A PANEL DISCUSSION ON:

"COUNTERING THE THREAT OF RADIOLOGICAL WEAPONS"

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DR. LAWRENCE KORB: My first announcement is to tell you that anybody who has a cell phone or pager please shut it off, and then what we have today I think is a terrific panel on an important subject.

If you can remember back to the 2004 campaign, both President Bush and Senator Kerry agreed that the greatest threat to the United States was a terrorist getting ahold of a nuclear weapon. And certainly that is a terrific threat, but it's much more likely, as I think you'll see today, that a terrorist could get ahold of a radiological weapon and we'll discuss today what that might mean and how we can deal with it.

We have three distinguished panelists. We have – since I have a degree in social science, there's a real doctor in Dr. Peggy Hamburg. We have a lawyer who's gone straight; Andy Grotto, the author of the thing. And Benn Tannenbaum is not an Indian chief, he's a scientist and Benn is the senior program associate at the AAAS. Before that he was at the Federation of American Scientists. He's worked up on the Hill for Congressman Markey.

Our real doctor, Dr. Peggy Hamburg, is a senior scientist at the Nuclear Threat Initiative and as you read her biography, which we mailed to you in the invitation, you'll see that she's had experience in the federal government at HHS, NIH, and she also probably, I think, had a more challenging job as the commissioner of health for the City of – uh City of New – New York. So she's certainly, I think, is terrifically qualified to deal with this. And then our first speaker – Andy Grotto, as I say, is a lawyer who's gone straight. He is national security analyst here at the Center specializing in the whole question of weapons of mass destruction.

What I'm going to do is I'm going to ask Andy to summarize his very good paper for you and then we'll ask Benn and Peggy to comment on it from their perspective; Benn from the strictly scientific perspective in terms of how somebody might physically develop one of these weapons and then Peggy to talk about how well prepared we are and how you would deal with it medically.

So, Andy, please.

MR. ANDREW J. GROTTO: Thanks Larry. You should all have a hard copy of the paper either in your folder or on your chair, so rather than go into the nitty-gritty details of it, I thought give it a mountaintop overview of it and that might serve as a framework to guide our discussion here today.

With all of the unconventional weapons that a terrorist could use to attack the United States, a radiological weapon or a dirty bomb is the most likely. Materials needed to build the weapon exist in many places around the world. It is very difficult to detect

illicit shipments of these materials and once materials are acquired it takes comparatively little expertise to actually build the device.

So what is a dirty bomb? It's primarily an economic and psychological weapon made by lacing conventional explosives with radioactive material. When detonated, the explosives spread the material and contaminate the environment. A dirty bomb's not a nuclear weapon. The presence of radioactive materials does not affect the size of the explosion. The amount of damage a dirty bomb can cause varies enormously and depends on three factors: the radioactivity of the materials used in the device, environmental factors such as wind or geography, and how we respond.

A dirty bomb made with comparatively weak materials may cause little direct damage beyond the force of the conventional explosion. But the presence of any radioactivity could cause people to panic and vastly complicate the emergency response. It could also cause a disproportionate emergency response as leaders hope for the best but plan for the worst. For instance, there could be pressure to shut down major transit routes in an attempt to forestall additional attacks.

A dirty bomb made with stronger materials has the potential to cause catastrophic damage. One worst-case scenario involves an attack on Lower Manhattan with cobalt-60, an element used to irradiate food and medical equipment. A foot long rod of cobalt-60 could render much of Manhattan virtually uninhabitable and cost billions, possibly even trillions, of dollars in economic damage. Carrying out such an attack would be difficult because cobalt-60 and the elements like it are more difficult to acquire and very difficult to handle, but it's certainly not impossible.

Based on these threat circumstances, the paper stresses the need for a layered defense to minimize the chance that the terrorists acquire the highest risk materials, the United States should improve regulatory controls over them. At a minimum, authorities should know where these materials are; currently they do not.

The United States should also accelerate efforts to track down sources that have been lost or stolen and properly dispose of them. The most potent materials are most likely to come from a source that's been abandoned overseas. This is known as the orphan source problem. The U.S. should model an expanded effort to track down these materials on the very successful U.S. Offsite Source Recovery Project which tracked down and disposed of 10,000 sources in the United States since 2000. If a country doesn't have the capacity to safely and securely dispose of sealed sources, the country that exported that source should take them back. Currently only France does this today. These are sealed sources, not spent fuel so these are not – these don't pose a threat out – once – unless they're removed from their device. The Department of Energy has ample space in its labs and its facilities to store these facilities securely and safely.

United States should also enhance our ability to identify and intercept illicit shipments of these materials. For instance, intercepting shipments of radiological weapons should be fully integrated into the Proliferation Security Initiative. This will

require must stronger cooperation among national regulatory authorities. Congress should also grant the administration's 227 million dollar request to launch the Domestic Nuclear Detection Office, but ensure that the program does not become a cash cow for manufacturers of expensive hardware of questionable utility. Training personnel in how to use the equipment is essential for that to work.

Finally, the paper stresses the need for strong emergency response capability. This is vital to minimize the destructive effects of an attack using weaker materials and contain the damage of an attack using more radioactive materials.

Currently there are significant gaps. For instance, the U.S. government does not have the capability to launch a rapid, large-scale clean-up, nor is there an adequate stockpile of drugs that may be essential to help treat a large number of people for exposure to radiation.

With that introduction, I turn to Peggy to get our conversation started.

DR. MARGARET A. HAMBURG: Okay.

DR. KORB: I've got to congratulate Andy. You know I've moderated hundreds of panels of people – I always say summarize your paper in five minutes. Everybody says sure and then they go on ten or 15. His was four. (Laughter.) So, Andy, thank you.

DR. HAMBURG: Well thank you. I've always been a believer in I think what Samuel Johnson said: that the hardest thing is to speak briefly. So I'll try to keep within my allotted time. This is, I think, a very important topic, a timely topic, and a bit of a complex one because it's in the area of enormous confusion about what it is we're talking about and then an area where people are sometimes a bit reluctant to talk about some of the details for fear that they may be communicating to people who want to do harm new ideas, but I think the sad truth is we need to take this threat seriously. It's a very real one. It's one where we know, unfortunately, that groups like al Qaeda have expressed interest in pursuing.

We know, as Andy said, that the materials to make dirty bombs are quite available in the world today in hospitals and healthcare settings, in research laboratories, in commercial laboratories, in construction sites, and in – obviously – government laboratories and a range of public and private programs both in this country and around the world. It's because there's so many commercial applications and legitimate applications for medical and other uses. It's an area where it's hard to put strict controls and it's an area where the knowledge to use these materials, if you obtain them, to do harm is quite accessible. You just need to go on the internet to find that out.

It's a confusing area because many people immediately when you start talking about radiologic weapons think nuclear devices. There are many types of radiologic exposures and certainly an atomic bomb or a nuclear bomb is one, but today we're

focused on the issue of dirty bombs which, as Andy said, is radioactive material being used in explosive device.

I think my task is to really talk from a medical and public health perspective and from that regard really the greatest risk of death and injury is in fact from the explosive itself and depending on the size of the explosive and the placement of the explosive there can be many deaths or a minimal number.

In terms of the radioactivity, there are about seven radioactive materials – radioisotopes that are of greatest concern for use in a dirty bomb because of both accessibility and their state enables them to be used in a bomb and for most of those in terms of the exposure, it – unless you're right there when the bomb explodes and there's a large dose of material used in the bomb, it's unlikely that there would be a high enough dose of radioactivity to cause immediate symptoms of radiologic poisoning. More likely there will be low-level exposures that will raise the issues of chronic disease and of course issues of contamination of the environment and food and water supplies that will be ongoing in nature and create concerns for management. But really from a medical point of view first and foremost will be the injuries from the explosive itself. In terms of managing patients and those exposed who don't have significant injuries from the explosion, there will be medical management issues.

Sort of moving from the site of exposure to the ongoing care, let me just lay out some issues to think about and also some issues to think about in terms of individuals in a community where such an event occurs. There are sort of three critical elements to reducing exposure and protecting oneself: time, distance, and shielding. You want to limit your time of exposure to the radioactive material, you want to increase your distance from the source of exposure, and you want to increase your shielding and the requirements for shielding, again, vary on the radioactive material involved, but barriers between you and the material are a good thing.

In terms of medical management, decontamination is important – of the individual – both to reduce their exposure and also to prevent concentric circles of exposure from a contaminated individual. So medical management involves the emergency rescue crews that go to the site – through the chain of healthcare providers you want to as quickly as possible remove dirty – you want to remove clothing which may have been exposed to dust particles from the explosion that contain radioactive materials and you want to wash the individuals off. You want to do that offsite, out of the direction the wind is blowing from the explosion, but you want to remove the potentially contaminated clothing and wash them off before you move them into a healthcare setting where there are patients who have other medical problems that you don't want to potentially contaminate by this movement – so offsite decon and movement into medical care.

For those who are in the area but haven't been right at the site, the same general rules apply. If you've been outside, you want to as quickly as possible go inside. You want to go into a building that has intact walls and windows, you want to remove your clothing if possible – your exterior clothing, put it in a plastic bag if possible. Ideally, put

that bag out of the way but save it so that in a calmer moment it can be checked for – to determine levels of exposure which will help you know your long-term risk. But you want to wash off and then you want to turn on your radio or TV to get information – continuing guidance for how to proceed.

If you're already inside, you want to stay inside. You want to turn off air conditioning or heating to prevent outside air from coming in, you want to close windows, close dampers on fireplaces, et cetera. You want to try to prevent outside air from coming in.

If you're in a car, you want to turn off the air conditioning, you want to turn off the heating, you want to close windows, you want to turn on the radio to try to get guidance on how to proceed. And hopefully in an integrated coordinated response there will be rapidly information from authorities about the nature of the problem and directions for how to proceed.

One of the stickiest issues I think – and I say this as a parent – is families that are separated at the time of the event and the temptation of course will be to gather up your family, but if children are in school they should stay in school. You should know – check at the beginning of the school year to find out what your school's preparedness plans are and if they don't have adequate ones encourage them to develop them. But you do not want to go and pick up your kids in the middle of a crisis. You want them to stay indoors following the guidelines I just mentioned until there's further guidance about how to proceed.

If you're outside, cover your face and nose with a cloth to prevent breathing in potentially contaminated particles to the greatest degree possible and then, again, when you get inside discard that cloth in a plastic bag.

In terms of other elements of preparedness and response from a medical public health perspective, communicating to the public some of the information I just gave and some of the information about the nature of this threat is critically important for a crisis. People are reluctant to talk about it sometimes for fear of creating greater anxiety, but I think people do better when they know what issues are before them, when they understand the nature of a problem, and they also have a clear sense of how to behave and how best to protect themselves and their loved ones. And I think that we know from other kinds of crises that information to the public and the behavior of the public is absolutely crucial in controlling the response, minimizing damage and injury, and I think it's something where we need to do a much better job in terms of communicating with the public, communicating with the media, local authorities, local officials, local leaders. We need to do it before an event and we need to make sure that we're doing it actively and in a credible way during an event.

We do need to look at stockpiles, as Andy mentioned, of tools for medical management. There are some drugs that can be useful in the management of radiologic poisoning. They're inadequate and with the levels of exposure that people may get they

may not really have much of a role. There are some distinct cases where medical management does involve giving drugs. A nuclear accident – a nuclear power plant accident likely would involve the release of radioactive materials that contain (iodine?), in which case potassium iodide would be useful in reducing the long-term risk of thyroid cancer, particularly in children. But most dirty bombs wouldn't involve that particular form of radioactivity and so people often ask the question, "Should I have potassium iodide in my home in case of a dirty bomb?" The answer is really that there would be very limited utility and you certainly don't want to be taking that medication inappropriately and when it will not do any good.

We need more research into developing new strategies for dealing with radiologic exposures, both acute high dose and lower dose. We need more understanding about the chronic effects and how to limit long-term complications. We also need much more research in terms of understanding both personal protective gear if you're in a site of exposure particularly for first responders and much more research into decontamination strategies because, as Andy mentioned, one of the things that's going to cause social disruption and economic disruption for a very long period is the inability to determine when it's safe to go back and what are the most effective strategies for decontamination.

I think that we also really need to make sure that in addition to educating the public and the media about the threat, we educate policymakers so that we are making the appropriate investments in terms of planning and preparedness. Today, as we know, this is a real and probably growing threat and to make sure that we integrate all of the critical partners for response; not just federal authorities, but state and local authorities, but also critically the private sector because so many elements of both damage and response rely on private sector and not-for-profit sector institutions who have not been fully integrated into our preparedness planning to date. So I think it's a serious problem, but in many ways in terms of the array of threats before us and things that one can imagine when you try to think like a terrorist, I think this is a problem that is a manageable one, but we need to think in a clear-eyed way about it. We need to put into place a set of elements of preparedness and importantly we need to work on prevention because of course it would be much better to stop such an attack from ever happening.

Thank you.

DR. KORB: Peggy, before I turn over to Benn, as John McLaughlin might say, on a scale of one to ten – ten being elegantly prepared and one not – where are we now in terms of dealing with the – an effective medical response?

DR. HAMBURG: Well, I think you can't separate the medical response from the overall response and I would say that we have moved forward from where we were pre-9/11. Our awareness of the range of potential threats before us, including this one, has increased and there have been very significant investments, but we still have a very fragmented system for response. We still, as I said at the end, have a failure to coordinate and integrate all the critical elements for response. We, I think, really are not providing the critical leadership in terms of trying to define roles and responsibilities, but we're sort

of letting communities and localities develop their own strategies for response and that of course reflects a desire to empower communities who know their own needs the best.

But communities need a lot more guidance. Both medical professionals, public health professionals, and other first responders and critical components of response are not all experts in the set of threats before them. They need much more guidance about what are the critical components of preparedness, what are the pieces of equipment that they need, what are the detectors that really work, what are the guidelines for response?

So we need leadership. We need continued support in terms of resources. We need priority setting because you can't prepare for every potential threat and I think part of what we need to do is build systems for preparedness that will help protect against the dirty bomb threat, but also the range of potential threats we face, including natural disasters that can have very serious consequences as we all know. So I think we have a long way to go and forums like this are important in continuing the discussion to move us forward.

DR. KORB: Okay. Fine. Those of you who want a seat, we've got a couple of seats up here if you want to come up before I turn it over to Benn.

DR. BENN TANNENBAUM: Thank you. I wanted to spend some time before I talk about dirty bombs themselves talking about radiation.

People have a fear about radiation. You can't see radiation, you can't smell it, you can't taste it, you can't touch it, but radiation is everywhere around us. There are cosmic rays coming down from above, there are cosmic rays passing through the palm of my hand and the palm or your hands as well at about one per second. There's radiation in the ground around us. There's radiation in the concrete used to build the walls of this building, the bananas that you had for breakfast, the kitty litter in your cat box, bananas, et cetera, so forth and so on. There are many, many things around us that have radiation in them: table salt for example. If you have Fiestaware that's bright orange, it's made with uranium ore. So radiation is everywhere around us and people are afraid of it.

However, we also have this attitude towards radiation where it's good for us. I go to the dentist, I go to the doctor; I get an x-ray. I think that's great. It's very useful as a diagnostic tool. I go to the doctor; I get radiation therapy treatment for my cancer or for other diseases, so in that instance we think of radiation as being beneficial. So we have this very two-minded attitude toward radiation. We need to recognize that there are some levels at which radiation is safe and there are other levels at which radiation is dangerous. When we go to the doctor, it's controlled. We can understand then that we're getting the right amount of radiation.

Now, the National Research Council has a draft report out – the final report should be out later this year – entitled, "The Biological Effects of Ionizing Radiation Number Seven: Health Risks and Exposure to Low Levels of Ionized Radiation." This is a report that – they've been doing this – as I said, this is the seventh report, so they've

been doing this over many decades now. They've been looking at survivors of the Hiroshima/Nagasaki nuclear weapons. They've been looking at people who work in nuclear power plants, people who work with radiation their entire lives and looking at the cancer rates from them. And what they've determined is that there is no safe level for radiation. So they said no matter how little radiation that you get, it will increase the chance of cancer, which is the main reason people are concerned about radiation.

So if we're surrounded by radiation all the time, there's nothing that you can do to – you know, and there's no safe level of radiation, what can you do? Well, what you can do is you can make sure that you get the lowest level of radiation possible. Random fact: transcontinental flight, you get the same amount of radiation as you do when you're getting a dental x-ray, okay? So you can minimize the number of flights that you take; perhaps not the best thing for the airline industry.

DR. HAMBURG: Or the dentist.

DR. TANNENBAUM: Or visits to the dentist, right. You're supposed to go every six months to the dentist. You don't have to go across the country every six months, right?

So the next point that I wanted to make is that unlike a biological or a chemical weapon, a radiological weapon can be detected immediately. As soon as we have personnel on site that are beginning to respond to an explosion, they can have detectors with them that can say the level of radiation in this area is above normal, so now we need to treat this like a dirty bomb. We don't have the abilities yet to do the same thing for chemical or biological weapons.

So then the last thing and – and there's the whole question of what do you do once the people are contaminated is clean up. How clean does this site have to be before we let people move back in? And, as I said, the National Research Council has just told us there is no safe level for radiation, so how clean do we have to get? Do we knock down buildings? Or do we merely come in, put on our space suits and come in and wipe down all the surfaces and then go on our merry way? And that's what remains to be set are the standards for what a clean building is post-attack and what the exposure rate should be. So with that I think we should just stop.

DR. KORB: Okay. Andy, do you have any comments on the comments before we turn it over to the audience.

MR. GROTTO: Well, I think that response is vitally important to this because we can do a lot of – we can do a lot better trying to track down materials – (nuclear high-risk?) materials. We can do a lot better developing technologies to try and identify illicit shipments of them, but it's very hard to do this. I mean there are millions – literally millions of materials around the world – sources for these materials. It's very – and it's relatively straightforward to hide them. You know, if weight is not an issue you can just add shielding and that can simply defeat most detection technology we have out there

today. So, I mean, response is vital and so I think that – you know, like charting a strong response is where we need to spend a lot of time and we're certainly not there yet.

For example, panic is perhaps – you can imagine scenarios where the panic following an attack – once the people find out that there's radiation – the panic itself could cause more casualties than the initial blast from the explosive. You can imagine people fleeing the scene and the like. Again, people – you know, radiation touches on people's nerves. People don't understand it and when people are confronted with something like this, they tend to look inward and they get scared and I'm not sure that you can educate the public on a grand scale to get them to not worry about radiation. As has been said, there are real risks and people do need to be aware of them, but there's certainly more we can do to educate the public about the dirty bomb threat in particular, especially in places like, say, Washington, D.C. where there might be an elevated risk of being a victim of an attack. So, for example, we might focus on making sure schools have strong plans in place to deal with worried parents, scared kids, and so on. So –

DR. KORB: Okay. On that note, let's –

DR. TANNENBAUM: Actually, I wanted to follow up on the notion of response.

DR. KORB: Oh, sure. Go ahead please.

DR. TANNENBAUM: We have chlorine tanker spills in this country on an unfortunately regular basis: a train runs off the tracks, tanker opens, chlorine gas comes out. There is an immediate response wherein the police come out and say, "You need to evacuate this area." People evacuate. There is little panic because this has become part of the fabric of our everyday lives where we know that this is going to happen. I have a train running through my back yard; chlorine comes on that train track every now and then. I'm going to have to respond. I'm going to have to evacuate my house.

Radiation should be treated much the same way. It is part of our daily lives, it is everywhere, it is around us and we need to educate the public that if a dirty bomb attack happens, you just don't panic, evacuate the area calmly, and then we'll worry about the cleanup as time comes.

DR. KORB: Okay. Please identify yourself when you ask a question if you would. Go ahead.

Q: Dave Eisenberg, British-American Security Information Council. (Inaudible.) At the beginning of the report on page one you say with regard to (planning?) a strategy that (inaudible). My question is, not all sources are equally lethal. I mean, radiological weapons (inaudible) is certainly far more menacing in terms of (inaudible). And based on analysis (done back?) a couple years by the Center for Nonproliferation (inaudible) they noted the wide disparity in (inaudible), so unfortunately this strategy really needs to have a cradle and grave requirement for all potential (inaudible). It seems to me that

would put such an onerous, burdensome regulatory requirement (inaudible) would be self-defeating. (Inaudible.)

MR. GROTTO: Yeah, no, further in the paper I do make a point that we should focus our efforts on the highest risk sources. These are the most dangerous sources, the most radioactive ones, but also ones that may not be quite as radioactive but are especially common because you're absolutely right. One of the problems, for example, with – I mentioned earlier during my introduction the orphan source problem. An orphan source is a source that has essentially fallen outside of regulatory control. That's a source that's been lost or stolen.

One reason why people – why so many sources get lost – I mean, in the U.S., for example, there is about one source lost per day. Now, most of these sources – in fact, the overwhelming majority of them are not dangerous. They don't pose individually a real dirty bomb threat. Part of the reason why the problem is so acute is there are real incentives for folks to take advantage of the fairly limited options out there for disposing them. There are incentives – for example, if you're in construction and you have a radiography machine in your truck and it – imagine if it falls out – you know – I mean, would you tell your boss that you lost this expensive piece of equipment that is potentially dangerous? No, you say it was stolen. You don't say, oh, well, maybe it fell off the truck down the road. So we – you know – you're right. I mean, we do need – want to make sure that there are incentives for folks to use the mechanisms in place, but also to develop new ones like tracking the highest risk sources to make sure we know where they are and make sure that the people who are supposed to be using them have them and the people who aren't supposed to be using them don't have them.

DR. TANNENBAUM: Another thing to think about is radiation is additive. The amount of americium is small, but if I go off and buy several thousand smoke detectors I'm not very smart, but I might then have enough radiation to put together into a single weapon that would be dangerous. I spent – you know during my career as a physicist, I dealt with radioactive sources all the time. These are small sources and every now and then one would wander off and if over time somebody were to collect a whole set of sources, then you might have something that is serious. Individually they're not dangerous, but when you put them together then, yes, you start having problems. So there has to be a threshold at which you say, "Okay, this source is going to be dangerous but these sources also together could be dangerous" and how do – how one decides where one sets that threshold for monitoring is important.

DR. HAMBURG: You know, I think that in a way this new awareness about the intentional use of available materials, whether it's radiologic or biological or chemical, to do harm is a wake up call to many communities to really examine standards of practice and it's important both in reducing the threat of terrorism using these materials, but it's also important in terms of general safety. I spend most of my time working on the biological threat and there – you know the life sciences community – the biomedical research community really is only just now waking up to the fact that the line between pro-social and very important applications of modern science and misapplication is very

thin and there's a large gray zone and that people really need to think in a new way about the research they're doing and how they're doing it and the materials they're using and for safety as well as security – whether, as I said, in the biological, the chemical, or the radiologic realm – I think that we need to really reinvigorate our standards of good practice in securing materials and responsible use of materials in science.

MR. GROTTO: Yeah, one thing to that. I find it useful to think about the threat in terms of a dirty bomb made with weak materials that will not cause any added damage beyond the force of the explosion itself, but whose presence causes people to panic, and a dirty bomb made with materials that are in and of themselves dangerous and have the potential to contaminate a large amount of territory.

In the first case, you can imagine a scenario where a dirty bomb is made with materials that in and of themselves don't pose any particular threat. In that case I think that's where emergency response becomes especially important because you can manage panic and minimize the harm and then you don't need to track down all these sources, at least with the same level of vigor as you would with the high-risk sources that have the potential cause a great deal of damage if used in a device.

Now, that's somewhat simplistic because there's really a spectrum of weapons that can be used, but I find that thinking about the threat in those – along those two poles helps understand the relationship between having a strong response capability and tracking down the high-risk sources.

DR. KORB: Okay, our next question. Okay, if you get a mike and please identify yourself.

Q: I'm Gary Tidimore (ph). I'm with the Department of Energy's Radiological Threat Reduction Program.

DR. KORB: Now you're going to tell us what's really going on.

Q: My question has to do with – you used the term "we." I think each of you used the term "we" and you talked about response. You talked about what the threat really is. It was primarily along health lines, not around environmental lines. We mentioned (Monterey?) I believe. There does seem to be some activity in the NGO community. Why isn't there a sponsor – a champion for this? Why is it that nuclear obviously has its champions. Were concerned with an improvised nuclear device and we're concerned with bio-terrorism. We're concerned with chemical terrorism. But it seems at this point that radiological terrorism is an academic subject. It's not something that we as a society are taking very seriously. What is your view of why that is the case?

DR. KORB: I'm glad you mentioned that. It's one of the reasons why we had this panel, because we felt that this had actually fallen through the cracks and we asked Andy to write this paper because a lot of us feel that this is more likely than a nuclear attack to occur.

Any of the panelists?

DR. TANNENBAUM: Yes. I have a press release here from Congressman Markey. He himself has been following this particular issue for quite a while. This is a press release talking about the energy conference – the House-Senate energy conference – and how they were specific provisions that were adopted from legislation that he and Senator Hillary Clinton had introduced to help secure the materials to make dirty weapons – dirty bombs, so he is – he and the Senator Clinton have been very active on this particular issue, but beyond that you're correct. On the Hill, there are very few people who are actively involved on this particular topic.

DR. KORB: Peggy, from your experience at all levels of government –

DR. HAMBURG: Well, I think it's very hard to say what is the most likely next event and I don't know where I would put my money. But you don't have to think very hard to see that making a dirty bomb would be well within the capability of even the most ragtag group of terrorists in terms of it's basically – I mean, there's a whole spectrum of what you could create, but you need an explosive device and you need some radioactive material: both things are fairly readily available.

In terms of catastrophic events, it's much lower on my priority scale than a nuclear or a biological attack, but I think this is very much a real threat, and I think one can quite reasonably ask the question of why hasn't it happened already and I don't know the answer to that, but I'm just grateful.

But I think in terms of preparedness we need to think in a systematic way. We don't have the resources and we don't have the capacity to develop discrete programs against every potential threat that exists, but we do have the capability and the responsibility, I think, to make sure that we have systems for response in place across a realm of concerns, recognizing some of the special priority concerns both in terms of potential loss of life and injury and also economic and social disruption.

This, as many have said, is not a weapon of mass destruction, but a weapon of mass disruption, but that's critically important to society as we know it. In many ways preparedness against this threat combines the preparedness against conventional terrorism and bombs that we have been building capacity for some time against. But I think what you're getting at is the issue of control of radioactive materials to make it much more – much less likely that a conventional bomb won't be turned into a dirty bomb and there you get into the problem of how do you really control these materials that are used in so many activities – legitimate activities in so many parts of the world and I think you know legislation that is starting to look at systems for better oversight and control are very important.

It also involves, as I said before, I think greater responsibility on the part of people using these materials, recognizing the possible dangers and possible opportunities

for misuse. But it's – we live in a world that I think is increasingly dangerous for many, many reasons and I think that we don't want sort of boutique organizations for each and every possible threat. We want to have sensible, well supported, well thought through, well planned and practiced systems for response against a range of threats including this one.

DR. KORB: Andy, you know a couple of war games have been conducted on this.

MR. GROTTO: Yeah.

DR. KORB: What's been the result of the war games?

MR. GROTTO: Well, they tend to find that the – I mean, it depends on the materials used. There one scenario that the Center for Strategic International Studies did for Washington that found that an attack in Washington using Cesium-137, which is particularly potent material, would be very damaging and it would – but mostly it was the panic that would cause – that was usually singled out as a real destructive force.

To come back to your question, just to speculate I wonder if one reason why a dirty bomb threat has sort of fallen under the radar is that unlike nuclear, biological, and chemical weapons there is no real arms control community for these. I mean, both – those three issues areas have a legacy of arms control advocates who wanted states to not acquire those weapons and I think if someone – I'm haven't looked at the history, but I imagine if you went back and looked at the history of the nonproliferation movement, you know, that kind of maybe began (with the?) dissolution of the Soviet Union as people began to think about lose nukes. That kind of grew out of the arms control movement. In fact, just some of the early Nunn-Lugar efforts were tied to START treaties; the idea being that if the Soviets or Russia would dismantle weapons, that we would help them with that by providing them with the capacity to secure the materials and (unintelligible) materials. I think that might be one reason why there's no real arms control legacy behind dirty bombs, which is where I think some of the influence today on those issues comes from.

DR. KORB: Did you want to follow up, sir? Please, you can tell us.

DR. TANNENBAUM: We're here to learn.

Q: I truly wish I had something profound to say. You mention arms control and you think of Nunn-Lugar and just recently Senator Lugar put out a synopsis of a questionnaire he sent out to 130-some odd luminaries, including the person – Dr. Hecker from Los Alamos who coined the term weapon of mass disruption and they all – well, they didn't all answer exactly the same way, but their conclusion of that questionnaire – one of the conclusions was that radiological is much more likely than any of the other three weapons of mass disruption – destruction and chemical or biological also is not

really mass destruction. It's mass disruption, okay? The only mass destruction is nuclear.

MR. GROTTO: Well, I mean, a smallpox attack would be, I think, pretty –

Q: Well, depending on what you call destruction. Are you calling human beings destruction or are you calling real estate? What are you calling destruction? But it seemed that some of us follow this, we thought that after Lugar came out and then very shortly ex-Senator Nunn came out – he had a question. In the testimony he had, he asked this question he usually asks about INDs: what would we say the day after? What would we say, "Gee, if we only had –" so he now applied that to radiological. And there doesn't seem to be, with the exception of certain political figures, a lot of profound issue. You said underneath the radar. We – I think, at least in my mind I can't quite figure out why it's underneath the radar when you have almost who's who in the arms control community with the Lugar questionnaire who said this is the most likely and that was a list of luminaries – again it was almost a who's who. So, observation.

DR. KORB: Okay, good. I appreciate that.

Yes, ma'am? Here, Antoine, as long as you're up here.

Q: Hi. Yan Elioplith (ph). I'm with the government crowd here in the first row: NNSA, Office of International Radiological Threat Reduction. I don't want to give a PR speech, but the U.S. government – at least the Department of Energy is trying to address the threat of radiological threats internationally. Our program came out of an emergency supplemental in 2002 and we spent over $100 million since 2002 to support international efforts to secure high-activity sources and our list looks very similar to the ones in your paper.

We're looking at alpha emitters in the one to 10 curie range and gamma emitters in the 100 to 1000 curie range and we have supported now over 40 countries internationally to comply with the International Atomic Energy Agency's code of conduct. We've also provided the Office of Nuclear Security at the IAEA $11.5 million to do more work in assisting countries with regulatory support.

But four years later – three years later since Gary and others started this program, I feel that – I just want to echo what Dr. Tidimore said: we don't have any champions out there in the NGO and other communities and we don't have to compete with other offices because we're really the only show in town, or the only U.S. government office doing this work, and we feel like we're the single voice of trying to rally support for our program and fighting internally as well to compete for a finite pocket of money that is looking at higher threats such as INDs and the traditional other two classes of WMD.

I didn't want to leave without people knowing that we – that this program is something we're taking seriously. We were merged in the Office of Global Radiological

Threat Reduction which is something that NTI and others have focused on on the nuclear side and that's it.

DR. KORB: Well, you've got a champion here, but let me ask Peggy, now, at our organization how much priority does this get? I mean, you've got some of the people here who mentioned Senator Nunn involved and –

DR. HAMBURG: Well I think that the reality is that there is a huge gap between what is the threat and what are we doing in the radio-nuclear arena. Our organization is focused more on the nuclear threat than the radiologic threat in terms of trying to secure or destroy nuclear materials at their sources to prevent them from being mobilized and used in a true nuclear attack, but recognizing that this is also a very real threat and one that's being inadequately addressed.

Similarly, in the biological area it's a threat that we take very, very seriously – believe that it has the potential to range from a truly catastrophic event to a more disruptive than actual death and disease perspective, but that there is just a lot to worry about.

In terms of where the greatest threat is, I think that Senator Nunn would say that it's a nuclear device in the hands of a determined terrorist followed by the biological very closely with the dirty bomb representing a very real and serious concern, but one that will be much more limited in scope in terms of devastation and death. But that doesn't mean that we shouldn't do everything that we can do to address it and that involves putting in place a set of programs that range from prevention – trying to provide greater oversight of the materials so that they remain in the hands of those who have legitimate reasons to use them. It also involves developing the technology and using the technology that will allow for rapid detection, particularly in priority sites including, as Andy mentioned, ports and sites of entry into major areas of population density.

It also involves making sure that we have a response system that is fully supported with clear plans, communication to all partners including the public as a key partner in effective response, and that we not be satisfied by good intentions, but that we really make sure that we have a long-term commitment to these problems. And I think one of the issues at the moment is that as these problems have appeared on our radar screen of concern, there's been a lot of thrashing of hands and a lot of emotional rhetoric, a lot of money being put towards the problem, but not the kind of really concerted planning and well-integrated programs that we need. I think we're at a critical moment to sort of look at the array of threats before us, try to prioritize as best we can in an unknown world where we don't understand that much – not nearly much as we need to know – about intent, but try to make sure that at all these points of intervention that we are doing meaningful things in a sustained way.

DR. KORB: Benn, what priority does it get in your group?

DR. TANNENBAUM: Well, it – my group over at AAAS at the Center for Science Technology and Security Policy is more of a conduit between research groups at different universities and what goes on here in Washington.

By and large, most groups are focused on the threat from nuclear weapons, from chemical, biological, or cyber security and the academic community is not by and large focused on the threat of dirty bombs.

DR. KORB: Well, that's your answer then.

Yes, sir, and then go over here.

Q: Mr. Grotto, what is your recommendation –

DR. KORB: Could you tell us where you're –

Q: Oh, I'm sorry. John Hall of Media General News Service. What is your recommendation for alleviating public panic, which seems to be the overriding, overarching problem with radiological weapons? We're wide open, aren't we? The schools, the news media, the public services, employers – we're completely unprepared. Is that not true?

MR. GROTTO: I think so. I think so, and I think that we really need to target communities that are at high risk. You know you can't really undertake a massive education campaign because I think that campaign could scare people more than it would help them, but if you target the campaign to communities of high risk I think there's an enormous amount of value, from schools to –

Q: (Off mike.)

MR. GROTTO: No. I think that –

DR. KORB: Wait for the mike if you would.

MR. GROTTO: No, I mean it – you know it's been said people – radiation makes people scared. You know, some of that fear is based on misperceptions and some of it, of course, is legitimate: radiation can be dangerous. People need to understand the risks, but that's very hard to do I think on a – in a productive way on a very large scale to all segments of the country and for that reason I think it makes more sense to focus efforts on communities at high risk. Now, every community should have some plan, but it's a question of how much emphasis you give this particular threat. And again, you know, the plan should be integrated into other emergency response plans. You know, if there's other catastrophic events, do you want your children – do you want parents rushing to the school to pick up their children? Probably not in most situations because that could complicate the job of emergency responders. So there's a lot of room to grow, but the growth has to be targeted. It can't be – you can't just take a shotgun approach to it.

DR. TANNENBAUM: I think in many ways the response to chemical, biological and radiological weapons initially will be the same and the notion is you want to get as small an exposure to whatever the dangerous thing is as possible so you could develop a common education for all three of those kinds of things including – nuclear weapons will be in a different category, but we have – you know, I'm sure you're of an age when you hid under your desk in school to protect yourself from nuclear weapons. So people at least thought about – okay, maybe I should seek shelter against nuclear weapons, so you can think of a similar sort of education – perhaps not quite as useless – for chemical, biological and radiological weapons where people realize the best thing to do is to minimize your exposure to the substance, whatever it may be.

DR. HAMBURG: Unfortunately we live in a world where these threats are real and I think it is important that the public learns something about the concerns because it is really the case, and I know this from experience, that in a crisis people don't hear well and people don't communicate well and you do not want to be communicating critical information for health and safety to people for the first time in the middle of a crisis when panic and anxiety rule the day and when often instincts are not the appropriate responses. Fleeing may not be the best thing to do in this kind of scenario.

As I said, racing to collect your children may be putting yourself at greater risk and putting your children at greater risk, so people need to understand ahead of time what the types of scenarios are and what the types of responses may be and critically important – and I think we've done a rotten job of this – we need to develop true partnerships with the media because it is through the media that people are going to get the vital information that they need in terms of what is the nature of the crisis, what are the requirements for safety and for health, what should they be doing and where can they turn for help and so we really need – I think in a non-crisis environment to develop the plans, practice the plans, engage all the partners and not try to panic people.

I think – you know, we don't want a sky is falling, this is for sure going to happen to you and your life and the lives of your loved ones are at risk so you'd better read this pamphlet, but in a – in a more sober and informative way, I think, lay out the issues and importantly arm people with positive information about what they can do and how they can get information and assure that they are credible leaders and trusted figures who can communicate before, during, and after a crisis.

DR. KORB: Okay. Good.

Up here.

Q: I'm Cliff Singer with the Department of Nuclear Plasma and Radiological Engineering at the University of Illinois.

This question of clean-up standards – there's a lot of tension in what we heard between Lower Manhattan becoming uninhabitable and it's not much of a problem and

the industry standard below legal limits is as low as reasonably achievable, which makes sense from an economic perspective. It puts pressure on the nuclear industry to keep its act together and it does cost them money, but it doesn't cost them trillions of dollars.

The question I have for you is what standards should be put in place? It sounds from what you said is that we don't have a uniform agreement on how much we would clean up Washington or Lower Manhattan. I would hate to see a situation where all the corporate headquarters moved from Lower Manhattan to Denver because the radiation exposure had gotten twice as high in Lower Manhattan when it's already twice as high in Denver. (Laughter.) And so could you give us an idea of what kind of advice should we be giving and to whom? Does Congress need to be involved or is this essentially an administrative matter for the federal and state and local governments?

MR. GROTTO: Well on the issue of standards, Congress has to get involved. To change the rules would require congressional intervention. For example, the current rules at EPA and (Energy?), as I understand them, the assumption is that people will spend something like 40 – 24 hours a day, seven days a week for 40 years in an area and that's the baseline against which they judge exposure. Now, most people don't spend that much time in any territory.

The other issue that comes up is – you know, it's been mentioned – there is no safe level of radiation even though people are exposed to natural levels every day. I think any effort to change these standards, you have to engage local communities because you're talking about risk and risk is always political. There is no objective answer to what is an appropriate level of risk to ask people to bear and so I don't have a real cut and dry answer other than to say that any effort to change these rules would require really serious engagement with the public to avoid – to get them involved in this process.

DR. KORB(?): How would you change them?

MR. GROTTO: How would I change them? Well, I think it depends on the type of facility or area affected. Let's say a port is hit with a dirty bomb. A port is an attractive target because it's economically vital and you could do a whole lot of damage to the economy if you hit one of our ports. People don't spend all day in a port, so you might consider ways to try and let people move through that port without causing an aggregate level of radiation at any aggregate (that is?) as high as they would have, say, in Denver or an airline, but I don't think there is a real straightforward answer to this.

Different facilities have different needs and different uses and – but I do think that to the extent possible this conversation should start before a crisis, because after a crisis people are in panic mode and it's hard to have a rational discussion when you're sort of dealing with a catastrophe and so that would be my other recommendation: deal with this now rather than later.

DR. KORB: Thank you. Peggy or Benn? Do you want to say anything?

DR. TANNENBAUM: Well, this also probably an ethical question because do we – if you get this much radiation you may increase the risk of getting cancer by one in 10,000, but if you get this much radiation it may go up by one in 100, and how do you decide what risk you put the population that goes into that area? And that's definitely an ethical question and that's why certainly Congress needs to be involved because they're the representative part of the government and they need to be involved in this and you need to get local communities involved as well.

DR. KORB: Well, didn't we face something like this after the attacks of September 11th when EPA let people go back downtown. I mean wasn't that the big issue.

DR. TANNENBAUM: There was also the question of proper information about what was dangerous and what was not dangerous in that instance, yes.

DR. KORB: Okay.

Yes, ma'am?

Q: Hi I'm Gigi Kwik Gronvall from the Center for Biosecurity.

I have a question about insurance and has this topic gotten much attention from insurance companies because I would imagine they would have a lot to say afterwards and also insurance as far as those who insure construction sites or construction companies and people who might have some things stolen.

DR. KORB: Does anybody know that?

MR. GROTTO: Yeah, I –

DR. KORB: Andy?

MR. GROTTO: I don't know of any insurance company that insures against radiological risks. It's sort of a legacy of the Cold War. How do you insure against a nuclear war? You just can't. There is a piece of legislation that's in place now. It's called the Terrorism Risk Insurance Act – it expires at the end of the year – that helps industry bear some of the costs of a catastrophic event. Radiological terrorism would be covered by that, but the act does not require an industry – insurance companies to offer that coverage.

One more of my recommendations is that this act expires in December of this year – December 31st this year – and that renewal should be conditioned on industry getting coverage to radiological incidents, not necessarily nuclear weapons attacks. I think that's – that would be unfair. It's a different category, but it should be – renewal of that act should be conditioned on industry getting – covering radiological incidents.

DR. HAMBURG: What about the other side of Gigi's questions, which is, I think, if you're an institution that has radiologic materials, either a construction companies that has it or research lab that's using them or whatever and you have materials that go missing and it can be shown that you don't have – you didn't have adequate security in place, what liability issues in that? You know –

DR. KOLB: Put on your legal hat.

MR. GROTTO: Well, I would find the nearest phonebook and look on the back page and call that guy because someone's going to get sued for that and – you know, one of the problems – I alluded to this earlier – is that there aren't real incentives, I think, for industry to report missing or disused sources and if you have – many sources are valuable. I mean, these sources have important industrial applications and they're valued by the holder. It's when something goes wrong that they for whatever reason lose them. They need to have an incentive to report that. Whether you can insure against that, I don't know. I think that would – might fall under a liability provision, but I'm not sure that – does that –

DR. HAMBURG: Yeah, I mean, I don't know much about the whole regulatory mechanism, but clearly there is a system in place that it probably could be strengthened – penalties for failure to provide proper oversight for these materials and that kind of thing.

MR. GROTTO: Yeah.

DR. HAMBURG: Through NRC.

MR. GROTTO: Yeah. I mean, it's actually – there are certainly things that NRC could be doing much better to do this. The hard part, though, is there are so many sources out there that (NRC?) doesn't have the capacity to go out and inspect before the fact. We're sort of dealing with a situation where sources are lost and then what do you do? There is a mechanism, as I mentioned earlier, the Offsite Source Recovery Project that a company can call that has a disuse source, a source it no longer wants, or it finds an abandoned source and they will come and dispose of it. You know, it's one of the sources they can dispose of. But I think if I were a lawyer – well, I am a lawyer – (Laughter.)

DR. KORB: A practicing lawyer.

MR. GROTTO: A practicing lawyer. By the way, I notice that I'm only doctor not on here and a juris doctor is a doctor.

(Cross talk.)

DR. KORB: Talk about a real doctor.

DR. HAMBURG: Esquire?

MR. GROTTO: Yeah, that's right. (Laughter.) But, you know, I'm not sure if insurance companies actually cover that type of loss. It might fall under a general liability provision, but I just don't know for sure.

DR. HAMBURG: But like so many things, as we start to sort of peel away the layers of our security concerns, there are very real costs to institutions to comply with proper management of these materials and I think corners have historically been cut to save money in terms of proper disposal of these materials and we need to rethink and work with these institutions to understand their responsibilities and – you know, and we need to really for national and global security make sure that the incentives are lined up to enhance rather than reduce good stewardship.

MR. GROTTO: Yeah, and then this does require active collaboration with the industries that use these materials because they're – they know their practices, they know – they should understand the risks and there's a lot of knowledge to be gained from engaging them on this issue, so I agree absolutely.

DR. KORB: Yes, ma'am?

Q: Hi, my name is Emily Roth and I'm from the Arlington Institute and I just have a question that's primarily addressed to Mr. Grotto. It's kind of his foreign policy angle.

One of the things that I noticed in your report which I think is extremely important is the necessity to track down and secure the open sources, a lot of which are kind of floating around the former Soviet Union zone and as I looked at that I kind of thought about Vladimir Putin and how at this particular junction in time he's not really – he's kind of doing things that the United States wouldn't really approve of. He is supporting an Iranian nuclear facility; he's cracking down on freedom of speech, freedom of the press, and freedom of expression and clearly we might need his help when we're trying to secure these sources in an area that he has a lot of influence on. And I was just wondering what way you thought we could best ensure cooperation because this is clearly an area that needs to be addressed.

MR. GROTTO: On this issue I think the Russians are cooperating pretty well. I mean, they actually have enormous interest in securing these sources, too. Those incidents several years ago where a Chechen group planted a dispersion device in a park and – you know, just to sort of say, "Look, we got you. If we wanted to cause a dirty bomb attack, we could." An attack never happened. So the Russians are worried about this, too, because they could be a target. So securing their cooperation, as I understand it, has not been a real roadblock to this – to success.

DR. HAMBURG: Money is a roadblock and the Russians, working through the Nunn-Lugar Program and other activities, have been trying to secure or destroy nuclear

materials, chemical materials in particular, and also address some of the issues from their former bio-weapons program, but it's enormously expensive.

The G-8 did identify this as a concern for the broader community and have been mobilizing some resources, but I don't think they've met their own goals and I think it's critically important that there continues to be pressure to provide the resources to achieve this increased security and clean up and destruction of weapons grade materials because it really is one of the most immediate threats in terms of terrorism in the near future.

DR. KORB: You raised the classic question: the difference between realism and idealism and foreign policy and that in the real world a lot of times you have to make compromises and all great nations have throughout their history.

Okay, yes sir?

Q: Hi, I'm Alejandro Carolin (ph); international policy analyst for the Sierra Club and I'm wondering if it's a mistake – and I don't know obviously the answer to this, but I'm wondering if it's a mistake to separate radiological sources from nuclear threats in terms of negotiation with other countries for securing these materials. I understand that the effects are very different and the way they are delivered is very different, but would it be wise to have the U.S. government negotiate these agreements with other countries and both issues at the same time since there's a relationship in a lot of the policy decisions that are made?

MR. GROTTO: Well, I'm not sure if I understand your question correctly, you're wondering why we shouldn't essentially merge programs to track down radiologic materials with programs to track down and secure nuclear, biological, chemical? Is that – am I understanding you?

Q: The recommendations made in your report suggest – a lot of the recommendations in your report are similar recommendations that have been made with respect to nuclear materials that could be used as nuclear weapons by terrorists, so I'm wondering if there is a linkage there also in terms of negotiating these agreements.

MR. GROTTO: My instinct is no and that's because the issues that are plaguing progress on the nuclear side on threat reduction work in the former Soviet Union are – the issues are very different. I mean, funding is always an issue so kind of bracketing that as a separate issue. The political issues right now are things like liability and access and those just aren't present on the radiological side and so by including radiological in those negotiations – in those discussions, I think you needlessly complicate the already difficult task of resolving these issues that are hampering progress on the nuclear weapons side, so –

DR. HAMBURG: I think it would be extremely difficult to merge them into one in terms of foreign policy and international treaties, et cetera, because they are quite different in terms of where the materials reside and how they're used. You know,

weapons grade material for nuclear weapons have to be created in a program – I mean, Benn knows a lot more about it than I do, but that requires really basically a state-sponsored or major program. There are limited sites where those materials are produced and there's an existing supply of those materials that is at least officially held in very discreet places with a set of standards and expectations.

The radiologic materials are really dispersed – that might be a bad word to use in this context, but they exist across many, many domains of commerce and activity. The nuclear weapons materials are basically in government entities or a limited number of private facilities. The radiologic are in hospitals, in research labs, in universities, in national labs and government labs, construction sites – all kinds of equipment – and of course exist in nature as well, so it seems to me it's a much different set of oversight and control issues.

That doesn't mean that we shouldn't work very hard to develop national and international strategies for control and oversight and that there's a great deal more that can be done and needs to be done to secure those materials and assure appropriate use, but I think that they are apples and oranges in some ways in terms of the appropriate and most effective strategies.

DR. KORB: Benn, you want to –

DR. TANNENBAUM: It's been said very well.

DR. KORB: Okay, let me – we'll get one final question. Richard, go ahead.

Q: Richard Weitz, the Hudson Institute. Andrew in his paper talks – or in his presentation talked about the importance of dealing with supply side and one way he mentioned was intercepting through PSI or another initiatives.

Would it be possible technically to reduce the amount of these materials that are being used as a specific policy, and I know that that's happening in some places by itself – you know, as our medical technology improves, we need to use less and less radiation to detect diseases in people and (sort of?) – and then the question is not just technologically whether also economically that would make sense because my understanding from the IAEA is that there are hundreds of thousands of possible radiological sources out there used in for (unintelligible), medicine, food processing, et cetera. Would it make sense to try and reduce the amount of dispersible material being used if there's already so much out there? So it's basically a technical question and an economic question in terms of resources and priorities.

Thank you.

MR. GROTTO: Well, on the technical side I'll mostly defer to Benn because I think he can speak to this better than I can, but one of my proposals in the paper and it's one that Congressman Markey has – hopefully will come out of this Energy conference

committee is to ask the National Academy of Science to conduct a study of where it's possible to find economically viable replacements for dangerous materials, so – but I'll defer to Benn on the technical side.

DR. KORB: And if Benn and Peggy, if you would, any final remarks that you would like to make and I'll let you have the floor.

DR. TANNENBAUM: The more things that we can switch to using non-radioactive sources the better and, yes, there are lots of distortions that are disbursed right now, but the very feature that makes things radioactive means that over time they become less radioactive and there are fewer and fewer radioactive bits that you have to worry about.

Most of the things that we're talking about have half-lives on the order of tens of years to maybe a few hundreds of years meaning that if I start off with one pound of something that has a half-life of one year, one year from now I'll have a half pound, two years from now I'll have a quarter pound and so on and so on. So as time goes on, if we're not making new sources, they will go away and they will no longer be a threat to us. So certainly the faster that we switch to using non-radiological sources for whatever the better off we'll be.

Now, as for concluding thoughts, we've talked a lot about dirty bombs and how dangerous they are. I think we also need to be very clear that – that while they're not as difficult to construct as a nuclear weapon they're also not trivial to construct. If you just take your cobalt-60 rod and wrap a couple of sticks of dynamite about it, you're going to break the cobalt-60 rod into chunks and you're going to have chunks of cobalt that you can then go pick up. That's not going to be dangerous. It's more when you designed a well-designed weapon is going to be something that is going to vaporize. The materials that you now have it formed into an aerosol so that it adheres to the surfaces around you, you breath it in, et cetera, et cetera, et cetera. That's when it's dangerous and that's much more difficult to do than you might think.

DR. KORB: Okay. Peggy?

DR. HAMBURG: You know, I think I've pretty much made my points and said my piece. I guess I would just close with the plea that we do live in a dangerous world and there's a lot that needs to be done and that we all have a responsibility to educate ourselves and others and to really hold our policymakers accountable for making sure that we are using our limited resources as wisely as possible and that we are making wise and sustained investments in critical systems for preparedness and response and I think that unfortunately we still have a long way to go there.

There are, I think, a lot of steps that have been taken that point us in the right direction, but that we have a lot of work to do and we want to make sure that we continue to focus on critical problems of concern, bring new light to areas that have been under-addressed and I think in many ways, as we talked about this morning, this issue tends to

get sidelined and people move into the more catastrophic threat of nuclear, but it's a real one and it's one that can cause enormous damage to communities and so I hope that this will not just be a morning's discussion and move on to the next problem of concern but that we all continue to think about and work on these problems together.

DR. KORB: Andy?

MR. GROTTO: I just want to say that the paper's printed and bound, but I regard all my work as a work in progress so I welcome any comments, criticisms, suggestions so please e-mail me or call me with any thoughts you have.

DR. KORB: Well, I want to thank a lot of people for this. I do want to point out if you look at our mission statement I think one of the things we talk about is to provide a forum to generate new progressive ideas and policy proposals, so for our colleagues from government here we're trying to get people to think about this issue to generate some of these ideas and some of the things that Andy pointed out.

Before I thank our panel, these things require an awful lot of work and the two people responsible for putting these as well as many other things are Antoine and Alex back there. They do all of the hard work, so I do want to thank them for what they've done here and for all the other things we've put on. And I want to thank our three doctors here. We have an M.D., Ph.D. and a J.D. and I want to thank you all for coming very much and we hope to see you all again.

DR. TANNENBAUM: Thank you.

(Applause.)

(END)