[H.A.S.C. No. 109–19]

HEARING

ON

NATIONAL DEFENSE AUTHORIZATION ACT FOR FISCAL YEAR 2006

AND

OVERSIGHT OF PREVIOUSLY AUTHORIZED PROGRAMS

BEFORE THE

COMMITTEE ON ARMED SERVICES HOUSE OF REPRESENTATIVES

ONE HUNDRED NINTH CONGRESS

FIRST SESSION

TERRORISM, UNCONVENTIONAL THREATS AND CAPABILITIES SUBCOMMITTEE HEARING

ON

BUDGET REQUEST ON DESTRUCTION OF THE U.S. CHEMICAL WEAPONS STOCKPILE-PROGRAM STATUS AND ISSUES

HEARING HELD
APRIL 6, 2005

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FISCAL YEAR 2006 NATIONAL DEFENSE AUTHORIZATION ACT—DESTRUCTION OF THE U.S. CHEMICAL WEAPONS STOCKPILE

HOUSE OF REPRESENTATIVES,
COMMITTEE ON ARMED SERVICES,
TERRORISM, UNCONVENTIONAL THREATS AND CAPABILITIES SUBCOMMITTEE,
Washington, DC, Wednesday, April 6, 2005.

The subcommittee met, pursuant to call, at 1:06 p.m., in room 2212, Rayburn House Office Building, Hon. Jim Saxton (chairman of the subcommittee) presiding.

OPENING STATEMENT OF HON. JIM SAXTON, A REPRESENTATIVE FROM NEW JERSEY, CHAIRMAN, TERRORISM, UNCONVENTIONAL THREATS AND CAPABILITIES SUBCOMMITTEE

Mr. SAXTON. The subcommittee will come to order.

Today, the Terrorism, Unconventional Threats and Capabilities Subcommittee meets to review the Department of Defense program for the destruction of the U.S. stockpile lethal chemical warfare agents and munitions for the fiscal year 2006 budget request for the program.

Several Members of Congress who have chemical stockpile storage sites in their districts and who are interested in the chemical demil program are joining us in this hearing, and I would like to welcome them at this point.

The U.S. chemical weapons stockpile originally consisted of approximately 31,000 tons of lethal chemical agents in a wide variety of munitions located at Johnston Atoll in the Pacific, southwest of Hawaii, and in eight sites in the continental United States.

The fiscal year 1986 Defense Authorization Act requires that the destruction of the stockpile be carried out so as to ensure maximum protection of the environment, the general public and the workers at the storage and demil sites.

Destruction of the stockpile began at Johnston Atoll in 1990, and destruction of the entire U.S. stockpile is supposed to be completed by April 29, 2007, in accordance with the Chemical Weapons Convention (CWC) Treaty to which the United States is a party.

Based on the current cost and schedule estimates, however, the United States will not complete destruction of her stockpile by the required date. The good news is that as of March 23, 2005, over 11,200 tons of lethal chemical agents—which amounts to almost 36 percent—of the total U.S. stockpile has been destroyed.

Chemical stockpiles at Johnston Atoll and Aberdeen Proving Ground, Maryland, have been destroyed. The four baseline incinerators at Tooele, Utah; Anniston, Alabama; and Umatilla, Oregon;

in Pine Bluff, Arkansas, are all operational and are destroying their stocks of lethal chemical agents and munitions.

Yesterday the Army advised Congress that within 30 days it plans to begin a neutralization of VX nerve gas agent stockpile at Newport, Indiana. Although the decision regarding the final disposal of the toxic wastewater byproducts of the neutralization is still pending completion of a review of the disposal process at the Center for Disease Control.

The bad news is that estimates of the cost and time required to destroy the chemical weapon stockpile—which we noted in last year's hearing on the chemical demil program—continued to increase.

Current worst-case estimates of the total cost of destroying the stockpile range from $26.8 billion to $37.3 billion, and estimates of the dates for completion of destruction of the stockpile range from 2021 to 2030.

Because of the growth of the life cycle cost estimates and time required to destroy the chemical weapons stockpiles at Pueblo, Colorado, and Bluegrass, Kentucky, using technologies developed in the Assembled Chemical Weapons Alternatives program, the Under Secretary of Defense for Acquisition, Technology and Logistics, Michael Wynne, has essentially put the construction of the destruction plants at those sites on hold.

Secretary Wynne has also directed a number of actions to attempt to bring the program costs and scheduled increases under control, focus the program on meeting the next Chemical Weapons Convention milestone for destroying 45 percent of the stockpile by December 2007 and assess alternative ways to achieve the treaty deadline for 100 percent destruction of stockpile while optimizing safety costs in the schedule.

Many of these alternatives, such as deferring construction of the Pueblo and Bluegrass destruction plants, and studying the potential relocation of chemical agents and munitions for the destruction at existing chemical demil facilities are contentious issues for the communities that might be affected.

Our witnesses today are expected to address these and other issues in their testimony, and I expect that the members present will also address them in the question and answer period that follow.

To address the issues and the facilities for the fiscal year 2006 budget request for the program, our witnesses today include Dr. Dale Klein, Assistant Secretary of Defense for Nuclear, Chemical and Biological Defense Programs; Mr. Patrick Wakefield, Deputy Assistant to the Secretary of Defense for Chemical De-mil and Counterproliferation; the Honorable Claude M. Bolton, Assistant Secretary of the Army for Acquisition, Logistics and Technology; Mr. Michael Parker, Director of the U.S. Army Chemical Materials Agency; Mr. Craig Conklin from the Emergency Preparedness and Response Directorate of the Department of Homeland Security; and Dr. Thomas Sinks, Acting Director of the National Center for Environmental Health, Agency for Toxic Substances and Disease Registry Center for Disease Control.

Gentlemen, welcome. We look forward to your testimony.

At this time, I will turn to our ranking member for his opening statement.

STATEMENT OF HON. MARTY MEEHAN, A REPRESENTATIVE FROM MASSACHUSETTS, RANKING MEMBER, TERRORISM, UNCONVENTIONAL THREATS AND CAPABILITIES SUBCOMMITTEE

Mr. MEEHAN. Thank you, Mr. Chairman. I join you in welcoming today's witnesses.

I am in a hearing on the Patriot Act with the Attorney General and the Judiciary Committee, so I am going back and forth. But I do want to welcome today's witnesses.

Mr. Chairman, as you mentioned, the huge cost estimates and potential schedule delays of the chem demil program are mind-boggling. What began in 1986 as a projected $2 billion, 10-year-long destruction program has become, based on current estimates, a $25 billion to $35 billion burden that will stretch beyond 2020.

Yet despite the programmatical and financial setbacks, we should be most concerned with our credibility and standing in the international community. We will almost certainly fail to meet obligations under the Chemical Weapons Convention Treaty.

One waiver has already been granted, and predictions for the program completion are now well past the 2012 target.

I understand past delays have been caused by modification destruction rates, new environmental regulations, worse-than-expected stockpile conditions and unanticipated emergency preparedness requirements.

But I also know that some of the delay has been self-imposed by the department. There have been frequent turnovers in the program leadership team, bureaucratic roles and responsibilities were often uncoordinated and left unclear, and a comprehensive programmatic strategy has been lacking.

Now, I recognize progress has been made; 35 percent stockpile destruction is no small achievement.

But our nation's interests are best served through the promotion of laws and respect for international protocols. The failure to comply with Chemical Weapons Convention undermines our credibility in the world. I would like to believe that we find ourselves at a turning point in this effort.

I would also like to believe that the Administration is poised to apply new-found commitment to the program.

I would also like to believe that today's testimony will move us down a clear and scientifically sound path toward treaty compliance.

This should be our goal, and I hope it will ultimately guide our decisions.

And again, Mr. Chairman, I thank you and the panelists.

Mr. SAXTON. Let me just ask unanimous consent at this point that the Members of Congress who are with us who are not part of this panel be permitted to sit at the dais and take part in the hearing.

Without objection, so ordered.

Dr. Klein, I understand that you and Secretary Bolton will offer your statements for the Department of Defense and Department of

the Army, respectively, and that Mr. Wakefield and Mr. Parker will be available to answer questions during the question period.

So, sir, if you would like to go ahead and offer your testimony at this time.

Thank you.

STATEMENT OF DR. DALE KLEIN, ASSISTANT TO THE SECRETARY OF DEFENSE FOR NUCLEAR AND CHEMICAL AND BIOLOGICAL DEFENSE PROGRAMS

Dr. KLEIN. Thank you, Mr. Chairman and distinguished subcommittee members. Thank you for the opportunity to offer my views concerning the Department of Defense chemical demilitarization program.

As you recall, I testified before you one year ago, and I look forward to continuing this dialogue on the matter of the destruction of our chemical weapons stockpile.

I request to submit my written testimony for the record.

As indicated, I am Dale Klein, the Assistant Secretary of Defense for Nuclear, Chemical and Biological Defense Programs. As I had previously testified, in my current capacity I am the principal adviser to the Secretary and to the Deputy Secretary of Defense and the Under Secretary of Defense for Acquisition, Technology and Logistics for all matters concerning the formulation of policy and plans for nuclear, chemical and biological programs.

And the most important topic that we have today is for the chemical weapons demilitarization.

The Army has made good progress this past year. As soon as the facility starts operation in Newport, Indiana, six out of our eight chemical demilitarization sites will be operational.

I would like to make three points today during my briefing: safety and security, funding the President's budget for chemical demilitarization, and the department's recent acquisition decision for the chemical demilitarization program.

First, I want to emphasize my commitment to safety and security as a paramount consideration of chemical demilitarization program. I have championed this cause vigorously during the past four years while focusing on destroying our aging stocks of chemical weapons.

As the chemical demilitarization program moves forward, the department will balance resources to maximize the chemical weapons destroyed while protecting our workers, the surrounding public and the environment.

Second, I want to emphasize and respectfully request that you fully fund the fiscal year 2006 President's budget for the chemical demilitarization program. This budget requests funds existing and future chemical weapons destruction efforts. As of December 31, 2004, the U.S. has destroyed more chemical agent in accordance with Chemical Weapons Convention than all other state parties combined.

By May 2005, the department expects to be operating six chemical weapons destruction sites, and the U.S. remains on track to meet the Chemical Weapons Convention extended 45 percent destruction deadline of December 31, 2007.

The U.S. continues to be a leader in the international community regarding the destruction of chemical weapons, and now more than ever, each and every dollar that we spend goes directly toward destroying our aging chemical weapons stockpile and maintaining our commitments as outlined by the Chemical Weapons Convention.

Third, I will discuss the department's recent acquisition decision.

The department is currently implementing the Acquisition Decision Memorandum, or the ADM, that was signed on December 21, 2004. The ADM directs the department to divide the program into three major defense acquisition programs and prioritize the funding to support the operations at existing chemical demilitarization facilities in order to ensure compliance with our extended deadline of December 31, 2007, for the 45 percent CWC convention.

The ADM also directs the development of alternatives that are safe, secure and cost effective to complete the stockpile destruction within the existing resources by the Chemical Weapons Convention, extended 100 percent destruction deadline of April 2012.

If we do not manage physical resources, the projected life cycle cost to destroy the U.S. chemical weapons stockpile could grow from $26.8 billion in 2004 to as much as $40 billion in 2012. Therefore, the analysis of potential alternatives helps manage and fulfill the department's obligations of responsible resource management to the U.S. taxpayer.

The department expects to complete this evaluation by April 2005, and I ask for your support as we continue the safe, secure, cost effective and timely destruction of our chemical weapons.

In closing, the department is fully committed to destroying our nation's chemical weapons stockpile safely, securely and expeditiously.

To be fully effective, we ask for your assistance in fully funding our budget requests and supporting us as we leverage all means necessary to meet our commitments to the citizens and to the world.

While we have our challenges, Mr. Claude Bolton, representing the Army as executive agent for the chemical demilitarization program, has made significant progress over this last year and should be complimented for his activities.

We are making the world a safer and more secure place by having destroyed over 11,000 tons of chemical agents as of March 23, 2005.

Mr. Chairman, I welcome any comments or questions you and other members of the subcommittee have regarding the chemical demilitarization program. I look forward to working with you as we advance our common goal of safe, secure, cost effective, timely and complete destruction of our nation's chemical weapons stockpile.

Thank you.

[The prepared statement of Dr. Klein can be found in the Appendix on page 43.]

Mr. SAXTON. Thank you, Dr. Klein, very much for your testimony.

Secretary Bolton.

STATEMENT OF HON. CLAUDE M. BOLTON, JR., ASSISTANT SECRETARY OF THE ARMY FOR ACQUISITION, LOGISTICS AND TECHNOLOGY, U.S. ARMY

Secretary BOLTON. Chairman Saxton, Representative Meehan, distinguished members of this committee, it is again my privilege to appear before you as the Assistant Secretary of the Army for Acquisition, Logistics and Technology and as the Army Acquisition Executive to discuss the status of the chemical demilitarization program.

I, too, respectfully request that my written statement be entered into the record in its entirety.

Mr. SAXTON. Without objection. Thank you, sir.

Secretary BOLTON. I am joined today by Mr. Mike Parker, Director of the Chemical Materials Agency. And on behalf of Mr. Parker and the men and women of that agency who perform the safe and expeditious destruction of aging chemical agents and munitions for the Army, I want to thank the committee, the committee members and staff for their unwavering support of this important and difficult mission.

Your candid appraisals of this endeavor guide our paths and help us achieve the tasks you have charged us to perform. Your dedication to this mission is recognized and much appreciated.

As the Army acquisition executive, I am responsible to the Secretary of the Army and to the Defense Acquisition Executive for all aspects of the chemical demilitarization program, except for disposal efforts at Pueblo, Colorado and Bluegrass, Kentucky.

The Army's paramount objective is to destroy the stockpiles of chemical agent and munitions at disposal sites in Alabama, Arkansas, Indiana, Maryland, Oregon and Utah, as well as the nation's non-stockpile chemical warfare materiel, while ensuring the safety and protection of the workforce, the general public and the environment.

I would like to outline my main three points today.

First I will illustrate the excellent progress the Army has made over the past year; second, I will offer evidence that indicates we are conducting the mission safely; and third, I will describe some of the issues that affect the program's cost and schedule.

I would like to point out that this has been and is a remarkable time for the Army chemical demilitarization program. I am proud to report that over 36 percent of the total stockpile has been destroyed, using two different chronologies, mainly chemical neutralization and incineration.

At our neutralization facility at Aberdeen, Maryland, we have completely destroyed all agent drained from ton containers, making it the first facility within the continental United States to completely eliminate the risk of agent exposure to nearby communities.

Our neutralization facility at Newport, Indiana, is expected to begin agent destruction operations next month.

Our incineration facilities also are making tremendous progress. I am pleased to report that all of our incineration facilities are operating. We have destroyed more than half of the Tooele, Utah, stockpile, which originally constituted over 40 percent of the total U.S. stockpile. Over 1 million munitions have been destroyed at Tooele, including all the sarin-filled weapons and nearly all of the

VX munitions, which together represent 99 percent reduction in the risks to their community there.

The employees at our facility at Anniston, Alabama, have destroyed all the sarin-filled rockets at that site, which represents a 33 percent reduction in risk to the surrounding communities.

Employees at the facility at Umatilla, Oregon, also are doing their part to reduce the risk posed by continued storage. Since the beginning of operations, since September 2004, they have safely eliminated over 8,000 sarin-filled rockets. And last week, workers at our facility at Pine Bluff, Arkansas, began destroying munitions and reducing the risk to that community.

The international treaty requires the complete destruction of the nation's stockpile of chemical agents and munitions. But it also requires destruction of non-stockpiled chemical warfare material. And I am pleased to report that over 80 percent of the former production facilities have already been destroyed. And we are on schedule to meet the April 2007 non-stockpile treaty deadline.

Focusing on the second point, I would like to emphasize that we are accomplishing all of these activities safely. The Army and its contractors have achieved exceptional safety records. And by focusing our efforts on protecting the worker, who is turning a valve during a plant operation, we protect the general public and the environment as well.

Our facilities have achieved an average annual reportable injury rate that, according to the Bureau of Labor Statistics, is somewhere between those of a credit union and a shoe store.

Our sites have logged millions and millions of hours without a lost-time incident. Our facilities in Alabama, Arkansas and Oregon have recently received prestigious safety awards from state government offices in recognition of their extraordinary achievements.

In addition, the Chemical Stockpile Emergency Preparedness Program, or CSEPP, the Army works closely with the Department of Homeland Security's Federal Emergency Management Agency and with state and local governments to review emergency preparedness requirements as individual weapon storage sites reduce risk to the communities through the destruction of their stockpiles. All 10 CSEPP states have achieved full program benchmark compliance.

My third and final point is that a number of different issues have the ability to impact the program's cost and schedule. No one envisioned the peaceful destruction of these weapons when they were first manufactured over 50 years ago. However, achieving a mission of this scope and magnitude, and one that holds the interest of so many important stakeholders, poses unique challenges. These challenges can be grouped generally into three categories: technical, external and internal.

As an example of the technical, we recently identified the presence of mercury in portions of the Tooele stockpile. The Tooele plant must be modified to remain compliant with environmental regulations and prevent the release of mercury in the environment.

External has been touched on, and that involves movement of hydrolysate, which is a caustic waste material, from our neutralization plant in Newport to another facility. The ongoing studies with the Centers for Disease Control (CDC) and the Environmental Pro-

tection Agency (EPA) must be concluded and then determination made as to whether or not that process is safe for the environment.

The internal was mentioned earlier by the ranking member, and that deals with our own processes in the Army, within the agency and within the building, and those are all being addressed.

I think to date, Mr. Chairman, we could see that the program has achieved its major objective and that is to reduce the stockpile safely to the surrounding communities, the workers who are involved and to the environment.

With your continued support and those of the staff, I am convinced that we will be able to reduce the threat, eliminate the chemical weapons and munitions and eliminate this threat for our communities and for the country.

That concludes my remarks. I look forward to your questions.

[The prepared statement of Secretary Bolton can be found in the Appendix on page 49.]

Mr. SAXTON. Secretary, thank you. And thank you for concentrating on the safety aspects of this.

It is interesting to note that we are one-third of the way through the program, and according to the information that you have just given us, we have been, from a safety of point of view, very, very successful.

Secretary BOLTON. Yes, sir.

Mr. SAXTON. Thank you for that information.

Mr. Conklin.

STATEMENT OF CRAIG CONKLIN, CHIEF, NUCLEAR AND CHEMICAL HAZARDS BRANCH, DEPARTMENT OF HOMELAND SECURITY, FEDERAL EMERGENCY MANAGEMENT AGENCY

Mr. CONKLIN. Yes, sir.

Mr. Chairman and distinguished members of the subcommittee, I am Craig Conklin, Chief of the Nuclear and Chemical Hazards Branch located within the Department of Homeland Security's Federal Emergency Management Agency (FEMA).

I am pleased to provide this update on the progress of the Chemical Stockpile Emergency Preparedness Program since my last testimony before this subcommittee on April 1, 2004.

I also respectfully request that my written statement be entered into the record.

The CSEPP mission is an extension of the Department of Homeland Security mission to lead America to prepare for, prevent, respond to and recover from disasters. CSEPP's mission is to enhance existing local installation of tribal, state and Federal capabilities to protect the health and safety of the public, workforce and the environment from the effects of a chemical accident or incident involving the U.S. Army chemical stockpile.

The CSEPP mission is successfully accomplished through effective partnerships with the Army, other Federal departments and agencies in 52 state, tribal and local government organizations.

The current state of the program is a positive one. Due to the effect of working partnerships, previously mentioned, all CSEPP communities are capable of responding to incidents involving chemical warfare agents. In fact, CSEPP communities are better pre-

pared to respond to natural and man-made hazards as a result of their involvement in this program.

In addition, CSEPP is actively working to share its best practices and experiences so they may be applied to other homeland security needs.

We have undertaken several initiatives to ensure continued effective program implementation.

With the chemical stockpile at Aberdeen Proving Ground now completely destroyed, FEMA is working with Maryland officials to close out that community from the program. The closeout lessons learned from Aberdeen are being captured by a national-level working group and will be used to develop policies and procedures for closing out the other CSEPP sites when they have accomplished their missions.

We have also initiated negotiations with our state and local partners to translate the benefits gained from risk reduction and to reduce program cost. We are committed to a collaborative process that continues to produce community-specific preparedness programs that are commensurate with actual community risk.

FEMA will continue to ensure that baseline emergency preparedness capabilities are maintained at all sites until the chemical stockpiles are completely destroyed.

FEMA and the Army have also published a joint strategic plan for the CSEPP that codifies our system of national benchmarks as official program goals and defines objectives for meeting them.

While the CSEPP has made significant strides forward, it still faces several challenges.

As the disposal schedule is extended, program costs increase. These costs increase can be significant because many major infrastructure systems, such as answer-operable communications and outdoor siren systems, have a finite lifespan and may require replacement during the program's life cycle. These system replacements were not originally budgeted because stockpile destruction was planned before system obsolescence.

Although off-post preparedness comprises only six percent of the total overall chemical demilitarization budget, FEMA and Army personnel are working closely with our state, tribal and county partners to sustain community preparedness in the most efficient manner possible.

FEMA is also working to reduce its cost. Personnel levels at FEMA headquarters and in several FEMA regions have been reduced through attrition. Staffing needs will be continually evaluated to ensure that FEMA staffing is appropriate to fulfill our preparedness mission.

Two appropriations issues also create challenges for program management.

The loss of two-year availability for operations and maintenance funding and the imposition of fenced appropriations for on-post and off-post preparedness funding reduces the amount of time that our state and local partners have to implement major projects and eliminates the flexibility of the Army and FEMA to employ Federal funds where they provide the greatest public protection.

In closing, although the CSEPP has significantly enhanced the ability of the state, tribal and local officials to respond to a chemi-

cal incident at the Army's installations, FEMA will not rest on this accomplishment. I would like to emphatically state that until all chemical weapons stockpiles are destroyed, the Department of Homeland Security, working through FEMA, will continue to work with our state, tribal and county partners to ensure that they are prepared to respond to an event.

I will gladly respond to any questions that you may have.

Thank you.

[The prepared statement of Mr. Conklin can be found in the Appendix on page 56.]

Mr. SAXTON. Thank you, sir.

Dr. Sinks.

STATEMENT OF DR. THOMAS SINKS, ACTING DIRECTOR, NATIONAL CENTER FOR ENVIRONMENTAL HEALTH, AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY, CENTERS FOR DISEASE CONTROL AND PREVENTION, DEPARTMENT OF HEALTH AND HUMAN SERVICES

Dr. SINKS. Thank you, Mr. Chairman and members of the subcommittee.

My name is Tom Sinks, and I am the Acting Director at the Centers for Disease Control and Prevention's National Center for Environmental Health and the Agency for Toxic Substances and Disease Registry, both within the Department of Health and Human Services.

I would like to thank the subcommittee for inviting me here today. We share with you and the Department of Defense (DOD) the obligation and desire to safely destroy and dispose of our nation's chemical weapons stockpile.

My testimony will focus on CDC's involvement with the Newport chemical agent disposal facility.

CDC and other oversight organizations have worked with the Army and achieved several notable successes in safe destruction of chemical weapons at Johnston Atoll; Tooele, Utah; Anniston, Alabama; and Aberdeen, Maryland. We look forward to continuing this notable record for safety and accomplishment.

CDC's oversight function primarily involves reviewing the Army's plans at each facility and focusing on provisions and procedures to protect the workforce and surrounding communities. CDC conducts periodic on-site reviews and consults with the Department of Defense and contractors on an ongoing basis for the purpose of ensuring safety.

Today our challenges involve different non-incineration technologies, such as the technology at Newport, Indiana, and those proposed for Pueblo, Colorado, and Bluegrass, Kentucky.

CDC has reviewed the Newport facility operations and plans. CDC believes the facility is prepared to begin processing a portion of the VX stockpile.

CDC will continue to review the status of the Newport facility on an ongoing basis.

Congress has requested that CDC conduct an independent review and report on the DuPont and DOD plan for the handling, transport and disposal of caustic VX hydrolysate waste.

CDC used internal and external experts to review the DuPont-DOD report, including those from the Agency for Toxic Substances and Disease Registry, the Department of Transportation, Carmagen Engineering and EPA.

CDC sought extensive documentation from both the Army and DuPont. CDC reviewed several thousand pages of studies and background information.

To ensure technical accuracy of CDC's findings, the entire report was peer reviewed by subject matter experts outside the government and the Department of Defense. The report was sent yesterday to the subcommittee and Members of Congress who requested it.

Our summary findings were, first, caustic VX hydrolysate is highly corrosive, requiring appropriate personal protective equipment during handling and transportation. The hydrolysate is consistent with other caustic products and can be dealt with by proper training and ensuring that responders understand the proper equipment for an emergency response.

Second, CDC believes that the Newport facility can begin effectively destroying approximately half of the VX stockpile. However, insufficient information has been provided to determine the efficacy of neutralization of the remaining VX stabilized with a different chemical additive.

In addition, studies provided CDC to date support destroying smaller portions of VX per batch than was originally designed—8 percent versus 32 percent—which will increase both the processing time and the volume of hydrolysate waste generated. We understand that the Army is conducting additional testing to see if it can resolve these two issues.

Third, risks associated with transporting the hydrolysate from Newport to the DuPont facility in New Jersey are limited to its corrosive properties. The hydrolysate waste can be transported utilizing precautions and equipment similar to other caustic materials currently being conveyed on our highways.

Fourth, insufficient data were provided to the EPA reviewers to ensure that the disposal of hydrolysate waste into the Delaware River is acceptable. Because EPA found the assessments were not acceptable, CDC cannot recommend proceeding with the disposal plan until EPA's concerns are adequately addressed.

In October of 2004, CDC received a second congressional request to review a revised Army-DuPont plan for further phosphonate reduction at DuPont. CDC received the Army-DuPont report on phosphonate treatability last month. CDC recently began to review this information and hopes to have a review complete as soon as possible.

In summary, CDC will diligently continue the evaluation of existing chemical demilitarization facilities for safety, monitoring and medical programs, and work in partnership with the Army on this important program of the U.S. Government.

CDC has had a long and successful working relationship with the Army's Chemical Materials Agency. Together with the Department of Defense we hope to report continued successes of this program to the subcommittee.

Again, I appreciate the subcommittee's interest and attention to this important project and the opportunity to protect the health of the people of the United States.

Mr. Chairman and members of the subcommittee, this concludes my testimony. I have provided more detailed testimony in writing.

I would be happy to answer any questions.

[The prepared statement of Dr. Sinks can be found in the Appendix on page 64.]

Mr. SAXTON. Dr. Sinks, thank you very much. And thank you for your comments on the CDC report.

I would like to say at this point that I have a copy of the report, which is entitled, "A Review of the U.S. Army Proposal for Off-Site Treatment and Disposal of Caustic VX Hydrolysate From the Newport Chemical Agent Disposal Factory."

I would like to ask unanimous consent at this point that the report be made part of the record of this hearing, as well as the comments of the Department of Defense that were sent to CDC.

So that will be made part of the record, without objection.

Let me also say at this point that the ranking member—who is also a member of the Judiciary Committee, which is in session, considering reauthorization of the Patriot Act—and so I am going to yield first to the ranking member, Mr. Meehan, and then I will ask my questions.

[The information referred to can be found in the Appendix on page 77, 79.]

Mr. MEEHAN. Thank you, Mr. Chairman.

Dr. Klein and Mr. Wakefield, I understand that the current chemical weapons demilitarization program will not complete stockpile destruction until 2020 or 2021, which is at least eight to nine years beyond the extended deadline provided by the Chemical Weapons Convention.

If not addressed, doesn't this undermine our ability to press other countries to adhere to the convention's deadlines. And are we prepared to give up that leverage?

It seems to me that the United States' failure to eliminate our chemical weapons stockpile in a timely fashion could give Russia, for example, an excuse to provide less than good-faith cooperation under the Cooperative Threat Reduction Program.

And what implications does our delay have for the Cooperative Threat Reduction Program?

I am concerned that a slow rate of demilitarization on the Russian side, where stockpiles are less secure, is a very serious threat to national security.

So the question is: How do you suggest that the United States—you know, a country committed to ridding other countries of weapons of mass destruction and stockpiles—explain to the world our failure to eliminate the chemical weapons stockpiles as required by the international treaty?

Dr. KLEIN. Mr. Congressman, if you look, for example, where we are to date, we have our six—hopefully soon—six out of the eight sites operational. So we are making good progress, and we do believe that we will have 45 percent of our chemical agents destroyed by December 2007.

On the current schedule that we are operating on, we believe that we will have at least 90 percent of our chemical agents destroyed by 2012, if not more.

The last two sites that are, as we say, the long pole in the tent are the sites at Pueblo and Bluegrass. Pueblo is about eight percent of our stockpile; Bluegrass is about two percent of the stockpile.

So the bottom line is, we do not know those end dates, because we currently have studies that will be ongoing that will have more information hopefully by the end of this month, and we will make decisions this year on a better definitive schedule for those last two remaining sites.

I would say that we are going to make every effort to make 2012. We have not given up on that. It is going to be difficult. Everyday that we operate the plant safely and securely, we have reduced the risk to not only our citizens but to the world. And we do believe we are making progress.

We would like to do it quicker. We would like to do it with less cost. But we also want to make sure we do it safely and also protect the environment. So we want to take prudent action.

Clearly, we are making better progress than Russia. Russia has about two percent of their agents destroyed to date. The Cooperative Threat Reduction Program also is under my office, and we are working with the Russians to make sure they safely and securely destroy theirs as well.

They, in all likelihood, will not even come close to 2012.

Mr. MEEHAN. Dr. Klein, we repeatedly state that weapons of mass destruction, getting them out of the terrorist hands, is a top priority. The Army maintains that public safety is its top consideration.

Numerous studies have shown that the continued storage of chemical weapons is the highest-risk option.

I am trying to determine how we can justify the delay of construction that you mentioned at Bluegrass and Pueblo. What is really preventing the destruction of these stockpiles in a timely manner?

In testimony before the Senate Budget Committee in March, Deputy Secretary of Defense Paul Wolfowitz said that we are reexamining what is going on in Colorado and Kentucky, and he said, "My gravest concern is that projects be cost effective."

So are you telling us that there has been a shift in priority from public safety/national security to cost? And what did Secretary Wolfowitz mean by that?

Dr. KLEIN. Well, I would certainly not want to interpret what the Deputy Secretary stated.

What I will say is that the department is committed to the safe and timely destruction of these chemical weapons. We would like to do this as expeditiously as we can.

In terms of the plants at Pueblo and Bluegrass, these are the last two sites. We did not decide the technique that those two sites would utilize until 2002.

We certified to Congress in 2003 what the cost of those facilities would be. In Pueblo it was $1.5 billion, in 2002 dollars.

When we were getting some of the designs back, the cost increased to $2.6 billion, and that was a significant increase in cost.

So we are now looking at alternatives to that, whether we could stage the destruction in a different way, where we would remove energetics and then look at destroying the mustard gas, in the case of Pueblo, so that we can do it safely.

So we are looking at a lot of options in order to do this in a more safe and timely manner.

So I would say that the department has not shifted its focus at all. But we are responsible to the taxpayers, and we want to do this in the best way that we can to balance cost, performance and schedule.

I would say that the materials are safely stored in all of our eight sites. But we would like to get rid of these as soon as we can.

Mr. MEEHAN. The reason I ask—and maybe Secretary Bolton can comment on it—the Administration's fiscal 2005 budget slashed funding for the plant facilities in Pueblo and Bluegrass. In the budget projections for fiscal year 2006 to fiscal year 2011, the estimated request remains extremely low, about $31 million per year to be shared by both sites.

The chemical weapons destruction technology plan for Pueblo and Bluegrass is a water neutralization technology, an alternative to incineration developed through years of negotiation between the Army, local officials and citizens.

Why has this pilot destruction process been singled out for budget cuts? And what does this say about the Army's commitment to developing alternative destruction methods that are less harmful to the environment and more acceptable to the local communities?

Dr. KLEIN. Let me start to answer that question.

These two plants in Pueblo and Bluegrass are using a neutralization technique similar to that that was used in Aberdeen and will be used in Newport.

We learned a lot in the operation of the plants at Aberdeen. It took a year longer than we had expected. There were a lot of operational issues that caused it to take a lot longer than we had initially expected.

And I think the fact that we understand the science of how to do this is sometimes easier than the operational side of doing it. And so we had some material incompatibilities that took longer than we expected.

The numbers that you refer to in the delay of Pueblo and Bluegrass are basically our program objective memorandum (POM) budget within our existing physical resources. That does not mean that is the schedule that we will stay on. That is the five-year budget projection.

I believe that when we operate Newport, we will learn from that and be able to design the plant at Bluegrass better. We learned a lot from Aberdeen that will help us on the Pueblo plant.

So there is no less focus on getting rid of these in a safe and timely manner.

What we did do when Mike Wynne made his decision in December, he did make the decision to concentrate on those plants that are operating so that we could more likely increase and meet our 45 percent deadline that we have for December of 2007.

So it does not mean that we are diminishing the importance of Pueblo nor that in Bluegrass. It just means that we wanted to concentrate and keep the plants that are running, running, and to meet that 45 percent deadline.

Secretary BOLTON. Congressman Meehan, as I stated in my opening comments, these two sites are not directly under my management purview. But I feel I have a moral obligation to Dr. Klein and to Mr. Wynne to offer whatever expertise they think they need—they work on that.

So obviously, whether it is Aberdeen that is now closing down, or Newport that is starting up, whatever we learn from those sites we pass on to them.

But it is not under my purview to look at the cost and schedule of those two sites.

Mr. MEEHAN. Thank you, Mr. Secretary.

Thank you, Mr. Chairman.

Mr. SAXTON. Gentlemen, it seems like you bring us good news and bad news. The good news part of the story is that this has been a remarkable effort in terms of not harming people or the environment. The good news, on the safety side, is that we have done a pretty good job here, it seems.

On the other hand, there are two other parts of this issue that are obviously troublesome. One is the length of the period of time that this job is taking.

When this program was conceived in the 1980's, I believe it was hoped that we would be able to move through the entire destruction of these agents in 8 years and at the cost projected at the time of $2.1 billion. This is not new information to you, because you told me this.

Of course, we did not make the 1994 deadline, and here we are in 2005, and this year's projection is $26.8 billion. And Dr. Klein using his ruler, has built this little chart that I have in front of me that says that by something around 2014 or 2015, the cost could be as high as $40.2 billion.

So in terms of—and would not be completed until 2030, Gene tells me.

So the good news is that we have done this in a safe way; the bad news is that is taken many times longer than we expected it would at the beginning and at a cost many multiples in excess of what it was originally projected to take.

So here is my question: Being as brutally frank as you can, tell us what happened to the cost projections and the time projections and what the Department of Defense did in the past—which it may do differently in the future—and what role also Congress may have had to play in slowing this program down and perhaps making it more expensive than it should be.

Dr. KLEIN. I will start, Mr. Chairman, and then pass it to the Honorable Claude Bolton to add his comments as well.

I think a lot of factors happened in the cost and schedule, and that has been one of the most frustrating parts. As you indicated, we have good news and bad news. The good news is we are doing it safely. We have not injured people and it is doing it in an environmentally sound manner.

I think a lot of things happened. As Mr. Bolton indicated, we do get some technical surprises along the way. For example, when we sampled some of the ton containers in Tooele, we found that they had mercury in them. And the environmental laws and regulations that we have on the books today for the release of mercury into the environment is much different than that that was projected in 1985.

So there have been environmental changes. There have been technological surprises.

One of the frustrating parts, I believe, is that we have not gotten the through-put of the plants as we had expected. And, again, we will have surprises where there is material incompatibility, changing environmental regulations—a lot of things have resulted in not meeting the schedules.

So we probably have a variety of factors. There is no single one cause to do that.

But it has been optimistic schedules that have not come to pass. It has been the plants that have not been meeting their target objectives.

So what we have done, when I was confirmed in my position in late 2001, November of 2001 and coming into 2002, was when we were wrestling with a $9 billion increase. I was new to the Pentagon, and it was gut-wrenching. We had a $9 billion increase. We went from roughly $15 billion to $24 billion. And that was not a pleasant time to be there to make those decisions.

What we did for that activity is that Claude and I meet often, we review schedules, we challenge the people that are monitoring the plants that have their plans.

In terms of the recent decisions that we are taking on Pueblo and Bluegrass is, we are going to look at various stages being competitive. We want to look at incentives for the contractors with no compromise to safety. We want to look at right-sizing the plants, smaller footprints.

So we are taking a lot of actions to hold cost and also to hold schedules.

Secretary BOLTON. Mr. Chairman, I agree with what Dr. Klein has just said.

I think when we started this program, we obviously looked at things a bit differently in those days, both from a national standpoint, certainly from an environmental standpoint.

A lot of rules, laws at all levels—local, state and federal—have changed in the interim, and I think for the right reasons: to protect us, to protect the public and protect the environment. Those were not envisioned at the time.

CSEPP was not envisioned at the time when we started this, and that is to protect the local communities, and that is all added in terms of adding requirements and adding costs.

We have been very, very tough on ourselves when it comes to safety. There is absolutely no reason to hurt anybody when we are trying to dispose of these types of weapons. And so we have been very, very cautious, and I would say not too cautious.

And we have learned. Now that we have a number of sites up and running, now is the time to take those lessons learned—and

we are, but those are across various plants—and see if there is a way we can get more efficient.

It is interesting to note that once we get a plant up and running that it runs fairly well. And we see that at Aberdeen, we just started Pine Bluff, and they are moving along very, very well.

You asked us to be brutally frank and honest. This is before my watch—and Dr. Klein will tell you that when I came here, I was not involved with this program. It was not under my purview at all, the chem demil.

And quite frankly, I did not want it. There were just too many moving parts here, and rightfully so. But if you want to do something on a time line, you have to be able to control certain things, and we did not have that.

Well, after about a year of brow-beating I was finally asked to take over six of these. And I noted that as I got into the programs, I said, "Well, you have eight sites. Why am I only getting six?" And then I was told about the Assembled Chemical Weapons Alternatives (ACWA) and what was going on there.

And I knew from the get-go this is going to be problematic, because I have a burning desire to get things done as a package, because we can learn across that. I can put an organization together that can do the whole thing.

I can certainly respond to the desires and wishes of Congress, both Houses, and get the job done. But if you separate it, it will take longer.

And I think, as I mentioned in my last comment, I have done the best I can in supporting Mr. Wynne and Dale Klein, but I cannot tell you how many times I have bit my lip knowing that I would do things a little bit differently if we had the entire program.

So separation of the programs has been, at least in my mind, problematic and has caused problems in cost and schedule delays.

I mentioned in my opening comments that delays break down in three areas—Dr. Klein has already touched on those: technical, internal and external.

The external I just talked on, in terms of rules, regulations, separation of the programs and projects.

Internal basically boils down to how you organize to get the work done. We are improving that. We did that by setting up this Chemical Materials Agency (CMA) a couple of years ago.

And the technical, the technical sometimes will surprise us. Take the mercury in the ton containers and so forth, we have gone out to the other sites and we are looking to see if that is going to be a problem there.

But if you really want to get this down—I think we understand what the communities expect from us in terms of the environmental and wanting to do things safely. I think we know how to do that. We have demonstrated that.

Now it is a matter of bringing these things together and getting on with the job and keeping the community well aware of what we are doing.

Mr. SAXTON. Thank you.

Help me look ahead a little bit.

Based on what we know, at the end of last year we had—well, let me go back and say that when we started this program back

in the early 1990's, when demil actually started, we had no or almost no demil plants—is that right?—very limited capability.

And at the end of 2004, we had a plant operating Umatilla, Oregon; in Tooele, Utah; in Anniston, Alabama; and in Aberdeen, Maryland. So at the end of last year we had four plants up and running.

Earlier this year Pine Bluff, Arkansas, came on line, and in a few months a plant at Newport, Indiana, will come on line. So we can essentially look at six out of eight plants in operation or soon to be in operation.

What does this mean for the future? We have been able to demil roughly a third of the capacity—of the product that we have to demil over these many years that have passed, and now we have six plants up and running. What does this mean in terms of cost in the future and schedule in the future?

Secretary BOLTON. Well, obviously we are going to be reviewing this with Dr. Klein and Mr. Wynne here shortly, looking at our revised estimates and so forth.

We are challenged by the Office of Secretary of Defense as we look at the Cost Analysis Improvement Group (CAIG) numbers. Their numbers are a bit higher than mine, so we are looking at all of that. We may all gravitate together here eventually.

But what it means to me to have the six plants is that I can stabilize operations across those plants, get some experience under our belts how to do this, and then start driving the time down in terms of how long it is going to take to do the destruction at those plants.

So having everything up and working, we can start to focusing on the day-to-day operations of all plants, sharing those lessons learned and then finding ways that we can actually bring that schedule back.

Mr. SAXTON. Can you predict how many tons you will be able to process a year with the six plants up?

Secretary BOLTON. Mike, do you want to take that?

While Mike is getting up, I will tell you that we have an obligation to have 45 percent—go from the 36 where we are now to 45 in 2 years. But I think we can beat that.

Mr. PARKER. Yes, sir.

We are in a process of rebaselining across the program as we speak and have that ready to come up by the end of May time frame.

But I think if we look back on where we are at—this is the first time I think that we have had the operational history with Johnston Island, Tooele, seeing multiple plant startups at Anniston, Umatilla and now Pine Bluff, where we really have had the statistical base and the confidence in our operating history to do a good solid forecast.

This rebaselining effort that we are going through now I think will produce something which we will be able to bring up through the Army chain to the Office of the Secretary of Defense and over to the Congress and basically to the American people with a very high confidence cost and schedule.

From that we have also been able to identify, based on this operating data, many opportunities to accelerate the program—as we

call it, pull it back to the left in our schedule terms—which will not only accelerate the program but also be able to address some of the cost issues which we find challenging.

We do have that operational data now. We know where to go after, in an engineering context, to improve performance.

As Dr. Klein touched on, the biggest thing on the plant side is that the plants have only been operating at about half of the designed efficiency that we had forecasted.

The factors, while they are a consideration, involving environmental requirements—and totally new requirements, such as Chemical Stockpile Emergency Preparedness, the non-stockpile chemical demil program—add to the cost.

But the biggest single factor is the operation of the plants.

We have solid data, and I think we will be able to come back to you in the summer time frame and lay out a schedule which will answer your questions as to what we believe we can do with a very high confidence number.

Mr. SAXTON. Well, we look forward to seeing that information, and we appreciate your efforts in that regard.

I am extremely interested in the disposal of the VX gas at the DuPont plant on the Delaware River. However, I think I have overstayed my welcome here in terms of using time. There are two other Members of Congress who are on this panel who are also interested in this subject. So here is what I suggest we do: We are going to Mr. Hefley, he is next, and then we will come back to Mr. Andrews and Mr. LoBiondo, who are——

Mr. ANDREWS. Mr. Chairman, I would be willing to go after Mr. LoBiondo.

Mr. SAXTON. Okay, we will do it that way.

We will go from Mr. Hefley, then, and then Mr. LoBiondo and Mr. Andrews.

Mr. HEFLEY. Well, you know, I came in here today, I wanted to know what the heck is happening in Pueblo. And with the questions that have been asked by our chairman and ranking member and by your testimony, you have given us a little idea of that.

But I am still very concerned about Pueblo. Is mustard gas not as important as some of these other things? It is fallen down on the priority list.

The thing that concerns me is the fits and starts we have had there, that we think we have the thing going, we think a decision has been made—I was out there just a few months ago—last fall, John, or some time? It is actually in John's district, and I refer to him for most of the questioning in this.

But here the contractor was in a big, new temporary building, but it was big and new. And they took me outside, and they showed me where they had staked out for the new plant, and they had this system and they explained that in great detail to me, and it had all been agreed upon.

And it seemed like no time after that I go home, and I read somewhere that this has been put on hold, that we are not going to do this after all.

Now, is that because of the cost? Or is that because we are still looking at the idea of moving it to Utah to destroy it?

I remember Jim Hansen, when he was here, that was always his dream, that we would move it to Utah and not have to build another plant.

If that is what you are thinking about doing, tell us about that.

But the thing I think that frustrates the community of Pueblo is that they get all excited that we are actually going to move forward, and then it is changed, everything changed and we are not moving forward at all.

So any light you can shed on that, I would appreciate.

Dr. KLEIN. Mr. Congressman, it has been a challenge. And when we were seeing—when we had certified the cost and schedule in roughly 2003 and it came back a lot higher than we had expected, we started looking at alternatives.

We believe that at the end of this month we will have some alternatives that we will examine. I will be meeting with the Colorado delegation later this month. I met with individuals, the Colorado community group, in Denver a few weeks, and we try to keep them informed.

The difficulty is if you ask us right now, do we have a decision exactly how we are going to proceed, we do not. We are trying to get the plant right-sized into a smaller footprint. We are trying to do it within reasonable cost and schedule.

We have talked to the contractors involved. They believe they have some creative and innovative ways that they can do it within a reasonable time period and a reasonable cost. They just had not looked at all the options that we now are asking them to look at.

So I definitely understand the frustration. We have it, too, so it is not just from Colorado's perspective.

We do hope, though, within the end of this month to have some definitive numbers that we can look at. And as soon as we have it planned for, we will pass those on to you and to the community and certainly to Congressman Salazar as well since it is in his area.

But we definitely are trying to look at both cost and schedule in terms of—and certainly safety.

Mr. HEFLEY. Well, I would appreciate it if you would keep us in the circle. I do not like reading about it in the newspapers after I thought I had a thorough briefing. It makes me look a little silly when I say, "Oh, no, I just talked to them and they said we were going to do it this way," and obviously that is not the case.

Mr. Chairman, I have to go chair the Readiness Committee, and I apologize, because I would like to stay for the rest of this, but I have a very able colleague here that I am sure will not let you off easy. [Laughter.]

Mr. SAXTON. Thank you, Mr. Hefley.

Mr. LoBiondo.

Mr. LOBIONDO. Thank you, Mr. Chairman.

I thank our distinguished panel for being here today.

This is very informative and we are getting a lot of information, but as Chairman Saxton said, Mr. Saxton, Mr. Andrews and myself have many, many, many unanswered questions.

And I know that the questions that are raised are leading us to say that you, Dr. Sinks, need additional information by the EPA before you can conclude what the ecological risks are, the long-term

risks, and where we may go from this particular treatment at DuPont.

I have also been made aware that DuPont made some recent upgrades to their disposal process, and I am told it involves some new techniques that some are saying would significantly remove a couple of additional agents from the wastewater, and that these results were shared with the CDC, but that these upgrades were not included in the current report.

So my question is: Is the information concerning these upgrades being considered by the CDC? And if so, will a supplemental report be issued encompassing this information and any other additional information that the EPA requires?

And what kind of time line are we talking about? Soon? Fast? Where do we go from here?

Dr. SINKS. Thank you, Congressman. Let me try to address your questions.

First, in terms of CDC's review of the data from DuPont and the Department of Defense on the phosphonate treatability, the revised treatability plan of DuPont.

We became aware of this when it was announced in the media of November. I believe Congress became aware of it at that point of time.

We just received a technical report itself to look at. It is about 400 pages long. We received it in March. We will proceed to go ahead and review that as quickly as we can with the people and resources we have available.

We know this is an urgent issue, and we certainly want to address it in a timely manner and hope to have that done as quick as possible. But we have not had the time to review it yet in a scientifically rigorous manner. And we did not, for that reason, did not include it in the report that we released today.

In terms of what the EPA needs, the EPA is not providing us data. They are asking for more information I believe from DuPont and the Department of Defense to fill in some of the questions they had in order to determine whether or not they felt that DuPont could dispose of this material into the Delaware River.

Mr. LOBIONDO. The entire program is enormously important to the nation, but I venture to say not a lot of people were paying attention other than those areas where the site is located.

Congressmen Saxton and Andrews and I, we share this district to DuPont, and these are the very issues that will crank people up as quickly or as tightly as discussion about releasing to the Delaware River of an unknown, in their view.

So there is going to be a lot of interest that is generated from this particular hearing, and I know we are anxious to get accurate information. But can you give us any idea of how much time we are talking about here?

I know we want to do it accurately and we want to do it thoroughly, but I know what the first question I am going to get back home is: Are we talking about a month? Six months? Six years? What are we talking about here?

Dr. SINKS. Well, I would hope we are talking in the terms of months rather than years, for sure.

I do want to emphasize that this is a very small program in our center. It is approximately four individuals, full time, who are working on responding to requests from Congress as well as oversight with all of these facilities.

Our individuals travel to these facilities, work alongside of Department of Defense and contractors to assure the safety in these plants and the safety for the public.

So we have many different tasks in front of us to achieve. We understand the urgency of this matter. We certainly make it a very high priority, and we will proceed as quickly as we can.

And as I said, I would hope it would be in the matter of months.

I will say that one of the reasons why we took a little longer with the first report than we expected to take was our decision to go ahead and have our report externally peer reviewed and to ask the Department of Defense to give us technical advice on the report. After all, we had used information from the Department of Defense in developing the report. We wanted to assure that we were giving you the best science and the most credible report we could.

It is a very challenging, complex issue. It is a very important issue. We wanted to make sure we are giving you the best report we could, and we hope to do that with the follow-up.

Mr. LOBIONDO. Mr. Chairman, do I have time for one more question?

Mr. SAXTON. Yes, sir.

Mr. LOBIONDO. I would like to ask either Dr. Klein or Secretary Bolton: Can you comment or do you choose to comment on what alternatives to off-site disposal there may be, depending on what is concluded here?

Secretary BOLTON. Well, as noted earlier, there is a notification here to Congress about starting Newport after the 30-day notification period is ended, and we will have storage on site there at Newport, and we will use that until we make a determination as to which way we are going to go with the hydrolysate.

Mr. LOBIONDO. So your idea is to wait on this information from this report, start the process in Indiana, and then make a decision based on the data that is revealed at that time.

Secretary BOLTON. Well, the data here, and EPA is also doing some work, sir.

Mr. LOBIONDO. Thank you very much.

Yes?

Dr. KLEIN. That material will be stored in robust containers on site in a safe, secure manner.

And one thing I would like to comment on is that while we do not have the final disposition of the hydrolysate determined, it is a lot more safer to the citizens of Indiana and the Nation to have it transferred from the VX to the hydrolysate. So we think it is a right decision to start the process, then store on site until we do the final disposition.

Mr. LOBIONDO. So it is safe to assume they are happy about this?

Secretary BOLTON. Oh, yes, sir. We have been talking to the community there.

Mr. LOBIONDO. Thank you very much.

Thank you, Mr. Chairman.

Mr. SAXTON. Thank you, Mr. LoBiondo.

Mr. Andrews.

Mr. ANDREWS. Thank you.

I want to begin by thanking the witnesses for their preparation.

I want to thank you, Mr. Chairman and Mr. LoBiondo, for the work that you have done on this issue of great concern to our region in procuring this CDC report and language in last year's authorization bill which made this report very meaningful. It is truly appreciated.

I also want to say to Dr. Sinks: Your agency I think did a very, very good job. And I hope you would convey to the people who work with you that we appreciate their professionalism and thoroughness.

And we appreciate you interrupting a family vacation, as I understand it, to be here to testify today. I think each one of us can relate to that risk.

To Dr. Klein, Secretary Wakefield: I know that in these kinds of cases you are confronted with members who do not want things done in their district. It is a way of life around here.

I have looked at this issue very carefully, and as far as I am concerned, this is more than just a matter of not wanting this process to take place in the Delaware River. I do not. And I think the report points out many of the reasons why.

But I also understand we have a responsibility to work with you to solve a very important problem that the country has and to meet a very important obligation the country has.

So I look at this and here is what I see: I see our fellow citizens in Indiana, who have a very serious problem, they are sitting next to a chemical weapons supply, and they very much want those chemical weapons neutralized or done away with in some way. And I think that should be our first priority, to meet the concerns of the people in Indiana.

The second thing that I see is language in the CDC report which doubts whether the neutralization process that you are talking about doing will deal with half the supply at all.

Page seven of Dr. Sinks testimony says, "As a result of the chemical stabilizers added to the VX to maintain its potency, CDC is concerned about the effectiveness of the current neutralization technology to destroy the other approximately half of the stockpile."

So there is some real doubt as to whether the method you have chosen is going to even address half of the problem.

By the way, I assume that the other point that is made is that they are calling on the—I will use an amateur term—but they are calling upon the "concentration" of the hydrolysate to be much lower than you had originally contemplated. Instead of 32 percent concentration in the fluid, they are now talking about 8 percent, which I think means you have a lot more stuff to handle, process, transport, dispose of than you thought you did, which leads to a concern about cost.

I have asked repeatedly for the last year about the difference in cost between the neutralization method you are proposing here and the cost of supercritical water oxidation, which is one of the methods recommended above this method by the National Academy of Sciences. And I have yet to get a straight answer what that cost

differential is. And I think that the fact that you have this new factor adds in.

The third thing that I see is in the EPA's letter, which is an appendage of the CDC report, the EPA makes—this is Walter Mugden's letter—makes the following point: In addition to their concerns about the discharge of the hydrolysate, they say there are several additional issues that need to be addressed before treatment and discharge of this treated hydrolysate can occur, including whole effluent toxicity tests procedure, the potential for the presence of VX nerve agent.

In other words, the EPA believes that the data you have assembled, the data that DuPont assembled, do not rule out the possibility that trace elements of the active VX nerve agent could still be in the hydrolysate.

If you take these problems altogether and you take the comment you just made about the ability to start on half that stockpile and store the hydrolysate on site, I would just ask the question: Why don't you start doing that and then look for an on-site disposal method for the hydrolysate that could be more cost effective and efficient?

I mean, why are we thinking about trucking stuff 800 miles across the country when we have all these questions?

Dr. KLEIN. Let me start and answer some of your questions, and then I will defer to Mike Parker, who has a lot more of the technical details.

The decision to use the neutralization technique in general was made quite some time ago. The National Academy of Sciences said that it was safe and well understood. So the chemistry——

Mr. ANDREWS. But didn't they rank it eighth out of eight preferred methods, number eight of the eight methods they looked at?

Dr. KLEIN. In terms of the neutralization or compared to incineration?

Mr. ANDREWS. In terms of efficacy, did not they rank it number eight out of eight?

Mr. PARKER. Not as the primary treatment method, which is what we are talking about.

Dr. KLEIN. I am not familiar with that ranking. It is my understanding that the neutralization technique is well understood and recommended as safe and well understood. So I am not sure what the ranking that you might be referring to.

Let me just say that, again, the Army has spent a lot of time looking at how to best dispose of the hydrolysate. And Mr. Parker can tell you some of the decisions along that.

I think we should keep in mind that the DuPont facility has a great track record. It has been operated safely, and it will continue to operate safely. And the amount of material, the hydrolysate, that goes in there is a very small part of their typical operation.

However, we do want to make sure that the questions that individuals have, and certainly the regulatory bodies, that these questions are answered so that it is safely.

I think Mr. Parker can go through and talk about some of the reasons we went with the eight percent and what the measurement will be to ensure that there is no live VX agent in that hydrolysate.

Mr. ANDREWS. Well, with all respect, I have read some of the things that I think he is going to say.

The question I would ask is: What does that do to the cost? If you have to go to the 8 percent instead of the 32, what does this do to the cost of this neutralization, then?

Mr. PARKER. Let me address that by answering your question first on the effect of the stabilizer.

Since the point where CDC had to cut off data submission for the purposes of analyzing and producing the report, we had continued work with both stabilizers and a mixture of the two and have been able to confirm that the reaction at both 8-weight percent and 16-weight percent is effective in neutralizing the VX, and the analytical procedures that are necessary to confirm that meet the EPA criteria.

The 16-weight percent is what we look at as an optimal level to run the plant and also address some of the issues with shipping.

As both efficiency and the flammability of the product, if it is more concentrated, then about 20 percent shifts to a different circumstance.

The chronic effect that you cite that was noted by EPA, DuPont has been in contact with EPA to identify the additional aquatic species that EPA believes need to be looked at from a chronic standpoint. DuPont's estimate is something on the order of a month. They have identified those species and they think EPA is in agreement. They are going to proceed with those studies and then would provide the information through CDC to EPA.

The last factor, on cost, the original concept was for on-site treatment by supercritical water oxidation (SCWO). To revert back to that, a government-built and-operated supercritical water oxidation facility would add something in excess of $300 million and a couple more years to the operating cost.

So it is a very expensive alternative to one that I think once we fully address all of the concerns in the report, which I believe we now have the data. The only outstanding element I believe at this point in time is the aquatic toxicity, which DuPont is in the process of addressing.

We have both a procedure and a process on both ends, at Newport and at DuPont, Deepwater, which meets the mandate of maximum protection of the public.

Mr. ANDREWS. The question that I asked you was: What difference in the cost of this neutralization procedure do we get by going from 32 percent down to 8? What difference does it make in your cost projections with respect to the neutralization process you have chosen?

Mr. PARKER. Sir, the 32 percent, which was the original concept, was based on an on-site treatment by supercritical water oxidation. The 32-weight percent product would have been diluted down to about somewhere between 5 and 10 percent before it was processed into SCWO.

So we have a real apples and oranges. This is comparing an on-site treatment approach to an off-site treatment approach with a much different standard of protecting the public.

Mr. ANDREWS. Which assumption were you making when you did your original cost projection? And has that changed as a result of this CDC report?

Mr. PARKER. The original cost projection, as I said, was based on a 32-weight percent neutralization and a significantly diluted product treated by supercritical water oxidation.

Once we made the decision to change the fundamental approach—after 9/11 and the considerable concern about the threat that this material presents to the neat VX, or the pure VX presents to that community—and moved to a much more accelerated program, we have been consistently looking at the same fundamental approach.

Mr. ANDREWS. I have more than exhausted my time, but I will just make this one point: Are you testifying that with the CDC saying that they doubt whether your process will deal with half the stockpile at all, that the cost is not going to go up above what you originally estimated?

Mr. PARKER. Sir, I do not believe that is what the CDC report said. The CDC report said——

Mr. ANDREWS. Would you like to read it?

Mr. PARKER [continuing]. Before we proceed we need to resolve those issues. We have done that and we provided the data, and the data is in line with what is necessary to protect the workforce and the public.

Mr. ANDREWS. The report says that CDC is concerned about the effectiveness of the current neutralization technology to destroy the other approximately half of the stockpile. That is what it says.

And if they are right and you have to do something else other than what you contemplated with half of what is there, is it not going to make the cost go up?

Mr. PARKER. Sir, we provided——

Secretary BOLTON. Well, the cost would go up——

Mr. ANDREWS. How much?

Secretary BOLTON. I do not know, because I do not believe the report and we do not——

Mr. ANDREWS. You do not believe the report.

Secretary BOLTON. We do not believe the report because, as Mike pointed out, CDC only had a certain amount of data. They do not have the rest of the data that addressed the entire stockpile there. I think once they have the data, that statement will go away.

Mr. ANDREWS. Well, Mr. Chairman, I am sure we would like to see the CDC continue to do its independent, professional work on this.

I would simply say from my perspective, the first time I heard about this proposal, which is to discharge something into the drinking water of the people I represent, was in the newspaper, in a legal notice. Not from you, not from the other people involved.

Now, I must say, with all due respect, that the credibility of those of you involved in managing this program took a bit of a hit in our area as a result of that, which is why we asked the CDC to become involved.

Now, if you think that their work product is deficient in some way, I think you should put your points on the record. But we have a great deal of confidence in their work product.

Mr. PARKER. I do not believe he said——

Secretary BOLTON. As do I. And that is why we work very closely with the CDC——

Mr. ANDREWS. But you just said you thought the report was wrong.

Secretary BOLTON. No, that is what you said, Congressman; that is not what I said.

Mr. ANDREWS. What did you say?

Secretary BOLTON. I said——

Mr. ANDREWS. You said you do not believe their report?

Secretary BOLTON. I said that they had incomplete data——

Mr. ANDREWS. You said you do not believe their report.

Secretary BOLTON [continuing]. Which is what Mr. Parker said, that they cut-off date——

Mr. ANDREWS. You said you do not believe their report. Is that not what we you said?

Secretary BOLTON. I do not believe I said that.

Mr. ANDREWS. Well, I think the transcript will reflect that is what you said.

Secretary BOLTON. If that is what I said, then I apologize. However, the truth of the matter is, the CDC, like any organization, had a cut-off date. We continued doing our analysis, which I think when they see this data, these data, which say that this is a safe process for the entire stockpile, we are going to provide that data.

And to get back to your point: None of us were here 50 years ago when this country decided to build these munitions. Most of us were not here when this country decided to sign a piece of paper to the rest of the world saying we will get rid of this.

It is true that we are talking about the state of Indiana and the people there. It is true I am trying to go ahead and make sure we reduce the immediate threat to them.

But this nation has an obligation to get rid of this stuff. If it costs more money, it will cost more money and everybody in this country will have to pay for it. My job is to do it safely and to try to do that within the constraints that you give me. That is all I am trying to do.

Mr. ANDREWS. One of your other obligations is to advise representatives of the people when you are going to make a decision that would affect those representatives, and you did not do that in this case. We were notified about this through the public media at the last minute. And it has created a serious credibility problem.

Mr. SAXTON. Is the gentleman finished?

Mr. ANDREWS. Yes.

Mr. SAXTON. Thank you.

We are going to go to Mr. Davis next, but before we do, just let me ask a couple of questions.

Can you describe the nature of the substance that will be transferred to the DuPont site on the Delaware River for disposal, Dr. Klein—or one of you?

Secretary BOLTON. A hydrolysate is a caustic water substance, not unlike leach, and it has a 4 percent concentration caustic material. On our highways today we have similar materials that have a concentration up to 50 percent. We have been transporting to

Deepwater similar materials from Aberdeen very safely—not one accident, no incident.

Given the amount that is processed at DuPont, we represent something like a percent or two of their daily intake.

Mr. PARKER. As Secretary Bolton indicated, the predominant safety risk associated with the hydrolysate is the sorting hydroxide, the caustic content, which is around 4-weight percent. There is another small fraction of organic materials, which in addition which are present, those breakdown products which were noted by CDC and EPA as items that need to be addressed in the DuPont procedure before the material can be discharged into the river.

Mr. SAXTON. Dr. Sinks, can you add anything that would be enlightening for those of us who are not scientists?

Dr. SINKS. Thank you.

Let me just say, and to be perfectly clear, that our report was based on information provided to us by the Department of Defense and DuPont. We do not run our own scientific experiments on this material, nor could we. And we based our conclusions on the information that was provided to us.

We have not excluded the possibility or the feasibility that the Department of Defense can treat I believe it is the dicychlohexylcarbodiimide (DCC)-stabilized VX. We just have not seen the data to demonstrate that they can.

We have not excluded the possibility that they can treat at higher loads than eight percent, but we felt that the information provided to us was insufficient for us to draw the conclusion that they could.

Mr. SAXTON. Mr. Secretary, do you have that information? And are you going to provide it to CDC?

Secretary BOLTON. We will be providing that information.

Mr. SAXTON. Thank you.

Mr. Secretary, either you or Mr. Parker mentioned that this is a relatively small percentage of the work—or would be a relatively small percentage of the work that goes on at DuPont.

Can this material in any way be considered more harmful, less harmful, than other materials that are treated at DuPont?

Mr. PARKER. Sir, it is comparable to many materials that DuPont treats in the family of caustic-type waste products. DuPont treats materials which are substantially more toxic than inherent in this product and more difficult in the sense of their chemical processes and the controls that they have to mandate in order to meet their discharge permit and to have a product that is safe to discharge to the river.

So this is well within DuPont's demonstrated capability of over 35 years of operating this facility.

Mr. SAXTON. Where does the material that DuPont treats originate, other than the proposed VX derivative?

Mr. PARKER. I believe in a broad sense, DuPont established the facility, as I understand it, initially to treat products from their own manufacturing operation. And given the capacity of the facility, they accept waste from New Jersey, Pennsylvania, New York, Delaware and other places across the United States that they have the capability of treating—12 million to 15 million gallons a day of material that is treated in the facility.

We would be asking DuPont to treat 5,000 to 10,000 gallons a day through the facility.

They have, as I mentioned, a 35-year history of compliance, and I think being an excellent neighbor and a steward of the river.

They do treat beyond the industrial waste, which is their profit center. They also treat for adjoining municipalities, their municipal waste, to take that capital burden off those communities.

And they treat a large volume of storm water through the facility that would go into the river untreated if it was not for the availability of the facility.

So they clean up that water that is contaminated from surface contamination and clean it up and actually improve significantly the discharge into the river.

Mr. SAXTON. You mentioned New Jersey, Pennsylvania, Delaware——

Mr. PARKER. New York.

Mr. SAXTON [continuing]. New York. Is there any way to describe the nature of the material that comes from those locations, that is treated at the DuPont plant?

Mr. PARKER. I think that is best answered by DuPont. They are permitted, under the Delaware River Basin Commission, to treat waste of a specific nature of which our hydrolysate falls well within the capabilities. But they are treating significantly more hazardous materials through the facility safely and have a long demonstrated capability.

Mr. SAXTON. You mentioned a minute ago that this is a permitted process. By whom is it permitted?

Mr. PARKER. There are two direct regulatory elements, as I understand, the state of New Jersey's Department of Natural Resources and Environmental——

Mr. SAXTON. Department of Environmental——

Mr. PARKER [continuing]. Commission oversees the operation of the facility and permits it.

The discharge product into the river is regulated by the Delaware River Basin Commission, which is a consortium of state oversight elements from New York, Pennsylvania, Delaware, New Jersey and the Corps of Engineers who regulate not only DuPont but other facilities that discharge into the Delaware River.

Mr. SAXTON. Mr. LoBiondo has indicated he has a question.

Mr. LOBIONDO. Thank you, Mr. Chairman.

Just along these lines that the Chairman is pursuing, am I to understand, then, that the state of New Jersey, through the Department of Environmental Protection, licensed this, and if they feel, for whatever reason, they are not satisfied, that the state of New Jersey has a major say in this?

Mr. PARKER. Yes, sir. DuPont's facility is currently going under a renewal, and that pre-draft is in its final stage of comments and will return, as I understand, to the two regulatory bodies—the state and the river commission.

Until that is fully resolved and the permit is updated, DuPont will continue to operate under their existing permit. I believe the existing permit has a provision in it which would preclude the ability to treat and discharge this material in the river subject to full

resolution of all of the concerns by the state regulatory body in New Jersey.

Mr. LOBIONDO. So the state of New Jersey, through the commission of DuPont (DP), really has to be satisfied before this can ultimately moved totally forward.

Mr. PARKER. Yes, sir.

Mr. LOBIONDO. And do you have any time line on their review process?

Mr. PARKER. It is basically tied to resolving the CDC comments and——

Mr. LOBIONDO. Okay.

Thank you, Mr. Chairman.

Mr. SAXTON. We from New Jersey are particularly sensitive to these kinds of issues. As you know, we have a number of hazardous waste facilities, hazard waste dumps that are in the process of being cleaned up.

And we have had, particularly in my district, in Toms River, we have had a high rate of childhood brain cancer, brain stem cancer, and it is suspected that there may be some chemical causes for that.

So we thank you for bearing with us. We understand that you have a job to do, and we understand that it is a tough one. But at the same time, we represent a couple of million people among us, so we are going to continue to have these concerns until we resolve this issue.

So thank you.

Mr. Davis.

Mr. DAVIS. Thank you, Mr. Chairman.

I would like to shift the discussion, if we could, from the Ohio Valley into the Bluegrass for a moment where Congressman Chandler and I are from, sharing the Bluegrass depot.

As Congressman Andrews and Congressman Hefley I think very aptly pointed out—I could speak as a former project manager myself—we have the practicalities of executing the project, accomplishing management objectives, but at the same time is the perception of your customer, the public in this case.

I am really concerned that, you know, we set expectations for our communities. All of us in here who have facilities in our areas get questions about this all the time. And certainly the credibility of not only of your agencies but also the perception of the government's reliability in general is the ability to meet these.

And I feel like in some ways we have had some shifting plans and priorities—the direction where my questions are going to be going—in the fiscal year 2005 military construction budget. I think, for example, in the case of Bluegrass we had about $30 million that were released for neutral site improvements. In the 2006 fiscal year budget, we did not have any funds for construction at Bluegrass, or Pueblo for that matter, in the request.

My first question is: What is the basis for that reduction in construction funding for the Assembled Chemical Weapons Alternatives program, dealing with, you know, what is a very serious issue in our area. It kind of came out as the red-headed children, if you will, of eight facilities that were going to be addressed.

Dr. KLEIN. What we are doing on the ACWA program is—unfortunately, as new information comes, we have to evaluate that and make decisions the best that we can.

The Under Secretary of Defense looked at some of the cost projections and schedules in December of 2004, and we believe that we can do better on schedule and on cost by looking at some alternatives.

As you probably know, Mike Parker is dual-headed. He has the responsibility both for the CMA program and the ACWA program. So a lot of this work is done by some of the same Army individuals within Mr. Bolton's purview, the same professional staff.

What we looked at in 2004 when we started seeing both schedule slippages and cost increases and we wanted to look at some alternatives to make sure that we are doing it not only safely but for a cost, schedule and performance balance, and that is what we are looking at right now.

The unfortunate thing is I know what you would like to know, and I am sure that Representative Chandler and Representative Salazar both would like to have an answer right now on what we are going to do. And unfortunately, we just do not have that.

We are getting information in, we will have the end of this month, we will evaluate that information and we will be making decisions. And as soon as we do, you will not read about it in the press; we will let you know personally.

But right now we do not have information to really tell you exactly how we going to proceeding with those.

Under Secretary Mike Wynne wanted to lay all of the options on the table. We want to look at all of those options. We want to provide that information to the Congress and certainly to the—that you have an interest in your communities—to make the best decision we can, to do this safely and balance cost, schedule and performance, but safety number one.

Mr. DAVIS. Would all that distill down to you did not have enough money to execute it? Or was it a question over the technical means by which you were going to gain treaty compliance?

Dr. KLEIN. There is 2004 and 2005 money that it is still held both for Pueblo and for Bluegrass. And so there are funds that are still available once we make the decision.

We believe that for 2005 and 2006, once we make the decision, there are funds available to implement those decisions.

Mr. DAVIS. One question on the delay, particularly for two facilities that have not had a lot of attention paid to them yet: What is an alternative? Is it reasonable to simply move from a—if it is a capital investment or infrastructure issue at Bluegrass, is it oversimplifying matters to say that these chemicals could be moved to a like facility with a similar destruction capability and have them neutralized there?

Dr. KLEIN. We are certainly aware of a law that says we cannot move them. So if we do move materials, then we certainly will need to come back to Congress to make some modifications.

In the case of Bluegrass, Bluegrass is a challenge because it has about 1.7 percent of the stockpile, but it has a lot of variety. And so what we want to look at is how can we best get rid of that small but complicated mixture in the best way.

We do want to look at the cost of moving them to another facility as one of our decision-choices.

So we wanted to look at all options.

Mr. DAVIS. Well, I think if it is going to save the taxpayers a lot of money and it gets that stuff out of our region, that would be acceptable, based on the safety and security that could be provided.

And if it is a matter of—without an infrastructure, I would encourage you to look at alternatives that could take an advantage of an economy of scale, and if it requires a regulatory or a legal amendment, then I am sure we would be glad to discuss that.

But back to the original point: Not only is this a practical matter from a standpoint of science and engineering and effective budgeting, but I am very concerned about being able to clearly and consistently communicate one message from the Congress and from your agencies to our people who have a wide variety of perceptions about this.

I do not want fear to reign. I would like it to be a true bipartisan win for your agencies, for the government, where we could set an expectation, clearly have it met on time, on budget and move from there.

I yield back.

Dr. KLEIN. One of the challenges that we have, if you look at just the cost alone and you look at the cost at the last two sites, Pueblo and Bluegrass, and you look at the cost that it takes per ton of that material, it is high, because you have a smaller volume of material, but in the case of Bluegrass, a lot of complicated devices.

Mr. DAVIS. Thank you.

Mr. SAXTON. Mr. Langevin.

Mr. LANGEVIN. Thank you, Mr. Chairman.

And, gentlemen, thank you for your testimony today.

If I could, I would like to just follow up on the line of questioning that Mr. Andrews had raised with respect to the National Academy of Sciences report, which cited that your destruction technique that you have chosen ranks eighth out of eight. You said that you are not familiar with that ranking or that report, if I am understanding that correctly.

So my question is: If that is true, then why are not you familiar with that report and that ranking?

Second, then what criteria and techniques did you compare—the kind of technique that you chose, what did you compare that against? And where does the technique that you have chosen, where does your technique fall in that ranking?

Dr. KLEIN. I think Mr. Parker can probably answer the technical decisions.

But in terms of the technique that was selected, we essentially have two fundamental choices: incineration or we can have a neutralization technique. I believe that both are safe, both have proven technologies.

We do have more experience on the incineration plants in terms of their operational characteristics.

The National Academy of Sciences has basically responded that both techniques are appropriate.

And I am just not familiar with this particular ranking that you are referring to. Mike might have some information.

Mr. PARKER. I believe the report that was referenced addressed treating what we call secondary waste, and that is the hydrolysis product, versus the primary agent. The National Research Council (NRC) found the, as Dr. Klein summarized, the treatment either by incineration or neutralization to be equally effective for the purposes of destroying the primary agent.

There are a variety of techniques available to treat the secondary waste. They were ranked—the bio treatment of the VX product is more difficult because the phosphonate does not bio-treat as well. Therefore that is why DuPont chose to supplement their bio treatment with a chemical pre-treatment—actually two chemical pre-treatments—before doing the bio treatment.

The end point effectiveness is still attained. It is met——

Mr. LANGEVIN. So where does that rank in terms of its effectiveness?

Mr. PARKER. I think if the NRC——

Mr. LANGEVIN. It sounds like to me that you just chose a technique and you went ahead and picked it because it works, but it may not necessarily be the best. I am trying to get to where does it fall in the ranking in comparison to other techniques?

Mr. PARKER. Well, I think it is a mistake to take the final treatment out of context of the broader issues that were address at the point of 9/11, where we had to take a step back and look at what we could do to accelerate the disposal of chemical weapons to get that threat out of communities. And one of those techniques was on-site primary treatment of agent followed by fully permitted treatment facilities in the commercial sector. And that is a considerably faster way of doing business than building on-site 100 percent capabilities.

And in the context of "best," I believe to the American public, of removing the risk, that that is best.

Mr. LANGEVIN. Thank you for that, but could you answer my question: Where does it rank?

Mr. PARKER. I do not think we compared it in that manner. And the NRC comparison——

Mr. LANGEVIN. So you looked at nothing else. You chose that technique, for whatever reason, and you compared it to nothing.

Mr. PARKER. I did not say that.

We looked at, through our prime contractor, the Parsons company, a number of commercial-permitted facilities: incinerators, deep-well injection, bio treatment and additional chemical treatment. Those were looked at, and proposals were solicited from those industries, and we made a judgment that bio treatment was a viable technique—chemical plus bio treatment was a viable technique, it was cost effective, and it met the time lines we were looking for.

Mr. LANGEVIN. What I am hearing, then, is that you have no idea where this ranks. It is a technique that works, but it could the best or it could be the worst, you have no idea.

Mr. PARKER. I believe I said within what the commercial industry proposed in permitted facilities, this was, we found, to be the best-value technique.

Mr. LANGEVIN. Where does it rank in the National Academy of Sciences list, then?

Mr. PARKER. The particular procedure that is being applied at DuPont, the heavy chemical treatment followed by bio treatment, is something that evolved after the National Academy did their preliminary work. So I believe it would be a very poor fit for me to have to jam in to what the NRC did what the current state of DuPont's technology is.

Mr. LANGEVIN. Mr. Parker, your answer disturbs me. And I would ask that you respond to the committee, respond to my question in writing a more detailed answer as to where this falls in the ranking in comparison to techniques that you have looked at.

And I encourage you also to review the National Academy of Sciences report so that you are more informed. Because that answer you gave me is unacceptable.

Thank you, Mr. Chairman.

Mr. SAXTON. Thank you.

Mr. Chandler.

Mr. CHANDLER. Mr. Chairman, thank you very much for the invitation today. I appreciate that. I appreciate the opportunity to discuss this issue.

Gentlemen, thank you for being here today.

I must tell you, though, that I come here with some frustration. I know that many of you are frustrated as well. But I can assure you that the people that I represent in Central Kentucky are extremely frustrated.

As you may know—well, I am sure you know, we have been wrangling over this issue at the Bluegrass Army Depot for in excess of 20 years. I suspect that no one on this panel has been dealing with this issue for all 20-plus years. And I have only been in Congress for one year, but I have been dealing with this issue off and on, or been familiar with it, as a citizen of Central Kentucky for all of that time.

It is a very, very critical issue in our area.

During those years, those 20-plus years, we have seen analysis after analysis done by the Department of the Army, often reviewed and concurred with by the National Research Council. These analyses have unequivocally determined that to continue to store chemical weapons in communities is indeed the highest-risk option. We know that.

Now, specifically, Bluegrass in Kentucky has the most dangerous weapons and agents in the entire U.S. arsenal. That is my understanding.

For example, the M55 GB rockets that are stored there have been identified as having the highest risk of any in the entire stockpile. Yet in the latest schedule provided to members on January 18, 2005, the two storage sites of Pueblo, Colorado, and Bluegrass in Kentucky are designed "caretaker status" between the years of 2005 and 2010, with no significant action in those years taken toward disposal.

Additionally, according to an April 2002 Army study, the Bluegrass storage site will have the highest terrorism risk of all of the stockpiles beginning in 2007. Yet according to the most recent schedule, Bluegrass does not even begin the destruction of these weapons until 2017 or 2018.

Now, Dr. Klein or Mr. Wakefield or whoever would like to tackle this question, how do I—or better yet, how do you all explain to my constituents that such established risks that exist, both of storage and potentially of terrorism, why those risks should take a backseat to other department funding priorities?

Dr. KLEIN. Well, I think when we go through and do funding priorities, getting rid of our chemical weapons is very high on the list. I can tell you that Mr. Bolton and I spent a lot of time dealing with the safe destruction of the chemical weapons.

What we will do in April of 2005, when we have alternatives before us, we hope to make some decisions on the path forward, and we would like to do that as expeditiously as we can. So we will not be waiting until the 2017 to make a decision. We will be working with our budget officials to put the proper funds to those, both Pueblo and Bluegrass plants, once we evaluate some alternatives later this month.

You know, during 2005 we will be making some decisions to move both these facilities forward. So these are not sites that we are just going to sit on.

I think some of the data you may be referring to is the artificial result of the way that DOD does their five-year budgeting——

Mr. CHANDLER. So that is inaccurate? The time line that I have been given is inaccurate and you intend to actually bring it forward from that time line?

Dr. KLEIN. My goal is to bring it forward from that time line.

As I often tell people, some of our budgeting processes are accurate but incorrect.

Mr. CHANDLER. Okay, I will think about that.

Dr. KLEIN. It is part of the way we have to do our budgets within the fiscal constraints that we do.

But I can assure that no one in the department, no one in the Army wants to sit on these weapons any longer than we have to.

Mr. CHANDLER. Well, the Department of Defense, as you well know, has frozen several hundred million dollars, I think about $300 million, give or take, for these two projects: Pueblo and Bluegrass. I assume you are waiting to make a decision to utilize that money. I hope that is the case. There is no plan to divert that money to another project, is there?

Dr. KLEIN. We will be making those plans—hopefully we will get those alternatives at the end of this month, and then we will be making plans and moving forward.

Mr. CHANDLER. Will that money be diverted to other projects?

Dr. KLEIN. The short answer is in the——

Mr. CHANDLER. "No" I hope is the short answer. [Laughter.]

Dr. KLEIN. The short answer is, I hope not.

Mike Wynne made the decision, within the fiscal constraints, that we will concentrate on the operating plants, but that does mean that we are going to sit on these plants and not take action until 2017.

Mr. WAKEFIELD. Mr. Chandler, it is necessary when we develop the budget, as Dr. Klein points out, where we have to put the cost and a schedule together, this schedule represents what the current budget was. But as Dr. Klein points out, we bring these analyses forward, we seek the approval of leadership of the department,

these schedules will change commensurate with budgets in their future.

Mr. CHANDLER. Change in a favorable manner toward getting this done more quickly, you believe?

Mr. WAKEFIELD. Indeed, as Dr. Klein had indicated, yes.

Mr. CHANDLER. I would like to just for a second pursue this issue of transportation.

I think I understood, in response to Congressman Davis's questions, that transportation is an option that you are in fact considering? Is that true?

Dr. KLEIN. We want to look at what the cost and schedule would be for transportation. Whether we implement——

Mr. CHANDLER. So the answer is yes, you are considering that or you would not look at it, I would assume.

Dr. KLEIN. We are looking at all options, and then once we get the information, we will evaluate that and make a recommendation.

Mr. CHANDLER. You would not be looking at an option that you are not considering, though, I would assume.

Dr. KLEIN. That is correct.

Mr. CHANDLER. So the answer is yes, you are considering transporting these materials if your study determines that that is the preferable option?

Dr. KLEIN. If the results indicate that that is preferable—and preferable would mean cost, schedule, safety and all of those activities—we will obviously be involved in a lot of discussions, and hopefully that would be implemented.

Mr. CHANDLER. Well, I can assure you—that is a very mild way of putting it, "a lot of discussions"—the agitation will be something that—well, you will be surprised I think at the amount of agitation that you will see.

Dr. KLEIN. My background is in the nuclear field and the transportation of spent nuclear fuel——

Mr. CHANDLER. Well, you will probably see a nuclear response from the citizens of our district if that effort is attempted. [Laughter.]

I just want you to understand that we believe—myself, as the representative of the people of Central Kentucky, and contrary I think actually to what Mr. Davis said, if I understood him correctly—transportation is not an option to us, just very simply.

Dr. KLEIN. Got it.

Mr. CHANDLER. Thank you, sir.

Mr. SAXTON. Mr. Salazar, please.

Mr. SALAZAR. Thank you, Mr. Chairman. I appreciate you inviting us to your committee today.

I really appreciate Dr. Klein and Mr. Wakefield being out in Pueblo to visit with the folks at Pueblo.

I think our Congressman Hefley put it quite clearly, that it is important for us that represent the public to be able know what is coming down the pike before things are made public.

And I reiterate what Congressman Chandler stated about the possibility of moving these weapons across state lines. I think in Colorado, as you know, it is very difficult to get the environmental

community and local communities involved to be able to come together and agree on a process.

I am hearing you say that now other alternatives, such as incineration, might even be considered in Pueblo. Is that correct?

Dr. KLEIN. No. I do not believe of the options that we are looking at includes incineration in Pueblo.

Mr. SALAZAR. But the possibility of transporting these weapons across state lines to another facility. Correct?

Dr. KLEIN. We will look at the cost to do that, yes.

Mr. SALAZAR. Just for the record I would like to clarify: I believe that what you stated was that the cost is now being projected at $2.6 billion for the facility in Pueblo. This was based on a project that was actually supposed to be an accelerated type of project which had three line facilities, I believe.

Would you be willing to say right now that if the cost would come down to $1.6 billion for a down-scaled project that you would okay that?

Dr. KLEIN. The probability that if—and in fact we have talked to some of the contractors—that if the cost comes down to $1.6 billion, which was the cost we certified to Congress, I believe that that would be the favored alternative.

Mr. SALAZAR. Okay.

Mr. Klein, also I think I hear what everyone here is saying is that it is important for all of us Congressmen to know ahead of time what is coming down the pike. You are telling us that you will be making a decision basically in April, the latter part of April, I believe?

Dr. KLEIN. We should be getting the information the end of April and make the decision as soon as we can. And we will make sure we notify you so you do not read it in the paper.

Mr. SALAZAR. Thank you.

Mr. WAKEFIELD. Mr. Salazar, if I may interject here, one of the things that we have instituted with your staff and others is, we do indeed have monthly meetings with all of your staff to keep them informed. We bring to them the information that is forthcoming out of the department early on. We do this each and every month. We package that, provide them a briefing.

I would tell you the recent decision of Mr. Wynne was briefed to them just the other day, prior to its even release in a public manner, so that they had a heads-up information on this.

So we are making every effort to try to keep you as well informed as we possibly can.

Mr. SALAZAR. Well, I do appreciate that.

And I just have one final comment.

I think that what I am hearing from most of you is that once you initiate a project, like the project that you did in Aberdeen, you found out that you were actually more efficient than what you thought, and you were able to reach the time lines ahead of schedule, or actually destructed the weapons ahead of schedule. Correct?

Dr. KLEIN. No, it was a year later than we expected.

Mr. SALAZAR. Oh, it was a year later?

Dr. KLEIN. Yes.

Mr. SALAZAR. Okay, thank you very much.

Mr. SAXTON. Well, I am sure you will be happy to know, or unhappy—you will be disappointed that we do not have more members here. [Laughter.]

Thank you for being here. We appreciate it very much.

We have identified a number of unanswered questions, in particular regarding Newport, Pueblo and Bluegrass, issues that have to do with processes, time, costs, et cetera. So we will be sending you some additional questions, if that is permissible, for the record.

And we look forward to answers to those questions, as this is an important process from many perspectives. It is important to the country, it is important to the communities in which your facilities are located or where your activities take place, and of course it is important from a budgetary point of view.

So we thank you for your cooperation and for being here today. And we look forward to working with you as we move forward together.

Thank you.

[Whereupon, at 3:06 p.m., the subcommittee was adjourned.]

A P P E N D I X

April 6, 2005

PREPARED STATEMENTS SUBMITTED FOR THE RECORD

APRIL 6, 2005

FOR OFFICIAL USE ONLY
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HOUSE ARMED SERVICES COMMITTEE

STATEMENT OF THE HONORABLE DALE KLEIN
ASSISTANT TO THE SECRETARY OF DEFENSE FOR
NUCLEAR AND CHEMICAL AND BIOLOGICAL DEFENSE PROGRAMS

BEFORE THE
COMMITTEE ON ARMED SERVICES

SUBCOMMITTEE ON TERRORISM, UNCONVENTIONAL THREATS
AND CAPABILITIES

UNITED STATES HOUSE OF REPRESENTATIVES
FIRST SESSION 109TH CONGRESS

THE U.S. CHEMICAL DEMILITARIZATION PROGRAM

APRIL 6, 2005

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HOUSE ARMED SERVICES COMMITTEE

I am Dr. Dale Klein, the Assistant to the Secretary of Defense for Nuclear and Chemical and Biological Defense Programs. As I previously testified, in my current capacity, I am the principal advisor to the Secretary and Deputy Secretary of Defense and the Under Secretary of Defense for Acquisition, Technology and Logistics, for all matters concerning the formulation of policy and plans for nuclear, chemical, and biological programs, and, most important to our topic of discussion today, chemical weapons demilitarization.

Today, I will discuss three major points: 1) the current status of the DoD Chemical Demilitarization Program and its positive safety record; 2) the importance of fully funding the Fiscal Year 2006 President's Budget request, which has been submitted in compliance with Public Law 107-314, Section 141a; and 3) the directives of the recent Acquisition Decision Memorandum (ADM).

First, I want to emphasize my commitment to safety as the paramount consideration in the Chemical Demilitarization Program. I have championed this cause vigorously during the past four years while focusing on destroying our aging stocks of chemical weapons. As the Chemical Demilitarization Program moves forward, the Department will balance resources to maximize the amount of chemical weapons destroyed while protecting our workers, the surrounding public, and the environment.

Second, I want to emphasize and respectfully request that you fully fund the Fiscal Year 2006 President's Budget. This budget request funds existing and future chemical weapons destruction efforts. As of December 31, 2004, the U.S. destroyed more chemical agent in accordance with the Chemical Weapons Convention than all other state parties combined. By May 2005, the Department expects to be operating six chemical weapons destruction sites, and the U.S. remains on track to meet the Chemical Weapons Convention extended 45% destruction deadline of December 31, 2007. The U.S. continues to be a leader in the international community regarding the destruction of chemical weapons, and now, more than ever, each and every dollar requested directly supports destroying our aging chemical weapons stockpile and maintaining our commitments as outlined by the Chemical Weapons Convention.

Third, I will discuss the Department's recent efforts to implement the ADM that was signed on December 21, 2004. We have learned since 1986, when Congress mandated the destruction of our chemical weapons stockpile, that there are many unanticipated challenges associated with a national program of this magnitude. By May 2005, the Chemical

Demilitarization Program expects to be simultaneously destroying different chemical agents in various configurations at six separate sites, 24 hours a day, seven days a week, and in four time zones, using different technologies and employing different contractors. The ADM provides guidance for meeting these continuing challenges while destroying our chemical weapons stockpile in a safe, cost effective, and timely manner.

Program Status and Safety Record

The Chemical Demilitarization Program is composed of two primary programs, the Chemical Materials Agency (CMA) under the Secretary of the Army; and Assembled Chemical Weapons Alternatives Program (ACWA) under the Secretary of Defense. Currently, four of the CMA chemical weapons destruction sites are operational, the incinerators at Anniston, Alabama, Tooele, Utah and Umatilla, Oregon, and neutralization facility at Aberdeen, Maryland. The Department expects to begin operations by May 2005 at the other two CMA sites, the incinerator at Pine Bluff, Arkansas, and the neutralization facility at Newport, Indiana. The Pine Bluff, Arkansas facility is completing the State permitting process, and the Newport, Indiana facility is determining a method for treating hydrolysate, which is a product of operations. To that end, the Newport, Indiana facility is completing National Environmental Policy Act requirements and will provide Congressional notification prior to the start of destruction operations as mandated by 50 U.S.C. Section 1512. The ACWA Program sites at Blue Grass, Kentucky and Pueblo, Colorado are in the design stages of development. While this is a summary of the overall status of the facilities, the Department can provide you a more detailed account on a site-by-site basis if desired.

While engaged in the important and challenging task of destroying these chemical weapons, the Chemical Demilitarization Program fully succeeded in protecting the surrounding public and the environment during the past year. For example, in February 2005, the Governor of Alabama presented the Anniston Chemical Demilitarization Facility's operating contractor with an Award of Superior Achievement for two years of safe, continuous operation. Similarly, in January 2005, the Umatilla Chemical Demilitarization Facility's contractor received a 2005 Oregon Governor's Occupational Safety and Health Award. The program will continue to build on this success and maintain safety as the top priority.

FY 2006 Budget Summary

The funds requested for the Chemical Demilitarization Program in the Fiscal Year 2006 President's Budget are necessary for destroying the U.S. chemical weapons stockpile as mandated by Public Law 99-145 and the Chemical Weapons Convention. These funds will allow the Department to continue chemical weapons destruction operations at Anniston, Alabama, Tooele, Utah, and Umatilla, Oregon, continue ton container cleanout operations at Aberdeen, Maryland, and begin operations at Newport, Indiana and Pine Bluff, Arkansas during 2005. The Department plans for all of these sites to be operational during 2005. The Department is also in the process of evaluating alternatives that will allow the ACWA Program sites at Blue Grass, Kentucky and Pueblo, Colorado to remain within their budgets, balance cost, schedule, and performance, and meet program objectives. The budget request also maintains Chemical Stockpile Emergency Preparedness Program activities at all the chemical weapons stockpile sites. The Fiscal Year 2006 President's Budget reflects these funding priorities.

Acquisition Decision Memorandum (ADM)

Since I testified before this committee last year, the Chemical Demilitarization Program has experienced unanticipated technical challenges resulting in increased funding requirements. In November 2004, the Acting Under Secretary of Defense for Acquisition, Technology, and Logistics (Acting USD(AT&L)) convened a meeting of the Defense Acquisition Board (DAB) to review the entire Chemical Demilitarization Program. Based on the advice and counsel of the DAB, the Acting USD(AT&L) signed an Acquisition Decision Memorandum (ADM) on December 21, 2004 that included three major directives.

First, the Acting USD(AT&L) divided the Chemical Demilitarization Program into three Major Defense Acquisition Programs (MDAPs) as follows: 1) the ACWA, which includes the Blue Grass, Kentucky and Pueblo, Colorado sites; 2) the Newport, Indiana neutralization facility; and 3) the CMA, which includes the remaining five destruction facilities, non-stockpile chemical materiel product, and Chemical Stockpile Emergency Preparedness Program. The Program Manager ACWA (PM ACWA) is responsible for the ACWA MDAP, and the Director of CMA is responsible for both the Newport and CMA MDAPs.

Second, the Acting USD(AT&L) directed that funding be prioritized to maximize the destruction of chemical weapons and meet our intermediate Chemical Weapons Convention

obligation of destroying 45% of our stockpile by December 2007. As noted above, the CMA includes the six sites that are operating or will begin operating during 2005. Maintaining operations at all existing destruction sites will allow the U.S. to comply with the Chemical Weapons Convention extended 45% deadline of December 31, 2007. The ACWA Program funding will be used to incorporate lessons learned from the Aberdeen and Newport sites into the emerging designs for the Blue Grass, Kentucky and Pueblo, Colorado sites.

Third, the Acting USD(AT&L) directed the PM ACWA and CMA to develop alternatives that are safe, cost effective, and achieve the Chemical Weapons Convention extended 100% destruction deadline of April 2012 within existing resources. The potential alternatives may include the following: consolidating the stockpile by transportation; redefining requirements in terms of cost, schedule, and performance; seeking competition for future work; and modifying contracts and contract incentives. The Department understands that any alternative must comply with statutory authority, but all alternatives are being considered at this point. Further, evaluation of potential alternatives may well result in the continuation of our current efforts, but, at a minimum, it gives us the opportunity to ascertain the costs and benefits. Therefore, these analyses help manage and fulfill the Department's obligation of responsible resource management to the U.S. taxpayer. The Department expects to complete this evaluation by April 2005, and I ask for your support as we evaluate all alternatives that enable the continued safe, cost effective, and timely destruction of our chemical weapons.

As a first step to improve cost management, the Acting USD(AT&L) has directed the PM ACWA to modify existing contracts to better balance cost, schedule, and performance, and to redesign the facilities to stay within budgets. The complete evaluation of design alternatives for the destruction of the chemical weapons stockpiles at the Blue Grass, Kentucky and Pueblo, Colorado sites is expected to be complete by the end of Fiscal Year 2005. A plan for implementation of the selected alternative will be developed at that time.

Our efforts to exercise fiscal responsibility within the Chemical Demilitarization Program have never been intended to delay the destruction of chemical agents at Blue Grass or Pueblo. While we agree with citizens and elected officials alike that it is important to begin destruction efforts at Blue Grass and Pueblo, we also agree that any facility we design, construct, and operate must be safe, environmentally protective, timely, and cost effective, as required by the Congressional mandate that created the ACWA Program. If we do not manage fiscal resources,

the projected life-cycle cost to destroy the U.S. chemical weapons stockpile could grow from $26.8 billion in 2004 to as much as $40.2 billion in 2012, based on historical data (see Attachment 1). The Cost Analysis Improvement Group (CAIG) also provided a similar estimate. Therefore, the Department is evaluating alternatives to ensure that the program conforms to reasonable cost and schedule guidelines as it moves forward. The directives contained in the ADM provide sound guidance for continuing the safe destruction of the chemical weapons stockpile and meeting our obligations under the Chemical Weapons Convention.

Final Remarks

In conclusion, I would like to reiterate three important points. First, safety is our top priority, and the Department will continue to protect its employees, the public, and the environment, while destroying our aging chemical weapons stockpile. Second, funding of the Fiscal Year 2006 President's Budget request is needed to maintain this important program. Third, the Department needs your support as we implement the Acquisition Decision Memorandum and provide the best value to the taxpayers.

Finally, I want to emphasize the Department's commitment to this prominent national security program of destroying our nation's chemical weapons safely and expeditiously. Eliminating targets of opportunity for terrorists such as these deadly chemical agents is essential. We face many unique challenges, but we are continuing our efforts to meet our statutory requirements and obligations under the Chemical Weapons Convention. I welcome your comments on our program's progress, and I look forward to working with you to advance our common goal of the safe and complete destruction of our national chemical weapons stockpile.

RECORD VERSION

STATEMENT BY THE UNITED STATES ARMY:

THE HONORABLE CLAUDE M. BOLTON, JR

ASSISTANT SECRETARY OF THE ARMY
ACQUISITION, LOGISTICS AND TECHNOLOGY

BEFORE THE

COMMITTEE ON ARMED SERVICES

SUBCOMMITTEE ON TERRORISM, UNCONVENTIONAL THREATS
AND CAPABILITIES

HOUSE OF REPRESENTATIVES
FIRST SESSION 109TH CONGRESS

CHEMICAL DEMILITARIZATION

06 APRIL 2005

NOT FOR PUBLICATION
UNTIL RELEASED BY THE
COMMITTEE ON ARMED SERVICES

STATEMENT BY
THE HONORABLE CLAUDE M. BOLTON, JR.
ASSISTANT SECRETARY OF THE ARMY
ACQUISITION, LOGISTICS AND TECHNOLOGY
ON THE UNITED STATES CHEMICAL DEMILITARIZATION PROGRAM

Chairman Saxton, Representative Meehan, distinguished Members of the Committee - -

It is my privilege to appear before you as the Assistant Secretary of the Army for Acquisition, Logistics and Technology and as the Army Acquisition Executive to discuss the status of the Chemical Demilitarization Program. On behalf of the men and women who perform the safe and expeditious destruction of aging chemical agents and munitions for the Army, I want to thank the committee Members and staff for your unwavering support of this important and difficult mission. Your candid appraisals of this important endeavor guide our path and help us to achieve the task you have charged us to perform. Your dedication to this mission is recognized and appreciated.

As the Army Acquisition Executive, I am responsible to the Secretary of the Army and to the Defense Acquisition Executive for all aspects of the Chemical Demilitarization Program, except for the demilitarization efforts at Pueblo, Colorado and Blue Grass, Kentucky. The Army's paramount objective is to destroy the stockpiles of chemical agent and munitions at the demilitarization sites in Alabama, Arkansas, Indiana, Maryland, Oregon, and Utah, as well as the Nation's non-stockpile chemical warfare materiel, while ensuring the safety and protection of the workforce, the general public, and the environment. The management attention that I personally give this program is commensurate with its tremendous importance to the American public, in terms of both ensuring safety and proceeding expeditiously with the destruction of these weapons in a cost effective manner.

This is a remarkable time for the Army's Chemical Demilitarization Program. We are achieving a great deal and are doing so safely. Executing the mission, however, is not without its challenges.

I am proud to report that over thirty-five percent (35%) of the total stockpile is destroyed, and the bulk of the agent at our neutralization facility in Aberdeen, Maryland has been destroyed. Aberdeen is the first facility within the continental United States to completely eliminate the risk of agent exposure to nearby communities. The bulk agent neutralization facility at Newport, Indiana is expected to begin agent destruction operations next month.

Our incineration facilities also are making tremendous progress. Our first incineration facility, on Johnston Atoll in the Pacific, safely completed destruction operations many years ago. We are in the process of closing out the Resource Conservation and Recovery Act permit for that site. We have destroyed more than half of the stockpile stored near Tooele, Utah. This site originally stored forty-four percent (44%) of the original U.S. stockpile of chemical agents and munitions. In essence, the Tooele facility, alone, has now destroyed nearly one quarter of the entire U.S. stockpile, and more than is stored at any other single location. Over one million munitions have been destroyed at Tooele, including all of the sarin-filled weapons, and nearly all configurations of the VX munitions, which together represent a ninety-nine percent (99%) reduction in risk to the surrounding communities. I am very proud of the Tooele workforce's accomplishments. The employees at our facility in Anniston, Alabama also have reason to be proud of their accomplishments. They have destroyed all of the sarin-filled rockets, which represents a thirty-three percent (33%) reduction in risk to their surrounding communities, and they continue to work safely and diligently to achieve their remaining schedule milestones. The employees at our facility at Umatilla, Oregon also are doing their part to reduce the risk posed by the continued storage of these aging weapons. Since beginning operations in September 2004, they have safely eliminated over 8,000 M55 sarin-filled rockets. I am very pleased to report that last week, the workers at our facility in Pine Bluff, Arkansas began destroying agent, thereby reducing risk to their surrounding communities.

The Chemical Weapons Convention (CWC) not only requires the complete destruction of our Nation's stockpile of agent and munitions, it provides for the destruction of our non-stockpile chemical warfare materiel as well. This component of the treaty requires the complete destruction of all of our former chemical weapons production facilities by April 2007, a deadline for which there is no extension provision. I am pleased to report that over eighty percent (80%) of our former production facilities have already been destroyed. The remaining two facilities, at

Pine Bluff Arsenal and Newport Chemical Depot, are undergoing demolition and we are on schedule to meet our international treaty commitments. The non-stockpile program has also developed and deployed a number of innovative, safe and efficient destruction technologies, such as the Explosive Destruction System (EDS), and the Single CAIS (Chemical Agent Identification Set) Access and Neutralization System (SCANS). These technologies effectively destroy chemical agent munitions and identification sets that contain agent, and they are completely mobile and proven to be safe. The EDS has safely processed nearly 300 rounds since entering into service in 1999, including the World War I chemical weapons recovered in nearby Spring Valley, Washington, D.C., and we have used SCANS to destroy recovered CAIS vials and bottles with improved safety and cost effectiveness as compared to previous technology. The non-stockpile program also has developed useful chemical agent assessment technologies, such as the Mobile Munitions Assessment System (MMAS), which helps operators identify the configuration and contents of recovered munitions. This capability greatly enhances the safety and efficiency of recovered munitions destruction operations.

In short, the Army has safely completed destruction of the stockpile at Johnston Atoll in the Pacific and drained all of the agent at Aberdeen, Maryland. Four sites are currently using incinerators to safely eliminate significant stockpiles. The last of the facilities under Army management is expected to begin destruction operations very soon and the destruction of our former production facilities and other non-stockpile chemical materiel is proceeding on schedule.

The most important fact is that we are accomplishing all of these activities safely. The Army and its contractors have achieved exceptional safety records, and by focusing our Safety Management System on protecting the worker who is turning a valve during a plant operation, we protect the general public and the environment as well. Overall, our facilities have achieved an average Annual Recordable Injury Rate of 1.39, which, according to the Bureau of Labor Statistics, is somewhere between those of credit unions and shoe stores. Our sites have logged millions of hours without a lost-time incident. As of February of this year, the Anniston facility logged more than six and a half million man-hours, equating to two years, without a lost-time injury. In recognition, the Governor of Alabama and the Alabama Department of Industrial Relations presented our Anniston contractor with a prestigious safety award. The Pine Bluff facility received the Arkansas Department of Labor safety award last September in recognition

of having logged five million man-hours without a lost time injury; their record continues and they have now worked more than five and a half million man-hours without any lost time. Last month, our Umatilla contractor received the 2005 Oregon Governor's Occupational Safety and Health Employer Award for its "outstanding contributions to occupational safety and health."

We continue to strive for improved excellence in agent monitoring technology and practices. In an effort to conform to industry standards for worker and population protection, all of our facilities implemented new Airborne Exposure Limits (AELs) promulgated by the Centers for Disease Control and Prevention (CDC).

Compliance with environmental protection requirements is not negotiable. Our incineration facilities fully comply with the Environmental Protection Agency's (EPA) Maximum Achievable Control Technology (MACT) requirements for emissions controls. We work daily to effectively implement the myriad requirements for the management of our solid and hazardous wastes. In addition, we work closely with our state and Federal environmental regulators and proactively take steps to stay ahead of the ever-changing regulatory environment under which we must operate.

The Army and the Federal Emergency Management Agency (FEMA) of the Department of Homeland Security (DHS) work closely with affected state and local governments to review emergency preparedness requirements as the individual weapons storage sites reduce risk to their communities through the destruction of their stockpiles. The Army and DHS FEMA share responsibility for the Chemical Stockpile Emergency Preparedness Program (CSEPP), which protects public health and safety by ensuring the emergency preparedness capabilities of Army installations and surrounding communities are ready to respond to an off-site chemical agent emergency. All ten CSEPP states have achieved full program benchmark compliance. Capability Assessment and Readiness reports conducted by the States and annual program exercises consistently show that CSEPP states are better prepared to meet any emergencies than their non-CSEPP counterparts.

No one envisioned the peaceful destruction of these weapons when they were first manufactured. I am fond of saying that these chemical weapons are not fine wine; they do not improve with age. It is imperative that we continue to make significant strides toward destroying the nation's

stockpiles while still ensuring the safety of all involved. However, achieving a mission of this scope and magnitude, and one that holds the interest of so many important stakeholders, poses unique challenges. While we are focused on addressing these challenges, they will continue to cause significant growth in both cost and schedule as they have done in the past.

Our challenges can be grouped generally into three categories: technical, external, and internal. As examples of new technical requirements, our plants are aging beyond their expected service life, which will result in increased maintenance and refurbishment costs as well as schedule increases. As another example of a technical challenge, we recently identified the presence of mercury in portions of the Tooele, Utah mustard stockpile. The Tooele plant must be modified to remain compliant with environmental regulations and prevent the release of mercury into the environment. We are currently investigating whether mercury contamination exists in the mustard at our other stockpile sites and the potential cost and schedule impacts of processing.

Challenges related to changing external requirements include the AELs and MACT requirements that I previously mentioned as well as state regulatory requirements, emergency response requirements, and litigation. While new requirements generally contribute to increased safety and environmental protection, their implementation also impacts the program's cost and schedule. In our efforts to safely dispose of byproducts resulting from the destruction of VX in Indiana and the mustard in Maryland, the Army has pursued several technically and environmentally sound offsite disposal options. Attempts to resolve public concerns that have been expressed regarding the transport and treatment of secondary wastes have caused us to examine alternatives that are equally effective but potentially more expensive. Facility startups at Tooele and Anniston were delayed in response to community concerns, increased local emergency response requirements, and litigation.

With respect to internal challenges, operational events also have caused schedule delays and cost increases. Chemical warfare agents were designed to be deadly. To protect those who have the greatest contact with these weapons, our workers, we demand the safe operation of these plants. We work diligently to preclude, or at least minimize, the effect of these events through well-designed equipment and facilities, thoroughly vetted operational procedures, and comprehensive operator training. From this starting point, we are focused on improving safe destruction

operations through a continuous improvement approach that results from thoroughly examining each event. We stop, take time to assess what went wrong, implement corrective actions, and proceed again with caution. I would prefer to stop operations – even for months – to ensure that our operations are safe and environmentally protective than to have any doubt about our ability to do this job safely. Our improving record on safety, about which I spoke earlier, demonstrates clearly that our continuous improvement program is working.

Finally, all stakeholders with an interest in this program play an important role. We are sensitive to the concerns of communities near the stockpile disposal facilities, and we work hard to effectively address their concerns while ensuring that we meet our program goals. We must be able to clearly articulate technically correct rationales for our decisions based on sound science while acknowledging citizen concerns in a way that recognizes personal and community perspectives about our program.

This is indeed a remarkable time for the Army's chemical demilitarization program. As recited in my testimony here today we continue to accomplish the mission of safely destroying the stockpile. There have been, and will continue to be, challenges to overcome as we move forward. We look forward to working with the Congress to achieve the mission it has laid out for us and to addressing the many challenges that affect this program. I have been to three sites, and I look forward to visiting them all in due course. I am extremely impressed with the professionalism, dedication and ingenuity of our workforce and by the robustness of our facilities. I welcome each and every one of you to visit any of our disposal facilities and see them for yourselves; each is an impressive sight. I will continue to identify our requirements and then work to effectively use the resources that Congress provides to the program.

In closing, I ask for your continued support of this critical national program so that we may sustain our commitment to the communities surrounding the storage sites, to the nation, and to our international partners. Thank you for the opportunity to discuss this important program with you. I look forward to answering any questions you may have.

TESTIMONY OF CRAIG CONKLIN

CHIEF, NUCLEAR AND CHEMICAL HAZARDS BRANCH
DEPARTMENT OF HOMELAND SECURITY FEDERAL EMERGENCY MANAGEMENT AGENCY BEFORE THE HOUSE ARMED SERVICES COMMITTEE
SUBCOMMITTEE ON TERRORISM, UNCONVENTIONAL THREATS AND CAPABILITIES
HOUSE OF REPRESENTATIVES

APRIL 6, 2005

Mr. Chairman and members of the Subcommittee, I am Craig Conklin, Chief of the Department of Homeland Security (DHS) Federal Emergency Management Agency's (FEMA) Nuclear and Chemical Hazards Branch. I am pleased to provide this update on our progress in support of the Chemical Stockpile Emergency Preparedness Program (CSEPP) since my last testimony before this Subcommittee on April 1, 2004.

Once again, we welcome the opportunity to share with the committee CSEPP's continued successes and how this important program is benefiting our Nations' emergency preparedness and homeland security efforts.

I will briefly cover FEMA's roles and responsibilities in CSEPP; the structure and operation of the program; the current status and challenges presented by this complex program; and the continuing efforts to share the lessons learned from this program within DHS.

CHEMICAL STOCKPILE EMERGENCY PREPAREDNESS PROGRAM (CSEPP)

The statutory foundation of the CSEPP is Public Law (P.L.) 99-145, wherein Congress directed the Department of Defense (DOD) to dispose of its lethal chemical agents and munitions while providing "maximum protection for the environment, the general public and the personnel involved in the destruction of lethal chemical agents and munitions . . ." Both the U.S. Army and FEMA continue to work towards Congress' goal of maximum protection for the environment, workers, and the general public. FEMA and the Army jointly formed CSEPP to ensure that Congress' intent was followed.

Since 1988, FEMA and the Army have cooperated in enhancing public safety and working towards maximum protection at the Army's chemical stockpile sites. We also have signed three Memoranda of Understanding and one reaffirmation to show our cooperation and resolve

in protecting the public. Currently, FEMA and the Army enjoy a close and productive working relationship at the Federal level, and the Army installations are working effectively with State and local governments.

FEMA'S CSEPP RESPONSIBILITIES

CSEPP is an outstanding example of partnership among the Army, FEMA, States, Tribal Nations, and local jurisdictions. The Federal management structure is uniquely designed to capitalize on each Federal partner's expertise and administrative infrastructure to develop and enhance the emergency preparedness capabilities of the affected Army installations and the participating State, Tribal, and local jurisdictions.

Within CSEPP, FEMA's responsibility and accountability entail all aspects of off-post emergency preparedness, including:

- Administering off-post CSEPP funds;
- Supporting the States in developing response plans;
- Preparing, developing, delivering, and evaluating training;
- Providing technical assistance; and
- Developing programs for evaluating off-site readiness capability.

PROGRAM STRUCTURE

Ten States, 41 counties, and one Tribal Nation surrounding the eight U.S. Army stockpile sites participate in CSEPP. The eight States hosting installations with chemical stockpiles are: Alabama, Arkansas, Colorado, Indiana, Kentucky, Maryland, Oregon, and Utah. Two additional States, Illinois and Washington, also participate in the program because of their borders' proximity to the stockpiles in Indiana and Oregon, respectively. The Confederated Tribes of the Umatilla Reservation in Oregon also actively participate in the program.

Thirteen (13) counties are in Immediate Response Zones, the areas closest to where the chemical agents are stored and generally within approximately a ten-mile radius. Twenty-five counties are in Protective Action Zones, beginning at the outer edge of the Immediate Response Zones and extending to a distance of between six and 31 miles. The remaining three counties are

designated as host counties, which lie outside the Immediate Response Zones and Protective Action Zones.

Like FEMA's other emergency preparedness programs, CSEPP is administered through the States. Funds are distributed to the States under Cooperative Agreements, based upon a negotiated work plan between the States and FEMA Regional Offices. Under the agreements, each State identifies needs, develops proposed projects to meet those needs, requests funds, and disburses those funds at the State level and to local governments.

Budgeting for the CSEPP is done according to DOD's Planning Programming, Budgeting, and Execution process (PPBE). The budget for off-post emergency preparedness is based in large part on Life Cycle Cost Estimates (LCCEs) that are prepared by the States in conjunction with FEMA, and updated regularly.

At the Federal level, FEMA and Army Headquarters are responsible for CSEPP policy and program development, while the FEMA Regions and the Army's Chemical Materials Agency manage day-to-day operations. Site-specific issues are dealt with through site-specific Integrated Process Teams. These teams (required by Section 1076 of P.L. 104-201, the Department of Defense Authorization Act for FY1997) serve as the primary local forum for identifying site-specific operational issues, proposing solutions to those issues to the appropriate level decision makers, and implementing programmatic and operational decisions.

CSEPP MANAGEMENT SYSTEM

CSEPP focuses on providing the personnel, equipment, and training necessary to establish a response infrastructure that enables emergency managers to quickly alert the public, manage the response, and communicate with the public, the media, and emergency responders. Equally important is public awareness of what to do in the event of an incident. CSEPP programmatic benchmarks define a level of response functionality necessary to protect the public (benchmark compliance) and provide resources as needed to eliminate preparedness weaknesses.

Fiduciary requirements dictate that FEMA carefully evaluate requests from the States and communities to achieve "maximum protection" capability within the limits of funds provided. As such, our goal is to deliver maximum available resources to the local communities in relation to the level of risk faced by the community.

FEMA's innovative efforts in relating resources to risk reduction have been recognized as an example of sound fiscal management, including receipt of a "Profiles in Innovation" award for Emergency Preparedness Excellence at the 2004 GOVSEC, U.S. Law, & READY! Exposition and Conference.

As of March 31, 2005, approximately $746 million had been allocated to the States under the annual Cooperative Agreements over the life of the program since 1988. In addition, $80.1 million more has been applied to FEMA-managed contracts that support the States. The allocation of resources is tracked according to the jurisdiction that spends the funds rather than the jurisdiction that benefits from the service. Therefore, funds spent at the State and county levels do not reflect the true picture of the benefits the counties have received through the program.

For FY2006, FEMA has programmed $90.1 million into the budget to cover off-post CSEPP-preparedness.

OVERALL MISSION

CSEPP activities are an extension of the FEMA mission "to lead America to prepare for, prevent, respond to, and recover from disasters." CSEPP's mission is to "enhance existing local, installation, tribal, State, and Federal capabilities to protect the health and safety of the public, work force, and environment from the effects of a chemical accident or incident involving the U.S. Army chemical stockpile." Both missions are accomplished in CSEPP through partnerships with other DHS Directorates, the Army, Federal departments and agencies, States, one Tribal Nation, local governments, volunteer organizations, and the private industry.

CURRENT SITUATION

All our CSEPP communities have attained the public safety capabilities reflected by our programmatic benchmarks. FEMA and the Army continue to manage CSEPP through the 12 benchmarks. These benchmarks date back to 1993 and capture the outcome-oriented capabilities necessary to ensure public safety. The Program continues to develop metrics and strategic plans to ensure the environment, workers, and public are protected.

The benchmarks are the primary system by which we manage performance in CSEPP. The eight CSEPP communities evaluate and update their benchmark status. The FEMA Regional CSEPP personnel then report benchmark status to FEMA headquarters. CSEPP has made significant strides in improving benchmark compliance during 2004. In fact, during that year, compliance increased from 95.4 percent at the end of Fiscal Year 2003 to 98.5 percent by the end of Fiscal Year 2004.

CSEPP communities are better prepared to respond to all natural and man-made hazards as a result of their involvement in this Program. The lessons learned through CSEPP and the materials created to prepare the public apply to many other homeland security needs. CSEPP actively works to share its best practices and experience.

NEW INITIATIVES

During the past year, initiatives have begun that relate to reducing both community risk and program costs associated with CSEPP. With the chemical stockpile at Aberdeen Proving Ground now completely destroyed, FEMA is working with Maryland officials to close out that community from the Program. The closeout lessons learned from Aberdeen are being captured by a national working group and will be used to develop policy for closing out other CSEPP sites.

FEMA and the Army have also begun a dialogue with the State CSEPP managers to discuss a reduction in program support in communities with active chemical disposal plants. Successful destruction of chemical agents has already resulted in significant risk reduction. We are committed to working with our Program partners in a collaborative process that will structure program support that is commensurate with actual community risk. FEMA is also committed to using risk-based decision making methodologies in reviewing program requirements. FEMA will continue to ensure that a baseline emergency preparedness capability is maintained until the chemical stockpiles are completely destroyed.

Although the preparedness budget represents only about 6 percent of the overall chemical demilitarization budget, our successes loom large. FEMA and Army personnel are working closely with our State, county and Tribal partners to sustain community preparedness, evaluate

program requirements and continue our planning, training and exercise activities in the most efficient manner possible.

Adjusting to the changing program requirements, FEMA has reduced CSEPP staffing at our headquarters in Washington, DC, and in several FEMA Regions. In addition, several Integrated Process Teams that have successfully completed their missions were disbanded and other workgroups were consolidated to better address the current status of the Program. This past year, a study was conducted to develop recommendations on the effective use of Program-wide Integrated Process Teams. Effective teams will remain and continue to provide a collaborative process for developing policy recommendations or developing specific products. We are proud of the accomplishments of our IPTs and are committed to ensuring that teams focus on current program requirements and that they are provided the tools necessary to operate effectively. Staffing needs will also continue to be evaluated to ensure that FEMA and State and local staffing is appropriate to fulfill our preparedness mission.

Last year, DHS introduced the National Incident Management System (NIMS) to standardize national emergency response command structures. States are required to be NIMS-compliant by the end of Fiscal Year 2005. Building on established Federal, State, and local partnerships, FEMA is actively working to integrate NIMS with CSEPP.

CHALLENGES

As the disposal schedule is extended, the cost of CSEPP increases. The cost escalation can be significant because many major infrastructure systems such as interoperable communications, outdoor sirens, and automation systems have a finite life span and may require replacement during the Program's life cycle. These system replacements were not originally budgeted because stockpile destruction was planned before system obsolescence.

Two appropriations issues also create challenges for Program management. The loss of two-year availability for Operations and Maintenance (O&M) funding and the imposition of fenced appropriations for on-post preparedness funding, removes the needed time period for our State and local partners to implement projects and the flexibility to employ Federal funds where they provide the most public protection.

CONTINUED SUCCESSES

The partnership between the Army and FEMA is very strong and getting stronger. Our two organizations have worked well together resulting in numerous accomplishments. Building on those successes, we are working on other initiatives that are designed to enhance public protection, to streamline budgeting and administrative tasks. Since my last testimony, the program has achieved many notable successes.

EXERCISES

FEMA and the Army, along with their State and local partners, have conducted eight (8) Community CSEPP Exercises and published and updated the CSEPP Exercise Policy Document within the past year. It should be noted that the DHS/Office for Domestic Preparedness' Homeland Security Exercise Evaluation Program (HSEEP) uses an exercise methodology adapted from the CSEPP Exercise Program. CSEPP and HSEEP use similar terminology and exercise outcomes in order to reduce confusion in the communities and increase interoperability of evaluators among the two national exercise programs.

TRAINING

CSEPP training is offered on a continual basis to the communities surrounding the chemical storage sites. CSEPP training has been made available to non-CSEPP communities via the CSEPP Training site at http://emc.ornl.gov/CSEPPweb/FEMACSEPPHome.html. To date, over 500,000 down loads of training materials have been recorded. CSEPP training has been recognized as an important component in protecting emergency responders and the general public outside of CSEPP. The CSEPP "Residential Shelter-in-Place" video/DVD has been recommended as a resource to all new home buyers in "Protecting Your Family and Home", a publication developed by the Homeowners Alliance and DHS.

PUBLIC OUTREACH

CSEPP continues a public outreach program that informs residents of the necessary actions they would need to take in the unlikely event of a chemical incident. Outreach includes school-based programs, community events, and advertisements using radio, television and newspapers.

Through the proactive work of our network of public information officers (PIOs), we continue to reach out to the CSEPP communities. For example, our Utah PIOs were responsible for much of the behind-the-scenes support when the commander of Deseret Chemical Depot addressed the Tooele County Chamber of Commerce. About 50 local business owners and public officials attended this event.

In Alabama, Arkansas, Washington/Oregon and Indiana, CSEPP-funded media campaigns are bringing the CSEPP message to the public. To capitalize on intrinsic interest, the campaigns are timed so as to coincide with high-profile events. For example, the Arkansas PIO contingent has tied the start of its campaign's second-year phase with the start of stockpile incineration at the Pine Bluff site.

The impressive work of our outreach team is not going unnoticed. Just last month the Army recognized the Washington/Oregon PIO contingent with the Chief of Public Affairs' Special Award of Excellence. The group was cited for its support of the start-up of the Umatilla Chemical Agent Disposal Facility.

CONCLUSION

CSEPP has significantly enhanced the ability of State, Tribal and local officials to respond to a chemical incident at the Army's installations. However, FEMA will not rest on these accomplishments, no matter how significant they may be. Until all agent and weapon systems are destroyed, FEMA will continue to work with our State, tribal, and county partners to ensure they are prepared to respond to an event if one was to occur. Our efforts to improve public safety will not cease until all the chemical weapons stockpiles are destroyed.

We all look forward to that day when the last chemical weapon and warfare agent is destroyed. In closing, I want to thank the members of the Subcommittee for their past support of CSEPP and I appreciate the opportunity to testify before you today. I would be pleased to answer any questions you may have.

Testimony
Before the Committee on Armed Services
Subcommittee on Terrorism, Unconventional Threats and Capabilities
United States House of Representatives

CDC's Public Health Role in the Chemical Demilitarization Program

Statement of
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Acting Director
National Center for Environmental Health/Agency for Toxic Substances and Disease Registry
Centers for Disease Control and Prevention
U.S. Department of Health and Human Services

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Mr. Chairman and members of the Subcommittee, I am, Tom Sinks, Acting Director, at the Centers for Disease Control and Prevention's (CDC) National Center for Environmental Health and the Agency for Toxic Substances and Disease Registry. I would like to thank the Subcommittee for inviting me here today to discuss the Centers for Disease Control and Prevention's (CDC) legislatively mandated public health oversight role in the chemical demilitarization program of the Department of Defense (DOD). I would like also to thank the subcommittee for its interest in ensuring the safe destruction and disposal of our Nation's chemical weapons stockpile.

My testimony will focus on two general topics: (1) CDC's mandated role in overseeing DOD's plans for destroying the Nation's stockpile of chemical weapons, and (2) CDC's recently released report for Congress reviewing the U.S. Army proposal for off-site treatment and disposal of caustic VX hydrolysate from the Newport Chemical Agent Disposal Facility.

CDC's Overall Chemical Demilitarization Mission

The U.S. Department of Defense is mandated by Public Laws 91-121, 91-441, and 99-145 (50 U.S.C. 1512 and 1521) to obtain review and oversight from the U.S. Department of Health and Human Services of its plans for destroying the nation's stockpile of chemical weapons, including any plans to transport or dispose of lethal chemical or biological warfare agents. This responsibility was

delegated to CDC from the Office of the Surgeon General in 1981. CDC's primary focus has been on preventing potential problems that could adversely affect the health of disposal site workers and the surrounding communities. CDC's chemical demilitarization mission statement is *"To protect public health and safety by providing oversight and guidance to the U.S. Army's chemical warfare material demilitarization program through reviewing, advising, and making recommendations on the Army's plans to destroy stockpile and non-stockpile chemical weapons."* The CDC is required to provide recommendations to the Secretary of Defense for precautionary measures to protect the public health and safety.

CDC and other oversight organizations have worked with the Army and achieved several notable successes that have resulted in reducing the threat of chemical weapons. Successes include the complete destruction of the chemical weapon stockpile and site remediation at Johnson Atoll in the Pacific Ocean, and the safe elimination of the sarin stockpile at Tooele, Utah and the sarin-filled rockets at Anniston, Alabama. Moreover, recently, the Army celebrated the elimination of the mustard stockpile at Aberdeen, Maryland. Lessons learned from it have been incorporated at Newport, Indiana.

CDC begins its oversight function for the disposal of chemical warfare agents by reviewing the Army's proposed destruction technology. CDC focuses on the prevention of agent incidents by evaluating engineering controls such as air

monitoring, containment and abatement, emergency response plans, medical provisions and other procedural and administrative controls. CDC examines facility design provisions and operating procedures to protect the workforce and surrounding communities. During operations at chemical weapons destruction facilities, CDC conducts periodic on-site reviews for the purpose of ensuring safety. Because air monitoring is a critical element in detecting any possible release of chemical agents, CDC regularly examines air monitoring procedures and strategies, including the number and placement of air monitors as well as the quality of the data from these systems.

In undertaking our oversight responsibilities at destruction sites, CDC is currently addressing several key issues. First CDC is working with the Army to implement revised airborne exposure limits of chemical warfare agents for workers and the general population. In response to a request from the Army, CDC updated these limits to ensure that workers and the public are protected from exposure to a harmful concentration of agent. Second, CDC strives to ensure worker and public safety are adequately addressed during the start-up of disposal facilities. Third, CDC is working closely with the Army to improve air monitoring methods and technology to improve detection performance and response times, and to meet the airborne exposure limits. Finally, we are faced with the task of examining unique problems impacting human health associated with non-incineration technologies such as the technology at Newport, Indiana and those proposed for Pueblo, Colorado and Bluegrass, Kentucky. CDC is committed to

providing the same rigorous reviews of these sites and the technologies involved as it has for the incineration sites and their technology.

CDC's Activities at the Newport Chemical Agent Disposal Facility

During 2004 and 2005, many of CDC's activities in its chemical demilitarization program have focused on the Newport Chemical Agent Disposal Facility in Indiana, because; 1) the planned process is a relatively new technology; 2) the project management has declared the Newport site ready to begin, and 3) the Army has scheduled operations to begin soon. The proposed process at Newport will use sodium hydroxide to destroy the chemical agent VX via a process referred to as chemical hydrolysis, followed by secondary transportation to and treatment and disposal of the resulting waste stream at an off-site facility in Deepwater, New Jersey. CDC has devoted significant resources to evaluating the safety of the chemical hydrolysis of VX at the Newport site. The two basic concerns with this first phase are 1) ensuring that the waste byproduct of hydrolyzed VX, known as caustic VX hydrolysate, does not contain any detectable level of VX; and 2) ensuring that the facility can operate in a manner that ensures both worker and public safety.

CDC has reviewed the proposed process and observed selected integrated operations demonstrations to assess the facility and staff's readiness for actual

agent operations on-site at the Newport facility. Due to the complex nature of the processing issues, CDC acted as co-lead, along with an Army representative, of a *Tiger Team* focusing on medical and worker safety. This team produced five major action items, all of which have been addressed effectively by the Newport facility. CDC continues to work closely with the Army and the Newport team to oversee operational demonstrations, review new team findings, and finalize resolutions to CDC concerns.

The Army's proposal for shipment of the resulting caustic VX hydrolysate waste generated at the Newport site to the Dupont facility in New Jersey where it would be treated and disposed of has generated public concern. In conformity with public laws delineating CDC's involvement in chemical demilitarization, CDC's role generally ends when the waste no longer contains any detectable level of chemical weapons agent, at which time the responsibility for the waste falls under existing transportation and environmental disposal regulations overseen by other government agencies.

In March of 2004, CDC received a Congressional request to review the DuPont treatability plan. DuPont's report describing its treatment plans was organized into four major components, 1) a toxicology assessment, 2) a transportation review, 3) a report on the treatability of the waste and 4) an ecological impact assessment on the Delaware River estuary. While CDC had some internal experience in the first three areas, we also utilized outside experts to assist in

reviewing the various aspects of the DuPont report. CDC reviewed the toxicology assessment with assistance of the Division of Toxicology in the Agency for Toxic Substances and Disease Registry; the DuPont transportation plan with assistance of Department of Transportation; and the treatability analysis with assistance of Carmagen Engineering, a consulting firm. Since CDC does not have expertise in ecologic risk assessment, the U.S. Environmental Protection Agency (EPA) was requested to review the ecologic risks associated with disposal of effluent in the Delaware River.

Many of the items in the DuPont studies required documentation from both the Army and DuPont. The Army and DuPont provided several thousand pages of studies and background information for the CDC team's review. To ensure its technical accuracy, the entire report was peer reviewed by subject matter experts outside the government, and revised by CDC, as appropriate based on peer reviewer comments. DOD reviewed the revised draft with peer reviewer comments for technical accuracy in December of 2004. CDC's response to DOD comments, include an external peer review of the EPA portion of the CDC report. CDC responses and resolutions of the DOD comments were peer reviewed for accuracy and technical content. CDC finalized the observations and recommendations and incorporated them into the report for Congress.

CDC's review of the Army proposal for off-site treatment and disposal of hydrolysate from Newport describes four critical issues. The first is potential

health hazards associated with waste produced at the Newport facility. Caustic VX hydrolysate is highly corrosive and requires appropriate personal protective equipment during handling and transportation. While this is a concern, the hydrolysate is consistent with other caustic products and can be dealt with by proper training and ensuring that responders understand the proper equipment for an emergency response.

CDC believes that the Newport facility can begin effectively destroying approximately half of the VX stockpile. As a result of chemical stabilizers added to the VX to maintain its potency, CDC is concerned about the effectiveness of the current neutralization technology to destroy the other (approximately) half of the stockpile. These stabilizers have been shown to interfere with both the destruction process and chemical analysis. This initially will require smaller portions of VX being treated per batch than was originally designed (8% verses 32%); which, unfortunately, increases both the processing time and the volume of hydrolysate (waste) that is generated. Moreover, for one type of stabilizer, which is found at various levels in the remainder of the VX stockpile, the Army has not yet presented a destruction process to CDC. We understand that the Army is conducting additional testing to see if it can resolve these issues.

The third issue involves the potential risks associated with transporting the hydrolysate from Newport to the DuPont facility in New Jersey, due primarily to its corrosive properties. CDC agrees with the Department of Transportation

assessment that the hydrolysate waste can be safely transported utilizing precautions and equipment similar to other caustic materials currently being conveyed on our highways.

The final issue is the potential ecologic impact associated with disposal of DuPont-treated waste into the Delaware River. CDC's question to the EPA stated, "From an ecological standpoint, is the disposal of material as presented in the DuPont Chambers ecological risk assessment acceptable?" The EPA's response was, "Based on our review of the information provided and the amount of outstanding issues that need to be addressed, EPA's position is that DuPont has not demonstrated that the disposal of material as presented in the ecological risk assessment is acceptable." Because EPA found the assessments were not acceptable, CDC cannot recommend proceeding with the disposal plan until EPA's concerns are adequately addressed.

In October 2004, CDC received a second Congressional request to review a revised Army/DuPont plan for further phosponate reduction at DuPont. CDC received the Army/DuPont report on phosponate treatability in March 2005. It is too early to determine if this new study will provide the additional information needed to address the EPA's concerns.

Going forward, CDC will diligently continue the evaluation of existing chemical demilitarization facilities for safety, monitoring and medical programs and work

with the Army in evaluating the path forward for the Pueblo, Colorado and Bluegrass, Kentucky programs in addition to the Newport, Indiana process.

Although I have pointed out a number of challenges currently associated with the Army's proposal for off-site treatment and disposal of waste from the Newport, Indiana facility, I must again emphasize that CDC has had a long and successful working relationship with the Army's Chemical Materials Agency. As stated in the beginning of my testimony, the successful completion of the agent destruction mission at Johnson Atoll, the safe elimination of the sarin stockpile at Tooele, Utah, the mustard stockpile at Aberdeen, Maryland, and the sarin-filled rockets at Anniston, Alabama are all representative of the true accomplishments that have been achieved in reducing the threat of chemical weapons. CDC looks forward to contributing to continued safe progress in this vital program.

Mr. Chairman and members of the subcommittee, this concludes my testimony. I would be happy to answer any questions and respond to any requests for additional information.

DOCUMENTS SUBMITTED FOR THE RECORD

APRIL 6, 2005

DEPARTMENT OF DEFENSE COMMENTS

The Department of Defense (DOD) has received a copy of the Centers for Disease Control (CDC) report titled "*Review of the U.S. Army Proposal for Off-Site Treatment and Disposal of Caustic VX from the Newport Chemical Agent Disposal Facility*" dated March 2005. The DOD appreciates the opportunity to review and comment upon the report.

We believe that there is a typographical error on the cover and that the report should be titled, "*Review of the U.S. Army Proposal for Off-Site Treatment and Disposal of Caustic VX* ***Hydrolysate*** *from the Newport Chemical Agent Disposal Facility.*"

Like the CDC, we believe that safety of the workers, public, and environment is paramount and must be addressed. DOD agrees with a number of the CDC findings and recommendations that support the start of agent destruction operations at Newport and subsequent transport to a commercial treatment, storage, and disposal facility (TSDF). These include:

1) Destruction of the DIC-stabilized agent can proceed forward at an 8% percent loading.

2) The potential hazard of the caustic hydrolysate is predominantly associated with its corrosive and caustic properties and not nerve agent effects.

3) The corrosive and caustic hazards of the hydrolysate do not preclude handling or transportation and the precautions in the transportation plan meet the Department of Transportation regulations to safely protect the public, personnel, and environment.

4) The DuPont Secure Environmental Treatment process is capable of treating the major components in the caustic hydrolysate wastewater.

The DOD recently completed tests on the VX drawn from the stockpile stored at Newport. These tests confirm that the same criteria used to clear 8 % DIC-stabilized VX were met for the entire stockpile and that the issues associated with the DCC stabilized agent or the blended DIC/DCC stabilized agent have been addressed. Additionally, the total quantity of the stockpile that is stabilized with DIC is 60%. The detailed results from these tests are being furnished to CDC to update previously submitted data and address the concerns they have identified in their report.

Early last month the DOD provided a copy of DuPont's phosphonate removal technology report to the CDC for review. The concerns raised by the EPA regarding the contribution of treated caustic hydrolysate to the ecological risk to

the Delaware River are noted, and the DOD will work with the CDC and EPA to address these concerns.

Based on the results of the treatability studies, the DOD is convinced that the pretreatment process developed by DuPont will address potential data gaps raised by the EPA in its findings and address concerns raised over the past year by members of the public.

The DOD appreciates the professionalism and thoroughness of the CDC in completing this study and look forward to working with the CDC scientists to address their concens.

Review of the U.S. Army Proposal for Off-Site Treatment and Disposal of Caustic VX Hydrolysate from the Newport Chemical Agent Disposal Facility

A Report to Congress

Prepared by:

Department of Health and Human Services

Centers for Disease Control and Prevention

April 2005

DEPARTMENT OF HEALTH AND HUMAN SERVICES
Centers for Disease Control and Prevention

CDC
Centers for Disease Control and Prevention

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SUMMARY

The U.S. Army proposal for caustic VX hydrolysate (CVXH) transportation, treatment, and discharge into the Delaware River has raised concerns and questions about potential impacts on public health and the environment. This report describes the findings from the Centers for Disease Control and Prevention (CDC) evaluation of this proposal. CVXH is the waste product of the hydrolysis reaction of nerve agent VX, water, and sodium hydroxide that will be generated at the Newport Chemical Agent Disposal Facility (NECDF) in Newport, Indiana. The proposal is to transport CVXH from NECDF to the DuPont Secure Environmental Treatment (SET) Chambers Works facility in Deepwater, New Jersey, for secondary treatment and subsequent discharge in the Delaware River. Please note that the term *CVXH* is referred to in some reports as *Newport caustic hydrolysate* or *NCH*.

CDC's review of the CVXH disposal plan examined several critical issues, including (1) potential health hazards associated with the waste produced at NECDF, (2) potential risks associated with transportation of the material from Indiana to New Jersey, (3) ability of the DuPont facility to adequately treat the CVXH in addition to the ability of NECDF to produce caustic VX hydrolysate meeting clearance criteria, and (4) potential ecologic impact associated with discharge of the DuPont-treated material into the Delaware River. Because CDC did not have the expertise to review DuPont's ecologic report, CDC requested assistance from the U.S. Environmental Protection Agency (EPA), Region II. A summary of the results of CDC's evaluation are described below:

- CDC found that the potential human health hazards of the untreated CVXH are associated predominantly with its corrosive and caustic properties and not nerve agent effects, although trace levels of VX and EA 2192 (a degradation product with nerve agent properties) may be present. The toxicity of CVXH does not preclude handling and transportation provided that proper precautions are in place.

- The transportation plan meets Department of Transportation regulations, and precautions in the plan are adequate to protect the public, personnel, and environment.

Major Findings:

- The potential human health hazards of caustic hydrolysate are associated predominately with its corrosive and caustic properties.
- The precautions in the transportation plan are adequate to protect the public.
- The DuPont process should be capable of treating the major components of the waste with noted exceptions.
- More information is needed to evaluate the ecological risk of discharge of this waste into the Delaware River.

CDC does not recommend proceeding with the treatment and disposal at DuPont until EPA's noted deficiencies in the ecologic risk assessment are addressed.

- CDC's technical review of the DuPont SET indicated it is a viable process and should be capable of treating the major components of CVXH (see subsequent discussion on phosphonic acids). However, the NECDF VX stockpile utilizes two chemicals (referred to as stabilizers), diisopropylcarbodiimide (DIC) and dicyclohexylcarbodiimide (DCC), added to prevent VX degradation during storage. The data indicate that CVXH produced from DIC-stabilized VX at the 8% agent loading level should meet the Army's clearance criteria for VX and EA 2192 during storage and can be treated at DuPont. The term "loading" refers to the total percentage of VX added to the NECDF process for reaction. Loadings greater than 8% of DIC-stabilized VX or any treatment of VX stabilized with DCC is not recommended until the treatment effectiveness is demonstrated and confirmed. Consequently, only a portion of the Newport VX stockpile currently can be processed to meet clearance criteria.

- The Environmental Protection Agency's (EPA's) analysis indicates that the DuPont risk assessment does not contain adequate information to determine that the aquatic ecologic risk from the discharge of treated CVXH to the Delaware River is acceptable. Further, the EPA expressed concerns that the 20 ppb clearance criterion for VX in CVXH is based "solely on the protection of humans from a drinking water source and may not be protective of aquatic organisms through ingestion or dermal exposure."

In conclusion, while the CDC found that the Army/Dupont proposal was sufficient to address critical issues in the areas of potential human toxicity, transportation, and treatment of CVXH (generated from recommended VX loading and stabilizer), EPA concluded that the information regarding the ecologic risk of treated CVXH discharge into the Delaware River was inadequate.

Consequently, CDC cannot recommend proceeding with the treatment and disposal at the DuPont SET facility until EPA's noted deficiencies are addressed.

INTRODUCTION

The U.S. Army proposal for CVXH waste transportation, treatment, and discharge of treated material into the Delaware River has raised concerns and questions about potential impacts on public health and the environment. In a March 29, 2004, letter to the CDC, the four U.S. Senators from New Jersey and Delaware, along with four members of Congress (two from each State) requested that CDC formally review the proposal for off-site treatment of CVXH to determine "if there are public health risks involved with the Army's proposal." Additionally, the Governors and environmental protection officials of the affected States (Delaware and New Jersey) have publicly expressed concerns about the proposal.

This evaluation was conducted in response to a request from several senators and members of Congress.

Public Laws 99-145 (1986), and 91-121 (1970), as amended by 91-441 (1971) (50 U.S.C. 1521 and 1512) require the Department of Defense to obtain public health review and oversight by the Department of Health and Human Services of plans for the testing, transportation, and disposal of lethal chemical weapons. This function was delegated to CDC from the Office of the Surgeon General in 1981. CDC's public health oversight role usually ends when the lethal chemical warfare materials are destroyed, generally meaning that they have been reduced to hazardous waste that potentially contain only trace levels of chemical warfare agent. At that time the oversight responsibility falls under existing transportation and environmental disposal regulations. With respect to this specific proposal, however, CDC evaluated the off-site disposal plan pursuant to the congressional request, despite initial Army process information suggesting the waste would no longer contain detectable VX. This decision to conduct the evaluation was documented in a CDC letter to Congress dated April 16, 2004. CDC's review of NECDF process safety is not within the scope of this report; however, process safety at NECDF is reviewed by CDC as part of its routine oversight of chemical warfare agent disposal activities.

BACKGROUND

The Chemical Stockpile

The stockpile at Newport Chemical Depot, Newport, Indiana, consists of the chemical nerve agent O-ethyl S-[2- (diisopropylamino) ethyl] methyl phosphonothioate (VX) stored in bulk quantities (1,269 tons in 1,690 containers). VX contains phosphorus, oxygen, carbon, hydrogen, nitrogen and sulfur and is referred to as an organophosphate. VX is stabilized with several percent of either DIC or DCC or both to protect against decomposition. Forty-six percent of the stockpile at Newport consists of VX stabilized with DIC (potentially with small amounts of DCC stabilizer as a contaminant), 16% stabilized with DCC, and 38% stabilized with both DIC and DCC.

The Newport Chemical Agent Disposal Facility

NECDF was designed, and is to be operated, as a pilot-plant facility to destroy VX using caustic hydrolysis in a hot (194°F) aqueous solution of sodium hydroxide. This process forms CVXH, referred to in some reports as Newport caustic hydrolysate or NCH. The original plan was to further treat the resulting CVXH on-site by supercritical water oxidation (SCWO) to destroy organic components and then to ship the final SCWO effluent (brine) to a treatment, storage, and disposal facility. Because of mechanical problems encountered in the SCWO engineering scale test, conducted in Corpus Christi, Texas, in 2000, the Army initiated studies to directly ship NECDF CVXH off-site for disposal as an alternative to on-site SCWO treatment. The terrorist attacks of September 11, 2001, and continuing questions about the feasibility of implementing SCWO on-site within a reasonable timeframe supported the Army's decision to adopt "Project Speedy Neutralization." This approach involves shipping the CVXH to an existing treatment, storage, and disposal facility.

Issues Related to Destroying VX

Detailed testing of the caustic hydrolysis, as a process to destroy VX, began in the 1990s as part of the Army's Alternative Technologies and Approaches program. Various "recipes" for the destruction of the VX chemical agent stored at NECDF using sodium hydroxide were tested. Initially, an agent loading of 33% by weight was chosen for the program.

Confirmation of the completeness of destruction of VX depends on the analytical methods available to measure residual VX and EA 2192 (a degradation product) levels in the CVXH. During the past ten years, improvements in analytical techniques and instrumentation, coupled with increased personnel experience with these analyses, have lowered the detectable concentration of VX to the low parts per billion (ppb) levels and the detectable concentration of EA 2192 to the low tenths of parts per million (ppm) levels. However, the complexity and variability of the 33% VX loading caustic hydrolysate continued to complicate the VX analysis.

In October 2003, the Project Manager for Alternative Technologies and Approaches began to investigate the use of reduced VX agent loading in the hydrolysis reaction as a means of resolving analytical problems related to characterization of 33% agent loading CVXH. The Army currently plans to begin operation destroying DIC-stabilized VX at the 8% agent loading level and then, through a carefully monitored ramping-up process, move to 16% agent loading of DIC-stabilized VX.

The CVXH that will result from the caustic hydrolysis of VX at NECDF will consist of an organic phase and an aqueous phase. The organic phase exists both as an upper layer, floating on top of the aqueous phase, and as a suspension of droplets distributed throughout the aqueous phase (also known as an "emulsion"). The extent of organic layer forming above the aqueous layer depends on the amount of VX agent loaded into the batch to be treated. For instance, at 8% VX loading, only a thin sheen of organic layer reportedly is formed. However, at 33% VX agent loading, the organic layer comprises 3–5% of the mixture.

The Army's Proposal

The Army is investigating shipping the untreated caustic VX hydrolysate to the DuPont Secure Environmental Treatment (SET) facility in Deepwater, New Jersey for final treatment and disposal. The stated SET process objectives are to treat 3,000 to 7,000 gallons per day of CVXH. Process objectives will be (1) control of wastewater and sludge odors, (2) control of SET wastewater treatment plant operations (*e.g.*, effective dissolved organic carbon [DOC] removal, manageable foaming, pH control, solids management), and (3) meeting permit compliance limits for effluent biochemical oxygen demand (BOD5), whole effluent toxicity, total suspended solids, and ammonia.

The pH adjustment of the CVXH is the first step of the pretreatment process prior to introducing the waste to the biologic treatment system. Peroxide treatment, to destroy odorous substances, follows CVXH pH adjustment. The final step in the treatment train utilizes a two-stage powder activated carbon treatment system® (PACT®); testing of the process was conducted under conditions emulating the actual plant flow rate and hydraulic retention time. The solids in the effluent will be settled, dewatered, and buried in a permitted hazardous waste landfill on site at DuPont. The remaining effluent, which includes other plant waste, then will be disposed in the Delaware River. A proposal to remove phosphonates from the effluent has been developed by DuPont, and this report was provided to CDC on March 2, 2005. This new process will be evaluated separately in a subsequent CDC report.

APPROACH

This comprehensive evaluation of the CVXH disposal plan included examination of several critical aspects, including (1) potential health hazards associated with the waste produced at NECDF, (2) potential risks associated with transportation of the material from Indiana to New Jersey, (3) ability of the DuPont facility to adequately treat the CVXH in addition to the ability of NECDF to produce caustic VX hydrolysate meeting Army-defined clearance criteria while also meeting DuPont acceptance requirements, and (4) potential ecologic impact associated with discharge of the DuPont-treated material into the Delaware River. Each aspect of the shipment, treatment, and disposal were evaluated as described below.

- DuPont's report, *Health Hazard Considerations for Safe Management of Newport Caustic Hydrolysate,* along with original referenced studies and supplemental material provided by DuPont and the U.S. Army, were reviewed and evaluated in a collaboration between CDC and the Division of Toxicology of the Agency for Toxic Substances and Disease Registry (ATSDR). Because the primary scientific studies cited in support of DuPont's report were not peer-reviewed, ATSDR/CDC had these studies independently peer-reviewed before examination. The final ATSDR evaluation was peer reviewed external to the government in addition to the usual approval process for CDC/ ATSDR documents.

- DuPont's transportation report, *Transportation Safety Assessment and Risk Management Plan,* was reviewed and evaluated by CDC in collaboration with the Department of Transportation (DOT). This evaluation comprised two aspects. The first aspect was to determine whether the plan is consistent with DOT regulations for shipping hazardous materials. Representatives from DOT assisted CDC in making this determination. The second aspect involved examination of the transportation plan with respect to the specific hazards associated with caustic VX hydrolysate. CDC conducted this evaluation directly. The entire CDC evaluation of the transportation plan was reviewed by DOT, peer-reviewed external to the government, and subjected to the normal approval process for CDC documents.

In conducting this evaluation CDC partnered with several organizations, including the Agency for Toxic Substances and Disease Registry, the Environmental Protection Agency and Carmagen Engineering, Inc.

This report was peer-reviewed by subject matter experts in toxicology, ecology and engineering.

- DuPont's treatability report, *Treatability of Newport Caustic Hydrolysate*, and DuPont's subsequent *Basic Data Report* were reviewed and evaluated in close collaboration between CDC and a contractor, Carmagen Engineering, Inc., of Rockaway, New Jersey. Carmagen assembled a group of experts knowledgeable in the requisite disciplines to assist CDC in this review and assessment. The group consisted of a former chairman of the National Research Council Stockpile Committee, a retired assistant director for the CDC Division of Laboratory Sciences, a retired Program Manager for Chemical Demilitarization, a professor at Stevens Institute of Technology, a retired regional laboratory director for EPA, and a former environmental health and safety manager/process design manager for ARCO Chemical. Because the reliability of the DuPont process partly depends on the ability of NECDF to produce CVXH in a consistent manner that meets DuPont acceptance criteria, Carmagen also evaluated the NECDF process to produce CVXH. The Carmagen report was peer-reviewed external to the government in addition to the normal clearance process for CDC documents.

- Because CDC did not have the expertise to review DuPont's ecologic report, *Screening Level Ecological Risk Assessment for Discharge of Effluent from the Treatment of Newport Caustic Hydrolysate*, CDC requested assistance from the U.S. Environmental Protection Agency (EPA), Region II. EPA agreed to independently evaluate the ecologic risk associated with discharge of SET-treated CVXH in the Delaware River. EPA internally peer-reviewed their evaluation, and CDC had the EPA assessment peer-reviewed external to the government.

Each of the evaluations is attached in its entirety (attachments 2-5), along with a list of abbreviations (attachment 1). The external peer-review comments are available upon request. Because of data gaps, the complexity of issues examined, and interrelations between the different aspects of the proposal, several lengthy rounds of formal questions and requests for information were submitted to DuPont, the U.S. Army, and Army contractors. The findings from this evaluation are based primarily on data requested by and provided to CDC. Each evaluation itemizes the pertinent materials reviewed. CDC cannot guarantee the completeness or accuracy of all information used to complete this evaluation. Therefore, significant new information that may become available after publication of this report could change CDC's findings and conclusions.

Finally, in the interest of ensuring technical accuracy, the Department of Health and Human Services provided officials at the Department of Defense (DoD) with a draft copy of this report in December 2004. Comments were received from DoD officials in January 2005 and were addressed by CDC and EPA. A final external peer-review of the entire report, plus EPA's findings and the responses to comments from DoD officials was conducted, and the results of each of these efforts are available upon request. Once the report was completed, the DoD requested to provide official comments.

FINDINGS

The major findings for each aspect of the evaluation are presented below.

Health Hazard Considerations for Safe Management of Newport Caustic Hydrolysate [Caustic VX Hydrolysate]

- The untreated CVXH is highly corrosive (pH > 13). The major potential human exposure pathway for the material is dermal contact that could result in severe, possibly irreversible, burns to the skin or eyes. Overall, the risk from an accidental spill appears to be comparable to that expected for any highly corrosive material with high pH.

- Although the individual DuPont and U.S. Army toxicity studies are limited in scope and applicability, the studies—considered in their totality—do not preclude the handling and transportation of untreated CVXH if appropriate engineering and administrative controls and personal protective equipment are used.

- Regarding ethyl methylphosphonic acid (EMPA) and methylphosphonic acid (MPA), two degradation products contained in CVXH, if an accident occurs during handling and transportation, groundwater or surface water contamination and subsequent human ingestion is unlikely but possible. Limited data are available to determine the risks from exposure to nonlethal ingestion of EMPA and MPA. However, oral lethality studies indicate the two substances have a Hodge and Sterner toxicity rating of 4 (slightly toxic).

- Although the health effects demonstrated in animal toxicity studies of exposure to CVXH were not due to residual VX or EA 2192 (another degradation product, potentially present in CVXH, with nerve agent properties), the data in one of the cited studies were inconclusive due to the lack of appropriate study controls.

- The clearance criteria for VX and EA 2192 are suitable for the risk management approaches proposed by the Army. According to these criteria, the CVXH will be certified to be non-detected for VX and EA 2192 using analytical methods with an EPA method detection limit of • 20 ppb for VX and • 1 ppm for EA 2192. The 20 ppb criterion for VX is the same as that used for the U.S. Army emergency drinking water standard for soldiers.

Transportation Safety Assessment and Risk Management Plan

- The DuPont transportation plan appropriately addresses key risk management considerations, as well as DOT's regulations for transporting hazardous materials.
- Precautions used to manage the corrosivity hazard characteristic in the event of a spill are adequate to protect response personnel from the caustic nature of the CVXH, low-level residual agent VX, or residual EA 2192 at levels estimated for maximum credible event analysis.
- Transportation of CVXH produced when processing VX with the DIC stabilizer at 8% loading is feasible. However, transportation of CVXH produced with VX stabilized with DCC or at agent loadings greater than 8% is not recommended at this time because of uncertainties in the amount of organic layer and potential residual VX exceeding 20 ppb and/or EA 2192 exceeding 1 ppm.

Treatability of Newport Caustic Hydrolysate [Caustic VX Hydrolysate]

Production of Caustic VX Hydrolysate at NECDF

- The data demonstrate the effectiveness of neutralizing DIC-stabilized VX using sodium hydroxide at the 8% VX agent loading rate. Scale-up of the process from laboratory/bench-scale to pilot-scale should be feasible. However, because NECDF will be a pilot facility, process changes must be anticipated, along with resultant variations in hydrolysate composition sent for off-site treatment.
- The VX agent loading recipe and the specific stabilizer (DIC, DCC) employed significantly impacts the destruction process, hydrolysate composition, analytical methods validation, and possibly solids formation. Scale-up of the process from 8% to 16% VX agent loading and processing of DCC-stabilized VX are of particular concern because of the potentially significant VX concentration in the resulting organic layer, and possible problems in the analysis of CVXH. The process and analytical data for VX stabilized with DCC or mixtures of DIC and DCC have not been provided to CDC. [1]

[1] On March 2, 2005, CDC received the U.S. Army Technical Data Report 81-05, VX-Sodium Hydroxide Hydrolysate Manufacture (CAMDS 100 gallon reactor) dated August 26, 2003. CDC will include a review of this report in a subsequent report.

- The impact of potential solids formation during the hydrolysis process on operations (e.g. possible blockage of the in-line static mixer, control valves, and sampling system), VX analytical methods, and off-site hydrolysate treatment is unknown. The transition from 8% to 16% VX agent loading, as well as variation in the VX stabilizer characteristics, is of concern and requires additional detailed studies.

Analytical Methods for VX and EA 2192 in Caustic VX Hydrolysate

- The current analytical methods for the analysis of VX agent and EA 2192 in 8% VX loaded, DIC-stabilized CVXH are adequate to detect and quantify at the established clearance levels for VX (• 20 ppb) and EA 2192 (• 1 ppm).
- The Army's proposed use of EPA's method detection limit (MDL) concept in the clearance of off-site shipment does not preclude analytical instrument detection of low-levels of VX and EA 2192 (generally below 20 ppb for VX and 1 ppm for EA 2192) in the DIC-stabilized, 8% agent loading CVXH. The perception that the clearance criteria (defined as "non-detected" with a MDL of • 20 ppb VX or • 1 ppm EA 2192) indicate absence of analytically detectable VX and/or EA 2192 could be misleading. While CDC believes that utilizing the MDL approach would not result in public health concerns, the Army needs to address potential public misperceptions regarding the detection or non-detection of VX in CVXH. A simpler reporting scheme (i.e., non-detected, detected at <20 ppb, or detected at >20 ppb) should be considered.
- The overall quality assurance/quality control (QA/QC) plan and procedures for the NECDF laboratory are well designed and documented. However, NECDF laboratory personnel must continue to implement the QA/QC plan by developing day-to-day operational data to demonstrate that all analytical systems are operational and under control before plant startup.

Treatment of Caustic VX Hydrolysate at DuPont

- The DuPont facility should be able to effectively treat the CVXH generated from an 8% VX agent loading with DIC stabilizer (i.e., pH adjustment, thiolamine destruction, conversion of EMPA to MPA), with the exception of MPA, for which only minimal reduction has been demonstrated. DuPont has recent developed a process to remove phosphonates, including MPA. CDC will evaluate this process in a separate report.

- The performance of the DuPont facility should be unaffected when treatment of material is alternated between Aberdeen sulfur mustard hydrolysate and Newport CVXH.

- The DuPont treatability studies have not yet demonstrated the effective treatment of CVXH produced from 16% agent VX loading, nor has effective treatment been shown for CVXH produced from 8% agent VX loading, where the VX was originally stabilized with DCC or a mixture of DIC and DCC stabilizers.

Screening Level Ecological Risk Assessment for Discharge of Effluent from the Treatment of Newport Caustic Hydrolysate [Caustic VX Hydrolysate] - Summary of EPA Findings

As additional ecologic assessment information is made available, EPA and CDC will conduct further evaluation of this proposal.

- DuPont's Screening Level Ecological Risk Assessment (SLERA) does not contain information adequate to conclude that there is no unacceptable risk from the discharge of treated CVXH to the Delaware River. Also, a number of constituents of the discharged waste were omitted from the analysis.

- Several issues need to be addressed before treatment and discharge of this treated CVXH to the Delaware River can occur, including whole effluent toxicity testing procedures, potential for the presence of VX nerve agent and other toxic breakdown products in the CVXH, addition of phosphorus to the estuary, and the National Pollutant Discharge Elimination System permit.

- The EPA expressed concerns that the 20 ppb clearance criteria for VX is based "solely on the protection of humans from a drinking water source and may not be protective of aquatic organisms through ingestion or dermal exposure."

- EPA believes that the conclusions of the SLERA for discharge of treated CVXH in the Delaware River are not valid.

CONCLUSIONS

The potential human toxicity of the untreated CVXH predominantly is associated with its corrosive and caustic properties and not nerve agent effects, although low levels of VX and EA 2192 may be present in CVXH. The transportation plan meets DOT regulations, and precautions in the plan are adequate to protect the public and personnel. The database supports the position that CVXH produced with DIC-stabilized VX at the 8% VX agent loading level should meet the Army's clearance criteria for VX and EA 2192. Loadings greater than 8% of DIC stabilized VX or any treatment of VX stabilized with DCC is not recommended until the treatment effectiveness is demonstrated and confirmed. Therefore, based on information provided for this review, only a portion of the Newport VX stockpile can be processed to meet clearance criteria. The technical review of the DuPont SET indicated it is a viable process and should be capable of treating the CVXH. EPA's ecologic analysis indicates the DuPont assessment does not contain information adequate to determine that the ecologic risk from the discharge of treated CVXH to the Delaware River is acceptable. Consequently, CDC cannot recommend proceeding with the treatment and disposal at the DuPont SET facility until EPA's noted deficiencies are addressed.

Attachment #1

LIST OF ABBREVIATIONS

ALD	approximate lethal dose
ATSDR	Agency for Toxic Substances and Disease Registry
BOD5	five day biological oxygen demand
°C	degrees Celsius
cal/g	calories per gram
CAMDS	Chemical Agent Munitions Disposal System
Carmagen	Carmagen Engineering, Inc.
CAS	Chemical Abstract Services
CDC	Centers for Disease Control and Prevention
CFR	Code of Federal Regulations
CHPPM	U.S. Army Center for Health Promotion and Preventive Medicine
CVXH	Caustic VX Hydrolysate (equivalent to VX hydrolysate or Newport caustic hydrolysate)
CWA	chemical warfare agent
DA	U.S. Department of the Army
DCC	dicyclohexyldicarbodiimide
DIC	diisopropylcarbodiimide
DIP	dissolved inorganic phosphorus
DOC	effective dissolved organic carbon
DOT	U.S. Department of Transportation
EA 2192	S-[2-diisopropylaminoethyl] methylphosphonothioic acid
EMPA	ethyl methylphosphonic acid
EPA	U.S. Environmental Protection Agency
°F	degrees Fahrenheit
FMEA	Failure Mode and Effects Analysis
g	grams
g/L	grams per liter
GC/IT/MS/MS	gas chromatography coupled with ion-trap mass spectrometry
GC-ITMS	gas chromatography—ion -trap mass spectrometry
gpd	gallons per day
H_2O_2	hydrogen peroxide
H_2SO_4	sulfuric acid
HD	sulfur mustard
HI	Hazard Index
IERP	Integrated Emergency Response Plan
IMPA	isopropyl methylphosphonic acid
ISO tanks	transportable tote containers
LC/IT/MS/MS	liquid chromatography coupled with ion–trap mass spectrometry
LD_{50}	classical lethal dose in 50% of animal population
LLVX	Low Level VX
m/z	mass-to-charge ratio
MDL	[U.S. EPA defined] method detection limit
mg/kg	milligrams per kilogram

mg/kg/d	milligrams per kilogram per day
Min	minutes
MPA	methyl phosphonic acid
MSDS	Material Safety Data Sheet
N	nitrogen
N	not determined
NaOH	sodium hydroxide
NCEH	National Center for Environmental Health
NCH	Newport (Indiana) Caustic Hydrolysate (equivalent to caustic VX hydrolysate)
NECDF	Newport Chemical Agent Disposal Facility
NJDEP	New Jersey Department of Environmental Protection
NJPDES	New Jersey Pollution Discharge Elimination System
NPDES	National Pollutant Discharge Elimination System
NRC	National Research Council
OECD	Organization for Economic Cooperation and Development
P	phosphorus
PACT®	Powdered Activated Carbon Treatment System
PAM	pamphlet
pH	negative log of hydrogen ion concentration
PI	Performance Indicator
PMATA	Project Manager for Alternative Technologies and Approaches
ppb	parts per billion
ppm	parts per million
PRG	preliminary remediation goal
Q	acceptable [with] qualifications
QA/QC	quality assurance/quality control
QC	quality control
RCWA	recovered chemical warfare materials
RfD	reference dose
S/N	signal-to-noise
SAIC	Science Applications International Corporation
SAR	structure activity relationships
SCWO	Supercritical Water Oxidation
SET	[DuPont] Secure Environmental Treatment [Chamber Works]
SLERA	Screening Level Ecological Risk Assessment
SPE	solid-phase extraction
TB MED	Army's Medical Technical Bulletin
Team	Carmagen Team
TSDF	Treatment, Storage, and Disposal Facility
U	unacceptable
µg/mL	microgram per milliliter
USEPA	U.S. Environmental Protection Agency
VX	O-ethyl S-([2-(diisopropylamino) ethyl)] methyl phosphonothioate
wt. %	weight percent

Attachment #2

Review of the Toxicology and Health Hazard Considerations for Safe Management of Newport (Indiana) Caustic VX Hydrolysate

By

Agency for Toxic Substances and Disease Registry
in collaboration with the
Centers for Disease Control and Prevention
Atlanta, Georgia

November 3, 2004

SUMMARY

The Centers for Disease Control and Prevention (CDC) requested that the Agency for Toxic Substances and Disease Registry (ATSDR) assess DuPont Report 14523, *Toxicology Assessment of Health Hazard Considerations for Safe Management of Newport Caustic Hydrolysate,* dated March 3, 2004, and its supporting documentation as part of a larger evaluation of the proposed transportation and disposal of caustic VX hydrolysate (CVXH), waste material produced by the reaction of the nerve agent VX with sodium hydroxide. In response to this request, ATSDR conducted the following assessment in collaboration with CDC. Please note that in this report, the more technically accurate term *CVXH* generally is used in place of *Newport caustic hydrolysate* or *NCH.*

It should be noted that the CVXH toxicity testing discussed in ATSDR's assessment was conducted on 33 weight percent loading material. The current treatment plan by the Army is to process at an 8 weight percent loading. Because of the lower loading in the current plan, the toxicity testing that was conducted at the higher loading percentages should be considered "worst case" in terms of the potential toxicity of the CVXH.

The major findings and conclusions of the ATSDR assessment are as follows:

- The untreated CVXH is highly corrosive. The major human exposure pathway for the material is dermal contact, which could result in severe, possibly irreversible, burns to the skin or eyes. Overall, the health risk from exposure resulting from an accidental spill appears comparable with that expected for any highly corrosive material with high pH.
- Although the individual toxicity studies are limited in scope and applicability, the studies—considered in their totality—do not preclude the handling and transportation of untreated CVXH if appropriate engineering and administrative controls and personal protective equipment are used.
- The supporting studies do not provide adequate data on the nature of the toxicity of ethyl methylphosphonic acid (EMPA) and methyl phosphonic acid (MPA) (constituents of CVXH). EMPA and MPA are highly water soluble; therefore, if an accident occurs during handling and transportation, groundwater or surface water contamination and subsequent human ingestion are unlikely, but possible, outcomes. Limited data are available to determine the risks from exposure to nonlethal ingestion of EMPA and MPA. However, oral lethality studies indicate the two substances have a Hodge and Sterner toxicity rating of 4 (slightly toxic).
- While the effects in animals following administration of CVXH are not likely due to residual VX or EA 2192 (a degradation product of VX with nerve agent properties potentially present in CVXH), the data in one of the cited studies are not conclusive due to lack of appropriate controls.
- Clearance criteria for VX and EA 2192 are suitable for the risk management approaches presented.

INTRODUCTION

ATSDR was provided copies of the toxicity studies examined by DuPont, as well as other studies commissioned by the Army or its contractors. The studies examined major components of the CVXH. Because neither the studies cited by DuPont nor the other toxicity studies provided were peer-reviewed, ATSDR first had the studies peer-reviewed. An ATSDR contractor identified nongovernmental independent professionals for the peer review. After receiving the peer-reviewer comments, ATSDR reviewed DuPont's report and referenced studies to generate the following comments.

DuPont stated that its assessment of potential health risks of CVXH was conducted to support decisions related to the transportation and treatment of CVXH at the DuPont Secure Environmental Treatment (SET) facility. DuPont and the Army proposed that the CVXH be transported from the Newport Chemical Agent Disposal Facility in Newport, Indiana, to the DuPont SET Facility in Deepwater, New Jersey, for final treatment and discharged into the Delaware River.

The DuPont assessment states that the composition of the CVXH is 80% water with minor amounts of sodium hydroxide (Chemical Abstract Services [CAS]# 1310-73-2), diisopropylamino ethylthiolate (thiolamine, CAS# 5842-07-9), ethyl methylphosphonic acid (EMPA, CAS# 1832-53-7), and methylphosphonic acid (MPA, CAS# 993-13-5). Approximately 1% is composed of "other compounds," including ethanol (CAS# 64-17-5), diisopropylamino ethyl disulfide (CAS# 65332-44-7), and diisopropylamine (CAS# 108-18-9).

ANALYSIS AND DISCUSSION

DuPont's assessment concludes CVXH is not a Department of Transportation (DOT) poison or toxic material and has no nerve agent characteristics. DuPont indicates that CVXH is corrosive and capable of damaging the eye and skin after contact exposure. Gastrointestinal injury can result from ingestion. In support of these conclusions, the DuPont assessment of CVXH cited the following studies:

- Finlay, C. Ethyl Methylphosphonate: Oral Approximate Lethal Dose (ALD) in Rats. Haskell Laboratories, February 26, 2004.
- Finlay, C. Methylphosphonic Acid: Oral Approximate Lethal Dose (ALD) in Rats. Haskell Laboratories, February 26, 2004.
- Manthei J, Way R, Gaviola B, Burnett D, Bona D, Durst H, Thompson S. Toxicological Evaluation of VX Decontamination Wastestreams According to DOT Test Procedures, February 1999.
- Kemper, R. Ethyl Methylphosphonate: Computational Toxicology Analysis. Haskell Laboratories, March 1, 2004.
- Kemper, R. Methylphosphonic Acid: Computational Toxicology Analysis. Haskell Laboratories, March 1, 2004.

The Army subsequently provided additional studies:

- Manthei J, Way R, Gaviola B, Bona D, Burnett D. Alternative Technology Program: Intravenous Toxicological Evaluation of Four VX Wastestreams in Mice." U.S. Army ERDEC, ECBC-TR-173, August 2001.
- Janus, E.R. Analysis of EA2192 Monitoring and Sampling Issues at Newport Chemical Agent Disposal Facility. Environmental Health Risk Assessment Program. U.S. Army Center for Health Promotion and Preventive Medicine, November 2001.
- McDonald, J., and Campen M., Revised Final Report, Acute Inhalation Toxicity Testing of 2-(diisopropylamino)Ethyl Mercaptan. Lovelace Respiratory Research Institute, April 2, 2004.

Analysis of the Finlay (2004) studies

The studies conducted by Finlay (2004) determined a lethal dose of 2300 milligram per kilogram (mg/kg) and 3400 mg/kg for MPA and EMPA, respectively. The chemicals were administered as a single oral (intragastric intubation) dose to one rat per dose level; body weights and clinical signs of toxicity were observed for 14 days postexposure. These studies provide useful information about lethality. The Finlay (2004) studies were "approximate lethal dose" studies that use fewer animals but have been shown to closely predict the results of classical lethal dose in 50% of animal population (LD_{50}) studies. However, the studies presented no information to assess the nature of the acute toxicity—that is, this study generated no information about the type of toxic effects (i.e., organ system affected). Therefore, DuPont's statement in its toxicology assessment—"...MPA and EMPA have relatively low acute oral toxicity..."—provides limited perspective on the toxicity of these components of CVXH. In reality, the Findlay studies were lethality studies, not acute exposure studies; the "acutely toxic effects" observed at 2300 mg/kg MPA and 3400 mg/kg EMPA were death. With respect to handling and transportation of CVXH, however, the likelihood of ingestion of CVXH (including MPA and EMPA) is low. The Hodge and Sterner toxicity rating for MPA and EMPA is 4 (slightly toxic). Therefore, although cited studies were limited in scope, when considered in conjunction with the toxicity rating and potential exposure scenarios, MPA and EMPA components do not introduce excess risk in handling and transportation activities.

Analysis of the Manthei et al. (1999) study

The Manthei et al. (1999) study, performed by the Army, provided toxicity data to establish shipping and packaging criteria (for CVXH) according to 49 Code of Federal Regulations (CFR). In this study, severe dermal injuries occurred when the CVXH homogenate was applied to rabbit skin at 1000 mg/kg; and gastrointestinal injury and death (two of 12 rats) occurred in rats dosed orally at 500 mg/kg. The study concluded that this compound was less than a Level III toxic according to 49 CFR. If, as is our understanding, the Level III requirement is for an LD_{50} of <500 mg/kg, then the CVXH would appear to meet this requirement. For caustic compounds, 40 CFR outlines

corrosivity characterization needs. Under some circumstances, DOT recommends further toxicity tests for more complete characterization (49 CFR 173.137 and 1992 Organization for Economic Cooperation and Development Guideline No. 404).

Additionally, toxicity testing of the top organic layer of test material killed 12 of 12 dermally treated rabbits (500 mg/kg) and 12 of 12 orally treated rats (1000 mg/kg). The animals died from agent (VX)-associated effects. Subsequent testing revealed that the organic layer contained 2000 ppm VX. The Manthei et al. (1999) abstract states that a follow-up study would be conducted, but as of this writing, no follow-up study has been provided. However, it is clear that the samples were contaminated with VX as a result of laboratory error, rendering the results of this study questionable. Furthermore, this high-level VX contamination was not consistent with other work by the same laboratory. In summary, the results of this particular part of the Manthei et al. (1999) study must be discounted as not representative of the toxicity of CVXH.

DuPont's assessment states that the CVXH contains no VX (later clarified to "no detectable VX) with a MDL (method detection limit) of twenty parts per billion (ppb) or less" (DuPont Position on the Question of VX in Hydrolysate, July 24, 2004). The ATSDR review assumes this to be the case because the CVXH will be analyzed for VX and must meet the 20 ppb criteria before shipment.

Analysis of the Manthei (2001) Study

In another study by Manthei (2001), adult, male ICR mice were dosed intravenously with CVXH. LD_{50} values were calculated to be 349.5 mg/kg, 39.0 mg/kg, and 279.3 mg/kg for the bottom, top, and homogenate samples, respectively. Chemical analysis indicated no VX at or above the detection limit of 20 ppb in the bottom layer or the homogenate. The top layer was not analyzed for VX. Effects observed included convulsions, exophthalmus, straub tail, collapse, and prostration. Although the toxic signs in the mice probably resulted from by-product salts, the investigators did not use controls needed to determine whether the effects were due strictly to the by-product salts and not to residual VX or EA 2192. The conclusion was based on the absence of observed tremors and salivation. The use of controls or acetylcholinesterase activity would have provided more definitive results. ATSDR concludes that the upper organic layer material on CVXH is more toxic than the aqueous lower layer, and the effects in the animals probably resulted from by-product salts and high pH (caustic nature).

Analysis of the McDonald and Campen (2004) Study

The McDonald and Campen (2004) study was designed as an acute toxicity screen for diisopropylamino ethylthiolate (thiolamine), which typically is used as a basis for establishing a dose regimen in subchronic and other studies. Decreased body weight gain and nasal porphyrin accumulation was observed in the high dose groups (316 mg/m^3). Because no sham or age-matched control animals were used in this study, it is not possible to draw definitive conclusions about these effects. McDonald and Campen (2004) noted the pathology analysis was a crude indicator of a lack of toxicity of this

component of CVXH. The usefulness of this study in assessing inhalation toxicity of thiolamine for use in the CVXH assessment is limited.

Analysis of the Kemper (2004) studies

As stated in the DuPont assessment, the computational toxicology analyses of MPA and EMPA (Kemper 2004) did not provide useful predictions of the acute toxicity of these chemicals. The positive predictions of toxicity for developmental effects for both MPA and EMPA (by the Toxicity Prediction by Computer-Assisted Technology [TOPKAT] model), and bacterial mutagenicity for EMPA (by the Deductive Estimation of Risk from Existing Knowledge [DEREK] model), and the negative prediction for skin sensitization (by TOPKAT) are not reliable because the query structures are poorly represented in the TOPKAT or DEREK models' datasets. The report also provides a nonuseful large predictive oral LD_{50} range (which appears to be the predicted 95% confidence limits), instead of the single predicted LD_{50} value it should have provided. Thus, ATSDR agrees with DuPont that the Structure Activity Relationships analyses performed did not provide useful predictions of the toxicity of these chemicals.

The results of the DEREK analysis (by Kemper 2004) suggested that EMPA could cause mutagenic effects in bacteria. The DuPont document states that mutagenicity is unlikely on the basis of negative test results for isopropyl methylphosphonate (IMPA), a close structural analogue of EMPA. However, because of its chemical structure, IMPA would not be expected to react similarly in the body as EMPA. Thus, whether IMPA should be used as a surrogate to make conclusions about the mutagenicity of EMPA is not clear.

Analysis of the Janus (2001) Study

The purpose of the Janus (2001) paper was to calculate a Performance Indicator (PI) value for EA 2192. The document states that PIs are "developed to monitor and evaluate discrete subsystem requirements that must be demonstrated to achieve the design and technical performance goals of the Newport Pilot Plant." The document briefly discusses the relative potency of VX and EA 2192, stating that EA 2192 toxicity is generally within the same order of magnitude as VX, therefore, it is appropriate to use the interim VX reference dose (RfD) to calculate the PI for EA 2192. The document uses an algorithm to calculate the PI that is based on U.S. Environmental Protection Agency (EPA) Region IX's Preliminary Remediation Goal (PRG) approach. In this algorithm, the interim oral RfD for VX (of 6E-07 mg/kg/day) is used to develop a dermal PI value of 1.128 ppm for EA 2192. The PI methodology appears appropriate; however, the EPA PRG User's Guide/Technical Background Document states, "For many chemicals, a scientifically defensible data base does not exist for making an adjustment to the oral slope factor/RfD to estimate a dermal toxicity value." Whether the permeability coefficient, as used in the PI algorithm, is appropriate is unclear because the caustic nature of the CVXH will compromise the ability of the stratum corneum to serve as a protective barrier, thereby allowing more direct entry. Nonetheless, Manthei et al. (1999) did not observe VX or EA 2192 effects after dermal application of caustic VX hydrolysate to rabbits (1000 mg/kg

for 24 hours). Therefore, ATSDR believes that the PI appears to be suitable for worker protection when appropriate personal protective equipment is used to handle CVXH.

FINDINGS

- Although the individual toxicity studies were limited in scope and applicability, the studies considered in their totality do not preclude the handling and transportation of CVXH, assuming appropriate engineering, administrative, and personal protection policies are in place.

- Although the studies on MPA and EMPA do not provide data on the nature of the toxicity, the oral lethality studies indicate that the two compounds have a Hodge and Sterner toxicity rating of 4 (slightly toxic). Furthermore, oral ingestion of MPA and EMPA during handling and transportation of CVXH is unlikely.

- MPA and EMPA are highly water-soluble; therefore, if an accident occurs during handling and transportation, groundwater or surface water contamination and subsequent human ingestion is an unlikely, but possible outcome. Data are insufficient to determine the risks from exposure to nonlethal ingestion of MPA and EMPA.

- Information about thiolamine is limited. Mercaptans in general are well-known noxious volatile odorants and skin irritants.

- Although the effects noted in the intravenous studies (Manthei et al. 2001) probably do not result from residual VX or EA 2192 in the CVXH, the data are not conclusive because of a lack of appropriate controls to distinguish between agent effects and by-product salts or high pH (caustic) at the 33% VX loading. In another study (Manthei et al. 1999), lack of nerve agent effects were observed after CVXH exposure in dermally exposed rabbits and orally exposed rats.

- The PI of 1 ppm for EA 2192 appears to be adequate given the Manthei et al. (1999) data, which did not note any VX or EA 2192 effects in rabbits after dermal exposure to CVXH. Although no chemical analysis for EA 2192 was conducted, this CVXH fraction obtained from a 33% VX loading is assumed to have contained at least representative quantities of EA 2192. For the 8 weight percent loading CVXH planned for disposal, the concentration of EA 2192 probably would be lower than that found in these experiments.

- As the DuPont assessment indicates, CVXH is highly corrosive. This is supported by the Manthei et al. (1999) study and the chemical property information. The major human exposure pathway is dermal contact, which will result in severe, possibly irreversible damage. Eye injury is also possible, and inhalation of aerosolized CVXH potentially could damage the respiratory tract.

CONCLUSION

ATSDR believes that, in the event of an exposure after an acute release, the greatest concern would be the caustic nature of the CVXH, which potentially could cause severe burns upon contact. Overall, the risk from an accidental spill appears to be comparable with what would be expected for any highly corrosive material with a high pH.

Attachment #3

Review of the Transportation and Risk Management Provisions for Caustic VX Hydrolysate

By

Centers for Disease Control and Prevention
in collaboration with the
Department of Transportation

INTRODUCTION

CDC prepared this report to analyze DuPont's *Transportation Safety Assessment and Risk Management Plan* Safety, dated March 3, 2004. CDC considered this component of the response from two perspectives, described as follows:

First, CDC determined whether the transportation plan is consistent with Department of Transportation (DOT) requirements for shipping hazardous materials from the point of generation—Newport, Indiana—to the point of final treatment and disposal—Deepwater, New Jersey. This determination differs from typical CDC reviews because of the different hazard characteristics and larger volumes involved; therefore, CDC requested and received assistance from DOT in conducting this part of the review.

Second, CDC determined whether the safeguards, emergency planning, and other risk management considerations that will be applied to this proposed project are comparable to transportation of other potentially hazardous substances, such as recovered chemical weapons material (RCWM). Some of the criteria considered by CDC included route selection considerations, shipping containment provisions, emergency planning, and notification activities. CDC is conducting this analysis directly. Considerable overlap exists in the safety considerations required by DOT and the safety provisions considered by CDC in reviews of RCWM transportation plans.

BACKGROUND

The Newport Chemical Agent Disposal Facility proposes to treat agent VX with sodium hydroxide to produce caustic VX hydrolysate (CVXH) with no agent detected ≤20 parts per billion (ppb). This clearance criteria is equivalent to the Army's drinking water standard for nerve agents for field use by soldiers, and CDC considers it appropriately conservative for use as a clearance criteria for shipment of waste.

The CVXH can be characterized as being predominantly caustic and aqueous with a smaller organic fraction, the extent of which depends on the VX loading rate used in the batch process. Batch VX loadings of 8%, 16%, and 33% have been examined for the Newport facility. The current plan calls for plant startup using an 8% loading of VX stabilized with diisopropylcarbodiimide (DIC), and this is the only VX loading rate fully evaluated in this review. Please note that in this report, the more technically accurate term *CVXH* generally is used in place of *Newport caustic hydrolysate* or *NCH.*

Other major by-products of interest in the caustic VX hydrolysate are ethyl methyl phosphonic acid (EMPA), methyl phosphonic acid (MPA), thiolamine, and EA 2192. EMPA and MPA are of interest because of their potential for persistence in the environment, and thiolamine is of interest because of its strong and disagreeable characteristic odor. As a general matter, EA 2192 exhibits nerve agent properties similar to VX. However, EA 2192 will be limited to ≤1 part per million (ppm) for a cleared batch of CVXH, a concentration deemed by CDC to be suitable for the risk management

practices contained in this proposal. Toxicity considerations of these by-products are discussed in the full CDC report.

DISCUSSION

CDC considers four broad functional areas applicable to the proposed Newport CVXH transportation plan.

- Packaging and Containment—The DuPont transportation plan discusses several options for the containment, including dedicated tank trucks and transportable tote containers ("ISO tanks"). The materials of construction and strength of the container design were considered, as were placement of valves, remote operability characteristics designed to minimize personnel potential exposure to tank contents, and vulnerability of the valves to bump hazards. DOT, in correspondence to CDC, noted that the plan "proposes to use equipment and procedures that go beyond what the regulations require for materials with the specific hazard and risk involved."[1]
- Personnel Qualifications—The transportation plan proposes use of two hazardous materials shippers that have "excellent safety records" as evidenced by "very low DOT recordable accident rates" and "very favorable DOT safety ratings." Each of the two shippers reportedly maintains high qualification standards by employing experienced personnel who have passed rigorous background checks. Extensive training, including hazardous materials spill response, will be required of the drivers for this project. A team of two prequalified drivers will be used for each trip.
- Route Planning—DuPont analyzed potential risk associated with four identified highway routes and one combined rail and highway route for transporting the CVXH from Newport, Indiana, to Deepwater, New Jersey. Factors considered included number, length, and duration of each trip; accident potential based on historic truck accident rates for each route; general population exposure potential for each route; potential environmental impact from accidental CVXH release for each route; and emergency response capability for each route. A commercially available risk analysis algorithm was used to quantitatively estimate total potential impact potential for each route option analyzed.
- Emergency Preparedness—DuPont describes its Integrated Emergency Response Plan (IERP) used to support ongoing transportation incidents. A detailed specific emergency response plan would be developed for this proposed CVXH shipping plan and shared with appropriate state and local responders along the selected transportation route. DuPont also has IERP teams in place in Belle, West Virginia, and Deepwater, New Jersey, to serve as regional service centers to support incident responses if needed. In accordance with the IERP, these teams consult with and advise on-scene DuPont personnel and local emergency response personnel. As needed, additional on-scene advisors or response resources may be deployed.

[1] E-mail correspondence from Reeves (DOT) to Decker (CDC), May 19, 2004, re: Transportation Plan for Chemical Weapons Waste

DuPont's transportation analysis is predicated on the assumption that the CVXH poses a corrosivity hazard with no attendant nerve agent properties. Most transportation plans reviewed by CDC involve limited amounts of chemical warfare agents moved in one or a very limited number of moves. This plan differs both in the volumes of and predominant characterization of the material to be moved.

CDC asked DOT personnel to review the DuPont transportation plan for overall consistency with DOT requirements for hauling hazardous materials. DOT determined the plan generally met or exceeded DOT requirements. However, DOT recommended that the shipping designation for the CVXH be reconsidered to reflect that it is a corrosive liquid, basic, inorganic, not otherwise specified, rather than the organic corrosive designation described in the plan. DOT's review reflected DuPont's characterization of the CVXH.

In evaluating RCWM transportation plans, CDC also typically reviews agent air monitoring. Air monitoring for chemical agent before and after a move of RCWM is usually an integral part of a plan to detect any breech in containment so corrective action can be taken. For the CVXH, the Army and DuPont have stated that VX agent is required to be destroyed to ≤20 ppb to qualify for shipment.[2] Because this clearance level would produce minimal safety hazard when compared with the corrosive nature of the CVXH, agent air monitoring for VX would not be useful and consequently was not included in the DuPont proposal.

Batch processing studies indicate that, if VX survives, it would partition into the organic fraction of the caustic VX hydrolysate. The Army has stated that, at an 8%–16% VX loading, the organic fraction should be limited to approximately <1%–3% of VX hydrolysate. In the absence of mixing or agitation, the organic fraction separates, and layers on top of the aqueous component of the CVXH. At an 8% VX (DIC-stabilized) batch loading, the organic layer remains nearly indistinguishable from the much larger inorganic, aqueous fraction. The CVXH will be reprocessed if VX is detected above the MDL. However, the current sampling and analytical method used for process batch clearance does not attempt to evaluate potential VX in the organic layer of CVXH but instead evaluates the organic and aqueous components as a mixture.

Examination of the impact of potential agent VX survival in the organic fraction of the CVXH requires estimation of an upper-bound level for the VX concentration within this fraction. On the basis of existing batch studies, CDC believes a reasonable upper-bound estimate is approximately 1–10 ppm of residual VX. This assumes a maximum of ≤20 ppb VX for the CVXH mixture and a VX loading of 8%. CDC noted, however, that one study showed a VX residual of approximately 2100 ppm in the organic layer (at a VX feed rate of 33%) of VX/sodium hydroxide (NaOH) batch hydrolysate,[3] despite analysis

[2] Presentation to CDC by Parsons and U.S. Army Chemical Materials Agency, May 24, 2004, re: Response to CDC questions regarding proposed operations at the Newport Chemical Agent Disposal Facility.
[3] Manthei JH, Way RA, Gaviola BI, et al. Toxicological Evaluation of VX Decontamination Wastestreams According to Department of Transportation (DOT) Test Procedures, U.S. Army ERDEC, 1999 February.

showing that the hydrolysate mixture had ≤20 ppb VX. CDC contacted the lead author on this study to ask whether follow-up work was conducted to resolve and clarify this finding. Although recommended, the study was not repeated. The author believed, however, that this VX finding in the organic layer resulted from a sample mishandling in the laboratory and is not consistent with his laboratory's other studies of VX/NaOH hydrolysate.

A maximum credible event could involve a 5000-gallon tank truck or tote in an in-transit accident that ruptures the containment. If the above study result is the outlier it appears to be, then human exposure to VX at an estimated maximum of 1–10 ppm could occur with direct, unprotected contact with the organic fraction of the spilled material. The nerve agent effects of this level of VX and possible concurrent EA 2192 at the 1-ppm level are difficult to assess. However, to reach this maximum exposure to VX, the organic fraction (estimated at <0.5% by volume of the total contents for the 8% loading level CVXH) would need to remain undiluted from any mixing from the spill, which CDC believes is highly unlikely. Mixture and dilution of the organic fraction with the much larger aqueous fraction, to the extent that the corrosivity of the spilled material would present the most significant hazard, would be more likely.

Inhalation exposure to VX vapor in a spill is believed to be negligible given its low initial assumed concentration in the CVXH and the relatively low volatility of VX. Because of the corrosivity of the bulk of the CVXH, emergency responders are required to take appropriate precautions to avoid contact with the spilled material; consequently, prevention of exposure to low residual VX, even if the organic fraction remains intact, should not require extraordinary measures. As with any release of hazardous liquid materials, untrained observers and the public should be kept away from the active response zone.[4]

To be thorough, CDC sought to evaluate the likelihood and potential impact of a shipment of off-specification CVXH that could contain residual VX above the clearance level (≥20 ppb VX). At CDC's request, the Army's contractor evaluated the probability of human or system error resulting in shipping of off-specification CVXH.[5]

The review of off-specification scenarios identified a potential cross-contamination link (a three-way valve that controls flow of both hydrolysate and agent) that could result in agent VX reaching the CVXH holding tank after batch reactor sampling. This potential link, without mitigation, reportedly would result in a calculated annual event frequency of shipping off-specification CVXH of approximately 1 per 20,000. Processing estimates for NECDF range from a low of less than 200 shipments per year up to a maximum of about 900 shipments per year if the entire stockpile is processed in one year. For cross-contamination to risk health or safety of transportation personnel would require

[4] The risk concerns of residual VX discussed herein also would apply to the low level residual EA 2192 that could reside in the hydrolysate.

[5] "Quantitative Subsystem Hazard Analysis of Potential for Off Site Transfer of Hydrolysate Containing Above the 20 ppb Method Detection Limit", Mary Kay O'Connor Process Safety Center, Texas A&M University System (TAMUS), August 2004.

coincidence of the event with a shipping accident large enough to release the VX hydrolysate and to splash the drivers or other people who might be in the area of the accident. The DuPont transportation review estimates the maximum likelihood of an accident involving a release of CVXH at 1 in 13,000. This estimate is based on actual observed transportation accident statistics in the United States. Combining the probabilities of two independent events—an off-specification shipment of CVXH involved in an accident severe enough to release its contents—yields an event likelihood of well under 1 in 1,000,000, which risk management specialists consider insignificant. Add to this the probability of a responder or other person being splashed during the event, and the total risk would be further reduced. Nonetheless, Dupont should consider deferring CVXH shipment during severe weather, such as heavy prolonged rains, icing, and snowstorms, to reduce accident risk.

CDC believes the potential agent-related risk to human health and safety from a transportation accident involving off-specification CVXH is negligible. Nonetheless, the Material Safety Data Sheet (MSDS) for CVXH should recommend as a precaution that medical response personnel evaluate anyone having direct skin contact with released CVXH for possible nerve agent effects so appropriate medical intervention can be taken if needed. However, nerve agent effects are extremely unlikely, and the corrosiveness of caustic VX hydrolysate is likely to be the major concern.

Finally, the highly odorous nature of normal-process CVXH should be noted. Although the cause of the odors would not be expected to result in adverse health impacts directly, knowledge that the spilled material originated from a facility processing agent VX could result in considerable confusion and possible panic during the event. This characteristic of CVXH should be described clearly to avoid potential misunderstandings. The MSDS for CVXH should alert responders to its disagreeable odor characteristics to help inform both responders and the public and to minimize possible confusion or concern over exposure to airborne VX.

CONCLUSIONS

This transportation analysis was based on information about CVXH produced with VX at the 8% loading level and stabilized with DIC. The remainder of the stockpiled VX, which is stabilized with DCC or with a mixture of DIC and DCC, is not addressed in this review because of inadequate characterization of the organic layer.

The DuPont plan appropriately addresses CDC's key risk management considerations, as well as DOT's requirements for transporting hazardous materials. The predominant potential hazard during transportation of CVXH is its corrosivity. Precautions used to manage this hazard in a spill are adequate to protect response personnel from the low-level residual agent VX or residual EA 2192 at levels estimated for maximum credible event analysis.

MATERIALS REVIEWED

1. E-mail correspondence from Reeves (DOT) to Decker (CDC), May 19, 2004, re: Transportation Plan for Chemical Weapons Waste

2. Presentation to CDC by Parsons and U.S. Army Chemical Materials Agency, May 24, 2004, re: Response to CDC questions regarding proposed operations at the Newport Chemical Agent Disposal Facility.

3. Manthei J, Way R, Gaviola B, Burnett D, Bona D, Durst H, Thompson S. Toxicological Evaluation of VX Decontamination Wastestreams According to DOT Test Procedures, February 1999.

4. Manthei J, Way R, Gaviola B, Bona D, Burnett D. "Alternative Technology Program: Intravenous Toxicological Evaluation of Four VX Wastestreams in Mice." U.S. Army ERDEC, ECBC-TR-173, August 2001.

5. "Quantitative Subsystem Hazard Analysis of Potential for Off Site Transfer of Hydrolysate Containing Above the 20 ppb Method Detection Limit", Mary Kay O'Connor Process Safety Center, Texas A&M University System (TAMUS), August 2004.

6. DuPont Technical Assessment on U.S. Army Newport (Indiana) Project, Executive Summary, E.I. du Pont de Nemours and Company, March 2004.

7. Burke C. Transportation Safety Assessment and Risk Management Plan – Shipments of Newport (Indiana) Caustic Hydrolysate (NCH) Newport IN to Deepwater NJ, DuPont Safety, Health and Environment Excellence Center, March 2004.

8. Zimmerman G, Ensminger J, Saulsbury J. Transportation Analysis for the Off-Site Shipment of Liquid Process Effluent from the Newport Chemical Agent Disposal Facility at the Newport Chemical Depot, Indiana, Oak Ridge National Laboratory for the U.S. Army Chemical Materials Agency, December 2003.

Attachment #4

Assessment of the Treatability of Caustic VX Hydrolysate at the DuPont Secure Environmental Treatment Facility

By

Carmagen Engineering, Inc.
in consultation with the
Centers for Disease Control and Prevention

November 3, 2004

SUMMARY

To completely ascertain the capability and effectiveness of the DuPont Secure Environmental Treatment (SET) facility to treat caustic VX hydrolysate (CVXH), the Centers for Disease Control and Prevention (CDC) and Carmagen Engineering, Inc. (Carmagen), recognized that, in addition to reviewing the DuPont treatability test results, the Newport Chemical Agent Disposal Facility (NECDF) destruction process and the analytical methodologies for CVXH clearance also had to be assessed to ensure that the hydrolysate being shipped to the SET facility will be adequately characterized and that VX and EA 2192 levels in the CVXH will meet Army clearance specifications. Please note that in this report, the more technically accurate term *CVXH* generally is used in place of *Newport caustic hydrolysate* or *NCH*. These assessments were considered essential elements to ensure safe SET facility operations. Therefore, the Carmagen Team (Team) focused its review in three areas consisting of (1) process issues at NECDF, (2) analytical methods, and (3) CVXH treatment at DuPont. The review comprised several meetings with people from the Army, Chemical Materials Agency, Parsons, and DuPont at which presentations were made, followed by in-depth discussions. These meetings were followed up by written questions and requests for additional documentation. Documentation received in response to the Team's questions and requests for additional information was substantial.

The major findings from the three areas examined by the Team are shown below. *These findings are valid only for an 8% diisopropylcarbodiimide (DIC)-stabilized VX hydrolysate. The current database is insufficient to allow extrapolation to other VX loadings or stabilizers.*

Process Issues (Chapter 2)

Only laboratory/bench-scale runs have been completed for the process, and scale-up to the integrated full-size facility is based on anticipated processing conditions. Recently, several safety studies were completed that recommended changes in the design and operation of the NECDF. The impact of the responses to these recommendations and possible facility changes on the final process is unknown.

Finding 2.1. The database supports the efficacy of neutralizing DIC-stabilized VX using sodium hydroxide at the 8% VX-loading rate. Scale-up of the process from laboratory/bench scale to pilot scale should be operationally feasible. However, because the NECDF will be a pilot facility, changes must be anticipated in operating mode and hydrolysate composition sent for off-site treatment.

Finding 2.2. VX loading (weight percent) and the specific stabilizer (DIC; dicyclohexyldicarbodiimide [DCC]) employed significantly impact the process, hydrolysate composition, analytical methods validation, and possibly solids formation. Scale-up of the process from 8% to 16% VX loading is of particular concern (because of the similarity of the organic-phase volumes from 16% to 33% VX-loading batches), the potentially high VX concentration in the resulting organic layer, and the analytical problems identified with 33% VX loading.

Finding 2.3. The impact is unknown of solids formation during hydrolysis on operations (potential for blockage of the in-line static mixer, control valves, and sampling system), VX analytic methods, and off-site hydrolysate treatment. The transition from 8% to 16% VX loading, as well as stabilizer change, is of concern and requires additional detailed studies.

Analytical Methods (Chapter 3)

The purpose of the review and evaluation of the analytical methods was to define the adequacy of the proposed NECDF analytical methods to meet current programmatic requirements for detecting and quantifying VX and EA 2192 in the CVXH.

Finding 3.1. The methods for analyzing VX and EA 2192 in 8% VX-loaded, DIC-stabilized CVXH are adequate to detect and quantify at the established clearance levels for VX and EA 2192 (non-detected with a U.S. Environmental Protection Agency (EPA) method detection limit (MDL) of ≤20 parts per billion [ppb] for VX and ≤1 part per million [ppm] for EA 2192).

Finding 3.2. The use of the EPA's method detection limit (MDL) for clearance levels does not preclude analytical instrument detection of low levels of VX and EA 2192 (generally <20 ppb VX and <1 ppm EA 2192) in the CVXH. The perception that the MDL clearance criteria indicate absence of analytically detectable VX and EA 2192 could be misleading. While CDC believes that utilizing the MDL approach would not result in public health concerns, the Army needs to address potential public misperceptions regarding the detection or non-detection of VX in CVXH. A simpler reporting scheme (i.e., non-detected, detected at <20 ppb, or detected at >20 ppb) should be considered.

Finding 3.3. The overall quality assurance (QA) and quality control (QC) plan and procedures for the NECDF laboratory are well designed and documented. However, NECDF laboratory personnel must continue to implement the QA/QC plan by developing day-to-day operational QC data to demonstrate that all analytical systems are operational and under control before plant startup.

Caustic VX Hydrolysate Treatment (Chapter 4)

Once transported to the SET facility, CVXH will be further treated to adjust the pH and remove the organic by-products by a series of physicochemical and biologic processes. The DuPont treatability studies were designed and executed to obtain scale-up parameters for engineering design and regulatory compliance, rather than (except for a few specific species) to assess fate, transport, and biodegradability of environmental contaminates. The treatability studies also investigated the capability of the SET facility to treat alternating hydrolysate feeds from Aberdeen (sulfur mustard [HD]) and Newport (VX).

Finding 4.1 The SET facility effectively treats the CVXH generated from an 8% VX loading with DIC stabilizer (i.e., pH adjustment, thiolamine destruction, conversion of ethyl methylphosphonic acid to methyl phosphonic acid [MPA]), except for MPA, for which only minimal reduction is demonstrated.

Finding 4.2. The SET facility treatment performance should be unaffected when treatment of hydrolysate feeds from Aberdeen (HD) and Newport (VX) is alternated.

Finding 4.3. The DuPont treatability studies have not yet demonstrated the effective treatment of 16% VX-loaded CVXH, nor of 8% VX-loaded CVXH with DCC or a mixture of DIC and DCC stabilizers.

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1. Introduction

1.1 Background

The Newport Chemical Depot, Newport, Indiana, stockpile comprises the chemical nerve agent O-ethyl S-[2- (diisopropylamino) ethyl] methyl phosphonothiolate (VX) stored in bulk quantities (1269 tons in 1690 containers). VX contains phosphorus double-bonded to an oxygen atom and single-bonded to a carbon atom. VX is stabilized with several percent of either diisopropylcarbodiimide (DIC) or dicyclohexyldicarbodiimide (DCC) to protect against decomposition. Forty-six percent of the stockpile at Newport consists of VX stabilized with DIC (potentially with small amounts of DCC stabilizer as a contaminant), 16% stabilized with DCC, and 38% stabilized with both DIC and DCC. VX is highly toxic and lethal in both liquid and vapor forms. Because munitions containing agent and energetics are not present at Newport, the process requirements for disposing of only ton containers of agent are less demanding than the processing requirements for the more complex stockpiles at most sites.

The Newport Chemical Agent Disposal Facility (NECDF) was designed and is to be operated as a pilot-plant facility because the process has been demonstrated only at a laboratory/bench scale. Production operation will begin only after pilot-scale operations have been completed, the data reviewed and assessed, and approval granted by the State of Indiana and the federal government. Because pilot-plant operations generally uncover unknown elements, the probability is high of process modifications and change—including possible changes in the analytical methods and procedures used to support plant operations and hydrolysate clearance—during this piloting period.

The NECDF was designed to destroy VX using caustic hydrolysis in a hot (194 degrees Fahrenheit [°F]) solution of sodium hydroxide. Initially the plan was to further treat the resulting hydrolysate on-site by Supercritical Water Oxidation (SCWO) and to ship the final SCWO effluent (brine) to a Treatment, Storage, and Disposal Facility (TSDF). Mechanical problems encountered in the SCWO engineering-scale test, conducted in Corpus Christi, Texas, in 2000, led to initiation of studies to directly ship the NECDF hydrolysate to an off-site treatment facility as an alternative to on-site SCWO treatment. The terrorist attacks of September 11, 2001, and continuing questions about the feasibility of implementing SCWO on-site in any reasonable timeframe supported the decision to adopt "Project Speedy Neutralization." This involves shipment of the neutralized product (i.e., caustic hydrolysate) off-site for further treatment.

Detailed testing of the caustic hydrolysis process began with the Alternative Technologies and Approaches program in the 1990s. The "recipe" for NECDF agent destruction using sodium hydroxide was tested on a laboratory scale, and an agent loading of 33% was chosen for the program.

Confirmation of the efficiency of destruction of VX depends on the analytical methods available to monitor for residual VX and EA 2192 levels in the resultant hydrolysate. During the past ten years changes in analytical techniques and instrumentation, coupled

with increased personnel experience with these analyses, have lowered the detectable concentration of VX to the low parts per billion (ppb) levels and the detectable concentration of EA 2192 to the low tenths of parts per million (ppm) levels for 8% VX loading hydrolysate. However, the complexity and variability of the 33% VX loading hydrolysate continued to complicate the VX analysis.

By October 2003, the Project Manager for Alternative Technologies and Approaches had begun to investigate the use of reduced VX loading to preserve resources and obviate the need to resolve differences in data and data interpretation for the 33% VX-loading hydrolysate. The program plans to begin operations at 8% VX loading of DIC-stabilized agent and then, through a carefully monitored ramping-up process, move to 16% VX-loading, DIC-stabilized agent.

1.2 Nature of the Caustic VX Hydrolysate

The hydrolysate that will result from the caustic hydrolysis of VX at the NECDF comprises an aqueous phase and an organic phase. The organic phase exists both as an emulsion with droplets distributed throughout the continuous aqueous phase and as a visible organic layer that floats on top of the continuous aqueous phase. The extent to which a separate organic phase floats on the lower aqueous layer depends on the VX loading. As the VX loading increases, the quantity of organic phase available to form an organic layer (above that which forms a stable [or metastable] emulsion) increases.

At 33% agent loading (weight percent), the organic layer was significant (3%–5% by volume). The VX concentration in this organic layer was approximately 20 times the concentration in the bulk hydrolysate (>20 ppb), although disagreement exists within the program about the validity of the measurements (Wojciechowski, 2003). For 16% agent loading, the organic layer was 2–3 volume percent; for 8% agent loading, the separate "organic layer" was only a sheen at the surface of the hydrolysate. The "organic layer" has not been analyzed at 8% and 16% agent loadings; only mixed (homogenized) samples were analyzed. Obtaining samples of this organic layer for 8% agent loading poses significant technical difficulties. Centrifugation of a 550-milliliter (mL) sample of 8% CVXH showed that the maximum organic layer that could be "separated" was 0.45%–0.5%. These differences demonstrate the significant impact of agent loading on hydrolysate characteristics.

1.3 Clearance

Since its inception, a key tenet of the Army Chemical Demilitarization program has been safety of the workers and public. Department of the Army (DA) Pamphlet (PAM) 385-61, entitled "Toxic Chemical Agent Safety Standards," defines the approach for verifying the thoroughness of the neutralization process as using laboratory analyses to ensure that the chemical agent is ≤20 ppb. This concentration is measurable and is a quantifiable upper limit concentration in drinking water (20 ppb criterion is for soldiers). However, the procedure and methodology to verify the 20 ppb criterion in CVXH have been a

challenge (see Section 3). As stated in the Low Level VX (LLVX) panel report (Science Applications International Corporation [SAIC], 2003):

> The panel is not aware of any document that clearly states the exact criteria for offsite shipment of VX hydrolysate from NECDF or any document that codifies the Army's commitment to the public for offsite shipment.

The report, *Generation and Clearance of Hydrolysate for Treatability Studies in Support of Newport Operations*, states:

> To clear the hydrolysate, the analytical results must be non-detect for VX with a method detection limit (MDL) of less than or equal to 20 parts per billion (ppb). Non-detect is defined as the absence of a signal in the VX retention time window for ion 128, or a signal with a signal-to-noise (S/N) ratio of less than or equal to 3, or a concentration below the calculated MDL.

These criteria are incompatible in that an analytical response for VX could be classified as "analytically detected" by implementation of the "analyte retention time/signal-to-noise (S/N) ratio equal to or greater than 3" detection criteria, but reported as "non-detect" by the "less than the established MDL" criterion (see Section 3).

1.4 Analytical Methods

Significant resources were expended for almost a decade to develop an analytical method that could reliably and accurately measure VX concentration in CVXH at lower and lower levels for a 33% VX agent loading without success. The newer analytical methods demonstrated the presence of detectable levels of VX in 33% DIC-stabilized CVXH and the inability to demonstrate an MDL of ≤20 ppb. This unexpected result led to an aggressive investigation of the causes and possible solutions for addressing the issue to bring the plant into operation.

An independent assessment panel was convened in October 2003 to evaluate the significance of the observation of "persistent" LLVX in caustic hydrolysate at the 33% agent loading level and to determine whether data were sufficient to confirm whether VX forms in CVXH (SAIC, 2003). Two conclusions of the panel were:

> There are significant uncertainties in the Solid Phase Extraction (SPE)/gas chromatography-ion trap mass spectrometry (GC-ITMS) method that make it difficult or impossible to quantify LLVX.
>
> It is not possible to determine the origin of the "persistent" LLVX in VX hydrolysate from the currently available data. The panel could not rule out formation of VX in VX hydrolysate or the hypothesis that has been advanced that there is a quasi steady state concentration of VX in VX hydrolysate due to a competition between agent destruction and formation. The current data from the analytical method did not enable the panel to determine if detectable VX was

originating from VX hydrolysate (that is, either residual untreated VX or formation within the VX hydrolysate matrix) or was formed during the analytical procedure.

Consequently, efforts during the past year have been devoted to evaluating the effect of reduced VX loading on

- VX caustic hydrolysis destruction,
- VX reformation during long-term storage, and
- VX formation after a reduction in pH accompanied by a concomitant formation of an organic layer.

This evaluation has paralleled the development, evaluation, and validation of analytical methodologies for measuring VX and EA 2192 in the 8% DIC-stabilized CVXH. At the time of this writing, methods for analyzing VX and EA 2192 in 8% DIC-stabilized CVXH and VX in 16% DIC-stabilized CVXH had been established in the NECDF laboratory, and the performance of these methods had been validated through various precision and accuracy studies. Implementation and validation of methods for ethyl methylphosphonic acid (EMPA), methyl phosphonic acid (MPA), and thiolamine in 8% DIC-stabilized hydrolysate are expected to be completed shortly. Similar work on other methods required for 16% DIC-stabilized hydrolysate and 8% DCC-stabilized hydrolysate were scheduled for completion later in 2004. Validated methods for anticipated processing conditions are essential to ensure that hydrolysate shipped off-site to a TSDF meets Army criteria.

1.5 Carmagen Engineering, Inc.

The Centers for Disease Control and Prevention (CDC) engaged Carmagen Engineering, Inc. (Carmagen) to assemble a group of knowledgeable experts (Team) to help evaluate the DuPont Technical Assessment on U.S. Army Newport (Indiana) Project (March 2004). The Team consisted of a former chairman of the National Research Council Stockpile Committee, a retired assistant director for the CDC/NCEH Division of Laboratory Sciences, a retired Program Manager for Chemical Demilitarization, a professor at Stevens Institute of Technology, a retired regional laboratory director for EPA, and a former environmental health and safety manager/process design manager for ARCO Chemical. Specifically, Carmagen was asked to evaluate the "Treatability of Newport (Indiana) Caustic Hydrolysate" portion of the DuPont report.

To ascertain the capability and effectiveness of the DuPont Secure Environmental Treatment (SET) facility at Chambers Works (Deepwater, New Jersey) to treat CVXH, the Team recognized that an assessment of the NECDF destruction process and an examination of the analytical methodologies to be used for CVXH clearance were required to ensure that the hydrolysate being shipped to the SET facility will be adequately characterized and that VX and EA 2192 levels in the CVXH will meet Army clearance specifications. These assessments were considered essential elements to ensure safe SET facility operations. Therefore the Carmagen Team focused on three areas:

- Process Issues (NECDF),
- Analytical Methods, and
- Caustic VX Hydrolysate Treatment (DuPont).

The review comprised several meetings with people from the Army, Chemical Materials Agency, Parsons, and DuPont at which presentations were made and discussed in depth. These meetings were followed up by written questions and requests for additional documentation. Documentation received in response to the Team's questions and requests for additional information was substantial.

1.6 Report Outline

The report contains five chapters.

- Introduction—Discusses the historical evolution of the NECDF project and the charge to and approach taken by the Carmagen Team.
- Process Issues—Discusses the impact of VX loading on the process, i.e., nature and extent of the two-phase CVXH, VX partitioning to the organic layer, clearance quality assurance (QA) and quality control (QC), scale-up, and storage.
- Analytical Methods—Reviews and evaluates the use and data quality objectives of VX and EA 2192 measurements, sampling procedures, validation of methods, and QC of the analytical processes.
- Caustic VX Hydrolysate Treatment—Describes pH adjustment, oxidative pretreatment, PACT® biotreatment, and VX and EA 2192 destruction.
- Major Findings—Presents major findings.

2. Process Issues

2.1 Introduction

Although the primary purpose of this report is to examine issues associated with the treatability of the hydrolysate produced by the Newport facility, as noted in the Introduction, a discussion of processing issues is important. The composition of hydrolysate sent for treatment depends on the nature of the VX being hydrolyzed (i.e., agent loading, stabilizer), neutralization process, process operating conditions, process effectiveness, and consistent process operation. Confirmation of the composition of the hydrolysate (efficacy of treatment) is related to the accuracy of the analytical methodologies (see Chapter 3) and whether the sample(s) used for the analysis represent the batch being processed. The satisfactory treatment of each batch is determined on the basis of analysis of the hydrolysate samples.

Only laboratory/bench-scale runs have been completed for the process, and scale-up to the integrated full-size facility is based on the anticipated processing conditions. At startup, NECDF intends to operate the reactor at a VX loading of 8%, rather than the 33%

originally planned. This has process and operational consequences that are discussed later in this chapter. The Army proposes that VX loading will be increased to 16% as experience is gained with the process and equipment, and when analytical methodologies and successful off-site treatment capability demonstrated at the higher loading are validated. The change from the proposed 33% VX loading to 8% VX loading will increase substantially the total quantity of hydrolysate to be treated and the length of time the Newport facility will operate.

2.2 Process Description

The process for VX neutralization at Newport uses batch processing (Figure 2-1). Each batch consists of the following sequential steps:

1. The reactor is charged with caustic.
2. The reactor is heated to approximately 194°F.
3. The reactor circulation loop is activated, and the agitator in the reactor is started.
4. Agent is added to the reactor using a feed line in the recirculation piping. The amount of agent added is determined by the VX loading target for a given batch. Two phases are present in the reaction mixture—an aqueous phase and an organic phase. The relative volumes of the two phases are determined by the VX loading.
5. VX and caustic are mixed by the agitator in the reactor and by the static mixer in the recirculation piping. The static mixer is designed to achieve an organic droplet size of approximately 10–30 microns (μm).
6. After the reaction has been circulated at temperature (194°F) for a period of time sufficient to complete the hydrolysis reaction, the mixture is cooled and a sample taken from the recirculation line. If the sample meets the criteria for VX and EA 2192 destruction, the resulting mixture (the hydrolysate) is pumped from the reactor to storage. If the VX and EA 2192 destruction criteria are not met, then the mixture is reheated, and processing continues. This is repeated until the batch is successfully processed.
7. After the batch is processed, it will be transferred to intermediate storage, and then shipped off-site for final treatment.

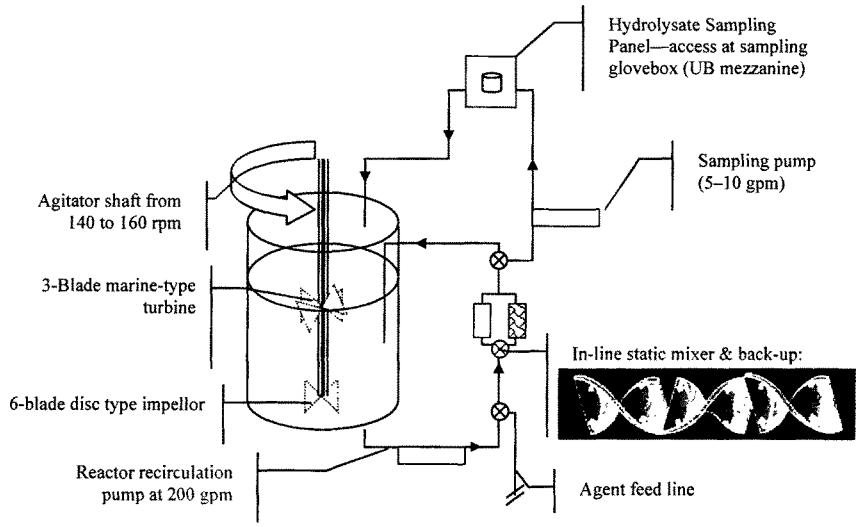

Figure 2-1. Hydrolysate reactor

Texas A&M performed a safety study of the Newport facility using fault-tree techniques. One scenario examined was "Offsite Transfer of Hydrolysate Containing Excess VX Concentration."

The Executive Summary of this report stated:

> *Fault tree analysis techniques were applied to the VX project speedy neutralization (PSN) process and related process support systems in order to estimate the frequency that the cited hazard scenario can be expected to occur.*
>
> *The study results indicate that the best estimate for an annual frequency of this undesired event is 5 x 10^{-5}.*

The annual frequency is estimated at 1 in 20,000 chance for CVXH being outside of specification for VX (>20 ppb). The existing design does not detect contamination of acceptable hydrolysate after the batch sampling procedures have been completed. The amount of potential contamination is minor and not thought to present a public health risk. This issue could be corrected by good engineering practices such as physical isolation using piping blinds, spool pieces or a double block and bleed valve configuration or by development of a sampling method at the storage tank. CDC has alerted Army representatives regarding this design issue as part of the normal oversight activity. Any potential design changes to the facility and schedule impacts need to be balanced by the national security risk associated with extended storage of the VX.

At the time of this report, the recommendations in Safety Study Reports by Texas A&M and other safety studies relating to the design and operation of the Newport facility were still being evaluated for implementation.

2.3 Process Chemistry

The process chemistry involved with VX neutralization is complex when an extremely high destruction of VX is required. At the time this report was written, investigations into the process chemistry are still under way, and not all of the details of the main and side reactions involved (e.g. solids formation) were fully understood. The major variables that affect the chemistry include the agent loading (i.e., the relative amount of agent per unit volume of caustic in the reactor at the start of the batch) and the type of stabilizer present in the agent being processed. (The stabilizers used to minimize the decomposition of the VX during storage were DIC or DCC or DIC + DCC).

The main reaction by which VX is neutralized by caustic is well understood and is pseudo-first order with respect to VX concentration. However, the presence of two phases (organic and aqueous), the presence of VX in the organic phase, the creation of EA 2192, and the presence of stabilizers complicate the physical and chemical process. If all other system parameters and the composition of initial caustic solution remain constant, then the size, composition, and partitioning of the reaction products between the aqueous and organic layers depend on the VX loading. Mass transfer limitations become more pronounced as the droplet size increases and the organic layer is formed. This will affect the rate, as well as the pathways of the reactions, and may produce different final products. In addition, some of the ton containers are now known to contain gelled/solid material. How much of this material will be removed with the VX and how much will remain in the ton container is uncertain. The effect of any gelled/solid material on the chemistry or operation of the neutralization reactor mixing process and sampling system also is unknown.

The purpose of the agitator and the static mixer are to mix the phases and to transform the organic phase into tiny droplets. The smaller the droplet size, the faster the diffusion processes in leaching and neutralizing the VX in the organic droplets. Therefore, VX is rapidly destroyed at the start of the batch operation; then a slower, diffusion-limited process follows as the VX in the organic phase droplets is neutralized. Moreover, the size

and chemical compositions of the dispersed droplets and the organic layer will differ for the various VX loadings and stabilizer types.

In a response to questions from CDC, the Army and its contractor (Parsons) summarized these issues:

> *Because of the highly reactive nature of hot caustic, less than 0.1% of the VX added to the reactor during the FILL period accumulates in the reactor with virtually all of this residual VX removed during the first minute of REACT. Additional REACT time is needed to destroy residual VX that partitions into the organic phase during FILL, and to ensure that EA2192 is non-detect. ……. It is expected that the NECDF's full-scale pilot reactor will provide the necessary mixing and droplet size to produce non-detectable levels of both VX and EA2192. This conclusion is based on laboratory-scale results and full-scale pilot plant calculation results provided herein. The actual reaction time required to obtain non-detectable levels of both VX and EA2192 will be determined during Controlled Start-up testing of the full-scale NECDF pilot plant. If the reaction time required to obtain non-detectable levels of both VX and EA2192 determined during Controlled Start-up differs from that which was predicted during laboratory-scale testing, the types and configuration of the elements within the static mixer and the volumetric flow rate through the recirculation line can be changed, as needed.*

This response accurately describes the process, neglecting the effect of any gelled/solid materials in the feed to the reactor or generated within the reactor.

As previously noted, the reaction originally was designed to have used a 33% agent loading in each batch. However, studies demonstrated that, at 33% agent loading, a significant organic phase (3%–5% by volume) formed during the reaction, and this organic layer separated from the aqueous phase during storage and floated on top. Remaining (un-neutralized) VX partitioned into this organic phase, and the VX concentration in this organic phase was approximately 20 times the VX concentration in the bulk hydrolysate (nominally <20 ppb). Therefore, operation with 33% agent loading could have resulted in a "significant" volume of organic phase with a "high" VX concentration in storage tanks and during transportation. This was considered unacceptable, and modifications to the process were proposed and implemented.

Additional investigation showed that operation at 16% agent loading reduced the organic layer to approximately 2–3 volume percent. At 8% agent loading, the organic layer was only a sheen on the surface of the hydrolysate (approximately 0.5% by volume determined by centrifuging the sample). The VX concentrations in the organic phase for 8% and 16% agent loadings had not been determined at the time this report was written.

Significant changes in organic liquid loading occur between 8% VX loading and 16% VX loading (approximately a 1:5 volume ratio at a minimum) and between the 16% and 33% VX loading (approximately 1:1.5 ratio). The physical and/or chemical processes involved and the reason(s) for such a significant increase in organic loading between 8% and 16% VX loading have been the subject of some investigation, but no conclusion has been reached.

Laboratory studies have demonstrated that the reaction times required to complete neutralization vary with agent loading and stabilizer. With DIC-stabilized agent (approximately 46% of the Newport stockpile), the reaction times are 2.5–4 hours for 8% loading and 4–6 hours for 16% loading. With DCC-stabilized agent, the reaction time is 10–14 hours for 8% loading. The reason(s) for the apparent additional processing time required by DCC-stabilized agent is (are) not fully understood. The amount of stabilizer in each ton container also can vary significantly. Therefore, what is valid for 8% VX loading stabilized with DIC may not be valid for 16% VX loading case and other stabilizers. The data do not warrant generalizations that apply to all VX loadings and stabilizers.

In addition, laboratory studies have determined that solids are generated during the neutralization process. These solids have been variously described as a sticky gel and as a more coherent material. The amount of solids, their composition, and the amount of VX, (if any) these solids contain have not been determined.

The presence of solids in the hydrolysate within the reactor may be problematic in the full-scale unit and impact plant operations. Concern has been expressed that the solids may precipitate onto the surfaces of the agitator in the reactor and result in an imbalance that could cause mechanical failure of this item. A more likely source of concern may be the potential blockage of the in-line static mixer or deterioration of the performance of control valves, particularly the three-port valve that controls the introduction of chemical agent to the reactor and the transfer of the hydrolysate to the storage tanks. The in-line mixer is constructed deliberately with small flow paths (10–30 μm) to break up the organic phase into small droplets. Any solids formation could result in blockage, with the potential for reduced production rates and the need to remove the in-line mixer for cleaning. Solids also can also be deposited on the surfaces of the internal parts of the three-port valve, impacting valve closure and enabling leakage of agent, thereby contaminating previously sampled and acceptable hydrolysate batches as they are transferred from the reactor to the storage tanks. Another possibility is that modification of the process equipment to incorporate an upstream filter may be required. Furthermore, the solids may negatively impact the sampling system and the analytic measurements and treatment of the hydrolysate.

Appendix K of the documentation, provided in response to CDC Question 1, discusses solids formation. The "Conclusions" section of this document states

a. Formation of solids in 8 weight % hydrolysate have (SIC) the potential to impact process throughput due to reactor hardware

plugging in the pumps or static mixer. Preventative maintenance needs to be scheduled as experience determines.

b. Difficulties have been encountered clearing the hydrolysate with gelatinous material. When hydrolysate fails to clear, more processing is required. Detailed analysis of the gelatinous material may lead to procedures that could expedite clearance.

c. Further testing is underway to characterize the observed solids and identify whether stabilizer type (DCC vs. DIC) or VX loading causes changes in solid volume or content.

d. At [the Chemical Agent Munitions Disposal System (CAMDS)], twenty five batches of DCC hydrolysate and one batch containing DIC hydrolysate were processed without process failure due to these solids. (Note—Whether a static mixer with very small passages [such as at Newport] was installed at CAMDS) is not known)

In the subsystem hazard analysis of the process, the following finding (Failure Mode and Effects Analysis [FMEA] Item 01-04-134) was noted:

> *Over-or Under-Reaction Creates Gelatinous Matrix in Neutralization Reactor Containing VX*
>
> *Several mis-operations and reaction inconsistencies can result in the creation of a gelatinous matrix in the neutralization reactor (1- and 2-L401). It might not be possible to completely prevent this occurrence. A study is being performed to identify ways to dissolve or solubilize any gelatinous matrix that might form. Additional information or data from the study could determine methods to prevent the polymer formation and ways to mitigate such a formation if it occurs. This evaluation addresses FMEA Item 01-04-134.*

Whether this finding in the safety studies documenting issues associated with solid/gel formation in the reaction system has been addressed at the time this report was completed is not known.

Except for solids formation and its possible effects, the scale-up of the reactor from laboratory to full-scale operation should succeed. Adequate heating and cooling have been provided for the reactor system, the equipment is simple in design and the batch will be run until the analytic methods demonstrate that VX and EA 2192 have been adequately destroyed. However, the effect of gelled/solid material in the ton containers passed into the reactor does not appear to have been examined in detail. Therefore, no conclusion can be reached about the effects of such material on the neutralization reaction, the destruction efficiency, and the operation of the reaction system.

2.4 Findings

1. Scale-up of the process for 8% VX loading from laboratory-scale data should be operationally feasible. The database supports the efficacy of neutralizing 8% VX (stabilized with DIC) using sodium hydroxide. However, the Newport facility will be a pilot operation when it starts operation, and changes must be anticipated in operating mode and hydrolysate composition sent for off-site treatment.

2. VX loading and the specific stabilizer employed significantly impacts the process, hydrolysate composition, analytical methodology, and possibly solids formation. Scale-up of the process from 8% to 16% VX loading is of particular concern (because of the similarity of the organic-phase volumes between 16% and 33% VX loading batches) and the analytical problems identified with 33% VX loading.

3. The effects of solids formed during the hydrolysis reaction in the process on the hydrolysate and on the efficacy of treatment at a TSDF are unknown. The solids may contain VX. The impact of solids formation on the operation of the reaction system and, in particular, the potential for blockage of the in-line static mixer and other components (including the sampling system) is unknown. In addition, the presence of solids may impact the VX analytics, as well as the off-site hydrolysate treatment process.

4. At the time this report was written, all the findings from safety studies had not been fully addressed. In particular, findings relating to possible solids formation in the reactor and the required process modifications to provide additional assurance that no off-specification CVXH is shipped from the Newport facility may affect the CVXH composition shipped off-site.

3. Analytical Methods

3.1 Introduction

The purpose of this review and evaluation is to define the adequacy of the proposed methods for the analysis of VX and EA 2192 in the CVXH to meet the programmatic requirements of the NECDF. The scope of this review is limited to laboratory analyses of hydrolysate from the neutralization of DIC-stabilized VX at the 8% VX-loading level. Adequate analytical data were not available to evaluate analyses of hydrolysate related to other VX-loading levels or stabilizers.

3.2 Sampling Representativeness

We recognize that the validity of the clearance process depends on the sample taken and delivered to the laboratory for analysis; the sample must truly represent the total hydrolysate process batch. To evaluate the sample procurement process, all available documents describing the design and operation of the equipment and the sampling procedures were reviewed. We also had detailed discussions with NECDF personnel.

NECDF personnel believe the sampling will be highly representative on the basis of the mixing capability of the reactor, the design and operation of the sampling equipment, and the detailed protocols that have been established. On the basis of our understanding of reviewed information, we agree—as long as solids formation does not block the sampling points. The planned sampling program should provide representative samples for CVXH batches to the laboratory for analyses.

QA/QC procedures are in place to ensure and document adequate training of personnel, performance of sampling equipment, availability and quality of supplies, proper and complete recordkeeping, establishment and maintenance of chain of custody, and the safety of plant and laboratory personnel.

Maintaining representativeness of the analytical sample during transfer of the 5-mL analytical portion from the plant batch sample will be challenging because of the potential for separation of an organic layer. The laboratory method for VX analysis in CVXH calls for the analyst to "verify hydrolysate is as homogeneous as possible" during the subsampling process. This process can be highly subject to analyst technique error and will require careful QC.

3.3 Analysis of VX in Caustic VX Hydrolysate

3.3.1 Data Evaluation/Interpretation Criteria

Instrument or qualitative detection as defined in Laboratory Field Instruction (LAFI)-A-30-053:

Consider VX present in the sample if the following criteria are met:

1. Retention time of analyte peak within +/- 0.1 minute of average standard VX retention time.
2. The m/z 128 ion, the m/z 139 ion, and the m/z 167 ion maximize within 0.05 minute of each other.
3. The m/z 139 and 167 ions may not be present at concentrations <1 microgram per milliliter (μg/mL) in the sample.
4. The m/z 128 ion response must be at least three times the background noise level, i.e., S/N ratio 3 or greater.

Quantitative criterion as defined by the Army is as follows:

MDL, calculated according to U.S. Environmental Protection Agency (EPA) procedure published in the Code of Federal Regulations (40 CFR, Part 136, Appendix B) ≤20 ppb.

3.3.2 Method Description and Documentation

LAFI-A-30-053 provides a comprehensive, step-by-step description of the method for analyzing VX in CVXH. The method is based on multiple hexane extractions of the hydrolysate, followed with solid-phase extraction techniques for initial fractionation of the extract, then final separation and detection of the VX using gas chromatography (GC) coupled with ion-trap (IT) mass-spectrometry/mass-spectrometry (MS/MS) techniques. The use of high-resolution capillary GC coupled with the dual-phased MS/MS IT techniques gives this method extremely high selectivity and sensitivity for VX in the hydrolysate. Stated in layman's terms, the method can detect and quantify VX in the highly complex CVXH mixture at $\leq$20 ppb with a high level of confidence against both false positives and false negatives.

The laboratory QC procedures defined in LAFI-A-30-053 and in Section 11.2 of the NECDF Laboratory Quality Control Plan, Revision 2, are consistent with procedures and requirements published in EPA SW-846. Implementation of these procedures should provide the QC data needed to define the overall validity of the analytical results.

Evaluation of MDL data for 8%VX-loaded, DIC-stabilized hydrolysate shows that, with this type of hydrolysate, the NECDF laboratory can consistently generate MDL values below the 20-ppb criterion. In a study to characterize batch-to-batch variation, the NECDF laboratory generated three MDL values for each of two batches of hydrolysate. The six MDL values ranged from 6 to 17 ppb, with a mean of 11 ppb, with no appreciable differences between the two hydrolysates.

In summary, the current method for analyzing VX in CVXH is adequate to detect and quantify VX well below the established clearance level of 20 ppb. The GC/IT/MS/MS technique provide a method with extremely high analyte selectivity and sensitivity. The method consistently shows an instrument detection limit below the 5–10 ppb range.

3.4 Analysis of EA 2192 in Caustic VX Hydrolysate

3.4.1 Data Evaluation/Interpretation Criteria

Instrument or qualitative detection as defined in LAFI-A-30-030:

Consider EA 2192 present in the sample if the following criteria are met:

1. Retention time of analyte peak is within +/- 1.0 minute of the average retention time of the standard EA 2192 during instrument calibration.
2. The m/z 162 ion is present with a 128/162 ion ratio of 0.3.
3. At EA 2192 concentrations <1 mg/mL the 128/162 ion ratio may not equal 0.3, but m/z 162 ion must be present.
4. The m/z 128 ion response must have a minimum S/N ratio of 3.

Quantitative criterion as defined by the Army:

MDL, calculated according to EPA procedure published in 40 CRF, Part 136, Appendix B, $\leq$1 ppm.

3.4.2 Method Description and Documentation

LAFI-A-30-030 provides a comprehensive, step-by-step description of the method for analyzing EA 2192 in CVXH. The method consists of a simple 1:25 dilution of the CVXH sample, followed by analyte separation using liquid chromatography (LC) techniques, with final detection and quantification using dual-phase IT/MS/MS. The use of LC/IT/MS/MS techniques results in a highly sensitive, extremely selective analysis of EA 2192 in the CVXH.

Laboratory QA/QC procedures defined in LAFI-A-30-030 and the NECDF Laboratory Quality Control Plan are consistent with those published in EPA SW-846. Analytical data characterizing the performance of this method are limited. MDL data show values of 0.23 ppm and 0.09 ppm; both well below the clearance level of 1 ppm. Precision and accuracy data show overall very good precision of the method with analyte recoveries ranging from 82% to 95%.

In summary, the current method for analyzing EA 2192 in CVXH is adequate to detect and quantify EA 2192 in laboratory-generated hydrolysate well below the established clearance level of 1 ppm. Data also indicate that the qualitative (analytical presence) instrument detection limit of the method is consistently <0.1 ppm.

3.5 Use of Analytical Data for Clearance

The Army has stated its intended use of VX and EA 2192 analytical data in the clearance of CVXH for off-site shipment, as follows:

> Since its inception, a key tenet of the Army Chemical Militarization program has been the safety of the workers and the public. Department of the Army (DA) Pamphlet (PAM) 385-61, entitled "Toxic Chemical Agent Safety Standards," defines the approach for verifying the thoroughness of the neutralization process as using laboratory analysis to assure that the chemical agent is at a level less than or equal to 20 ppb. This level has been deemed protective of soldiers and Department of Defense personnel. The Project Manager for Alternative Technologies and Approaches (PMATA) elected to use the standard EPA method detection limit (MDL) as the means for determining whether the detection limit specified in the DA PAM has been met. Thus, the requirement for successful neutralization of VX is that the hydrolysate must be non-detect for VX with an MDL of 20 ppb or less.

The Army also has stated that EA 2192 must be "non-detect with an MDL of 1 ppm or less."

As discussed in Sections 3.3 and 3.4, we believe that NECDF methods LAFI-A-30-053 for VX in CVXH and LAFI-A-30-030 for EA 2192 in CVXH can provide valid qualitative and quantitative data for detecting and quantifying VX and EA 2192, respectively, in the concentration ranges needed for programmatic clearance of the hydrolysate material for off-site shipment. NECDF's intended practice for measuring and reporting "non-detects" is potentially misleading. Specifically, we are concerned with the Army's plan to classify and report analytical results above the instrument detection level, but below the established MDL, as "non-detects." While CDC believes that utilizing the MDL approach would not result in public health concerns, the Army needs to address potential public misperceptions regarding the detection or non-detection of VX in CVXH. A simpler reporting scheme (i.e., non-detected, detected at <20 ppb, or detected at >20 ppb) should be considered.

The Army's clearance criteria of "non-detect with an MDL less than an established concentration level" combines two related, but different, analytical chemistry concepts. First, "instrument or analytical detection" is a qualitative-based "yes or no" criterion. Second, MDL is a statistically calculated, quantitative criterion.

The first criterion, "detection," addresses two questions: (a) Was an instrument response observed at the expected retention time of the analyte? and (b) If so, was the level of that response greater than three times the background noise (S/N ratio ≥ 3)? If the answers to both of these questions are "yes," then according to instructions in LAFI-A-30-053 and LAFI-A-30-030, the analyte (either VX or EA 2192) is considered "present" or "detected." If the answer to either question is "no," then the result of the analysis is a "non-detect."

The second criterion, MDL, addresses the level of confidence in the quantitative value calculated from the observed instrument response using an established calibration curve for the instrument. EPA's definition of an MDL, calculated according to the published procedures in 40 CFR, Part 136, Appendix B, is the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero. This is a highly conservative criterion designed to all but completely eliminate false-positive results. Failure to meet the quantitative-based MDL criterion does not negate the analytical "presence" established by the "detection" criterion.

Our issue is that the Army, through its current use of the EPA MDL concept, could improperly classify analytical data as "non-detects" when, in fact, the data have been determined analytically as "detects." Although EPA-prescribed uses of the MDL concept may be appropriate for many applications in regulatory monitoring, in this public health-driven application, it is open to criticism when low-level instrument detects are discarded.

We are not suggesting that using the MDL concept and reporting "analytical detects" as "non-detects" will compromise the process of clearing the CVXH concentration at 20 ppb for VX and 1 ppm for EA 2192. Rather the issue is improper classification of analytical

results. Usually no issue would involve MDL, if the MDL was used only to help determine a quantitation level at which a reliable number can be provided to help make an action decision. In this case, the Army used "detection," not a quantitative level, as its primary clearance criterion. We stated in sections 3.3 and 3.4 that the current NECDF methods can support a clearance process on the basis of quantifiable measurements. The Army could report analytical results as "less then," rather than as "detects" and "non-detects," which would more accurately represent the analytical data.

3.6 Quality Assurance and Quality Control Procedures

The Laboratory Quality Control Plan clearly defines the comprehensive laboratory QA/QC procedures and techniques. This document defines the procedures for: preparation and verification of analytical standards; the certification, maintenance, and calibration of analytical instruments; the certification of methods and personnel; and the QC procedures, techniques, and samples used to define the operational status of the analytical processes and the basic validity of the analytical data. The overall QA/QC plan and procedures are well designed and documented.

3.7 Findings

1. The planned sampling program should provide representative samples for CVXH batches.

2. The current method for analyzing VX in CVXH (LAFI-A-30-053) is adequate to detect and quantify VX in laboratory-generated, 8% VX-loaded, DIC-stabilized hydrolysate well below the established clearance level of 20 ppb.

3. The current method for analyzing EA 2192 in CVXH (LAFI-A-30-030) is adequate to detect and quantify EA 2192 in laboratory-generated, 8% VX-loaded, DIC-stabilized hydrolysate well below the established clearance level of 1 ppm.

4. The use of EPA's MDL for clearance levels does not preclude analytical instrument detection of low levels of VX and EA 2192 (generally <20 ppb VX and <1 ppm EA 2192) in the CVXH. The perception that the clearance criteria (defined as "non-detected" with a MDL of ≤20 ppb VX or ≤1 ppm EA 2192) indicate absence of analytically detectable VX and/or EA 2192 could be misleading. While CDC believes that utilizing the MDL approach would not result in public health concerns, the Army needs to address potential public misperceptions regarding the detection or non-detection of VX in CVXH. A simpler reporting scheme (i.e., non-detected, detected at <20 ppb, or detected at >20 ppb) should be considered.

5. The overall QA/QC plan and procedures are well designed, and documented. NECDF laboratory personnel must generate day-to-day operational QC data to demonstrate that all analytical systems are operational and under control before plant startup according to written plans and procedures.

4. Caustic VX Hydrolysate Treatment

4.1 Introduction

The CVXH is the liquor obtained from the alkaline hydrolysis of the chemical agent VX at elevated temperatures. The details of the processes that generate the CVXH at the Newport facility are described earlier in this report. Once transported to the DuPont SET facility, CVXH will be further treated to remove the organic by-products by a series of physicochemical and biologic processes. The exact composition and phase characteristics of the CVXH received at the SET plant will depend on the stabilizer type and VX loading used in the NECDF process batch. The major parameters and characteristics of 8% VX–loaded, DIC-stabilized hydrolysate (which is the main focus of this report), as received by DuPont, are given in the Table 4.1 for two separate CVXH samples.

pH	TOC, mg/L	COD mg/L	TN mg/L	EMPA mg/L	MPA mg/L	Thiolamine mg/L
>13	33,852	61,000	6,739	39,135	2,789	11,200
13.1	44,147		4,334	35,937	2,826	42,900

total organic carbon (TOC), total nitrogen (TN), milligrams per liter (mg/L)

Table 4.1 Characteristics of caustic VX hydrolysate generated from 8% VX loading with DIC stabilizer

The DuPont treatability studies were designed and executed to obtain scale-up parameters for engineering design and regulatory compliance. Because of their relatively high concentrations in the CVXH, only thiolamine, EMPA, and MPA were analyzed or monitored within the treatment train or in the process effluent. Trace contaminates, such as VX and EA 2192, were not monitored during the studies. (Note: Because of the high 1500- to 2000-fold dilution factor in the DuPont SET process, monitoring of these compounds may not be analytically possible.)

The pH adjustment and neutralization of the CVXH is the first step of the pretreatment process before introduction of the waste to the biologic treatment system. CVXH neutralization is followed by peroxide treatment to destroy odorous substances. The most recent biotreatability studies, the final step in the treatment train, use two-stage PACT®-activated sludge systems that are operated under conditions emulating the actual plant flow rate and hydraulic retention time. In addition to CVXH, the reactors received mustard (HD) hydrolysate from the Aberdeen operations because an alternating treatment scheme may be implemented at the DuPont SET facility.

The studies described in the two DuPont treatability reports (March 3, 2004, and July 19, 2004) were performed with different types of hydrolysates. The inconsistencies in the samples used to conduct the treatability studies make evaluation of the entire treatment process on the same basis and extrapolation of the treatability studies to pilot-plant performance challenging. For example, the pH adjustment and neutralization experiments reported in the Basic Data Summary Report (July 19, 2004) were conducted using 16% VX–loaded, DIC-stabilized CVXH (actual), but the biotreatability studies were

performed with 8% VX-loaded, DIC-stabilized CVXH (actual). Although 20% sulfuric acid was used in the pH-treatment experiments, DuPont proposes to use 5% acid in the full-scale process. The heat of reaction for acidification was measured for 8% and 16% VX-loaded CVXH (reformulated)[1] with DCC stabilizer, not DIC, which is the focus of our investigation. In summary, the studies reported in the Technical Assessment and the Basic Data Summary Report suffer from inconsistencies with respect to the type of CVXH used in each test. The experimental findings do not support the assumption that the CVXH has identical physical and chemical properties regardless of the VX loading and stabilizer type. The volume of the organic layer formed, which differs for 16% VX-loaded CVXH and 8% VX-loaded CVXH, clearly indicates that the system chemistry differs depending on how much VX is added to the caustic solution. Moreover, the volume of the organic layer formed during hydrolysis is not directly proportional to the VX loading. Therefore, linear extrapolations of the experimental results obtained in the preliminary treatment studies should not be used to predict performance at higher agent loadings, and equating the 8% VX-loaded 7000-gallons per day (gpd) CVXH with 16% VX-loaded 3500-gpd CVXH (Table 5, Basic Data Summary Report) for design and modeling purposes should be avoided.

Because the Army's stated objective is to begin operations with 8% VX-loaded, DIC-stabilized CVXH, the assessment of the DuPont treatability studies focused mainly on treatment of the CVXH at this condition. Occasionally, however, other data and material reported by Parsons on the VX alkaline hydrolysis treatment are cited to support the main findings of this assessment. Data are insufficient to assess treatment of CVXH at other VX loadings and for other stabilizers. In the following sections, the hydrolysate acidification process, the peroxide oxidation, and the biologic treatment studies are evaluated and the major findings presented.

4.2 Extent of Treatment

4.2.1 pH Adjustment

The CVXH acidification experiments were conducted with actual CVXH (16% VX-loaded, DIC-stabilized) titrated with 20% sulfuric acid to a final pH of 4–6. The titration curve obtained from the actual CVXH was compared with the aqueous layer from a centrifuged sample after separation of the organic layer. The heat of reaction also was computed, but for 8% and 16% VX-loaded, DCC-stabilized (reformulated) CVXH. The results of these experiments demonstrated that

- The organic layer is destroyed. pH adjustment produces a homogeneous amber yellow clear solution.
- The process generates 3.07 calories per gram (cal/g) during the titration of 8% VX-loaded, DCC-stabilized (reformulated) CVXH, producing a temperature increase of 6.4 °C. This energy is expected to dissipate through heat losses during plant operation, and cooling and heat exchanger installation will be unnecessary.

[1] Reformulated VX hydrolysate was prepared by diluting 33% VX loaded hydrolysate to achieve the desired VX loading.

- Removal of the organic layer lowers the buffering capacity of the mixture (hydronium ions appear to be consumed during destruction of the organic layers).
- The process increases the volume of the CVXH waste by about 30%. If 5% sulfuric acid is used, as DuPont proposes to avoid cooling the reaction mixture, the volume increase will be close to 100%, further diluting the sample by a factor of 2. The effect of the 5% sulfuric acid on the organic treatment is unknown; the available reports did not present data using 5% sulfuric acid.

In response to the May 25, 2004, clarification questions (Responses to CDC Clarification Questions, Final, 17 June, 2004), Parsons indicates that pH adjustment does not destroy the organic layer. DuPont's 3 March 2004 report, "Treatability of Newport (Indiana) Caustic Hydrolysate" (Reich et al), confirmed that the adjustment of pH without additional treatment measures aggravates the odor of hydrolysate. Furthermore, the uncharged form of thiolamine is poorly-soluble and results in the formation of a large organic layer, on the order of 10% by volume. This organic layer is presumed to have a low flashpoint, which would add risk to the shipping process.

However, DuPont and its treatability study as presented in the Basic Data Summary Report, states

> *The sample was observed to change from a yellowish cloudy color to a slightly amber clear color once a single phase was formed which occurred around pH 6.0. Once a single phase formed, there was no longer any organic material coating the glass.*

Addition of a strong acid to the CVXH profoundly affects the physical and chemical stability of the organic droplets dispersed in the hydrolysis liquor and the dissipation of the organic layer. Attachment 1, "Characterization of Droplets Resulting from NECDF Static Mixers," of the Parsons report (July 22, 2004) states that the average size of the colloidal droplets ranges from 5 to 10 μm, with specific gravity of about 0.87 and strong negative charges. This charge most likely keeps the droplets suspended, preventing efficient collisions and subsequent aggregation. The electrophoresis experiments to determine the particle surface charge were performed with 16% VX- loaded, DIC-stabilized CVXH (actual). No experimental data are presented in the Parsons white paper on the properties of the droplets formed in the hydrolysate from the 8% VX-loaded, DIC-stabilized CVXH. The Parsons reports documented, and experimental observations by DuPont verified, that the volume of the organic layer and the size distribution and dispersion of the droplets in the final CVXH depends on the VX loading. The higher the loading rate the larger the resulting organic layer volume. However a direct proportional relation does not appear to exist (i.e., doubling the VX loading does not increase the volume of the organic layer by a factor of two). Visual observations by Parsons personnel of the formation of the organic layer estimated that the layer thickness remains unchanged for up to 4 months. However, no kinetic information is provided about the rate of formation of the organic layer.

Given that the organic droplets carry an overall negative charge, addition of hydronium ions should compress the electrical double layer that typically exists in the boundary of the organic-aqueous interface and allow the attraction forces to take over. Because this is not observed, i.e., addition of sulfuric acid does not appear to enhance flocculation or layer formation and separation, we can conclude that either the solubility of the organic phase is higher or its components become chemically unstable and decompose at lower pH or both. The disappearance of the organic phase during pH adjustment supports this.

The exact composition of the organic layer is not known, but the response of the whole (as received) CVXH to the addition of sulfuric acid suggests that it imparts alkalinity to the sample, probably because of weak organophosphorous acids and carbonates in the process water. More sulfuric acid (about 30 grams [g]) is required to reduce the pH of the whole CVXH sample than the aqueous layer to a pH of 8 (Figure 1 of the Basic Data Summary Report). However, the two titration curves intersect at a pH of 7 indicating that the same amount of acid is needed to bring the solutions to this endpoint. From that point, further addition of small amounts of acid brings about a steep pH drop in the aqueous layer but has little effect on the whole CVXH (as received), until about 380 g acid (x-axis of Figure 4-1), where pH drops substantially. This behavior is consistent with a chemically reactive solution. The organics exert a hydronium ion demand in excess of the amount required to neutralize the base. The organic layer appears to react with the hydronium ions participating in a chemical reaction rather than to be simple acid-base equilibrium chemistry. Moreover, the observation that this step modifies the odorous intensity of the mixture provides additional evidence that the organic components undergo significant chemical changes during pH adjustment.

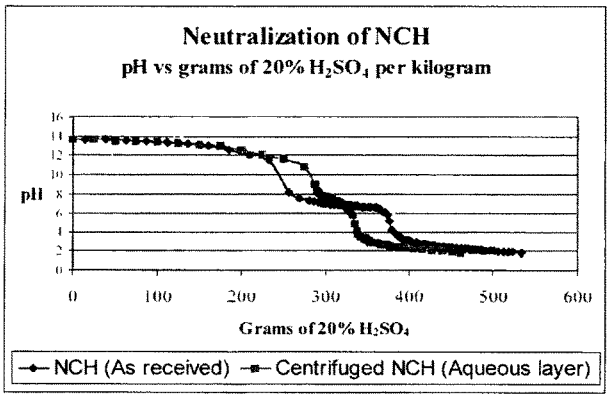

Figure 4-1 Caustic CVXH titration curves provided by DuPont in the Basic Data Summary Report.

4.2.2 Hydrogen Peroxide Oxidation

Once the pH of the hydrolysate is adjusted to a pH of 4–6, the mixture is treated with 10% peroxide to control objectionable odors emanating from the CVXH caused mainly by the volatilization of thiolamine. Peroxide and the free radicals formed by its addition to the reaction mixture attack the organics present in the hydrolysis liquor and initiate thiolamine destruction. Again, these studies were conducted with 16% VX- loaded, DCC-stabilized CVXH (actual or reformulated). Thiolamine is destroyed quickly by the peroxide, with most of the compound depleted within the first minute of reaction (Figure 4-2). After 20 minutes, the concentration drops below the detection limit of 5 ppm. The degradation products of thiolamine are presented in the Technical Assessment Report (March 3, 2004). Four compounds were identified as possible thiolamine degradation products: acetic acid, diisopropyl amine, urea, and 2-diisopropylaminoethyl ethyl disulfide. Acetic acid and urea are readily biodegradable compounds and are expected to break down in the two-stage PACT® bioreactors. However, the biodegradability of isopropyl amine and the 2-diisopropylaminoethyl ethyl disulfide is not documented in the Technical Assessment Report or the Basic Data Summary Report; only qualitative references (page 49 of the Technical Assessment Report) state that samples analyzed from the effluent of one of the bioreactors had no detectable amounts of thiolamine or any of its oxidation products. No other information is provided that confirms the biodegradation of these two by-products. EMPA and MPA remain unaffected by the peroxide process.

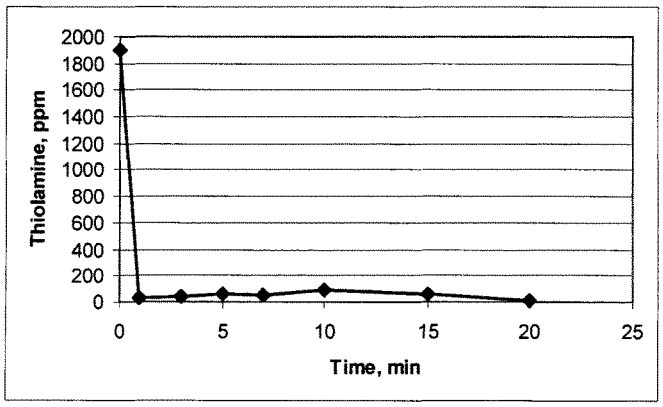

Figure 4-2 Destruction of thiolamine by hydrogen peroxide oxidation.

The oxidation step is an exothermic process releasing approximately 14 cal/g of heat. This value was obtained from a reformulated 16% VX–loaded, DCC-stabilized, CVXH that was first treated with 20% sulfuric acid to a pH of 6.4, then subjected to 20% weight equivalent of 10% hydrogen peroxide solution. Gas-generation measurements conducted in 2-liter flasks showed that the amount of gas generated during the peroxide oxidation is

negligible. The lack of gas evolution suggests that the degradation of thiolamine is incomplete; in other words, the compound is not mineralized to the simple innocuous carbon dioxide and water.

4.2.3 PACT® Biotreatment

Two sets of biodegradation experiments were conducted using one- and two-stage PACT® bioreactors. The first treatability study was performed with CVXH; in the second, both CVXH and HD hydrolysate from Aberdeen were tested to determine the effect of alternating the bioreactor feeds on the performance of the biologic system. Co-processing will be necessary when both types of hydrolysates will be sent for treatment to DuPont's SET facility. The objectives and the criteria of both studies were stated in the Basic Data Summary Report:

1. To confirm that the anticipated rates of CVXH can be processed successfully through the SET [wastewater treatment plant (WWTP)], enhancing the database provided by the original treatability study;
2. To assure that the CVXH can be processed at appropriate rates while HD hydrolysate from Aberdeen is being managed at the WWTP using a plan to either alternately campaign each hydrolysate or process the pretreated hydrolysates simultaneously;
3. To ascertain the degree of improvement in treatment that can be anticipated with a two stage PACT® system.

As for the earlier Treatability Study there were three general criteria for judging the treatment of CVXH to be successful:

1. Ability to maintain satisfactory control of wastewater and sludge odors.
2. Ability to maintain control of SET WWTP operations (e.g., effective dissolved organic carbon [DOC] removal, manageable foaming, pH control, solids management, etc.)
3. Ability to assure permit compliance (e.g., effluent BOD5 [5-day biochemical oxygen demand], BOD5 percent removal, effluent TSS, effluent NH3-N and WET). In addition the fate of EMPA, MPA and thiolamine were monitored.

As mentioned before, the studies were designed to provide information about system performance in terms of regulatory compliance and to obtain design parameters for scale-up.

To ensure adequate treatment, two PACT® bioreactors were operated in series. This biologic system, in addition to the microbial degradation, was dosed with activated carbon, which in general enhances the treatment capacity by removing recalcitrant compounds that are resistant to biodegradation. Six reactors were set up to evaluate various treatment scenarios using 8% VX-loaded, DIC-stabilized CVXH and the HD hydrolysate. The flow rate and retention time in the bioreactors were set to simulate actual plant conditions treating 7000-gpd CVXH and 15,000- and 25,000-gpd HD

hydrolysate. A large dilution of the hydrolysate, to the order of approximately 2000 times, occurred at introduction of the pretreated CVXH to the biologic PACT® system. Appropriate controls were used throughout the study, and all pertinent system parameters were monitored to assess system performance. However, the fate of individual compounds as they pass through the bioreactors is not as well documented. Only EMPA and MPA were monitored in the pilot-plant effluent.

The data presented in figures 7, 8, 9, and 10 and tables 8 and 9 of the Basic Data Summary Report indicate that, after a short acclimation period, the removal efficiency, as measured by DOC and BOD reduction, stabilizes to an average of about 85%–90% in all reactors. Even during the acclimation period, the removal does not drop below 75%. This high-removal efficiency also is observed in the alternating Aberdeen/DIC CVXH influents, indicating that the biologic system is not affected by these input changes. The 7000–gpd, 8% VX-loaded CVXH is equated to 3500–gpd, 16% VX-loaded CVXH (Table 5). However no evidence suggests that this is a valid approach. See Section 4.3 for a discussion of the potential differences on the composition and general chemistry of the 8% and 16% VX-loaded CVXH.

The Technical Assessment and Basic Data Summary reports clearly document the conversion of EMPA to MPA. Both compounds remain unaffected by the pH reduction, and conversion during peroxide treatment appears to be limited. Biologic treatment by the two-stage PACT® process converts essentially all of the EMPA to MPA but appears not to affect the MPA decomposition. Data are sufficient to support this conclusion. The slight decrease in MPA effluent concentration most likely results from partitioning in the organic sludge.

DuPont's Technical Assessment and Basic Data Summary reports contain no information about the fate of VX or EA 2192 during treatment of the CVXH in the DuPont SET facility. The presence of these two compounds in the plant effluent in trace amounts cannot be excluded.

4.3 Environmental Persistence and Agent Loading Effects

The major hydrolysis products of VX are well characterized, and the reaction rate and pathways depend strongly on solution pH and temperature (Figures 4-3 and 4-4). With solubility of approximately 30 grams per liter (g/L), VX is considered to be highly mobile in the environment and can persist for days or even weeks in slightly acidic waters. Other VX hydrolysis products in the CVXH include EMPA, which has a half life in soils of about 8 days, with MPA being the major transformation product.

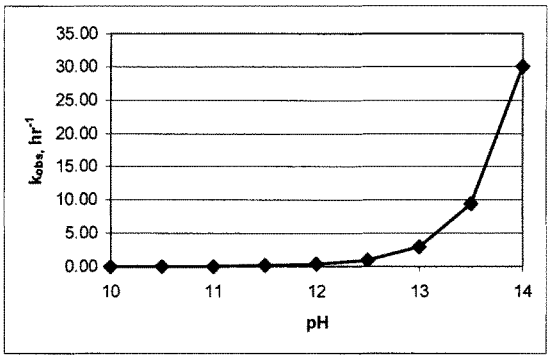

Figure 4-3 pH dependence of apparent rate constant for VX hydrolysis

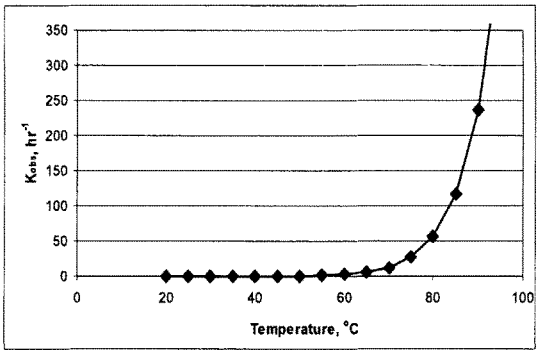

Figure 4-4 Temperature dependence of apparent rate constant for VX hydrolysis at a pH of 7.7.

As discussed in Section 4.2.3, the treatability studies with the 8% VX-loaded CVXH demonstrates conversion of EMPA to MPA in the activated sludge bioreactors. MPA is stable in the environment because it is resistant to hydrolysis, photolysis, and thermal decomposition. It is also soluble in water and has a low coefficient for sorption onto soil particles. Therefore, it can migrate easily in the soil and groundwater (Munro et al., 1999). Another major by-product of the hydrolysis of VX at neutral and high pH values, is EA 2192 (S-(2-diisopropylaminoethyl)methyl phosphonothioic acid), an environmentally persistent highly toxic compound with infinite water solubility.

Some of the hydrolysis products, namely EA 2192, EMPA and MPA, are stable at neutral pH; whether these, or other byproducts that are not identified or exist at low concentrations, can react and form stable VX molecules is questionable. This is a concern because the CVXH is adjusted to a pH below 6 in preparation for the oxidation and

biologic treatment. Parsons attempted to partially address this concern by studying the CVXH over a 5-hour period at a pH of 10 or 71 days at a pH of 14. These conditions, however, do not represent the low (<6) pH range in the system after pH adjustment. Neutral pH is a worst-case scenario because of the stability of the by-products at those conditions and the possibility of recombining to reform VX. Thermodynamic analyses also should have been performed to assess the tendency of the pH-adjusted CVXH to move toward VX reformation. Because experimental data are not presented, the questions regarding possible VX reformation remain unanswered.

4.4 Findings

1. The 8% VX-loaded, DIC-stabilized CVXH is treated by pH adjustment to a pH <6 to eliminate the two-phase mixture, followed by hydrogen peroxide oxidation to destroy the odor-causing thiolamine, and finally biologic treatment to convert most of the EMPA to MPA.
2. The DuPont SET facility effectively treats the CVXH generated from an 8% VX loading with DIC stabilizer, except for MPA, for which only minimal reduction is demonstrated.
3. Alternating feeds from Aberdeen HD hydrolysate and CVXH did not affect the performance of the DuPont bench-scale reactor.
4. The effects of the SET facility on the destruction of any trace quantities of VX and EA 2192 in the CVXH are unknown. In addition, the fate of diisopropyl amine and 2-diisopropylaminoethyl ethyl disulfide through the SET plant is not well documented.
5. The possibility of VX reformulation at acidic (<6) pH conditions (after pH adjustment) in the Dupont SET treatment process has not been adequately investigated and remains unresolved.
6. Effective treatment of 16% VX-loaded CVXH and 8% VX-loaded CVXH with DCC or DIC/DCC stabilizers were not demonstrated in the DuPont studies.

5. Major Findings

NECDF was designed to destroy VX using caustic hydrolysis in a hot solution of sodium hydroxide. Initially the plan was to further treat the resulting waste on-site by SCWO and to ship the SCWO effluent to a TSDF. After the terrorist attacks of September 11, 2001, the plan was modified to eliminate on-site SCWO treatment and ship the resulting hydrolysate directly off-site for treatment at a TSDF. Critical to this modified plan was the development and validation of analytical methods to clear the hydrolysate for shipment. The stringent Army clearance levels for VX and EA 2192 proved challenging to the analysts. The original plan to operate at 33% VX loading was abandoned, and the program plans to begin operations at 8% VX loading and move to 16% VX loading.

This programmatic change has necessitated an intensive effort to develop the analytical methods needed to assess process performance and suitability of the hydrolysate for off-

site shipping, process modification to ensure adequate mixing and VX droplet size, and search for a TSDF capable of treating the hydrolysate. The current plans are for NECDF to ship the CVXH to the DuPont SET facility in Deepwater, New Jersey.

CDC engaged Carmagen Engineering, Inc., to assemble a team of experts (Team) to assist in the evaluation of the DuPont SET facility's treatment of the CVXH. The Team recognized that an assessment of the NECDF destruction process and an examination of the analytical methods to be used for CVXH clearance were required to ensure that the hydrolysate being shipped to SET will be adequately characterized and that VX and EA 2192 levels in the CVXH meets Army specifications.

The Team addresses its findings in chapters 2–4 of the report. The reader is encouraged to review all of the findings, as well as the supporting documentation in each chapter. The major findings follow.

Process Issues (Chapter 2)

Finding 2.1. The database supports the efficacy of neutralizing DIC-stabilized VX using sodium hydroxide at the 8% VX-loading rate. Scale-up of the process from laboratory/bench scale to pilot scale should be operationally feasible. However, because the NECDF will be a pilot facility, changes must be anticipated in operating mode and hydrolysate composition sent for off-site treatment.

Finding 2.2. VX loading (weight percent) and the specific stabilizer (DIC, DCC) employed significantly impact the process, hydrolysate composition, analytical methods validation, and possibly solids formation. Scale-up of the process from 8% to 16% VX loading is of particular concern (because of the similarity of the organic-phase volumes from 16% to 33% VX-loading batches), the potentially high VX concentration in the resulting organic layer, and the analytical problems identified with 33% VX loading.

Finding 2.3. The impact is unknown of solids formation during the hydrolysis process on operations (potential for blockage of the in-line static mixer, control valves, and sampling system), VX analytic methods, and off-site hydrolysate treatment. The transition from 8% to 16% VX loading, as well as stabilizer change, is of concern and requires additional detailed studies.

Analytical Methods (Chapter 3)

Finding 3.1. The methods for analyzing VX and EA 2192 in 8% VX-loaded, DIC-stabilized CVXH are adequate to detect and quantify at the established clearance levels for VX (20 ppb) and EA 2192 (1 ppm).

Finding 3.2. The use of EPA's MDL for clearance levels does not preclude analytical instrument detection of low-level VX and EA 2192 (generally <20 ppb VX and <1 ppm EA 2192) in the CVXH. The perception that the MDL clearance criteria indicate absence of analytically detectable VX and EA 2192 could be misleading. While CDC believes

that utilizing the MDL approach would not result in public health concerns, the Army needs to address potential public misperceptions regarding the detection or non-detection of VX in CVXH. A simpler reporting scheme (i.e., non-detected, detected at <20 ppb, or detected at >20 ppb) should be considered.

Finding 3.2. The overall QA/QC plan and procedures for the NECDF laboratory are well designed and documented. However, NECDF laboratory personnel should continue implementing the QA/QC plan by developing day-to-day operational QC data to demonstrate that all analytical systems are operational and under control before plant startup.

Caustic VX Hydrolysate Treatment (Chapter 4)

Finding 4.1. The SET facility effectively treats the CVXH generated from an 8% VX loading with DIC stabilizer (i.e., pH adjustment, thiolamine destruction, conversion of EMPA to MPA), except for MPA, for which only minimal reduction is demonstrated.

Finding 4.2. The SET facility treatment performance should be unaffected when treatment of hydrolysate feeds from Aberdeen (HD) and Newport (VX) are alternated.

Finding 4.3. The DuPont treatability studies have not yet demonstrated the effective treatment of 16% VX-loaded CVXH, nor of 8% VX-loaded CVXH with DCC or DIC + DCC stabilizers.

6. References

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Attachment #5

Assessment of the Screening Level Ecological Risk Assessment for Discharge of Effluent from the Treatment of Newport (Indiana) Caustic Hydrolysate (NCH)

By

United States Environmental Protection Agency, Region 2
at the request of the
Centers for Disease Control and Prevention

October 5, 2004

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
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Dear Dr. Sinks:

In response to a request from several New Jersey and Delaware Senators and Congressmen for a formal review of the Army's proposal for off-site treatment of the VX hydrolysate at the DuPont wastewater treatment facility and discharge to the Delaware River, the Centers for Disease Control and Prevention (CDC) agreed "to conduct a review of the off-site disposal plan within our areas of expertise." In turn, CDC requested that the United States Environmental Protection Agency's (EPA) Region 2 office review and comment on the Screening Level Ecological Risk Assessment for Discharge of Effluent From The Treatment of Newport (Indiana) Caustic Hydrolysate (NCH) prepared by DuPont dated March 3, 2004. This letter outlines EPA's comments on this document.

The basic question that EPA Region 2 was asked to respond to was "From an ecological standpoint, is the disposal of material as presented in the DuPont Chambers ecological risk assessment acceptable?" Based on our review of the information provided and the amount of outstanding issues that need to be addressed, EPA's position is that DuPont has not demonstrated that the disposal of material as presented in the ecological risk assessment is acceptable.

Enclosed is a detailed discussion of EPA's findings. In summary, the Screening Level Ecological Risk Assessment (SLERA) does not contain adequate information to conclude that there is no unacceptable risk from the discharge of treated VX hydrolysate to the Delaware River, and a number of constituents were left out of the analysis completely. In addition, there are several additional issues that need to be addressed before treatment and discharge of this treated hydrolysate to the Delaware River can occur including: whole effluent toxicity tests procedures, the potential for the presence of VX nerve agent and other toxic breakdown products in the hydrolysate, the addition of phosphorus to the estuary, and the NPDES permit with New Jersey.

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Therefore, EPA believes that the conclusions of the SLERA are not valid and that the ecological risk process on the Army's proposal to discharge treated VX hydrolysate to the Delaware River must continue.

If you have any questions regarding this letter, please contact me at (212) 637-3725 or have your staff contact Grace Musumeci, Acting Chief of the Strategic Planning and Multi-Media Programs Branch at (212) 637-3504.

Sincerely yours,

Walter Mugdan, Director
Division of Environmental Planning and Protection

Enclosure

cc: (w/ enclosure)
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ENCLOSURE A

General Comments

The Screening Level Ecological Risk Assessment (SLERA) lacks conservatism. SLERAs are meant to be "conservative assessments in that they provide a high level of confidence in determining a low probability of adverse risk, and they incorporate uncertainty in a precautionary manner" (USEPA, 2001). The goal of a screening assessment is to minimize the likelihood of underestimating potential or current risk to ecological receptors through the use of conservative assumptions ensuring that the results will most likely overestimate actual risk.

DuPont's lack of conservatism in the SLERA is illustrated by the following:

- The SLERA does not include and evaluate all detected constituents found in the VX hydrolysate. DuPont focused the assessment only on the "principal constituents"of ethyl methylphosphonic acid (EMPA) and methylphosphonic acid (MPA). The Waste Characterization Profile Sheet located in Appendix B of the March 2004 Treatability Study indicates that several metals including arsenic, chromium, and lead were found in low ppm concentrations in the hydrolysate. Metals were also found in the hydrolysate as indicated in a July 2002 Oak Ridge National Laboratory report prepared for the Army (Oak Ridge National Laboratory, 2002). EA2192 or (S-[2-diisopropylaminoethyl] methylphosphonothioic acid), another breakdown product of VX nerve agent, is not included in the SLERA (more on this constituent below).

- Because some compounds in the hydrolysate mixture are unidentified, a conservative screening assessment of the mixture toxicity should be performed by assuming that unidentified chemicals are as toxic as the most toxic identified chemical in the mixture and by applying a concentration addition model to all constituents. The results would not constitute a risk estimate but could be used to determine whether the issue of mixture toxicity can be eliminated or requires more study.

- Maximum concentrations of all detected hydrolysate constituents, not just the "principal components," must be used in the screening level risk quotients. Concentrations for both EMPA and MPA are estimated in the SLERA.

- Dilution factors should not be used for estimating the in-stream concentrations of MPA and EMPA or any other detected constituents. In order to be conservative, the maximum hydrolysate concentrations for all detected constituents must be used in the risk calculations without a dilution factor.

- The Risk Characterization section of the SLERA should contain a Hazard Index (HI) calculation for constituents that have the same ecological effect endpoint and/or the same mechanism of toxic effect. EMPA and MPA were assumed to have similar toxic mechanisms in the SLERA and their hazard quotients should have been added together to

calculate a hazard index. All detected nerve agent breakdown products found in the hydrolysate with similar toxic mechanisms as EMPA and MPA should be included in the Hazard Index calculations.

In order to have a high degree of confidence in the predictive value of the hazard quotient method, there must be great certainty in the constituent concentrations and NOAELs used in the SLERA. Based on the non-conservative assumptions used in this SLERA, USEPA has little certainty in both the concentrations and NOAELs used in the hazard quotient calculations and therefore, does not believe that a statement of "no unacceptable risk" can be made for hazard quotients less than 1. The use of more conservative assumptions in the SLERA as listed above will certainly increase the risk quotients and risk indices. These increases will ultimately produce higher risk quotients that may approach or exceed 1 indicating a potential for adverse ecological effects and that a more thorough risk assessment is warranted

Toxicity Test Issues

A full Summary of Findings and Technical Recommendations (Enclosure B) follows this and provides an overview of the toxicity tests, a data review, and recommendations. Only the recommendations are presented here as follows:

- The data from the Treatability Study and the pure chemical testing are acceptable as screening evaluations.

- The results from the data study are not acceptable due to the limited effluent concentrations used in testing. The acute toxicity testing done for the data study must be re-run with the following concentrations of effluent after treatment through the second bio-reactor: 12.5%, 25%, 50%, 75% and 100%. Testing must be conducted with the following three species that are currently listed in the NJPDES permit: *Pimephales promelas* (fathead minnow), *Cyprinodon variegatus* (sheepshead minnow) and *Ceriodaphnia dubia*. The sheepshead minnow is included because any tests conducted on effluent from the treatment of NCH through the first and second phase PACT must consider all scenarios under the current NJPDES permit. This includes a discharge into the Delaware estuary when the receiving water salinity is greater than 3.5 ppt. When salinity is greater than 3.5 ppt the NJPDES permit states that testing must be conducted with the sheepshead minnow, *C. variegatus*.

- In addition, because the NJPDES permit is under review it is likely that chronic endpoints (which were to be reviewed for inclusion in the current permit) will be required. Therefore, chronic testing should be conducted on the final NCH effluent using species to be determined by the NJDEP in the new NJPDES permit. At a minimum, chronic testing with the same three species used for acute testing, ie *P. promelas, C. variegatus* and *C. dubia,* should be conducted to provide more sensitive endpoints to the data study than acute testing alone.

- All testing must be conducted following all quality control procedures as outlined in the EPA acute and chronic testing manuals (EPA 2002, 2002a & 2002b) in order for the data to be acceptable.

Some of these required QA/QC procedures include:

- test with both freshwater and marine species
- use controls on all tests
- conduct/pass reference toxicant tests with organisms cultured in-house or supplied from an outside source
- use organisms of the same age at start of the test and ensure ages are within the proper age range
- use required number of replicates and number of organisms per replicate for all tests
- ensure sample holding times are less than 36 hours
- use concentrations of 12.5%, 25%, 50%, 75%, and 100% effluent.

VX nerve agent and other toxic breakdown products could be present in the hydrolysate.

The VX nerve agent method detection limit in the hydrolysate is 20 ppb. According to a May 15, 2004 US Army document prepared by Parsons titled VX hydrolysate analytical testing results Response to CEC Request for Information: Item No. 1, this limit evolved from a Department of the Army pamphlet that states "The thoroughness of the neutralization process will be verified by laboratory analyses to assure that an agent concentration above the emergency drinking water standards in TB Med 577 does not exist . . . " The drinking water standard for nerve agents is listed as 0.02mg/l (20 ppb) in the Army's Medical Technical Bulletin Sanitary Control and Surveillance of Field Water Supplies (TB Med 577). This detection limit is based solely on the protection of humans from a drinking water source and may not be protective of aquatic organisms through ingestion or dermal exposure.

Acute exposure studies of the VX nerve agent have been performed demonstrating that 7 out of 10 juvenile striped bass were killed after 14 to 20 hours of exposure to 20 ppb (method detection limit) of VX nerve agent. All of the white perch (10 of 10) exposed to 25 ppb (slightly above the detection limit) of VX nerve agent in aqueous medium died in approximately 9 hours (Weimer, et.al, 1970). This report stated that "the effects of chronic exposures to lower levels of VX have not been studied." These chronic exposure studies, using aquatic species included in the NPDES permit, should be performed prior to discharge of the hydrolysate effluent to the river. Discharge of even small amounts of VX nerve agent remaining in the hydrolysate effluent to the Delaware River could have potentially adverse effects on aquatic organisms since this effluent is planned to be discharged about two times per day for approximately two years.

EA2192 is another toxic breakdown product generated during the destruction of VX nerve agent. According to a November 2001 US Army Center for Health Promotion and Preventive Medicine report, "based on its persistence and toxicity it has been suggested in several reports that EA2192 be viewed as a serious consideration wherever VX is being destroyed." The report also states that EA2192 may "pose a greater potential for chronic toxicity" than VX and once in solution, it is extremely persistent in the environment. This constituent was not included or evaluated in the SLERA nor were any data on this constituent's toxicity presented in the document.

There is no information demonstrating that the SET is capable of treating VX nerve agent or EA2192 that may be present in the hydrolysate so that if they were present in the effluent, they

would go untreated and be directly discharged into the Delaware River. Important aquatic species that could be adversely affected by the presence of VX nerve agent, EA2192, and any other toxic breakdown products in the river include striped bass, shad, white perch as well as invertebrates such as crabs, clams, and lobsters.

The addition of phosphorus to the Delaware River could be detrimental.

Based upon the data presented in the risk assessment, we cannot accurately predict the availability of phosphorus in the receiving waters based on breakdown of the phosphonic acid compounds, which are proposed to be discharged. If they are easily broken down to biologically available phosphorus which is generally considered to be total phosphorus (portions of both the inorganic and organic phases of total phosphorus have been found to be biologically available), they will have more of an impact than if they do not break down easily in the environment.

As discussed in Chapter 2 of EPA's October 2001, "Nutrient Criteria Technical Guidance Manual: Estuarine and Coastal Waters," often both nitrogen (N) and phosphorus (P) "elicit greater phytoplankton biomass stimulation than the sum of both N and P added separately. There are reported cases where both N and P are required to elicit phytoplankton biomass production response in estuaries, suggesting that N and P supply rates are equally limiting." This Guidance goes on to state that, "a number of temperate estuaries exhibit seasonal shifts in nutrient limitation with winter-spring P limitation and summer-fall N limitation."

In addition, according to the Draft National Coastal Condition Report II (USEPA, 2004), the tributaries of the Delaware River near the outfall of the SET already have poor grades for water quality, dissolved inorganic phosphorus (DIP), and benthic index. Although the current conditions in the Delaware Estuary do not demonstrate that eutrophication is occurring, it is unclear of the effect of the addition of MPA and other phosphorus-containing compounds from the discharge of the VX hydrolysate effluent into the Delaware River. The concern is that the addition of these compounds could increase the amounts of DIP in the estuary to such a point that the system would create unwanted algal blooms. Given the fact that the proposed discharge is located in Zone 5 of the Delaware River, which is characterized as the transition zone, an increase in the concentration of P to the system may result in phytoplankton biomass production, as outlined above.

EPA recommends that hydrodynamic modeling considering the addition of MPA and other phosphorus-containing compounds from the discharge of the VX hydrolysate effluent into the Delaware River be conducted to demonstrate that the addition of these compounds will not have any adverse effects on the estuary and its tributaries.

NPDES Permit Issues

DuPont Chambers Work discharges wastewater into the Delaware River under the terms, conditions and provisions of a National Pollutant Discharge Elimination System (NPDES) permit that is administered by NJDEP. The NJDEP has been delegated as the permitting authority for the State of New Jersey. EPA's role in the NPDES program involves oversight of New Jersey

State's NPDES permitting program.

The current permit (NJ0005100) was issued by NJDEP on December 31, 1998 and expired on January 31, 2004. Although the permit has expired, the conditions of the permit are considered to be administratively extended and still in effect, and enforceable. Effluent limitations were included in the permit to address Chamber Work facility's discharge of process wastewater, stormwater, cooling water, groundwater remediation wastewater, leachate, and wastewater delivered from offsite facilities.

The following represent issues that USEPA has concerning the treatment and discharge of the VX hydrolysate at the DuPont SET facility that need to be addressed before the SET's treatment of VX hydrolysate effluent can be discharged to the Delaware River through the permitted outfall:

- DuPont needs to clarify whether their Chamber Works facility was authorized under the current NJPDES permit (NJ0005100) to treat the Army's Newport Caustic Hydrolysate (NCH).

- The current NJPDES permit issued for this facility (NJ0005100) that expired January 31, 2004 does not include a limit nor a requirement to monitor and report on MPA, thiolamine, and EA2192 if DuPont is allowed to accept the Army's NCH for treatment. USEPA is concerned that the Army's VX hydrolysate sent to DuPont's SET treatment facility for treatment will contain MPA, thiolamine, and EA2192, which are not limited, and will be discharged to the Delaware River and Estuary. In sufficient dosages, these pollutants may present serious hazards to aquatic organisms. Based on DuPont's study, SET WWTP has limited effects on the treatment of MPA. There is a concern about the environmental effects of MPA and other toxic breakdown products that may be associated with the Army's wastewater.

- Since the proposed Army project is expected to take several years to complete, we recommend the Army's application be addressed and evaluated by NJDEP in the upcoming renewal process. Additionally, the Army's proposal would be considered a major alteration per 40 CFR 122.62 (a) (1) since the addition of this wastestream will result in changes in the permittee's practice that are different in the DuPont's NJPDES renewal application.

- The Army and/or DuPont should provide effluent characterization studies so that a decision can be made on whether additional limitations and/or conditions on the identified pollutants are necessary in the renewal permit.

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ENCLOSURE B

SUMMARY OF FINDINGS AND TECHNICAL RECOMMENDATIONS - DUPONT TOXICITY EXPOSURE DATA FOR NEWPORT CAUSTIC HYSDROLYSATE

ACRONYMS:

ACH: Aberdeen Caustic Hydrolysate, waste currently being treated by DuPont from the Army Aberdeen Test Center, Aberdeen, MD

SET: DuPont Secure Environmental Treatment Center located at the DuPont Chambers Works site in Deepwater, NJ. Operates under NJPDES #0005100 for DSN662 (formerly DSN661).

EMPA: Ethyl Methylphosphonic acid

NCH: Newport Caustic Hydrolysate, or VX Hydrolysate, is the byproduct of the neutralization of VX nerve agent .

MPA: Methylphosphonic acid

PACT: Powdered Activated Carbon Treatment System (DuPont patented technology); multi-step process of aeration, biodegradation and clarification of wastes.

OVERVIEW

The DuPont Chambers Secure Environmental Treatment facility in Deepwater, NJ is seeking an Army contract to treat 4 million gallons of wastewater, Newport Caustic Hydrolysate (NCH), from the neutralization of a stockpile of VX nerve agent in Newport, IN. The Center for Disease Control is reviewing DuPont's Human Health Toxicity Assessment for the project whiled EPA Region 2 reviewed the Ecological Risk Assessment.

As part of the assessment, DuPont contracted with EA Engineering, Science and Technology, Inc, to conduct toxicity tests for three different phases of the project.

1. Treatability Study: Small scale studies designed to test different NCH treatments in order to remove odor, maintain efficient operation of the DuPont PACT biotreatment system and to meet NJPDES permit limits. Acute. 48 hour toxicity tests were conducted using Fathead Minnows, *Pimephales promelas*, on effluents from 10 potential treatments. This study simulated wastes from treatment through the PACT system.

2. Pure chemical testing: EMPA & MPA are major constituents of NCH. The treatability study demonstrated that only a small amount of EMPA will be converted to MPA during processing. Chronic toxicity tests were conducted on EMPA & MPA using a freshwater species, *Ceriodaphnia dubia* a water flea, and the opossum shrimp, *Americamysis bahia*, which is a marine species.

3. Basic Data Biotreatment Study: Designed to test treatment of NCH as processed along with outside wastes handled by SET on a routine basis. Acute, 96 hour toxicity tests were conducted using the Fathead Minnow, *Pimephales promelas,* a freshwater species. This

study simulated wastes from treatment through both first and second stage PACT systems.

DATA REVIEW

1. Treatability Study

The treatability studies were conducted by DuPont using a single stage Eckenfelder reactor which simulates the first of the two-stage PACT used in processing wastewater. Samples of NCH were treated and processed ten different ways through the Eckenfelder to simulate various feed rates and possible ways the facility could control NCH odors and pH with different stabilizers before safely discharging into the Delaware Estuary. EA Engineering conducted limited scale acute 48 hour toxicity tests using fathead minnows on the resulting wastewater. Tests were repeated approximately a month later on the same samples with a CO_2 headspace to control pH drift. LC50s were calculated for each treatment and both series of tests.

The data from the first series of tests conducted on January 8-12, 2004, are acceptable with qualifications. An LC50 cannot be calculated with certainty because the highest test concentration was only 50% effluent. This was based on the SET NJDPES permit limit of an LC50 of ≥50% effluent for acute fathead minnow testing. The 50% effluent concentration should have been bracketed with not only lower concentrations but at least one dilution higher, preferably two concentrations, i.e., 75% and 100%. The data, however, is acceptable to show trends in the various treatments to assist DuPont in determining the best way to process the NCH.

All data from the second series of tests conducted on February 9-13, 2004 are unacceptable for the following reasons:

- holding times for wastewater far exceeded standard 36 hours
- no controls were tested
- DuPont's NJPDES permit does not indicate the use of CO_2 headspace to control pH drift
- two samples were tested at 25% and 50% dilutions while the remaining eight samples were tested at only 50%
- an LC50 cannot be calculated from only one or two concentrations nor without valid control data
- Fatheads were different ages from those tested in first series
- these results may not be combined with the first test series results to estimate an LC50 for each treatment

2. Pure Chemical Testing

Ethylmethylphosphonic acid (EMPA) and methylphosphonic acid (MPA) are major constituents of NCH. After the treatability studies it appeared that the majority of MPA would be released untreated into the Delaware Estuary and that only a small amount of EMPA would be converted to MPA during biotreatment through the PACT. EA Engineering conducted pure chemical chronic toxicity tests using freshwater and marine species (the water flea, *Ceriodaphnia dubia*, and the opossum shrimp, *Americamysis bahia*, respectively) for both EMPA and MPA. The marine species sheepshead minnow, *Cyprinodon variegatus*, was also tested using MPA.

Data was provided for range finding tests and definitive tests. The toxicity data for the definitive tests only were reviewed with emphasis on control survival, test design, reference toxicant testing, water quality, statistical analysis, organism handling/acclimation and effluent holding/handling (See Table 1). There are four possible determinations for reviewed data:

A - Acceptable Q- Acceptable w/Qualifications U- Unacceptable N- Notdetermined

Table 1. QA/QC Checklist for Pure Chemical Testing

Chemical	EMPA	EMPA	MPA	MPA	MPA
Organism	Daphnid *C. dubia*	Mysid *A. bahia*	Daphnid *C. dubia*	Mysid *A. bahia*	Minnow *C. variegatus*
Control Survival	Q[1]	Q[1]	Q[1]	Q[1]	Q[1]
Reference Toxicant	A	Q[2]	A	Q[2]	A
Test Concentrations	A	A	A	A	A
Test Procedures	A	A	A	A	A
Temperature	A	A	A	A	A
Dissolved Oxygen	A	A	A	A	A
pH	A	A	A	A	A
Salinity	N/A	N/A	A	A	A
Acclimation Procedures	A	A	A	A	A
Sample Holding Time	A	A	A	A	A
Statistical Analyses	A	A	A	A	A
Loading Factors	A	A	A	A	A

1 - A sodium hydroxide control should have been run in conjunction with a normal control to test the effect of adjusting the pH of the test solutions prior to testing with sodium hydroxide
2 - Reference toxicant testing with *A. bahia* using KCl was out of acceptable range for IC25.

Results of the definitive testing with MPA and EMPA are acceptable except for those conducted with *A. bahia* due to the out-of-range reference toxicity testing. The reference toxicity test was conducted by the lab which provided the organisms. The out-of-range result may have been avoided if EA had conducted their lab with *A.abdita* after acclimating to test conditions.

3. Basic Data Biotreatment Study

This study built on the treatability study by testing both the first and second stages of the PACT system. It also mimics real life situations in which NCH pretreated with peroxide and then with one of two possible stabilizers would alternate being processed through the PACT with other wastes such as ACH.

There are inconsistancies between the numbering of the samples in Appendix K-1 of this draft report. The numbers in the first table of the appendix, page K-1, appear to match the sample numbers in Table 14 on page 42 of the report; however, the data sheets in Appendix K do not match up with these numbers.

Due to these inconsistencies, it is impossible to review the data for each individual test. The test results, however, are not acceptable because as in the treatability studies, an LC50 cannot be calculated with certainty because the highest test concentration was only 50% effluent. Even though this was acceptable with qualifications for the range finding tests, it is not acceptable for definitive testing.

RECOMMENDATIONS

- The data from the Treatability Study and the pure chemical testing are acceptable as screening evaluations.

- The results from the data study are not acceptable due to the limited effluent concentrations used in testing. The acute toxicity testing done for the data study must be re-run with the following concentrations of effluent after treatment through the second bio-reactor: 12.5%, 25%, 50%, 75% and 100%. Testing must be conducted with the following three species that are currently listed in the NJPDES permit: *Pimephales promelas* (fathead minnow), *Cyprinodon variegatus* (sheepshead minnow) and *Ceriodaphnia dubia*. The sheepshead minnow is included because any tests conducted on effluent from the treatment of NCH through the first and second phase PACT must consider all scenarios under the current NJPDES permit. This includes a discharge into the Delaware estuary when the receiving water salinity is greater than 3.5 ppt. When salinity is greater than 3.5 ppt the NJPDES permit states that testing must be conducted with the sheepshead minnow, *C. variegatus*.

- In addition, because the NJPDES permit is under review it is likely that chronic endpoints (which were to be reviewed for inclusion in the current permit) will be required. Therefore, chronic testing should be conducted on the final NCH effluent using species to be determined by the NJDEP in the new NJPDES permit. At a minimum, chronic testing with the same three species used for acute testing, ie *P. promelas, C. variegatus* and *C. dubia,* should be conducted to provide more sensitive endpoints to the data study than acute testing alone.

- All testing must be conducted following all quality control procedures as outlined in the EPA acute and chronic testing manuals (EPA 2002, 2002a & 2002b) in order for the data to be acceptable.

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