112(g) and 15 U.S.C. § 272 note.

- recommending the necessary measures to protect these key resources and critical infrastructure.

DHS does not currently have the authority to require all chemical facilities to conduct vulnerability assessments or to enter chemical facilities without their permission to assess security or to require and enforce security improvements.[11] There is also no legislation requiring chemical facilities to provide information about their security and vulnerabilities. Furthermore, except with respect to certain chemical facilities covered under federal security requirements for other critical infrastructures, existing laws do not give DHS the right to enter a chemical facility to assess its vulnerability to a terrorist attack or the authority to require and enforce the implementation of any needed security improvements at these facilities. The Homeland Security Act, with some limited exceptions, does not provide any new regulatory authority to DHS and only transferred the existing regulatory authority of any agency, program, or function transferred to DHS, thereby limiting actions DHS might otherwise be able to take under the Homeland Security Act.[12] Therefore, DHS has relied solely on the voluntary participation of the private sector to address facility security. As a result, DHS cannot ensure that all high-risk facilities are assessing their vulnerability to terrorist attacks and taking corrective action, where necessary.

DHS has concluded that its existing patchwork of authorities does not permit it to regulate the chemical industry effectively, and that the Congress should enact federal requirements for chemical facilities. Echoing public statements by the Secretary of Homeland Security and the Administrator of EPA in 2002 that voluntary efforts alone are not sufficient to assure the public of the industry's preparedness, in June 2005, both DHS and EPA called for legislation to give the federal government greater

[11]Under the Maritime Transportation Security Act, DHS's Coast Guard requires maritime facility owners/operators to conduct assessments of vulnerabilities, develop security plans, and implement security measures. The Coast Guard also has the authority to enter facilities. However, the Coast Guard reports that these requirements currently apply to only 300 chemical facilities.

[12]The Secretary may issue regulations for antiterrorism technology and may issue necessary regulations with respect to research; development; demonstration; testing; and evaluation activities of the department, including the conducting, reviewing, and funding of such activities.

authority over chemical facility security.[13] Similarly, we concluded in 2003, and continue to believe, that additional federal legislation is needed because of the significant risks posed by thousands of chemical facilities across the country to millions of Americans and because the extent of security preparedness at these facilities is unknown.[14]

In testimony before the Congress in June 2005, the Acting Undersecretary for IAIP stated that any proposed regulatory structure (1) must recognize that not all facilities within the chemical sector present the same level of risk, and that the most scrutiny should be focused on those facilities that, if attacked, could endanger the greatest number of lives, have the greatest impact on the economy, or present other significant risks; (2) should be based on reasonable, clear, equitable, and measurable performance standards; and (3) should recognize the progress that responsible companies have made to date. He also stated that the performance standards should be enforceable and based on the types and severity of potential risks posed by terrorists, and that facilities should have the flexibility to select among appropriate site-specific security measures that will effectively address those risks. In addition, he said that DHS would need the ability to audit vulnerability assessment activities and a mechanism to ensure compliance with requirements.

Stakeholders' Views on Safer Technologies Requirement in Chemical Security Legislation Are Mixed

While many stakeholders—including representatives from industry, research centers, and government—agreed on the need for additional legislation that would place federal security requirements on chemical facilities, they expressed divergent views on whether such legislation should require the use of inherently safer technologies. Implementing inherently safer technologies could potentially lessen the consequences of an attack by reducing the chemical risks present at facilities. The Department of Justice, in introducing a methodology to assess chemical facilities' vulnerabilities, recognized that reducing the quantity of hazardous material may make facilities less attractive to terrorist attack and reduce the severity of an attack. Furthermore, DHS's July 2004 draft Chemical Sector-Specific Plan states that inherently safer chemistry and engineering practices can prevent or delay a terrorist incident, noting that

[13]Testimony before the House Committee on Homeland Security, Subcommittee on Economic Security, Infrastructure Protection and Cybersecurity and the Senate Committee on Homeland Security and Governmental Affairs on June 15, 2005.

[14]GAO-03-439.

it is important to make sure that facility owners/operators consider alternate ways to reduce risk, such as using inherently safer design, implementing just-in-time manufacturing, or replacing high-risk chemicals with safer alternatives. However, DHS told us that the use of inherently safer technologies tends to shift risks rather than eliminate risks, often with unintended consequences. Some previous chemical security legislative proposals have included a requirement that facility security plans include safer design and maintenance actions, or that facility security plans include "consideration" of alternative approaches regarding safer design.

Representatives from three environmental groups told us that facilities have defined security too narrowly, without focusing on reducing facility risks through safer technologies. Noting that no existing laws require facilities to analyze inherently safer options, these representatives believe legislation should require such an analysis and give DHS or EPA the authority to require the implementation of technologies if high-risk facilities are not doing so. Process safety experts at one research organization recognized that reducing facility hazards and the potential consequences of chemical releases makes facilities less vulnerable to attack. However, these experts also explained that inherently safer technologies can be prohibitively expensive and can shift risks onto other facilities or the transportation sector. For example, reducing the amount of chemicals stored at a facility may increase reliance on rail or truck shipments of chemicals. However, the substitution of chemicals such as liquid bleach for chlorine gas at drinking water facilities reduces overall risks. These experts support legislative provisions requiring analysis or consideration of technology options but do not support giving the federal government the authority to require specific technology changes because of the complexity of these decisions. Representatives of two research centers affiliated with the industry told us that while facilities should look at inherently safer technologies when assessing their vulnerability to terrorist attack, safer technologies are not a substitute for security.

Industry associations and company officials were strongly opposed to any requirements to use inherently safer technologies. The majority of the industry officials we contacted opposed an inherently safer technologies requirement, with many stating that inherently safer technologies involve a safety issue that is unrelated to facility security. Industry officials voiced concerns about the federal government's second-guessing complex safety decisions made by facility process safety engineers. Representatives from four associations and two companies told us that, in many cases, it is not feasible to substitute safer chemicals or change to safer processes. Certain

hazardous chemicals may be essential to necessary chemical processes, while changing chemical processes may require new chemicals that carry different risks. In July 2005 testimony before the Congress, a Synthetic Organic Chemical Manufacturers Association representative explained that while inherently safer technologies are intended to reduce the overall risks at a facility, they could do so only if a chemical hazard was not displaced to another time or location or did not magnify another hazard. Furthermore, process safety experts and representatives from associations and companies report that some safer alternatives are extremely expensive. For example, reducing facility chemical inventories by moving to on-site manufacturing when chemicals are needed can cost millions of dollars, according to a stakeholder. One company also voiced opposition even to a legislative requirement that facilities "consider" safer options. The official explained that the company opposed such a provision—even if legislation does not explicitly give the government the authority to require implementation of safer technologies—because it might leave companies liable for an accident that might have been prevented by a technology option that was considered but not implemented.

Conclusions

Despite voluntary efforts by industry associations and a number of DHS programs to assist companies in protecting their chemical facilities, the extent of security preparedness at U.S. chemical facilities remains largely unknown. DHS does not currently have the authority to require the chemical industry to take actions to improve their security. On this basis, DHS has concluded—as we did in 2003 and again in January 2006—that its existing authorities do not allow it to effectively regulate chemical sector security. Since 2002, both DHS and EPA have called for legislation creating security requirements at chemical facilities, and legislation has been introduced without success in every Congress since September 11, 2001. By granting DHS the authority to require high-risk chemical facilities to take security actions, policy makers can better ensure the preparedness of the chemical sector. Furthermore, implementing inherently safer technologies potentially could lessen the consequences of a terrorist attack by reducing the chemical risks present at facilities, thereby making facilities less attractive targets. However, substituting safer technologies can be prohibitively expensive and can shift risks onto other facilities or the transportation sector. Also, in many cases, it may not be feasible to substitute safer chemicals or change to safer processes. Therefore, given the possible security and safety benefits as well as the potential costs to some companies of substituting safer technologies, a collaborative study employing DHS's security expertise and EPA's chemical expertise could

help policy makers determine the appropriate role of safer technologies in facility security efforts.

Contacts and Acknowledgments

For further information about this statement, please contact John B. Stephenson at (202) 512-3841. Karen Keegan, Omari Norman, Joanna Owusu, Vincent P. Price, and Leigh White made key contributions to this statement.

Appendix I: Overview of Key Chemical Security Legislative Proposals in the 109th Congress

Since 2001, the Congress has considered a number of legislative proposals that would give the federal government a greater role in ensuring the protection of the nation's chemical facilities. These legislative proposals would have granted DHS or EPA, or one of these agencies in consultation with the other, the authority to require chemical facilities to conduct vulnerability assessments and implement security measures to address their vulnerabilities. In the 109th Congress, five bills have been introduced but have not yet been acted upon: H.R. 1562, H.R. 2237, S. 2145, H.R. 4999, and S. 2486.

Major provisions	H.R. 1562	H.R. 2237	S. 2145 / H.R. 4999
General requirements	High-priority facilities would be required to submit vulnerability assessments and security plans to DHS; other chemical sources would be required to self-certify completion of assessments and plans and provide DHS copies upon request.	High-priority facilities would be required to submit vulnerability assessments and to certify that they have prepared prevention, preparedness, and response plans to EPA.	Designated chemical sources would be required to submit vulnerability assessments, security plans, and emergency response plans to DHS. The assessment and security plan would be required to address security performance standards established by DHS for each risk-based tier. Chemical sources would be required to self-certify completion of assessments and plans.
Role of DHS and EPA	DHS, in consultation with EPA, would identify high-priority categories of facilities; DHS would receive and review assessments and plans.	EPA, in consultation with DHS and state and local agencies, would identify high-priority categories of facilities; EPA would receive assessments and certifications.	DHS would designate facilities as chemical sources and assign each chemical source to a risk-based tier. DHS would receive and review assessments, plans and certifications. EPA would have no role.
Compliance enforcement	DHS would, when and where it deems appropriate, conduct or require the conduct of vulnerability assessments and other activities to ensure and evaluate compliance; DHS could disapprove a vulnerability assessment or site security plan; following written notification and consultation with the owner or operator, DHS could issue a compliance order.	Not later than 3 years after the deadline for submission of vulnerability assessments and response plans, EPA, in consultation with DHS, would review and certify compliance of each assessment and plan; following consultation with DHS, and 30 days after providing notification to the facility and providing advice and technical assistance to bring the assessment or plan into compliance and address threats, EPA could issue a compliance order.	DHS would review and approve or disapprove all vulnerability assessments, security plans, and emergency response plans for facilities in higher risk tiers within one year, and within five years for all other facilities. DHS would be required to disapprove of any vulnerability assessment, site security plan, or emergency response plan not in compliance with the vulnerability assessment, site security plan, and emergency response plan requirements. For higher risk facilities, if DHS disapproves the assessment or plans, the Secretary could issue an order to a chemical source to cease operation. For other facilities, the Secretary could issue an order to a chemical source to cease operation, but only after a process of written notification, consultation and time for compliance.

Major provisions	H.R. 1562	H.R. 2237	S. 2145 / H.R. 4999
Penalties for noncompliance	Would provide for court awarded civil penalties up to $50,000 per day for failure to comply with an order, site security plan, or other recognized procedures, protocols, or standards, and administrative penalties up to $250,000 for failure to comply with an order.	Would provide for court awarded civil penalties up to $25,000 per day, criminal penalties, and administrative penalties (if the total civil penalties do not exceed $125,000) for failure to comply with an order.	Would provide for court awarded civil penalties up to $50,000 per day, and administrative penalties of not more than $25,000 per day (not to exceed $1 million per year) for failure to comply with a DHS order or directive issued under the act. Also calls for criminal penalties of up to $50,000 in fines per day, imprisonment for not more than two years, or both for knowingly violating an order or failing to comply with a site security plan.
Inherently safer technologies requirements	None.	Response plans would be required to include a description of safer design and maintenance options considered and reasons those options were not implemented; EPA would be required to establish a clearinghouse for information on inherently safer technologies and would be authorized to provide grants to assist chemical facilities demonstrating financial hardship in implementing inherently safer technologies.	None.
Information protections	Would exempt information obtained from disclosure under the Freedom of Information Act (FOIA) or otherwise, or from disclosure under state or local laws; information would also not be subject to discovery or admitted into evidence in any federal or state civil judicial or administrative procedure other than in civil compliance action brought by DHS. Calls for DHS, in consultation with others, to establish confidentiality protocols.	Would exempt information obtained from disclosure under FOIA; calls for EPA, in consultation with DHS, to establish information protection protocols.	Would exempt information obtained from disclosure under FOIA, or from disclosure under state or local laws. Certifications submitted by the chemical sources, orders for failure to comply, and certificates of compliance and other orders would generally be made available to the public. Calls for DHS, in consultation with the Director of the Office of Management and Budget and appropriate federal law enforcement officials, to create confidentiality protocols for the maintenance and use of records; would establish penalties for the unlawful disclosure of protected information.
Equivalence of industry codes	Upon petition, DHS would be required to endorse other industry, state, or federal protocols or standards that the Secretary of DHS determines to be substantially equivalent.	None.	Would allow the Secretary to determine that vulnerability assessments, security plans, and emergency response plans prepared under alternative security programs meet the act's requirements and to permit submissions or modifications to the assessments or plans.

Major provisions	H.R. 1562	H.R. 2237	S. 2145 / H.R. 4999
Other	Would grant DHS right of entry; would exempt facilities that are subject to MTSA (port facilities) or the Bioterrorism Act (community water systems). Except with respect to protection of information, would not affect requirements imposed under state law.	Would grant EPA right of entry; would authorize EPA to provide grants for training of first responders and employees at chemical facilities; would not affect requirements imposed under state law.	Would grant DHS right of entry; would exempt facilities that are subject to MTSA from certain area security requirements but these facilities would otherwise comply with the act's requirements. Would preserve the right of States to adopt chemical security requirements that are more stringent than the Federal standard, as long as the State standard does not conflict with the Federal standard.

Source: GAO analysis of proposed legislation.

S. 2486, introduced on March 30, 2006, would impose a general duty on chemical facility owners and operators, in the same manner as the duty under the Clean Air Act's Section 112(r), to identify hazards that may result from a criminal release, ensure the design, operation, and maintenance of safe facilities by taking such actions as are necessary to prevent criminal releases, and eliminate or significantly reduce the consequences of any criminal release that does occur. S. 2486 also directs DHS to work with EPA, as well as state and local agencies, to identify not fewer than 3,000 high priority chemical facilities. These facilities would be required to take adequate actions (including the design, operation, and maintenance of safe facilities), to detect, prevent, or eliminate or significantly reduce the consequences of criminal releases and to submit a report to DHS that includes a vulnerability assessment; a hazards assessment; a prevention, preparedness, and response plan; statements as to how the response plan meets regulatory requirements and general duty requirements; and a discussion of the consideration of the elements of design, operation, and maintenance of safe facilities. "Design, operation, and maintenance of safe facilities" is defined as practices of preventing or reducing the possibility of a release through use of inherently safer technologies, among other things. DHS would certify compliance and DHS and EPA would establish a program to conduct inspections of facilities. The bill also provides for civil penalties, administrative penalties, and criminal penalties (including imprisonment for up to 2 years for first violations and up to 4 years for subsequent violations), for owners or operators of high priority facilities who fail to comply with an order.

Also in the 109th Congress, the conference committee for H.R. 2360, making appropriations for DHS for fiscal year 2006, directed DHS to

- submit a report to the Senate and House Committees on Appropriations by February 10, 2006, describing (1) the resources needed to implement

mandatory security requirements for the chemical sector and to create a system for auditing and ensuring compliance with the security standards and (2) the security requirements and any reasons why the requirements should differ from those already in place for chemical facilities that operate in a port zone;

- complete vulnerability assessments of the highest risk U.S. chemical facilities by December 2006, giving preference to facilities that, if attacked, pose the greatest threat to human life and the economy; and
- complete a national security strategy for the chemical sector by February 10, 2006.[1]

[1]H.R. Conf. Rep. No. 109-24 (2005).

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Inherently Safer Technologies Can Eliminate Catastrophic Risks

High Volume Substances & High Hazard Facilities Should Be Prioritized

Rick Hind
Legislative Director
Greenpeace Toxics Campaign

June 27, 2005

"Of all the various remaining civilian vulnerabilities in America today, one stands alone as uniquely deadly, pervasive and susceptible to terrorist attack: toxic- inhalation-hazard industrial chemicals...To date the federal government has made no material reduction in the inherent vulnerability of hazardous chemical targets inside the United States." --- Richard Falkenrath, former Deputy Homeland Security Adviser to President Bush

"If there are enough terrorists who are dedicated enough and equipped well enough, they're going to overwhelm everything that you put up short of some sort of Fort Knox -- which doesn't make much sense, given the cost and the relatively remote possibility that any specific site is going to be targeted." --- Representative Joe Barton (R-TX), chairman of the House Energy and Commerce Committee

SAFER TECHNOLOGY: THE ONLY SOLUTION WHEN SECURITY FAILS

Four years after September 11th, sobering warnings have gone unheeded regarding the vulnerability of U.S. chemical plants. Journalists across the country have repeatedly demonstrated the ease with which fence-line security can be penetrated as they have made their way into more than 80 chemical plants.

The potential for loss of life and economic disruption from an attack on one of these plants is staggering. A 2001 U.S. Army Surgeon General study estimated that 900,000 to 2.4 million people could be killed or injured in a terrorist attack on a U.S. chemical plant in a densely populated area. According to the Environmental Protection Agency (EPA), at least 100 chemical plants threaten a million or more people. Chlorine gas is the most common industrial chemical hazards at the 100 highest risk plants. According to the Chlorine Institute, a chlorine gas cloud can drift through a city and remain dangerous for at least 14 miles.

While high-tech security cannot ensure against a successful terrorist attack at a chemical plant, hundreds of communities have already secured their home towns by neutralizing the chemical hazards at local chemical plants. The New York Times reported in April that, ***"225 industrial plants in this country have switched to using less dangerous chemicals since the 2001 terrorist attacks, lowering the risk that people nearby would be injured or killed by toxic plumes..."***

The Department of Homeland Security (DHS) has now identified 3,400 high priority chemical facilities in the U.S. which put more than 1,000 people at risk. Of these DHS estimates that 272 facilities each put more than 50,000 people at risk.

Clearly these are priority facilities. The day after a catastrophic attack no one will argue that we should NOT require the elimination or reduction of these hazards where cost-effective alternatives exist. These alternatives include a wide range of options such as process changes, chemical substitutions, smaller storage facilities or any other measures that will reduce or eliminate the inherent hazard posed by the facility's storage, use or production of an ultra-hazardous substance. This range of options is a far from "dictating" a specific technology as has been claimed by some opponents.

The largest category of inherently dangerous substances is toxic-by-inhalation (TIH) gases. According to the EPA just **four TIH gases account for <u>55 percent</u>** of all categories of processes that threaten communities nationwide. They are:

anhydrous ammonia --- 32.5% (8,343 processes)
chlorine --- 18.3% (4,682 processes)
sulfur dioxide --- 3% (768 processes)
hydrogen fluoride --- 1.2% (315 processes)

Among the high threat facilities, these chemical processes deserve high priority because of their prevalent use at thousands of facilities. Fortunately, the major uses of these substances have widely available safer alternatives. For example, the Center for American Progress (CAP) analysis of EPA's Risk Management Program data showed that 284 facilities have converted. For example:

*** More than 200 water treatment facilities (including Washington, D.C.) have already converted to safer alternatives such as ultraviolet light since 1999 eliminating the use of **chlorine** and **sulfur dioxide** gas. But more than 100 water treatment plants still threaten more than 100,000 people.

*** Ninety-eight petroleum refineries already use safer alternatives to **hydrogen fluoride (HF)**. But 48 refineries still threaten millions of people with the use of HF.

*** At least 36 electric power plants already use safer alternatives to **anhydrous ammonia** gas such as dry urea. But 166 power plants still use anhydrous ammonia gas each threatening an average of 21,506 people.

While conversion costs can be amortized over time, the CAP report also showed that 87% of the converted facilities spent less than $1 million and half spent less than $100,000. While the CAP analysis proves the technological feasibility of safer alternatives, only 10% of the conversions took place at facilities that threaten the largest populations. Furthermore, 72% of the facilities that converted were water treatment plants. These are generally run by local governments which are more responsive to public safety concerns than private sector facilities. The CAP estimates that at this rate of conversion, without any new regulatory requirements, it will take 45 years to eliminate hazards that pose the highest risk to America's hometowns.

Clearly these conversion costs pale in comparison to the cost of disaster response, relocating communities, defending against personal injury law suits or resolving environmental clean up liability which can significantly impact the financial health of a facility or company.

The use of safer technologies offers a more stable business plan with much fewer regulations, potentially zero liability, sustainable profitability and better relationships with workers and neighboring communities and no threat of a catastrophic attack or accident. Requiring safer technologies simply establishes a level playing field that will allow proven cost-effective systems to grow profitably while providing communities safety and security.

Expert Opinions:

A 2006 GAO report (GAO-06-150), Homeland Security DHS Is Taking Steps to Enhance Security at Chemical Facilities, But Additional Authority Is Needed," concluded that ***"Implementing inherently safer technologies potentially could lessen the consequences of a terrorist attack by reducing the chemical risks present at facilities, thereby making facilities less attractive targets."***

A 2005 Government Accountability Office report (GAO-05-165) identifies chlorine gas and 90-ton chlorine rail cars as ***"among the top five terrorist-related wastewater system vulnerabilities."*** Among the top three recommendations: ***"Replacing gaseous chemicals used in wastewater treatment with less hazardous alternatives."*** In addition, the largest majority of experts gave replacing these chlorine the highest priority for federal funding. The report also identifies using smaller containers for shipping and storing chlorine, such as 1-ton cylinders.

A May 2006 report by the National Academy of Sciences, "Terrorism and the Chemical Infrastructure: Protecting people and Reducing Vulnerabilities," recommended more research on new technologies but stated, ***"The most desirable solution to preventing chemical releases is to reduce or eliminate the hazard where possible, not to control it. This can be achieved by modifying processes where possible to minimize the amount of hazardous material used, lower the temperatures and pressures required, replace a hazardous substance with a less hazardous substitute, or minimize the complexity of a chemical process."***

"Railroads agree, and strongly support efforts aimed at finding and utilizing 'inherently safer technologies' as substitutes for hazardous materials, especially TIH." -- Association of American Railroads (AAR) President, and CEO Edward R. Hamberger in testimony before the House Transportation and Infrastructure Committee's Railroad Subcommittee.

Retired Rohm and Haas engineer, Dennis Hendershot advised, ***"The first solution to a process safety problem should always be to get rid of the hazard, not control it."*** Trever Kletz, formerly with Imperial Chemical Industries (ICI) says, ***"The very best way to prevent an explosion is to simply replace the material that explodes with one that does not or at least keep the stock down so low that it hardly matters if it all leaks out."***

Almost Five Years of Neglect

The September 11th terrorist attacks successfully used our own infrastructure against us with tragic results. They also demonstrated that tight perimeter security, such as in the case of the Pentagon, is incapable of preventing such attacks. Should a chemical plant be targeted, a truck bomb, a small plane or a high powered rifle would easily render the industry's current reliance on fence-line security totally useless. In fact, U.S. chemical facilities have been referred to as ***"pre-positioned"*** weapons of mass destruction (WMD).

On July 22, 2004 ***"The 9/11 Commission Report"*** identified four failures in preventing an attack by the U.S. government the first of which was the failure of ***"imagination."*** A continuing lack of imagination today exposes millions of Americans to Bhopal magnitude risks largely because new laws or regulations have not yet been adopted to clarify the chemical industry's obligation to prevent catastrophic releases at U.S. chemical plants. In June, 2002 a promising proposal drafted by the EPA could have completed the first phase of such a program by the middle of 2003 but it was derailed by the White House in the fall of 2002. It was not unlike a bill (S. 1602) authored in 2001 by Senator Jon Corzine (D-NJ) and based on a bill introduced by Senator Frank Lautenberg (D-NJ) in 1999.

The EPA's 2002 proposal included ***"substituting less hazardous chemicals for extremely hazardous ones."*** The conversion of Washington, D.C.'s main sewage treatment plant from chlorine to safer chemicals, just eight weeks after 9/11, exemplifies the feasibility of such a strategy. At the time of the attacks they had 7 90-ton rail cars of chlorine stored on site.

Of the 15,000 facilities required to report their worst-case chemical disaster scenarios to the EPA's RMP, 7,728 plants pose an ***"off site consequence" (OSC)*** to more than 1,000 people. Approximately 100 facilities reported an OSC to the EPA putting one million or more people at risk. Approximately 65 percent of these facilities' "worst-case-scenarios" are chlorine disasters. Rather than address these risks through the new regulations suggested by the EPA, the DHS used a new methodology to downsize the priority list of chemical plants by forty-three percent to 3,400 facilities that put 1,000 or more people at risk.

EPA's 2002 chemical security proposal was slated for a media ***"rollout"*** at the White House. According to draft documents, ***"higher priority chemical facilities should be able to complete a vulnerability assessment and address security vulnerabilities as described in the guidance in 12-18 months."*** --- In other words many facilities could already have eliminated or reduced hazards by early 2004.

EPA's 2002 documents included a question and answer sheet. EPA Administrator Whitman saying, ***"EPA is not seeking legislation on chemical security at this time. Using existing authority under the Clean Air Act, we believe that the guidance and regulation I have announced today are the quickest paths to improving chemical facility security...If we later find that there are legislative gaps, then we will consider seeking legislation."***

Ultimately, the reversal by the Bush administration and the lobbying pressure by the industry (American Chemistry Council, American Petroleum Institute, etc.) paid off and chemical security legislation was excluded from the Homeland Security Act signed into law in November 2002.

One of the Bush administration's leading opponents of the EPA's 2002 chemical security proposal, Philip J. Perry, (Vice-President Cheney's son-in-law, formerly with the Office of Management and Budget) is now the general counsel to the DHS. This should inform Congress that any legislation enacted should be drafted using language that minimizes administrative discretion in requiring cost-effective hazard reduction and elimination programs where feasible.

In March, 2003 a report by the General Accounting Office (GAO) concluded ***"EPA has not attempted to use these Clean Air Act provisions [because] EPA is concerned that such an interpretation would pose significant litigation risk..."*** The GAO concluded that chemical facility security would be more effectively addressed by passage of specific legislation.

Finally the newly elected Republican controlled Congress, the White House and the chemical industry warmed up to the idea of legislation. In May, 2003 Senator James Inhofe (R-OK) introduced a chemical security bill (S. 994), however it would have allowed the new DHS to ***"endorse"*** chemical industry programs as regulations and done nothing to neutralize inherently dangerous chemical facilities.

In December 2003 President Bush further undermined EPA's authority and issued a directive (Directive/Hspd-7) limiting EPA's role on chemical security to ***"drinking water and water treatment systems."*** Under questionable legal authority, this directive attempts to shift responsibility for 15,000 chemical plants to the DHS which has no legislative authority, experience or inclination to regulate this industry.

Finally in January 2005, former White House homeland security deputy, Richard Falkenrath told the Senate Homeland Security and Governmental Affairs Committee, **"the federal government has made no material reduction in the inherent vulnerability of hazardous chemical**

targets inside the United States. Doing so should be the highest critical infrastructure protection priority for the Department of Homeland Security in the next two years."

The Threat Is Real

In his book, --- "America the Vulnerable" Stephen Flynn, of the Council on Foreign Relations warned, ***"The chemical industry deserves urgent attention because the stakes are high, the opportunities for terrorists are rich, and no credible oversight process exists. It is the very ubiquity of the U.S. chemical industry that gives it potential to be a serious source of national alarm."***

Others agree including, the Brookings Institute, Rand Corporation, U.S. Army, U.S. Naval Research Laboratory, GAO, Congressional Research Service, , FBI, the Department of Justice, DHS, chemical industry leaders, members of Congress and investigative journalists.

The magnitude of this threat is daunting. Chemical facility disaster reports to the EPA's RMP show that the release of a toxic gas cloud could spread 14 miles in an urban zone and up to 25 miles in rural terrain. According to a 2000 report by the EPA which first identified over 100 facilities that threaten a million or more people, ***"the high number of facilities in both class intervals is primarily due to the prevalent use of 90-ton rail tank cars for chlorine storage in the United States."***

Although flammable materials such as gasoline also pose frightening scenarios, the worst case disaster scenario for a flammable substance is dwarfed by a poison gas which can drift and remain harmful 10 to 20 miles from its release. Acutely toxic chemicals such as chlorine, ammonia and hydrogen fluoride are categorized as toxic-by-inhalation (TIH).

--- In July, 2004, the Homeland Security Council estimated that an attack on a single chlorine facility could kill 17,500 people, severely injure an additional 10,000 and result in 100,000 hospitalizations and 70,000 evacuations.

--- In January, 2004, the U.S. Naval Research Laboratory testified before the Washington, D.C. City Council warning that 100,000 people could be killed or injured in the first 30 minutes of a catastrophic release of a tank car of chlorine or similar chemical within blocks of Capitol Hill. They further estimated that people could ***"die at rate of 100 per second."***

--- In June, 2003 FBI specialist on WMDs, Troy Morgan, in a speech at a chemical industry conference warned, ***"You've heard about sarin and other chemical weapons in the news. But it's far easier to attack a rail car full of toxic industrial chemicals than it is to compromise the security of a military base and obtain these materials."***

The Risks Have Been Known for Nearly a Century

The potential for sudden large-scale loss of life is not theoretical. Chlorine was the first lethal chemical weapon used in modern warfare in World War I, when it was used by the Germans against the French in Belgium in 1915 with horrific effects resulting in as many as 5,000 casualties. According to the U.S. government, by the end of World War I, poison gas had inflicted 1.3 million casualties and 90,000 deaths.

Deadly Accidents

Based on government estimates a terrorist attack on a chemical plant could easily exceed the loss of life suffered at the 1984 Union Carbide Bhopal disaster, the worst industrial accident in history. Forty tons (half a rail car) of methylisocyanate (MIC) leaked into the community at midnight killing 8,000 people within days and claiming another 12,000 lives since. The Bhopal legacy continues to this day. The plant was abandoned leaving tons of pesticides to seep into ground water causing extensive contamination of drinking water supplies.

According to the U.S. Coast Guard's National Response Center, there have been more than 3,000 chemical accidents involving more than 10,000 pounds of hazardous materials since 1987. A December 2000 assessment by the Argonne National Laboratory on the risks of transporting hazardous materials warned that, ***"...releases of toxic chemicals can kill and injure people located relatively far from the accident...As a result, failure to identify and evaluate opportunities to reduce the risks from these types of relatively rare accidents could ultimately lead to thousands of fatalities, injuries, and evacuations."***

Of the 1,900 accidents identified by the EPA between 1994 and 1999, 518 of them were chlorine accidents listed by plants required to submit report to the EPA's RMP. Of these, 226 were at water treatment facilities, many of which are located in populated areas.

The RMP came to being as the ***"Bhopal amendment"*** to the 1990 Clean Air Act. This program built upon the success of the Toxic Release Inventory (TRI) program that was added to the 1986 Superfund reauthorization, also inspired by the Bhopal disaster.

In June, 2004, three people were killed in a train accident in a remote area southwest of San Antonio, Texas when a tank car carrying chlorine broke open in the 25 mph crash, releasing a portion of the tank car contents.

On January 6, 2005 ten people were killed, 58 hospitalized and hundreds sought treatment in Graniteville, South Carolina when chlorine was released again when one train slammed into a parked train in the middle of the night. The cars involved were allegedly state of the art construction.

Both of these tragedies could have resulted in a much higher number of fatalities and injuries if they had occurred in densely populated areas.

Community Involvement & Right-to-Know

Following the January 2005 Graniteville train disaster, the U.S. Conference of Mayors wrote to Secretary Ridge urging ***"immediate action"*** to improve notification of the rail transport of hazardous material transported through cities. Today few emergency responders, let alone local residents are aware of the lethality of high volume tank cars that routinely roll through their communities. Full respirator suits required to respond to such a disaster are in short supply at fire departments.

Shortly after the Graniteville disaster, the U.S. Conference of Mayors formally requested tat the federal government "take immediate action with the freight railroads" to notify cities of all hazardous materials transported through local communities.

Acute Health Effects Can Be Lethal

There is no doubt about the lethality of chlorine and other TIH substances. According to the EPA, the acute health effects of chlorine on humans range from shortness of breath, chest pain, vomiting to heart complications and death from pulmonary edema (drowning in lung fluid). Immediate health consequences can begin with as little as 1-3 parts per million (ppm) exposure. At concentrations of 46 to 60 ppm pulmonary edema can begin to occur. At 430 ppm chlorine can kill after 30 minutes of exposure. The Chlorine Institute's disaster models assume a plume of chlorine gas could remain at 40 ppm concentration more than 10 miles from the release. The also assume a win speed that could only be out run by a runner who meets the qualifying time for the Boston Marathon.

There is a Safer Way

Safer technologies should be substituted where feasible at all facilities producing, using or storing large quantities of TIH chemicals. These safer alternatives have been referred to as ***"inherently safer technology"*** (IST) or "alternative approaches."

In his 2001 book, *Materials Matter*, Kenneth Geiser says, ***"If we paid closer attention to the materials that we produce, we could pay less attention to the impacts of those materials once they are released into the environment and people are exposed to them. Instead of investing in complex technologies for managing toxic pollutants and hazardous wastes and negotiating complicated institutional systems for permitting environmental releases and enforcing standards of human exposure, we could try to produce safer materials and use them more carefully."***

Choosing safer technologies and chemicals instead of inherently dangerous ones or those that have not been fully tested for their impact on human health and the environment is also known as taking the *"precautionary principle."* This approach was put forth by the International Joint Commission (IJC) in their 1992 and 1994 biennial reports and in 2001 by the United Nations in the Stockholm Convention on POPs. Chaired by conservative Republican Gordon Durnil, the IJC concluded, ***"persistent toxic substances are too dangerous to the biosphere and to humans to permit their release in ANY quantity...Accordingly, the Commission concludes that the use of chlorine and its compounds should be avoided in the manufacturing process."***

Some of the relatively small uses of chorine represent one of the greatest acute toxic threats to densely populated areas. The use of chlorine in water treatment, particularly sewage treatment, which represents approximately 4 percent of the total use of chlorine, is widely distributed by 90-ton rail cars which are also used as temporary storage vessels across the country. Fortunately, this is one of the easiest uses of chlorine to substitute.

For example, the Blue Plains sewage treatment plant in Washington, D.C. halted its use of chlorine and switched to safer chemicals just eight weeks after the 9/11 attacks due to fears of another attack. The plant had seven rail cars of chlorine on sight following the 9/11 attacks. The conversion only cost approximately .50 per year for each water customer. In other words, by using safer technologies we can neutralize and eliminate targeting by terrorists and prevent catastrophic accidents as well at negligible costs.

This is only the first step. Switching to safer ***"drop-in"*** chemicals, such as sodium hypochlorite (bleach) without a long-term plan can leave lingering risks in communities where the bleach is produced. While switching to bleach at a sewage plant clearly eliminates the immediate hazard at that facility, the bleach formulators who use and store large quantities of chlorine to make bleach still pose serious risks to workers and surrounding communities. However, as part of an orderly transitional program these formulators can offer safe and effective alternative disinfectants to their customers. Bleach makers are well positioned to guide their customers toward alternatives such as ozone and ultra-violet light (UV) which are widely available and do not pose catastrophic hazards. UV is superior to chlorine in that it also kills anthrax and cryptosporidium which chlorine does not.

A Government Accountability Office report (GAO-05-165) identifies chlorine gas and 90-ton chlorine rail cars as "among the top five terrorist-related wastewater system vulnerabilities." Among the top three recommendations: "Replacing gaseous chemicals used in wastewater treatment with less hazardous alternatives." In addition, the largest majority of experts gave replacing these chlorine the highest priority for federal funding. The report also identifies using smaller containers for shipping and storing chlorine, such as 1-ton cylinders.

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A 2003 report by Environmental Defense (ED), "Eliminating Hometown Hazards: Cutting Chemical Risks at Wastewater Treatment Facilities" identified facilities that posed a threat to 100,000 or more residents have already converted to safer alternatives since 1999. Four of these switched to UV technologies. The full ED report is available at www.environmentaldefense.org

An April 2006 report, "Preventing Toxic Terrorism How Some Chemical Facilities are Removing Danger to American Communities," by the Center for American Progress (CAP) identified 284 facilities in 47 states that have converted to safer chemicals, processes or moved to more remote locations since 1999. Seventy-two percent of these plants were wastewater and water treatment facilities. The full report is at: www.americanprogress.org

Inadequate Actions

But without new preventive state or federal safety standards the country remains at the mercy of voluntary programs designed by the American Chemistry Council, the American Petroleum Institute and other lobbying groups. Voluntary initiatives by the industry are neither adequate nor acceptable. It is naïve to believe that they will either be maintained or rigorously enforced. Furthermore none of these industry programs include safer technologies as a way to eliminate these hazards.

The primary flaw in the chemical industry's voluntary programs and legislative agenda is its focus on fence-line security. Guarding a plant perimeter, although necessary while inherently dangerous chemicals are present, is inadequate in preventing dedicated terrorist attacks and has been dramatically exposed by the media as woefully lacking even on its own terms. Prevention through safer technologies is clearly the only prudent response.

The DHS announced in June, 2004 that they are installing web cameras at 17 priority chemical plants at a cost of $4.2 million to deter terrorists and possibly increase intelligence. Unfortunately site security only deters those who don't want to be caught. Suicide squads are not deterred by the possibility of being caught. In addition, site security advocates say that intelligence reports will provide *"threat based"* information to heighten security. This fails to recognize the limits of our intelligence gathering and the almost limitless choices an attacker would have among U.S. chemical facilities. Public safety should not depend upon on promises of new intelligence, especially given the spectacular failures of intelligence leading up to and following the 9/11 attacks. Furthermore, no one predicted the Oklahoma City bombing or even suspected a Gulf War veteran initially.

While security should have been enhanced by the chemical industry immediately following 9/11, web cameras are hardly more than we had in airports before 9/11. Seeing grainy photos of the next set of terrorists, after another tragedy, will not be consolation to the families of the victims.

Will Congress Act?

Continuing negligence by industry and government will not be judged kindly by posterity. Stephen Flynn, Senior Fellow in National Security Studies at the Council on Foreign Relations said in his book, America the Vulnerable, ***" The morning after the first terrorist strike on this sector, Americans will look around their neighborhoods and suddenly discover that potentially lethal chemicals are everywhere, and be aghast to learn that the U.S. government has still not developed a plan to secure them. The subsequent political pressure to shut down the industry until some minimal new safeguards can be put in place -- as we did with commercial aviation following the 9/11 attacks -- will be overwhelming."*** In his book Flynn also recommended converting dangerous chemical plants and re-routing ultra-hazardous cargoes.

Clearly, facilities that use or store TIH substances pose an inherent risk to workers and surrounding populations. This is a threat that has been studied by many agencies of government and other independent organizations. In July of 2002 Senator Corzine's bill (S. 1602 in the 107th Congress) was unanimously adopted by the Environment and Public Works Committee but was never made part of the Homeland Security Act in 2002.

Corzine's bill would not only have beefed up site security, it would have required high priority plants to evaluate the availability of a wide variety of safer technologies or chemicals. If these alternatives were shown NOT to be cost-effective or ***"practicable"*** they would not be required to adopt them. The bill is both modest and limited in scope. It does not ban or phase out any dangerous chemicals.

Chemical industry opponents of Corzine's bill claim that "a one-size-fits-all" program won't work for such a diverse industry. However, the bill anticipated this concern and allowed enough flexibility to include a wide range of options including, safer chemicals/substances, smaller quantities of dangerous chemicals, increased efficiency, reduced storage, buffer zones, etc. -- Ideally, any risk *reduction* would be seen as the first step toward efforts to *eliminate* these risks in the long-term.

Although Senator James Inhofe (R-OK) voted for the Corzine bill in July, 2002 he flip-flopped in the fall of 2002, effectively blocking the bill from inclusion in the 2002 Homeland Security bill.

Inhofe introduced an industry friendly bill (S. 994) in May 2003. It was narrowly adopted on a party-line vote in the EPW Committee in October, 2003 and ultimately died.

Before Hurricane Katrina, a May 22, 2005 New York Times editorial entitled, "Inside the Kill Zone" captures the urgency surrounding this neglected vulnerability:

"*There is a park outside New Orleans with rows of old oak trees and the ruins of a colonial plantation. It is a pleasant place to take a stroll - and it would be an ideal staging ground for a terrorist attack on Chalmette Refining. An attack on the refinery, which has 600,000 pounds of hydrofluoric acid on hand, could put the entire population of New Orleans at risk of death or serious injury.*

"Chalmette Refining, a joint venture of Exxon Mobil, is one of more than 15,000 potentially deadly chemical plants and refineries nationwide. More than 100 of them put a million or more people at risk. These time bombs are everywhere, from big cities like Los Angeles to small towns like Barberton, Ohio. Many are so inconspicuous - a chlorine plant may be a couple of tanks and access to a railroad line - that the people in the kill zone do not even know to be worried.

"The worst possible outcomes are chilling. A successful terrorist attack on a chlorine tank could produce, according to a Department of Homeland Security report, 17,500 deaths, 10,000 severe injuries and 100,000 hospitalizations. In Bhopal, India, in 1984, when methyl isocyanate escaped accidentally from a chemical plant, at least 3,800 people were killed and as many as 600,000 injured.

"The security holes at chemical facilities are glaringly obvious. On a recent visit to Chalmette Refining, a Times editorial writer had no trouble standing in the nearby park for 15 minutes with a large knapsack. At two plants in Dallas that use large amounts of chlorine, the same writer parked a car on the periphery and milled about for more than a half-hour without being stopped. The fencing was minimal - far less than at a nearby automobile factory. It would not have been hard to explode a bomb or fire a weapon near the chlorine.

"Nuclear power plants are required by federal law to have physical barriers and trained security forces, and to hold simulated terrorist attack exercises. Chemical plants should be subject to the same sort of requirements. But common-sense safety measures are being blocked by special interest politics. Chemical companies do not want to pay for reasonable security, and the industry, a major contributor to presidential and Congressional campaigns, has succeeded in preventing Congress from acting.

"There is no way to guarantee that terrorists will not successfully attack a chemical facility. But it would be grossly negligent not to take defensive measures. The question Americans should be asking themselves, says Rick Hind, legislative director of the Greenpeace Toxics Campaign, is, "If you fast-forward to a disaster, what would you want to have done?" These should be some of the priorities:

"1. Tighter plant security There should be tough federal standards for perimeter fencing, concrete blockades, armed guards and other forms of security at all of the 15,000 facilities that use deadly chemicals.

"2. Use of safer chemicals Refineries, when practical, should adopt processes that do not use hydrofluoric acid, the chemical that is now putting New Orleans at risk. Some plants that once

used chlorine, such as the Blue Plains wastewater treatment plant in Washington, D.C., have switched to safer alternatives.

"3. Reducing quantities of dangerous chemicals An important reason that chemical facilities make such tempting targets for terrorists is the enormous quantity of chemicals they have on hand. The industry should be encouraged, and in some cases required, to store and transport dangerous chemicals in smaller quantities.

"4. Limiting chemical facilities in highly populated areas Many chemical facilities were built long before terrorism was a concern, and when fewer people lived in their surrounding areas. There should be a national initiative to move dangerous chemical facilities, where practical, to low-population areas.

"5. Government oversight of chemical safety The chemical industry wants to police itself through voluntary programs. But the risks are too great to leave chemical security in private hands. Facilities that use dangerous chemicals should be required to identify their vulnerabilities to the Environmental Protection Agency and the Department of Homeland Security, and to meet federal safety standards.."

On May 23rd the Senate Environment and Public Works voted along party lines in rejecting an amendment by Senators Jeffords (I-VT) and Boxer (D-CA) to provide grants to convert high hazard water treatment plants to safer technologies based on a bill by Senator Joseph Biden (D-DE), the Community Water Treatment Hazards Reduction Act of 2005 (S.2855).

On June 15th, the HSGAC voted against a compromise offered by Senator Lieberman (D-CT) that would have at least made 360 of the highest risk chemical plants determine which safer cost-effective chemicals or technologies are available to them. Without a provision to eliminate preventable risks, proven solutions will remain optional as they are under current law.

Major deficiencies in S. 2145 include:

- No requirement for the use of safer cost-effective technologies to eliminate inherent hazards
- Allows companies to sue DHS to challenge an order but prohibits citizens from suing to issue an order
- Keeps secret the names of chemical facilities that are NOT in compliance with the new law
- Failure to provide a significant role for the federal agency with 35 years of experience enforcing laws at chemical plants, the Environmental Protection Agency
- Failure to involve plant workers in identifying vulnerabilities and developing security plans

Since the demise of the 2002 EPA chemical security proposal, safer technology legislation has been opposed by the Bush administration and the chemical and oil industries. In fact, DHS Secretary Chertoff called safer technologies "mission creep" at a March 21, 2006 news conference co-hosted by the chemical industry lobbying arm, the American Chemistry Council.

Chertoff also favored disaster response over prevention, "*if one approach is to say we'll do a little less on prevention but we'll have much more on [disaster] response and mitigation, I think that's worth weighing as part of the total mix.*" This failure to invest in prevention added to the damage and losses suffered in the Gulf by Hurricane Katrina, it should not be repeated in preventing disasters at chemical plants.

Immediate Next Steps on Regulations and Legislation

Without enacting new legislation, the Bush administration could:

--- Use existing EPA authority under the Clean Air Act's "general duty clause" (section 112 r) to require chemical plants to prevent disasters, as the EPA proposed in 2002. This should include the immediate issuance of "guidance" by the EPA, followed by enforceable regulations to encourage the use of plant design changes, safer technologies and buffers zones if necessary to prevent catastrophes.

However, given the failure of the Bush administration to implement new standards to prevent chemical plants from being turned into weapons of mass destruction, new legislative authority is needed to require federal agencies to at a minimum:

>>> Require high priority facilities, to go beyond fence line security efforts to safer available technologies. Where available, safer technologies should be used to *eliminate risks*. Legislation introduced by Senators Frank Lautenberg (D-NJ), Barack Obama (D-IL) "Chemical Security and Safety Act of 2006" (S. 2486) and Representative Frank Pallone's (D-NJ) "Chemical Security Act of 2005" (H.R. 2237) represent essential first steps in making this a reality.

>>> Provide federal funds to convert high hazard water treatment facilities, currently using chlorine or sulfur dioxide gas, to safer technologies, such as ultra-violet light as outlined in Senator Biden's (D-DE) "Community Water Treatment Hazards Reduction Act of 2005" (S. 2855).

>>> Prohibit the siting of any new facilities that store, make or use large quantities of utlra-hazardous chemicals (such as chlorine, anhydrous ammonia, sulfur dioxide, hydrofluoric acid) in populated areas.

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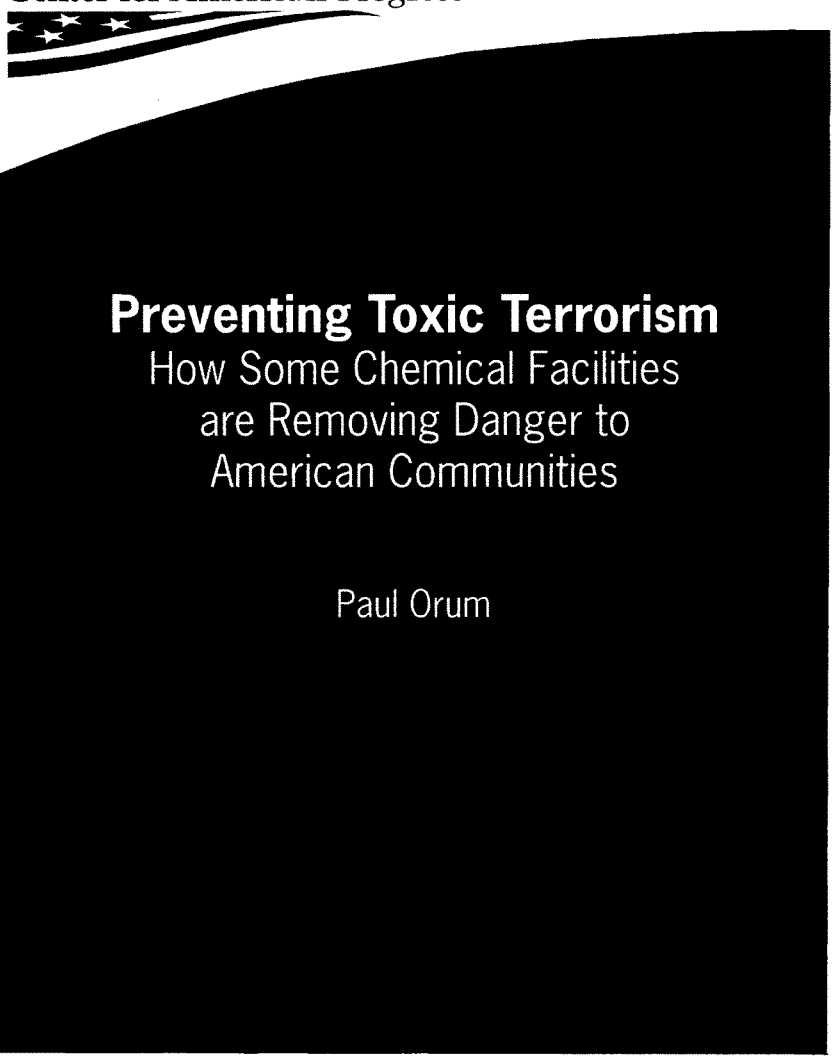

Preventing Toxic Terrorism

How Some Chemical Facilities are Removing Danger to American Communities

Paul Orum

Preventing Toxic Terrorism
How Some Chemical Facilities are Removing Danger to American Communities

April 2006

By Paul Orum

Project Manager: Reece Rushing

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Executive Summary

Across the country, some 14,000 chemical plants, manufacturers, water utilities and other facilities store and use extremely hazardous substances that can injure or kill employees or residents in nearby communities if suddenly released. Approximately 450 of these facilities each put more than 100,000 people in harm's way.

The Department of Homeland Security and numerous security experts have warned that terrorists could turn hazardous chemical facilities into improvised weapons of mass destruction. Some of these facilities have replaced acutely hazardous chemicals with safer, readily available alternatives—making themselves less appealing terrorist targets, while also removing the ever-present danger of a serious accident. At these facilities, no failure in safety or security can send a catastrophic gas cloud into a nearby community.

The Center for American Progress, with assistance from the National Association of State PIRGs and National Environmental Trust, conducted a survey to identify such facilities and spotlight successful practices that have removed unnecessary chemical dangers from our communities. This survey (which covered facilities that no longer report using extremely hazardous substances under the federal Risk Management Planning program) found that facilities across the country, representing a range of industries, have switched to safer alternatives from a variety of hazardous chemicals, producing dramatic security and safety benefits at a reasonable cost.

Key findings from the survey include the following:

- Some 284 facilities in 47 states have dramatically reduced the danger of a chemical release into nearby communities by switching to less acutely hazardous processes or chemicals or moving to safer locations.
- As a result of these changes, at least 38 million people no longer live under the threat of a major toxic gas cloud from these facilities.
- Eleven of these facilities formerly threatened more than one million people; a further 33 facilities threatened more than 100,000; and an additional 100 threatened more than 10,000.
- Of respondents that provided cost estimates, roughly half reported spending less than $100,000 to switch to safer alternatives and few spent over $1 million.
- Survey respondents represent a range of facilities small and large, including water utilities, manufacturers, power plants, service companies, waste management facilities, and agricultural chemical suppliers.
- Facilities reported replacing gaseous chlorine, ammonia, and sulfur dioxide, among other chemicals.
- The most common reasons cited for making changes included the security and safety of employees and nearby communities, as well as regulatory incentives and business opportunities.
- Facilities cut a variety of costs and regulatory burdens by switching to less hazardous chemicals or processes. These facilities need fewer physical security and safety measures and can better focus on producing valuable products and services.

Despite this progress, thousands of facilities that could switch to safer alternatives still have not done so. For example, several thousand water treatment plants, many situated in cities and towns, still use chlorine gas. Removing such hazards should be a national strategic priority. Unfortunately, more than four years after the 9/11 terrorist attacks, the White House and Congress have failed to act. Currently, no federal law or regulation requires hazardous chemical facilities to review or use readily available alternatives.

The facilities identified by the survey show that dramatic improvements are feasible if safety and security are given priority (see full list in Appendix A). For example:

- The Nottingham Water Treatment Plant in Cleveland, Ohio, now treats drinking water with liquid bleach instead of chlorine gas; some 1.1 million people are no longer at risk of a toxic gas release.
- The Wyandotte Wastewater Treatment Facility near Detroit, Mich., switched from chlorine gas to ultraviolet light; more than 1 million people are no longer at risk of a toxic gas release.
- Manhattan Products, in Carlstadt, N.J., now produces household cleaning products with liquid ammonia instead of gaseous ammonia, removing the threat to 160,000 residents.
- Solae Company dba DuPont Soy Polymers in Louisville, Ky., switched from anhydrous sulfur dioxide to the safer sodium bisulfite for producing food products from soy; the change removed the threat to 37,000 residents.
- Wisconsin Power's Pulliam Plant in Green Bay switched from anhydrous to solid sulfur dioxide for pollution control, removing the threat to 180,000 residents.
- U.S. Filter Recovery Services, in Roseville, Minn., changed treatment chemicals for certain hazardous waste recovery processes; the change eliminated the threat of a gas release to 62,000 residents.

"We are very pleased at no longer having one-ton cylinders of the dangerous chlorine and sulfur dioxide gases on our property."

–Operations Manager, Springbrook Water Reclamation Center, Naperville, Ill.

In some cases, facilities may be unable to identify a viable alternative to reduce chemical hazards, but may be able to improve safety and security by consolidating operations or relocating to a less populated area. For example, the Niklor Chemical Company moved from Carson, Calif., to a remote location near Mojave, removing a chlorine-gas danger from an area of 3.5 million residents.

Adopting safer alternatives, however, is the only certain way to prevent a catastrophic chemical release. Many chemical facilities have already taken this step thereby protecting millions of Americans. Millions more could be taken out of harm's way with a concerted national effort to convert other high-risk facilities to safer chemicals and processes.

Background

Risk Management Planning

Certain extremely hazardous industrial chemicals, when released in worst-case conditions, can form dense ground-hugging plumes of gas that remain lethal over many miles—areas that may include homes, schools, hospitals, parks or shopping centers. Some 14,000 facilities that use these chemicals over threshold amounts are regulated under the federal Risk Management Planning (RMP) program, which is carried out by the Environmental Protection Agency (EPA). Each of these facilities prepares a Risk Management Plan that includes a hazard assessment, a prevention plan and an emergency response plan. The facilities must estimate how far a chemical could travel off-site in a worst-case release, along with the number of people living within the "vulnerability zone"—the area potentially affected by the release.[1]

These plans save lives, prevent pollution and protect property by guiding companies in managing chemical hazards. Since the RMP program's inception in 1999, there has been a decline in hazardous chemical facilities that report a vulnerability zone of more than 10,000 people. From 2000 to 2005, the number of these high-hazard facilities declined by as many as 544, from 3,055 facilities[2] to 2,511.[3]

The terrorist threat heightens the risk presented by facilities that still have large vulnerability zones. However, the RMP program does not currently address the potential for a deliberate terrorist release of chemicals. Nor does any federal law require companies to assess readily available alternative chemicals and processes that pose fewer dangers.

Survey Scope

Chemical facilities deregister from the RMP program upon notifying EPA that they no longer use a regulated substance; have reduced chemicals below reporting thresholds; or have terminated, merged or moved operations. The Center for American Progress surveyed deregistered facilities to see if they had switched to "less acutely hazardous chemicals or processes" that significantly reduced or eliminated the *possibility* of a catastrophic chemical release.[4]

The survey identified 284 such facilities that reduced hazards or moved operations to safer locations, listed in Appendix A. This list represents a strong sample but is not comprehensive. Many other facilities use less hazardous alternatives. In particular, with a few rare exceptions,[5] the survey did not include facilities that:

- Eliminated some but not all RMP substances;
- Reduced RMP substances below reporting thresholds;[6]
- Selected a less hazardous process prior to the RMP program (prior to 1999); or
- Did not respond to the survey or did not follow requirements to deregister from the RMP program.

The survey consisted of a cover letter and response form (Appendix C), designed for response in a few minutes by mail or fax. The Center for American Progress mailed the survey to some 1,800 deregistered RMP facilities. For most of these facilities the reason for deregistering was not known; many had closed. Follow-up phone calls generated additional responses. (For details on survey scope and responses, see Appendix B, Methodology).

Warnings and Inaction

Numerous federal agencies and other observers have warned that terrorists could turn hazardous chemical facilities into improvised weapons of mass destruction. These agencies include the Department of Homeland Security,[7] Department of Justice,[8] Government Accountability Office,[9] Environmental Protection Agency,[10] Agency for Toxic Substances and Disease Registry,[11] Army Surgeon General,[12] and Naval Research Laboratory,[13] among others. The non-governmental Brookings Institution,[14] Rand Corporation,[15] PACE International Union,[16] and Center for Strategic and International Studies[17] also have documented the threat. Investigative news reporters have found lax security at more than 80 hazardous chemical facilities, including at least 20 covered by voluntary industry security programs.[18]

The good news is that this threat can be substantially reduced. Public interest organizations and labor unions have long pressed for effective, readily available techniques to reduce chemical hazards, including materials substitution, just-in-time manufacturing, inventory reduction and hardened storage, among other options. A year ago, in April 2005, the Center for American Progress recommended a 12-month action plan to reduce the risk posed by the nation's most vulnerable chemical facilities using these techniques.[19] Recent reports also illustrate the broad potential for less acutely hazardous chemical operations in three industries: wastewater treatment, petroleum refineries and power plants.[20]

Nonetheless, the chemical industry and Bush administration have focused on physical site security rather than technological progress to safer chemicals and processes. Even with improvements, physical site security and safety measures will never be able to fully assure the security and safety of surrounding communities. There will always be the danger of a terrorist strike or catastrophic accident. Indeed, the EPA has recognized that eliminating hazardous characteristics during facility or process design is generally preferable to adding on safety equipment or security measures.[21]

Despite ample opportunities for improvements, there has been almost no federal effort to move facilities to less acutely hazardous chemicals or processes. The Bush administration has stifled specific proposals to reduce chemical hazards, while Congress has failed to pass comprehensive legislation (see box).

Chemical Security Timeline

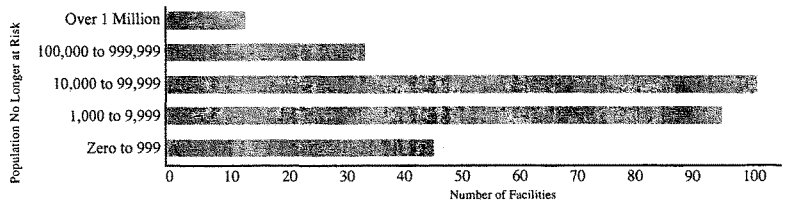
- In 1999, Sen. Frank Lautenberg (D-NJ) introduced a chemical-plant security bill, S.1470, which included a requirement that chemical facilities review safer technologies where available. Sen. Lautenberg's bill did not receive a hearing despite requests.[22]
- In 2002, the EPA and then-Office of Homeland Security jointly prepared federal chemical security standards, which would have required that facilities review options to reduce unnecessary chemical dangers. The White House killed the initiative under pressure from the chemical industry.[23]
- In July 2002, the Senate Environment and Public Works Committee unanimously passed chemical security legislation, S.1602, introduced by Sen. Jon Corzine (D-NJ), which also required companies to review less hazardous chemicals. This bill later stalled, however, under pressure from seven senators who had voted for the measure in committee.[24]
- In 2003, Sen. Corzine again introduced legislation, S.157, while Sen. James Inhofe (R-OK), put forward a weak industry-backed bill, S.994. The Senate Environment and Public Works Committee strengthened S.994 in October 2003 by adding a requirement that facilities evaluate "alternative approaches"—such as using less hazardous substances, processes or quantities—to make themselves less attractive terrorist targets. However, this bill received no action by the full Senate.
- Rep. Frank Pallone (D-NJ) has introduced chemical security legislation, including provisions for safer design and maintenance, in the last three sessions of Congress—as H.R.2237 in 2005, H.R.1861 in 2003, and H.R.5300 in 2002. These bills were never voted out of committee to the House floor.
- In April 2005, Rep. Edward Markey (D-MA) offered strong chemical security amendments to the homeland security authorization bill in the House Homeland Security Committee. These amendments were later included in a comprehensive homeland security measure offered on the House floor by Rep. Bennie Thompson (D-MS), the ranking member of the Homeland Security Committee. These amendments failed on near party line votes.
- Pending legislation includes S.2145, introduced by Sens. Susan Collins (R-ME) and Joseph Lieberman (D-CT), and an identical bill, H.R.4999, introduced by Reps. Christopher Shays (R-CT) and Jim Langevin (D-RI). These bills have modest requirements for facilities to review safer alternatives. A stronger bill, S.2486, introduced by Sens. Lautenberg, Barack Obama (D-IL) and others, requires chemical facilities to thoroughly review and use safer technologies where practicable.

Major Findings

Safety and Security Improvements

Some 284 respondents in 47 states reported they had switched to less acutely hazardous chemicals or processes or moved to safer locations. As a result, more than 38 million Americans no longer live under the threat of a harmful toxic gas release from these facilities.[25] Eleven of these facilities formerly threatened more than one million people; another 33 facilities threatened more than 100,000; and an additional 100 threatened more than 10,000.

Former Vulnerability Zones of Respondents



Reasons for Change

The survey asked facilities to indicate why they had switched to safer chemicals or processes. The most common reasons cited were safety, security, regulatory requirements and community expectations. Below are the aggregated responses of the 284 facilities identified in Appendix A. Facilities were presented with these possible explanations and selected all that applied.

Concern over an accidental chemical release and improved safety	217
Concern over terrorism and improved security[26]	117
Legal or regulatory requirements	106
Meeting community expectations	56
Improved operations efficiency or business opportunities	38
Projected cost savings	35
Other	29
No answer[27]	46

Costs and Savings

Of the 284 survey respondents that reported switching to less acutely hazardous chemicals or processes, 195 provided general information on the cost of making the change. Of these 195 facilities, 95 (49 percent) reported the changes cost less than $100,000; 75 (38 percent) reported costs between $100,000 and $1 million; 20 (10 percent) reported costs between $1 million and $10 million; three (two percent) reported costs between $10 million and $20 million; and two (one percent) reported costs over $20 million. The remaining 89 facilities did not respond to or were not surveyed on this question.[28] Facilities that reported the largest costs often also reported major facility upgrades (an opportune time for switching to safer technologies).[29]

Adopting safer technologies can also produce significant cost savings. Using less acutely hazardous chemicals can reduce or avoid many security and safety costs (see box). Some 226 respondents provided general information on cost savings from switching to safer alternatives. Of these 226 facilities, 76 (34 percent) expected changes to result in cost savings or improved profitability, 103 (45 percent) did not expect cost savings and 47 (21 percent) expected little change in costs.[30] The remaining 58 facilities did not respond to or were not surveyed on this question.[31] Respondents did not typically consult detailed figures on actual or potential cost savings.[32]

Costs Avoided with Safer Alternatives

Survey respondents identified a variety of costs and regulatory burdens that facilities fully or partly eliminated as a result of switching to less hazardous substances or processes. Avoided costs mentioned in survey responses include the following:

- Theft and theft prevention
- Personal protective equipment (such as gas masks)
- Safety devices (such as leak detection or scrubbers)
- Safety inspections
- Higher risk-group insurance premiums
- Potential liability
- Regulatory certifications, permits, and fees
- Compliance staff
- Certain chemical purchases
- Specialized emergency response teams
- Hazardous materials safety training
- Lost work time from chemical exposures
- Chemical damage to infrastructure
- Certain fire code requirements
- Certain physical security measures
- Unreliable chemical supply lines
- Placards and material safety data sheets
- Community notification
- Evacuation and contingency plans
- Background checks
- Compliance with OSHA Process Safety Management
- Compliance with EPA Risk Management Planning

Survey Examples: Switching to Less Hazardous Alternatives

"Making changes was cheaper than complying with RMPs."

–Plant Manager, City of Vicksburg Water Treatment Facility, Vicksburg, Miss.

The survey identified facilities in a diverse range of industries that switched to safer alternatives, including water utilities, manufacturers, power plants, waste management facilities, pool service companies and agricultural chemical suppliers. These facilities have together dramatically reduced chemical dangers to millions of Americans. Notably, most of the changes rely on common and available technologies rather than new innovations. Thousands of additional facilities across a range of industries could make similar changes. Below are examples of facilities, grouped by major industry category, that have improved safety and security by switching to less acutely hazardous alternatives.

Drinking Water and Wastewater

Some 114 wastewater facilities and 93 drinking water plants reported switching to less acutely hazardous chemicals. These facilities generally replaced chlorine gas with liquid chlorine bleach (sodium hypochlorite) or ultraviolet light. Some generate bleach on-site in a dilute solution. Some also replaced anhydrous sulfur dioxide with sodium bisulfite for removing chlorine after treating wastewater. Despite these improvements, approximately 1,150 wastewater facilities and 1,700 drinking water plants remain in the RMP program for extremely hazardous chemicals, primarily chlorine gas.

"When the Risk Management Plan was submitted, the off-site consequence analysis indicated that 5,000 people would be adversely affected if an accidental chlorine release occurred. So for the safety of the public and plant operators, the City switched to a non-hazardous substitute for chlorine gas."

–Director, McMinnville Wastewater Plant, McMinnville, Tenn.

From Chlorine Gas to Liquid Bleach

Some 166 respondents are water utilities that switched from chlorine gas to liquid bleach. Respondents frequently noted that liquid chlorine bleach is safer to work with than chlorine gas. Chemical costs tend to be higher for liquid bleach than chlorine gas, but overall costs are competitive when the full dangers and costs of safety and security are considered, according to respondents. More than 33 million people are no longer at risk of being exposed to toxic gas from these water utilities.

Hazards remain at the few facilities that manufacture the liquid bleach. Nonetheless, shipping chlorine gas to many locations is arguably more hazardous than securing a few manufacturing facilities in less populated areas. Other substitutes for chlorine gas, such as ultraviolet light or dilute bleach generated on-site, do not involve off-site chemical manufacturing and bulk storage.

Survey Examples

- City of Wilmington Water Pollution Control, Wilmington, Del., 560,000 people no longer at risk
- Middlesex County Utilities Authority, Sayreville, N.J., 10.7 million people no longer at risk
- Metropolitan Wastewater Treatment Plant, St. Paul, Minn., 520,000 people no longer at risk
- Nottingham Water Treatment Plant, Cleveland, Ohio, 1.1 million people no longer at risk
- Blue Plains Wastewater Treatment Plant, Washington, D.C., 1.7 people no longer at risk

From Chlorine Gas to Ultraviolet Light

Some 42 respondents switched from chlorine gas to ultraviolet light for water treatment, eliminating chemical danger to over 3.5 million people. The use of ultraviolet light also eliminates the hazards of transporting and working with chlorine gas.

More than 3,000 water facilities in the United States use ultraviolet light, primarily in wastewater treatment. More drinking water facilities are expected to use ultraviolet light, often in conjunction with other treatments, as a result of new EPA regulations to reduce disinfection byproducts and enhance surface water treatment.[33] Ultraviolet light and other options such as ozone are more effective than chlorine against certain biological agents such as anthrax that could contaminate drinking water. A multiple barriers approach, such as ultraviolet light and bleach with appropriate site security, has the best chance of preventing deliberate contamination of drinking water.[34]

Survey Examples

- White Slough Water Pollution Control Facility, Lodi, Calif., 606,500 people no longer at risk
- South Valley Water Reclamation Facility, West Jordan, Utah, 131,968 people no longer at risk
- R. M. Clayton WRC, Atlanta, Ga., 1.1 million people no longer at risk
- Stamford Water Pollution Control Facility, Stamford, Conn., 70,000 people no longer at risk
- Wyandotte Wastewater Treatment Facility, Wyandotte, Mich., 1.1 million people no longer at risk

From Chlorine Gas to Bleach Generated On-Site

A dozen survey respondents now treat water by generating bleach disinfectant on-site.[35] This practice eliminates bulk storage and transportation of hazardous chemicals. The process uses salt, water and electricity to produce a dilute bleach solution. Survey respondents noted that this dilute solution is even safer than the stronger bleach that many utilities receive by truck or rail. Generating bleach on-site virtually eliminates potential community and workplace exposure to toxic chemicals. An estimated 2,000 municipal drinking water systems now generate bleach on-site, with additional applications in wastewater, cooling towers and food processing.[36]

Survey Examples

- Ketchikan Chlorination Plant, Ketchikan, Alaska, 5,510 people no longer at risk
- Yorba Linda Water District, Placentia, Calif., 27,000 people no longer at risk
- LaVergne Water Treatment Plant, Lavergne, Tenn., 3,400 people no longer at risk
- East & West Site Water & Wastewater Facilities, Margate, Fla., 98,000 people no longer at risk
- Edison Filtration Plant and Well Field, South Bend, Ind., 18,815 people no longer at risk

From Chlorine Gas to Calcium Hypochlorite

One wastewater facility, **Town of Garner WWTP, Garner, N.C.,** reported switching from chlorine gas to calcium hypochlorite, a solid. This land-disposal facility spray-irrigates some 300 acres of hay fields with over a million gallons of treated wastewater each day. Calcium hypochlorite is less potentially harmful to soil than alternative sodium hypochlorite. Switching to calcium hypochlorite eliminates the risk of a chlorine gas leak to employees and 205 nearby residents.

Manufacturing

Some 18 manufacturing facilities reported process changes that reduced the danger of an off-site gas release. As a result, more than 1.5 million people are no longer threatened at these facilities. These manufacturers represent diverse industries and made an array of changes. Examples are provided below. Notably, the majority of these facilities reported neutral costs or anticipated cost savings from their changes. Roughly 2,300 non-food manufacturing facilities[37] are still regulated for extremely hazardous substances under the RMP program.

Cleaning Products

- **Manhattan Products, Carlstadt, N.J.,** manufactures household ammonia cleaners and other cleaning products. This mid-sized company switched from gaseous ammonia to liquid ammonia below RMP reportable thresholds. The switch involved altering pumps and material feed lines. This change created a safer workplace and eliminated the chance of a toxic release affecting any of 160,000 people who live within the facility's former vulnerability zone.

"The change to the ammonia solution results in an inherently safer workplace, and the chance of a toxic release affecting the public is negated."
–Regulatory Manager, Manhattan Products, Carlstadt, N.J.

- **The Proctor and Gamble Company, Alexandria Plant, Pineville, La.,** makes surfactants for detergents and dry laundry products. Previously, the company purchased oleum (fuming sulfuric acid) from another company. As part of a major plant upgrade, the facility installed a sulfur-burning unit that makes sulfur trioxide on demand for immediate use. This "just-in-time" production eliminated the need to transport and store large quantities of oleum. The new production method eliminated the danger of a chemical release to some 2,200 residents in the community, as well as to schools, churches and a Wal-Mart nearby.

Paper

- **SCA Tissue (formerly Wisconsin Tissue Mills), Menasha, Wis.,** is a large recycled paper mill that formerly used chlorine gas as a bleaching aid. The facility revamped the deinking process to use sodium hydrosulfite and hydrogen peroxide. This change significantly reduced workplace and community chemical hazards, while avoiding costs of complying with pollution rules, such as certain testing, sampling and permit reporting. Switching to different chemicals eliminated the danger of a chemical release to any of 210,000 people living within the facility's former vulnerability zone.

- **Wausau-Mosinee Paper Corporation, Brokaw, Wis.,** manufactures printing and writing paper. The mill switched from chlorine for bleaching pulp to an oxygen and hydrogen peroxide process. This change improved environmental security and safety by eliminating both the danger of a chlorine gas release and chlorine byproducts from waste streams. The change eliminated a chlorine gas vulnerability to an area containing 59,000 people.

- **Katahdin Paper (formerly Great Northern Paper), East Millinocket, Maine,** manufactures newsprint and telephone directory paper. Under new ownership, the mill eliminated chlorine gas and switched to chlorine bleach for treating incoming process water. The change eliminated a vulnerability zone of 3,200 nearby residents.

Glass

- **PPG Industries, Works No. 15, Fresno, Calif.,** manufactures flat glass used in windows and architectural applications. In 2000, the facility went from air natural gas combustion to oxygen natural gas combustion, called "oxyfuel." Using this different firing method eliminated the need for anhydrous ammonia in pollution control. The change was part of a larger $40 million upgrade that reduced nitrous oxide emissions to meet air quality requirements. In addition, the company realized improved manufacturing efficiency and product quality, while eliminating the danger anhydrous ammonia formerly posed to some 14,300 nearby residents.

- **AFG Industries, Victorville, Calif.,** a manufacturer of flat glass, formerly used an ammonia injection system to control nitrous oxide emissions. This system required storing anhydrous ammonia. To further reduce air emissions from glass furnaces, the company adopted a natural gas process (Pilkington 3R technology). The change eliminated a vulnerability zone of 82,000 people.

Circuit Board Manufacturing

- **Photocircuits Corporation, Glen Cove, N.Y.,** manufactures printed circuit boards for use in computers, cars, phones and many other products. The facility formerly used chlorine gas in the copper etching process used to make circuit boards, but switched to sodium chlorate. This change reduced hazards to employees and eliminated an off-site vulnerability zone that encompassed 21,000 people.

- **Sanmina-SCI (formerly Hadco), Phoenix, Ariz.,** manufactures high-end printed circuit boards and switched from chlorine gas to sodium chlorate in a closed loop system that directly feeds the etching process. The change eliminated the threat of a gas release to employees and 4,000 Phoenix residents.

Food Products

- **Cargill, Inc. plants, Memphis, Tenn., and Eddyville, Iowa,** produce products such as corn oil, corn syrup and animal feed from corn. These plants formerly used anhydrous sulfur dioxide to soak and soften corn kernels in the corn-milling process. Both switched to the less hazardous—but still effective—sodium bisulfite as a replacement. This industry best practice eliminated off-site vulnerability to 19,000 people in Eddyville and 370,000 people in Memphis.

"Switching to the safer sodium bisulfite is a good best practice for the industry."
–Environmental Manager, Cargill, Inc., Memphis, Tenn.

- **Solae Company, dba DuPont Soy Polymers (formerly Protein Technologies International), Louisville, Ky.,** extracts protein from soybean flakes for use in products such as soy flours, concentrates and isolates. The facility formerly used anhydrous sulfur dioxide to bleach products, stabilize drying, and lower pH. To improve safety, Solae switched to sodium bisulfite, a less acutely hazardous chemical. The change improved the safety of more than 37,000 residents and others who work in Louisville.

Metal Products

- **Kaiser Aluminum Trentwood Works, Spokane, Wash.,** is a large aluminum rolling mill. The facility formerly used large volumes of chlorine gas from 90-ton rail cars in fluxing operations that remove impurities from molten aluminum. Workers on the plant's safety and health committee and plant management became concerned with recurring chlorine leaks and injuries as well as corrosion of tools and infrastructure. After further investigation, the facility changed the fluxing process to a solid magnesium chloride salt injected with nitrogen gas. This change greatly improves worker safety, reduces maintenance costs and eliminates the danger of a major chlorine gas release to any of 137,000 nearby residents.

- **Henkel Surface Technologies, Calhoun, Ga.,** makes industrial coating products for cleaning and treating metal surfaces. The facility formerly used highly concentrated (70 percent) hydrofluoric acid. Henkel switched to less concentrated (less than 49 percent) hydrofluoric acid as a result of a company-wide safety policy. While still hazardous upon contact, less concentrated hydrofluoric acid in an aqueous solution is less volatile and does not readily form a toxic gas cloud that can drift off-site if released. The change eliminated a vulnerability zone that is home to 300 nearby residents.

- **The Ford Meter Box Company, Inc., Pell City, Ala.,** makes water utility equipment such as clamps and repair sleeves. The company formerly used hydrofluoric acid in a dip tank to clean and make the surface of metal parts less reactive for use in harsh environments underground. The company switched to a process that uses ammonium bifluoride to generate less hazardous hydrofluoric acid solution. This change eliminated a vulnerability zone encompassing 50 people.

Chemical Manufacturing

- **PVS Technologies, Augusta, Ga.,** manufactures ferric chloride, which is used in the water and wastewater treatment industries as a flocculent and coagulant. The manufacturing process uses chlorine gas, formerly delivered in 90-ton rail cars. The company eliminated rail cars from the site by constructing a direct pipeline to the chlorine producer, a nearby facility. Eliminating rail transportation removes the dangers of filling, moving, and unloading a large vessel, including more likely incidents such as transfer-hose failures as well as a potential worst-case rupture into an area encompassing 290,000 people.

- **Calgon Carbon Corporation, Neville Island Plant, Pittsburgh, Pa.,** produces activated carbon for use in respirators and other products. The company previously treated the carbon with aqueous ammonia that was produced on-site from anhydrous ammonia. The company

retained the same carbon treating process, but now starts with the aqueous ammonia. Savings on safety and security compliance offset slightly increased shipping costs. The change eliminated a vulnerability zone that formerly encompassed 120,000 people.

Electric Power Production

Eleven power plants reported switching to less acutely hazardous substances, eliminating previously reported off-site vulnerabilities to more than a million people. Examples of the various changes made are provided below. Electric power plants primarily report using anhydrous ammonia or aqueous ammonia in air pollution control equipment or chlorine gas to prevent fouling of cooling towers. Approximately 320 power plants are regulated under the RMP program.

From Anhydrous to Aqueous Ammonia

- **GWF Power Systems, Calif.,** produces electricity. At six California power plants, GWF formerly used anhydrous ammonia gas in air pollution control devices. GWF switched all six plants to aqueous ammonia below RMP thresholds as a safeguard to protect surrounding communities. Aqueous ammonia below RMP thresholds retains certain hazards, but is unlikely to form a gas cloud that can affect people off-site. (A less hazardous option than either gaseous or aqueous ammonia is dry urea, which allows power plants to generate ammonia on demand.) These six facilities combined formerly had more than 100,000 people living in their vulnerability zone areas.

> *"The conversion was considered a safeguard from impacting the communities in which we operate."*
>
> *–Director of Environment and Safety, GWF Power Systems, Calif.*

From Anhydrous to Solid Sulfur Dioxide

- **Wisconsin Power's Pulliam Plant, Green Bay, Wis.,** switched from 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 any of 180,000 people.

Eliminating Anhydrous Sulfur Dioxide

- **Xcel Energy's Arapahoe Station (formerly New Century Energies), Denver, Colo.,** retired two older power-generating units to reduce overall emissions as part of a larger voluntary regional air pollution agreement. These older units used anhydrous sulfur dioxide, which is not used in the currently operating units. This facility formerly reported 915,000 people living within range of an anhydrous sulfur dioxide gas release.

From Chorine Gas to Bleach

- **The Public Service Company of Oklahoma (PSO)** produces electricity. At three power plants, PSO switched from chlorine gas to chlorine bleach as a water treatment to prevent algae and fouling of cooling towers. Before making this simple change, these three facilities together endangered some 3,500 nearby residents in Oklahoma. Additional examples of the

same change include **Xcel Energy's Pawnee Station, Brush, Colo.,** with just 88 people in its former vulnerability zone, and **PPL Montana, Colstrip, Mont.,** which formerly threatened 1,400 people.

Pool Service

From Chlorine Gas to Chlorine Tabs or Liquid Bleach

Some swimming pool service companies switched from chlorine gas to chlorine tabs or liquid bleach. These facilities typically transferred chlorine gas from one-ton cylinders into 20-pound containers for use at residential pools. This transfer process could endanger people who live or work nearby. Using bleach or tabs eliminates any need for the pool service company to transfer chlorine gas out of one-ton cylinders. Some pools also may generate ozone or chlorine on-site, or use ionizers, further reducing transportation. One respondent noted that homeland security regulations now require background checks on drivers who handle chlorine gas. These background checks can take four to eight weeks, a significant impediment for a seasonal business. Such delays, along with increasingly strict regulatory requirements and concern for public safety, motivated the switch to bleach or tabs.

Survey Examples

- Nevada Chemical Company, Las Vegas, Nev., 60,000 people no longer at risk
- Blue Water Pool Chemical Company, Scottsdale, Ariz., 8,300 people no longer at risk
- RBD Enterprises dba Pure Water Pool Services, Austin, Texas, 4,800 people no longer at risk
- Splash Pool Chemicals, Las Vegas, Nev., 7,720 people no longer at risk
- CalChem Water Treatment, in Visalia, Fresno, and Modesto, Calif., combined 153,000 people no longer at risk

Hazardous Waste

Hazardous waste management facilities treat or dispose of a wide variety of chemical wastes generated by other industries. Two hazardous waste facilities responded to the survey; one reported changing processes and the other improved inventory accounting to store RMP chemicals only in lesser amounts. Approximately two-dozen or more RMP facilities still accept hazardous waste for incineration, treatment or disposal.

From Anhydrous Sulfur Dioxide and Chlorine Gas to Sodium Metabisulfite and Bleach

- **U.S. Filter Recovery Services, Roseville, Minn.,** treats and recovers industrial wastes that contain heavy metals and cyanide. This process involves precipitating toxic materials out of the wastes through chemical reactions. The facility formerly used anhydrous sulfur dioxide to treat chromium waste but switched to sodium metabisulfite. The facility formerly also used chlorine gas to treat cyanide wastes but switched to sodium hypochlorite (bleach). The changes were part of a larger reevaluation of business needs, costs and technologies. These and other changes eliminated the danger of a catastrophic chemical release to some 62,000 nearby residents.

Agricultural Ammonia

From Anhydrous Ammonia Gas to Liquid or Granular Fertilizers

More than 4,000 current RMP facilities supply agricultural chemicals, principally anhydrous ammonia for use as fertilizer. Many of these facilities are small and located in less populated areas. Two-dozen facilities reported eliminating anhydrous ammonia in favor of less acutely hazardous fertilizers. These facilities often already sold liquid nitrogen or dry urea fertilizers, the commonly reported alternatives. These alternate fertilizers eliminate the danger of an ammonia gas release to employees, customers and the general public. This change also cuts potential liability, eliminates the burden of complying with hazardous materials regulations and prevents siphoning from fertilizer tanks for illegal methamphetamine (meth) production.

No longer handling anhydrous ammonia (NH3) has "safety benefits for our employees, customers and general public because of health hazards if there was a sudden release. Theft of NH3 for use in illegal drug manufacturing has been eliminated."

–Manager, Leone Grain & Supply, Peru, Ill.

A number of respondents in this industry cited theft of anhydrous ammonia for illegal meth labs, a pervasive problem. One survey respondent reported that night cameras and automatic dialers to the state police generated 28 arrests over a two-year period at just one facility. Thieves also can cause emergency releases.[38] Common liquid or dry nitrogen fertilizers are not suitable for illegal meth production or for improvising explosives (such as the ammonium nitrate bomb used at the Oklahoma City federal building).

Survey Examples

- Battle Creek Farm Bureau Association, Climax, Mich., 2,500 people no longer at risk
- Helena Chemical Company, Mesquite, N.M., 12,659 people no longer at risk
- Lawhorn Farm Services, McCrory, Ark., 1,900 people no longer at risk
- Agro Distribution, Plainview, Texas, 7,500 people no longer at risk
- Robertsdale 142 (Royster-Clark), Robertsdale, Ala., 3,300 people no longer at risk

Oil Refineries

From Hydrofluoric Acid to Sulfuric Acid or Solid Acid Catalysts

The universe of surveyed facilities did not include any currently operating oil refineries that formerly used extremely hazardous toxic chemicals. Nonetheless, recent press reports have generated interest in intended changes announced by the Sunoco Philadelphia Refinery.[39] This refinery recently announced plans to switch from highly hazardous hydrofluoric acid to somewhat safer modified hydrofluoric acid. This change will substantially reduce the facility's vulnerability zone but still leave thousands of people—and downtown Philadelphia—in harm's way. Of the

148 petroleum refineries across the country, 50 use hydrofluoric acid, while the other 98 already use a safer alternative that does not endanger surrounding communities, such as sulfuric acid. An additional option, solid acid catalyst, eliminates the need to use either hydrofluoric acid or sulfuric acid—while eliminating chemical-release hazards to the public. This technology is currently in the demonstration phase in European refineries, and is commercially available, but inertia in the oil industry has so far prevented its use in the United States.[40]

Survey Examples: Additional Options for Improving Safety and Security

Switching to less acutely hazardous chemicals and processes is the first option for improving safety and security, as it is the only alternative that can eliminate the possibility of a toxic gas release. However, there may be cases where safer technologies are not readily available. In these cases, there are other options facilities can pursue that improve both safety and security. The Center for American Progress discussed some of these options in recommendations issued last year.[41]

This survey identified facilities that reduced the number of people in danger by consolidating multiple facilities to fewer locations or relocating to less populated areas. Such changes can produce significant safety and security benefits, but may still leave some people in danger of a toxic gas release.

Consolidating Locations

Consolidating operations to fewer locations can reduce the overall number of people in danger, but significant populations may still live within the vulnerability zones of consolidated locations. Companies reported consolidating for business efficiency reasons rather than, or in addition to, safety and security.

Among ammonia fertilizer suppliers, for example, consolidating or moving to more remote or more secure locations is relatively common. Tanks may move as customers' needs change. Ammonia tanks were often originally located at rail lines and terminals. Towns grew up around these rail hubs as well. Tanks may still be in town by the rail line even in cases where ammonia is now delivered by truck. Efficiency may be the main motivation for consolidating operations—it takes two deliveries to fill tanks in two places—but consolidating does reduce transfer operations and take some populations out of harm's way. Examples from the survey include **Producers Cooperative Association #2, Girard, Kan.**, with 2,900 people formerly in its vulnerability zone; and **Big Flag Farm Supply Gibbon Anhydrous, Gibbon, Neb.**, with 1,968 people formerly in its vulnerability zone.

Below are other companies that reported consolidating to fewer but already existing locations.

- **Oregon Cherry Growers, Salem, Ore.**, consolidated cherry brining operations from populous locations in Salem, Oregon's capital city, to less populated eastern Oregon. Cherry brining uses anhydrous sulfur dioxide as a feedstock in preserving and firming cherries for year-round food processing. Transporting anhydrous sulfur dioxide is hazardous. (Producing sodium metabisulfite from sulfur dioxide generated on-site could eliminate this transportation hazard.) Nonetheless, consolidating operations improved business efficiency and eliminated a large vulnerability zone that encompassed 1.2 million people in Salem and surrounding areas.

- **Nalco Chemical Company Plant 1, Chicago, Ill.,** consolidated production of epichlorohydrin, dimethylamine and cyclohexylamine at other facilities. These other locations manufacture the chemicals into less hazardous polymers that are then distributed through this Chicago warehouse. This facility formerly had 870 people in its vulnerability zone.

- **Hill Brothers Chemical Co., Los Angeles, Ca.,** consolidated ammonia processing at two locations into one existing location. These facilities processed anhydrous ammonia into aqueous ammonia. The company ceased this operation at its downtown Los Angeles facility; a potential ammonia gas release formerly threatened 469,000 people at this site.

- **U.S. Steel Group—Fairless Works, Fairless Hills, Pa.,** formerly employed a process called "tin-free steel" manufacturing that used anhydrous sulfur dioxide to reduce chromium in wastewater. For business reasons unrelated to safety, the company entirely discontinued this process at Fairless Hills. Two other U.S. Steel plants, located in Indiana, already produced tin-free steel and never used sulfur dioxide for wastewater treatment, relying instead on sodium metabisulfite. While sodium metabisulfite is corrosive and can irritate the skin and eyes, it is much less dangerous than anhydrous sulfur dioxide in an emergency release. More than 200,000 people lived in the former vulnerability zone of the Fairless Hills facility.

Moving Locations

Facilities may also decide to relocate in safer or remote settings, farther from off-site populations. Some facilities can relocate more readily than others. For example, a chemical distributor may find a remote location less congested, but a wastewater treatment facility must be near the population it serves. (Some facilities may also buy-out and relocate nearby residents, a disruptive option for communities that is beyond the scope of this survey.)

- **Niklor Chemical Company, Inc.** moved from Carson, Calif., in Los Angeles County to a remote location near Mojave, Calif. The facility uses chlorine gas in processing and manufacturing. The move to Mojave eliminated the hazard to 3.5 million people around the Carson site and reduced chemical transportation through a busy metropolis.

Conclusion and Recommendations

This survey shows that many chemical facilities have made significant, cost-effective improvements in safety and security by switching to less acutely hazardous chemicals and processes. Millions of Americans are safer as a result of these changes.

Nonetheless, thousands of other facilities could make similar changes but have not done so. They continue to use high-hazard chemicals when safer alternatives are available. Nearly 3,000 drinking water and wastewater treatment plants, for example, still use chlorine gas instead of ultraviolet light or liquid bleach. Many of these plants sit near cities and towns.

Congress and the Bush administration have so far not required these facilities to evaluate and adopt readily available alternatives that eliminate the danger to communities, nor has the chemical industry set public goals to do so. As a result, millions of people remain unnecessarily vulnerable.

A catastrophic chemical release at just one of the nation's most dangerous facilities could kill, injure or sicken tens of thousands. Adopting less acutely hazardous chemicals or processes is the only *certain* way to protect the public from a toxic gas cloud.

Many facilities achieved significant safety and security improvements with relatively minor expenditures, and some reported cost savings. Nonetheless, many other facilities that could make similar improvements remain potential terrorist targets. Accordingly, the chemical industry and government should make conversion of high-hazard facilities to safer available technologies a national strategic priority. Specifically:

- Where safer alternative chemicals and processes are available, each chemical facility should establish a timeline and measurable goals to eliminate the possibility of a catastrophic chemical release into surrounding communities.
- Where safer chemicals or processes are not feasible, chemical facilities should develop other options, such as consolidating locations or moving to less populated areas.
- Congress should enact legislation that promotes systematic review and adoption of less acutely hazardous chemicals and processes. This legislation should authorize the Department of Homeland Security (DHS) and EPA to require high-hazard facilities to identify, evaluate and adopt safer alternatives that are feasible and cost effective.
- EPA and DHS should use existing authorities and resources to make it a general duty of high-risk facilities to review and switch to less acutely hazardous chemicals and processes, particularly in cases where similar facilities have already successfully done so.
- DHS should develop methodologies to evaluate the impact of different production technologies on a facility's security. These methodologies should identify savings, costs, hazards and the technical feasibility of alternatives.
- DHS should allocate homeland security grants, where necessary and appropriate, to convert priority facilities to safer technologies. In prioritizing funding for chemical plant security, reducing unnecessary chemical hazards should be the top concern.
- Congress and the administration should provide academic institutions and the National Institute for Standards and Technology resources to identify, research and provide technical assistance on substitutes for industrial applications of acutely toxic chemicals.
- Congress and the administration should fund training grants through the National Institute for Environmental Health Sciences to help facility employees identify and evaluate security and safety improvements afforded by safer technologies.

Appendix A – Facilities Reporting Less Acutely Hazardous Operations

Facility Name**	City	State	Industry Type	Previous EHS Chemicals***	Change Made	Former Vulnerability Zone Population
Ketchikan Chlorination Plant	Ketchikan	AK	Drinking water treatment	Chlorine gas	Switched to generating bleach on-site	5,510
Sugar Creek Wastewater Treatment Plant	Alexander City	AL	Wastewater treatment	Chlorine gas	Switched to liquid bleach disinfection	660
The Ford Meter Box Company, Inc.	Pell City	AL	Hardware manufacturing	Hydrofluoric acid (concentration >50%)	Switched to ammonium bifluoride treatment	50
Robertsdale, AL 142 [Royster-Clark]	Robertsdale	AL	Farm supply	Ammonia (anhydrous)	Sells alternate fertilizers	3,300
Massard Wastewater Treatment Facility	Barling	AR	Wastewater treatment	Chlorine gas	Switched to ultraviolet light disinfection	2,701
Berryville, City of-WWTP	Berryville	AR	Wastewater treatment	Chlorine gas	Switched to ultraviolet light disinfection	4,000
Lawhorn Farm Services, Inc.	Mc Crory	AR	Farm supply	Ammonia (anhydrous)	Sells alternate fertilizers	1,900
Goodyear 157th Ave. Wastewater Treatment Plant	Goodyear	AZ	Wastewater treatment	Chlorine gas	Switched to liquid bleach disinfection	200
Southeast Water Reclamation Plant	Mesa	AZ	Wastewater treatment	Chlorine gas	Switched to ultraviolet light disinfection	2,400
Hadco Phoenix, Inc [now Sanmina-SCI]	Phoenix	AZ	Printed circuit board manufacturing	Chlorine gas	Switched to sodium chlorate etching	4,000
Blue Water Pool Chemical Company, Inc.	Scottsdale	AZ	Swimming pool treatment	Chlorine gas	Switched to chlorine tabs	8,300
Wilbur West Power Plant [GWF Power]	Antioch	CA	Electric power generation	Ammonia (anhydrous)	Switched to aqueous ammonia below thresholds	36,000
Wilbur Avenue East Power Plant [GWF Power]	Antioch	CA	Electric power generation	Ammonia (anhydrous)	Switched to aqueous ammonia below thresholds	22,000
Canyon Chlorination Facility	Azusa	CA	Drinking water treatment	Chlorine gas	Switched to liquid bleach disinfection	5,000
Canyon Filtration Plant	Azusa	CA	Drinking water treatment	Chlorine gas	Switched to liquid bleach disinfection	5,000
Tapia Water Reclamation Facility	Calabasas	CA	Wastewater treatment	Chlorine gas and sulfur dioxide (anhydrous)	Switched to liquid bleach and sodium bisulfite	23,000
Niklor Chemical Company, Inc.	Carson	CA	Agricultural chemical manufacturing	Chlorine gas	Moved to less populated location	3,500,000
Joint Water Pollution Control Plant	Carson	CA	Wastewater treatment	Chlorine gas	Switched to liquid bleach disinfection	210,000
CalChem Water Treatment	Fresno	CA	Swimming pool treatment	Chlorine gas	Switched to liquid bleach	18,000
PPG Industries, Inc., Works No. 15, Fresno	Fresno	CA	Flat glass manufacturing	Ammonia (anhydrous)	Changed combustion process	14,312
Hanford Power Plant [GWF Power]	Hanford	CA	Electric power generation	Ammonia (anhydrous)	Switched to aqueous ammonia below thresholds	2,200
3A Treatment Plant	Laguna Niguel	CA	Wastewater treatment	Chlorine gas	Switched to liquid bleach disinfection	42,000
Regional Wastewater Facility	Lake Elsinore	CA	Wastewater treatment	Chlorine gas	Switched to ultraviolet light disinfection	1,070
White Slough Water Pollution Control Facility	Lodi	CA	Wastewater treatment	Chlorine gas and sulfur dioxide (anhydrous)	Switched to ultraviolet light disinfection	606,505
Hill Brothers Chemical Co. - Los Angeles	Los Angeles	CA	Chemical product manufacturing	Ammonia (anhydrous) and ammonia (aqueous)	Consolidated EHS chemicals to another location	469,144
City of Merced Wastewater Treatment Facility	Merced	CA	Wastewater treatment	Sulfur dioxide (anhydrous) and chlorine gas	Switched to liquid bleach and sodium bisulfite	68,270
CalChem Stanislaus County Inc.	Modesto	CA	Swimming pool treatment	Chlorine gas	Switched to liquid bleach	55,000
CalOaks Pumping Station	Murietta	CA	Drinking water treatment	Chlorine gas	Switching to generating bleach on-site	4,200
Regional Plant #1	Ontario	CA	Wastewater treatment	Chlorine gas	Switched to liquid bleach disinfection	350,000
Western Farm Service, Paso Robles	Paso Robles	CA	Farm supply	Ammonia (aqueous)	Sells alternate fertilizers	576

Loveridge Road Power Plant [GWF Power]	Pittsburg	CA	Electric power generation	Ammonia (anhydrous)	Switched to aqueous ammonia below thresholds	55,000
East Third Street Power Plant [GWF Power]	Pittsburg	CA	Electric power generation	Ammonia (anhydrous)	Switched to aqueous ammonia below thresholds	40,000
Nichols Road Power Plant [GWF Power]	Pittsburg	CA	Electric power generation	Ammonia (anhydrous)	Switched to aqueous ammonia below thresholds	13,000
Yorba Linda Water District	Placentia	CA	Drinking water treatment	Chlorine gas	Switched to generating bleach on-site	27,000
Lake Mathews Reservoir	Riverside	CA	Drinking water treatment	Chlorine gas (occasional use)	Switched to liquid bleach chlorination	94,000
South Tahoe Public Utility District	South Lake Tahoe	CA	Wastewater treatment	Chorine gas	Switched to liquid bleach disinfection	27,000
D.C. Tillman Water Reclamation Plant	Van Nuys	CA	Wastewater treatment	Chlorine gas and sulfur dioxide (anhydrous)	Switched to liquid bleach and sodium bisulfite	112,000
AFG Industries, Inc. - Victorville	Victorville	CA	Flat glass manufacturing	Ammonia (anhydrous)	Changed combustion process	82,364
CalChem Tulare County	Visalia	CA	Swimming pool treatment	Chlorine gas	Switched to liquid bleach	80,000
Arvada Water Treatment Plant	Arvada	CO	Drinking water treatment	Chlorine gas	Switched to liquid bleach disinfection	23,878
Ralston Water Treatment Plant	Arvada	CO	Drinking water treatment	Chlorine gas	Switched to liquid bleach disinfection	23,878
Pawnee Station [Xcel Energy]	Brush	CO	Electric power generation	Chlorine gas	Switched to bleach anti-fouling	88
Arapahoe Station [Xcel Energy]	Denver	CO	Electric power generation	Sulfur dioxide (anhydrous)	Retired older power generation units	915,000
City of Golden Water Treatment Plant	Golden	CO	Drinking water treatment	Chlorine gas	Switched to liquid bleach disinfection	5,900
Clean Harbors of Connecticut, Inc.	Bristol	CT	Hazardous waste disposal	Phosphorus oxychloride and 19 other RMP chemicals	Improved inventory accounting	17,312
Mianus Water Treatment Plant-Aquarion Water Co.	Cos Cob	CT	Drinking water treatment	Chlorine gas	Switched to liquid bleach disinfection	9,700
BHC Easton LakeTreatment Plant	Easton	CT	Drinking water treatment	Chlorine gas	Switched to liquid bleach disinfection	26,000
Lake Gaillard Water Treatment Plant	North Branford	CT	Drinking water treatment	Chlorine gas	Switched to liquid bleach disinfection	24,000
Stamford WPCF	Stamford	CT	Wastewater treatment	Chlorine gas	Switched to ultraviolet light disinfection	70,000
BHC Stamford Water Treatment Plant	Stamford	CT	Drinking water treatment	Chlorine gas	Switched to liquid bleach disinfection	30,000
City of West Haven Water Pollution Control Fac.	West Haven	CT	Wastewater treatment	Chlorine gas	Switched to liquid bleach disinfection	113,192
West River Water Treatment Plant	Woodbridge	CT	Drinking water treatment	Chlorine gas	Switched to liquid bleach disinfection	29,000
Blue Plains Wastewater Treatment Plant	Washington	DC	Wastewater treatment	Sulfur dioxide (anhydrous) and chlorine gas	Switched to liquid bleach and sodium bisulfite	1,700,000
City of Wilmington Water Pollution Control Fac.	Wilmington	DE	Wastewater treatment	Chlorine gas	Switched to liquid bleach disinfection	560,000
BSU Water Treatment Plant	Bonita Springs	FL	Drinking water treatment	Chlorine gas and ammonia (anhydrous)	Switched to liquid bleach; ammonia below threshold	300
Brennan Water Treatment Plant	Daytona Beach	FL	Drinking water treatment	Chlorine gas	Switched to generating bleach on-site	75
Hudson Wastewater Treatment Plant	Hudson	FL	Wastewater treatment	Chlorine gas	Switched to liquid bleach disinfection	6,200
Buckman Water Reclamation Facility	Jacksonville	FL	Wastewater treatment	Chlorine gas and sulfur dioxide (anhydrous)	Switched to ultraviolet light disinfection	360,000
Fairfax Water Treatment Plant	Jacksonville	FL	Drinking water treatment	Chlorine gas	Switched to liquid bleach disinfection	57,000
Norwood Water Treatment Plant	Jacksonville	FL	Drinking water treatment	Chlorine gas	Switched to liquid bleach disinfection	50,000
Arlington Water Treatment Plant	Jacksonville	FL	Drinking water treatment	Chlorine gas	Switched to liquid bleach disinfection	45,000
McDuff Water Treatment Plant	Jacksonville	FL	Drinking water treatment	Chlorine gas	Switched to liquid bleach disinfection	44,000
Lovegrove Water Treatment Plant	Jacksonville	FL	Drinking water treatment	Chlorine gas	Switched to liquid bleach disinfection	30,000

Lakeshore Water Treatment Plant	Jacksonville	FL	Drinking water treatment	Chlorine gas	Switched to liquid bleach disinfection	29,000
Main Street Water Treatment Plant	Jacksonville	FL	Drinking water treatment	Chlorine gas	Switched to liquid bleach disinfection	29,000
River Oaks Water Treatment Plant	Jacksonville	FL	Drinking water treatment	Chlorine gas	Switched to liquid bleach disinfection	28,000
Southwest Water Treatment Plant	Jacksonville	FL	Drinking water treatment	Chlorine gas	Switched to liquid bleach disinfection	28,000
Highlands Water Treatment Plant	Jacksonville	FL	Drinking water treatment	Chlorine gas	Switched to liquid bleach disinfection	18,000
Community Hall Water Treatment Plant	Jacksonville	FL	Drinking water treatment	Chlorine gas	Switched to liquid bleach disinfection	17,000
Hendricks Water Treatment Plant	Jacksonville	FL	Drinking water treatment	Chlorine gas	Switched to liquid bleach disinfection	17,000
Oakridge Water Treatment Plant	Jacksonville	FL	Drinking water treatment	Chlorine gas	Switched to liquid bleach disinfection	15,000
Ridenour Water Treatment Plant	Jacksonville	FL	Drinking water treatment	Chlorine gas	Switched to liquid bleach disinfection	15,000
Deerwood 3 Water Treatment Plant	Jacksonville	FL	Drinking water treatment	Chlorine gas	Switched to liquid bleach disinfection	14,000
Marietta Water Treatment Plant	Jacksonville	FL	Drinking water treatment	Chlorine gas	Switched to liquid bleach disinfection	12,000
Southeast Water Treatment Plant	Jacksonville	FL	Drinking water treatment	Chlorine gas	Switched to liquid bleach disinfection	4,400
District II Water Reclamation Facility	Jacksonville	FL	Wastewater treatment	Chlorine gas and sulfur dioxide (anhydrous)	Switched to ultraviolet light disinfection	3,000
Cypress Creek Pumping Station	Land O' Lakes	FL	Drinking water treatment	Chlorine gas	Switched to liquid bleach disinfection	4,386
Lake Bridge Water Treatment Plant	Lutz	FL	Drinking water treatment	Chlorine gas	Switched to liquid bleach disinfection	5,606
East & West Site Water & Wastewater Facilities	Margate	FL	Drinking water/wastewater treatment	Chlorine gas	Switched to generating bleach on-site	98,000
D. B. Lee Wastewater Treatment Facility	Melbourne	FL	Wastewater treatment	Chlorine gas	Switched to liquid bleach disinfection	10,596
The City of Miramar East Water Treatment Plant	Miramar	FL	Drinking water treatment	Chlorine gas	Switched to liquid bleach disinfection	35,000
Deer Park Wastewater Treatment Plant	New Port Richey	FL	Wastewater treatment	Chlorine gas	Switched to liquid bleach disinfection	22,600
Embassy Hills Wastewater Treatment Plant	Newport Richey	FL	Wastewater treatment	Chlorine gas	Switched to liquid bleach disinfection	7,900
City of North Port Water Treatment Plant	North Port	FL	Drinking water treatment	Chlorine gas	Switched to liquid bleach disinfection	3,312
City of North Port Wastewater Treatment Plant	North Port	FL	Wastewater treatment	Chlorine gas	Switched to liquid bleach disinfection	1,197
Water Reclamation Facility #1	Ocala	FL	Wastewater treatment	Chlorine gas	Switched to liquid bleach disinfection	71
Water Reclamation Facility #2	Ocala	FL	Wastewater treatment	Chlorine gas	Switched to liquid bleach disinfection	71
Eastern Regional Water Reclamation Facility	Orlando	FL	Wastewater treatment	Chlorine gas	Switched to liquid bleach disinfection	576
R. Dwayne Huffman Reclaimed Water Plant	Port Orange	FL	Wastewater treatment	Chlorine gas and sulfur dioxide (anhydrous)	Switched to liquid bleach disinfection	18,000
Northwest Regional WWTP	Sanford	FL	Wastewater treatment	Chlorine gas	Switched to liquid bleach disinfection	4
Shady Hills Wastewater Treatment Plant	Spring Hill	FL	Wastewater treatment	Chlorine gas	Switched to liquid bleach disinfection	2,900
Greater Pine Island Reverse Osmosis WTP	St. James City	FL	Drinking water treatment	Chlorine gas	Switched to liquid bleach disinfection	290
City of Venice R. O. Water Treatment Plant	Venice	FL	Drinking water treatment	Chlorine gas	Switched to liquid bleach disinfection	5,993
T. Mabry Carlton Water Treatment Facility	Venice	FL	Drinking water treatment	Chlorine gas	Switched to liquid bleach disinfection	2,200
Wesley Center Wastewater Treatment Plant	Wesley Chapel	FL	Wastewater treatment	Chlorine gas	Switched to liquid bleach disinfection	2,500
Polk County Central Regional WWTF	Winter Haven	FL	Wastewater treatment	Chlorine gas	Switched to liquid bleach disinfection	14,316
Southeast Wastewater Treatment Plant	Zephyrhills	FL	Wastewater treatment	Chlorine gas	Switched to liquid bleach disinfection	970

R. M. Clayton WRC	Atlanta	GA	Wastewater treatment	Chlorine gas	Switched to ultraviolet light disinfection	1,151,993
PVS Technologies, Inc. (Augusta)	Augusta	GA	Inorganic chemical manufacturing	Chlorine gas	Changed to pipeline delivery of chlorine	290,000
Henkel Surface Technologies	Calhoun	GA	Surface active agent manufacturing	Hydrofluoric acid (concentration >50%)	Changed to less concentrated hydrofluoric acid	320
Naval Submarine Base (NSB) Kings Bay	Kings Bay	GA	Drinking water/wastewater treatment	Chlorine gas	Switched to liquid bleach disinfection	652
Tybee Island Wastewater Treatment Plant	Tybee Island	GA	Wastewater treatment	Chlorine gas	Switched to ultraviolet light disinfection	2,000
Brewer Environmental Industries, LLC - Kahului	Kahului	HI	Warehousing and storage	Ammonia (anhydrous)	Handles aqueous ammonia	1,000
Brewer Environmental Industries, LLC - Port Allen	Liheu	HI	Warehousing and storage	Ammonia (anhydrous)	Handles aqueous ammonia	500
Eagle Point Water Plant	Dubuque	IA	Drinking water treatment	Chlorine gas	Switched to liquid bleach disinfection	59,459
Cargill, Inc.	Eddyville	IA	Corn milling	Sulfur dioxide (anhydrous)	Switched to liquid sodium bisulfite	19,000
Hull Cooperative Association - NH3	Hull	IA	Farm supply	Ammonia (anhydrous)	Sells alternate fertilizers	2,152
West Des Moines Water Works	West Des Moines	IA	Drinking water treatment	Chlorine gas	Switched to liquid bleach disinfection	87,874
City of Boise- West Boise WWTP	Boise	ID	Wastewater treatment	Chlorine gas and sulfur dioxide (anhydrous)	Switched to ultraviolet light disinfection	6,000
Nalco Chemical Company -- Plant 1	Chicago	IL	Chemical warehousing	Epichlorohydrin, cyclohexylamine, dimethylamine	Consolidated EHS production to another location	870
City of Elmhurst Wastewater Treatment Plant	Elmhurst	IL	Wastewater treatment	Chlorine gas	Switched to liquid bleach disinfection	100,000
Moline Water Treatment Plant	Moline	IL	Drinking water treatment	Chlorine gas	Switched to liquid bleach disinfection	198,871
Springbrook Water Reclamation Center	Naperville	IL	Wastewater treatment	Sulfur dioxide (anhydrous) and chlorine gas	Switched to liquid bleach disinfection	4,830
Leone Grain & Supply, Inc.	Peru	IL	Farm supply	Ammonia (anhydrous)	Sells alternate fertilizers	250
Wilmette Water Plant	Wilmette	IL	Drinking water treatment	Chlorine gas	Switched to liquid bleach disinfection	50,000
Helena Chemical Company	Goshen	IN	Farm supply	Ammonia (anhydrous)	Sells alternate fertilizers	12,315
White River Water Treatment Plant	Indianapolis	IN	Drinking water treatment	Chlorine gas	Switched to liquid bleach disinfection	968,579
Fall Creek Water Treatment Plant	Indianapolis	IN	Drinking water treatment	Chlorine gas	Switched to liquid bleach disinfection	771,633
Jasper Wastewater Treatment Plant	Jasper	IN	Wastewater treatment	Chlorine gas	Switched to ultraviolet light disinfection	7,000
Lebanon Plant Food and Petroleum	Lebanon	IN	Farm supply	Ammonia (anhydrous)	Stores alternate fertilizers	4,368
Edison Filtration Plant and Well Field	South Bend	IN	Drinking water treatment	Chlorine gas	Switched to generating bleach on-site	18,815
Olive St. Well Field	South Bend	IN	Drinking water treatment	Chlorine gas	Switched to generating bleach on-site	14,158
Flint Lake Treatment Plant 2	Vallparaiso	IN	Drinking water treatment	Chlorine gas	Switched to liquid bleach disinfection	1,523
Producers Cooperative Association #2	Girard	KS	Farm supply	Ammonia (anhydrous)	Consolidated EHS chemicals to another location	2,900
Norcatur - NH3 Plant	Norcatur	KS	Farm supply	Ammonia (anhydrous)	Sells alternate fertilizers	190
Topeka KS - N. Topeka Wastewater Treatment Plant	Topeka	KS	Wastewater treatment	Sulfur dioxide (anhydrous) and chlorine gas	Switching to liquid bleach disinfection	39,000
Big Creek Fertilizer, Inc.	Wakeeney	KS	Farm supply	Ammonia (anhydrous)	Sells alternate fertilizers	2,500
Sewage Treatment Plant No. 2	Wichita	KS	Wastewater treatment	Chlorine gas and sulfur dioxide (anhydrous)	Switched to ultraviolet light disinfection	18,000
Dry Creek Wastewater Treatment Plant	Erlanger	KY	Wastewater treatment	Chlorine gas	Switched to liquid bleach disinfection	5,900
Fort Thomas Filtration Plant	Fort Thomas	KY	Drinking water treatment	Chlorine gas	Switched to liquid bleach disinfection	47,706
Franklin Water Treatment Plant	Franklin	KY	Drinking water treatment	Chlorine gas	Switched to liquid bleach disinfection	3,100
London Wastewater Treatment Plant	London	KY	Wastewater treatment	Chlorine gas	Switched to ultraviolet light disinfection	18,238

Protein Technologies International [now Solae/DuPont]	Louisville	KY	Adhesive manufacturing	Sulfur dioxide (anhydrous)	Switched to liquid sodium bisulfite	37,153
Waste Water Treatment Plant, West	Owensboro	KY	Wastewater treatment	Chlorine gas	Switched to liquid bleach disinfection	90,000
RWRA East Wastewater Treatment Plant	Owensboro	KY	Wastewater treatment	Chlorine gas	Switched to liquid bleach disinfection	27,750
Jefferson Parish East Bank WWTP	Harahan	LA	Wastewater treatment	Chlorine gas	Switched to liquid bleach disinfection	790,000
The Procter & Gamble Mfg. Company-Alexandria Plant	Pineville	LA	Soap and detergent manufacturing	Oleum (fuming sulfuric acid)	Changed to just in time sulfur trioxide	2,200
City of Attleboro Wastewater Treatment Plant	Attleboro	MA	Wastewater treatment	Chlorine gas	Switched to liquid bleach and sodium bisulfite	67,026
Lowell Regional Water Utility Intake Station	Lowell	MA	Drinking water treatment	Chlorine gas	Switched to generating chlorine dioxide on-site	7,552
Wyman-Gordon Company North Grafton Plant	North Grafton	MA	Forging	Hydrofluoric acid (concentration >50%)	Changed to less concentrated hydrofluoric acid	400
Back River Wastewater Treatment Facility*	Baltimore	MD	Wastewater treatment	Chlorine gas	Switched to liquid bleach disinfection	1,470,000
Ashburton Filtration Plant	Baltimore	MD	Drinking water treatment	Chlorine gas	Switched to liquid bleach disinfection	338,837
Broadwater Water Reclamation Facility	Churchton	MD	Wastewater treatment	Sulfur dioxide (anhydrous) and chlorine gas	Switched to ultraviolet light disinfection	5,000
Patuxent Water Reclamation Facility	Crofton	MD	Wastewater treatment	Sulfur dioxide (anhydrous) and chlorine gas	Switched to ultraviolet light disinfection	25,000
Great Northern Paper, Inc. [now Katahdin Paper]	East Millinocket	ME	Paper mill	Chlorine gas	Switched to liquid bleach process water treatment	3,200
Monson Companies, Inc.	South Portland	ME	Chemical product wholesale	Chlorine gas, sulfur dioxide (anhydrous), ammonia (anhydrous)	Provided no details	75,000
City of Adrian, MI - Water Treatment Plant	Adrian	MI	Drinking water treatment	Chlorine gas	Switched to liquid bleach disinfection	25,922
Battle Creek Farm Bureau Association	Climax	MI	Farm supply	Ammonia (anhydrous)	Sells alternate fertilizers	2,500
CBPU Waste Water Treatment Plant	Coldwater	MI	Wastewater treatment	Chlorine gas	Switched to ultraviolet light disinfection	0
City of Monroe Water Filtration Plant	Monroe	MI	Drinking water treatment	Chlorine gas	Switched to liquid bleach disinfection	18,000
Petoskey Wastewater Treatment Plant	Petoskey	MI	Wastewater treatment	Chlorine gas	Switched to liquid bleach disinfection	1,900
Pigeon Anhydrous Ammonia Site	Pigeon	MI	Farm supply	Ammonia (anhydrous)	Sells alternate fertilizers	1,250
Wyandotte Wastewater Treatment Facility	Wyandotte	MI	Wastewater treatment	Chlorine gas	Switched to ultraviolet light disinfection	1,100,000
Ypsilanti Community Ultilities Authority	Ypsilanti	MI	Wastewater treatment	Chlorine gas and sulfur dioxide (anhydrous)	Switched to ultraviolet light disinfection	10,613
Zeeland Farm Services	Zeeland	MI	Farm supply	Ammonia (anhydrous)	Sells alternate fertilizers	4,500
Cottage Grove Wastewater Treatment Plant	Cottage Grove	MN	Wastewater treatment	Chlorine gas	Switched to ultraviolet light disinfection	3,100
Metropolitan Council - Empire WWTP*	Farmington	MN	Wastewater treatment	Sulfur dioxide (anhydrous) and chlorine gas	Switching to ultraviolet light disinfection	1,664
Metropolitan Council - Hastings WWTP	Hastings	MN	Wastewater treatment	Chlorine gas	Switched to liquid bleach disinfection	11,504
Metropolitan Council - Rosemount WWTP*	Rosemount	MN	Wastewater treatment	Chlorine gas	Switched to ultraviolet light disinfection	351
US Filter Recovery Services Inc.	Roseville	MN	Hazardous waste disposal	Chlorine gas and sulfur dioxide (anhydrous)****	Switched to sodium metabisulfite and liquid bleach	62,000
Metropolitan Wastewater Treatment Plant*	St. Paul	MN	Wastewater treatment	Chlorine gas and sulfur dioxide (anhydrous)	Switching to liquid bleach and sodium bisulfite	520,000
Van Waters & Rogers Inc.	Berkeley	MO	Chemical product wholesale	Hydrofluoric acid (concentration >50%)	Changed to less concentrated hydrofluoric acid	0
Liberty Water Treatment Plant	Liberty	MO	Drinking water treatment	Chlorine gas	Switched to liquid bleach disinfection	2,250

Maryville Water Treatment Plant	Maryville	MO	Drinking water treatment	Chlorine gas	Switched to liquid bleach disinfection	6,850
Tallahatchie Farmers Supply, Inc.	Charleston	MS	Farm supply	Ammonia (anhydrous)	Sells alternate fertilizers	78
WWTP #2	Laurel	MS	Wastewater treatment	Chlorine gas	Switched to ultraviolet light/less chlorine	800
Laurel WWTP #1	Laurel	MS	Wastewater treatment	Chlorine gas	Switched to ultraviolet light/less chlorine	500
City of Vicksburg, Water Treatment Facility	Vicksburg	MS	Drinking water treatment	Chlorine gas	Switched to liquid bleach disinfection	3,417
PPL Montana	Colstrip	MT	Electric power generation	Chlorine gas	Switched to bleach anti-fouling	1,400
Havre Water Plant	Havre	MT	Drinking water treatment	Chlorine gas	Switched to generating bleach on-site	10,000
Ed Thomas Water Treatment Plant	Burlington	NC	Drinking water treatment	Chlorine gas	Switched to liquid bleach disinfection	8,400
Sugar Creek Wastewater Treatment Plant	Charlotte	NC	Wastewater treatment	Chlorine gas	Switched to ultraviolet light disinfection	13,200
Irwin Creek Wastewater Treatment Plant	Charlotte	NC	Wastewater treatment	Chlorine gas	Switched to ultraviolet light disinfection	4,700
Williams Water Treatment Plant	Durham	NC	Drinking water treatment	Chlorine gas	Switched to liquid bleach disinfection	9,800
Brown Water Treatment Plant	Durham	NC	Drinking water treatment	Chlorine gas	Switched to liquid bleach disinfection	1,400
A.B.Uzzle, Jr. Water Plant	Erwin	NC	Drinking water treatment	Chlorine gas	Switched to liquid bleach disinfection	3,100
Cross Creek Water Reclamation Facility	Fayetteville	NC	Wastewater treatment	Chlorine gas	Switched to liquid bleach disinfection	0
Rockfish Creek Water Reclamation	Fayetteville	NC	Wastewater treatment	Chlorine gas	Switched to liquid bleach disinfection	0
Town of Garner WWTP Facility	Garner	NC	Wastewater treatment	Chlorine gas	Switched to solid calcium hypochlorite	205
City of Kannapolis Water Treatment Plant	Kannapolis	NC	Drinking water treatment	Chlorine gas	Switched to liquid bleach disinfection	12,770
City of Lincolnton Waste Water Treatment Plant	Lincolnton	NC	Wastewater treatment	Chlorine gas	Switched to liquid bleach disinfection	5,000
City of Sanford Water Treatment Plant	Sanford	NC	Drinking water treatment	Chlorine gas	Switched to liquid bleach disinfection	72
Big Flag Farm Supply Gibbon-Anhydrous	Gibbon	NE	Farm supply	Ammonia (anhydrous)	Consolidated EHS chemicals to another location	1,968
78th & Harrison Pump Station	Lavista	NE	Drinking water treatment	Chlorine gas	Switched to liquid bleach disinfection	60,000
Walnut Hill Pump Station	Omaha	NE	Drinking water treatment	Chlorine gas	Switched to liquid bleach disinfection	104,000
Turner Boulevard Pump Station	Omaha	NE	Drinking water treatment	Chlorine gas	Switched to liquid bleach disinfection	93,000
36th & Edna Pump Station	Omaha	NE	Drinking water treatment	Chlorine gas	Switched to liquid bleach disinfection	59,000
132nd & Harney Pump Station	Omaha	NE	Drinking water treatment	Chlorine gas	Switched to liquid bleach disinfection	39,000
Maple Road Pump Station	Omaha	NE	Drinking water treatment	Chlorine gas	Switched to liquid bleach disinfection	17,000
Rainwood Pump Station	Omaha	NE	Drinking water treatment	Chlorine gas	Switched to liquid bleach disinfection	11,000
Skyline Pump Station	Omaha	NE	Drinking water treatment	Chlorine gas	Switched to liquid bleach disinfection	2,700
D & D Fertilizer - Auxiliary Storage	Weeping Water	NE	Farm supply	Ammonia (anhydrous)	Sells alternate fertilizers	1,750
Manhattan Products, Inc.	Carlstadt	NJ	Cleaning compound manufacturing	Ammonia (anhydrous)	Switched to aqueous ammonia below thresholds	160,000
Edward P. Decher Secondary Wastewater Trmt. Plant	Elizabeth	NJ	Wastewater treatment	Chlorine gas	Switched to liquid bleach disinfection	50,000
Middlesex County Utilities Authority	Sayreville	NJ	Wastewater treatment	Chlorine gas	Switched to liquid bleach disinfection	10,740,000
Little Falls Water Treatment Plant	Totowa	NJ	Drinking water treatment	Chlorine gas	Switched to liquid bleach disinfection	430,000
Helena Chemical Company, Mesquite, NM Facility	Mesquite	NM	Farm supply	Ammonia (anhydrous)	Sells alternate fertilizers	12,659
Agro Distribution LLC - Vado	Vado	NM	Farm supply	Ammonia (anhydrous)	Sells alternate fertilizers	800

Nevada Chemical Company	Las Vegas	NV	Swimming pool treatment	Chlorine gas	Switched to liquid bleach	60,000
Splash Pool Chemicals Inc.	Las Vegas	NV	Swimming pool treatment	Chlorine gas	Switched to liquid bleach	7,720
Truckee Meadows Water Reclamation Facility	Reno	NV	Wastewater treatment	Chlorine gas	Switched to liquid bleach disinfection	113,000
ECSD #2 - Big Sister Creek WWTP	Angola	NY	Wastewater treatment	Chlorine gas	Switched to liquid bleach disinfection	8,789
City of Auburn Water Purification Plant	Auburn	NY	Drinking water treatment	Chlorine gas	Switched to liquid bleach disinfection	8,500
Erie County Southtowns WWTP	Buffalo	NY	Wastewater treatment	Chlorine gas	Switched to liquid bleach disinfection	32,983
Photocircuits Corporation	Glen Cove	NY	Printed circuit board manufacturing	Chlorine gas	Switched to sodium chlorate etching	21,000
ECSD #6 - Lackawanna WWTP	Lackawanna	NY	Wastewater treatment	Chlorine gas	Switched to liquid bleach disinfection	54,157
Hewitt Brothers, Inc.	Locke	NY	Farm supply	Ammonia (anhydrous)	Sells alternate fertilizers	300
City of Niagara Falls Wastewater Treatment Plant	Niagara Falls	NY	Wastewater treatment	Chlorine gas	Switched to liquid bleach disinfection	1,100,000
Poughkeepsies' Water Treatment Facility	Poughkeepsie	NY	Drinking water treatment	Chlorine gas	Switched to liquid bleach disinfection	15,907
Oneida County Water Pollution Control Plant	Utica	NY	Wastewater treatment	Chlorine gas and sulfur dioxide (anhydrous)	Switched to liquid bleach disinfection	13,500
City of Bowling Green Water Treatment	Bowling Green	OH	Drinking water treatment	Chlorine gas	Switched to liquid bleach disinfection	580
Mill Creek WWTP	Cincinnati	OH	Wastewater treatment	Chlorine gas	Switched to liquid bleach disinfection	860,000
Nottingham Water Treatment Plant	Cleveland	OH	Drinking water treatment	Chlorine gas	Switched to liquid bleach disinfection	1,100,000
Baldwin Water Treatment Plant	Cleveland	OH	Drinking water treatment	Chlorine gas	Switched to liquid bleach disinfection	38,300
Helena Chemical Company	Coldwater	OH	Farm supply	Ammonia (anhydrous)	Sells alternate fertilizers	7,962
Jackson Pike Wastewater Treatment Plant	Columbus	OH	Wastewater treatment	Chlorine gas	Switched to liquid bleach disinfection	57,000
East Liverpool Water Department	East Liverpool	OH	Drinking water treatment	Chlorine gas	Switched to liquid bleach disinfection	25,500
Akron Water Supply Plant	Kent	OH	Drinking water treatment	Chlorine gas	Switched to liquid bleach disinfection	411,356
Middletown Wastewater Treatment Plant	Middletown	OH	Wastewater treatment	Chlorine gas	Switched to liquid bleach disinfection	21,000
Maumee River Wastewater Treatment Plant	Waterville	OH	Wastewater treatment	Chlorine gas	Switched to ultraviolet light disinfection	1,500
Xenia Ford Road Wastewater Treatment Plant	Xenia	OH	Wastewater treatment	Chlorine gas	Switched to ultraviolet light disinfection	6,510
PSO Southwestern Station	Anadarko	OK	Electric power generation	Chlorine gas	Switched to bleach anti-fouling	600
PSO Riverside Power Station	Jenks	OK	Electric power generation	Chlorine gas	Switched to bleach anti-fouling	1,700
City of Lawton Water Treatment Plant	Medicine Park	OK	Drinking water treatment	Chlorine gas	Switched to liquid bleach disinfection	500
PSO Northeastern Station	Oologah	OK	Electric power generation	Chlorine gas	Switched to bleach anti-fouling	1,200
Western Farm Service, LaGrande	Lagrande	OR	Farm supply	Ammonia (aqueous)	Sells alternate fertilizers	131
City of Myrtle Creek Wastewater Treatment Plant	Myrtle Creek	OR	Wastewater treatment	Chlorine gas	Switched to ultraviolet light and liquid bleach	7,200
Columbia Boulevard Wastewater Treatment Plant	Portland	OR	Wastewater treatment	Chlorine gas	Switched to liquid bleach disinfection	157,500
Oregon Cherry Growers, Inc. - Salem	Salem	OR	Fruit and vegetable canning	Sulfur dioxide (anhydrous)	Consolidated EHS chemicals to another location	1,200,000
Oregon Cherry Growers- Sigland Receiving Station	Salem	OR	Fruit and vegetable canning	Sulfur dioxide (anhydrous)	Consolidated EHS chemicals to another location	47,400
Matsunk Water Pollution Control Center	Bridgeport	PA	Wastewater treatment	Chlorine gas	Switched to liquid bleach disinfection	14,361

Easton Area Joint Sewer Authority WPCF	Easton	PA	Wastewater treatment	Chlorine gas	Switched to liquid bleach disinfection	8,735
U.S. Steel Group - Fairless Works	Fairless Hills	PA	Steel mill	Sulfur dioxide (anhydrous)	Closed process; consolidated in other facilities	210,000
Northeast Water Pollution Control Plant	Philadelphia	PA	Wastewater treatment	Chlorine gas	Switched to liquid bleach disinfection	1,575,971
Southeast Water Pollution Control Plant	Philadelphia	PA	Wastewater treatment	Chlorine gas	Switched to liquid bleach disinfection	1,182,741
Samuel S. Baxter Water Treatment Plant	Philadelphia	PA	Drinking water treatment	Chlorine gas	Switched to liquid bleach disinfection	787,271
Calgon Carbon Corp. Neville Island Plant	Pittsburgh	PA	Inorganic chemical manufacturing	Ammonia (anhydrous)	Switched to aqueous ammonia below thresholds	120,000
Joint Municipal Authority of Wyomissing Valley	Reading	PA	Wastewater treatment	Chlorine gas	Switched to liquid bleach disinfection	64,000
St. Marys Wastewater Treatment Plant	St. Marys	PA	Wastewater treatment	Chlorine gas	Switched to ultraviolet light disinfection	770
Williamsport Sanitary Authority - West Plant	Williamsport	PA	Wastewater treatment	Chlorine gas	Switched to liquid bleach disinfection	38,000
Quonset Point Wastewater Treatment Facility	North Kingstown	RI	Wastewater treatment	Chlorine gas	Switched to liquid bleach disinfection	12,200
Warwick Wastewater Treatment Facility	Warwick	RI	Wastewater treatment	Chlorine gas	Switched to liquid bleach disinfection	100
City of Bishopville Wastewater Treatment Facility	Bishopville	SC	Wastewater treatment	Chlorine gas	Switched to ultraviolet light disinfection	1,300
Plum Island WWTP	Charleston	SC	Wastewater treatment	Chlorine gas	Switched to generating bleach on-site	7,500
Middle Branch WWTP	Easley	SC	Wastewater treatment	Chlorine gas	Switched to ultraviolet light disinfection	137
City of Johnsonville Wastewater Treatment Plant	Johnsonville	SC	Wastewater treatment	Chlorine gas	Switched to liquid bleach disinfection	2,600
City of Aberdeen Wastewater Treatment Plant	Aberdeen	SD	Wastewater treatment	Chlorine gas	Switched to ultraviolet light disinfection	15,000
Tabor Lumber Coop	Tabor	SD	Farm supply	Ammonia (anhydrous)	Sells alternate fertilizers	490
Wastewater Treatment Plant	Yankton	SD	Wastewater treatment	Chlorine gas	Switched to ultraviolet light disinfection	10,000
Jonesborough Water Treatment Plant	Jonesborough	TN	Drinking water treatment	Chlorine gas	Switched to generating bleach on-site	3,000
LaVergne Water Treatment Plant	Lavergne	TN	Drinking water treatment	Chlorine gas	Switched to generating bleach on-site	3,400
McMinnville Wastewater Plant	Mcminnville	TN	Wastewater treatment	Chlorine gas	Switched to liquid bleach disinfection	5,000
Warren County Utility District Water Treat. Plant	Mcminnville	TN	Drinking water treatment	Chlorine gas	Switched to liquid bleach disinfection	1,200
Cargill, Inc.	Memphis	TN	Corn milling	Sulfur dioxide (anhydrous)	Switched to liquid sodium bisulfite	370,000
Newport Utilities Board Wastewater Treatment Plant	Newport	TN	Wastewater treatment	Chlorine gas	Switched to liquid bleach disinfection	9,595
RBD Enterprises DBA Pure Water Pool Service	Austin	TX	Swimming pool treatment	Chlorine gas	Switched to liquid bleach	4,800
Lakeway MUD - Wastewater Treatment Plant S-4	Lakeway	TX	Wastewater treatment	Chlorine gas	Switched to liquid bleach disinfection	576
Helena Chemical Company, Pearsall Facility	Pearsall	TX	Farm supply	Ammonia (anhydrous)	Sells alternate fertilizers	253
Agro Distribution LLC - Plainview	Plainview	TX	Farm supply	Ammonia (anhydrous)	Sells alternate fertilizers	7,500
Seabrook Wastewater Treatment Plant	Seabrook	TX	Wastewater treatment	Chlorine gas	Switched to liquid bleach disinfection	61,036
Wastewater Treatment Plant	Sherman	TX	Wastewater treatment	Chlorine gas and sulfur dioxide (anhydrous)	Switched to ultraviolet light disinfection	2,800
Water Treatment Plant #3	Layton	UT	Drinking water treatment	Chlorine gas	Switched to liquid bleach disinfection	4,125
Water Treatment Plant #2	Ogden	UT	Drinking water treatment	Chlorine gas	Switched to liquid bleach disinfection	8,475

South Valley Water Reclamation Facility	West Jordan	UT	Wastewater treatment	Chlorine gas and sulfur dioxide (anhydrous)	Switched to ultraviolet light disinfection	131,968
Kenneth B. Rollins Memorial Water Filtration Plant	Leesburg	VA	Drinking water treatment	Chlorine gas	Switched to liquid bleach disinfection	6,000
Town of South Hill Regional WWTP	South Hill	VA	Wastewater treatment	Chlorine gas	Switched to ultraviolet light disinfection	260
Ni River Water Treatment Plant	Spotsylvania	VA	Drinking water treatment	Chlorine gas	Switched to liquid bleach disinfection	1,884
Smith Lake Water Treatment Facility	Stafford	VA	Drinking water treatment	Chlorine gas	Switched to liquid bleach disinfection	17,000
City of St. Albans Wastewater Treatment Facility	St. Albans	VT	Wastewater treatment	Chlorine gas and sulfur dioxide (anhydrous)	Switched to liquid bleach and sodium bisulfite	3,500
City of Edmonds Wastewater Treatment Plant	Edmonds	WA	Wastewater treatment	Chlorine gas	Switched to liquid bleach disinfection	8,800
Central Kitsap Tr. Plant	Poulsbo	WA	Wastewater treatment	Chlorine gas	Switched to ultraviolet light disinfection	8,330
Lemolo Chlorine Station, L.S. 96	Poulsbo	WA	Wastewater treatment	Chlorine gas	Switched to liquid bleach disinfection	3,453
South Treatment Plant*	Renton	WA	Wastewater treatment	Chlorine gas	Switched to liquid bleach disinfection	650,000
Kaiser Aluminum & Chemical Corp. - Trentwood Works	Spokane	WA	Aluminum rolling mill	Chlorine gas	Switched to magnesium chloride fluxing	137,000
City of Walla Walla Wastewater Treatment Facility	Walla Walla	WA	Wastewater treatment	Chlorine gas and sulfur dioxide (anhydrous)	Switched to ultraviolet light and on-site bleach	5,200
Wisconsin River Agronomy LLC - Adams Plant	Adams	WI	Farm supply	Ammonia (anhydrous)	Sells alternate fertilizers	4,491
Wausau-Mosinee Paper Corporation (Brokaw, WI)	Brokaw	WI	Pulp and paper mill	Chlorine gas	Switched to oxygen and peroxide bleaching	59,000
Wisconsin Public Service Corp, Pulliam Power Plant	Green Bay	WI	Electric power generation	Sulfur dioxide (anhydrous)	Changed to solid sulfur dioxide	180,000
Fertilizer Plant -- Kiel	Kiel	WI	Farm supply	Ammonia (anhydrous)	Sells alternate fertilizers	924
Wisconsin River Agronomy LLC - Mauston Dry Plant	Mauston	WI	Farm supply	Ammonia (anhydrous)	Consolidated EHS chemicals to another location	5,060
Wisconsin Tissue Mills, Inc. [now SCA Tissue]	Menasha	WI	Paper mill	Chlorine gas	Hydrogen peroxide and sodium hydrosulfite bleaching	210,000
Crow Creek Wastewater Facility	Cheyenne	WY	Wastewater treatment	Chlorine gas	Switched to ultraviolet light disinfection	1,492
Dry Creek Wastewater Facility	Cheyenne	WY	Wastewater treatment	Chlorine gas	Switched to ultraviolet light disinfection	477

* Facility is still registered under Risk Management Planning program or is in the process of deregistering.

** Except where noted in brackets, facility names appear as formerly registered under EPA's Risk Management Planning program. Current facility names may have changed.

*** Except where otherwise noted, the first chemical listed is the basis chemical from which the facility calculated its vulnerability zone population.

**** Facility used anhydrous ammonia when calculating its vulnerability zone population.

Appendix B – Methodology

The survey consisted of a cover letter and response form (Appendix C). The response form was designed to enable a knowledgeable person to respond in a few minutes. The Center for American Progress mailed the survey to some 1,800 facilities that had deregistered from EPA's Risk Management Planning (RMP) program as of Nov. 1, 2005. These 1,800 facilities were able to deregister from the RMP program because they no longer used extremely hazardous substances above threshold amounts.

An additional 800 facilities had deregistered from the RMP program, but were not included in the survey because their reasons for deregistering were unlikely to be related to less acutely hazardous chemicals or processes—for example if a facility terminated business operations.[42] Another 165 deregistered facilities (EPA's "Program 1" facilities) were not included in the survey because they had not reported potential off-site consequences or recent accidents.

Some 615 surveys proved to be undeliverable at a facility's last reported address. This was not unexpected, since many deregistered facilities have closed. Since June 2004, EPA has required facilities to indicate why they are deregistering, but the agency did not require that information during the first five years of the reporting program from June 1999 to May 2004. Thus, it was not known which facilities that deregistered during this period had closed.

A total of 115 facilities completed the survey by mail or fax. Follow-up calls to approximately 400 facilities by the Center for American Progress, National Association of State PIRGs, National Environmental Trust and the survey author generated an additional 221 responses. Callers found at least 80 of these facilities had closed and many others were unreachable. A follow-up emailing netted an additional eight responses. Eleven facilities completed the survey that deregistered from the RMP program after Nov. 1, 2005 or that plan to deregister in the near future. An additional 25 facilities were included in the survey based on having reported safer technology information to EPA or other sources. Of the facilities surveyed, 284 reported using less acutely hazardous chemicals or processes (Appendix A).

Appendix C – Survey Cover Letter and Response Form

Center for American Progress

1333 H Street, NW, 10th Floor
Washington, DC 20005
Tel: 202 682.1611 • Fax: 202 682.1867

www.americanprogress.org

December 8, 2005

Attn: {RMP Contact}
{Facility Name}
{Facility Street 1}
{Facility Street 2}
{Facility City}, {State} {Zip}

Dear {RMP Contact} or Facility Manager:

The Center for American Progress invites your response to a brief survey to identify successes in American industry on an important national priority: preventing the possibility of a sudden spill or terrorist release of hazardous chemicals into American communities.

You are receiving this survey because your facility formerly reported under the EPA's Risk Management Plan (RMP) program but no longer reports storing threshold amounts of an extremely hazardous substance.

We are interested if you have adopted less acutely hazardous chemicals or processes. For example, many wastewater plants have switched from chlorine gas to chlorine bleach or other safer alternatives. We intend to recognize companies that have successfully reduced or eliminated catastrophic chemical release hazards. However, the survey report won't use facility or company names if you request that we not use them.

This survey does not seek and will not publish information about site security measures. The survey covers substances that your facility formerly reported under the RMP program, but you may provide information about measures to reduce hazards of additional acutely hazardous chemicals if appropriate.

Your answers to the questions on the attached page will help us document and recognize progress in reducing chemical dangers in American communities.

If you have any questions, feel free to contact Paul Orum at 202-548-4020.

We greatly appreciate your response, and will be glad to provide you a completed survey report if you request.

Sincerely,

Reece Rushing
Associate Director for Regulatory Policy
Center for American Progress

Survey of American Progress: Chemical Security
December 2005

You may mail your completed survey to Center for American Progress, 1333 H Street, NW - 10th Floor; Washington, DC 20005, or fax to the attention of Reece Rushing at 202-682-1867 (fax).

Please provide any necessary corrections:

Attn: {RMP Contact}, {RMP Contact Title}
{Facility Name}
{Facility Street 1}
{Facility Street 2}
{Facility City}, {State} {Zip}
EPA Facility Identifier: {EPA Facility Identifier}
Facility phone: {Facility Phone}, Operator phone: {Operator Phone}
Operator name: {Operator Name}

Respondent's name: _____ Job title: _____

Phone: _____ Email: _____

1) Please tell us why your facility is no longer covered by the chemical Risk Management Plan (RMP) program:

[ ] Facility switched to less acutely hazardous chemicals or processes.
[ ] Facility terminated operations.
[ ] Facility changed business activities.
[ ] Facility reduced RMP substance below thresholds.
[ ] Facility is otherwise not covered by RMP program.
[ ] Other: _____

If your facility is no longer covered by the RMP program because it switched to less acutely hazardous chemicals or processes, please respond to the following.

2) Briefly describe the changes you made.

(Page 1 of 2, Continued...)

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3) Why did you decide to make these changes? Check all that apply.

[ ] Concern over terrorism and improved security.
[ ] Concern over an accidental chemical release and improved safety.
[ ] Projected cost savings.
[ ] Legal or regulatory requirements.
[ ] Improved operations efficiency or business opportunities.
[ ] Meeting community expectations.
[ ] Other (please explain):

4) How much did it cost to make these changes?

[ ] Less than $ 100,000
[ ] Between $ 100,000 and $1 million
[ ] Between $ 1 million and $10 million
[ ] Between $ 10 million and $ 20 million
[ ] More than $ 20 million

Do you expect these changes to result in cost savings and/or improved profitability?
[ ] Yes [ ] No

5) Please provide any additional information that you think would be helpful in interpreting these changes at your facility (e.g., health and safety or other benefits).

Appendix D – Dangers of Selected Extremely Hazardous Substances

AMMONIA (ANHYDROUS)
Ammonia is a corrosive colorless gas with a strong odor. It is used in making fertilizer, plastics, dyes, textiles, detergents and pesticides. Acute ammonia exposure can irritate the skin; burn the eyes, causing 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.

CHLORINE
Chlorine is a greenish-yellow gas with a strong, irritating odor. It is used in making other chemicals, as a disinfectant, in bleaching and for purifying water and sewage. Acute exposure can severely burn the eyes and skin, causing permanent damage, and may cause throat irritation, tearing, coughing, nose bleeds, chest pain, fluid build-up in the lungs (pulmonary edema) and 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.

EPICHLOROHYDRIN
Epichlorohydrin is a reactive colorless liquid with a slightly irritating, chloroform-like odor. It is used to make plastics, resins and glycerin. Acute exposure to epichlorohydrin vapor irritates the eyes, nose, bronchial tubes and lungs. High levels can chemically burn the lungs or cause dangerous fluid build-up, which may lead to death. Eye contact may cause permanent damage, and skin contact can cause painful blistering which may be delayed in onset for minutes or hours. Chronic exposure can damage the kidneys, liver and lungs. Epichlorohydrin is a probable human carcinogen and may decrease fertility in males.

HYDROGEN CHLORIDE (HYDROCHLORIC ACID)
Hydrogen chloride is a corrosive colorless to slightly yellow gas with a strong odor. It is used in metal processing, analytical chemistry, and in making other chemicals. Acute exposure to hydrogen chloride can cause severe burns of the skin and eyes, leading to permanent damage and blindness. Breathing hydrogen chloride vapor irritates the mouth, nose, throat and lungs, causing coughing, shortness of breath, fluid build-up in the lungs (pulmonary edema) and possibly death. Chronic exposure damages the lungs and may erode the teeth.

HYDROGEN FLUORIDE (HYDROFLUORIC ACID)
Hydrogen fluoride is a corrosive colorless fuming liquid or gas with a strong irritating odor. It is used in etching glass and in making other chemicals, including gasoline. Breathing the vapor causes extreme respiratory irritation (with cough, fever, chills and tightness) that may be fatal. Contact can severely burn the skin and eyes, resulting in permanent eye damage or blindness. Long-term exposure may damage the liver and kidneys, and causes fluorosis, with symptoms of weight loss, malaise, anemia and osteosclerosis.

SULFUR DIOXIDE (ANHYDROUS)
Sulfur dioxide is a colorless gas with a sharp pungent odor. It may be shipped and stored as a compressed liquefied gas. Sulfur dioxide is used in the manufacture of sulfuric acid, sulfur

trioxide and sulfites; in solvent extraction; and as a refrigerant, among other uses. Acute exposure irritates the eyes and air passages. High exposures to the skin and eyes can cause severe burns and blindness, and breathing high levels can lead to permanent lung damage and death.

SULFUR TRIOXIDE

Sulfur trioxide is a corrosive colorless liquid that fumes in the air forming sulfuric acid vapor or mist. Its health effects in the air are essentially those of sulfuric acid (and are similar to sulfur dioxide and to oleum). Sulfur trioxide vapor can severely irritate and burn the skin, eyes, throat and lungs. Eye damage can include blindness. Breathing the vapor can lead to choking, spasm and pulmonary edema. Exposure can cause bronchitis, emphysema and permanent lung damage.

Endnotes

[1] Vulnerability zone figures are residential populations at risk, not forecasts of potential casualties.

[2] James Belke, U.S. Environmental Protection Agency, Chemical Accident Risks in U.S. Industry—A Preliminary Analysis of Accident Risk Data from U.S. Hazardous Chemical Facilities (Sept. 25, 2000).

[3] Congressional Research Service, CRS Analysis of EPA RMP*National Database, requested by Congressman Edward Markey (May 2005). The number of facilities with over 10,000 people at risk may be as many as 2,841.

[4] Cutting catastrophic hazards is not the same as absolute safety or "zero risk." However, at these facilities, no failure in safety or security can lead to the release of a major toxic gas cloud.

[5] The survey includes five facilities that eliminated a significant chemical hazard but remain registered under the RMP program (see notes to Appendix A).

[6] Facilities that reduced chemicals below RMP reporting thresholds were not included in this report unless they also changed to a less acutely hazardous chemical or process. When used below RMP thresholds, extremely hazardous substances in some cases still pose serious hazards.

[7] Department of Homeland Security, Press Release: Statement by the Department of Homeland Security on Continued Al-Qaeda Threats (Nov. 21, 2003).

[8] U.S. Department of Justice, Assessment of the Increased Risk of Terrorist or Other Criminal Activity Associated With Posting Off-site Consequence Analysis Information on the Internet (April 18, 2000); and, U.S. Department of Justice, A Method to Assess the Vulnerability of U.S. Chemical Facilities, National Institute of Justice (November 2002).

[9] U.S. General Accounting Office, GAO-03-439, Homeland Security: Voluntary Initiatives Are Under Way at Chemical Facilities, but the Extent of Security Preparedness is Unknown (March 14, 2003); and, U.S. Government Accountability Office, GAO-06-150, Homeland Security: DHS is Taking Steps to Enhance Security at Chemical Facilities but Additional Authority is Needed (January 2006).

[10] U.S. Environmental Protection Agency, Strategic Plan for Homeland Security (September 2002).

[11] Agency for Toxic Substances and Disease Registry, Industrial Chemicals and Terrorism: Human Health Threat Analysis, Mitigation and Prevention (1999); and Agency for Toxic Substances and Disease Registry, Terrorist Use of Expedient Chemical Agents: Health Risk Assessment and Las Vegas Case Study, (1997).

[12] Eric Pianin, *Study Assesses Risk of Attack on Chemical Plant*, The Washington Post, March 12, 2002.

[13] 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, Jan. 23, 2004.

[14] Brookings Institution, Protecting the American Homeland (March 2002).

[15] RAND Corporation, Toxic Warfare, 2002.

[16] Paper, Allied-Industrial, Chemical and Energy Workers International Union, PACE International Union Survey: Workplace Incident Prevention and Response Since 9/11, Paper, Oct. 27, 2004. PACE is now part of United Steelworkers.

[17] Center for Strategic and International Studies, News Release: Chemical Facilities Vulnerable (Dec. 23, 2003).

[18] Working Group on Community Right-to-Know, Chemical Plant Security Breaches in the News (January 2006).

[19] Linda Greer for the Center for American Progress, New Strategies to Protect America: Securing our Nation's Chemical Facilities (April 6, 2005).

[20] Environmental Defense, Eliminating Hometown Hazards: Cutting Chemical Risks at Wastewater Treatment Facilities (2003); U.S. Public Interest Research Group Education Fund, Needless Risk: Oil Refineries and Hazard Reduction (2005); Working Group on Community Right-to-Know, Unnecessary Dangers: Emergency Chemical Release Hazards at Power Plants (2004).

[21] U.S. Environmental Protection Agency, EPA-K-550-002, Chemical Safety Alert, Chemical Accident Prevention: Site Security at 3 (February 2000).

[22] Hearing request letter for S.1470 from Sen. Frank Lautenberg to Sen. James Inhofe, Chairman, Environment and Public Works Committee, April 28, 2000.

[23] Douglas Waller and Mark Thompson, *It's Do-It-Yourself Security*, Time Magazine, Feb. 27, 2006; letter from Presidential Advisor Karl Rove to Michael Graff, BP Amoco Chemical Company, Oct. 31, 2002; letter from Michael Graff on behalf of American Chemistry Council to Karl Rove, Sept. 23, 2002; letter from Red Cavaney, President and CEO of American Petroleum Institute to James Connaughton, Chairman, Council on Environmental Quality, Sept. 6, 2002.

[24] Senate "Dear Colleague" letter signed by Sens. James Inhofe, Arlen Specter, Pete Domenici, Kit Bond, Bob Smith, George Voinovich, and Mike Crapo, Sept. 10, 2002.

[25] This figure factors in overlapping vulnerability zones. The vulnerability-zone populations of the 284 facilities identified in this survey total 42 million.

[26] Some 59 respondents changed to safer alternatives before the terrorist attacks of Sept. 11, 2001, and 225 changed after the attacks. Of respondents that changed before the Sept. 11, 2001 attacks, 25 percent indicated security was a reason for making the change; of respondents that changed after the attacks 45 percent indicated that security was a reason.

[27] Approximately 25 facilities did not have the opportunity to provide information on costs or reasons for their changes because they were added to the list of facilities (in Appendix A) from information supplied to EPA or other sources.

[28] *Ibid.*

[29] Facilities noting major upgrades included PPG Industries (Fresno, Calif.) and Proctor and Gamble (Pineville, La.), among others.

[30] While the survey form provides for a yes/no answer to the question on cost savings, many facilities responding to phone interviews indicated that costs were about even.

[31] *Id.* at 28

[32] Previous studies show businesses often do not fully assess costs in business decisions, focusing on raw materials and equipment costs more than other compliance costs. See Hampshire Research Associates, Evaluation of the Effectiveness of Pollution Prevention Planning in New Jersey: A Program-Based Evaluation (May 1996). Further, risk-based security assessment methodologies typically do not systematically evaluate safer technologies. Rather, they focus on physical security options, such as guards and gates. These methodologies determine "acceptable" risks, but without consulting communities that are at risk, informing communities of options that can eliminate chemical spill dangers, or even assessing such safer options.

[33] 71 Fed. Reg. 388 (Jan. 4, 2006); and 71 Fed. Reg. 654 (Jan. 5, 2006).

[34] Findings of the Water Security Working Group delivered to the National Drinking Water Advisory Council, May 18, 2005.

[35] The survey did not ask, and respondents did not always indicate, whether they generate bleach on-site or receive deliveries.

[36] Rough estimate from MIOX Corporation; U.S. vendors include MIOX Corporation (MIOX), U.S. Filter (OSEC), and Severn Trent Services (Clortec).

[37] Several thousand additional food manufacturers are regulated under the RMP program solely for anhydrous ammonia used in refrigeration.

[38] Associated Press, *Attempted Theft Leads to Chemical Leak, Evacuations*, June 21, 2004.

[39] Harold Brubaker, *Sunoco Commits to Safety Project*, Philadelphia Inquirer, March 3, 2006.

[40] Meghan Purvis and Margaret Herman, U.S. Public Interest Research Group Education Fund, Needless Risk: Oil Refineries and Hazard Reduction (2005).

[41] *Id.* at 19

[42] Other reasons for deregistering include: facility reduced chemical inventory below thresholds; facility combined formerly separate RMP filings; facility erroneously reported to the RMP program; and facility used a substance that is no longer covered by the RMP program.

Center for American Progress

ABOUT THE CENTER FOR AMERICAN PROGRESS

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American Chemistry Council Good Chemistry Makes It Possible

Chemistry Sector Trade Data

- Though still the leading US export sector, the chemistry sector has been in a trade deficit position since 2002. Our trade surplus peaked at $20.4 billion in 1995.
- The business of chemistry went from a net export position (or surplus) of $8.3 billion in 1999 to a net import position (or deficit) of $9.0 billion in 2005.
- According to the Bureau of Labor Statistics, during this same time period, employment in the business of chemistry fell from 982,000 to 879,000, a 104,000 job loss.
- During this period, the industry's employment in Ohio, for example, fell from 53,000 to 47,000, a 6,000 job loss. Employment in New Jersey fell from 78,000 to 70,000, an 8,000 job loss.
- And the outlook is very uncertain. On May 2, 2005 *Business Week* reported that "of 120 chemical plants being built around the world with price tags of $1 billion or more, just one...is in the U.S., reports Independent Project Analysis Inc. China, by comparison, has 50. "

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