Tape 1, 6/20/02

(TAPE 1, SIDE A)

Stewart-Craig: All right, good morning, my name is Elaine Stewart-Craig. I represent Soldier Chemical Biological Command, which is easier SBCCOM, as much as I hate acronyms. Today we're talk about a related topic that we've been talking about the last two days, which is the protective ensemble that a emergency responder may be wearing in a chemical, nuclear, and biological event. Before I get too far, I just want to make sure that everyone who has not been here the last two days realizes that this whole thing is being taped so that we have a record of what questions were asked, what were the answers, not that we're trying to inhibit anything you say, in fact quite the opposite. This meeting in particular really looking for input from manufacturers, users and testers. Nothing's been put on paper for, in ink yet for this project so we're looking for your input so when we put out the first revision it reflects as many people's input as possible. That's okay. We don't want to tell them why you're having trouble. Go ahead. Okay. This is agenda; I was switching it again even as we speak this morning. The important thing to note is, we're going to be flexible. When we need a break you're going to get a break once I find out that half of you, and I can see you, are back in the coffee area, its break time. At the same time, I think we'll probably be a little quicker than the original agenda says. So if we can, we will, but I don't want anyone to feel rushed or anyone to feel like if they have comments not to make them, 'cause that's my main objective is to get information, but at the same time if we don't need to be here till 5:00 we're not going to be here till 5:00. You can keep

going. Okay, I guess the purpose here is to for the whole program is to develop a standard or work with another group, in this case NFPA we hope, to have a standard for protective ensembles for emergency responders in a CBRN event. All right go ahead. Going to let him talk about (...inaudible...). Okay, some of this you're going to here again in a minute from Phil so I'm not going to go in too much detail, but basically, as you all know there is no standards for a lot of the equipment out there and there's certainly no standards for any CBRN equipment, so what we're trying to do is come up with a standard that reflects the needs of the users and is able to be produced by the manufacturers. Go ahead. We're working with the interagency board, I don't know, most of you probably know who they are, if you don't, it's a group of emergency responders from state and local from across the country as well as a few federal participants of which I'm one. I'm actually the Federal co-chair of DCON and Detection, not PPE. Bill Haskell is the Federal coordinator for that. But, as my job as SBCCOM I am developing and helping develop the standards. All right. This is some of the goals for the program. First year we're going to talk about is "Develop the Hazard Analysis" and Jim's going to talk about that in a little while. Now those of you who have been here the last two days, it's all one and the same hazard analysis, but today it's a little different twist. Today, he's going to talk about where we are and where we're going in the warm zone and more about the chemical warfare agents and not so much about the ticks. Not that we're not concerned about the ticks as well, but today's presentation is slightly different. Go ahead. As

we get into next year, which I guess actually next year starts as soon as our second year money comes which should be any second, hopefully. We're still waiting for our 02 money. We're going to continue looking at the standards that exist, use whichever ones we can, and hopefully after this meeting and a few months later when we come up with a draft and get some input we can start doing some preliminary testing to see how the suits do against the actual test methods. And finally by year three which will be starting about a year from now we hope to actually have some validated test methods and to start actually testing suits and getting some approvals. But in this case approval's a little different than we working with NIOSH, there is no regulatory group with suits, I'm sure you well know that. So these standards are going to be voluntary. They're going to be held by NIST and it's going to be up to the manufacturers to decide if they want to get their's approved or not and its going to be up to the users to decide whether or not they want to buy one that has been approved or not but this is not going to be a requirement; it's all going to be voluntary. All right, go ahead. Urgency, I guess we don't need to talk about that. We've been working on this, as I said, for well over a year, but obviously since September 11th, you know there's a new urgency in getting this moving quicker and faster and making sure the equipment that's out in the field with the responders is what they need. Okay, and with that I'll turn it over to Phil.

Mattson: I was taught in speech-giving class the one time they tried to teach more or they were told they were supposed to teach me that the presenter is supposed

to get a feel for the audience. So, how many of you have been here for the past two days? And how many of you are new here today? Not that it matters, I just wanted to get a little audience interaction here. (Laughter) Now you pay attention, because there's going to be a quiz at the end of the presentation. Okay? I'm Phil Mattson, I'm a (...inaudible...) contractor working in support of the Office of Law Enforcement Standards. I work for and receive primary direction from Dr. Al Fatah, from NIST, and this is going to be very similar, in fact the slides are identical to the ones you saw earlier this week. Well, there's a couple of subtle changes and we'll see if you can pick those up. That's the second part of the quiz. Let me start by answering a question that we're asked a lot, and that is "Why does a National Institute of Standards and Technology even have an office related to law enforcement?" After all, NIST is a part of the Department of Commerce and not the Department of Justice, and, "What does the Office of Law Enforcement Standards or OLES as we call ourselves, do?" To understand that we need to jump back to 1967. The 1960's you might, or may not, remember were not all good days and sunshine. The United States was in the grip of political and social transition, the rate of serious and violent crime was skyrocketing, and the public's sense of security and its confidence in law enforcement were plummeting. The Presidential Commission studied the problem and reported that law enforcement officers at all levels were inadequately equipped to protect themselves in the public. Not just because they didn't have enough money, although that's always true, but because they had no source of reliable information about the equipment they

needed to buy. When a county sheriff in New Mexico, as state police superintendent in Tennessee, or even the chief of Police of New York City needed to buy any kind of equipment for their personnel, they were on their own. There was no Consumer Reports type of magazine for law enforcement, or for the fire service or for anybody, for their equipment. In fact, there were no performance standards or guidelines for anything used in these fields. The only information available for making even the most critical buying decisions was a manufacturer's sales brochures and whatever you could learn through the grapevine. And federal, state, and local agencies were spending money by the truckload on equipment that came with no assurance that it would perform as advertised, and often it didn't. And that's not necessarily the fault of the manufacturers. Again, as we're finding out here, that we need to do a detailed hazards analysis to understand the threats, to understand the mission of the folks that we're trying to protect in order to develop the proper equipment in order to provide the service that is needed. (...inaudible...) little truck. There's my truck. Next slide please. Congress directed the Department of Justice to fix this message and Department of Justice's research arm, the National Institute of Justice, came to NIST. Now why is that? Before you can recommend to 52,000 law enforcement and public safety agencies what equipment they should buy you have to be able to evaluate that equipment. The only way to fairly and accurately to do that is to establish uniform standards and test the equipment to determine whether or not it meets these standards. NIST has been in this kind of business for about 70 years helping

the government and industry develop standards for manufacturing, procurement, and federal regulations. We've been involved in tackling these technical challenges for a number of years. So, in 1971 through an agreement with the Department of Commerce and the Department of Justice, OLES was born, and NIJ and OLES have been partners ever since. Office of Law Enforcement Standards is funded by the National Institute of Justice, and the National Institute of Justice has been providing the funding for this standards development program. The majority of the funds for the development of the respiratory protective standards we've been talking about for the past two days and the funding for this program have been coming primarily through NIJ. Some funding has been coming through other agencies such as the Memorial Institute for the Prevention of Terrorism. Next slide please. OLES is a matrix management organization, a group of project managers and contractors, each with specific areas of expertise. Now this picture was taken on a particularly good day, I'm not in there, though. And we design projects to, we help NIJ and its partners identify standards that are needed most and design projects to meet those needs. With the exception of projects involving ballistics and body armor, which we do in-house at OLES, we go out and find the very best investigators and subject matter experts to do the bench work. Again, we're project managers, so we manage the projects as opposed to actually doing the work, which is (...inaudible...). Next slide please. Over the years, OLES has evolved six core program areas each dedicated to specific technology and although, together we've developed more than 250 standards

test protocols, technical reports and user guides for our clients and sponsors for all type of equipment. The majority of the work for the CB standards to date has been in the chemical systems and materials program area where Al Fatah is the lead program manager. We have since established a new program area, Critical Incident Technologies, and it's going to be taking on some of the RN and explosive areas. Next slide please. Our joint mission is straightforward. We identify standards for the criminal justice and public safety community needs that they need the most. And by the criminal justice and public safety community we mean law enforcement agencies, prisons, fire service, haz-mat, EMS, and those type of folks. We help develop test methods and procedures for evaluating equipment according to these standards. For critical equipment we set up compliance testing programs. If you use qualified independent laboratories to evaluate items that manufacturers submit to us. Again, NIST does not have the test facilities in house to conduct this testing. Next. We also publish technical reports and user guides that give equipment manufacturers the information they need to understand the standards, and like Consumer Reports, give end users the information they need to make smart buying decisions. In addition, we provide information and guidance on how to use that equipment. The standard is, and test procedures are, by the nature of the beast very technical, but we have a separate document which goes to the users so they understand the limitations and the constraints in which to employ that equipment. Next slide. Now, as I said, we don't do this all by our self. So we have a number of partners who serve as investigators and

consultants on specific programs and several laboratories also right in house at NIST. There are universities and private laboratories, government military organizations, manufacturers, U.S. and foreign law enforcement agencies, scientific and technical working groups, and recognized experts around the world. These partners are key to our success and their hard work is behind much of what we've accomplished. And they're also the reason that OLES has been able to continually expend their mission into new areas and take on new responsibilities, as we have since September 11th. Now let me transition a little bit and talk about standards and voluntary standards. Voluntary standards movement began in this country in the private sector over a hundred years ago. It quickly became the framework in which America built its industrial base and modern infrastructure. In the late 1800's, companies within certain industries got together and created their own standards committees. These committees developed procedures for specifying product characteristics and setting safety and performance criteria, and determining if products conformed to these criteria. Individual manufacturers were free to follow the standards or not, but if they didn't, in many cases they discovered that their products were ignored in the marketplace and came under close scrutiny of regulators. Ever since, since the system worked so well, the United States never really felt the need for centralized government-run standards system. And so, they developed the IRS instead. (Laughter) Now that doesn't mean that we can't—that everyone just comes up with a standard and have it generally accepted, a standard has to meet certain standards. Now like

industry, the federal government depends on standards. The standards are written into procurement contracts to ensure that the taxpayers get their money's worth for suppliers, and of course there's volumes of compulsory standards related to everything from the environment to worker safety. Since before World War II and up until the mid-90s, the number of government and especially DOD standards was multiplying exponentially. Every new regulation meant writing a new standard or set of standards and every item DOD wanted to purchase, from a cannon to a bottle of ketchup, demanded a specific kind of standard known as a military specification. In the mid-1990's, somebody realized that a lot of government standards and specifications weren't all that different from the voluntary consensus standards already on the books or being developed in the private sector. In fact, a good percentage were practically identical. That led to the idea that Uncle Sam could save a lot of redundant effort and taxpayer money if he got out of the standards writing business, instead borrowed and modified existing standards when he needed to. And that's the essence of the National Technology Transfer and Advancement Act, the NTTAA. Very simply the NTTAA states that in developing regulations and procurement guidelines, federal agencies will adopt existing voluntary consensus standards whenever possible. They will also participate in the standards development process by sending their own scientific and technical folks representing the government's interests before various private standards organizations. And that's one reason why OLES serves on a number of standards committees. As you can imagine, the

NTTAA has deeply affected the work OLES does. In particular, it spared us from having to develop every standard from scratch. Every one of our programs starts with reviewing the literature and seeing what standards already exist from other organizations and considering which ones we can modify and adapt to the needs of the criminal justice community. The second point that I want to make about our standards process is that they're minimum performance standards. And we had a number of comments and a lot of discussion in the past couple days on the concept of performance standards. Each one defines essential performance criteria for a type of equipment and sets thresholds that the equipment must meet to satisfy the needs of the people who actually use it. Performance standards are different from other types of standards, design standards. As we're all familiar, design standards tell the manufacturer exactly how to make the mousetrap, whereas performance standards specify how well the mousetrap has to work and under what conditions. Manufacturers are free to come up with their own approaches and designs. Of course, NIST, being a part of the Department of Commerce, fully supports that concept. Now you've heard about the IAB yesterday and then Elaine mentioned it this morning. Our work on technology for the first responders is being done largely through our participation in the IAB, the Interagency Board for Equipment Standardization and Interoperability, and a number of you are members or participate in the IAB process. The IAP was created in 1998 by the Department of Justice and the Department of Defense to help state and local law enforcement and public safety organizations equip

themselves to protect their own personnel and minimize the impact on the public in the event of a terrorist incident. The IAB's core mission was to develop and maintain a standard equipment list or the SEL. SEL includes hundreds of items considered essential for responding to CBRNE attacks, that is attacks, as we all know, involving chemical, biological, radiological, nuclear, and high-yield explosive events. Items range from detection, communications, personal protection equipment, which is what we're here talking about these past three days, to decontamination equipment, medical supplies, and pharmaceuticals. The list is updated and published annually through the IAB. The SEL was a good start, but it was just a list. From very early on, the IAB noticed and admitted that a lot of the equipment available on the market simply didn't fit the needs of the first responders. This was a serious problem and very much like the situation back in 1967 for the law enforcement community which spawned OLES. There's plenty of equipment out there, but nobody really knows which items, if any, will perform as needed when the time comes. Again, understanding the requirements and the situations in which that equipment needs to be used is essential to that. IAB created its own standards coordination committee which is currently chaired by the National Fire Protection Association and NIOSH. OLES has a seat on this committee for almost three years. In 2000, we were appointed the committee's executive agent, making us the arbiter of the CBRNE standards nationwide, the coordinator of multi-agency efforts to develop standards, which is why I'm here and we're all here, and the organization responsible for

implementing and administering those standards. We were chosen for this role, not only because we know how to develop standards and test methods, but also because of our long history and proven track record of bringing together the best qualified individuals and agencies, organizations to tackle big technical challenges. Now, one thing, as was mentioned before, we in the IAB process look at existing standards that may apply directly to the equipment that we need for the first responders, if current existing standards don't apply, then we seek to modify existing standards, and if there are no standards that exist or can be modified, then we look at means to develop new standards and then publish them through the appropriate agencies be that through NIOSH as we're doing with the CBRN standards, working through NFPA as we are now or if all else fails, if we can't find niche as we're developing a standard for bomb suits, that might be published through NIJ as an NIJ standard. Next. The technical challenges are enormous and we're all familiar with them. Prior to a few months ago, the only existing CBRNE standards were hybrids of industrial standards for hazardous materials equipment and military standards for the battlefield. We know that the CBRNE and you heard it in the hazards analysis yesterday, and you're going to hear it again today, that the scenarios and the events that the first responders are going to be responding to are different than the battlefield scenarios. In addition, existing standards were developed and tested using tradition laboratory techniques and technologies, which may be inadequate to ensure safety and reliability against the kinds of threats we're talking about.

We've had a lot of discussion in the past couple of days on test methods and threat concentrations and how we got there and if they're correct. There's a lot of unanswered questions out there, and we're all working together to answer those. Thanks. Again, a few months ago, we only had a general idea of what the threat was, the type of pathogens, toxins, agents, the concentrations that they'll be encountered, and so, CBRNE hazards had not been systematically identified and measured and, in fact, we're still working on that. And so, there's many critical areas of CBRNE research and development, and we've really had to start basically from scratch. The IAB had to pick a starting point and their top priority was standards for personal protection equipment. You need to keep the first responders alive in order to respond to the incident to save lives. In the summer of 1999, the Standards Coordination Committee members of the NFPA, NIOSH, and OLES were joined by representatives from a number of other long time partners within the NIJ, Office of Defense Preparedness, Occupational Safety and Health Administration, TISWIG, and SBCCOM, and this group established its first objective to develop standards for CBRNE respiratory devices. Participants signed a memorandum of understanding and NIJ reapportioned sufficient funds to begin work, and OLES was appointed the project manager. NIOSH, based on its expertise and its statutory role for developing respiratory protection standards for occupational workers was given the lead role in developing the respiratory standards. And SBCCOM, which is DOD's national center for research and development chemical and biological defense was contracted to support

NIOSH's efforts. Continuing on in a parallel process, we've been working on the respiratory protection standards, the hazard analysis that was done to support that is supporting the development of the PPD standards and SBCCOM is taking the lead role in doing the work on that. Achievements, and we've been talking about things that we've done for the past couple of days. We've completed the hazard analysis for the hot zone for the chemical agents. Developed a, and you've received a presentation yesterday and you get some more today about modeling tools that have been u—developed to assist in the hazards analysis development. And, we've conducted an analysis of existing (...inaudible...) respiratory standards and that's been talked over the past couple of days. And, as we all know, the first standard for the self-contained breathing apparatus was implemented in January and testing is currently going on. And as we're all very familiar, we're working on the next phase, which is for the air purifying respirators. Next slide. Additionally, through NIJ and through the, with consultation with a number of other partners, we've developed and printed a set of users guides in hard copy and they'll soon be published in a CD-ROM, which is information on personal protection equipment, decontamination detection and communications equipment for the first responders, that's in kind of a... in some cases we like to think that it's a user-friendly report because its, we have it coded, kind of like a consumer guide as to what the equipment does or does not do, and this is all based on the input we received from the manufacturers. This equipment has not been tested per se, because we do not have the standard test protocols

yet. Next slide. The program is being expanded, in FY '03 and on, to look at a number of other areas. On CB detection, decontamination procedures, materials, and equipment, and we're expanding the program also to cover the radiological, nuclear, and explosive threats. Again, this is being done in conjunction with our current partners, and who knows, we may pick up a few more in the future. Next slide. So, I hope you understand why we're so passionate about standards. Standards play an enormous role in the world of criminal justice and public safety, in many cases they're the difference between life and death for the first responders and the people that they're trying to save. And that's why at OLES, when people ask us for the definition of a standard, we often give them this one, which you've seen before. That was going to be my test question, too, doggone it. I'll have to come up with another one. That concludes my formal portion of the presentation, now before I let you ask any questions, okay, the first question is, "When's the first break?" and there were three subtle differences between this presentation and the one I gave two days ago, anybody catch that? No? Okay, I'm going to have to do it again. Any questions? Mr. Haskell.

Haskell: (...inaudible...)

Mattson: Yes. You will. Because I have to be out of here before then, too. Anything else? Yes sir.

M: (...inaudible...)

Mattson: Jeff, I guess since we're recording this, if you could come up and identify your name and the organization so we can capture this for posterity.

Stull: Jeff Stull, International Personal Protection. Does OLES have any particular plan to take any of its standards and put them into the consensus process?

Mattson: In—which standards are you—

Stull: For example, unrelated to this area, there was a series of correctional standards, correctional glove standards, for example, and those, I was wondering if there was a process (...inaudible...) for maintenance or future development or enhancement of the standards to take a project that OLES has undertaken and then to move that into some consensus form where there might be a broader range of input.

Mattson: Dr. Fatah, who's the program manager for that particular project?

Fatah: Al Fatah, Office of Law Enforcement Standards of NIST. We have glove test protocol that we issued for gloves that are used by law enforcement and corrections community. And, initially when we started about five years ago at the request of the corrections and law enforcement people, we wanted to develop a standard and at that time we did not have enough resources and it looked like it would take a much longer time to come up with a standard. So instead, what we did is come up with a test protocol. We called it a test protocol, not a standard. And the test protocol just tests the commercial gloves that are submitted to us and we just list how they performed on three major properties or requirements that the community requested which is pathogenic resistant, cut resistance, and puncture resistance, and dexterity. So it's a ANSI standard for gloves and we are looking in the future, maybe we should adopt

that, or look if it meets our needs. Otherwise we'll just stay with the test protocol. Does that answer your question.

Mattson: I guess, again, we try to work with existing standards and existing organizations as much as possible. In some cases, if it's a—again and the example I mentioned was for the bomb suit standard that we're starting to work on, I don't know if there's any other organization out there in the country that really wants to take that on, and it's a law enforcement type of issue, so for the actual development of the standard it's probably going to be coming out as an NIJ standard.

Fatah: Okay. One other thing I want to drive is that the standards that are issued by the National Institute of Justice are voluntary standards but they are not consensus in the sense of ASTM, for example. We—they conduct public hearings, they send them out for reviews, but essentially they decide when they think it should be issued, and they don't have like endless round of comments and whatever like the typical consensus standards group. So they're voluntary but they are not exactly consensus.

Mattson: Any other questions? Thank you. (applause)

Stewart-Craig: All right next we're going to hear from Mr. Jim Genovese.

Genovese: Morning. My name's Jim Genovese. I'm from U.S. Army Soldier Biological and Chemical Command, and for those of you who were here two days ago some of this will sound familiar, but what I'm going to try to do is put a little bit of a different spin on it considering the nature of the group here with looking at PPE equipment in general, as opposed to my specific comments on

Tuesday looking at basically APR standards. First off, let me just explain that hazard analysis and vulnerability assessment is not straightforward, it's not easy. There's, I've mentioned this at many conferences and I'll relay this story again, too. I remember John Szalajda and John Dower inviting me up a couple of years, was it Morgantown where we had our first conference, John? At that conference, fortunately I got to speak before Chief John Eversole from Chicago and you never want to speak after John Eversole because you just, you fall by the wayside. People are really not paying attention after John gets done. So fortunately, I came first. After that particular briefing where we were looking at this whole area of CBR standards for protection equipment, Eversole, over some scotch and waters pulled me aside and asked me, "Look, Genovese. I know you have the threats and all the answers that first responders need, and they're in the basement of Edgewood." And I looked at him and I said well I'm not sure he's right or wrong. I spent a lot of time at Edgewood, Mark (...inaudible...) and I looking at archives, looking at information both highly classified and things that were just out in the open literature, and I can tell you that I don't have the answers in the basement. They just don't exist. The specifics, the things that are in some of those documents do not tell you how the bad guy's going to deploy it and how what those resulting hazard distributions are going to be. So, our option then was to develop a systematic hazard prediction based on a range of scenarios that are maybe chemical-specific and target-specific so at least we could come up with a number that would build a vulnerability sphere or a vulnerability box which

I'll allude to here in a little bit, in that when you build a big enough vulnerability box all your threats fit within the box. And what we're hoping is that if we build the box big enough that all the threats fit within there and so therefore, then, you can respond effectively. So that's kind of the nature for what Art Stuempfle, my colleague at Edgewood, he's forty years in the business, he was Chief of Physics Division at SBCCOM and really a world-class physicist relating to chemical/biological defense. Okay. John. So we're going to look at the, I'll review what we're doing with hot zone. Hot zone was bad enough. It was tough to even be able to come up with some kind of numbers and we're not saying this is the right approach or the wrong approach, but from my experience of twenty years in this business, I feel confident in the fact that if you're going to build a standard, you're going to build a requirement for testing my feeling is, as a scientist, as a chemist, if I'm tracking the molecules and I can track the molecules to people and how those molecules get in the people and I look at the physiological effects of those people, then I at least have a rough idea of what's to be expected in these different scenarios, and that's certainly a good start. Okay, so we're going to look at the analytical process and the assessment process through this, through these various charts. John. Okay. As I've mentioned before on Tuesday, trying to get a handle on hot zone is difficult enough, it's related to the amount and type of source, the venue, characteristics of that venue, and then the type and efficiency of the dissemination system at hand, and so, it's a pretty rigorous computational process to be able to characterize, especially a large gamut of

different hazards – chemical, biological, and radiological, and then looking at, as we did on Tuesday, just the chemicals alone, I've got a ten thousand fold increase from VX all the way up to carbon monoxide, so I've got a toxicity range and also a volatility range that spans into at least three orders of magnitude. So that becomes very problematic in dealing with what numbers do we use? To add insult to injury, after we've attempted the hot zone, we're now attempting to do the warm zone, and I actually was, I guess uneducated enough to figure that somebody had to do this before Art and I suggested it. And really, for APR use, if you don't look at really what's happening in the warm zone because it's not supposed to be in the hot zone, according to the statutes and so if you don't know what's happening in the warm zone, then you need, we need to at least make the attempt. And so, our logic train has been you start from the hot zone, figure out what's going on there and then develop the source terms from the hot zone and then find out where those particular source terms are and from that we can get a fairly good picture of what's going on in the warm zone. All right. And from that then we can develop some baseline assessments based on the toxicity and nature of the hazard for what we need to do for physical protection in general, both skin protection as well as inhalation protection. John. You've seen this chart on Tuesday. Let me just go over this again. This is why it's so difficult. It's why the number crunching gets cumbersome. I've got a look at the venues that drive the concentrations, all right? And also these concentrations are driven not only by the venue, but by how the people are actually placed in the venue.

Remember that dosage is driven by where you are in time and space. That's what makes it difficult. And, the hazard isn't staying still and neither are the people, so if you don't look at your problem from a time and space perspective and track molecules and track people at the same time, you don't have a handle on what your dosage is, and dosage is the driver, bottom-line. Okay, so you need to have a good handle on that. Contamination sources and methods. Do I have a spill, a spray, explosive, a compressed air cylinder, and if I have those, what are the efficiencies, how fast do they get the material out? This part here on toxicology, notice this is a little bit changed from what I presented on Tuesday, I'm looking at two routes of entry, and if you don't look at two routes of entry when you're looking at exposure to humans in this environment, I'm talking about not just responders, but unprotected personnel, then you're not doing your homework. You need to look at these responders as a system. That will really be the tone I'll sort of harp on, if you will, in my next presentation, but you really do need to look at the concomitant exposure to these personnel from both routes of entry. And the physical protection that is provided by those, for those two routes of entry, ensemble that allows, gloves and boots that protect the skin penetration and permeation as well as the respiratory protection. So, when you look at all this, when you come up with this little vulnerability box here, and what I'm saying to you is that if you build enough scenarios, and that vulnerability box is big enough, then what we're hoping is that all your threats fall within that box. And that's the game that Art and I are playing with this hot zone and this warm zone analysis.

John. So here's the box. I didn't show this Tuesday, but it involves the paradigm change, "boxing in our problem" and to build this box you need to look at the range of hazards on one line, the location, the venue characteristics, where the people are... And the other thing you need to look at when you look at venue characteristics is not only the number of people in a venue changes over seasons of the year, time of the day, weather, it also changes the positions over minutes, and also, egress time to escape after you've been exposed. If you don't look at the whole problem then you really can't get a handle on that magic dosage that I've been driving here. And then, looking at dissemination characteristics, what are the efficiencies here. When you build that box big enough, then any threat that you think might happen. For instance, weaponized anthrax (...inaudible...) strain anthrax inside a two cent envelope, if that threat fits within that vulnerability box then you've probably got that particular threat and response to that threat covered. John. This is one way we actually use a model called Indevap and actually what I've done here is I've switched it from "threat" to the source term because really it's the same thing different characteristics specific source terms are really different threats that are being used against a specific target and we're building a library of these different source terms so that when you specify what your hazard is, we hopefully will have the specific data point source term in the library so we can turn the crank and give you and Indevap calculation on what are the peak concentrations, what's the integrated concentration, maximum dosage and the like. And we like Indevap because it

goes beyond the traditional modeling, you have a source term and then everything automatically magically goes two gallons of agent goes magically into the vapor state and there's no mass tracking of fingers, no distribution of aerosol and vapor and (...inaudible...) droplet and it's just magically been doing that for years in the military and so is the civilian sector. Indevap actually looks at all three of those mass phenomenon, vapor, aerosol, and bulk deposition so you really get a handle. That source term is really a descriptor for what's going on in that event. And it's better than this computational fluid dynamics because it's just painful to do that, you need trays to actually calculate those and you've got too much information to get into the thing to even make it worthwhile. Although we can use CFD to get some specific source terms to load up that library. So we are looking at that. John. All right, Definitions. You're going to see some definitions here that are Genovese-Stuempfle Definitions. Hot zone is pretty much what you see there, it's where the bad stuff is, it's usually around where the hazard is. Art and I like to call that also, the major or the center point where the dissemination sphere occurs, where the major part of the hazard occurs in a chemical/biological/radiological dispersion event. Warm zone is usually the area outside that dissemination sphere and we're just giving you arbitrarily this descriptor, it's not really locked in stone, it's just our description in doing this hazard analysis. We've actually added another zone called the cool zone. This is away from the site and it makes sense, because if you look at, you can do a technical decon on a person contaminated, I'm saying someone that's

been walking around in Mustard and has got loaded up Mustard on his shoes and whatever and you can do a tech decon with supertropical bleach and you think that's guys clean, and he'll be desorbing Mustard off after he leaves, you know, hours after the fact because the, his shoes have a memory for that Mustard that we really haven't taken care of. So this cool zone is another area that we need to look at. This is away from the site, could be at a hospital or something along that line and we need to look at that because low-level, chronic exposure could be problematic. Especially when you put people, who are off-gassing at low levels and you put them in a confined space, you put all these emergency personnel in one area. If you don't look at that cool zone source term then you may be missing something. And also, if these people, they could actually be off-gassing and contributing to each other's, if they're not protected, to each other's problems via inhalation or maybe even through skin contact. And obviously, cold zone is where it isn't. And that's always a precarious one, where the heck is the cold zone, and usually it's time, distance, and shielding. Get as far away from the stuff as possible. John. This is just some comparative look at inhalation toxicities which is what we have to consider for hazard analysis. VX is from inhalation toxicity. Pretty bad actor and the more volatile nerve agents, g agents fall behind that. And then you move all the way up into methyl (...inaudible...) and (...inaudible...) that are certainly less toxic, but these guys here, certainly the (...inaudible...) and the Hydrogen Cyanide with volatilities in the millions of milligrams per cubic meter, they're going to go wherever they want to go and so you've got a

problem in inside scenarios where these things, even though they have a lower toxicity, are going to be distributed quite well inside closed box scenarios. Okay. Again, we're looking at inhalation toxicities here using the standard GB as the baseline here and you can see significantly lower toxicities for some of the toxic industrial chemicals. Why this is in there, I don't know. I mean, carbon monoxide just, as a weapon it's not a good weapon. It's a terrible weapon. It doesn't have, it's lighter than air, can't, how to disseminate it I'm not even sure. I know down at Bethlehem Steel we could do it because we got nine foot wide pipes that I used to walk through that we actually used to distribute carbon monoxide, that's how the blast furnaces actually are fired, because it's a fuel, that's how they're fired in Bethlehem Steel. But, how you use it as a terrorist weapon, it's going to be problematic. I think you guys ought to keep that in the structural firefighting arena and not bring it in as a terrorist weapon. I would not use it if I were the bad guy. Okay, next, John. Now we're looking at percutaneous toxicities, again looking at that route of entry. Your skin's a pretty good protector. And in most cases, it's even Level D will be okay if you are contaminated. But, some things like sarin, definitely, VX, Mustard, are going to have. Mustard's a bad actor; I call it the boogie man because it has delayed effects. You can get exposed to Mustard via the skin and you're burning and wheeling and blistering that occurs, that can be six to nine hours later after exposure, so you'll smell like garlic but you won't be experiencing any symptoms even though you're cells have been alkylated severely. You have been burned and you need to get this stuff off as soon as

you can, but the problem is that you won't be really feeling any of those symptoms for a few hours after the exposure. And then hydrogen cyanide, this is the other reason why, as a terrorist I'd rather use hydrogen cyanide than carbon monoxide. I get the same basically distribution because the volatilities are roughly the same, but hydrogen cyanide gives me my onset time to effect is seconds for reasonable doses of hydrogen cyanide. For Carbon Monoxide, I could hang out for quite a long time based on the toxicity. So if I were to choose a lighter than air gas, definitely Hydrogen Cyanide would be the way I'd knock out a multi-story building. Just a little bit for you guys that are practicing, Cyanide's probably the way to go. All right. Hot zone exposure scenarios and concentrations. We'll do a little bit on that. John. I showed this chart Thursday, it's just a chart that describes different types of dissemination spheres. A sprayer here, could be an explosive there, or a spill. And then, you get an initial hazard sphere that Art and I called our dissemination sphere. If your personnel in their venue or in that environment closest to the source, where you could get bulk droplet, you could get high vapor concentration or if it's an explosive where you could get collateral damage from explosively driven frag, that's you're, the expectant zone. Using the start triage methodologies for describing casualties, you would expect these people to be expectant. So, as you move out away from that environment, then obviously those casualties get less of an exposure, less of a dosage, and there's where your immediate and your delayed casualties are probably going to be. And the guys that are way out in the outer area, they're probably not even anywhere

near the source, you're going to have asymptomatic personnel, as well as some slightly symptomatic personnel that are ambulatory, so you've go the whole nine yards. Actually in the model that Art and I built, we actually can describe what that casualty distribution is based on the scenario and the type of devices used. Anyway, you can also play games with this thing as well, besides characterizing the distribution of the hazard overlaying it over top of the people, we can also look at collective protection systems for cleaning out the environment or also for positive pressure ventilation, you can actually use a PPV from an engine, firefighting engine and use it dilute or even distribute the hazard so that you can extract personnel that may be unprotected. John. Here's just a typical concentration time contour. See, this is, as I mentioned Tuesday. See that high slope there where the concentration increasing over short period of time, that's a good device. If you have a device that's going out flat like this, that's not a good device. You want to maximize that concentration time so, and the reason why you do that is because, from a physiological perspective, many of the agents that we're talking about are also driven by what's called, not just "dosage" but "dose rate phenomenon". If the dose rate is higher I need less material to produce the same physiological effect, so that's what I'm trying to achieve here with a weapon. When I test training weapons, I make sure I try to get that peak as high as possible. So this is a bad actor. Now, just opening the doors or windows in an environment can severely cause a decay in that environment, and look at what happens when you use positive pressure ventilation. You open up, twenty foot away, with

maybe eight foot wide cone for your PPV, and you see significant drop in concentration. This would be a very good environment to use, if you had to pull people out that were unprotected. You could actually use the PPV to hold it back or dilute it to allow for extraction. John. And here's some Mustard concentration profiles. These are all about ten different scenarios, I think we've done twenty. These are just some representative concentration time contours here. It shows, with different devices in different scenarios with different amounts you get different curves, okay? And that just stands to reason. And what we do to get these challenge numbers, we try to pick the bad actors here, we try to pick the ones that are giving us the highest CT so we're on the conservative side, so we make sure that our vulnerability box when we're doing our testing so we handle all those potential threats. John. Okay, warm zone. First of all you have to define what the hot zone is and after you define the hot zone, the hot zone is where you really get the source terms for the warm zone. And obviously you can think there's a lot of different ways to do that. I'm not going to go into that except to show you that here are the two means, there's a third one that Art will mention later that you actually get leakage from a building, assuming that would be the hot zone, you get leakage from the building, that's a source term. But the main source terms are going to be from victims, especially those victims that can get out of the building. Not those expectant people that I told you earlier, but certainly the immediately and delayed casualties are going to get out. They may have sufficient vapor, aerosol, and bulk droplet contamination, and then they got to be inside a

decontamination corridor in a queue waiting to get cleaned up. Well, while they're doing that, they're off-gassing. And they don't have physical protection. So we need, we feel that we can predict the level of contamination of these victims and the first responders. Those guys that come out slimed in Level A who've gone through a tech decon they're also a source term. We feel that we can characterize what those numbers are so that we will know, we're going to look at it two ways. We're going to do a homogenous, generic concentration profile of the entire warm zone, and then we're going to do hot spots of the hot zone, excuse me of the warm zone. So we're going to do it both ways. And A couple things I'll mention why you want to do it that way. In any case, we're looking at victims and first responders as a source term. Just to kind of relay a pretty interesting comment. I was talking to VA the other day, and I said, "I know how to do, they were asking me what I was going to do in hospitals. And I said, you're going to get a lot of people self-referring, they're not even going to go through a decon line they're just going to show up. And I, in my typical Jim Genovese Munitions Twenty Years of Munitions Way, explained to the, well it's easy. What they are, those people that are self-referred that don't go through a decon line, they are sub-emissions. And the doctors are looking around the room and their laughing. And I'm saying, "Why are you laughing?" They said, we call them "patients." And I said, "Well, I can't get out of that weapons perspective." And they really are weapons. They're vectors of the hazard. And so, when those victims show up, they are vectoring vapor, aerosol, and bulk droplet deposition, no

matter where they are, whether they're still in the warm zone getting deconned, or whether they self-refer to a health care facility, there's where the sources come from. So we need to determine the amounts on the clothing and the equipment, apply condepenedent computational models. This is where Art Stuempfle is just absolutely fantastic, between he and Paul Fidale(?), they just do—I can't get beyond simple integration. These guys are doing triple integration to do some of this analysis and expanded differential equations and it's sort of beyond my capabilities but it's really good stuff. To look at the liquid contamination and off-gassing from all of these deposition sources and to look at what is happening over time and space, and that is what's important. You will find, my guess, my gut feeling is that in that warm zone, you're going to have some hot spots, but you're going to get rapid decay, it's not going to last long, and depending on who comes out and how they're contaminated will determine what is that warm zone concentration. John. So, we're going to look at that whole phenomenon, that time/space phenomenon, these sub-emissions that are coming out of the hot zone and we're going to look at that over time to make sure we're getting a good feel for these. And remember. The different agents, depending on what you're exposed to, with their different volatilities, are going to give us different time/space off-gassing relationships. And also there's another thing that you need to consider here. While we're thinking about this, even though we're doing chemistry, there's no reason not to think about re-suspension of biological or radiological materials, that also could be looked at as well. And we have been looking at

that because we've been talking to the U.S. Postal Service and the Capitol Police, and they'd like to have some numbers on what happens in that decon line. All right and then we're going to estimate the degree of protection required in these warm zones, in these cool zones. Do we really have to be in Level A and Level B or are these things transient concentrations that we can deal with in a Level C scenario or a turnout gear firefighter with SCBA, these are things that I think our analysis will be able to help us make a better estimate on what we really need. John. So, basically, this is more of the same thing. We're going to look at the liquid and vapor, all of the sources of these source terms, these moving source terms as they come out of the hot zone, we're going to do, we're going to look at the process of off-gassing. Now remember there's two types, you've got off-gassing from just bulk evaporation from the liquid on there, and then you also have permeation into the clothes and into even the skin, that also can off-gas back out. For instance, your hair. Your protein in your hair will absorb GB and so, even though after you wash, do a quick rinse, you can still get off-gassing off of that, say after you're in a warm environment or say you're in an environment where that off-gassing can occur. So the computational process is not straightforward. We feel we're looking at a lot of different areas to really cover our bases there. John.

(END OF TAPE 1, SIDE A)

Genovese: ... they looked at all those, the way we're going to do the computational processes, it may not make sense. Why don't we put some boxes up there? If the President can do it for Homeland Security, I think I can do it for this, and

hopefully I can get a little bit further along than he does with Homeland Security. Anyway, indoor closed events, here's what you got: liquid and vapor. Here's your sources: explosive, spray, spill, and miscellaneous drops or whatever, and on the vapor side, possibly high concentration, now this is the victims as the vectors, and look what it says here. Red, what does that red say, "in…

M: (…inaudible…)

Genovese: "…indicates likely exposure routes" and so, all right. So what do we do here? So, these are probably the main actors for, in other words, what Art is saying here is, "likely exposure routes when they come out". These guys will probably come out if it's a spill unless they're walking or sitting in it. If you're close to an explosive or a spray and you're near or in that dissemination sphere, you may not come out, so these are probably, I think what Art is saying here is that these are the expectant casualties, these here are the ones that are probably going to make it out, and will be the source terms for the warm zone. Okay? So, let's do the next one, John, and see if that makes sense.

M: (…inaudible…)

Genovese: If it's green, yeah, if it's green it means that you're not coming out, you're probably…

M: …(…inaudible…)

Genovese: Yeah, if you're red, you're bad, you're going to come out and you're still going to pose to a responder working in the warm zone, you're still going to pose a problem for them. And, this is just a repeat of that chart, but then Art does "Indoor/Open" which is a large area like a domed stadium and pretty much the same kind of logic where, in that case, the spill or the droplet or the other exposure here, the high concentration might be the driver and that might

be what actually ends up in the warm zone. And then, the outdoor and open scenario, again using the liquid and vapor, you see these guys probably, with the explosive or the spray, these guys that are nearest the source probably are going to make it into the warm zone. They're going to be expectant they will stay in that hot zone scenario. You will not move them because you're going to, we're going to be working on immediate and delayed casualties, so you're going to be working with these two here. So basically what Art's doing is explaining to you, some people are not coming out. Obviously, the responders we hope are coming out, but this is showing us that the victims, that some of the victims may stay in there because of the high exposure rates, being close to an explosive for collateral damage or whatever, and that these are the terms, the green terms are the ones that we're going to be using in the calculation of our warm zone concentrations. And then, here's first responders. Now these guys were wearing gear. So, in that case, liquid and vapor exposure, where you see the source terms, is, what did Art say here?

M/F?: (...inaudible...)

Genovese: Right. Okay. Right here...

M/F?: ...(...inaudible...)...

Genovese: ...likely exposure route. Right. I'm not sure what this...

M/F?: ...(...inaudible...)...

Genovese: Yes. Yeah.

M/F?: ...(...inaudible...)...

F?: ...(...inaudible...)...

Genovese: Right, but what it's driving, though is that...

M/F?: ...(...inaudible...)...

Genovese: That's right, with protection, but they're still going to be, they're going to have levels of contamination that are significant, but they're going to make it

out. So, it's sort of the reverse, normally, now, unless you're doing and RSP on a chemical or biological where, then you become a casualty because of secondary effects of the explosive, that might be a possibility, but you're going to be taking out the hazard with your gear, right? And so, these are the possible sample (...inaudible...). We think there's going to be a large amount in the technical responder area where the clothing is contaminated based on the operations, the reconnaissance, or detection operations, or extraction operations that are going to be done in that hot zone. One of the recommendations that Art and I have looked at with that, though, is *maybe* to reduce the warm zone concentration from the responder personnel, is to do a gross decon in the hot zone. Just remove bulk, because probably mostly it's going to be bulk liquid, and then come out and do your regular technical... If that can't be done then we're just going to be stuck with the way things are, you go out there, and usually your time with target's limited anyway, but if it isn't possible, well, then you'll run it the old way.

M: (...inaudible...)

Genovese: Could be, usually on the, well, if you get bulk droplet of GB on there, it'll be persistent enough, if you actually have it in liquid form, on your gear it's going to be persistent enough where you're going to take it out with you. So, let's just say from semi-persistent all the way up to persistent, those bulk droplet contamination scenarios are going to be viable on the outside as far as off-gassing.

M: (...inaudible...)

Genovese: Yes.

M: (...inaudible...)

Genovese: No. These, and there are going to be, these scenarios may change depending on the kind of hazard that you're dealing with. Remember if you have higher

volatility, you may not even have any liquid there, but that's, there's an infinite number of scenarios here and we're just trying to show you, the way we're looking at it right now, our source terms are based on victims carrying out the hazard, usually vapor or aerosol, on their clothing or on their skin and then also the first responders carrying it out on their gear before they're technically deconned. So that's kind of the logic that we're using, looking at the source terms in the warm zone and that's really where they're coming from, as well as possibly a leakage from the hot zone itself. Okay, John. Here's where Art gets, okay what does he say here, this is, okay, this is actually explain it. Dotted box means possible exposure, so we're really getting into where, there is, we're covering the whole range, where you're really hot, where you're not, and then the possibility of what is that total mass that you're actually transporting from hot zone to warm zone and so, this is pretty thorough, actually. At least the logic makes sense. You're trying to look at all these, what we call micro source terms. Where are they in the hot zone, how long do they last, and the off-gassing and the decay that you get is where we have to turn the crank, and that's based on how badly, for instance, on the first responders, how badly they get contaminated. Let's say they're in Level A, they could get slimed; they could actually fall into a puddle and come out. There's a serious off-gassing in that particular environment, and so what we're trying to do, if we build enough scenarios in there where, and actually Art and I are going to do that, where one guy goes in Level A, and he's doing a plug on a source, and he's getting slimed as he's doing it. We're going to look at that severe contamination and figure out what source terms we're getting in the warm zone. Okay, John. This is pretty much redundant. These sources of vapor hazard, we're looking at all three, by the way. We think the biggest ones are going to be contamination of bulk droplet and liquid, usually

from semi-persistent to persistent agents. However, we're doing the math, and we're doing the calculations for all the entire mass distribution, vapor, aerosol deposition, and bulk droplets so that we have a complete mass balance, even though those vapor sources might be extremely low, we're calculating them anyway. Because, in some cases, they may be a driver. Okay? And then first responders as well. John. Okay. And this is what I was mentioning earlier, we're going to look at what actually leaks from the incident site itself. Here's some guess that we're making right now, based on... a lot of this data we've gotten from military testing we've done over ages. Art walks around with four cloth bags that he gets from different conferences with all this data in the bags. Honest. So when you ask Art, "What do you think the vapor deposition might be?" He pulls the numbers right out of those bags, it's absolutely amazing. But anyway, here's the levels that we're looking at in milligrams. You can see that, that's splash, spray, and the liquid pick-up are fairly good contributors in that, but for completion purposes, for scientific purposes we're going to look at the whole nine yards when we're looking at the contribution of the hazard and the migration into the warm zone. John. We need some help. If anybody has any guidance or suggestions or recommendations, we're not saying this is right, what, as I mentioned, what we're doing is we're looking at common sense scenarios, we're looking at here's how the molecules get from one place to the other place, and here's, and we know that our physics equations are right, but if you have any different approaches or some other things that you would like to see us add to this, or you want to help us work on fine-tuning this thing, we really would appreciate that work with me, or see me. I really would like to integrate you into this process, because, you know, I feel like Art and I are really out on a limb here, but we're trying our best to give you the best product. Here's some issues. The rate of adsorption of the

chemical agents on equipment and protective ensembles. Anybody have any numbers during high exposures? What is—? Does anybody have any examples? We have some military stuff, but what's out there in the civilian community? Rates of off-gassing from contaminated clothing. Okay. Suspension and re-suspension of the biological or radiological, that one there, you see this one here, that is not going away. If we haven't recognized that aerosols re-suspend, especially weaponized anthrax aerosols, if we haven't recognized that after October, then we're never going to recognize anything. This is what's happening. This is what really went on, and because those things were so weaponizable, those bacillus anthracis molecules, you couldn't even look at them with a microscope, they would not even stay on the slide. You had to throw a buffered saline solution just to make them stick, they were that airborne, they had that kind of quality. So, re-suspension, re-aerosolization is going to be a problem. Also, along with that, vectoring of this and then re-suspension after vectoring. You take it home, got in your car; you got it in your car. You take it home to the kids, the kids take it somewhere else, and with biological and radiological with delayed effects, you're not going to know how well and how good a vector you are. So we need to get a handle on what's really going on there. Okay, and then the liquid pickup factors for clothing. Just another area where we could use some help if you guys have any guidelines or suggestions. John. Okay. Again. Are there any alternative approaches or integrated approaches that we might want to look at or hear from you all, and in your position here as producers and users of this, what are factors are we missing? Is there anything else that we need to do that would be helpful? Okay, John. So we're working on it, it's painful, to do warm zone, it's painful to do hot zone, but we think this is a logical approach. If we can track people and molecules we can at least start making some

assumptions on casualties and I think, and once you know that then you can make assumptions on what protection is required to reduce and minimize those casualties. So we feel that this is founded well in chemistry, physics, and toxicology and so we're going to stay with it. We've gotten, Al Fatah and Phil have given us a lot of moral support and I really appreciate their help there. I think that's it on this one, John. Do you want to do the other one or do you want to take a break? I'll take some questions now, and then we'll take a break, then we'll come back and do that responder is the system. Any comments or questions?

Maughn: Bill Maughn, AEGIS, North America. Two comments and categories. One in the analysis process; the other one, the other comments are in the category of potential processes to confine some of this. Your box approach, I think, has merit that the outcomes are infinite. I believe you used that several times in your presentation. Therefore, we have a situation here where we could all spend the rest of our lives trying to measure what's going to happen today or tomorrow. And so, we have to modify the box approach. There's no way that we're going to be able to analyze every known scenario known to God, even with the computer capabilities that we have. So, let's make some common sense analysis and scale that down to a level to where we can come out with a 90% response and get it done in three months. Number two. On the process. There should be, I think, the policy is evolving. We bring a perspective from ten years of research in Europe trying to solve this same problem. And I believe it would be helpful to look at: there is a hot zone, there is a warm zone where you do your decontamination, and then, nobody gets out of the warm zone unless they are certified to be clean. Now that's nobody that processed through the normal means. As Tokyo taught us, and New York, reaffirmed, a significant number of your casualties, I'll use that term, get to the medical

facilities themselves. So rather than try to measure what the impact of that is, put a system in place that addresses that actual event, because it will happen, not might happen. It will happen, and most of your people will get to the medical treatment facilities on their own as opposed to the process that you have set up at the pointy end (?), at the mishap scene. So this is a two-tiered process. Now you don't need to worry about measuring it. You have decontamination capability and make it mobile so it can be addressed to those facilities that will be involved in this particular scenario. Now you can address normal people, I'm pregnant and have a baby and didn't, I'm coming to have a baby and I didn't have anything to do with the decon. They go in one entrance, and you've got a decon facility up and in place for the folks "we're you involved in this?" "Yes I was." "You go over there." And now you've contained the problem and we don't even need to study that other than maybe from the perspective of "what is the random variable that's still going to sneak through the system even though we built it. So now we have a containable process that's measurable in our lifetime, and that perhaps we can come up with a policy and the quantified data for the research and then build the tools to solve, address this issue and establish a policy in a far shorter time than three years. I come out of the military, so I understand the necessity for an organized, thorough approach, and that always takes a longer time. But in the first slides I hear that "yes our goal is to define a standard three years from now" I cringe. I think that is absolutely, totally, unacceptable and must be addressed, and I fully recognize the manpower limitations, in particular, plus the process limitations that are imposed by a good process, okay, and that. But I think we can shrink that by half or maybe two thirds if we try to shrink the box a little bit and build a beast to contain or eliminate some of the risks that you're trying to measure. So thank you for your patience on that diatribe, and

I'm done.

Genovese: Okay. Elaine will answer your policy question and the egghead here will answer the other question on the box. That's a very good point. As a matter of fact, the box was not meant, although I show it as just one dot where I'd show you one threat scenario, and so in essence you could put an infinite number of dots in there. One of the attempts that we want to do, and this would be an application of AI and fuzzy logic, is that you build, you take that box that I just showed you, and you cut it up into finite cubes. Maybe it's 10 by 10 by 10. And then I have a thousand, that's a thousand. Maybe that's not good. Maybe 5 by 5 by 5, might be better. Okay. But, what you would do, is then you have a size cube with specifics in that cube, then you develop assets and response mechanisms for that section of the cube. But you're right, it will take us a while to do that, but I think, I really appreciate, 'cause that's a nice way to present, you know, I only threw out the threat, but I think you can also use the same cube to, and we could take, maybe the worst cases in that cube and build it that way instead of trying to fill all the cubes at the same time. For instance, spill scenarios. I think it's a very good question.

M: (...inaudible...) common denominator then you solve the whole problem and then redo it in a hundredth of the time.

Genovese: Right. And as far as your other comment, Art and I have built the decision support tool, it's in prototype stages, where when we look at, when we do the calculations for the distribution of the hazard over the personnel we include, at site, and at health care facility loading, so, in other words, we distribute to the Start Triage definition distribution at the site and also based on information we've gotten from St. Luke's Hospital from the OM incident, a distribution that would be a potentially around the health care facilities so that you look at both of them and you actually can predict for a hospital, let's say within three

miles of that event, you can predict what loading that that ER section's going to be up against, what decon assets they're going to require and whatever, and so, we, again, another good point is that this event and this site management's is not going to have all their, a lot of it's going to leave, but yet you still have to control it, you still have to manage it. Good, very good points. Thank you. Al. Jan. Oh.

M: I have the microphone.

Genovese: Why don't you

Dunbar: Jan Dunbar, International Association of Fire Chiefs. Jim, thank you very much. As usual, good job. This is a minor point, but nevertheless, it is a very important part with regards to definitions, new terms, acronyms, and one that was presented on the screen up there that I want to point out is what you described as the "cool zone". This is a new term. It is not standard within the jargon that is used in the emergency services community.

Genovese: I made it up. (Laughter)

Dunbar: I realized that, and so all I want to say here in maybe thirty seconds is to be careful in doing that.

Genovese: Sure.

Dunbar: Warm zone, hot zone, cold zone—very well established across the nation. Interestingly. Very well accepted across the nation. There is a process of egress/exit into/out of the hot zone to warm zone and to include a very detailed analysis of, as to, as best we can, control contamination. Most of the time we do it very well. Sometimes it's very difficult. The anthrax situation was a good test. Every time they found a new building or a new room that might have been suspected of contamination, the hot zone increased. The presumption that sometimes we will discover or allow or have to account for contamination being spread into the warm zone is also a misnomer. If we see

that, then that is probably a clue that the warm zone is too close and it needs to be backed up.

Genovese: Right.

Dunbar: So we don't use the term cool zone, but the process that I think you were trying to describe to include the work that is necessary within what you'd define as the cool zone, is easily also adapted into the normal jargon that we use in the emergency services.

Genovese: Sure. The cool zone is really an attempt to distinguish it from a radial distribution of the hazard through, over time and space, just to delineate that there were, that the problem, and this is the problem with CB and R, is that it's not like explosive where you saw you can pretty much isolate where you are, with Chem/Bio you don't and so our, not for lack of not knowing what term to use, we just titled it that, that can be changed.

M: If I could throw something out, I think you need to measure the cool zone, I think that cool zone may need to be a statistical analysis of the probability or existence of. I think from a regulatory or from the first responder EMS industry, it's our objective that there is no cool zone. Now you're not going to achieve that to 100%, but that should be the design of the policies and procedures that, and the equipage that we build as an outcome of this process so that there is no cool zone and you don't have anything to measure.

Genovese: Right.

M (Fatah?): I just want to make two comments with regard to your comments. Number one is with regard to the modeling Jim is doing which is a very important part of this work. I think it's a necessary part and we, we will not look at infinite number of modeling and infinite calculations, we don't have the resources or the time. Jim, though, will give recommendations as to what we are facing, and that will be the valuable part to the standards development process,

because without knowing the threats, it's very difficult to develop the protection pack system and the requirements. So it's a very important part, but we don't have the luxury to do infinite number of calculations and do, go on forever, even though, it's good science and we learn a lot from this. The second part, which is the three year limit, term for the standards development, as the manager of the standards development process this team of NIOSH, SBCCOM and NIST that's working together, we have two constraints. One is resources and we can only go as rapidly as we have resources to do them. So we have resource and funding limitations which determine how fast and properly we can proceed with this. The second one is the standards development process in our experience, a good standard of this complexity usually takes two to three years to develop because we have to do a lot of testing, develop the protocols, validations, (...inaudible...) program and three years is actually a normal, routine time period for this type of test, ah, development of a standard of this complexity. If we got resources and we got funding, we are planning with NIOSH and SBCCOM to develop more resources, more laboratory space, more testing capabilities, maybe more personnel and scientific power to accelerate this process, but so far we don't have the resources to do that. Hopefully they will come along.

Cloonan: Terry Cloonan, NIOSH. Jim, outstanding presentation. Two questions that I have are related to the Venn diagram and whether or not the tactical concept of surprise was integrated into the exposure scenarios, that's the first question.

Genovese: Uh, no.

Cloonan: And then in the ventilation diagram, the one where he showed the ultimate agent dispersal and the fact that ventilation was utilized to disperse the agent, is there an analysis where no ventilation was determined and the persistency of the agent in that enclosed venue?

Genovese: We do both. Actually, the parametric analysis, when we pick an agent with a certain amount, and a specific dispersion device – spill, spray, explosive – Art and I apply within the scenario, within the venue that it's functioning, we apply different air exchange rates, we have the AC turned on and off, we can even add in there mitigation procedures as well, so we do a range of scenarios so that we don't miss anything in a particular scenario analysis, and you do see, as a matter of fact, the analysis that we're doing with the Ticks with the AC on and off there's significant differences in distribution obviously and in the initial hot zone you actually have higher concentrations because you're not getting the air movement in dilution. So we look at both of those as a matter of fact because we understand that in closed areas, HVAC and convective currents are going to be a big player.

Reid: Robert Reid, Center for Domestic Preparedness.

Genovese: Hi, Robert.

Reid: I think an outstanding presentation. I talked with you last night a little bit at length about this. One thing I didn't think about and I was listening to your presentation was, I've watched quite a few exercises with fire departments, W&DCSTs, the decon process and in what you stated, in a perfect world, when you take decon systems and we strategically place them, because not everybody can afford them, that product, that trailer that we're going to drag out there to the field, when we have an actual attack or surprise, time will get people killed. Depending on the type of agent, and how long we have to wait to set things up and then start the decon process, that will get people killed. That will extremely raise the casualty rate, so in a perfect world, where we can do that, and I agree there is such a thing as a cool zone. And I think we need to maybe look at that. That's something that's new, hasn't been thought of much, but there is a residual, for those of us that have done real decon, it is a

problem. You track some of that away. It's just, in a perfect world you can't keep that contained inside that little box, so maybe we need to look at our terminology, maybe we need to pull that, I understand where you're coming from because everybody just came on line with the three terminologies.

M: I just thought it would be better with terms being used that are already out there…

Reid: …in a real world, but one thing we're not talking about, and I've seen a lot of sanitized products in the field, when we go out there and we play that we're responding to something, we already know the answer to the test. It's a sanitized product. I think what we need to do with this, and maybe to expand on it a little bit, because it's a great instant command tool. I see a lot of possibilities with this. Put a timeline in it, in the matrix to show the clock is ticking. How long do I have before my casualty freight starts to come up between ambulatory to non-ambulatory? That's one thing, as I was listening to it, that helps that process where you're actually building a timeline to show what your ambulatory and non-ambulatories going to be and the complexities that are involved for the incident commander, that fire chief or that EMS guy on the street, where he's gone from a 20% casualty rate now to a 50% between his ambulatory and non-ambulatory. That's just one thing I see was missing out of it. But I think it's a great product.

Genovese: Let me just make a comment on that. I didn't get into it because I don't want to make my presentation into a sales pitch – "work for the U.S. government" I'll do that after I retire in five years – but the point on the time and space following of the event is absolutely extremely important. Most people do exercises, they do not do them right, they cheat. And it's really hard to do a full, real up, actual time and space, we compress, we do a lot of things. In the decision tool that Mr. Stuempfle and I've developed, for instance when we

overlay the hazard over the casualties in a venue, we distribute that, so that we can get our Start Triage casualty distribution expectant, immediate, delayed, and minimal casualties, we're tracking the hazard over time, so we're tracking their dosage over time, we're tracking their, how fast, and actually you can get all this stuff on the Net, which is nice, how fast you can get out of different venues. Department of Transportation and ASHRAE have already done all that work to tell you how fast you can get out, so we know their exposure time. What it actually also does, that's the name of the decision tool, is not only do we look at the initial exposures and track that from ground zero to, you know if it's a continuous source, we track that as well, but we do another thing. Is that we look at that total systemic exposure and until you're decontaminated, that the numbers keep ticking, and so you can be an immediate casualty in the hot zone, they pull you out into the queue in a non-ambulatory litter patient decon mode, it actually tracks it and says, "Guess what? If you don't get that litter patient decon mode, or get another decon cart or started, that immediate casualty will be expectant in about twenty minutes." And so what it does is, it also says, "You haven't got the assets right to even do this, because you're supposed to be saving lives. Yeah, you extracted them out of the hot zone, but you still haven't handled the problem as it stands," and so, if you don't track all your key functions over time and space, decon, detection, physical protection, mitigation, medical treatment triage and transport, if you don't track all of them together because they're all happening at the same time, and I'm getting off the subject here because we're just doing PPE here, then you're not doing the job.

M: You need a system approach, your point is absolutely on target, that's been learned in Europe over ten years and in the two real world demonstrations that we've been through.

Genovese: All right. Yes, sir?

Berndtsson: Yes, Goran Berndtsson from SEA again. I don't know if you shared this information already, but I've been living in Australia for twenty years before I came over here and we were quite involved in what leading up to the Sidney Olympics and then there was a lot of trials and scenarios played out the 18 months prior to the Olympics. You maybe have shared that information with them.

Genovese: Yes.

Berndtsson: But one of the biggest problems seemed to be that containing the people who was involved in an incident. We had problems continuously with people leaking through the systems, coming into the different hospitals and health cards, through public transporting and decontaminated a big part of the town. And the end result of that actually was that, when they do Olympics, during the time of the Olympics there was nine hospitals who was allocated to be the emergency hospitals in case of something was going to happen, and all of them, including those who told us as soon as soon as something happens, every door is going to be locked and closed, and every person is going to be taken through specific decontamination departments outside.

Genovese: That comment is heard not only by foreign countries as you mentioned, I hear it in the United States when I teach across the country. Also I'm hearing it from our own military bases, I teach installation protection, both OCONUS and CONUS, continental United States and outside, and again they're saying the same thing, the docs are locking the doors until they can guarantee that these casualties are clean. And, which leads to an idea of the loading, and you have the right communication, then the technical assets needed to process those casualties so that they can be treated immediately, that needs to happen. And so, you have to have an idea based on the incident site, what's the

magnitude and distribution of the casualties, not only for decontamination but for pharmaceuticals, medical treatment, and I'm talking about near term care, long term care, the whole medical management thing plays into that. It's a very good point.

Berndtsson: The Olympic site in Sydney was classified at 450,000 people, so it was quite a big operation to take care of, and yeah. Fortunately, nothing happened.

Genovese: That's good.

Grace: Good morning, I'm Tom Grace. I'm with the University of Pennsylvania Health System in Philadelphia, and so…

Genovese: …Hi, Tom…

Grace: …I'm on the hospital side of things now. Actually, I was glad to hear that the emergency departments are being considered warm zones and am concerned about making sure that, as soon as possible, that we have, not only the PPE in place but also the detection systems so we know when to don them. The concern is that we have often, sort of, surprise, it occurs there, so the hospital becomes a first responder in a lot of these events. The other point of the cool zone, was very enlightening for me to hear that, and I had question around, if the people would be continuing to off-gas for long periods of time, even after decon, would it be better to be segregating them within the hospital, where they could be building up off each other, or are we better off to try to spread them across the whole place? Because the cool zone, depending on the volume and number of people, we could be creating warm zone, cool zone whatever you want to call that, we could be dealing with secondary contaminations for quite a while with our inpatient populations.

Genovese: Let me answer that in two ways. Number one, that scenario that I mentioned where you get the off-gassing would be probably in transport where you have them in a localized area, but it also could be maybe in a holding room that you

have in the hospital. Now, if they're stripped of their clothes 80% of the contamination for the most part is going off with the clothes. And if you have an effective decontamination, and I know there's a lot of medical people that don't like to use bleach, but you can try this experiment out one day if you don't believe me. You can take garlic. Rub garlic on your hands. Go to the bathroom, wash your hands. Smell your hands. What do you smell?

M: Garlic.

Genovese: Garlic. So, garlic's not a bad simulant for Mustard agent. Now you take that garlic and you put, you react it with a dilute bleach solution, let it sit on there for a little bit, and then do that, and you will see a significant decrease in it. Now, that's Genovese's perspective. That's not policy, I'm not recommending you do that, but what you do then is that residual mono-molecular contamination that could be in your hair or off-gassing you would tend to preclude that. But if you do a thorough decon and remove their clothes, basically, you're in pretty good shape. So I don't see that as a problem, but I see that before they get to decon in a transport vehicle or something like that, where off-gassing and collection in a confined space might be a problem. Okay.

M: The comments on the hospital system were on target from the perspective of there's a potential for a cool contamination, let's call it that, and the detection, but there was one missing word. Decontamination. All right. If one person gets in, depending on the agent, okay and what saved everybody in Tokyo is you had a non-persistent agent, okay? What I think from a policy point of view, a systemic approach is that we have to have, we have to recognize the requirement for a deconta—a two layer approach to decontamination. One, at the scene of the mishap, the other one at the facilities and closing the main entrances is the first step. I won't go into that in detail, we can talk about that

off line if you'd like to. The other issue is there may not be a off-gas, meaning a technical reason for concern, or what I'll use the term for isolation of the folks involved in the mishaps. I believe that there's a psychological impact and we've already, the Army and Air Force have already asked us about, "Can we erect an iso–", and they didn't use the term isolation ward but basically, a mobile treatment facility, extended care, to separate the folks involved in the mishap from the rest of the general population that are just coming in to get a broken arm fixed, and whether there's a medical or a nuclear/chemical/biological/technical reason to isolate them or separate them in some way, I suspect we're going to have to acknowledge that there is, in fact, and emotional and cultural reason to do so.

Genovese: Okay. I think in the interest of time, I think I'll move on to my next presentation. This one should go pretty quickly and it really relates to what we've already talked about as far as two routes of entry and looking at the responder as a system, and I think it's absolutely important that we begin looking specifically as a, to the responder as a system. Okay. I think you need to do it for a lot of reasons, is that the responder is a human system placed in a physical protection system, which is then placed into a hazardous environment system. So if you look at it from a system to system approach, you can at least then look at it somewhat globally and then start figuring out where are some of the weak spots as you describe each of the systems. John. This is again, one of those easy box diagrams to try to explain this. You have your human. He has certain characteristics. And in the hazardous environment, he will have both respiratory and skin protection, he should, in that particular environment, and yet you still have, based on the type and the amount of the hazard involved, you have the hazardous environment impinging and attacking the barriers protecting this human. And it's important to characterize these three

different systems. The hazardous environment, which I think I've done an okay job on presenting that in the last picture, you know, what's all involved in that hazardous environment, the fact that you got everything from soup to nuts, bio/chemical/rad, different types of bio, different volatilities, different toxicities, it's just a lot to absorb. And then, the gamut there, this is a real problem. I heard this yesterday, and I think it was one of the MSA colleagues, the last guy to speak yesterday, I was intrigued that he made a comment that he said, "You know, even after we do the inhalation and the APRs and the SCBAs and we work out what the certifications are, and we get them certified, what do we do when people mix and match gear?" I'm talking about protective ensemble and different types of inhalation protection. That could be problematic, because, as a system, if they're not matched, if they don't fit well, or one biases the other, that could be problematic for the human responder as a system in itself. So, understanding what is the limits of your gear that you're wearing, that's protecting both routes of entry, inhalation as well as percutaneous skin exposure, I think is going to be a real challenge, because I think in a lot of places they may not have a matched ensemble where that whole systems been tested, but they take bits and pieces from here and there, and how do you actually assess what their risk is? It's going to be a challenge. Okay. So you have the external world, which provides its environmental dosage based on where you are, the kind of event, the kind of hazard and amount and the kind of dissemination device that's used. The gear that you're wearing that protects both routes of entry, both inhalation and skin entry, and then you have your internal environment. Once the bad stuff gets past the barrier, your different routes of entry give you different, what we call bioequivalencies. You get different rates and actually different toxic effects for the same, let's say, vapor amount based on how it gets into your system.

For instance, sarin has a percutaneous vapor LCT50 of 12,000, which means your skin is pretty protective. You need 12,000 to get 50% of the population to get to death, with 12,000 milligram minutes per cubic meter. However, with just 100 milligrams per cubic meter, via inhalation, I can achieve the same effect. Now the problem that you have is that when you have both of those going on at the same time, which they are, is your gear protecting both of those routes of entry, because that total systemic exposure is being challenged by the environment, but entry through those two routes of exposure. So your gear is driving your final physiological effect or toxic effect. So how well are you positioned, let's say internally, to handle this physiological response. And it also involves how well-conditioned and metabolically how well you're able to handle some of the hazards. Okay. Understanding of hazardous sources. This is really just a repeat of what I've done in the hazard analysis. You can have all the types of hazard sources. Large or small. Chem/bio/rad. In- or outside. Just in- or outside for comparison purposes. Same device, say 155 projected with two gallons of explosive with a 2.2 pound comp explosive charge. On the outside will give you a certain concentration time profile with, you know, a reasonable wind. You take that same device and bring it on the inside and you can gain between 10 and 15 times the concentration, which could be roughly related to dosage, and so bringing things, the same system into different venues, for obviously drives the concentration, drives the dosage up, and also will drive the casualties up for the same device and so you need to be conscious of that and I've mentioned that before. Good device and bad devices, but if you put a poor device in a good venue it might work okay. You could put a good device in a lousy venue, that still might work okay. So you need to look at, as my vulnerability box does, all of those aspects to figure out kind of where you are. Where's the device located is absolutely important and

again as we mentioned, turning on the HVAC in indoor scenarios is going to make a change in the distribution of the hazard. By the way, let me just make that comment. If there's an incident, a chem/bio incident, especially bio, I hear this question, "What do you do with the HVAC?" I can only say one thing. I've done this three or four different ways. You want to turn off the HVAC you do not want to be distributing the material to other parts of the building. Now. For maybe, for carbon monoxide I might do that. Just to dilute it so I can take that low toxicity material and do that, but I'm telling you, for aim strain anthrax that's weaponized. You definitely do not want to do that. Because that distribution just makes your life a heck of a lot miserable. You'll still maintain roughly the same kind of risk assessment and all you've done is taken your risk assessment and all you've done is taken your ground zero and distributed the hazard throughout the building. So you definitely want to turn off the HVAC. You want to understand your targets in your buildings. A lot of people don't understand where, they don't understand pressurized stairwells, the engineers; I've talked to some engineers in high-rise buildings they don't understand how they work and so you need to understand these systems. An example is, I was doing a survey for the FBI in the '96 Olympics. I did the review of the MARTA subway, and so especially the Five Points MARTA which was near the Olympic venue and this female engineer said to me, "There's no problem. If we have a problem with a chemical or biological release, we're just going to reverse the engines on the subway and we're going to clean everything out." And I said, "This is wonderful. This is great. Can you show me where it goes?" And she showed me where it went. And it goes right into the Olympic Park is where it ventilates. And I said, "I don't think we want to use this." I would make that Plan D as a contingency, because you really need to know what your HVAC is doing. John. Routes of entry. I

mentioned this yesterday and I just want to make this point again. Skin and respiratory tract are going to be your two main routes of entry and obviously, this one you want to protect the most is that respiratory tract. The systemic system, that's the weak point is the lung-blood barrier. Okay, John. This I mentioned yesterday, toxicity. What are you dealing with, how much do you have in the environment, how long are you exposed? Obviously if you have your gear on your exposure time is moving toward zero which is what you want. How bad it is is the dosage, the CT that you get from that particular environment and then when, the time to effect. Depending on the hazard you're going to get different times to effect. Chemical, excuse me biological and radiological are going to be delayed somewhat and chemical could be delayed for Mustard agent, but for most case you're going to get immediate effects and you'll know when you're exposed to a chemical hazard. And this is just a comparison of chem and bio. It's kind of a nice comparison, comparing toxicities. You have the bios much more toxic. This one here has a lot of different ways of creating the contamination and the exposure, basically biological, except for maybe the micotoxins, aerosols through the inhalation route of entry's going to be the main actor here. Volatilities, they're really quite different. The non-volatile materials are really—particles are respirable aerosols, molecular weights are different. Time to effect. This is important for the bio. Seconds to minutes. Days to weeks. This is problematic. And because you have delayed time to effect, indicating whether you've got a bio or not is going to be really problematic, especially with the level of detection that we have at the present. And then routes of entry for chemical we have these tow that we need to consider definitely and that's why we're here, and for biological, really the main route of entry is going to be through inhalation. John. So this is really what you're up against. You have your external

environment with these types of properties, physical state, the amount, all this which builds our hazard box, you have your barrier which is your ensemble which protects your skin, and your inhalation protection, and then what's actually going on inside you. The type of hazard, what's the met—what's your metabolism doing with it? In some cases, the body, for instance Mustard agent doesn't even metabolize it just accumulates it, so it's not going to be, so you definitely want to get the Mustard off if you're contaminated. If it's something like hydrogen cyanide, the body will start to try to metabolize that, and so metabolism is important. The amount that's coming through your system through both routes of entry, and that total systemic dosage is really what's going to produce those effects and it's a concomitant effect, and that's why I'm heartily stressing that we need to look at this responder as a system. Okay. This is just a, from our decision analysis tool, this is just an example of one of the things that you can do. When you have a responder in PPE and he's entering into a hot zone, I think you need to do a lot of things with this guy. And we have the capability to do this, and I just haven't seen it all put together. We should monitoring, for this guy, who he is, what his weight is, what gear is he wearing, what activity is he performing, where is he, so actually tracking his location, and then his time in the hot zone, and actually be tracking, making estimation on his time in the hot zone. Right here we're just saying he entered at time 15, which is 15 minutes after the event happened and then he exits at 30. We should be time space tracking those individuals and it's easy to do now. We have the technology to do this. We also should be looking at environmental stressors. We should be looking at internal temperature. We should be looking at respiration rate, thermal load, location, and then even tracking his bottle, so we can tell him when he has so much time on target, if his approach time takes too long, we can tell him when

he's got to get out of the hot zone because he's got a ten minute decon and his bottle's got to last for that ten minute technical decon. If, and I can tell you right now if you ask an incident commander, they do not track any of that, and yet, these are the guys. These guys on the site are the most important parts of a technical response. We have the capability and the systems to monitor all the things I've just mentioned to you, and we don't do it. Okay. Next. So after you monitor his time on target which would be 30 minus 15 which would be 15 minutes, you can actually pick a protection level, this is turnout gear and SCBA with buddy taping, and my decision tool does this. It looks at protection factor, buddy taping, alright so we're getting 20.7 just for that. Head protection factor which is your SCBA 10,000. Unprotected dosage. This is a guy who doesn't wear anything, he's got 2 milligram minutes, so basically, there's not much for this particular scenario, but I think this was a spill scenario. And then time in hazard 15 minutes. But what it does it actually does the number crunching for you, looking at the ECT50s and LCT50s and ICT50s of the particular hazard and determines whether you have ocular, mild incapacitation, or severe incapacitation reached. It's done automatically. So what, in essence what you can do, you can track Joe. If you know Joe is 250 pounds and he's got an approach where he's going up 11 stories, and you're not tracking, knowing his location, there could be a lot of side consequences, collateral damage that has absolutely nothing to do with chemical or biological exposure, but if you're not looking at the guy as a total system, then you're not doing your job. Next slide. Just to reiterate. Protecting the two main routes of entry is really my job here. To show you that even though we're working on PPE systems, we need to include the inhalation systems as well. Especially like Level A. You could actually have, I've calculated for weaponizable biologicals, you might have a system where even the Level A

with the SCBA being inside the Level A, and you have to multiply the protection factors, you may have a scenario where that guy might be experiencing some kind of exposure based on a confined space, high concentration environment. So we need to look at this as a system. We really do need to do this. All right. We need to ensure that what they're wearing, that what it's monitoring, it's covering both routes of entry and make it performance based, ensemble based, and look at the hazard and then make sure that the protection assessment that we come up with matches the hazard that we're dealing with. Okay, John. And so the key points here is, we need to do an integrated approach to this problem. If you do this with blinders on, if you just look at APRs or you just look at SCBA, or you just look at Tyvek F, or you just look at Trelborg(?) Level A, and you don't look at the whole nine yards and you don't look at the mixing and matching, and even the individual himself and what environment he's under, we're not really covering the problem. So we need to look...

(END OF TAPE 1, SIDE B).

(TAPE 2, SIDE A)

Genovese: ...particular person and I really think we need to develop a system that tracks mixing and matching of PPE equipment for risk—that needs to be done now. If you think that people are not doing this, I can tell you that they are already. A company can go out and sell their ensemble, but I can tell you their doing mixing and matching. I've taught enough cities that I know that, based on the numbers that they see, they feel adequate they can do that, but it would be nice to be able to predict that combination of what would be the level of performance without actually doing a performance test. Okay, John. That's pretty much it. (applause)

Stewart-Craig: Thank you, Mr. Genovese. You're done. (applause) Okay, I know we're past schedule and I know a lot of you are nervous that we're going to be past the whole day. We're not. I knew Mr. Genovese was going to be the longest. Little longer and a little more controversial than I expected, but nonetheless we're still going to get out of here. So we're going to go ahead and take a short break, but before you come back, we're going to go right to the health hazard analysis. We are not going to let Mr. Genovese come back up quite yet. We'll save him for later on with the test methods, and then we're going to go ahead and move to the NFPA and law enforcement user needs before we get to lunch, and we'll be still ahead of schedule, I promise.

M: Jim, I just want to make one complementary addition to that statement about the mixing. I would like to state that it's the mil spec products that are also being mixed in with the industrial rated products as well.

Richardson: I'd like to thank Jim Genovese for letting me speak during his show. (laughter) Jim Genovese, Chem/Bio show coming soon to a theater near you. (laughter) Good morning everyone. My name is Irene Richardson. I'm an industrial hygienist with the U.S. Army Center for Health Promotion and Preventive Medicine at the lovely Edgewood area of Aberdeen Proving Ground. I will be filling in this morning for Miss Tina Waters who could not be with us this morning to give this presentation, so hopefully we'll get through her slides very smoothly and quickly. One of the things I noticed the other morning, kind of a little anecdote, I was sitting in the restaurant here having breakfast, I noticed how close the railroad runs to the back of this hotel. It's amazing watching the cars go by, some of the interesting things that they actually haul very close to populated areas like this. Watching this car go by had molten sulphur written on it, and I was like "ooh, that's kind of scary." One of the interesting things about railroads, do you know what the distance of a gauge is on a railroad track? Any railroad buffs out there? It's four feet, eight and a half inches. Any idea where that number come from? Was it based on engineering specifications…?

M: (…inaudible…) two horses.

Richardson: Two horses, okay, people already heard this story. It's based on the size of a Roman war chariot many, many years ago. Wide enough to fit behind the back ends of two horses. Nothing scientific about it. See, now you stole my thunder. I'm crushed. Okay. Anyway. The average person also falls asleep within seven minutes, so hopefully we can get through this before then, everybody starts nodding off. (laughter) I'm part of a small team of people up at Edgewood. We're

looking at all the existing standards and reports and things that are out there on percutaneous exposure to chemical warfare agents, and there's not a lot of information out there, as we've been discovering. One of the folks that's missing off this slide is the Oak Ridge National Laboratory; we have a toxicologist down there who is reviewing a lot of the information reports that have come out of SBCCOM and ECBC, the Edgewood Chemical and Biological Center, and some of their archives. So right now there's a lot of work ongoing, we don't have a lot of results to present to you, and if anybody has information out there that they can contribute to our effort, we'd be glad to have it. Next slide please. Some of the assumptions that we are making right now in looking at this information is that the individuals will already be wearing a full face respiratory protective device. Probably an SCBA, so we're not going to consider ocular exposure or respiratory exposure. We are looking strictly at percutaneous vapor exposure at this time just on the skin. The concentration and time will vary and be scenario-specific so we don't have any direct guidelines on that as well. We're looking at historic data, some old testing that was done in the laboratories there at Edgewood. There's not a lot of recent information. Most of this information is kind of dated. It's like I said, if anybody out there has anything or any ideas of other places we can look for information we'd be glad to have it. Next. We're looking at three main levels of exposure. Your least effects. Things that would be reversible that would not cause permanent damage on up into incapacitating effects; effects where people would not be able to escape on their own from a hazardous environment, and on up into, of course, your fatal effects. Next slide. These are the agents that we are

looking at. Again, just like we looked at when we were working on the SCBA standards and the other respiratory standards, we're going to use GB as a representative agent for all of our G nerve agents, VX of course, HD for those mustards and luicite. These are the agents we're going to be looking at. As I mentioned before, we're looking right now only at percutaneous vapor exposure. Down the road we hope to look at the liquid exposures, but right now we're dealing strictly with the vapor hazard. Our target population primarily is our responders, both male and female. We realize that they are probably more of a healthy population; we are not looking at the general public. So we are not looking at the older, elderly people or the very young. WE are looking mainly at your healthier, middle range population, primarily your first responders. Next, please. Some of the existing standards that we looked at, again, these are some of the same ones we looked at in setting the performance standards for the respiratory protection. And most of the standards that are out there are based on inhalation hazard. There really is not much for percutaneous. Are you familiar with OSHA hazard permissible exposure limits, and of course ACGIH, American Conference of Governmental Industrial Hygienists puts out their threshold limit values as exposure limits. Well, in the absence of having exposure limits for chemical warfare agents, the Army put together their own exposure limits called Airborne Exposure Limits and these are specifically for chemical warfare agents. Again, these are mainly inhalation hazards, so they're not helping us a whole lot. Next please. The other standards that are out there most of you are very familiar with: short term exposure limits is your 15 minute exposures. You can have up to

four of them during a working day. Again, it's inhalation-based. Again, OSHA PELs, inhalation-based. There are a few things out there that do have skin notations, but not a lot. So we don't have a whole lot to work from. The AEGLs, the Acute Emergency Guideline Levels. These are some interesting guidelines that we used when we were working on the SCBA standard. These are for one-time exposures. Okay, one time, lifetime exposure, and geared toward the general public and they cover a range of time anywhere from a ten minute up to an eight hour exposure for many different chemicals that are out there. The National Advisory Council developed AEGLs for the chemical warfare agents and these were, after a long review process, they are looked at and endorsed by the National Research Council Committee on Toxicology. And the Level I AEGLs are basically they're "potential minor discomfort or other noticeable and reversible effects." Okay. The key word here is "reversible". These do not cause any permanent damage. The AEGL IIs or Level II values could cause casualties. Okay. These are "obvious effects that impact your ability to escape or function in a contaminated environment." And on up to the Level IIIs which are life-threatening and can cause fatal casualties. So, these are some of the more recent research, and information has gone into these levels and these are some of the first areas that we're looking at as far as setting a standard. Again, this is some of the values that we used when we set the standard for the SCBA performances. Most of you are familiar with the term IDLH. These are some of the other values that we're looking at. Immediately Dangerous to Life and Health. There are actually a couple of different definitions of IDLH that are out there depending on who you

talk to. Army has their own definition, OSHA has their own, and so does NIOSH. The key difference with NIOSH is that they actually give you the levels that they set for their regular chemicals that are out there, but they give you a 30 minute escape time, where the OSHA standard does not. IDLH for OSHA means that it is going to hurt you *now*, it is going to impair you or kill you and you are not going to be able to escape. So these are some of the other things that we're looking at. A dosage, some of the things that Jim Genovese had covered earlier about CT, ICT50s, okay, your concentration and multiply by your time to give you an exposure that will incapacitate half of your population that's out there. These are also some of the numbers we are looking at. Okay. See, quickly. In conclusion, our goal is basically to determine the maximum use concentration for these suits and how much can actually permeate into the suit before it becomes a problem. What is going to be that standard, how much are we going to allow to come into the suit, either through seams, through closures, or through the material itself, before it becomes a problem for the wearer? We already realize that there are some weak spots in chemical protective clothing. Usually it's on the seams or on the closures. Also, realizing that some body regions are more susceptible to minute amounts of contamination than others. Usually those regions that have more blood flow will see effects a lot quicker. Anyway, this is some of the work that we're doing right now, and we welcome any comments, ideas, recommendations, or sources of information that we can look at to come up with these percutaneous vapor exposure standards for our CB personal protective

equipment. Thank you. Do I have any questions at this time? (applause) Thank you.

Stewart-Craig: Thank you, Irene. And right now you're going to see where we're going to make up some time, I swear. First thing, is we were going to have Mr. Genovese talk about some test methods. No we're not. (laughter). We may try to get to his presentation later, but I think it's going to be adequately by the NFPA presentation as well as the ones from Doug Way(?) and by Alex Pappas. I probably will include it on the docket site if anybody's interested; just a little more information about some different test methods. Secondly, Phil Mattson, whose name was spelled incorrectly, by me, is also not going to come back up here. He included what we had intended him to say in his opening presentation, so I just want to remind you, the reason we're working with NFPA is because they had an existing standard that already was addressing, CBRN, and they've been kind enough to look at revising it to include other than firefighters, emergency responders, EMS, law enforcement. So that is the route we are taking right now to get this standard in, is to work with NFPA to get the adjustments. So, with that, if we could have the NFPA reps come on up, they're on.

Stull: My name is Jeff Stull. I'm with a company called International Personal Protection, but more important to the matter here, I'm a member, and have been a member of the National Fire Protection Association's Technical Committee on Hazardous Materials Personal Protective Clothing and Equipment for, actually since it's inception back in the mid 80's. I was originally with the Coast Guard, and at that time, there were concerns about being able to respond to various types

of chemical spills. There wasn't really much in the way of a haz-mat community that had been established, and the level of personal protective equipment that existed for those response efforts was pretty much borrowed from the military or from some industrial applications and lacked a lot of the broad response capabilities that were needed by emergency responders. If I could have the next slide, please. What I'm going to be talking about today, is I'm going to be giving you an overview of the National Fire Protection Association, which is a consensus standards writing body. I'm going to talk a little bit about the development process, and I'm going to cover the standards that this group has prepared. One of which, NFP 1994 provides the basis of actually provides in an existing form now, criteria for the certification of protective clothing against chemical and biological warfare agents. So I want to give you the message that there is a standard that has been out since August of last year, 2001, that does cover a lot of the performance requirements that are needed in this area. Also, as a precept to that, I want to indicate that the organization, the technical committee that's working on the standard, is in the process of revising the standard. I know the standard just came out, but obviously there's been some concerns since 9/11, as well as some other areas that we'd like to address and take care of in this revision to the standard, so the standard is now open for additional changes and comments and, as Elaine pointed out, some of those areas are to address more aptly some of the concerns and issues related to the law enforcement community. Now let me go ahead and start with the next slide please. Well, as, right now, the basis for chemical emergency response is founded in the—what's commonly known as the

(...inaudible...) standard. And there's been a lot of issues as related in OSHA regulations as to whether this particular regulation pertains to incidents of chemical and biological terrorism. But, in this standard right now, this is literally the only regulation that exists for defining protection against chemicals in terms of an emergency response situation. And, it includes some basic requirements about the response efforts and the qualifications of the response organizations, and to some degree, sets some performance requirements for protective clothing. Next, please. Well, this standard, in terms of the personal protective clothing issue sets up a whole system of managing the clothing, its' selection, it's use, training of individuals, and so on. And it includes a series, what the emergency response community is familiar with is what is known as the EPA Levels of Protection or the Levels A, B, C, and D terms that you hear so commonly in this industry. Next. And these are them. This has been the basis for emergency response in this country by the first responder organizations, principally, the hazardous materials teams, the fire and other emergency response organizations that deal with chemical spills. And, unfortunately, through this system as general as it is, has been misinterpreted in many ways. It sets, essentially, it defines an ensemble in each of the respective categories for different threats of respiratory and skin exposure. But, what it doesn't do is it doesn't establish any performance criteria for these products. And now, certainly Level A being the highest requires an encapsulating suit, even that can be misinterpreted by various groups as to what an encapsulating suit might be, it requires a self contained breathing apparatus. Level B and C clothing, you hear people making distinction between those types

of clothing...they're the same thing, but the difference between Level B and C is actually the respiratory protection. And so, this is part of the basis and the reason that the NFPA got involved in the process of preparing standards for the responders in the hazardous materials area several years ago. Next. The committee itself, just to give you some background on what its general scope is that's working on the NFP 1994 standard, its general scope deals with all hazardous material personal protective clothing and equipment, excepting the respirator. And I know we've talked about systems testing here and the importance of that, and we've tried to address that in some fashions, but the NFPA has a separate technical committee that deals with respiratory protection issues. Next. The membership, and one of the unique things about NFPA is it has a system of balance in the participation and the creation of its' standards. What this balance system means is that persons that participate in the committee process are classified as a user, a manufacturer, some sort of enforcement agency, labor special experts, and so on. No one group can have more than one third of the membership, and overall our total membership is limited to usually about thirty people. So this creates the balance in terms of how standards are created. It also allows input from different interest groups. Next. Now the committee was first established in response to an incident that occurred with a chemical spill back in California in the early 80's in which emergency responders relying on their chemical protective clothing were exposed. And what happened, and Jan Dunbar is probably more familiar with this than I am, but what happened essentially is the res—by looking at the compatibility information they had on the protective

clothing that was available to the emergency response team, they found that their suits appeared to be compatible but in the process of working and mitigating the spill, their face shields, which were not tested, and not characterized in the same fashion as the material, did fail and actually caused the exposure of the individuals responding to that event. The National Transportation Safety Board investigated the incident, and saw that this lack of standards in the emergency response area, was one that warranted correction. And so, through the efforts of the International Association of Firefighters and other groups, a new committee was established within the National Fire Protection Association and addressed these concerns. And it has, since then, produced a number of standards on emergency response chemical protective clothing. Next. The process is a long one. And we have been talking about long term processes of two and three years. From start to finish, this process will take at least two years to create an NFPA standard. But the good news is with an NFPA process is there's an end in sight. When they engage in a process, their system of consensus, they're able to schedule that standard so that it does have a finite completion period. Which means that once a standard's development process has begun, it will be completed by a certain date, and the same thing is true for the revisions that occur that must be done at least every five years. Next. The other thing that's very unique about the NFPA process, in terms of the participation and the promotion of individual interests being looked at, is this, these phases for public input. There's two parts to this process. When a standard is either being initially developed or going through it's initial portion of revision, the public, and that means anybody, is

invited to provide proposals for either how that standard should look in terms of the requirements or criteria, or modifications for an existing standard. Those proposals have to be reviewed by the committee and action is taken on those proposals whether to accept or reject or accept in part or principle. And through that process, there is public input to how these standards are created. Well, after that initial phase, the committee works on the standard and comes up with a draft that incorporates whatever changes were included in the public proposal process. And that is then put back out to solicit comments, public comments, in which, again the persons have an opportunity, anybody that has an opportunity to provide a comment for a change to the standard. And this is important because the more input that we get from outside the committee, the better the quality of the standard and the more representative of the various interests that standard can have. Next. Well, right now, there are three standards. And I'm going to spend a little bit of time talking about NFP 1991 and 1992, even though that's not the heart of the matter for this group, just to give you an indication of how those standards are structured. Because there's information in those standards that also applies to NFP 1994. There are three standards that this committee has created. NFP 1991 is a standard that establishes performance design and certification criteria for, what we call vapor protective suits or vapor protective ensembles. There's also another standard, NFP 1992, which covers liquid splash protective clothing and ensembles, and then of course there's the NFP 1994 standard which establishes three classes of protective ensembles for chemical and biological terrorism incidents. Next. These standards establish a hierarchy. If you remember, I pointed

out the slide that showed the EPA levels of protection, which is the common basis of classifying clothing for the emergency response community. Well these standards, at least the first two standards, NFP 1991 and NFP 1992 are intended to provide performance-based definitions of the clothing that would be used as part of those ensembles. And so, essentially where we have relatively ambiguous and vague descriptions of clothing through the EPA and OSHA process, we have very definite definitions of performance and minimum protection established by the NFPA standards. The new standard that we have, NFP 1994, sets specific criteria for chemical and biological incidents. And I'll go into more detail about these standards. Next, please. Standards are fairly complicated. Anyone that's picked up an NFPA standard knows that it's not light reading. And, certainly, it's not entertaining reading, so I want to point out that the standards are relatively thick, and that's because there's an incredible amount of detail that goes into these standards. Not only are those portions of the standards that you expect in terms of what they apply to, and the scope, and definitions, and things of that order; there's certainly all the criteria, whether it be documentation in terms of the labels that are provided or user information; the performance criteria itself; there are some design criteria, although we try to avoid design criteria; there are the test methods, and they are explicitly laid out in terms of the number of samples, how the tests are conducted, even when other test methods might be referenced; and then there's the non-mandatory appendix section which provides other details or information or guidance for the use of the standard. The scope of the NFPA standards apply to emergency responders. And, a lot of people get the idea that,

just because these are standards from the National Fire Protection Association, that they're limited to the fire service, and that never has been the intention of this technical committee. It would apply to any emergency responder, whether it be from the fire service or other emergency groups, as long as their particular mission or activities fit within the scope of the standard. And for this standard, or for the standards at least for the normal emergency response activities, these include responding to various types of chemical releases, whether they be gasses, liquids. Unfortunately, the way the standards are set up right now, we do not address radiological criteria. That does not mean that these protective products would not provide that level of protection, we simply don't provide criteria in those areas. But the point of it is, as Phil pointed out, as NIST OLES does, we set minimum performance standards. These are standards that set a single level of performance that are not intended to restrict the way that manufacturers put together products or the variety of products that can be created. Next. Another very, very important provision of NFPA standards, which is not necessarily unique, but something that's from what I've seen the area of personal protective equipment unique, and that is the requirement for independent, third party certification. These requirements, first of all, actually specify the qualifications of the certification organization so it's just not someone's, Joe's Laboratory set up in someone's garage, but actually specify the requirements of the certification and the certification process itself. Very extensive requirements. It not only requires that the manufacturers submit products for testing and to qualify that product against a standard, but there's a system for listing the product, and for follow-on

testing to ensure that that product continues to maintain its requirements against the standard over the period in which its sold. In addition to that, there are requirements that the manufacturer undergo certain quality assurance control practices that are reviewed by the certification organization. So that when you see a product that has been certified that has the mark of that certification organization, there's definite proof that that particular item has been subjected to this standard and forms the bas—appropriate basis for manufacturer claims. Next. There are also, within the standards, documentation requirements. Certainly one part of that is labeling. Product labeling in terms of specific information that needs to appear on the label, but there's also the requirement for user information in terms of instruction are provided, and in some cases, technical data to support the certification that is provided upon request of the end user organization. Next. As I said, we have some design criteria. Those criteria are very limited. They are not intended to replace performance criteria, and in fact, it's just the opposite. Design criteria are usually included for the fact that we can't simply come up with performance criteria to address some features or aspects of the clothing's performance. And I've showed you some examples. There's issues related to sizing, there's issues related to certain configurations of the product which we simply just can't assess through some of the performance criteria that we've devised so far. Next. Well, within the first two standards, and again I'm going to draw some parallels with this when I talk about NFP 1994, there's some very key properties, and this is also true of 1994. There are criteria for the integrity of the products. We're looking at the overall system itself and how it provides

protection. In the case of 1991, we're looking at a gas-tight envelope. In the case of 1992, we're looking for protection from—liquid integrity from liquid splashes. Then there are the barrier requirements that apply to the materials, the seams, the closures, every part of that ensemble. Which, again, overcomes the problem that's existed in much of the industry for testing these products. You'll see lots of data provided on material. But if you see that same information on a visor, a seam, a visor seam, a closure, it's usually more of an exception, rather than the rule. And the NFPA standards require this testing of the complete system, that all of the components that go into that product. There are other criteria that apply to issues related to how durable the product is, how it might resist physical hazards, the functional performance of certain aspects, like being able to see through the visor among other things, the ability to be able to perform certain tasks in suits. And, various components are also evaluated for their specific performance. Next. Just the integrity tests. These are applied in NFP 1991 and 1992. There's inflation tests as used as a measure of gas-tight integrity. There's a shower test which is used for looking at liquid-tight integrity of clothing designed for splash protection. Next. The permeation process is something that a lot of people don't understand so I usually have this slide to promote it's familiarity to people. But, it's a key part of NFP 1991 and NFP 1994. Next. The way that—— But we also offer in our splash protection clothing programs protection against liquids where the vapor that might be associated with those liquids is not hazardous, so we have testing of products for penetration as opposed to permeation. And this slide shows the difference. Whereas penetration is a phenomenon of visible liquid penetrating in bulk

through a material whether it be through seams or pores of that product. Permeation of course is on a molecular level. Next. And the testing that we do is in accordance with various ASTM standards: American Society for Testing Materials 739 in the case of permeation; ASTM F903 for the case of penetration. And we have various exposure criteria that are set. The next slide shows that when we interpret permeation, this is for industrial chemicals, we use a bases of defining the break—a breakthrough time, as the time when the rate of chemical permeating through the material is equal to some level. And this is an important distinction, because with industrial chemicals, there are various detectors that can be used that may or be less or more sensitive depending on the chemical being evaluated. And so this provides somewhat of a normalization process for how breakthrough data, which manufacturers rely on very heavily, is presented. Now NFPA 1991 uses this breakthrough time that's normalized as part of its criteria against a variety of chemicals. Next. And that's, that was one of the challenges if you have an emergency responder that is dealing with any number of potential substances in a spill situation how do you choose which chemicals to test against? So we rely on batteries, actually there's a battery of standards by the American Society for Testing Materials, F1001 is the standard, it lists a bunch of chemicals and I'll show that in this next slide here. This includes a variety of different chemical classes. Usually smaller molecules from those classes that would generally be the more aggressive permeating chemicals. Where we make a distinction between NFP 1991 for vapor protection and NFP 1992 for liquid protection, we take out those chemicals that would not be appropriate for a splash

protection-type outfit. And so you can see that, in yellow, those are the same, all the chemicals are used for NFP 1991, but the yellow chemicals are the only ones used for 1992. Next. There's a variety of physical property tests on the materials themselves. We use tests to measure the strength, burst strength and tensile, puncture propagation tear. We also apply testing of the materials in the form of preconditioning of the materials prior to barrier testing. We have them go through flexing protocols and abrasion to simulate wear and tear that may occur in the field that ultimately could cause failure of the product. So essentially, the materials go through some precondition before they're actually tested for their barrier qualities. And that's what I'm showing in this testing. We have repeated flexing which can break down some materials, and certainly abrasion can take away some of the barrier qualities of a material as well. Next. One of the controversial areas of the emergency response standards is the requirement for flame-resistance testing the product. Now the idea here isn't that these products are flame-resistant in the same regard as, say structural fire fighting clothing or equipment, but the committee felt rather strongly at the time, that the clothing itself should not become a hazard. So that, if there was some unexpected contact with a flame or through a flashover environment, that the clothing itself would not pose a hazard to the wearer. And the testing that's done in the standard under NFP 1991, but not NFP 1994, requires the materials to have some level of flame-resistance. Next. There's a (...inaudible...) component test. We have tests looking at the field of vision for the visor, the operation of the exhaust valves used in NFP 1991 suits, dexterity requirements for gloves. Footwear has requirements for slip-

resistance or traction. So we have a comprehensive set of criteria that apply to all parts of the ensemble. Next. There are also requirements that go beyond the individual piece testing that we do. We have integrity tests, but there's also performance tests where we look at having people inside the clothing to evaluate how that clothing affects their mobility, their functionality in a variety of task situations. We also look at situations where, for example, an SCBA that's worn inside the clothing could fail, the suit could be come over-inflated, the suit has to have the capacity to vent that air in a safe manner, and so there's special tests that are added for those kind of conditions as well. Next. Well, I'm just going to go over 1991 and 1992 real quick, and then get into NFP 1994. These are full body clothing standards. 1991 addresses a product standard where we have a the gas tank integrity. Materials are tested for permeation resistance. But there's several options. Back several years ago, we recognized the need for having chemical and biological terrorism protection in these standards and so we actually added an option to address that area. Next slide please. We also have optional categories for liquefied gas protection which has some additional criteria as well as protection for escape from flash fire environments. Next. NFP 1992 does allow some partial body protective clothing, and again it's a lower standard. It's really nothing of consequence here, but for a liquid protection situation we're looking for the commensurate criteria of liquid tight integrity of the clothing as well as penetration resistance, not permeation resistance, of the clothing materials. Next. Well, 1994 I'd like to get into that in greater detail because that's the standard of greater interest to this group. Now this standard was actually evolved over the last

five years. And it was just coincidence that it came out in August 2001. But it establishes three separate classes of performance. And there's a lot of concern and controversy, and remember, that when I was talking about conventional chemical response, we talked about the EPA levels, you have Level A and Level B. So already you've got a group of emergency responders that are used to a two level system. But we felt that the special circumstances of a chemical and biological terrorism incident, and as Jim pointed out the separation of events in terms of their time and space was important to characterize in the hazard assessments that went into defining these three classes. We have some key tests in this. We have some integrity tests which include the inflation test for the highest level, but we also have inward leakage tests, which assess the clothing in a more realistic manner. We have testing, of course, against specific terrorism agents, and I'll go over that in detail. But a lot of the other tests in terms of the physical properties, the component performance are all very similar to the test methods that are established in NFP 1991 and 1992. And it's also possible, to the good news of the first responders, that this clothing could be certified against both NFP 1991 and 1994, to one of the respective classes for that matter, NFP 1992 and NFP 1994 for one of the lower classes. So that dual certification makes somewhat of a multifunctional type clothing for the first response community. Next. Well, here are the performance classes and the basis for these performance classes. We had very good input from SBCCOM in the development of these classes. We had Paul Fidel came to several of our meetings. We had representatives from NIOSH and other organizations that provided valuable input to how we create this

classification system. And the way that this system is set up is based on the differences in threats that might exist in a particular environment. And these may loosely be based to time and distance, or for that matter, just when the response organization arrives and what the situation might be during their part of the response effort. In Class I, this is the highest level of protection. And here there's the potential for exposure to the agent in a vapor, aerosol, or liquid form. We're not permitting any skin contact, the threat itself may be totally uncharacterized or unknown, and there's still a high possibility of contact with a liquid. Now, of course, you could devise any number of classes using these types of exposure scenario criteria, but we realized that not everyone is going to be able to drag a trailer behind them with all the clothing that they're going to need, so it was important to define a minimum number of classes. And the fact that we had a lot of arguments, whether three classes was too many, or we needed four, and so on. So we ended up with three classes. Now class two steps down a little bit. There's less of a vapor threat. There's still a liquid threat. But it's a more moderate threat in terms of liquid exposure. One of the differences that I don't have represented on the slide that we talked about, in fact I wish it was part of the standard itself. We talked about the scenario that the first responder might come across in terms of defining between a Class I and Class II response situation. Class I would be the type of situation that we envision where the emergency responder arrives on scene and the majority, say 19 out of 20 or 18 out of 20 of the victims there are dead. Whereas, Class II would be the opposite, where you have 18 would be, maybe non-ambulatory, but survivable and rescuable from the situation, so there's a big

distinction there in types of hazards and the criteria, the performance criteria that apply to the clothing itself that distinguish that level of threat. Now Class III is a level that is based more for the peripheral areas of the response event. Probably in the warm zone for perimeter control, decontamination, for other processes not directly connected with the hot zone. Although depending again on time and space, the Class III clothing may be appropriate for other aspects of the response well after the event has occurred. Next. The specific criteria that apply to the barrier performance of the product, in terms of both the integrity and the material, include two parts. There are integrity issues, and these, four are defined for each of the three classes. A Class I suit is essentially what we call gas-tight, and we lose that term rather loosely, but a gas-tight suit is inflation tested. It also goes through an overall inward leakage assessment, where we use sulphahexofluoride. Now why do we use sulphahexofluoride? We wanted to find a relatively small molecule leak detection substance that we could detect rather easily at small concentrations so we wouldn't have to expose a person in a suit to very high concentrations, so we could actually measure meaningful protection factors or intrusion coefficiences as we call them in the standard. We allow .02% leakage for a Class I product. In contrast to that, the Class II product allows up to 2%, but is not needing to be a gas-tight suit. It would still probably be in an encapsulating suit, but would maybe not have the features and bulk that often make up a Class I product. There are also differences in the barrier protection provided by the Class I and II suits in terms of their permeation resistance. All three classes are tested to permeation resistance. And we test them against TICKS and TIMS, gasses and

liquids that are representative for the, what were considered by the committee, as well as chemical agents. And we look at some fairly high challenge concentrations that are essentially 100% chemical in doing the Class I testing. That drops down to diluted or lower levels of exposures of these same agents and chemicals in the Class II, and even further down in Class III. We use two different manners of testing. The one of which for Class III is somewhat less severe. So, we have a system of hierarchy of not only in terms of what is represented by these classes but the way that they're tested and their classification. Next. Well, here's the substances that we test the clothing against. We have four different chemical agents to which the suit materials, the seams, the visor, everything that's used in this ensemble are tested. And we have some industrial chemicals, some Ticks that we use that include one liquid as well as a number of gasses. And there's a lot of debate as to whether this is the right mix of chemicals. Certainly we need to be concerned about those that are very skin toxic, but some of these challenges, for example something passes ammonium chlorine it's almost like you don't need to do the agent testing to figure out if the clothing will pass. So, in other words, they're more aggressive permeating substances under the conditions of the test. Next please. Well these standards. We're going to wrap up now, but what I want to do is invite questions and comments because we're at a stage right now where we're looking for proposals for modifying the standards. The standards themselves aren't the end-all. It would be ideal that we could address respiratory protection and dermal protection in a single standard. The system that we have in place doesn't do that. I can point out, though, that in NFP 1994, if the respirator

itself is part of the skin protection and it gets subjected to the same types of testing as the other products, which only makes sense. Or, the respirator itself can provide a basis for the integrity of the product. For example, in a Class II suit a powered air purifying respirator could be used to provide some positive pressure in the suit to limit the inward leakage of a chemical. So there is some interaction there, but its still evaluated from the perspective of the suit and its performance as opposed to the respiratory protection that's provided. There's certainly other aspects that NFPA does not address in these product minimum performance standards. There's lots of things related to human factors and use issues we just can't get into or just simply isn't really part of our scope. Next. The committee is working on a selection/care/maintenance standard that goes along with these products and that's going to come out, probably in another three years. We're trying to encourage compliance with our standards. The standard are pretty onerous in terms of the criteria. They're very expensive to comply with, but they do represent a consensus process standard and it's our hope that industry will start to adopt these standards to promote use of products that meet these standards. Now, the one point that I really want to stress here, and look for this group's input, whether it be here or formally in the public proposal process, is we're looking for, we're in a situation right now where we recognize that NFPA 1994 was a good standard, but it's not a perfect standard. It doesn't maybe cover all the needs of all the various groups that might or should use that standard, so we're looking for input from groups as to how the standards might be modified, additional criteria, criteria to be removed, different classification systems, that

would enable this standard to be more productive in terms of the emergency response community that it serves. Again, we're not limiting this to the fire service. We're not limiting this standard by any means, and it's our hope that through this consensus process the NFPA offers, that we can embody a broad range of protection for a wide range of first responders for chemical and biological terrorism incidents. And I think that should be my last slide, so I'm open for any questions or comments. Bill.

Haskell: My name is Bill Haskell from SBCCOM up at Nattick. I'm on this committee. And during the development of this program, we also had a lot of participation by the manufacturers that make the military protective type of clothing and equipment, the absorptive type, the permeable type, and the next-generation selectively permeable membranes. And the standard as currently written really favors a non-permeable product, and that's one of the areas we want to revisit during this open cycle of this standard. We do have a meeting coming up in July, and the manufacturers, some of them are here, are going to present to this committee again the advantages and use of the military type products like the JS List the Gentex, and some of the Gore materials. So we think we're really making an effort to bring in other types of products that could be used by law enforcement, emergency medical and systems like that.

Stull: Thank you Bill.

Berndtsson: Yeah, I'm Berndtsson from the SEA again. I think in Point 1, Point 1, Point 3, in the 1994 Standard you're saying it is a limited use suit standard. What do you really mean by that?

Stull: Well, what we're saying is… that's a good point. That's something that I didn't bring up. The criteria that we developed or predicated on is single use. We're not indicating that these products are reusable, we're not expecting that they're reusable, but we do not have criteria that would indicate that these products could be decontaminated and reused. In other words, we don't take into account the possible practice of reusable products. We simply based it on a single use. That's how the criteria were established.

Berndtsson: Does that include training and exercise? The problem here is that we don't, very often don't know if it is a live agent, and then of course is going to be thrown away every time or is it going to be thrown away after we know that it was a live agent? I mean, this is probably quite important to the user community because they're very expensive.

Stull: Certainly for training purposes, a lot of manufacturers will use a less expensive material or less expensive design features and they'll be able to provide product to organizations that allow for training purposes, but obviously, a group wouldn't want to use up its cache of equipment in a training exercise and then have to repurchase all that clothing and equipment. Actually, just one clarification. We define a single use as a single exposure. So it's, and that's also been a very hotly debated issue within the committee. Yes?

Pappas: Hi. Alex Pappas SBCCOM. We're involved in a lot of suit testing and I was wondering if you could, you just touched the issue about the SF6 testing. I was wondering if you could, maybe, go on a little bit in detail about it? How you actually test the suits?

Stull: Certainly. We use a test where an individual, a test subject, wears the suit and goes through a series of exercises in a closed environment which is filled with 1,000 parts per million sulphahexafluoride. Samples are taken in that suit at various periods of time, and we then measure the concentration of sulphahexafluoride that's leaked into the suit and can look at the ratio of the outside concentration to the inside concentration, actually the opposite to get an intrusion factor, and that's how we do it. Now we've looked at the mist test and I like the mist test, but the price tag that was associated with the mist test was somewhat...

M: (...inaudible...)

Stull: ...yeah, it certainly pushed us away from that because, and we're also concerned that the mist test may not have simulated the Ticks and Tims that we were concerned about as well. Sulphahexafluoride is a leak detection gas. That's how it's commonly used in a variety of industries and so, it's also can be easily detected by electron capture and some other methods as well. So it turned out that that was a simpler, more straightforward test that we chose over the mist test. I'm sure that's where you were coming from with that. Phil.

Mattson: Yeah, Phil Mattson with NIST OLES and I just want to underscore the point that we brought out earlier that this is an example of working with an existing standard and an existing standards organization. This standard was developed before the hazard analysis, which you can see we're still working on, was done, and so we're trying to leverage the results from that hazard analysis, and also incorporating some of the other technologies that Bill Haskell mentioned in law enforcement

needs into the standards, so I just wanted to, once again, to underscore this is an example of this working together and, you know, as we go along, we'll kind of refine our…

Stull: …we're hoping to…

Mattson: …perspectives on testing techniques and materials and so on.

Stull: Well, we appreciate that Phil, and certainly Phil and others have come into the process of late and it's been very helpful as I said. The more input that we get right now, we've got this opportunity, and before I forget to mention it, the committee, the technical committee will be meeting next on the 25th through the 27th of next month, in July, in Oklahoma City. I don't know if the hotel has been assigned, Bruce?

Bruce: I don't know what the hotel is, but Oklahoma City.

Stull: Uh, 25th through the 27th, and this will be the meeting where we look at proposals, and we will be generating the next draft of the standard for further review. So it's a critical meeting, so those of you that have interest, first of all, you can show up at the meeting, but what would be even better, is if you put your thoughts after reviewing this standard, in writing, as a public comment, or a proposal that would be really helpful to the committee. Just to tell you, you can get the proposal form off the NFPA website, www.NFPA.org, the standard itself is available free off the website. I think it's still posted so you can download the entire standard if you want to review it and find those portions, call someone on the committee if you're trying to find something that's of interest to you, and they'll help you find what

you're looking for, and again, put your proposals in because that's the way that this process works. Yes.

Palya: Yes. Frank Palya from NIOSH. How did you guys drive at SF6, sulphahexafluoride for a penetrating gas? You mentioned something that it was, it simulated the actual agents, or… I'm curious.

Stull: No, we didn't say that. We knew that, we were looking at a range of different substances that could be involved in any kind of terrorism incident, including of course chemical agents as well as Ticks and Tims. We knew that, first of all, there was not going to be one surrogate gas or aerosol that's going to simulate those conditions. Sulphahexafluoride was chosen simply because it's a well-demonstrated leak detection gas. If you want to measure integrity of a system, whether it's a piping system in an industrial facility, or in this case, chemical protective clothing, it allows you to do that. It's also a molecule that doesn't interact with materials. For example, it wouldn't necessarily be absorbed by carbon in a carbon-based suit system. So that was another reason it was chose. It…as with any chemical it has some toxicity associated with it, but we're able to use it at a level below any toxicity concern for the user, and for that matter, the user's wearing a respirator while they're going through this process anyway. And then lastly, it allows for a relatively low detection level, which allows us to precisely measure the inward leakage.

Palya: Thank you.

Berndtsson: I also was going to ask a question on that because, if I understand right, what we're doing is that we're taking samples from four different places, and we are

circulating it through a closed system and taking samples out of that closed system and then back into the suit again, is that correct?

Stull: Well, that or actually the way that some of the testing has been done is there are grab(?) samples that are taken inside the suit during the process. So that there's no, one of the concerns that you can have, particularly with a non-gas-tight suit, if you pull some volume out during the process, you're actually, that will be displaced by outside air coming into fill that void. So, we do it, it's done in a fashion where that type of problem is eliminated, but it's usually done by grab sampling as opposed to some kind of closed loop circulating system, but it could be done that way as well.

Berndtsson: Does this mean that you get an average more than a peak?

Stull: Well, the way it's done, conventionally, by most of the laboratories involved in the current process is, they look at discreet samples, so they don't get an idea of perhaps changes that might occur during the course of that entire exercise. Ideally, it would be best to have some sort of continuous monitoring process, where you could see if there's a peak during, say a deep knee bend or some other exercise where you have a significant volume change in the product.

Dickson: Eva Dickson from (...inaudible...) Military College. I was just wondering where you got your .02% and 2% numbers from?

Stull: Well, we had, those were set through a consensus process, so I can't say that they were based a lot on scientific merit, but we had the advice of several organizations present, including SBCCOM, and we had representative from NIOSH, and we were looking for levels of leakage that we thought would offer

appropriate protection factors. I mean, if you take the intrusion factors and invert it, then of course you come up with a protection factor. That's open to debate, and that's one of the issues why we reopened the standard, because we were a little... we didn't have the completed hazard assessment at the time when the standard was finalized, so certainly that is an area that will probably be revisited as whether those levels are appropriate.

Graham, Steve: Steve Graham from the Center for Health Promotion Preventive Medicine. Two comments. One is, I'm also the Vice Chair of NCCADA (?) and we're putting a proposal out to start a technical subcommittee to address selection and use of respirators in the chem/bio arena. And I think maybe you and I ought to talk and see if we can maybe run standards concurrently.

Stull: I think that would be a wise process, yes.

Graham: To see about it as a total system.

Stull: See, that's being done, AIHA is the secretariat on that.

Graham: Right. In my other capacity as a CHPPM employee, I also work with DA(?) safety office and they have a process under what's called the Chemical Agents Safety and Health Policy Action Committee, and within this group it has allowed in the past Army approval to use protective, commercial protective clothing in situations at Army depots where there could be the potential for exposure to military chemical agents. And this started out being the process of base closure, where they were looking at...

Stull: CCEPT(?)...

Graham: ...well not so much CCEPT but base closure. It's carried over into where we've had a tech escort unit come and request cash pack approval for commercial ensembles when they go onto depots and maybe have to deal with a chemical agent clean up, as far as a spill. CCEPT responds. I wanted to mention this for the record because I don't have the details of what that approval process has, even though there's a formal mechanism and a matrix, and I know it does involve several of the, you know, ensemble having a certain NFPA approval, besides getting testing through SBCCOM.

Stull: That's a good point, because I know that manufacturers have looked at some of the costs associated with these certifications, and they are enormous as far as testing goes. Any kind of encouragement from other sources

END OF TAPE 2, SIDE A

TAPE 2, SIDE B

Cloonan: Terry Cloonan, NIOSH. The 1994 is a remarkable product. I give you guys a lot of credit because it was much needed in the responder community, at least from my observations. One of the issues that I have about it is the, first the question I have is the Class II configuration. Is that equivalent to Level B?

Stull: It is not. A lot of people have tried to make that justification and comparison. Again, they're overlaying the commercial, not the commercial, the normal emergency response system on to this system and it doesn't fit. It only fits at the top area in terms of Level A is equivalent. In other words, an NFPA 1991 suit would probably in all cases that I can think of, probably meet Class I of NFPA 1994. I cannot say that an NFP 1992 would meet any of the NFP 1994 Class

criteria. I mean it's possible to be designed that way, but by just virtue of meeting the NFP 1992 requirements it would not. So, there really is no equivalence there at all. And the difference here, the key difference is that permeation testing is a requirement throughout all three classes to some degree, even though there are low dilution or low concentration chemical challenges in Class III, it's still a permeation process not a penetration process as used in NFP 1992.

Cloonan: Okay, and follow up to that, the ability for the respirator to interface with the suit ensemble and the equivalent of an EPA Level B configuration, what's your position on that?

Stull: Well, that's where I want to go. And we have this awkwardness because we have NIOSH of course that certifies respirators, and NFPA or not NFPA but organizations like UL and Safety Equipment Institute that can certify chemical protective clothing and they look at their respective parts separately. As I pointed out, there is an aspect of NFPA 1994 that looks at the respirator, but not from the standpoint of respiratory protection, from the standpoint of how it provides protection to the person's skin. But there's another aspect to this which is a little less known, and that is, a system, an ensemble can be designed so that the respirator helps to create a positive pressure inside the suit, and particularly for a Class II product, where you have a more generous inward leakage requirement, and that positive pressure would allow that suit not necessarily to be gas-tight, but provides some level of performance within the product.

M: So, Jeff, then in a Class III configuration, there's going to be a gap between the suit hood and the respirator.

Stull: Well, there's, you're right. Well, it's predicated on the fact that most Class III products that are envisioned would be a standard coverall with a hood and respirator face piece forming that seal in the face area. And of course, there's an interface issue right away. There has been a lot of other groups that looked at a two-piece cover all, essentially a coverall without a hood and then it has some kind of over hood type of design so that there's a visor built into that and that would be worn, but then you have complications of operation of an air purifying respirator and so on. There's some design challenges that are afforded by the standard. Thank you. Bruce.

Tialon(?) Bruce Tialon(?) NFPA. Jeff, as you well know I've wanted to point out to this group, one of the major criticisms that we've had about 1994 has been from the law enforcement community and people saying these three categories of suits, the three classes, certainly can't be used by law enforcement agents performing SWAT team activities, bomb disposal, evidence collection, etc. But, when, you may want to comment, that when the committee looked at writing 1994 they looked at all emergency response. That they picked out key areas for these suits to function in. One was size up, the other was threat assessment, victim…

Stull: …rescue…

Tialon: …yeah rescue…victim extrication, victim treatment. And they felt that any agency performing those functions, that that's what these suits were designed for, and if people want us to go beyond that for other functions, that ought to be part of the proposal process in order to do, for example, SWAT activities, then this is what our needs would be.

Stull: Those are important points and again why we're looking for the input that we are. One issue, one point that I'd like to make is that Class III is kind of an oddball class. Class II is oddball, too, but Class III is because the way we've defined the threat, we're not looking at a vapor protection but we're looking at liquid and we're also looking at the potential of those responders contacting blood borne pathogens to rescue victims that might have been part of the calamity, and so there's where a lot of the problems are, because liquid protection and charcoal absorbent suit, and there's some difficulty there, and so that, defining those classes has really been a challenge. The highest class, that's the easy thing. But you got to remember, the proportion of people using that highest level of protection is going to be relatively small to the people using all the other levels of protection. You're going to have vast, larger number of people using those Class II or Class III ensembles than you will Class I. So, getting those classes right is very, very important to this process.

F: Actually, what I was hoping was that you would amplify a little bit on that in this standard. How is the user directed that they are going to be using, when are they going to be using Class II or Class III. I mean, with NFPA 1991 an 1992 it's obvious, it's in the title. The user knows which one they're supposed to be using when. How have you differentiated it within the standard to say a Class III product is used here and a Class II is used here.

Stull: Well, we give some fairly vague guidelines and, NFPA has a process by which they try to keep use issues separate from product performance issues, and the reason they do that is this standard applies really to manufacturers of products, in

terms of how they qualify product, but as you well know, as everyone knows, you have to have a use part of it that directs people how these standards, or how these products that now meet these standards are used. We have a little bit of guidance in there, we talk about functional characteristics of a response effort and where those might be appropriate within the classes, but nowhere near to the degree that makes the standards as useful as they need to be. The use or selection/use/and characteristic document that we're trying to deal with will help in that regard, but that still will not provide the guidance that we need, and so that's an awkward price to write a performance standard and then not be able to really write use provisions that goes side by side with that, and there's a way that we need to deal with that, but I'm not sure how we will address that. Thank you.

Berndtsson: I'm just going to ask a question. Will you be here all day today?

Stull: Yes. I have a 7:00 flight so…

Berndtsson: That's fine because…

Stull: …I'm not going to keep you any later than I have to…

Berndtsson: No, no, because I am going to do a presentation. Have you done some testing according to this 1994 protocol and how we can interpret the results and I just wanted to have that as a communication point.

Maughn: Wes Maughn from AEGIS North America. I want to underscore the previous conversation. I believe it's essential in this review process that you're going to initiate as I understand it on the 25th through the 27th July, address the standard has to address both the manufacturing side and the user side. We need to merge that ambiguity. I think we need to… a viable goal, or a, well let's just leave it

there. A viable goal would be also to remove the ambiguity between I, II, and III, and where a piece of equipment is supposed to be used and what it's designed to be used for, both from the manufacturing perspective and from the user perspective, and then, I believe that we're going to see, that if we really look, that we're going to see that segments of the marketplace that are, by tradition use one form of protective equipment, may in fact find, if we can create the certification process to validate that, okay? That another form of protection may be more appropriate and address a number of user issues from the standpoint of view of comfort, flexibility, mission critical support, and durability, meaning durability of the human being putting in the environment, not just the equipment. That's all I have.

Stull: Those are good comments, and I think we need to, at the very least, define exactly the levels of protection, expected protection that is provided by that. WE may not necessarily get into use aspects of these products, but if we can define this is the kind of protection one would expect from this product that's certified to this class, then that would be helpful. Well, again, I want to thank everyone for their attention, their great questions, and unless I have…

M: Do you feel your matrix slide (…inaudible…) I won't ask you to answer (…inaudible…)

Stull: All right. Well. I guess we'll have that up, I'll turn the podium back over to Elaine and thank you very much again. (applause)

Stewart-Craig: Okay, it's about 12:30, we'll go ahead and have lunch break. I know once again a lot of you want to leave early, so at 1:30 promptly we're going to start with the

law enforcement briefing, and if any other attendees would like to give a briefing, please come see me. Otherwise, I'll see you in an hour.

M: ...had a lot of talk about needs for law enforcement and requirements and so on and so now we have a First Sergeant Ken Hasenei from the Maryland State Police, who will enlighten us on some work on this that has been done with SBCCOM and some other things, so all yours.

Hasenei: Good afternoon. I was scheduled originally before lunch, and I was wondering how it was going to be to speak after lunch today, but with the hunger frenzy that was going on right before we broke there, I think it's better that I'm now than earlier. I'm First Sergeant Ken Hasenei. I'm with the Maryland State Police. Let me give you a little disclaimer. I'm not a scientist. I don't have a Ph.D. I don't do testing in my office of any products, and I'm not Jim Genovese. So you won't be hearing about periodic tables today, or molecular weights or anything like that. It'll be a little bit more informal, and a brief thing. Basically, I'm currently the commander of the Grants Management Unit for the Department. The reason I'm here is for three years I was the Weapons of Mass Destruction coordinator for the Department of State Police. After 9/11 happened I got immediately redeployed full-time to doing that plus my current job, plus about twelve other things, and I've been still working mostly within the department and across the state level on Homeland Defense. I'd like to thank NIST, SBCCOM, and NIOSH for having me hear today because the law enforcement perspective on this for first responders is very near and dear to my heart, but it's a rarely expressed or presented side of things. So I hope to present some useful information to you today, about what's

going on in the law enforcement community, what our needs are as users. One of the big problems right now, the fire community has NFPA, they're a little more what I would call "gelled" across the country in terms of being on the same sheet of paper with needs than the law enforcement community is. They're little hundreds of groups and hundreds of meetings across the country going on and nobody's talking to each other, and they're all doing they're own thing. So that is a problem that hopefully will be addressed sometime in the near future. We've been close partners with SBCCOM since 1997. I started on the program with the chemical weapons improved response program back in 1996 with Bill Lake, and we've had a very close partnership with General Doseburgh(?) up there and his command, and basically we've allowed them to use any of the resources within the department since that time for whatever they needed for law enforcement studies. I was the co-chair of the law enforcement group and the law enforcement functional working group at that time, and will talk a little bit about that. Out of that group we published the law enforcement personal protective equipment report, we also have a report on law enforcement response guidelines to terrorism involving chemical weapons, mass decontamination report, and although I wasn't directly involved, the chemical weapon improved response program also published the firefighter personal protective equipment report, and the positive pressure ventilation studies. To date, some things I heard in the meetings here were very positive. It seems like some of the people from NIOSH and NIST, and SBCCOM have a very good grasp on what the user community needs. But I also heard some other things during the last two and a half days or so, that I guess they

were assumptions made, or some type of thought process happened there, maybe personal experience where people expressed what they thought the law enforcement community were going to be doing at the scene, and I was a little troubled by some of the things I heard. And there's a lot of misconceptions out there. I'm sure you've heard...you run the gamut. I've worked with departments that have said everything from "we're going to completely stay out of there and not go in at all, regardless of whether we have equipment" to working with New York City Police and Emergency Services Division, who want to do everything, fight fires, deal with the haz-mat, deal with explosives, deal with law enforcement issues and everything else. And what I hope to present to you to day is more of a middle of the road, a conservative approach to our roles and responsibilities at the scene. One of the problems early on about four or five years ago, I made some phone calls down to Washington, DC when the funding started for personal protective equipment was there was little or no input from the law enforcement community down in Washington, DC. Matter of fact, I'm not going to mention any names, but I called some very high ranking people down there and I was told that we were not first responders, and therefore funds would not be available to us and it was very troubling. Fortunately, that has been rectified. And there was a big question. Were law enforcement officers first responders or not? Today we face an even bigger problem because with all the federal funding coming out, everybody wants to be a first responder, veterinarians, and everybody wants to be a piece of the pie. Here's a question. What was the role of law enforcement at the scene, if any, and that was something that we had to explore, and not to knock my

fire department friends here, but basically I heard from some of the fire chiefs that I work with, "Hey, we're going to take care of everything. We know how you guys are, we don't want you in there. You don't have equipment, you're not trained, you're not prepared, so we're going to handle everything." That's not necessarily the case. The truth is, law enforcement response is critical to the scene. It is a crime scene. It involves the use of police officers. You have other issues such as security, securing personal property at the decon lines, detention of potential suspects, and we're going to get into some of those things, so it's a vital portion of what may be happening out there. The fire service is not, although they're equipped with high level equipment and much better training than the average law enforcement officer, they're not trained or equipped to deal with certain issues, and we certainly would not expect them on the law enforcement front to assume our role and grab guns and go through tactical training to do our job at the scene. And in most areas, and I don't know how this plays out in your state, but I can tell you in Maryland, eight or nine of every ten times we beat the fire department to the scene. We're already on patrol on the road, the fire department's in the fire house. I'm not saying it happens all the time, but most of the time we're at the call before the fire department arrives there. So it's important. A little bit of background: National Domestic Preparedness Program created back in FY '97 Defense Authorization Bill, and that also created a chemical weapon improved response program, to improve the response capabilities of the civilian community via first responders. Baltimore-Washington corridor volunteered to be the test bed for that program, and New York City

volunteered to be the test bed for the biological weapons improved response program. And the whole purpose behind it was it was designed to increase the country's readiness posture when responding to terrorist attacks using chemical weapons. The focus is on high priority responder needs in different communities and functional groups. They used a think-tank approach to all this and they conducted technical and operational investigations with associated exercises to ensure we came up with, not only valid solutions but scientifically backed solutions. And one of the big things we had to do was make sure that whatever recommendations we came up with, not only applied to a metropolitan police department, or metropolitan area, but a rural area, and it applied to local, state, and federal areas, and that was very important, and I think we were successful in doing that. Here are the participants. We had a health and safety group, fire and EMS group, a law enforcement group, and an emergency management group within the chemical weapon improved response program. The law enforcement group was composed of many different agencies, some of the larger agencies here. We had Baltimore City Police Department; New York City Police Department, including their Emergency Response Unit; Washington DC Police Special Operations, as well as some of their patrol officers. We had several county police departments, a very large county police departments in the metropolitan area and elsewhere throughout the state; we had sheriff's departments; we had local departments; and on the state we had the Maryland Transportation Authority Police, the State Police, and we had the Coast Guard, FBI, and some other federal agencies participating. So we really got a good cross

section of representation of law enforcement agencies, figuring that the recommendations we got back, or responses, would really cut across the boards in terms of applicability. We decided to break off and create a law enforcement functional group, to specifically look at the issues dealing with law enforcement that were unique challenges to that group. We created that group in 1998 and we met through September 2000. Our purpose was to sit around and discuss, evaluate, and make recommendations on the law enforcement missions, responsibilities, and protective equipment, including guidelines for a response to chemical weapons incidents. And the recommendations were put to the test and evaluated during several exercises. We had exercises that were run by SBCCOM out of Baltimore, and we called them BaltEx for Baltimore Exercise, and we did, I think 13 or 14 of those around the area. BaltEx was specifically designed to test out the recommendations in PPE that we had come up with in the technical group. And then we also hosted a functional exercise called Crime 2000, again, specifically, and it wasn't just law enforcement. We had emergency management represented there. We had the fire community represented there. We had the hospital community represented there. To make sure that what we were doing and the way this played and the recommendations were valid, not only to our self in our little tight-knit community, but that the fire community and other groups approved and understood what our role and responsibility was. In fact, we spent countless hours with our friends in the fire department and other functional groups, basically to understand what their roles and responsibilities at the scene were, and vice versa. Functional group identified unique challenges facing, like I

said, the law enforcement community. It outlined chemical response-specific roles of law enforcement, and we developed response guidelines from input from workshops and also backed by scientific testing. And we published those guidelines as part of the IRP Enhanced Response Procedures, and if you're interested in any of that information, it is on SBCCOM's website. Those are just some of the things that we came up with that would not have been possible without the technical support from SBCCOM. And, our intent on law enforcement personal protective equipment. We had some guidelines we had to stay within. First of all, it had to be readily available. You couldn't be going after some orange-spotted zebra out there, that you couldn't find anywhere or it was not available. It had to be easy to maintain. Some of the things I'm going to tell you in the next few minutes are going to really scare you, as far as the current equipment in the law enforcement community and the status of that. So it has to be easy for them to maintain. And it has to be affordable. In talking to law enforcement officers from small departments, chiefs there looking at budgets up to big departments, we figured, you know, what's really affordable for a law enforcement agency to purchase? And we came up with a figure of about $200 per officer, which included basically a whole ensemble and an APR. And it had to be affordable, again, local through state, when we made these recommendations. Looking at existing law enforcement equipment, the truth of the matter is most, if not all, law enforcement agencies in the United States use negative pressure PPE that they use for riot control right now. Unfortunately, most of those masks are M-17s, because they were free from the military, and that's a big problem. I can tell

you, we went to a meeting in SBCCOM one day, me and a whole bunch of other law enforcement folks, including FBI, and there was the guy there, Denny, from the fit testing facility up there, and he started talking to us a little bit about NIOSH. Not one of us had ever heard of NIOSH before that date. Not one. And he said, what are you guys using the law enforcement community as far as respiratory protection. We all answered the same thing. Well that's obvious, M-17s. They were free. Then he starts laughing at that point in time. And he says, "Have you guys complied with any of this stuff?" And we said, "What are you talk...you put the mask, and you deploy the riot control agent." Then he's laughing even harder at this point. So he says, "You know you have fit testing." And we said, "What's that; is that like you put it on and take it off or what?" So he says, "You have annual certification teardown, and the physical requirements..." We were completely blind. And I'm telling you, 98% of law enforcement around the country right now is in the same spot that we were at that meeting a few years ago. And one thing I've tried to do is let these law enforcement agencies know that these masks are old, they're falling apart. Replacement parts are an issue, they may not work, etc., etc., etc. This is one of the biggest problems we have in law enforcement right now. You have all these regulations, and I'm sitting here hearing about all these other regulations that are going to be coming out. No one has ever heard of NIOSH before in the law enforcement community. So that is a big issue. And I'm not saying we shouldn't be complying with any of this stuff; we should, for safety. We absolutely should, but the word has to be gotten out there to these law enforcement agencies that

there are regulations out there. That a mask that's not properly fit tested or torn down and inspected and these procedures are not complied with, could result in the loss of an officer or serious bodily injury or liability issues for the departments. Back in 1998 I wrote an article, which I had never intended to get in here, but National FOP Magazine called me up and asked me to publish it, and it was basically about M-17s and it was about law enforcement agencies getting all this free equipment from the military and then not going back and asking any questions to anybody. Well there was the military or the civilian community, whether there was upkeep, about replacement parts, were there regulations in place somewhere that you had to comply with with this stuff? I went on the phone for three weeks returning all the phone calls I got from across the United States from law enforcement. They said, "What?!, What is a fit test? What is this place NIOSH?" Just to give you an idea where we're at with that stuff right now. Masks obviously are not being fit tested. They're being sized incorrectly, and I'm going to show you a little bit of studies we had done on that with what's out there in law enforcement. Filters are all expired. First question I have with different departments was, "When was the last time you checked your filters?" Now we talked about leaving the filters in the container in here. They're not. They're all on the masks. They've been there for years. And I said, "How do you check when a filter's gone bad?" "They go bad?" I said, "Yeah, they go bad." Nobody knew anything about how to check the filters or life cycle or anything like that. So you've got millions and millions of these things out. Matter of fact, I don't want to put the military in a spot, but somebody from the military called me, and they

were unaware that the M-17s had been issued, or sent through the 1122 or 1133 program as surplus. They thought these masks were no good, and were being destroyed or whatever they do with them at that point. And they were absolutely outraged to learn that these things were being sold at a buck a piece at Fort Hood and being given away all over the country and everybody was using these things. Bad or rotten masks or parts or both when we examine these masks. The age is just deteriorating them to great levels. They're rated for riot control only. Even if they work for that, that's another question. And no one is obviously checking parts or serviceability. You look like you're a medium, here's a medium mask. Just put it on and walk in that gas over there. And that's what's happening. And that's really a big concern. It's been fifteen years since DOD phased out the M-17s. Ballistic vests are usually replaced every five years. It doesn't mean they degrade after five years, that is the recommendation though, and we make sure we do that on a regular basis. Most filters are expired after one year out of the package and five years in the package. No one has any idea how old these things are. Probably fifteen years old or older. So we did a little serviceability evaluation. We took twenty M-17 masks from a large metropolitan police department, just random. Took those masks, and this is what we learned. We took them up to Aberdeen. There's a special machine there to test the serviceability of the masks for leaks and things like that, just from the physical aspects. Five failed the manual inspection using the U.S. Army standards for dry rot. Fifteen were placed on the test machine and they all failed. They had leaks everywhere; around the eyepieces, filter systems, inlet valves, you name it. They then took all the

masks and rebuilt the masks with new parts. Now we're not talking police officers here, we're talking people who do this everyday, who know how to replace the parts on these things. Even after all that happened, retesting those same twenty masks, five of the fifteen still failed, which resulted in a 33% failure rate. Then we did a fit and function evaluation, because we said, "We kind of know how these things are being disseminated out there. Let's check to see if it's as bad as we really think it is out there." So we got 44 officers, and I'll tell you they came from the state police because we went out to the range one day and we had 44 volunteers show up. And we used OSHA testing standards. We had experienced personnel. We had people who had very little training, or had been trained on the use of a negative pressure mask for riot control. We had people who were active reserve people in NBC platoons who had extensive military experience putting these things on and fitting them. M-17s were what I called "new." That means they weren't issued. That doesn't mean they're new that means they were unissued on the pallet down at quartermaster. And we have thousands and thousands of those masks sitting down there now, with filters. Fifty percent couldn't pass the OSHA fit test standards, and Aberdeen came down and they actually did all the testing with the fit test machine down there. Twenty were not able to get a validated fit, and seven of the twenty who initially failed did end up passing with SBCCOM help, with an expert standing there helping them try to adjust the mask so that it fit properly. Others, it was very clear, lack training or familiarity needed to properly don their masks. And thirteen of the 44 were issued the wrong size as determined by SBCCOM. So folks, that's where we are right

now around the country with law enforcement protective equipment and awareness on the limitations and problems with that equipment that's in existence. What's the need? What do we need? We need a high quality respiratory protection and we've defined that with SBCCOM as the single most important piece of protective equipment for law enforcement officers. But we did recommend a full suit, I see Jim Genovese is not here. We did recommend that for the same reasons he cited this morning. Butyl rubber gloves, or some sort of glove, boots and ensemble protection for things like secondary devices going off. For things like inadvertent agent transfer, whether it be liquid, for off-gassing on victims, for these very reasons just as added protection against the skin of the police officer or law enforcement officer at the scene. We realize that the ensemble they're wearing is only as good as the respiratory protection that they have. One thing that we found with the testing, is most of these suits did not effectively seal the area between the mask and the suit, there was a gap. And as everybody knows, the neck region is an area that absorbs agent very quickly. So because of that, we also made a recommendation they should have some type of a hood in conjunction with the mask to protect the vital neck area. So where do we go from here? That's the big question. PB guidelines. I can't stress that enough, and that's not what is being done out there right now. Awareness, planning and training. I think one of the guys from NFPA is fire chief here, stressed that they need to know what they shouldn't be going against. Or what they shouldn't be using, and I kind of jokingly said, "If you give them a napkin, and they have a napkin in their patrol car, believe me, folks they will walk into a haz-mat wearing

a napkin." You've got to really be careful what equipment you give them. And I'm going to talk about the anthrax attacks in a minute and some of the stuff I saw with that, and what they were using. One thing they have to understand. Law enforcement personnel are not haz-mat responders. We do not and should not be taking over functions that are traditionally handled by the fire department, haz-mat teams, or any of these other specialty teams. They have far more training and experience on a daily basis than your typical law enforcement officer. Chemical protection is not for toxic industrial haz-mat incidents or anything happening on a traffic accident that may involve those materials. And that has to be stressed. What is our role with, at a WMD scene. Let' go over this a little bit. A: Crowd control. People trying to get into the scene. People trying to get out of the scene. Possible riots or any other problems that you have out there. The hospitals have identified a real need. They say when some of these victims walk in on their own, and they're contaminated and they shut down the ER because of contamination and you have that person who's coming with their broken arm or whatever, or other hysteria, hysteric people coming in, they're told they can't get in that hospital, they said our security guards are not going to be able to handle it. And most of our security are police officers working a secondary job. And they're going to be called out already. So they said, imagine, you can just expect we'll be calling you for security outside. There might be a civil disturbance going on out there, and they also plan to put some of the decon lines on the hospital parking lot for another decon after they've already gone through the main lines. So, that may be a purpose. Investigation. Preservation of evidence at the scene. You need to get

that perimeter started immediately. Try to control who's going in there, who's coming out, where the evidence is, and trying to do the best you can with that. We work with the fire folks trying to educate them on what was important to us. We understand victim rescue had the highest importance, but the least amount of things they moved around in the scene while they were doing that will be most beneficial to us. Scene security is critical. Traffic and perimeter control. I think on almost every terrorist event it was a problem getting equipment to and from the scene. You're going to need us out there not only for traffic control but to secure you some egress and ingress from the scene to get your equipment up there. Tactical response. Bomb or secondary device mitigation. Crime scene processing. Now let me talk about this a little bit. I talked to some chemists at SBCCOM. I don't really see the need for law enforcement to have their crime scene people going in there. Talking to the chemists, these agents last a very long time. Chances are the FBI will be on the scene with plenty of time to collect samples. Your haz-mat team may be able to collect samples. My view on it was, why take a civilian lab tech who's not haz-mat certified and expose them to unnecessary danger if it's not really critical to crime scene preservation. But, there are some departments who have chosen to fit their crime scene response teams with SCBA and train them up the haz-mat levels to do that. The other problem is, is your lab a Level III lab? Can you effectively package that stuff, or are you violating some regulation by pulling that back and sticking it in your crime lab? That may be another problem you have to look at. Assisting with security of the decon lines. One of the things the firefighters told us. We're going to be running decon right

on the edge of the warm/cold zone. You know, we don't want somebody coming up to us in a panicked state, grabbing a hose or grabbing a face piece. Suppose there's a potential suspect in that line going through there. And they said, here's something even more important to us. Is we're having people disrobe or take their clothing off, and they're processing through decon lines, we're going to be coming across the same thing you guys find every day: drugs; guns; knives. It may be evidence that goes along with the crime scene. We don't know anything about chain of custody. We don't know anything about that stuff. We would rather have a law enforcement officer standing there, not only for security of the decon line and our safety, but as we come across this stuff, we can say, "here you go" and you guys would maintain custody and take it from there. And, not to knock my friends in the FBI, because I'm very tight with them, but originally years ago, they were saying "Don't worry, the FBI's going to be there immediately; they'll be right on the scene; they'll take care of everything; they got all this equipment there; it'll be there instantly. They're going to vaporize it." The fact of the matter is, years ago the FBI said they would be handling all the bank robberies in this country. They had special teams made up, there became so many of those that they were overwhelmed. Anthrax attacks. We had one or two agents driving all over the state, I don't know how many, eighty a day or something we were averaging in Maryland. It was something outrageous. They can't be everywhere all the time, and even in a small state like Maryland where they're centrally located, if they can get to the scene on time, they're not going to have the manpower to do all these functions. So, you need to keep that in mind.

You're also going to have people, like Jim said this morning, who've left the scene on their own accord who had maybe minor doses of agent on them. Who've taken off. Who've gotten in their car, who maybe pass out or have other medically-related problems. You're having Mrs. Smith call the police station sometime after the incident. Or you may come across them in their car with a traffic accident or them passing out on somebody's lawn, there's contamination on those people. It may not always be EMS or fire department that gets the call to handle that. It may be a suspicious subject in somebody's backyard or a traffic accident that prompts that. There is a trend in the United States right now, and I've been pushing for this for the last five years, a cross-training. It's much easier to take a police officer or tactical officer who, and cross-train them in bomb or explosives mitigation, and haz-mat, than it is to take a firefighter or someone else and try to give them a gun and train them in law enforcement aspects of things. A couple, one issue that came up. Where are these masks going to be kept at? Well, you got issues. Some departments don't have take home cars. So what do you do with equipment that's personally sized to that person. Some officers are walking a foot patrol or they may be down in the subway. Where do they put all this equipment at? People like us who have take home cars, where do you stick it? I can tell you what police officers do. They throw it in the trunk when they get a new piece of equipment, and they stack everything they can find in their house on top of it. You got golf clubs, you've got boxes of flares. Realistically, if you have a bag or carrier that the mask goes in, it's not going to work for the simple fact their going to end up piling stuff on top of it and it's going to get crushed and bent

all out of shape. That's what they do. I'm not trying to be funny up here. I'm trying to tell you the harsh realities of what is going on and what has been going on in this country in the law enforcement community for years. And it's going to take some time to change. Let's look at the anthrax attacks back in November. I already said the FBI was completely overwhelmed. Fire departments: "we're not coming out." Haz-mat teams: "we're not coming out." It's a law enforcement issue, handle it. We were stuck. All the law enforcement agencies in Maryland probably outside of that state were stuck. Either they couldn't come out, they had other calls to go onto. Or in rural areas of the state where they didn't have haz-mat teams, they couldn't. They just couldn't dispose those teams all the time for running on letters or suspicious packages. We had to end up sending patrol officers in there, with little to no training, specifically in anthrax handling procedures. What do you think happened across the state? Guys were going in there without equipment, they were grabbing these packages, driving them back in their car, contamination problem? Better believe it. Then they would bring them back into the station and put them in the property room. So, you know, after a month or so you had a couple hundred of these things laying in there? Probably less than one percent were actually tested at the Department of Health and Mental Hygiene. So you've got unknown contents and substances laying in there that could have possibly exposed everybody. It got so bad, that you had officers who were being ordered to go on the call, and they would just flat out refuse and they would be suspended on the spot. That's how bad it got. We're a very rank-conscious, semi-military organization in the state police and when you're given an

order you carry it out, you don't question or ask why. And that happened to us sometimes, too. We told guys to go in there and they asked me, "What would you do?" I said I wouldn't go. You already have haz-mat, you don't go in there without equipment and training. But we had some real problems with that, just from what I saw around the state, and the anthrax attacks. Let's talk about escape masks. This is what we found with the technical studies at Aberdeen. The good, the bad, and the ugly. At one time they wanted to give all law enforcement officers escape masks. Bad idea. We didn't really like that too much. They were cheap. They didn't require you to fit test and they were available for quick use, so if you had an officer in a subway or something, boom, and they needed something to get on and get out of there quickly, they could carry it on their belt or whatever. Pretty good idea. But they're not rated or intended for long use or staying in the area, which is contradictory to what the law enforcement mission is. There are communications problems. Believe me, I've worn these things. We had our academy class volunteer one day to put these on and walk around for a while and do some running exercises, obstacle courses, things like that. The visors fog from what we found, and impaired the visibility, and some of the escape masks that had nose clips we had real problems with those. They would fall off and the bag would suck in on your nose. Claustrophobia. We had two tactical officers who had been on the team for years who always practice with negative pressure masks all the time, they couldn't stand it. They absolutely couldn't stand it. That was something we didn't consider. Is your officer claustrophobic when they're putting an escape mask on? And there's a lack of NIOSH standards for those. So, the

conclusion, they're not appropriate for what we need to do in law enforcement community. You might want to use them for executive protection. We protect the governor, the legislature, your city departments usually protect the mayor, and because of our proximity to DC, we have a lot of special dignitaries including the President that we are hand-in-hand on with the Secret Service. If they have a meeting out at Wye River, with the Israeli Prime Minister or whatever, we're usually out there hand-in-hand with Secret Service providing tactical support and security for that. So it's possible you could use it for that use. Maybe in a subway, a train, a confined space, but only to get out of there. Run like heck to get out of the area, so there might be some possible uses, but certainly not putting it on and staying in the area and working and completing missions that we've identified. We tried PAPRs. We tried those on, different manufacturers, different types of pappers. These are, now I'm not making these up. These are the comments we got back from the law enforcement community. The hose was not particularly desirable because they were afraid in a riot or something somebody might grab it and pull it. That's not a really big issue. The hose got caught or crimped in tactical equipment. That's not a huge issue, because it was very infrequently. The blower was too noisy for tactical operations. Now, the equipment that we used, it's been a couple years since this was tested; there maybe new systems out there that have reduced sound signature. Extra bulk and weight of the unit and battery were undesirable. Folks, you heard me talking about M-17s. Now give a police officer a battery now, that requires recharging or something. You're going to have problems when he needs it, like, in three or four years he uses it one time and he

pulls it out to use it. And we're worried about the battery life and maintenance. It was just too expensive to equip every police officer in an agency. Level A or SCBA. Now I'm not standing up here saying, "Hey the tactical team should be using SCBA, or they should be using negative pressure or whatever." That's for you guys to figure out. But these are just some of the considerations that our tactical teams had when they used this stuff. We know the FBI regional Weapons of Mass Destruction teams are using Level B. You don't need these things. If you're staying within the mission parameters of the patrol officer, if you're staying way out there, you don't really need SCBA. But, again, the key there is training them on the limitations of the equipment they're wearing; where they should not be at the scene. Limited duration due to air. One big thing we had, our tactical teams were going in a building, dynamic and stealth entries in the building. Big problem: ran out of air if they were doing, I mean stealth entries sometimes can take 90 minutes, and hour and a half or what ever, depending on the size of the building. You're going to run out of air. Communications are worse than negative pressure masks, and of course, there are extensive costs and maintenance, and again, I get back to the M-17 issue. Can you imagine a police officer who's not specially trained, or small units taking care of an SCBA and all the associated equipment that goes with that or Level A, and money's not in the budgets I can tell you that. Three factors determine risk-based exposure times that we identified. Protective system performance, chemical agent concentration, and chemical agent toxicity, and Jim did a great job, much better than I did explaining all that and going into that in more detail yesterday and today. Negative pressure

respirators. The advantages. The site picture with weapons. We went out one day, FBI, bunch of tactical guys, myself, got in negative pressure masks, boots, gloves; 85 degrees outside, pretty good amount of humidity, went to the range, we shot our normal 50 round course and we had a long history of scores with that. Barricaded positions, left-handed, right-handed, out to 25 yards. We put all the stuff on, did the same thing. What we found is there was really no degradation in the use of equipment or sighting weapons with the negative pressure mask. There was familiarity because law enforcement's been using those type of systems for years. Law enforcement could use those as a dual purpose mask for riot control, as well as for WMD if needed. There was no battery, hose or air supply problems associated with the system. Communication packages are available for tactical operations or regular patrol use. And they were adequate for officers operating on the perimeter of the warm zone and in the decon corridor, far away from the hot zone, where you didn't have a whole lot of liquid, direct-limit liquid cross-contamination. And again, here's the big one for law enforcement: they're not as expensive or maintenance intensive as other systems. What we did to test the equipment out: we used the man in simulant testing; the mist testing performed by SBCCOM, Dr. Fidel supervised part of that, Alex Pappas was involved in that testing up there; measured the chemical protection provided by chemical protection systems. Activities performed in the patrol officer: we put different manufacturers' equipment on, had them stand; walk on a treadmill; use hand movements, simulating traffic direction; evacuation procedures, knocking on doors, getting people out; running on a treadmill; seated at rest; and handcuffing

and using firearm for 30 minutes while they were in the suits and the masks and all. Here's, I don't want to go into that, I'm not really here to talk about the testing results, but there are some of the protective factors that were assigned, and you have to remember. I think those factors were a little higher. NIOSH standard for negative pressure protection is 50. They actually did a little bit of study on the negative pressure mask, where they can usually get 6,666 as a PF on those, and the protective factors actually went up if they used that figure. The other big problem with the patrol officer protection, again, there was a gap between the mask and the suit, even though there was an attached hood there, and we did get some agent vapor in that area. Ensembles were chose based on their compatibility to the mission that was performed. Patrol officers expected to be on the scene immediately. The duties included external perimeter security, internal perimeter security, security of the decon corridor, such as crowd control, law enforcement equipment, personal property, and evidence. Here's another big thing. I've heard different things talked about in here. What we recommended, all this equipment should be one time use only. You shouldn't have guys tromping with their equipment out of the scene after they're contaminated. Now I talked to somebody from SBCCOM the other day, and he said, "Well, in New York, they had some dirt and stuff they wanted to reuse the filters." And I said, "Yeah, that was a hygienic issue, that was dirt it wasn't sarin or Mustard. Big difference there." What we saw when I've been teaching people around the state and around the country is, if you go in there, and you might potentially be contaminated in an area, you go through the decon lines like everybody else, and all your stuff is

dropped. I don't care if it's your gun, your badge, your uniform or anything else. That poses a problem, and the recommendation is, law enforcement should have some type of secure lock box with security around it for law enforcement sensitive equipment like firearms, badges, things like that. Big problem there for us. Problems, as some other people mentioned already including Seyberth(?) yesterday, the heat buildup was a problem. It limited the wearer of the ensemble more than the respiratory protection factors of the ensemble. Sizing is an issue. We found we had different sized guys: huge guys, small guys. Sizing is an issue to prevent tearing on the ensembles when crouching or bending over. We had some of these guys, real big guys that were in huge suits, but when they did this, or bent over, those suits split right on down. Decrease in mobility which is going to be expected with something like that, but we found there was no decrease in the ability to use equipment or weapons while suited up. Full ensembles were recommended due to the risk of secondary devices. Suits provided levels of protection to that of the respirator. The chances of exposure to water in and around the decon corridor or at the scene was significant to us and therefore we recommended an impermeable suit. And the cost of equipping every officer with an impermeable suit is generally less expensive than trying to fit them with a non-permeable or re-use type suit. High-quality, full face piece negative respirator mask, and Level C clothing ensemble. We found, using the standards and concentrations, we said 14 hours and the limiting factor there was the guys saying that they could stay 14 hours. Believe me, I've been in these things, you've been in these things, I don't think that's a realistic time period there. I think Jim said, or

somebody said here, law enforcement was probably looking to stay closer to 12, if they can even manage that, because when there's an emergency, a snowstorm or something, you don't work your eight hours, you're usually extended to 12. But again, really tough if you get a hot day or something out there, staying in there that long. Heat stress was more of an issue than chemical exposure and again we talked about NIOSH Standards 50, but just for thrills conducted a quantitative fit test on each subject in the patrol study and obtained a respiratory factor greater than 1,000. Tactical team operations. Why would you equip your tactical team with SCBA or specialized equipment? They're better trained to operate with specialized equipment. They generally take much better care of specialized or expensive equipment so it's not a problem taking some small teams, specialized teams that have higher levels of training. They have a lot more time in training than regular patrol officers, and again, outfitting small specialized team with power PPE is easier and more cost effective. Tactical team operations. What will they be doing? Apprehension of a suspect at the incident. Now what's the likelihood you have a terrorist that's still in an area that has a high concentration of agent? Probably none. Even if he has an air bottle or whatever, he's going to go down eventually. I mean there's no need to rush right in there. One of the considerations we did have, is there, if there's a rumor that comes out that there's a potential armed suspect in there, fire department says, "We're not going in there, Jack." You better have somebody suited up. Haz-mat team says, "If there's a bomb, we're not going in there." The bomb team says, "We're not going in there if there's a fire issue or haz-mat or a suspect." So nobody wanted to do it,

we were kind of stuck holding the bag if something like that happens. Taking down a suspect in possession of a CWA before it's been released. A raid on a suspected facility or lab, or they may be going on a search and seizure warrant thinking it's a meth lab and it turns out to be CWAs or something else they're making there, cooking it up. Hostage rescue, and again, we covered dignitary protection. They're expected to operate in areas of increased agent concentration. We found that charcoal lined suits were more suitable to the mission and were more durable. They were going around wearing these bright lime-green and yellow suits that crinkled that they couldn't move around. We found that a woodland camouflage pattern, BDU, and a cotton charcoal material was much more conducive to tactical operations and didn't give away their location and things like that. It was compatible tactics and equipment, and we realized quickly what I just said, that the commercially available haz-mat suits or Level As were not conducive to what they were trying to do. We did mist test conducting and stealth and dynamic operations. We had a nice warehouse up at SBCCOM. What we did was took plywood, constructed rooms, doors, we had a dummy way in the back that was a mannequin. I'm not talking about a person, it was a mannequin back there we strung up. (laughter) And we had them change the rooms and the configuration around so that the guys were not complacent going in there knowing where everything was each time. Dynamic mode lasted two to three minutes. There was a forced entry through the main door, clearing of all areas of the building, sighting and discharging of a weapon using simunitions (we didn't use real live ammo up there), and a suspect takedown. And again, that lasted two-

three minutes when the SWAT team comes in, busts in, and clears everything very quickly. And we used a stealth mode. That was the other testing that we did. It lasted about 27-30 minutes. There was entry and recon. Forced entry through the door, clearing areas of all building, climbing a ladder and stairs, crawling, climbing, crouching, movement along walls, and hostage rescue with an eventual discharge of a weapon at the end. And again, that's much more slowly done, quietly, concerned, checking every little area out before you move an inch. Issues that the tactical team brought up with the use of the equipment. Tightness around their head and neck restricted their head movement. Reduced peripheral vision caused more hand to wall contact, which could increase liquid CWA exposure. These guys are usually, their bodies touch each other as they move. They know exactly where the next person is, they move as a unit. They found with not being able to move their head or peripheral vision, they had to rely on taking their hand and putting it against the wall to feel where they were, and that could certainly make a case for more liquid exposure. There was an inability at the time, this may have changed since then, to wear ballistic Kevlar helmets with their masks and their equipment. There was an inability to use the whisper mikes hampered by the masks that they had on. Again, technology changes may have fixed that. And there was definitely a heat build up that they complained about. There's some of the tactical team operations, again, I'm not in here really to discuss the testing today. Everything's available on the website. Some of the suits we tested under "garments." Here's the conclusion. Tactical suits tested clearly provided greater protection than those ensembles for patrol officers. Again, they said the stay time

they could stay in those things was up to 14 hours. I think the heat problem is definitely going to get you out of there before that. And a highly lethal concentration that we found there was about 3 minutes duration before they experienced mild effects with the suits tested. And most of those effects occurred around the eyes because of the level of protection they were using at the time before it started. Increased levels of protection are possible, but at a reduction of your tactical abilities that they were using. And again, the PF of 50 was set by NIOSH for negative respirators, and just for thrills they tested and they were able to obtain a factor of over 1,000 per person in each instance. Big conclusion: protection may be afforded only by providing serviceable and well-maintained equipment to officers who are trained in its proper use and that is key. That is absolutely key. And officers must be knowledgeable of the limits of the protection they're issued. During the anthrax attacks, I asked guys, "What have you been using to go in these houses." Most officers are issued a blood-borne pathogens kit or some type of first aid kit. Dust mask. And those people know surgical dust masks don't prevent things from coming in, they prevent things from your mouth getting into a surgical environment. They're certainly not going to stop anthrax. A year ago in the summer we had a train derailment. Baltimore city, in a tunnel. Known haz-mat, it's burning, it's on fire, copious amounts of smoke coming out of that tunnel. I checked with the on-scene commander. They had had the federal WMD program for a week. The officers were wearing dust masks out there right around the scene. Again, they don't know. They need to be trained. They need to be educated, or somebody's going to eventually get hurt. That's basically it. Just a

little perspective from law enforcement on what we need based on the roles we'll be performing out there. And again, one of our biggest problems out there is not just equipment, one of our biggest problems right now is, and I could already see it after 9/11, is terrorism equipment and terrorism training and response procedures as high a priority now as it was on September 12th. And the answer is no. Political issues have come up. Other issues have come up on the fire and these things are starting to slowly fade back in chiefs' minds in terms of importance until the next attack. So. Any questions? (applause) Thank you. I thought I was going to get out of here without any questions. Technical questions can be directed to Alex Pappas in the back. (laughter)

M: Where is Alex?

Hasenei: He's left already.

M: Great presentation. For this question I'm going to wear my Interagency Board, Personal Protection Chairman hat. Is you department, or will you department be procuring escape masks for your officers. At this time, we have no intention on doing it, but I think from the executive protection aspect, they've gotten specialized training from Secret Service, I think we may look into doing something like that.

M: Do you think if you're officers are adequately trained, that they could use a conventional APR and carry that with them in special cases where they could then use it for escape?

Hasenei: Yes, but I think the training would have to be more frequent, and they'd have to be more familiar on a regular, periodic basis with that equipment, and not just

once every ten years or however long. I have to mention to you, the comment was made here, well, they're not going to put those masks in their car and keep them there for three to four years. Now, they'll keep them there for ten. Training is a vital issue.

M: Are you training your officers now to observe signs and symptoms?

Hasenei: I've done that. I've just finished training 2,000 officers over the last four months on general awareness, indicators at the scene, use of equipment, and things like that. As our equipment's coming in, I've told them they have to comply with NIOSH regulations, fit testing, and we're geared up to start doing that now, as well as getting training on the use and donning of the equipment and disposal.

M: A question on preference or what you see is easier to integrate into your system. Will it be easier to train your people how to achieve a tight seal, with the various types of masks, or will it be easier to train them how to use the battery pack and loading batteries you got kids, so I know everyone of your guys is qualified to do that if they choose to make that a priority. Life and death is usually a pretty good motivator. Okay? So in your estimation, which is the easier form, a pappers system with positive pressure doesn't' require a fit, does require a blower, does require batteries unless we rewrite physics, so given and this isn't a finite, given your system and you guys have taken a close look at this, what's your gut feel?

Hasenei: I would say, overall, the papper would be easier to use with training, but knowing the general law enforcement community, the upkeep, the battery, the hoses, and all the things that go along with that system, I would really, I would think a negative pressure system would be much heartier and to rely on for a law

enforcement officer to use, even though it requires the fit testing and everything else that goes along with it.

M: All right, thank you.

M: Good afternoon.

Hasenei: Good afternoon;

Cloonan: Terry Cloonan, NIOSH. I'd like…

Hasenei: You're not going to fine us are you?

Cloonan: Say again?

Hasenei: You aren't going to fine us now are you? (laughter)

Cloonan: Well, quite contrary to popular belief, we do not represent OSHA…

Hasenei: Okay.

Cloonan: …and I think that's where we need to make a distinction between the APF and you're continually reference to the APF 50, in that, we support OSHA with the determination of APF values, but APFs are actually endorsed and regulated by OSHA, so we cannot accurately make a perception that might be misconstrued. Secondly, our CBR and APR protocol for Alex's testing, the LRPL, which stands for Laboratory Respiratory Protection Level, fit. Is he here now?

Hasenei: He is here.

Pappas: (…inaudible…)

Cloonan: Great. We are, and you're absolutely correct about that factor, about the 1,000. We are assigning 1,000 to the CBR and APR protocol for fit. So, actually, I recommended 2,000.

Hasenei: Good for you.

Cloonan: A lot of our figures are oriented on a lot of things, but the factor about the 6697, and how you quoted that, that actually is a JSGTM mill spec, which is not a NIOSH-approved product so I would just bring that up to your attention...

Hasenei: I appreciate that and I'm just quoting some of the things that were in the report, not necessarily

Cloonan: You're doing, I kind of wish we had more people here. What is the most, what is the current percentage of law enforcement officers that have prior service in the Department of Defense, in your estimation? Just out of, because that always, I got the impression that there's been either a, like in the past it used to be 60 – 70%, now it's gone...

Hasenei: ...I can tell you maybe it's 20, 30, maybe 40 in some departments. We actively recruit ex-military folks and they're usually drawn to us because again, we run things like a quasi-military organization. Other departments that I know of have probably less of a percentage than that. It's not like it used to be years ago when there was a very high percentage.

(END OF TAPE 2, SIDE B)

(TAPE 3, SIDE A)

Cloonan: ...manual training. All that is very significant, because as far as I'm concerned, your workplace employees, and it's very important to make that distinction that you are, in fact, responders, and that's very important.

Hasenei: I would agree with that, and again, that is, if you could do anything to help out or NIOSH or OSHA right now, that...

Cloonan: Sure, sure!

Hasenei: ...that word needs to get out to police chiefs, that you have to comply with these things and there are standards to meet.

Palya: Frank Palya NIOSH. First of all I'd like to take my NIOSH hat off and put my former SBCCOM hat on and just mention I want to reaffirm his point about the M-17 masks. A lot of those masks were slated for de-mil down at Pine Bluff, and they didn't even have probably maintenance manuals associated with them in them, you know and the carriers, so I feel for you. I understand what you're coming from. Questions? Okay, for our environmental testing, this has been going back and forth, as you could see we... some people don't feel we should be doing environmental testing on these respirators. What's your point on that? I mean, I, what we're trying to do is try to figure out operationally, where are these masks going to be used, and there's a wide variety of use, and we had a, we felt we had to go ahead and incorporate some sort of environmental testing.

Hasenei: I would whole heartedly agree with that. These, again, these masks will be used mostly in the warm zone, right around the decon zone, or maybe even the

cold area for inadvertent contact or vapor exposure, downward hazards. I can tell you generally, police officers on the whole, and again I'm not trying to down these guys, I'm just trying to tell you the simple reality, they are abusive on their equipment. I can tell you almost every department has officers who, you know you go out to the range they haven't cleaned their gun in such a long time it won't even fire. So, as far as… a lot of them will be kept in trunks so, humidity is definitely a factor. Temperature change is definitely a factor, hard use and rough handling is definitely a factor. And again, you heard me say that they're going to throw a bunch of stuff on top of it… that happens. That's the way things are.

Palya: Yes. Another issue during this presentation we were providing yesterday was the ready to use configuration. We just had a hard time getting a grip on what does this mean by ready to use configuration? I felt, maybe, it was like having a respirator and a mask carrier or some protective container and that's what we're going to test to that configuration for the ready to use configuration and we're just trying to get our arms around this so we could incorporate it into the test plan.

Hasenei: My recommendation, and I've heard this from other people, too, we want something that's available, but it's going to keep the equipment clean and protected if it's in the trunk or whatever. If it's held in a room at the local police station, maybe a bag would be fine, environmentally or climate-controlled area. If it's going to be in a trunk, I don't think a bag would be sufficient to protect the mask. What I envision is maybe a plastic case, a hard

plastic case. Your suit, your gloves, your boots and your mask would be in there. Your filter would be sealed in some type of a package that would be easily opened with a tear, because obviously the minute you expose it to air it starts absorbing, and with the replacement problems with existing filters now, you want to know that filter's 100% effective when that... you hope, when they tear it out of there. So that's what I would see at least for us and some other agencies as a ready for use. You may have to pop that filter out of a package and stick it on that mask, but everything's in that container, and you know exactly where it is, it's not scattered, it's not crushed, it's in the trunk and available for use.

Palya: Okay. Thank you. I can't even read my poor writing. (pause) Yes, sorry. You mentioned at the beginning of your presentation there are some issues that are troubling to you. Could you expand on that, or would you rather hold off on that? About this whole process about the standards, the...

Hasenei: Well, I think my point was there have been standards for years that were set. Nobody knew about them in the law enforcement community. The first time that we had heard anything about them was because of SBCCOM. It was fortunate we heard then, or we'd probably still be in the dark about NIOSH and fit testing and all this. But most of the agencies out there, I mean, they're going down to some of the training centers, and whatever, they're learning there, but most of the chiefs that have called me, most of the police officers from around the country that have called me have no idea. The FOP article sparked a lot of interest, and they were calling me. The chiefs said, "Hey, I'm

liable here. You better call him and find out what he's talking about here and what we may have to do." But I would still say the majority of the law enforcement community is very ignorant on, so if you set new standards or regulations, they are following what's out there now. There needs to be more public awareness and education across the board in the country on, because somebody's going to get hurt if it's not fitted properly and they're not following these regulations.

Palya: Thank you.

Cloonan: Terry Cloonan again, NIOSH. Let me just add a couple more things. To support your ready to use concept, perhaps there's a need for a training, canister configuration, and a contingency canister configuration for inhalation protection. The other thing is, there are several manufacturers that are focused toward ensembles that are designed to provide you with a ready to use package, whereby it's boots, gloves, hooded/shrouded device, etc. and they are in fact put into a pelican case. That seems to be a general method for protecting that. The other portion I'd like to talk about is there is, there's a school of thought that the law enforcement community is going to enter into a known chemical terrorism incident with a negative pressure device. Do you have any perception on that? And then I'll follow that up with the fact that there are several SWAT teams across the United States being sponsored by Larry Glick out of the National Tactical Order Officers Association, the NTOA, and the NTOA has been charged to present a tactical SCBA class across the United States, and Phoenix has been taking the lead on that.

Phoenix has been doing tactical SCBA operations with a stealth SCBA in conjunction with standard take-down operations, etc. And believe it or not, the SCBA only weighs 18 pounds and it'll give you…

Hasenei: So you don't think there's any issues to wearing that in a tactical environment as I described…

Cloonan: …well, actually you would need to talk to the on-site commander there, because he will relate to you more and provide you with a higher level of confidence in terms of their tactical operations. We're an SCBA. They don't have a cylinder fill problem because there's an answer to that.

Hasenei: Okay. Again, I'm not standing up here pretending to be a tactical officer. Those were some of the observations that were made. Now I know our tactical team will be getting SCBAs to use. And if it was me, I would much rather have an SCBA and negate some of the tactical advantage I would have for that added protection and that confidence going into that area. As far as your point on officers going into contaminated areas with negative pressure respiration, you are absolutely, positively correct. They may unknowingly do it when they get to the scene. Training's a big issue with that. As a matter of fact, when I did my training, I specifically told them, "You stay as far away as possible once the fire department or haz-mat team gets there. Use your haz-mat principles and the emergency response guidebook, and then you check with them as to where it was okay for you to go with that equipment." You certainly stayed away if the device went off in a building or an enclosed structure. You didn't want to be anywhere around that, and we used some

basic principles, but you're right, the training out there right now is really deficient in that.

Cloonan: So in your opinion essentially it's more of a training issue rather than a conscious risk-assessment decision.

Hasenei: Yes, I think based on where the device went off, evidence at the scene and indicators when you roll up to the scene you see those indicators, with proper training I think you would know exactly where you should be and where you can't be with that level of protection.

Graham: Steve Graham from the Army Center for Health Promotion Preventive Medicine. You talked about some tactical situations where the officers felt they could be in their protective equipment for up to 14 hours. Could you maybe expound a little on drinking tubes and carrying canteens and having access to a water source while they would be in maybe that kind of a climate?

Hasenei: The tactical teams, the patrol officers identified would really be a great thing for them to have the drink tubes, the problem is the added expense to each unit. You take in a department with 1700, 2000, 2500, 3000 people, and that really becomes a big expense. But the tactical teams expressed a real need for the availability of drinking tubes and water hydration, particularly in a stealth operation in a building.

Richardson: Hi, I'm Irene Richardson, also with CHPPM. I see a recurring theme here is training, training, training. Is this something you're going to be incorporating into your academies with your new recruits coming in and starting them from

the bottom up and familiarization with all these requirements and how to wear things and choose things and so on?

Hasenei: yes, I've been a big proponent about any new project that requires training that you not only train the existing personnel on the job, but you also have refresher training through in-service training which is given every year in my, and my big thing was in Maryland we've got a Maryland Police Training Commission that dictates what courses you're required to have every year. I went to them and I said, "Look. If an officer's required to have a 15 minute video tape or however long it is on haz-mat training, this stuff will kill you 10 times quicker, 100 times quicker." They should have refresher training in the use of equipment and WMD stuff and terrorist incidents every year and then we've also incorporated that at a base line level with the recruit training, so that everybody's covered.

Berndtsson: Okay, I'm going to make a comment on this escape hood. I'm Goran Berndtsson from SEA. I don't know why you as an organization even would consider an escape hood. I mean an escape hood is an escape hood. It would probably always only be approved as an escape hood. You have it on your belt, you put it on and get out. If you have it to go into a tactical operation, it's wrongly used, and it will never be following any laws.

Hasenei: Let me, I don't know if I made myself clear. Maybe I miscommunicated that. I thought I was clearer saying that we would never intend to use any type of escape mask for any long term operation. It would be used as is. Maybe if you were protecting a dignitary, special person, or executive, a device went off

you would immediately have that person don the escape mask. Your people would don that, you'd get out of there as quickly as possible. It was never any intent to use that as any type of respiratory device beyond the design for it.

Dunbar: Hi, Ken. Thank you for your presentation. Jan Dunbar, IAFC. What I would like to make here is a proposal. Also, I'm on the NFPA committee for the chemical protective clothing. I took a lot of notes here, and I can make you a promise that at our next upcoming meeting and several meetings after that, now that 1994 is up for immediate review and proposals, is to take your bullets back with me. But, what we need from you, too, if I can share this as a challenge back to your community, is that we need law enforcement input on this committee in the development of standards for the chemical protective clothing side of the PPE. There's nothing we can do with the breathing apparatus. We have frustratingly solicited for law enforcement input, so if I can just leave here with you two, for you to be perhaps a voice back in through the law enforcement community, the police chiefs, the police officers, the sheriffs association, that there are mechanisms, one being NFPA that is starving for your information, some of which you provided for us today and that we need participation on that committee so that we can help you press forward and provide for you perhaps guidelines for the very garments that you are looking for.

Hasenei: Point well taken. I apologize for my brothers and sisters in law enforcement when you requested that, but you know there are quite a few people out there

who feel this is extremely important to the community and would be more than happy to provide you input or attend meetings for that. (Applause)

Stewart-Craig: Okay, thank you very much for that insight. Now we're going to have Mr. Jim Henzelka come and talk to you a little bit about the PPE testing they do at Dougway (?).

Henzelka: Well, good afternoon. I'm glad I followed the law enforcement guy, because a lot of the information that he indicated they had problems with is what has prompted a lot of the testing that's being driven in the military. So, I want to present this just to get a flavor for how we got to where we are in our current testing programs and where we're going. And a lot of it will relate to the NFPA standards that we heard earlier this morning. I was surprised at how close the methodology is, there are some differences, but I was surprised at how close they were. Next slide. For those of you who don't know, Dougway is located in the west desert of Utah. We're about 85 miles outside Salt Lake. We're not at the end of the world, but I've been told you can definitely see it from there. Next slide. What do we do, why am I here talking to you? We are the Army tester for all items just before it's turned over to the military. This indicates some of the wide range of stuff we've tested in the individual and collective protection area that I happen to be the chief of. Everything from impermeable suits like steppo (?) JS List is up there, which is a permeable suit, collective protection both in tents and tanks, all of that we test at Dougway Proving Ground. We also have a section or a group that's dealing with training. We're currently training all the CST troops and some of the

special operators in actual exercises and on-site training. What that does is, that allows us to get direct feedback from the users back into our tests. And that's a really beneficial aspect of what we do. I'm going to, in the military we always tell you what we're going to tell you, then we tell you, then we tell you what we told you. So, what I'm going to basically walk through is a history of how we got to this testing process, tell you what the testing is, some of the underlying concepts of what we're using and then how we use that test and what we think some of the good points are and what some of the bad points are that we're trying to fix. Next slide. Prior to 1995 the U.S. accepted clothing primarily on swatch tests. We used an old method, it was a 1930's/1940's method. That's basically where we were. After the Gulf War, there were a number of issues raised about the protective clothing that were in the hands of the troops that were serving in the Gulf War. Because of that, the U.S. testing community, headed by Mr. Hollis (?) of the Army developed what they called a Process Action Team. That team sat down and looked at everything that was done from top to bottom. It included numbers from Natick, it included members from SBCCOM, TCOM who at that time was our parent headquarters at that time, the user community, the training community, all the communities, we sat down and we looked at how did we accept things into the Army? How did we train for them? How did we use them? Where do we go from here? The CDEPAT appointed various working groups that went off and worked on specific areas. A lot of that was in the PPE testing that we became involved with. Next slide. The PAT was basically the technical

directors of those organizations. The sub-groups were formed of subject matter experts. The aerosol/vapor/liquid action group was responsible for the chemical testing of materials and they had two groups. They had a group that looked at swatch testing and how we were going to fix that. They had a second group that looked at the systems testing and how are we going to test things as systems. Next slide. What that group with the swatch side found was that the existing swatch method, while it evaluated clothing, it didn't look at it under realistic conditions. In other words, when you're using a material, you're using it in the real world, so you'll have airflows, you'll have all kinds of operational things going on. The current swatch tests did not do that. They also said that swatch testing is fine, but you need to look at the thing as a system. I think we heard that several times over the last three days. You've got to look at the whole thing as a system or it doesn't do you much good. Next. So, in the process, we developed three testing processes. Swatch test was designed to look specifically at the materials. We added an aerosol test to look at particulates, and that primarily looks at penetrations around closures or seams or that areas, and the mist test looks at all three of those actions going on at the same time. Next slide. The AVLAG (?) test method. One of the things that we found is a problem with the test that we were currently using was it didn't look at real things like air flow; it didn't look at humidities or temperatures that you were likely to see on the battlefield. What the working group devised was a test method that concentrated on the concept of cumulative penetration, concentration versus time or CTs. We've heard those

earlier this week. And those were basically the individual penetration values divided by the airflows that come in over time. Typically, those are collected over three sampling periods. We've done up to ten and as low as two over the period of interest, and those were summed for a total accumulation and that's used to compare materials. That's a comparative test only, A is better than B, B is better than C. Lately we've started comparing that to a standard penetration but it's still a comparative test, it's not a hard and fast number that says this is *it* the be all, end all. Next slide. How do we do that test? We have a specialized cell. The swatches are placed in those, they're run at the condition of 90 degrees Fahrenheit, 80% relative humidity. We apply agent out of a robotic dispenser. The cup is then sealed in the test chamber for the duration of the test. We set a differential pressure that's equivalent to about 8 knots of wind for a standard suit of 0.1 millimeters and we use bubblers to sample the outlet airflow. Next slide. That test gives us a relative ranking. Once the suits are down selected from those relative, or the materials are down selected we shift over to systems tests. We have two that we use man-in simulant which is a mist test, it's a vapor test. The second one is an aerosol test that's routinely performed at RTI that looks at particulates. Next slide. Two differences in the tests. Primarily the aerosol test is looking at system integrity. It's a particulate simulant. The vapor test or mist test looks at both. It looks at the fabric, are we getting stuff coming through the fabric, or are we getting stuff coming through the system. Both of those tests look at two different effects. They look at a localized effect or a Mustard effect. They look at an overall systemic effect or

something like you'd see for a nerve agent. Next slide. The system testing process is basically the same. We take a wearer or user. He's put in a controlled environment with a sampler and his complete ensemble. The chamber is then brought up to a simulant challenge. They go and perform an exercise for a given period of time, two hours for a mist test, 30 minutes for a aerosol test. The folks come out, the samplers are removed, then they're sent to an analysis chem lab where the analysis is developed. That produces raw data that is then put in a model and allows us to evaluate suits on their performance and rank them A, B, C, D. Next slide. The whole basis for the mist test is a device that was developed at Natick. I wish we could say we developed it at Dougway but the folks up at Natick did this. Don Rivin who was here earlier. It's a passive, absorbent dosimeter. We call it the Natick Pillow but they didn't like that, so we found something else they could use. It's really an ingenious little device. It's got a adhesive backing so it can be stuck directly on the skin. Then it uses a polyethylene film as a rate limiting step. And what we've done is we've validated that polyethylene film so that it uptakes MES or simulant at the same rate that skin uptakes. Now skin uptakes at various rates, but this is in the general realm where you'll see for skin uptake. So we can get a comparison for how this thing looks or how the uptake rate is going on underneath the suit as we run the test. Next slide. These pads are placed at several places over the person's skin. There you see a picture of the pad with it's little tenex collector inside the actual pouch formed by a aluminum back and then the polyethylene film. Those pads are put

directly on the skin and then the individual is dressed in whatever ensemble he would use. He's then put in the chamber for two hours and run through a series of exercises. These exercises are designed to stress the suit as far as movement, so we get the maximum effects from movements: bending, reaching, whatever. And they come out. They're either extracted by an HPLC or in our case we use a GC which is thermally desorbed. Next slide. The chamber that we have was designed by the folks at the University of Utah to give us a uniform airflow. We took an old chamber that we had. They came in and put a series of baffles in there to give us a uniform airflow. This thing is also capable of handling temperature ranges from -20 up to 140 and relative humidities, since we're out in the desert we can pretty low, down to 10, 20 on a good day all the way up to 100%. We typically run at about 80 degrees and about 60% relative humidity in our chamber when we run a mist test. Next slide. Once those, I had to throw our equation up there. Sorry for those of you who aren't math guys. Once we get those initial readings off the pads, we develop a PF, everybody I think is familiar with a PF, we talked about that. We used the outside concentration which in our case is measured by a moran (?) and versus the inside concentration and that gives us a PF at each body region. Those can then be averaged over the individuals and they can also be summed to look at the total doses that you're going to see inside the suit. Next slide. Now one of the things that we found with both of those tests is we had to look at what happened to the individual material, and we also had to look at what happens to the system. But there's some things that we needed to look at

as subsystems or components, so we've recently added a series of tests that enable us to evaluate subcomponents of the system just to look at how they're doing as part of a ramp up for the test. One of those is smart man that we developed, that Edgewood developed and we sort of grabbed onto as a use, the second we've looked at is a whole-glove test cell that enables us to evaluate the whole glove. One of the problems with, one of the reasons we go to component testing is if you look at a glove, a butyl rubber glove's probably okay because it's a uniform material. If you look at some of the new gloves that are coming out that are multiple materials that are laminates or that have a palm different than a back, it's very difficult to evaluate how that whole glove works as a system. You know, if I take swatch from the palm and a swatch from the back and the back fails and the palm doesn't, does the glove work okay? So, what this enables us to do is take a whole glove, challenge the whole glove and look at that whole glove to see how it works. It enables us to look at both materials, look at the seams, and look at, in a lot of case, the interface between the seam and the suit arm if we elect to put it in that way. So we can evaluate that as a system, a subsystem before we include it in the overall system. What that enables us to do is to identify if we have a failure we can go back and say, "Oh it was the glove and this is why we know it was the glove." We just completed our first series of tests for the glove program and got some excellent results from those and so we will be moving on and completing a couple other series for the next round of military gloves. But that's a recent innovation that we've added. Next slide. This is a picture of the

glove box. You can see the hand forms. They're put in the box in four and then we can challenge each glove individually, we challenge them all together, we can sample each glove individually using a real time sampler. Next slide. Evaluation process. One of the things… once you get all this data what do you do with it? What we do is, ours is designed for a comparative evaluation process. A is better than B is better than C. Like I mentioned we recently modified that to use it against an existing standard. One of the reasons we did that is if you continually compare A to your best producer, you drive the gold standard way high and so you never get any tradeoffs for other things. One of the issues like the, I guess he left, the law enforcement individual was talking about is, that we are very interested in trading off protection for heat stress results because, you can protect everybody to the nth degree, but if the guy drops because of heat stress are you really giving him the protection that's valuable for the individual? We would like to base our future evaluations on toxicological endpoints, however… Are there some tox guys in the room? One of the problems that we found is that if you get five tox guys in the room you get twenty different opinions. (Laughter) So as soon as we can get the toxicological community to agree what the endpoint is, we're going to move to that direction. Next slide. What this has enabled us to do is build a testing pyramid starting at swatch testing where we can look at the base materials, build that up through subsystems testing, and finally a full system evaluation that will enable us to start with looking at a lot of candidates and progressing down to a finite system at the end. This also

mirrors the cost and inverses the cost. It's very cheap to do the swatch test; very expensive to do the system test. So you can find your failures out with less cost before you finally get up to doing your systems tests which are a higher cost. Next slide. Some of the strengths that we found is that this allows us, again, to identify materials and subsystems ahead of time which are not like poor performers or which need to be corrected at a less cost. And the focus on systems testing allows us to look at the whole protective ensemble. I think we talked about that earlier in the week; how we wanted to look at a system process. It allows an assessment of system compatibility. One of the problems that I think has been brought up several times is we got NIOSH doing masks, we got NIST doing suits. Trying to bring those two together is going to be a process issue, and this test allows us to do that because we're looking at both systems together. Rapid input of design and material changes. Just a war story. When we did the JS List test, in six months we identified a design flaw. Fed that back to the manufacturers. They input a change and fixed that change and we revalidated that change in a six month period. That type of turnaround is probably unheard of in a military system. I don't know how it is in civilian side. But to be able to identify a flaw, have it fixed and revalidated within six months, I thought was pretty good. The other thing is because we use actual users in our tests, we're getting two benefits. One, we get actual user input into the test data. The second thing is we've got a pool of users who've been to Dougway, been through the mist tests, seen how the process works, seen which suits work, which suits don't work, and are very

comfortable now with the suits that are out in the field, that they will give them the protection that they want and desire. So we build up confidence in our user base as we do that. Next slide. Some of the shortfalls. I'm glad Jan's here to see this. As we are starting to see new materials we're discovering that the test method that we currently have for swatch is being outstripped by the technology available in the suits. This is a problem you're going to find with system. As technology moves you got to move the testing bit to keep up with it and we are in the process of redesigning this ten year old swatch test method called AVLAG to cover these conditions that will help assess the newer materials. That's a CEEBART (?) process. That process is intended to be very similar to the process we're using here where we're going to involve the material developer community in the development of the process. In fact, that process right now is that we are doing an internal team brief in July, and after that we will probably include the, do a similar meeting like this. Bring the manufacturers in and show them the process and solicit their comments for where we need to go to change this process. Again, lack of agreement on the toxicological endpoints limits the flexibility in design. If you're constantly designing to a gold standard for protection, it limits the ability to trade off for heat stress, for user capability. We recognize that as a limitation. We've tried to get around that by going to some standard endpoints, but we would still like to drive toward tox endpoints. We think that's a better way to go. If you can do that in your testing, find what the actual toxicological endpoints, and I know with NIOSH we did that ad infinitum it seems like, looking at the

endpoints that we could use for the mask test, but that to me is a better way to go. If you can find what the minimum requirement for protection is it allows you to trade off into other areas. The other thing that really hurts is lack of real time sampling methods. It drives costs, and it drives the ability to really get at what's going on in the suit. One of the CEEBART directives is that they go to real time sampling for swatch methods. We think that's doable. We also have a line on a real time method for mist, which will enable us to make the same measurements in real time basis. And what that does is it gives you immediate feedback as to how well those suits are performing. It gives you also the ability to look at the performance curve or the performance envelope of the suit. So those are some of the things that we're looking at and fixing. Is that the last slide? Yup. Okay. The reason I wanted to present this is just to give everybody an overview of the military process, how we got there, what we're doing. I wasn't aware that I'd get some free advertisement from the Maryland State Police who said they'd already used the process. But that's the process that we used. I was particularly impressed as we started through reading the NFPA 1994 that independently, both groups came up with a very similar process, although they're not the same, and so there must be something to it because it seems to have worked for both groups. So with that, I'll leave it open for questions if anybody has questions about what we do on the military side, I'll be glad to answer them. Nobody?

M: Let me, I can't let you get away free. I'm in danger of becoming a nuisance here so I'll keep it very brief. There were two points that I think are absolutely

critical to what we're about in this process and in the industry right now. One is the gold standard. There's a line of thinking within certain sectors of the process that thinks that we can build one silver bullet that will defeat all beasts. Okay? Good or evil. That will never happen. It will cost too much, it'll take too long, and it won't be the right answer even if we could do it. Number two, your testing, okay? We've heard earlier that are three year roll out of papper testing for example. Okay. In three years, we'll be ten years ahead of what they spent three years writing. So we have to, in my opinion, address alternatives to that process and one of those is manpower. There are only so many hours in a day and so many people on that side of the equation to solve the problem. So we need to look at it so that the whole system can work. We don't want to solve twenty years ago's problem because that's what the certification requirements stipulated.

Henzelka: I'm a big believer in, to address the second point, I'm a big believer in continuous improvement. Get out there what you've got now, which is sort of what we did here. The problem with this testing process was ten years ago we did the mist and AVLAG development test and everybody said, "Well that's good enough, we're going to stop." And so what happened was we had a testing process that was fixed in time ten years ago. Meantime, the equipment developers are not stopping and they're leaving us in the dust. So, I'm a big believer in, once you get a process out there you need to continually update it to look at the horizon to make sure that you're moving that process to meet where industry looks like they're going. I think that's a good point, and well

taken. Any other questions? Good, if nobody has a question I want to make two points before I go. There was a number of statements made over the last couple days about testing surrogates. I wish everybody luck in looking for a surrogate although the folks at SBCCOM and the folks at Dougway have been looking for a surrogate for thirty years and we haven't found one, and the reason we haven't found one is this: If you look at the properties of an agent, you might be able to mimic one property, or two properties, or maybe even three properties, of fifteen or sixteen properties of the agent. What happens is, if you mimic all of them, you have the agent or something more toxic. So, what's going to happen is you're going to be able to identify certain properties that under certain conditions will give you a surrogate that you can check a piece or a second order interaction or maybe a third order interaction. You will never be able to check all of the interactions that happen with that material. If you can find a representative material in a group like we're doing with the Ticks and Tims, that's a good thing, you can probably do that because those will act close enough. But I would caution you, like we talked about the single gold standard that's going to do everything, you're going to have the same problem with your surrogate, in looking for a surrogate, to do all those simulant tests. So as long as everybody goes into that process understanding that's where you're going, that you might mimic a certain aspect of a test, you're going to have better success if you're looking for only one thing as opposed to, again, the silver bullet. Now I forgot what the other thing was I was going to say. (Laughter) (Applause)

Stewart-Craig: Okay, we're going to go ahead and have about a fifteen minute break and then we'll have the final two presentations and then we'll be done, so that's like twenty, twenty-five after, something? Okay thanks.

Pappas?: Okay. Where did everybody go? That's my first question.

M: Break out the beers.

Pappas?: Yeah. I know they're at Hooter's getting shots, right? Basically, I'm going to gloss over some of the stuff that we covered the first two days when we did mass testing, so I'll be skipping through some slides. If any of you want some of the previous stuff it'll be available by NIOSH so you can, or NFPA and you can get all that stuff. Elaine will have a copy. Frank will have a copy. Basically, I run the Mist Fit Test Facility. But our job is not only respirators. We also do testing for suits and just to give you a little background, back in 1995 when they had the terrorist attack at the World Trade Center underneath the garage, the parking garage, we were approached by the New York City Fire Department because they had a big concern that something would happen in the future with chem/bio so we got a bunch of New York City firemen and we brought them in and we tested their suits and respirators. So we did a SCBA test and then we did the bunker gear test. And we found, like bunker gear, have PF values of 2s. Two to ten. If you duct tape the openings you might get ten on them. So that's how all this evolved into domestic preparedness. Then the law enforcement people came into the picture. Then you had the NFPA and the standards and everything evolved. Basically, I want to cover the domestic preparedness program, because that's where we

handled a lot of suit testing evaluation of commercially available suits. Okay, here's some of the suits. Just to give you an idea, we do the full ensemble and then we take samples out of the suit. We'll skip the mission. Our mission is to, okay. One of the capabilities that we really didn't cover on the first two days was the vapor testing. Aerosol and the vapor testing I want to cover real quick. We test at least 22 people. We do multiple tests on the suits. We do at least 30 because that's considered statistically a large sample. Protection Factor, I think Jim covered it earlier and we covered it the other day. Okay. Now I want to talk about there's several types of suits. There's permeable suits and impermeable suits. Okay. Impermeable suits are basically your Level A, Level B suits, and then you have your permeable suits. Permeable suits are considered your charcoal impregnated fabrics. Suits that breathe. There's another class also that's under development that's called semi-permeable that I won't cover here but they're supposed to be more lightweight, better on heat stress. Okay. Vapor testing. When should you use a vapor simulant? Okay, we use methyl salicylate and we only use our vapor simulant when we do our permeable suit tests. Okay, permeable suit tests, because if you use an aerosol, aerosols will go through the actual material. So it's not a good evaluation of the absorption of the chemical methyl salicylate by the carbon. So we have devised two tests. We do our aerosol testing using Mazola Corn Oil for permeable, uh impermeable suits, and then vapor testing for permeable suits. Keep going, keep going. Just some of the equipment we use a laser photometer when we do our aerosol testing. That actually pulls a sample out

of the suit and it is real time testing. You actually do see every exercise, when he bends over, when he picks something up, the suit tests that we do are 40 minute tests doing moderate to heavy work, lifting boxes, crawling, climbing stairs with their SCBA and their suit on. Cover the aerosol generation system. We covered it previously. We have a generator that aerosolizes corn oil at 20 to 40 milligrams per cubic meter at a certain micron size, 0.4 to 0.6 microns. What we saw with the anthrax, the respirable anthrax size is 1 to 10 microns, so we're below that, so worst case when it comes to the chem/bio issue. Our concentrations are considered battlefield concentrations. These are low compared to what you might see in an enclosed environment. Like Jim said, you could have a one liter bottle of GB exploded in a stadium and it could get up to 1,000 milligrams per cubic meter very quickly. Our aerosol generation system, it's stainless steel. You can't see it in the picture but we have a critical orifice. It's a laser drilled cylinder where we actually pump compressed air into the unit, it bubbles up, comes through capillary tubes. If the particles are small enough, they get through the little laser drilled holes and come into the plenum system and come into the chamber. If they're too large, they impact on that cylinder and fall back down into the respirator. Just keep going. Filtration. Again, we covered that before. We turnover the control volume of our chamber ten times at least, and we can vary the CFM or the flow rate. It's always a negative pressure. Capability that I didn't discuss in the other presentation was this filtration unit. We can also put a carbon filter in it to handle the methyl salicylate and not just a HEPA quality filter for the aerosol.

Okay. ECU. We can do temperature control of our chamber also. Limited to those specs. Okay. Vapor testing. We have actually active, real time vapor testing. We use what are called mini-rays and we can do both in a PPB, parts per billion, and PPM, parts per million. And we use methyl salicylate and we usually generate about ten PPM and we can hook these detectors, they're small detectors onto your suit in whatever location you want, pull an air sample at 500 cc's and then exhaust it back into the suit. So you're not taking air out of the suit and not replacing it. It actually goes through the little detector and then it gets exhausted back into the suit. Okay. Okay, that's the ray detector. It's real time, you can download it to a computer. You can take up to 15,000 data points and you can see exactly what time period, what happened, you bent over, you broke the suit on your mask somewhere or your suit, your clothing, zippers that leak, that kind of stuff. We have a special vapor generation system we had custom made. Made by Kentek (?). Basically what it does is it heats methyl salicylate to 120°C and it vaporizes it and it comes into the chamber. Okay you can show them that. That's it basically. It's the same device that Lee and Ray used in the agent lab, but they used one oven, we use, this has four on it and it handles the big volume that we have. There's a suit. Real quick. There's your lime green suit the sergeant was talking about.

M: That's ugly. (Laughter)

Pappas?: When we run our tests we have soldiers in these for 40 minutes. The bottle lasts an hour.

M: They're blind when they come out.

Pappas?: A lot of them can't handle the heat stress at 40 minutes. And these guys are 18 – 25 year old male, in good condition, so heat stress is very important. Another thing I wanted to mention is, we have all these suit manufacturers developing suits and they buy material from one vendor. Usually, I won't mention the vendor but they buy the material from one vendor, so the material's good when we do the permeation testing. Well, these contractors then go ahead and make a suit with the same material and they come to us for testing and they say, "My suit is good." We test their suit, the other guy's suit is not so good. So they argue, why is his suit worse than my suit when it's the same material? Well, what they do is, the way they assemble it, they put outlet valve closures, they buy the cheaper zippers, they don't have a rubber coated zipper so the design is slightly different, and it causes big differences in performance of that suit. So even though the material might be a good agent-resistant material, the suit design might not be. This is… the charcoal impregnated… this is a candidate for the JS List, basically same thing. Langst (?) makes this, this is a Langst suit, Langst material. Basically, you can see the interface between the mask and the hood area. One thing about some of the suits that we've tested, the mask/suit interface is terrible on some of these Level B suits. Big gaps in the neck area, you can't possible seal that suit for vapor. Yeah. You can see, this is a suit that has a better seal around the face piece. It has a rubber gasket that goes around the face piece so it seals much tighter. And then you have your coverall, I guess paper, suits. And these are

the ones that we found that rip easily, you sit down you rip it open. That kind of stuff. We'll go over the customers. Just some of the customers. DP we've done at least thirty Level A suits we've tested and ranked them. It's on our web site. And then we've done like 20 Level B suits, so if you need information on contractor suits they're on the website and then, how we evaluate, my tests evaluate the man in the suit with the system. How we evaluate whether the material's good is we have Leah Ray do swatch testing. They cut swatches from the seams, visor, zipper area, and do their agent permeation testing on the suit material itself, so now you have your penetration, how much the suit leaks, and then your permeation. So you can make a good judgment on what suit performs well. We'll pass all that stuff. We'll pass all that stuff. Just go to the end. That's good. One thing I want to say is, I want to give you a quick ranking on how suits perform. A Level A suit in negative pressure mode, one of the more expensive suits can get form 1,000 to 10,000 PF, not vented. Okay? Now some of the other Level A suits that are cheaper in price, usually run around $800 - $900, they get 100 – 500 PF usually. They're openings are not as nice. They have some gaps, that kind of stuff. Level B suits, some of your splash suits only for liquid agents. We do aerosol tests on those. Those suits, untapped, will provide you 2 – 10 PF. Taped you get a little higher results, 10 – 15 PF. And then your permeable suits like the Langst suit, you can attain values 50 – 100 PF using the methyl salicylate method, so that's how we evaluate suits and if you want more detail you can look at some of our reports that are on the web. We basically don't

give an opinion on which suit is the best, we just provide the results and let first responders choose which one based on cost/benefit, which one they want to buy? So anybody have any questions? Okay.

M: Alex, throughout the last three days we've been hearing that the personal protective equipment is a system, is a system, is a system. But, this is one of those areas that really nobody wants to address, kind of like decon, it's hard to put your finger on it. The interface between the respirator and the suit is always a big problem area. Do you think that we should be looking into the area, and I'm glad Steve's still here on the NC Z88 (?) but as far as should we look into the development standards for the suits and the respirators so that they can fit. I know we run into the danger area of having a design limiting to the manufacturers, to both manufacturers. What's your position on that, standardizing the interface between respirator and suit?

Pappas?: Well the interface is usually... the Level A is fine. The Level B and the permeable suits have to be custom made to that particular respirator, and currently right now, the suits have terrible fit between the mask and the suit area. Another thing they do, like one of the people mentioned, the Saratoga suit. He had problems in his vision and his neck and turning because they didn't design the neck material properly in order to give them enough slack so they could move their heads around. They're constrictive. They don't have a nice seal on the respirator face piece, but it would probably be impossible to test every single configuration with every mask, would just be impossible.

M: Right, and that's what I was wondering. It was just a thought, it's not a NIOSH position or anything. I mean, should we be working toward standardizing the interface basically, between the respirator and the suit or do we just let the manufacturers work it out between them and the other suit manufacturers.

Pappas?: I think a lot of this stuff is market driven, so you'll see when, even the interchangeability is market driven. So I think if they can provide something that will work and the user wants to buy it, they'll develop it. If they don't, if he doesn't want it then they won't develop it.

M: Okay, thank you.

Papas?: Any other questions? I wanted to finally just introduce somebody from CHPPM. His name is Steve Graham and he wanted to talk a little bit about, just a quick, the cash pack program.

Graham: I'll just talk from here. Cash Pack was set up by one of the major commands within the Army to look at the procurement of commercial protective equipment for use by civilians, mainly by contractors, when base closure was an issue. And with the base closure, the issue was trying to clean up waste sites that could contain and I re-stress *could* contain chemical agent. In doing hazardous waste site clean-ups, the problem was the Army did not have enough of its own equipment to provide contractors, in case they came across a hazardous waste site that might contain chemical warfare agent or materials. And, what the Cash Pack program did was allow the Army to set up and develop a test matrix that included some of the NFPA suit testing

requirements as well as testing against chemical warfare agents at SBCCOM, looking at the scenario that was going to be used by the group or person or contractor with the suit, and then giving the go ahead to use it. It was sort of a liability issue, it was also looking at non-NIOSH approved equipment, well, looking at NIOSH approved equipment as far as the respirator went, and in a situation that NIOSH wasn't allowing that kind of equipment against chemical warfare agent at the time. And, the system has worked very well. I've spoken to Elaine about getting her copies of the test matrix to put into the record and that maybe will give some indication to the equipment manufacturers, the clothing manufacturers sort of what has been done in the past. And it may give NIOSH and group also some other criteria to be evaluating things against. Does that about cover it Alex?

(END OF TAPE 3, SIDE A)

(TAPE 3, SIDE B)

(Applause)

Stewart-Craig: Yeah. One was for Alex the rest was for Steve. (Laughter) All right now we have one attendee presentation by SEA.

Berndtsson: All right. Thank you, I want to run this from here and what I'm going to show, if I can, I hope we can see it, but for some reason the projector's not showing the right colors suddenly, so. But anyway, we have as you maybe saw in my presentations yesterday, we have been doing respirators for quite some time, and to, I believe if you're going to be involved in something you have to know exactly what you are doing and we've done a lot of research in that area.

Recently, we started combined our respirators with suits and as we had to do that we thought that we also need to understand exactly how that works and if we are going to get them approved against any particular standard we have to try to reproduce and understand how that testing is going to be done. So, in the last, before, in the last few months we have actually built an aerosol chamber, we're using DOP, we tried to, we were actually using the NFP 1994 test exercises and they take about 18 – 20 minutes. What we did was we did each exercise for about a minute and twenty seconds and then we had a forty seconds break in between them, and we sampled from the four sampling ports for twenty seconds at a time. That way we could read exactly on-line what was happening, if there was any leakage in the suits. And then after we done all those exercises, we actually jumped on an exercise bikes for about another eight minutes, increasing the working rate to 25 watts every second (...inaudible...) get up to 100 watts to get some breathing rates on these people. And we used two types of suits: one which is encapsulated with our positive pressure demand APRs and one was the disposable. And I hope that, it's not coming up, I will comment on what's going to happen on (...inaudible...). Yeah. So we used the sample port (...inaudible...)

M: (...inaudible...)

Berndtsson: What we see up here is two fan units we're using where we're making sure that we have 0.8 liters per second draft (...inaudible...) person, we are ventilating that out in the end of the chamber and what we saw in the very first minutes was a different sampling port. There's one on the chest, one on the

back, one in the crotch and one on the cloth (?). This is the aerosol generator we are using. This is actually what aerosol results comes out. We're using four sampling tubes: a round tube, we're using an ATI (...inaudible...) light as a (...inaudible...) instrument. That is designed as actually normally sampling at 28 liters. What we are done here is we are running that through clean airfield and diluting it down to 3 liters so we can, so we don't draw too much air out of the suit. And then we switching, between the switches you saw a minute ago between the different sampling ports. We also put a heart rate monitor on the person so we could monitoring and see after how hard he was working, and we were putting a (...inaudible...) on the breathing apparatus if we could see if that was in line with the heart rate. This film is actually available on our home page if you want to look at it on your own time on your own computers just to look in and have a look on it. And there is actually voice to it so we explain what's going on. Maybe doing it better than I do it, but you have to deal with me today. So, one thing which is very important and that is if we are going to expect any kind of performance for our first responders, the dressing up is really going to be the important part. You can't rush into these things. Of course, (...inaudible...) we have some complications because we have data logging (?) going at the same time but when you are dressing up, when you get the breathing apparatus on, and when you're actually closing off the suit, you have to put a lot of care and make sure that he does suit on properly and not rush through it. This is the heart rate monitoring. And I'm using one of the test subjects as well because I don't

want to get any of this on without knowing exactly what's going on, so in this particular case I help one of those people. What we're going to do when this is finished is to look at the, and we also have the exercises so you will see exactly what we are doing, so if you will just bear with me a second. This is what Alex Pappas talked about. You need to have collars all the way up so it sits on your face mask properly and that actually has to be taped up so it doesn't start gapping down there, after you… And there has to be enough material so you can turn your head, of course. Into the chamber and on the wall here on the right side we have, the test protocol loaded, the different exercises and we're using a watch up on the side, so we starting on the same time as we starting the process, so we can go back and look at exactly the data logging (?) knowing exactly what we did at the time and if we see any leakage coming through.

M: Is that the sample of different zones in this suit?

Berndtsson: That's right. So when and you will, we had some suits with leakage in and it was quite interesting to see how that reacted, where you couldn't read it on some of the ports, but you could read it on others. So, if you're not sampling on the right spots, or more than one spot, you can have leakage in the suit and never find out. This is how we are checking the (…inaudible…) the person which is 0.8 meters a second. Any questions when we're looking on this? This is actually what we are doing, what we're supposed to be doing according to that protocol. And of course, when you're doing this squatting, you get pretty

high negative pressure in the suit if you don't have the feed, if you don't feed air into it.

M: You may have mentioned this, the set up is to actually (...inaudible...) filter air is going into the suit (...inaudible...)

Berndtsson: That's correct. In this particular case, we are feeding a maximum of 30 liters from the powered unit into the suit, but we did it with power as we're (...inaudible...) into the suit and we have that comparison with no power into the suit, and we have done it into the fully encapsulated suit, so. And it's amazing what kind of differences you get. We actually took the same person doing one test and then just took him out, switched off the air into the suit and sent him back straight away without taking the suit off, doing a second test again, and I want to show you these two results. So what, say we're doing the exercise, we do it for a minute and twenty seconds, and every twenty seconds we change from the back to the front, to the crouch to the legs and then we are taking from the back actually for 40 seconds, we are doing nothing, and then we start the next, so we get a distinct difference between the different exercises. And we are feeding the information from the instruments straight into the computer so we have quite a lot of data points, it's very, very rapid in it's response. That's the next last test in the protocol for the NFPA 1994. This is a swimming exercise. (Laughter) Then we added the bike to it and we actually pedaled that for an additional 8 minutes with an increase, we start on 25 watts and increased it every second minutes. And that got some heart rate going and some breathing going and...

M: (...inaudible...) they spend a lot of time on their knees. When I went to fire school, I was on my knees all the time. Literally. Crawling. What they do, they crawl in.

Berndtsson: All right. (...inaudible...) I'm going to actually go into database. (...inaudible...) These modern computers, they're (...inaudible...). So. We have, let's start looking on, get that out of here. Let's start and look under "results" on a good fitted suit who works well. And this is actually 24, I don't know, can you see it from back there, otherwise, come closer. It is 24 minutes and you have the highest leakage is 0.26 which is something in the beginning, but you find that it is just a couple of particulates who was coming through, (...inaudible...) and we had something in the middle here, which was probably when you were crawling on the floor, no? And of course if you look on this as a combined or average, what we are doing now we are sampling and we see, every data point, every leakage, but we can then look on that as an average and of course, the total, the max leakage in here was 0.26% but the average is far below, 0.02. Of course, this suit works well, that is fine, that is what we expected to do. I'm going to show you some others which we had, just make sure I get the right one up. This particular, before we look on the result, oh, you can't see that up there. There's actually, up in the neck area, it's a 5 millimeter, a quarter of an inch hole about 8 inches from where the sampling probe on the back was. So if we look at what that means, we add that to the graph, and we're finding spikes here 9% leakage. When we are sampling in that area, and then we realized that, we turned that off and went to

a number of cycles where we didn't sample in that area, and we didn't see anything, and then we did it again and we got this high spikes back. Then you would say, "That wouldn't pass the NFPA 1994." is that what we would interpret that to be? So if you don't look on, if we averaged that out it would be maybe less than half a percent. So we had a spike here on about 9% leakage and less than half a percent as an average. So if we don't take and look on the suits where we have negative pressure so we didn't have any, we add that to the chart, and I don't know if you can see that it, it's actually 65% leakage up here, and you see every exercise we have in the beginning we have about 30 – 35% and then up to 55%, and when we're not doing anything it comes down 10% because you still have an accumulated contaminant inside the suit. And, at most I think we hit 65% here. This is the bike exercises which was the highest work rate and we had the highest leakage into the suit. If we now again look on that as an average, you will find that it is only 20% as an average. So, what I think is important is, I'm not trying to criticize anything here, just that we have to understand what it is we're trying to achieve, and how we are testing and measuring the results. So, basically, I'm just sharing this information. I will do more testing because I did tests on the suits with fully encapsulated with gas-tight zippers and I got some leakage in those as well. And when I communicate or discussed that with some colleagues from Los Alamos, they put on similar tests. He verified that he also seen that some 10-12 years ago when he was testing, but you can find, on encapsulated suits is, of course, you have ventilation valves and they can back leak. So even if

you have an open valve and it streams out all the time, you can get turbulence and particles back in. So I will try to do more testing to verify if that is the case, so? But we have to be careful, we really don't know about, because it's positive pressure and might not always means that there's no contamination the suits. I'm open for questions. Have I done anything wrong? Is it tested in the wrong way?

M: The leakage could be attributed to (...inaudible...). Just wanted to make a quick comment. Your leakage could be attributed to a bellows effect where you actually suck air in through your outlet valves when you're bending over.

Berndtsson: Because valves, the normal valves we're using are just dump valves, they're designed to open and close in a respirator motion time. When you have them in the positive pressure suit, they stand open all the time, no? And as you force changing the pressure inside the suit by doing this... it's very easy to get a back leakage into the valve if you're standing straight up and so. So that can of course be overcome in different designs but we have to understand what it is of course. But I think more importantly, we have to understand, first of all what is it we want to achieve in testing of suits and do we understand what kind of results we are getting and we are interpreting. Maybe we expected at 2% leakage in the Class II, 1994 to have peaks of 9 – 10%. I don't know, I didn't write the standards but maybe we did that. But I would assume that the user wouldn't expect that, based on the (...inaudible...) volunteer of the contaminants you heard in the last few days, 9% leakage around your neck would probably be good. Yah?

M: Thank you. We are in the NFPA technical committee looking to refine the testing technique that we used, and although we used sulphahexafluoride as our test agent, certainly, we use a discreet sampling method for determining protection factors of suits. And we're actively seeking input and advice in this area of testing simply because we did the best we could at the information as available to us at the time. So, certainly we would welcome the information you provided as well as anyone else for suggestions on how that test may be improved, or for that matter, an alternative test provided, because the intention is clearly to measure inward leakage, but how you characterize that in terms of, first of all, how the testing's done, and secondly, how you establish minimum criteria on the suit itself is important. This is going to become mostly a factor for this Class II performance which is in between a coverall and in between an encapsulating suit where you may be using the respirator to provide some of the positive pressure.

Berndtsson: You're right. That's why I was so eager you stayed today, so that you could look at this.

M: I had a comment to your comment I guess. Basically, the problem with suit testing is no one wants to come forward with a number and even the Army, they have permeation testing, but they don't have a protection factor number attributed to a certain type of suit and that's where working in the lab when you test a lot of these, you get an idea of which suit, how well these suits should be doing, and how well they actually do do. So, that's one thing NFPA might want to look at is saying, "A Level A suit has to attain 1,000 in that

suit." So that's 1,000 times cleaner than your outside environment. Then you have your SCBA that gives you 10,000 times cleaner than your outside environment, so now you gave that firefighter or policeman or whoever is wearing that SCBA an order of magnitude better, or actually 3 orders of magnitude better than their outside environment. So that would be helpful.

Berndtsson: All right. Any one else? Thank you very much for having the patience of waiting all day to see this. I really appreciate that. Thank you. (Applause)

Stewart-Craig: Okay, John's going to look for my closing slides, but that's okay, don't bother. There's only a couple of them and it was to you know thank everybody for coming. We went a lot longer than I thought, but I'm not going to apologize for that. There was a lot better discussion today, than I anticipated and we got a lot of good information and I hope NFPA got a lot of good information, manufacturers and users, so. Now we're going to go back and try to put it together and we'll come out with some sort of a document that we'll use as a draft, and I'm not sure when our next meeting is going to be, but I'll get it out either out in the Federal Register or however best it is to get to everyone, but in the meantime... Go ahead, go to the last one, there's only two or three. Yeah, that one. Okay, this is the same place you can comment to for the first two days. NIOSH has been gracious enough to let us use that. In addition, I put my own e-mail there if you want to send anything directly to me or it's easier or however you want to do it. You can send it to me as well. With all that, I'd like to thank NIOSH in particular for hosting us today. It was actually not their meeting but they were nice enough to get us the room and

the support and the food. (Applause) And with that, we're done. Thank you. Unless you want, I'm sorry, Jill did you want to say anything?

M: (...inaudible...)

Stewart-Craig: Tell us the joke. Come on.

M: As I said to Alex, that I heard a joke in L.A. a week ago, perhaps the other people heard it as well. Where one guy is going to make a presentation and he was, just one person showed up to listen to the presentation, so after presentation he thanked the guy to have the patience to stay, and he said, "Well, I appreciate that, but I'm the next speaker." (Laughter)

(END OF TAPE 3, SIDE B)