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AN UPDATE ON NORTH KOREAN NUCLEAR DEVELOPMENTS

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AN UPDATE ON NORTH KOREAN NUCLEAR DEVELOPMENTS

WEDNESDAY, JANUARY 21, 2004

U.S. SENATE,
COMMITTEE ON FOREIGN RELATIONS,
Washington, DC.

The committee met, pursuant to notice, at 9:05 a.m. in room SH–216, Hart Senate Office Building, Hon. Richard G. Lugar (chairman of the committee), presiding.

Present: Senators Lugar, Brownback, Sununu, Biden, and Corzine.

The CHAIRMAN. This hearing of the Senate Foreign Relations Committee is called to order.

OPENING STATEMENT OF HON. RICHARD G. LUGAR, CHAIRMAN

Today, the Senate Foreign Relations Committee will receive testimony on the observations of Dr. Siegfried Hecker, senior fellow at Los Alamos National Laboratory, following his January 8 tour of the Yongbyon nuclear facility in North Korea. This facility has been closed to outsiders since December 2002. Yesterday, Dr. Hecker briefed this committee on his observations, in closed session. He has briefed members of some executive branch agencies already, and he is scheduled to brief additional administration officials at the State Department later today.

The crisis surrounding North Korea's nuclear program has been the subject of six-way talks between the United States, Russia, Japan, China, South Korea, and North Korea. The administration and our allies understand the importance of these talks for regional stability and global security. The United States has consulted closely with other countries in the region in an effort to make these talks productive.

China has emerged as the pivotal country because of its links to the North Korean regime. The continued cooperation of China as an intermediary in the six-way talks is essential, and the administration is working hard to solidify Chinese support for mutual objectives.

In December, the committee requested administration testimony on the six-way talks and was assured that either Secretary Powell or Assistant Secretary James Kelly would oblige the request when Congress returned to session. Therefore, at an early date, our committee intends to hold another hearing, at which we will examine the progress of the six-way talks and the administration's policies toward North Korea.

Even as we attempt to achieve our objectives through the six-way talks, the United States must continue to refine its analysis and options related to North Korea. As this analysis occurs, we should keep in mind several factors. First, the central, overriding interest of the North Korean regime is in its own survival. Second, given their lack of friends and their dysfunctional economy, North Korean leaders increasingly perceive that their backs are to the wall. Third, recent events, including the ousters of Saddam Hussein and the Taliban, and even the voluntary opening of Libya's nuclear program, have pressurized the geopolitical environment for North Korea. Fourth, although there is still ambiguity surrounding the precise configuration of North Korea's nuclear program, the North Korean regime sees this program as the primary means through which it can protect and perpetuate itself. These realities combine to create a dangerous situation that requires focused attention by the United States and our allies.

North Korea's nuclear program is at odds with American national security. Our goal must be to stop and ultimately dismantle the North Korean nuclear weapons program, as well as its biological and chemical weapons programs, while preventing the transfer of weapons or dangerous materials and technology to other groups and to other nations. To achieve this objective, we should not rule out any option, including, as a last resort, the use of force.

Last year, President Bush announced his willingness to pursue a non-aggression pact with North Korea in the context of the elimination of North Korea's nuclear program. On January 9 this year, in an interview with a Japanese television station, Secretary Colin Powell underscored the administration's efforts to achieve a peaceful solution in North Korea. He stated, and I quote, "President Bush has made it clear that he wants to find a political, diplomatic solution to this challenge, and I think we can. If we were interested in the military option, we wouldn't have gotten the six-party talks organized. The United States does not seek war. We are not looking for enemies. We are seeking to solve problems, problems of the kind presented by North Korea's nuclear weapons programs."

As one of the authors of the Nunn-Lugar program, which has succeeded in safeguarding and destroying thousands of nuclear weapons and their delivery vehicles in the former Soviet Union, I am more optimistic than some about disarmament initiatives focused on implacable enemies. Late last year, Congress passed the Nunn-Lugar Expansion Act, which broadens the Defense Department's authority to provide cooperative disarmament assistance outside the former Soviet Union. If we maintain alliance cohesion and American resolve and apply creative diplomacy and disarmament tools to the situation on the Korean Peninsula, we can achieve our goals.

In this context, we welcome Dr. Hecker's testimony. As a former director of the Los Alamos National Laboratory, Dr. Hecker possesses extraordinary expertise related to the construction and operation of nuclear programs and facilities. Two of the central issues related to North Korea's nuclear activity are whether 8,000 spent fuel rods stored in the Yongbyon facility have been reprocessed—with plutonium extracted from them—and whether North Korea has a highly enriched uranium program.

Before we turn to these questions, however, I would like to underscore the work done by our committee in relation to human rights and humanitarian issues in North Korea. This has been a particular interest of Senator Biden and myself, as well as other members of the committee, including the East Asian and Pacific Affairs Subcommittee chairman, Senator Brownback. The visit of Dr. Hecker and the Stanford delegation to the Yongbyon site, understandably, has gained international attention. Keith Luse and Frank Jannuzi, professional staff of the committee, were in North Korea and accompanied Dr. Hecker and the Stanford delegation to the Yongbyon facility.

However, Mr. Luse and Mr. Jannuzi traveled to North Korea with additional agenda items. They met with high North Korea officials to discuss the deplorable conditions of the North Korean prison system, the harsh treatment of North Korean refugees, food scarcity in North Korea, and the matter of Japanese citizens abducted by North Korean agents since the mid 1950s. Mr. Luse and Mr. Jannuzi have briefed Senator Biden and me on these issues, and they will be issuing a comprehensive report [1] on their findings in the near future. In addition, they briefed executive-branch officials in both Beijing and Washington.

At this time, I would like to highlight a couple of the most urgent human rights issues. North Korean refugees seeking food and shelter continue to cross the border into China. Unfortunately, China has not yet allowed the United Nations' High Commissioner for Refugees to establish assistance centers.

In September 2003, I wrote to United Nations Secretary General Kofi Annan, asking for a written response outlining steps taken by the United States High Commissioner of Refugees to gain access to China and to assist North Koreans. Based upon the UNHCR response and after consultation with experts familiar with the refugee situation, I am hopeful the Bush administration is actively encouraging the Chinese to meet their international obligations so that North Koreans in need of protection in China may be assisted by the UNHCR.

A 2003 report by the U.S. Committee on Human Rights in North Korea [2] has documented the existence of two distinct prison systems in North Korea. That country maintains a gulag of forced-labor camps and prisons where, according to the report, "scores of thousands of prisoners—some political, some convicted felons—are worked, many to their deaths, in mining, logging, farming, and industrial enterprises." The report documents a second penal system composed of detention camps near the border with China that are used to mete out punishment to North Koreans who are caught attempting to flee to China, or who are forcibly returned to North Korea by the Chinese authorities.

This dual system of repression must be eliminated. The United States should press the North Koreans and the Chinese continuously on this point. We also should insist that a survey of food

[1] A copy of the report, "North Korea: Status Report on Nuclear Programs, Humanitarian Issues, and Economic Reforms," February 2004, S. Prt. 108-40, can be obtained from the Senate Foreign Relations Committee or accessed on the committee's Web site at: www.access.gpo.gov/congress/senate

[2] The report can be accessed at the U.S. Committee on Human Rights in North Korea Web site: www.hrng.org

needs within the two prison systems be conducted by the United Nations or a non-governmental organization familiar with North Korea.

The points I've outlined related to North Korea represent a sizable agenda for oversight activities of our Senate Foreign Relations Committee. We are pleased to continue our inquiries today with the benefit of these very special insights from Dr. Hecker.

Before calling upon our witness, I'd like to call upon the distinguished ranking member, Senator Biden, for opening comments he may have.

OPENING STATEMENT OF HON. JOSEPH R. BIDEN, JR.,
RANKING MEMBER

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

Let me say, to use the jargon of the Senate, I associate myself with the remarks that you've made, particularly the efforts of our staff persons in the report about to be filed.

But today, at least, I'm going to focus most directly on the testimony of Dr. Hecker and his visit to North Korea. There's been an awful lot of speculation in the media about his visit, and the delegation's visit, to Yongbyon nuclear complex, and today we're going to get to hear directly, in open session, the findings and impressions that Dr. Hecker came away with.

Many of us had an opportunity to meet with Dr. Hecker yesterday, and I can tell you, doctor, from the discussion with my colleagues on the committee, Democrat and Republican alike, the consensus was it was one of the most informative meetings that this committee has held, ever. And I think it was because you have the rare and unique capacity, as a man who's one of the best-known scientists—and probably there's very few people in the world that know more about plutonium than you do—to be able to translate that to a group of educated women and men, but most of whom are not physicist or scientists, and for us to understand what's at stake here.

I'm going to be a little didactic today in my questions, like I was yesterday, I think I can ask many of them in open session today—because, quite frankly, as policymakers and participants in the execution of American foreign policy, it's really important that we know the difference, for example, between highly enriched uranium and plutonium. And someone would say, well, why would you have to know that? That's irrelevant. Well, it's very relevant. It was relevant, in terms of our great concern about the prospect of the North Koreans providing plutonium on the black market, selling it to al-Qaeda, to terrorist groups. How usable is it? How would it be transported? Is it able to be detected? There's a great deal of discussion among—in the media and by policymakers about whether or not light water reactors or the old reactor we're going to talk about today, the five-megawatt reactor, or the 50-watt reactor, the 200-megawatt reactor. What's the difference? What difference does it make? Does it matter that a country goes one route versus the other? And does it increase the prospects of the difficulty of us being able to independently verify an agreement, if an agreement is reached, about cessation of programs.

And so I warn you, doctor, I'm going to go through that same exercise, in part, we did yesterday—and I'll be guided by the chairman and you—if you think anything remotely approaches anything that's classified for us to talk about, I'm not going to do that, but I think it's important for us to understand the context of these large foreign-policy discussions that we have here.

Three years ago, along with the chairman, I urged the Bush administration to test North Korea's commitment to peace by putting a serious proposal on the table. No one knows if North Korea—I certainly don't know, and I know you're not even going to speculate today, because you're a scientists here, you're not a diplomat, you're not a foreign-policy expert, you're not a Korean expert. But the truth is, I don't have any idea, even if we do everything the right way, if the Lord Almighty came down and said, "This is the way you should deal with North Korea," I'm not at all sure North Korea, under any circumstance, is willing to yield its nuclear capacity, its nuclear capability, for any deal. I think they are, but I don't know. And no one knows if they're prepared to abandon the pursuit of nuclear weapons. And, frankly, it may prove impossible to convince North Korea to change its path.

But one thing I do know, and I've known for some time, is, we have to try. And, so far—I say this not for your benefit, doctor, but for the opening of this whole discussion—and, so far, I don't think the administration has made a sufficient effort. The outlines of a deal with North Korea, if any is possible, were clear 3 years ago, and they're clear today. North Korea must fully and irreversibly and verifiably abandon its pursuit and possession of nuclear weapons and the production of intercontinental ballistic missile capability and the sale of ballistic missiles. If North Korea commits itself to this path, the United States and its allies should stand ready, and the President has made a tentative offer in this, to offer security assurances, sanctions relief, and normal diplomatic relations matching, action for action, and word for word.

President Bush has already pledged that the United States is prepared to offer security assurances to the North, but the details of any new non-proliferation framework with North Korea have yet to be worked out.

My concern today is much the same as it was 3 years ago. As North Korea's nuclear capability grows, there is an ever-growing risk that North Korea might choose to export capability, either in the form of fissile material or technology. As North Korea's nuclear arsenal grows, there's also a real and growing risk of a war on the Korean Peninsula arising out of miscalculation and miscommunication. There's clearly the possibility of us losing a dream and a hope of most of the nations of the world of having a nuclear-free Korean Peninsula. I predict if we cannot stem this rise, it's not going to be very long before Japan and South Korea decide they have to be nuclear powers. That will change the entire dynamic with regard to Chinese notions of what their needs are. That will, in turn, impact on India's nuclear decisions and capabilities and what they think they need. That, in turn, will impact on Pakistan. We can end up in a very, very, very much more dangerous world than we have now if we do not make a full-blown effort to see whether or not we're able to reach an agreement.

As we'll learn today, North Korea's not been idle during the 13 months since it kicked out international inspectors and restarted its facilities at Yongbyon. In fact, North Korea appears to be well along the path toward becoming a full-fledged nuclear-weapons state. Convincing North Korea to change course will not be easy—it requires a combination of sticks and carrots—but we must make plain the dangers of its current path, especially our complete intolerance for any form of nuclear exports from North Korea, but we must also hold out the promise of a different future if North Korea verifiably abandons its pursuit of nuclear weapons and its export of ballistic missiles.

We have done an OK job in communicating the risks; but, quite frankly, I think we've done a poor job in defining the alternatives for the North Korean people. We have had almost no dialog with North Korea, holding just three meetings in 3 years, all of them coming too late and without much little product.

At the most recent round of the six-party talks in Beijing, last August, the United States and North Korean officials held a total of 40 minutes of direct talks—not enough to make much headway. You have spent more time, and the delegation has spent more time, in serious discussion than all our negotiators have in direct talks up to now.

So I'm eager to hear your testimony, doctor, and, to state the obvious, but maybe not to everyone, you are one of the world's premier nuclear scientists, with an extensive international experience with nations of the former Soviet Union and China, and I can think of no one that we should—that we'd be happier to have here today than you. And what impressed me yesterday, in the closed hearing, quite frankly, was your absolute insistence that you would state only what you knew, you would not speculate. You said you would not speculate today, even though you could make educated guesses. You were very rigorous in that approach, and I think it's served you well and helped us all a great deal. So I'm anxious for the Nation and our colleagues and the press to hear what you have to say.

Without any further comment, Mr. Chairman, I yield the floor.

The CHAIRMAN. Well, thank you very much, Senator Biden.

As all of us have recognized, Dr. Hecker, your testimony is especially important, because, for us, you have been a good teacher, as well as an observer. Your expertise on the technical aspects of plutonium, as well as highly enriched uranium, and the specific facilities of North Korea and other countries is really very, very important for us to have some sort of focused judgment to make recommendations to do the oversight that we're charged with doing.

We welcome you, and we look forward to your testimony. We ask you to take whatever time you may require to make a full exposition. We understand that this hearing, and your participation, must conclude at about 11 o'clock for you to meet obligations to brief others, namely at the State Department and in our administration, and to meet with the press. So we will gauge our question period accordingly, after your testimony, to accommodate our members.

Please proceed.

STATEMENT OF DR. SIEGFRIED S. HECKER, SENIOR FELLOW, LOS ALAMOS NATIONAL LABORATORY, LOS ALAMOS, NM

Dr. HECKER. Thank you very much, Mr. Chairman, Senator Biden. It's an honor to appear before you to talk about this very important issue. And also, thank you for your very kind words, both of you. I hope I can live up to your expectations.

Let me first state that I wish to thank Professor John Lewis, of Stanford University. Without him, I would have not gone to North Korea. Without the relationship that he had developed with North Korean officials since 1987, including about ten visits, without building up the trust, they would have never let me in, and they certainly would not have let me in to their nuclear facilities. So it was John Lewis' doing that wound up with me going to Yongbyon, as well as my colleagues, the rest of the people on the delegation.

Now, you pointed out, both of you, the seriousness of the North Korean nuclear issues. And Senator Biden, as you know, I was here 2 years ago, talking about the more global issues of my concerns of nonproliferation, and North Korea was certainly near the top. At that time, Pakistan was at the top, and, I must say, it remains at the top, of my list of concerns today.

But this issue is very serious. Our government, as you had indicated, has stated that it's seeking a peaceful resolution to the North Korean nuclear crisis. And my objective, for this trip, as a scientist, was to attempt to bring, just as you indicated, some clarity to the ambiguities surrounding the nuclear issues in North Korea. And, in fact, I told my hosts that—the North Korean officials of the Ministry of Foreign Affairs—that what I would like to do is to bring some clarity to this great ambiguity. And I said to them, I realize some of this ambiguity may be intentional, but ambiguities tend to lead to miscalculations; and when it comes to nuclear things, miscalculations can be disastrous.

Now, let me briefly state what I viewed as the key issues that surrounded the nuclear crisis in North Korea, before we went. And, Mr. Chairman, you've already referred to the principal one. Actually, they were all surrounded with the issues of, what have they done to restart the nuclear program that was frozen—particularly nuclear plutonium program—that was frozen as part of the Agreed Framework, in 1994?

And the first principal issue is the one that you mentioned, Mr. Chairman, about, what have they done with these 8,000 fuel rods? Have they, indeed, removed them from the safe storage place? And have they reprocessed them to extract the plutonium that's grown in during normal reactor operations? And it's estimated that the amount of plutonium in those 8,000 fuel rods that had been sitting in the reactor while it was operating for somewhere between 4, 5, or 6 years is about 25 to 30 kilograms of plutonium. And, of course, the concern is that that plutonium would be used to build nuclear devices or nuclear weapons. And so that was the principal concern. Had they removed them? And if they removed them what did they do? Did they extract the plutonium?

The second concern was North Korea operating its current reactor. Senator Biden, you mentioned the so-called 5-megawatt electric nuclear reactor that was used to produce some electricity and heat, but also to produce plutonium. They also had, under construction,

two bigger reactors, a 50-megawatt and a 200-megawatt reactor. And the question is, was the 5-megawatt reactor operating? How long did they intend to operate it? And then, could they scale up by finishing the other reactors? That was the second question.

The third one was, how much plutonium did North Korea produce before the IAEA inspectors were allowed to come in? And that was in 1992. And then, of course, did they build nuclear devices and nuclear weapons with that plutonium?

And the fourth question is, what's the status of the alleged program to enrich uranium? Now, Senator Biden, you mentioned that that's an alternative route to nuclear weapons. In essence, the two principal routes are: one can make plutonium in a reactor, and that plutonium is the key element for a weapon; or one can enrich natural uranium, which contains only seven-tenths of a percent of the fissionable isotope, or what I would call the high-octane isotope, called 235 uranium. The rest of it is 238 uranium. So in order to use uranium, you'd have to enrich it in 235, and that can be done through enrichment processes, which also tend to be very complex. And so you either have a reactor to make plutonium, or you have enrichment processes to enrich uranium. And the question is, what's the status of that program?

So those were the four key issues. And I will confine myself, in my prepared remarks, to these technical issues.

Senator Biden, you pointed out I'm not a diplomat. I certainly——

Senator BIDEN. You're pretty good. I didn't mean to imply you weren't diplomatic. I just think that what we're focusing on today is your scientific background and reputation there. That's all I meant.

Dr. HECKER. So I will, indeed, limit my comments to those technical issues.

I do have a written statement, Mr. Chairman, that I would like to enter into the record, which gives a rather detailed exposition. And I tried there to very precisely indicate what did the North Korean officials tell us about their nuclear program, and then what did we see; and, on the basis of what we saw, what do I conclude, at this point in time.

The CHAIRMAN. The statement will be published in full.

Dr. HECKER. Thank you.

So we visited Yongbyon, what they call the Nuclear Scientific Research Center, on January 8. We were there at the center from 10:30 until 5 p.m. We were toured through the center by the center's leadership. That was impressive, right off the bat; they had the director of the entire center. And then the facilities we visited, they had the chief engineers tour us through those facilities. And that's exactly the right thing to do if you'd like to explain to someone what's going on in——

Senator BIDEN. Why is it important to have the engineers?

Dr. HECKER. I beg your pardon?

Senator BIDEN. Why having the engineers is important, why was that——

Dr. HECKER. Oh, because the chief engineer of a facility knows everything that goes on in that facility. The director has, sort of, an overview; but if you want to ask the technical questions, the

chief engineer is the person to explain that, and they had the chief engineers for the facilities that we visited.

Senator BIDEN. Thank you.

Dr. HECKER. What we saw were the 5-megawatt reactor, a drive-by—a couple of times, actually—of the 50-megawatt electric reactor construction site—I'll call it that—and then we visited the spent-fuel storage area, what's called "the pool"—and I'll explain that in a minute—and then we visited the radiochemical laboratory. And we were told we were the first American delegation to visit that. I have, since then, found out, not only the first American delegation, but the first Americans. The IAEA inspectors had been in there, but the North Koreans had always been very careful not to let countries that did not have diplomatic relations with it to visit that facility. But they did, indeed, tour us through there. As I said in my written statement—I described that in some detail.

What I'll try to do now is to summarize to address the questions that I posed. And so the first one I'll take directly is this issue of the fuel rods, because that's the most crucial immediate issue.

You've already stated, Mr. Chairman, the issue was one of the 8,000 spent fuel rods. Let me just explain, for a moment, what that means, and then the issue of storage and what the Agreed Framework tried to accomplish with those 8,000 spent fuel rods.

The fuel rods in the reactor—and it's the fissioning in the fuel rods that provides heat, and that heat is then transferred through either electricity or it can make steam to provide heat for the town. And, indeed, that's what they did say that their reactor did. It turns out, when you fission uranium, you make neutrons, and if you have this 238 isotope of uranium in the reactor fuel, it will pick up a neutron from the fissioning process, and it will turn into plutonium, so it transmutes. So what we say, then, is that those fuel rods, the uranium fuel rods, will accumulate plutonium during the course of operations, and the type of reactor that the North Koreans chose is a reactor that turns out to be very good at making plutonium. It's, quite frankly, not all that good for making heat or electricity. It's an old reactor that's patterned after a British reactor that was called Calder Hall. And then, also, the French built a number of these reactors. Both of those countries have pretty much given up on those reactors, because there are better ways to just make plutonium; there are also better ways to make electricity.

However, this reactor has the additional benefit for the North Koreans that it can be run with natural uranium. And so this is the place where actually those two things get crossed over, that if you want to run a light water reactor, you have to enrich the uranium a little bit, from seven-tenths of a percent to 3 or 4 percent; then you put that in the reactor, as fuel. In this kind of a reactor, called the magnox reactor, for the fact that it uses magnesium cladding—it's what's called a graphite-moderated gas-cooled reactor—it turns out to use uranium metal as a fuel, and you don't have to enrich it. And the North Koreans have plenty of natural uranium resources.

Senator BIDEN. In the ground, in North Korea.

Dr. HECKER. That's correct, within North Korea.

They could then mine that, and go ahead and make these fuel rods, with a little bit of metallurgy, that turns out to be a uranium-aluminum alloy.

Senator BIDEN. Could you explain what a fuel rod is? Can you give us——

Dr. HECKER. Yes. So what you do, for the reactor, is you actually process this by making little uranium aluminum-alloy cylinders, maybe a few centimeters in diameter, a few centimeters high. You stack them up in a fuel rod about half a meter long. And then you put a cladding around it. And so it's like a big, long cylinder. But, again, because of the nature of this reactor, the cladding is actually a very complex piece of machining. It has cooling fins in it, like your radiator would at home in hot-water heating, in order to be able to let the heat out so you can extract the heat.

Senator BIDEN. So you have this cylinder that's clad, and you drop these pellets in.

Dr. HECKER. And then you take these fuel rods, half a meter long, the magnesium alloy, and then you stack those up, all 8,000 of them, in the core of the reactor. So that's what was in the reactor, and that was in there in 1994. It had been operating, producing whatever, including plutonium. And then, through the Agreed Framework, the decision was that those fuel rods now would be taken out and attempted to store safely and securely. That was part of the deal. And, actually, part of the deal was also that by the time that the KEDO organization would provide light water reactors for North Korea, those fuel rods would then actually be shipped offsite, away from North Korea. So it was important to make sure those fuel rods are someplace where they're safe and then can be taken out.

Senator BIDEN. Because, figuratively speaking, the bottom of these rods is the plutonium that you extract.

Dr. HECKER. No, it's not in the bottom; it's all throughout, uniformly, so—because every atom that's in there, of 238, when it sees a neutron, will turn into plutonium. So—and I'll get to that later—extracting that plutonium is not all that easy, but it takes good chemistry, and we've known how to do that for a long, long time, since Manhattan Project days.

So the issue, then, was the fuel rods. North Koreans took the fuel rods out, actually against the wishes of the IAEA. They took them out prematurely, and they stacked them, when they took them out, into metal baskets that they made, and essentially stacked 40 of these fuel rods into one basket, and then they put all these baskets in a pool of water, in a very deep pool of water. And the reason that you do that is that the other thing that's produced when you fission the uranium are fission products—and that is, when the uranium atoms split, it creates two other elements. The result of those fission products is that those things are very hot, radioactively, meaning they have deeply penetrating radiation, and so you have to shield that fuel, that spent fuel. Now, with time, that radioactivity will decay. That's another reason why you put these things in a pool, let them radioactively decay for a while, so that they're somewhat easier to handle.

Now, these things had been sitting in the pool from 1994 to 2002. However, the United States, as part of Agreed Framework, said,

"What we we're going to do is to do this safely." And taking a bunch of magnesium-clad uranium fuel rods and dumping them into a pool is not a good idea, because the magnesium does not do well with water. It tends to oxidize, corrode. Corrosion can lead to fracture of the fuel rods, and then you've got a significant radiation problem. And so the United States had agreed, and it sent out a team—Department of State, Department of Energy—to help the North Koreans re-can these fuel rods, all underwater, into U.S.-built stainless-steel canisters. They would first have water, water would be extracted, backfilled with an inert gas, and then the hope was that within those canisters this fuel then can sit for a long, long time. And then, in addition, to make sure that it's secure, the U.S. also built a structure that would allow this thing to be monitored; and it was, by the IAEA. So they actually put seals in place and had cameras in place. And we saw the cameras, but they were disconnected when the inspectors were asked to leave in December of 2002.

So that was the key issue, what happened to those fuel rods. Now I'll get to the answer—so we walked in, with appropriate protective clothing. The chief engineer took us up to the observation platform. We looked into the pool. First thing is that none of the structure that had been built—so-called poles and lock-down plates—for the verification was there anymore. That was gone. Not in sight.

Second is, when we looked into the pool, there was a metal grid to separate these—I should have said the U.S. canisters—there were 20 fuel rods in each stainless-steel canister. those were over half a meter long and about 10 to 12 inches in diameter, or so. They were stacked in, two high, into this grid, so that they would be nicely separated, down deep in the pool, the pool being, from what I read, somewhere between five and seven meters, so over 20 feet, deep.

We looked in, and many of the gridded areas were empty. There were no canisters. And once upon a time, they were all full. Some of the canisters had their lids off, and there didn't seem to be anything in there. And some of them were still there, closed.

So our hosts showed us this, took us back out in the conference room and said, OK, look, the fuel rods are gone. And, you know, in typical scientific fashion, I said, well, some of them appear to be gone, but how can I tell that they're all gone? And so they thought for awhile, then said, well, suppose you go back in and you pick one at random that's closed, and we'll open it for you? I said, that's a pretty good test. So we went back in, they did all of the operations, picked up this canister, left it in the water, moved it to a work station, opened it up, brought the light over, I looked in, and there were no fuel rods.

I also had a chance to look around the back—there was a back side of the pool—and all of the observations then were consistent with the fact that the fuel rods are gone. Now, quite frankly, I can't guarantee—it turns out there were—like, three of these canisters held some small bits and parts of broken fuel rods, and whether one of those is still in the second stage, somewhere at the bottom, that's possible. But, for all intents and purposes those fuel rods are gone.

Senator BIDEN. There's 8,000 fuel rods——

Dr. HECKER. So they're out of the pool.

So I asked them, of course, what did you do with them? They told us. They said, we reprocessed them. And we not only reprocessed them, but we reprocessed them to make plutonium metal. I'll come back to why that's significant. And I asked them all kinds of questions, how often did you ship these out? How did you ship them out? The bottom line is, all of their answers were straightforward, and they were all technically sound.

So then the next issue, OK, what did you do with the fuel rods? So they took us to what they called the radiochemical laboratory. We would call it a reprocessing facility. This is the place where you take these spent fuel rods, you chop off the ends of the magnesium cladding, and then you do a lot of chemistry. And you just dissolve everything in hot nitric acid, and then you begin, through magic chemistry, separating out the different elements. First thing you need to do is, you have to get these nasty fission products out. Those are the things that are really hot——

Senator BIDEN. Radioactive things.

Dr. HECKER [continuing]. That have penetrating radiation. Because, as I'll get to in a moment, by the time you get to the uranium or the plutonium, it also has radiation, but it's not very penetrating radiation, so it's a very different situation.

So this first part, you have to do in what are called "hot cells." They're heavily shielded, and then remotely operated through manipulators. So what they did is, they took us up to the—this building is a huge building, six-story building—took us up to the third floor, where they said, we will walk you through the observation corridor. You can look into the hot cells. But, by the way, we began that processing in January, mid January 2003, and we finished in June, end of June 2003, and we ran everything through. And so the facility is not now operating because there are no more fuel rods at this moment to process, but you can take a look at it. And so we did.

So we looked at all the different stations, where they explained, in detail, the chemistry of how you go through and you extract, by reprocessing, the plutonium. And they said they use what's called the standard PUREX process. That was actually developed during Manhattan Project days, principally, initially, at Oak Ridge, and then applied, very much so, at Hanford. PUREX just stands for plutonium uranium extraction process.

So we went through all of that. But then we would have gotten to the interesting part, which is, once you get the fission products out, how do you make the plutonium, and what form of plutonium do you make? As I said, because of the difference in radiation level, you do that in glove boxes. Glove boxes are different than hot cells. In glove boxes, you actually stick your arms in, through gloves, and you work with the plutonium directly.

Senator BIDEN. You're looking through a clear glass.

Dr. HECKER. And so you're looking through glass—they're stainless-steel glove boxes, compared to a remotely operated hot cell.

OK, they said, well, we can't show you those. That wasn't part of their authorized tour. And they looked at me—I had asked lots of questions—they said, OK, now we've demonstrated that we did

this reprocessing. And, again, I said, well, you know, really, you haven't. What you've shown me is that you have the facility, you have the equipment, you appear to have the capacity, and you have the technical know-how, how to do this. And, by the way, from the facility, you know, there's no question that it was an industrial-scale reprocessing facility. But, of course, I could not tell whether it operated yesterday or whether it—well, yes, probably that's true, that it was not operating yesterday, but whether it operated a week ago or 6 months ago.

So they took us in a conference room. When I expressed my skepticism, they said, well, would you like to see the product? And I was, sort of, taken aback, and I said, well, yes. You know, if you have the product to show, that would be one step closer.

So we're in the conference room, and they brought in a red metal box, opened that up, and inside was a white wooden box with a slide-off top. They opened that up, and inside, were two glass jars, sort of like jelly jars, with a screw-on lid, tightly sealed. And they said, this first one has 150 grams of oxalate, plutonium oxalate powder, certain chemical form of plutonium, which is one of the steps along the route, after you've extracted out the uranium and before you get to, sort of, a stable plutonium product. So oxalate is a step along the way. And it was a greenish powder.

The second jar, they said, well, that's the product, that's plutonium metal in this jar, and they said, it's 200 grams of plutonium metal, so kind of a fifth of a kilogram, or something close to half a pound, so reasonably substantial.

Now, plutonium is very dense. If you think lead is heavy or dense, plutonium is, sort of, 50 percent heavier than lead, depending on what particular form of plutonium you have.

So they covered that back up. Actually, along the way, they told us a little bit about the plutonium, I think trying to impress us that it was plutonium, because I asked what the density was. They told me between 15 and 16 grams per cubic centimeter. That's something that I do know something about. And so I raised my eyebrows, because to me that tells me right away what phase the plutonium is in, and the director added right away, "it's alloyed," which it turns out is something that you have to do to the temperamental plutonium in order to make it manageable. To be able to cast it or to be able to shape it into anything, you have to add something. "Alloy" means you add an additional chemical element, which changes the structure of the plutonium.

So they had all of that right, took it back out, and said, OK, now we've demonstrated our plutonium—and they often like to say "our deterrent." And I said, well, you know, actually—I looked at it very closely, and it looked like it could be plutonium. I looked at the metal. It was a peculiar shape that I, to this day, have not figured out why, and that is a funnel shape, thin-walled—and I describe the dimensions in my testimony—and I looked at the surface of that, and it was consistent with plutonium that had been cast recently. And they actually told me, they said, "this plutonium was cast from our most recent campaign, and it's the scrap piece from a casting." And the surface of the plutonium was, sort of, dark gray, blackish, rough surface, because it—they said, from the cast-

ing, which typically means that one uses graphite molds, and so it has, sort of, a rough appearance. So it looked OK.

They took the box back out, and I said, well, look, you know, being a scientist, I'd still like to get one step closer to being able to identify it. And I should have said, at the beginning, both of us said that this was not an inspection. I didn't bring an inspection team. I didn't bring any monitoring instruments. We were there at their invitation. So I tried to do the best with what I had. Having handled a lot of plutonium in my lifetime, I knew, getting back to what I mentioned earlier, that plutonium does not have penetrating radiation, and in fact we have observed plutonium, at times, if we want to look at its structure, by putting Saran Wrap over the top of the plutonium to take a look at it and bring it outside. You have to do that very carefully, but you can do it. Inside a heavy glass jar, a heavy-walled glass jar, that plutonium is not going to do anything to you. And in spite of the popular belief that plutonium is the most dangerous substance in the entire world, that's just not true.

So I thought, well there are two things I could do, so I asked them to bring the plutonium back in. I offered to my colleagues to have them leave, since they may not be as comfortable with handling the plutonium. They chose not to leave, although they did stand back, I must say. So I then said, there are two things I can do. I can try to hold the jar to see whether it's consistent with being heavy, because plutonium's so heavy, and, second, since it's radioactive, it's warm. And 200 grams, I knew, was, sort of, medium warm.

Senator BIDEN. The jar would be warm.

Dr. HECKER. The jar, of course.

And so the director said, fine, but you'll have to wear gloves. And I was just going to ask for gloves, because the potential there is, the only potential health hazard is there's some contamination at the seal. So I said I would wear gloves.

So they brought the plutonium back in. I said, I don't want the powder, but I'll take a look at the metal. And so I held the metal jar with this presumed plutonium inside, to take a closer look. And the first comment I made was, you know, it's not very warm, but it was warm. And the director said, right away, well, that's because the 240 isotopic content of the plutonium, one of the many isotopes of plutonium that gets grown into the reactor, as well as the high-octane 239 plutonium that one uses either for reactor performances or for bombs, that tends to warm up the plutonium more, and he said, "it's low 240 content," which also turns out to be—the lower the 240, the better weapons grade it makes for the plutonium. And I—well, I asked them what 240 content, and he says, "well, I can't tell you that, but you can ask the IAEA."

Then the second thing, in terms of the weight, it seemed about right. And then we had one more test. When we finished, I put it back. I said, I'd like to get my gloves monitored, to make sure I didn't pick up any contamination. They brought a radiation detector. And, from everything I can tell—I didn't get a really close look, but it was a Geiger counter. As soon as the technician turned that on, the Geiger counter went off. And it would pick up the weak gamma rays from the plutonium. He said, right away, "take this

plutonium away from here." They did. The detector settled down. They monitored my hands, and they found nothing. It's not the greatest way to monitor for contamination, but it's a way.

So the bottom line, then, is the following—and I've done much talking to our additional experts at Los Alamos, since, about what I saw, the color of the oxalate, the plutonium again, trying to figure out the shape of the plutonium, and the bottom line is the following, is that it certainly was consistent with the way plutonium looks. The oxalate, perhaps some weeks old, at least—the powder, that is—the plutonium metal, not very old, because it would have picked up an oxide in that air in the jar. But certainly the general weight, the shape, and the density one can calculate, everything is consistent with it being plutonium. And something in there was radioactive, because the probe went off. But I still cannot say, with a 100-percent certainty, what they actually showed me was plutonium, and I told them that. And I said, and even if I could say that it was plutonium, there is no way I could guarantee that this was from the 8,000 fuel rods or whether it's from something you had done before. The director immediately said, "well, of course you can't." He said, "you'd have to know the americium to plutonium–241," yet another isotope of plutonium ratio. And, of course, it turns out he was correct. So they knew what they were showing me.

So the bottom line, then, in terms of reprocessing—and I'm taking a long time to try to, sort of, anticipate your questions, to some extent—is the following. The fuel rods, for all intents and purposes, had been moved. They could be stored someplace else. We don't know that for sure. They put them back in their baskets. They could have stored them in a dry pit someplace. But, quite frankly, that would make no sense. It's also dangerous to do that, because a lot of those canisters had leaked again and there was water exposure, and they had previously been in the water. The magnesium alloy cladding corrodes. If you expose uranium, then you have a significant problem, in terms of contamination. So they could have stored them someplace else, but it doesn't make much sense.

Now, as far as reprocessing, they said they reprocessed. They also told us they reprocessed the entire campaign to metal. Again, quite frankly, that doesn't make much sense, because metal is—plutonium metal is difficult to store. If you think steel rusts fast, plutonium rusts much faster than steel, especially with any moisture. And I'm told that the humidity in Yongbyon in the summer—by people who worked there—is horrendous. So it wouldn't make much sense to store it all as metal, but that's what they said that they did.

And so they showed us something that's consistent with plutonium, but I couldn't tell, and I can't tell for sure that it came from this last campaign. What they did demonstrate is that they have the industrial-scale capability, the equipment, and the technical know-how to do all of that. I have more details in my testimony, but that's the bottom line on the fuel rods.

The other three things will be much faster. Making more plutonium. We visited the reactor. The reactor is operating. That actually was known, because that one can spot by satellite by looking at the steam plume from the cooling tower, and we saw the steam

plume. But we were in the reactor control room and in the observation deck of the reactor hall. It's operating. They claim that it's operating smoothly, that it's providing heat for their town that's been cutoff because of—the heavy fuel oil shipment has been stopped—that that was crucial. However, it's also, at the same time, accumulating plutonium again. And so it is making plutonium as we speak. And the estimate—and that's all we can do without knowing their precise operating parameters—is that makes about 6 kilograms per year. And so since it's already been operating a year, another 6 kilograms has accumulated.

Senator BIDEN. For that to run again, is there a need for another 8,000 fuel rods?

Dr. HECKER. So what they did, they had another 8,000 fuel rods ready to go, and they inserted them as soon as the IAEA inspectors left, and they're running the reactor again, and they say they need to run the reactor to make heat. And I said, of course, you're making plutonium. They said, we're making heat and electricity. And I said, OK, you're making it as a byproduct, then, but you're making plutonium. They said, of course.

So they're making 6 kilograms a year, and that will accumulate for the next whatever number of years. I asked them all sorts of question as to, how long do you feel good in running this current load of fuel? Do you have another load of fuel ready to go? The answer was, "yes, we have one more complete 8,000 stack of fuel rods ready to go. We're not in any hurry to make more, but we have the facility to make more." So they are making 6 kilograms a year.

Can they scale this up? That was the intent, by constructing the 50-megawatt reactor, which we can calculate would make about 56 kilograms a year, approximately. And, by the way, I state in my testimony that Dr. David Albright's book, along with O'Neill, Kevin O'Neill, was immensely helpful to me for preparing for this trip. And, indeed, that number is from his book. And then the 200-megawatt reactor, which is at a different site 20 kilometers away, that could make four times as much, you know, approximately 220 kilograms of plutonium a year.

Now, the 50, we drove by, as I had indicated, and the answer on the 50 is the following—is that construction has not been restarted. The site looks like it's had no activity since the inspectors left.

Senator BIDEN. The 50 had never been completed in the first instance.

Dr. HECKER. It had never been completed. It was said to be within 1 year of completion. And here's one of the key observations. That reactor site is really a pitiful site. It's in bad state of repair. They have done nothing, there are no construction cranes. The building is cracked, the concrete is cracked, the exhaust tower of steel is heavily corroded, the stuff that's lying around outside is heavily corroded, there are no windows in the place. It looks like a deserted structure. And the director himself said it was really quite a pity as to what's happened to the site. When I asked, how long would it take you to get this back up, they said, that's under consideration.

But the bottom line, there is no way that, very soon, they could scale up past this 6 kilograms a year, because that reactor is not ready, and it's not clear to me whether any of it is salvageable.

The 200-megawatt reactor, the different site, we were not able to see. Again, what they told us is nothing has been done and, again, they are considering what to do with the 200-megawatt reactor. I would expect it not to be in much better shape, but I cannot attest to that.

And then, since they're making more plutonium again, accumulating, then the question is, could they reprocess it? And the answer is absolutely yes, because they have this capacity in the radiochemical laboratory. They could take those fuel rods out at any time and reprocess the plutonium, if they so chose.

The next question was, that previous plutonium, how much did they have, and did they make nuclear weapons? And the answer to that is, I don't know, and we were not able to find out on this trip. I asked questions about the disposal sites and the disposal tanks, because there was significant controversy when the IAEA first went to Yongbyon and the North Koreans made a declaration of how much plutonium they had previously made. And because plutonium is radioactive, of course, it's feared; but because it's radioactive, you can also trace it. So you can trace these various isotopes in the disposal sites and know where they came from, and there were inconsistencies, which indicated the North Koreans have not been truthful about how much plutonium that they had previously made. In other words, they declared something like 60——

Senator BIDEN. Prior to 1994?

Dr. HECKER. Prior to 1992, actually. They had declared something like 60 grams of plutonium in the form of plutonium oxide. The estimates, generally, in David Albright's book, are potentially as high as 8½ kilograms, prior to 1992. And you've seen some of these estimates, intelligence estimates, that it's possible that North Korea could have made approximately 10 kilograms of plutonium. Again, Albright's best guess is about 8½.

So we were not able to shed any light. I asked questions, as I mentioned, about the disposal sites, but they said we were not allowed to tour those, and they were not able to answer me.

Then there's the issue of nuclear weapons, and that is, have they constructed any? And this was an interesting discussion, in that they, several times went to the final punch line and say, OK, look, now you have seen our deterrent, or, we have demonstrated our deterrent. And they used this word "deterrent" in a very ambiguous fashion. Only a couple of times did they actually say, specifically—the Vice Minister of Foreign Affairs, Mr. Kim Gye Gwan, mentioned once specifically, "we have weapons of mass destruction," and I believe he was referring to nuclear weapons. And then twice there was an allusion to the "arsenal." Like, at one time, when I made a comment, they said, so you want to see our arsenal, nuclear arsenal. But all the rest of the time, the word "deterrent" was used.

So the last day, I had several discussions with Ambassador Li Gun and also with the Vice Minister, when they said once again that, OK, we've demonstrated our deterrent. And I went through the following, and I said, no, you haven't. Because, to me, it takes at least three things to have a deterrent. The first one is, you've got to make plutonium metal. The second one is, you have to make

a nuclear device. And the third one is, you have to integrate that nuclear device, weaponize it, into a delivery system of some sort. And so I said, let's make sure that you understand what I'm coming away with. The first step, the making the plutonium metal, you've made a pretty good case, but I still—you know, as a scientist, I still can't say, with 100-percent certainty, but you've made a good case. Facilities are there, people are there, and so forth. The second case, you have shown me no facilities, you have not shown me anyone that I could talk to that would——

Senator BIDEN. For the device.

Dr. HECKER [continuing]. That is the device—that would give me any indication whatsoever that you can build a nuclear device. The response was, well, you know, you saw our people at Yongbyon. From their technical competence, can't you tell, and from the facilities? And I said, absolutely not. What I saw was pretty good reactor physics and a lot of good chemical engineering to extract the plutonium, and maybe a little bit of metallurgy. But the next step takes a lot of physics, a lot of computation. It takes a lot more metallurgy. It takes the understanding of high explosives. You have to do some high explosives non-nuclear testing, and then it takes the rest of the materials, and you have to know how to assemble it. And so, I had actually told them, late on Friday morning, look, bring me somebody that I can talk to about this so that I can get a better sense. By dinner that night, they told me, that it wasn't possible, there wasn't enough time to do so. And I said, well, that's fine, but you'll have to understand that then I did not see a deterrent, I'm not able to make a judgment as to whether you either have built nuclear weapons or you know how to build nuclear weapons. All I can say is, sort of, that first step. So that was the issue of the deterrent.

Then the fourth and last point is the HEU discussion, this alternative route. In 1994, a principal issue was associated with the whole plutonium fuel cycle and the question of plutonium in nuclear weapons. And then, as you know, in 2002 there was the issue, at a meeting of James Kelly, from the Department of State—the Assistant Secretary—with one of the Vice Ministers, Kang, from North Korea, and at this meeting the North Koreans allegedly had admitted to having a highly enriched uranium program, being confronted with that by James Kelly. And so this issue was raised by Jack Pritchard and also by Professor Lewis, and all I'll relate to you is just the shorthand version of what we were told. That is, Vice Minister Kim Gye Gwan said, "we do not have a highly enriched uranium program; and, furthermore, we never admitted to one." Jack Pritchard pointed out that that's a matter of interpretation. Our people think you admitted, the—you don't think you admitted. But the key is that the United States acted on the basis of its intelligence, and Mr. Pritchard said, "and I found that intelligence compelling. So, in the end perhaps one has to resolve this issue of what was said or not said, but we really acted on the basis of what we believe you have."

Professor Lewis tried to give the Vice Minister a chance to weasel out of this, is the best way I can say it, by saying, well, look, we're not sure what constitutes a program. Maybe you don't have a program, but maybe you have equipment. The Vice Minister said,

"we have no program, we have no equipment, and we have no technical expertise for enriching uranium. We decided to go the plutonium route some time ago, and that's where our expertise is."

Now, I can just relate to you what I heard. At that point, I did not ask questions. And, of course, we would not have been shown any facilities associated with highly enriched uranium. So I cannot judge. All I can do—the clarity that's come out of this is that whatever was said before, or not said, this time the Vice Minister left no ambiguity. He said they had none of those—no program, no equipment, and no people.

So let me then summarize by saying, these observations that I've just gone through, not quite in that detail, but I shared those observations with the Vice Minister Kim Gye Gwan at the closeout dinner. And I said, Mr. Vice Minister, I want you to hear first—you showed us the facilities, and you had said at the beginning that I can form my own conclusions and take those back to my government. Here are my conclusions, as best as I know how. I also cautioned him, as I will caution you, as any scientist, when you get a bunch of information, you still have to analyze it. I've been doing that ever since I left North Korea, I will do that some more by talking to more people yet who were there in North Korea as part of the canning team, my own colleagues of Los Alamos, and other laboratories, to make sure that the conclusions I reach are with as little ambiguity as possible. And I told the Vice Minister that. I said, I've told you everything, because I want there to be no surprises to you when I go back, so you hear the same thing from me that our government's going to hear. I think he was a little disappointed that I wasn't able to be more definitive, but in the end, the bottom line was, he said, look, I respect what you said. Tell them what you told me. Don't add anything, don't subtract anything, and that is the way we left it.

So my thought, then, was also the importance of this "no surprises" is that obviously I couldn't answer all the questions. It was not an inspection team. And, quite frankly, I hope there is a return opportunity. And the only way that you can do that is to build some trust and some respect in this process, and I wanted them to know that I was going to do this in as fair a way and give as fair an analysis as I possibly could.

So I hope that there is a followup, in that at least a reduction of some of the ambiguity will facilitate a diplomatic solution, and that there will be a peaceful solution to the nuclear crisis on the Korean Peninsula. And then, of course, that's the reason that I went. I also would say the role of the scientist is such that should we somehow have a solution of a freeze or denuclearization, the scientists will have to implement, and then the scientists will have to verify and support the diplomatic process, and so I thought this was a good opportunity for a scientist to take that first little step along the way.

So thank you for being so patient for such a long presentation, but I wanted to lay it out as clearly as I could.

Thank you, Mr. Chairman, Senator Biden.

[The prepared statement of Dr. Hecker follows:]

PREPARED STATEMENT OF DR. SIEGFRIED S. HECKER, SENIOR FELLOW, LOS ALAMOS NATIONAL LABORATORY, UNIVERSITY OF CALIFORNIA

VISIT TO THE YONGBYON NUCLEAR SCIENTIFIC RESEARCH CENTER IN NORTH KOREA

Mr. Chairman, distinguished members of the Committee, I am honored to share with you my report of a rather unexpected and extraordinary visit to the Yongbyon Nuclear Scientific Research Center in North Korea (the Democratic People's Republic of Korea). I will submit a written statement for the record and summarize my observations this morning.

BACKGROUND

I visited the Democratic People's Republic of Korea (DPRK) and the Yongbyon Nuclear Scientific Research Center as part of an unofficial U.S. delegation led by Professor John W. Lewis of Stanford University. Professor Lewis is an Asian scholar at Stanford, specializing in China and North Korea. Professor Lewis' visit was part of his ongoing dialog with officials of the DPRK concerning the North's nuclear program. He has visited the DPRK ten times since he began this dialog in 1987. He last visited the DPRK just before the official six-party talks in Beijing last August. DPRK officials invited him to return. When they indicated that they may allow him to visit the nuclear facilities at the Yongbyon Nuclear Scientific Research Center, he contacted me to accompany him to provide scientific expertise. Since I work for the Los Alamos National Laboratory, which is operated by the University of California for the Department of Energy, I requested and received the necessary U.S. Government approvals for travel to China and the DPRK. I have known Prof. Lewis for approximately 15 years. We have collaborated on other global security issues.

Joining our delegation at Prof. Lewis' invitation was Charles L. (Jack) Pritchard, Visiting Scholar at the Brookings Institute and formerly the U.S. special envoy for DPRK negotiations. In addition, two Senate Foreign Relations Committee experts on Asian affairs, Mr. W. Keith Luse and Mr. Frank S. Jannuzi, had separately planned a trip to the DPRK. They joined our delegation in the DPRK and participated in our visit to the Yongbyon Nuclear Scientific Research Center.

The host organization for our visit was the DPRK Ministry of Foreign Affairs. Ambassador Li Gun accompanied us during the entire visit. Vice Minister Kim Gye Gwan met with us on three separate occasions. In addition to the visit to the Nuclear Scientific Research Center, Prof. Lewis had arranged other meetings with DPRK officials to cover economic, military, and science issues. Mr. Luse and Mr. Jannuzi arranged some additional meetings on their own. I will restrict my written statement to the areas of my expertise, namely the nuclear issues. More specifically, I will focus on what we learned during the visit to the Yongbyon Nuclear Scientific Research Center.

DPRK STATEMENTS AND MOTIVATION TO SET THE CONTEXT FOR THE VISIT

Vice Minister Kim [Gye Gwan] indicated that they were very interested in resuming the six-party talks. The DPRK made a proposal on Dec. 9, 2003 to freeze its nuclear activities and received no response from the United States. Vice Minister Kim indicated that they have just repeated this proposal and this time Secretary Powell responded positively. [The following quote from Secretary Powell appeared in AFP, January 7, 2004: "This is an interesting step on their part, a positive step, and we hope that it will allow us to move more rapidly to six-party framework talks. I am encouraged, I am encouraged by the statement the North Koreans made."]

Vice Minister Kim stated, "The most reasonable way to proceed] is to have simultaneous action steps. . . . The U.S. says it will give us a security assurance if we dismantle our nuclear program. We say it differently. The first step would be a freeze of the present [DPRK] nuclear activities. You will see how important a freeze will be when you are at Yongbyon. This means there will be no manufacturing, no testing, and no transferring of nuclear weapons."

Vice Minister Kim stated, "We view the delegation's visit to Yongbyon as a way to help contribute to breaking the stalemate and opening up a bright future. We will not play games with you. We have invited you to go to Yongbyon. The primary reason for this is to ensure transparency. This will reduce the assumptions and errors. . . . This visit can have great symbolic significance."

"We want you to take an objective look, and we will leave the conclusions to your side. This is why the inclusion of Dr. Sig Hecker is so significant." Mr. Pritchard stated that we are unofficial and that we are not an inspection team. Kim continued, "Hecker's presence will allow us to tell you everything. This is an extraordinary approval by us. . . . We, too, emphasize that you are not making an inspection.

But, because we are allowing this visit, we will provide you enough access to have good knowledge."

Vice Minister Kim indicated that based on the U.S. actions in November 2002, the DPRK decided that the Agreed Framework was no longer in its interest, so it terminated the IAEA [International Atomic Energy Agency] inspections and withdrew from the NPT. The DPRK decided to operate the 5MWe reactor and resume reprocessing of plutonium for peaceful nuclear activities. He stated, "It is the only way to keep the spent fuel rods safe." He added, "At the same time, the hostile U.S. policy had been intensified. So, we changed our purpose and informed the U.S. that the plutonium that was to have been used for peaceful purposes would now be used for weapons. Originally, we had wanted to keep the reprocessed plutonium in a way we could store it safely. Then, we changed the purpose in order to strengthen our deterrent."

Vice Minister Kim added that the DPRK wants a peaceful resolution of the nuclear crisis. They want a denuclearization of the Korean Peninsula. He emphasized that the DPRK has been very flexible and very patient, adding, "I should note that the time that has been lost [in dealing with us] has not been beneficial to the U.S. side. With an additional lapse in time, our nuclear arsenal could grow in quality and quantity. The outcome has not been a success for the U.S."

I provide this political background to set the context for potential motivations for the DPRK decision to invite us to visit the Nuclear Scientific Research Center. They have publicly stated that they have reprocessed the fuel rods to extract plutonium and strengthen their "deterrent." It appears they were concerned that the United States (and perhaps others) did not believe them. So, they may have invited us to provide independent confirmation of their claims.

However, Vice Minister Kim also expressed a concern about their decision to invite us to Yongbyon. He stated: "If you go back to the United States and say that the North already has nuclear weapons, this may cause the U.S. to act against us." At a later meeting, he returned to this concern by stating, "We are concerned that the U.S. Government will use what you conclude [as a pretext] to attack us. The U.S. might claim that this visit proves that the DPRK has crossed a red line when it restarted the reactor. Can we be sure that the U.S. will refrain from action if it declares that we have gone beyond its red line—such as finishing of the reprocessing and the change in the purpose of the reprocessing [from peaceful safety-related reasons to making weapons]?"

So, I believe the DPRK wanted to show us the Yongbyon Nuclear Scientific Research Center to verify that they had taken significant actions since December 2002 and to impress us with their nuclear capabilities. The Center leadership and its specialists were very cooperative within the boundaries of what they were authorized to show us. Nevertheless, DPRK officials had reservations about our visit and they recognized the risks involved. They obviously decided the potential benefits of our visit justified taking the risks.

MY MOTIVATIONS FOR GOING TO THE DPRK

I explained to our DPRK hosts my decision to accept Prof. Lewis' invitation to join him on this trip. I have been concerned about the ambiguities associated with the DPRK nuclear program. I realize that some of the ambiguities may be deliberate. However, ambiguities often lead to miscalculations, and in the case of nuclear weapons-related matters, such miscalculations could be disastrous. So, I had hoped that as a scientist I could help to bring some clarity to the DPRK nuclear situation by visiting the Yongbyon Nuclear Scientific Research Center.

I also stated that I believe the role of scientists (and I should add engineers) is very important to the diplomatic process. I see three important roles. First, to bring clarity to the issues so as to facilitate a diplomatic solution to the nuclear crisis. Second, if a diplomatic solution is found, scientists must help to implement any solution such as a freeze or eventual denuclearization. Third, scientists will be crucial to help verify any such solution. So, it is my hope that my visit might be a small step in this direction.

LOGISTICS OF THE VISIT TO THE YONGBYON NUCLEAR SCIENTIFIC RESEARCH CENTER

On Thursday, January 8, 2004, all five members of our delegation visited the Center, which is near the town of Yongbyon, roughly 100 km north of the DPRK capital of Pyongyang. We were accompanied by Ambassador Li Gun, an official from the General Bureau of Atomic Energy and a security escort. We were greeted by Professor Dr. Ri Hong Sop, Director of the Nuclear Scientific Research Center. The Center reports to the General Bureau of Atomic Energy. Also present at our introductory briefing were Choi Ku Man, Assistant Director of the Center, Li Yong ho, Safe-

guards Section Head, Kim Haik Soon, Senior Center Researcher, Pak Chang Su, Center Researcher.

At the Yongbyon Nuclear Scientific Research Center, Director Ri Hong Sop] toured us through the following facilities:

- The Experimental Nuclear Power Plant (the DPRK name for what we call the 5 MWe [5 megawatt electric] reactor). We were toured through the control room and the observation area for the reactor hall. This facility is inside the first security area of the Yongbyon facility. Our guide was Chief Engineer of the facility, Li Song Hwan.
- The spent fuel storage pool building next to the 5 MWe reactor, also guided by Chief Engineer Li Song Hwan.
- Drive by (twice) of the 50 MWe reactor site. Inside the second high-security area of the Yongbyon facility.
- Radiochemical Laboratory—3rd floor corridor that allowed for viewing of the hot cell operations through shielded glass windows and a conference room. (This facility is also inside the second high-security area). Our guide was Chief Engineer of the Radiochemical Laboratory, Li Yong Song.
- Guest House for introductory and wrap-up discussions with Center facility leadership.

Our hosts drove us from Pyongyang to the Yongbyon facility. We left the hotel at 8:30 a.m. and returned shortly before 7:00 p.m. We spent from 10:30 am to 5:15 p.m. at the facility.

OBSERVATIONS FROM THE VISIT: WHAT WE WERE TOLD AND WHAT WE SAW

I will present my observations for each facility. I will first summarize what we were told by the Center leadership (*shown in italics*) and then summarize my observations (in regular font). The director and the two chief engineers each stated that it was U.S. actions that forced the DPRK to take steps to resume nuclear operations.

The 5 MWe reactor

They stated that they have restarted only the Experimental Nuclear Power Plant (the 5 MWe reactor). The plant was restarted in February 2003. It now is operating smoothly at 100% of its rated thermal power. They are producing electricity and heat from the reactor now for their town. The reactor is the main source of heat for the town now that the 10,000 metric tons (tonnes) of heavy fuel oil supplied annually to their region (as part of the 500,000 tonnes agreed to in the Agreed Framework) has been cut off.

We confirmed that the 5 MWe reactor is operating now. We were shown the control room and the reactor hall. All indications from the display in the control room are that the reactor is operating smoothly now. The steam plume emanating from the cooling tower [visible both in the morning and afternoon] confirmed operation. However, we have no way of assessing independently how well the reactor has operated during the past year.

The length of time the reactor is expected to operate with the current load of fuel depends on how the situation with the United States develops. They do not have safety concerns about running the reactor for a long time [implying years]. They stated that some of the operational problems experienced previously have been corrected. However, they are prepared to reprocess the current fuel at any time.

We commented to our hosts that in addition to producing electricity and heat the reactor is also producing new plutonium. Best estimates are that under current reactor operations approximately 6 kg of plutonium is produced annually in the spent fuel.[1] The reactor may currently contain approximately 6 kg of plutonium in the spent fuel rods, and it will continue to produce an additional 6 kg each year assuming the reactor operates efficiently.

They stated that have one more charge of fuel for the reactor fabricated now. The fuel fabrication facility is partially operational and partially under maintenance. They are in no hurry to fabricate more fuel since the two bigger reactors under construction are not close to operation.

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[1] David Albright, Kevin O'Neill, editors. "*Solving the North Korean Nuclear Puzzle,*" ISIS Reports, The Institute for Science and International Security, Washington, D.C., 2000.

We did not have the opportunity to visit the fuel fabrication facility. However, these comments are consistent with previous U.S. estimates. In previous years, the fuel fabrication complex was reported to be making fuel elements containing about 100 tonnes per year of uranium. The complex is believed to have produced enough fuel for the initial loading of the core for the 50 MWe reactor under construction. Moreover, the nominal capacity was appreciably larger.[1]

50 MWe reactor

They told us that construction stopped in 1994. They stated that at that time it was within one year of completion. Nothing has been done since. They are currently evaluating what to do with the reactor.

We drove past the 50 MWe reactor site twice. We confirmed that there is no construction activity at this site. There were no construction cranes on site. The reactor building looks in a terrible state of repair. The concrete building structure showed cracks. The steel exhaust tower was heavily corroded, as was other steel equipment on the site. The building was not closed up and resembled a deserted structure. The NSC director expressed his great dismay about the deterioration of the facility because of the eight-year freeze. This reactor is much more than one year from completion now. It is not clear how much of the current structure can be salvaged.

200 MWe reactor at Tacheon (this reactor site is 20 km from Yongbyon)

They stated that construction also stopped in 1994. They are also evaluating what to do with the reactor.

This reactor location is at a different site. We were not able to assess the current situation.

Spent fuel storage building

They stated that they removed all 8000 fuel rods from the spent fuel storage pool and shipped them to the Radiochemical Laboratory (plutonium reprocessing facility) and reprocessed them [to extract the plutonium]. The fuel rods were taken out of the pool in Korean containers (metal baskets) and placed in specially shielded shipping casks. During the removal of the fuel rods they found that about half of the U.S. canisters had leaked during storage. But they claimed not to have experienced major problems getting the spent fuel rods out of the pool and transporting them in special casks by truck daily to the Radiochemical Laboratory for reprocessing.

These are the spent fuel rods that the DPRK had removed from the 5 MWe reactor after it ceased operation in 1994 as part of the Agreed Framework. In 1995, a few months after the Agreed Framework was signed, preparations for the canning began. The process turned out to be quite involved and was not finished until June 2000. During this time, the United States Department of State and Department of Energy (supported by the Pacific Northwest National Laboratory and the Nuclear Assurance Corporation) worked jointly with the DPRK to package these rods in 400 U.S. supplied stainless steel canisters to store safely (with dry inert gas inside the canisters) in a deep pool of water (for radiation shielding) to allow the radioactivity level of the rods to decrease with time. This facility was fitted with various devices and seals by IAEA inspectors to ensure that the fuel rods would not be tampered with. However, the IAEA inspectors were dismissed by the DPRK in December 2002. Only DPRK personnel have had access to the Nuclear Scientific Research Center since that time.

Our initial look into the spent fuel pool showed that the locking plates and associated structures that the U.S. Spent Fuel Team had put in place after the canisters (loaded with the 8000 fuel rods) were inserted into the pool were gone. We immediately confirmed the fact that all fuel rods were no longer in the pool because many of the canisters were missing and many were open. The building was not heated and we found a thin sheet of ice on the pool surface. When I expressed concern that some of the canisters were still closed, they took the extraordinary step of allowing me to pick one at random and open it [all done under water in the pool] to demonstrate that there are no fuel rods remaining, even in the closed canisters. The randomly selected canister did not contain any fuel rods (it initially contained 20). This and other observations convinced me that the spent fuel pool is empty; the fuel rods are gone. It is possible that they moved the 8000 fuel rods to a different storage location. However, such storage would represent a serious health and safety hazard. [During the tour of the Radiochemical Laboratory, I asked if we could visit the Dry Storage Building, which serves as the port of entry for the fuel rods into that laboratory, they said that it was not available for a tour because there was no activity and there were no workers in the building.]

Radiochemical Laboratory

They stated that they reprocessed all 8000 spent fuel rods in the Radiochemical Laboratory in one continuous campaign, starting in mid-January 2003 and finishing by the end of June 2003. They stated that their capacity in the Radiochemical Laboratory is 375 kg uranium per day (they said they worked four 6-hour shifts around the clock). They later added that the reprocessing capacity of the facility under normal operating conditions is 110 tonnes of spent uranium fuel per year. Therefore, they were able to finish the current campaign of 50 tonnes of spent fuel rods in less than six months. They told us that we would tour the corridor next to the hot cells in which the reprocessing occurs. The campaign is complete; the facility is not operating now. Everything has been cleaned up and there is no radiation hazard in the corridor.

At the Radiochemical Laboratory we confirmed that they possessed an industrial-scale reprocessing facility. The facility appeared in good repair. They demonstrated the requisite facilities, equipment, and technical expertise required for reprocessing plutonium at the scale in question. They use the standard PUREX (plutonium uranium extraction) process for separating plutonium from the fission products and uranium fuel. They answered all our technical questions about the reprocessing chemistry very competently. We were not able to see the glove boxes used for the final plutonium purification and production. They indicated that these were downstairs and not part of today's tour. In his book, Albright stated that five glove boxes were used during this process to produce plutonium dioxide product. He also reported that one or two glove boxes may have been removed before inspectors were permitted on site.[2] These boxes could presumably have been used to process plutonium dioxide the typical plutonium product from the reprocessing operation] into metal and to cast or shape plutonium metal. Based on our tour we are not able to confirm or deny that the facility operated during the first half of 2003.

They stated that the Radiochemical Laboratory was built through their own efforts. They began construction in 1986 and the main parts were completed by 1990. At that time they ran a "hot test" of the facility with 80 fuel rods and natural uranium rods to extract 60 grams of plutonium.

Albright reported that the hot test involved 86 fuel rods irradiated in the 5 MWe reactor combined with 172 fresh fuel rods. He also reported that in 1992 the DPRK presented plutonium oxide containing about 62 grams of plutonium to the IAEA inspectors. However, the total amount of plutonium actually processed by the DPRK before IAEA inspections began in 1992 is still strongly disputed.[2]

When asked about the disposition of the waste stream, they stated that the waste from the most recent reprocessing campaign was mixed in with the waste from the "hot test" of the 80 fuel rods processed in spring of 1990.

We were not able to visit the waste facilities and, hence, cannot confirm this statement. Even if we had toured the facility, we could not make a judgment without sophisticated sampling and measurements of the nuclear wastes. However, this type of information is important for tracing the reprocessing history of the facility.

They stated that they initially intended to run the fuel cycle for civilian purposes (which means they would have stored the plutonium product as plutonium dioxide) but because of the hostile U.S. actions, they reprocessed the entire campaign to plutonium metal. They stated that this processing was done in the Radiochemical Laboratory by installing some glove boxes that were not present during IAEA inspections. It took them three months to install the equipment and prepare it for the plutonium metal processing step.

We were not able to see the glove boxes for the final plutonium operations. However, their comments indicated that they had glove boxes for plutonium metal production ready to go. This indicates that they had experience making plutonium metal before the IAEA inspections began in 1992. Albright[3] estimated that the 8000 spent fuel rods in question could yield between 25 and 30 kg of plutonium metal.

Although we could not see the plutonium glove box operations, they took the extraordinary step of showing us the "product" from what they claimed to be their most recent reprocessing campaign. In a conference room following the tour, they brought a metal case that contained a wooden box with a glass jar they said contained 150 grams of plutonium oxalate powder and a glass jar they said contained 200 grams of plutonium metal for us to inspect.

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[2] See D. Albright and K. O'Neill, Reference 1.
[3] See D. Albright and K. O'Neill, Reference 1.

The glass jars were fitted with a screw-on metal lid and were tightly taped with transparent tape. (The plutonium's alpha-radiation is easily stopped by the glass jar). The green color of the plutonium oxalate powder is consistent with plutonium oxalate that has been stored in air for some time. The plutonium metal was a thin-walled (approximately ⅛-inch thick) funnel (approximately 2-inch diameter at the base and 1-inch diameter at the top, approximately 1½ inches high) that they claimed to have been scrap from a casting from this reprocessing campaign. When asked about its density, they responded, "between 15 and 16 g/cubic centimeter and that it was alloyed [a practice common in plutonium metallurgy to retain the δ-phase of plutonium which makes it easier to cast and shape]. The metal surface and color were consistent with moderately oxidized plutonium metal from a casting (I believe it could not have been in the jar for a period of many weeks because it did not show any loose oxide powder). I tried to get a feel for the density and heat content of the alleged plutonium metal by holding the glass jar in a gloved hand. The glass jar (very thick walled) was reasonably heavy and slightly warm (importantly, however, it was definitely not cold as was everything else in this building). The bottom line is that with the rather primitive tools at hand I was not able to definitively identify the purported metal and the powder as plutonium. It was radioactive, however, because a radiation probe (which appeared to be a Geiger counter [Geiger Müller detector]) registered a count when turned on near the wooden box containing the glass jars. With a few relatively simple tests, we would be able to positively identify the product as plutonium metal, but that was not possible to do during this visit.

Furthermore, even if we could confirm that the product we were shown is plutonium, we would not have been able to confirm that it came from the most recent campaign without additional, more sophisticated isotopic measurements that would let us identify the age of the plutonium. The director of the NSC confirmed this by stating, *"you would have to measure the americium to plutonium-241 ratio to determine its age."* He was correct.

When asked about the isotopic content of the plutonium, specifically its Pu-240 content, they stated, "the plutonium-240 content from this campaign is low, but we are not authorized to tell you. The IAEA knows, you can ask them."

We were in no position to assess the isotopic content of the plutonium produced or that shown to us.

They also stated that the plutonium metal was alloyed, but they were not authorized to tell us what alloying element was used [they did add, you know what it is, and we do it the same].

We were in no position to tell whether or not the plutonium metal shown to us was alloyed. However, the fact that it was not cracked and that their specialists claimed that the plutonium had a density between 15 and 16 grams/cubic centimeter is consistent with plutonium alloyed with approximately 1 weight percent of gallium or aluminum. A calculation of the rough dimensions and weight is also consistent with these values. However, the uncertainty in my observations is very large.

Mr. Luse asked about a concern of yours Mr. Chairman; that is, the security of their nuclear materials. Director Ri responded, "Be at ease with this problem. I am not authorized to give you an explanation on this, but we feel certain that the protection and safety—the security—are good."

We were also told that the effects of another freeze or decision to denuclearize would have devastating effects on the work force. Director Ri indicated that all of his people, including he, would have to look for new jobs.

OTHER OBSERVATIONS AND COMMENTS RELATED TO THE NUCLEAR ISSUES

The DPRK "deterrent"

During follow-up discussions with Ambassador Li and Vice Minister Kim in Pyongyang, they stressed that the DPRK now has a nuclear deterrent and that U.S. actions have caused them to strengthen their deterrent—both in quality and in quantity. Ambassador Li inquired if what I had seen at Yongbyon convinced me that they had this deterrent.

I explained to both of them that there is nothing that we saw at the Yongbyon Nuclear Scientific Research Center that would allow me to assess whether or not the DPRK possessed a nuclear deterrent if that meant a nuclear device or nuclear weapon. We found that both in our visit and in previous declarations by the government of the DPRK that the term "deterrent" was used in a very ambiguous manner.

I explained that I view a "deterrent" to have at least three components: 1) The ability to make plutonium metal, 2) the ability to design and build a nuclear device, and 3) the ability to integrate the nuclear device into a delivery system. What we saw at Yongbyon was that they apparently have the capability to do the first. However, I saw nothing and talked to no one that allowed me to assess whether or not they have the ability to design a nuclear device. And, of course, we were not able to assess the integration into a delivery vehicle. Moreover, during additional discussions I cautioned that "deterrence" might have worked between the United States and the Soviet Union, two equally armed nuclear superpowers under rather predictable circumstances. The concept of nuclear deterrence may have little meaning for the U.S.-DPRK situation. I asked Ambassador Li in the late morning of the last day of our visit if I could meet individuals who could talk to me in some detail about their "deterrent" in the spirit that I had just described. He said he would try, but that evening told me that the time was insufficient to make such arrangements.

Highly-enriched uranium issue

In the Foreign Ministry, we discussed the contentious issue of DPRK's supposed admission on October 4, 2002, to having a clandestine highly enriched uranium (HEU) program in violation of the letter and spirit of the 1994 Agreed Framework. There is a controversy about whether the DPRK admitted to having such a program at a meeting with U.S. officials. The disagreement concerns a difference between what DPRK officials believe they said and what U.S. officials believe they heard. DPRK officials provided us with a copy of the Korean text of what Vice Foreign Minister Kang Sok-ju said at the meeting. Regardless of how this issue is eventually clarified, one will still have to deal with the facts.

During our meeting, Mr. Pritchard stated, "The key issue is the intelligence that makes the United States believe that the DPRK has an HEU program. In the U.S., there is the widespread view that the complete, verifiable resolution of this HEU issue is now mandatory. This is a practical issue, and there must be a multilateral discussion to resolve it." In response, Vice Minister Kim Gye Gwan stated that the DPRK had no HEU program. Upon further questioning he stated that the DRPK had chosen the plutonium path to a deterrent. It had no facilities, equipment or scientists dedicated to an HEU program, adding, "We can be very serious when we talk about this. We are fully open to technical talks."

CONCLUDING REMARKS

Mr. Chairman, I would like to summarize my observations based on our visit to the Yongbyon Nuclear Scientific Research Center and discussions in Pyongyang.

- The 5 MWe reactor has been restarted. It appears to be operating smoothly providing heat and electricity, while also accumulating approximately 6 kg of plutonium per year in its spent fuel rods.
- The 50 MWe reactor construction site appears to have seen no activity since the IAEA inspectors were instructed to leave in 2002. The reactor and the construction site look in a bad state of repair. It would require a major construction program to finish the reactor.
- The spent fuel pond is empty; the approximately 8000 fuel rods have been moved.
- The DPRK claimed to have reprocessed all 8000 fuel rods to extract plutonium metal during one continuous campaign between mid-January 2003 and end of June 2003. The 8000 fuel rods are estimated to contain up to 25 to 30 kg of plutonium metal. We could not definitively substantiate that claim. However, the Radiochemical Laboratory staff demonstrated that they had the requisite facility, equipment and technical expertise, and they appear to have the capacity to do so.
- It is possible that they moved the 8000 fuel rods to a different storage location. However, such storage would represent a serious health and safety hazard.
- We were shown what was claimed to be a sample of plutonium metal product. I was not able to definitively confirm that what we saw was actually plutonium metal, but all observations I was able to make are consistent with the sample being plutonium metal. However, even if the sample were plutonium metal, I would not have been able to substantiate that it was plutonium from the most recent reprocessing campaign. Such a determination requires more sophisticated measurements.
- In the foreseeable future, the DPRK can produce 6 kg of plutonium per year in its 5 MWe reactor. It easily has the capacity to reprocess the spent fuel at any time to extract the plutonium. It also has the capacity to reload the reactor

with fresh fuel for a second and subsequent reloading. It is not, however, in a position to increase the rate of plutonium production much beyond 6 kg per year without a major construction project at the 50 MWe or 200 MWe reactor sites, something that would be difficult to do clandestinely.

- Officials of the DPRK Ministry of Foreign Affairs claimed that the DPRK had weapons of mass destruction. They believe that they provided us with evidence of their "deterrent." At Yongbyon, they demonstrated that they most likely had the capability to make plutonium metal. However, I saw nothing and spoke to no one who could convince me that they could build a nuclear device with that metal, and that they could weaponize such a device into a delivery vehicle. We were not able to arrange meetings with DPRK staff who may have such expertise or visit related facilities.
- Officials of the DPRK Ministry of Foreign Affairs also stated categorically that the DPRK has no program for enriching uranium. Moreover, they claim to have no equipment and no scientific expertise to do so. We were not able to substantiate these claims.

Let me close by stating that I shared these conclusions with our DPRK hosts before my departure. I told them that my observations still have uncertainties. I may be able to reduce some of the uncertainties through discussions with other U.S. specialists, with additional analysis, and through peer review. I intend to do so and write a more comprehensive technical report in the future. The response of the DRPK officials was quite positive although they had hoped that my conclusions would be more definitive. They asked me to report my observations as I presented them.

Finally, Mr. Chairman, I found the trip to be remarkable. Our DPRK hosts were most courteous and cooperative. I would like to acknowledge the Albright/O'Neill book on the Korean Nuclear Puzzle, the Report from the Department of State/Department of Energy Spent Fuel Canning Team, and discussions with several of my colleagues at Los Alamos, all of which helped me to prepare for this visit. I hope that our findings will contribute at least in some small way to a resolution of the current nuclear crisis and the eventual denuclearization of the Korean Peninsula. Thank you for giving me the opportunity to share our findings with you.

The CHAIRMAN. Well, thank you very much, Dr. Hecker. We appreciate your laying it out specifically and step by step, so that there is no ambiguity in our understanding of this very complex situation.

Now, let me proceed by indicating that a satisfactory resolution of the six-power talks is going to require full verification, and opportunities for full verification, that, the nuclear possibilities—that is, either weapons, metal, facilities, so forth—can be inspected, and continuously so. You have indicated, very clearly, that in your conversations with the North Koreans, they denied having another program—that is, the uranium route—and that they chose, they say, the plutonium route. Regardless of the ambiguities, in terms of their response to Secretary Kelly last year, we have to understand that that's the way that it is.

Obviously, the United States and hopefully others will still be interested. Are there other facilities, other than Yongbyon, where you have now observed what you've observed, whether they be enriched uranium facilities, plutonium, or anything else that has to do with weapons of mass destruction? The question is verification, obviously, at Yongbyon, which IAEA performed for 8 years, but, likewise, other situations that may be unknown to us. Can you give us any guidance as to how we ought to proceed? In other words, as this committee asked questions of Secretary Kelly or others who may come before our committee—because I've indicated we're deeply interested in the six-power talks and their progress—what should we ask, or what should we suggest? What is a reasonable

position—not only reasonable, but a safe one—for the United States, as we proceed down this trail?

Dr. HECKER. Mr. Chairman, that's a very good question, and obviously the $64,000 question, if we're going to achieve a verifiable final solution. Let me try to answer in the following way. First, to split the plutonium and the uranium issues.

On the plutonium, it is possible to verify what goes on at Yongbyon, in my opinion. And actually, the IAEA did a very good job of that. And particularly since the IAEA, because of the lessons of Iraq during the first gulf war and what was found afterward, had dramatically changed its approach to inspection and verification. They have become much, much more aggressive. Before, it was a matter of inspecting declared facilities. Well, you know, that's, sort of, a slam dunk. Undeclared facilities are the real issue, and that's what you asked. And they have developed many techniques that can be used to go after undeclared facilities.

At Yongbyon, I think that this is doable. At the other potential sites—you know, the North Koreans are reputed to have 15,000 tunnels. You know, they told us that 85 percent of their countryside is mountainous, and so they have, presumably, 15,000 tunnels. They could squirrel away various facilities in places. But with the additional protocol, is what the more vigorous inspection campaign of the IAEA is called, I still think, on the plutonium side, that if North Korea cooperates at all, allows proper onsite visits around the countryside, there are things that can be monitored that would give us pretty good assurance. Again, never a 100 percent, but I would say quite good.

The enriched-uranium story is different. If a country cooperates—example being South Africa; that was a terrific example of how with the cooperation of a government one can go in and really get the sense that, yes, they've done everything possible and they have now taken the weapons out and the whole complex out. The other example is Iraq before the first gulf war. They were completely uncooperative. They hid everything.

The enriched uranium is really difficult. The signature, as such, is much smaller, much more difficult to find, and that will be almost impossible, without some cooperation from North Korea. So that one is very, very difficult to do.

The CHAIRMAN. Well, let me ask about the course of your estimates of the metal. You have, I think, correctly pointed out that after the plutonium is taken off the rods and comes into the oxide form or the metal form—the metal, as you suggested, because it was slightly warm, might be the best weapons grade. You made some estimates that the 8,000 rods were at work for 4 to 6 years, and during that time, 6 kilograms a year adds up to 25 or 30, or so, of kilograms. Still, the connection, to move from the metal to the pit of a nuclear weapon or to whatever construction, is something that hasn't been demonstrated. Obviously North Koreans wanted you to have an impression of a "deterrent," and used that word a number of times. Nor has the delivery mechanism for a weapon been demonstrated, although obviously tests of missiles by North Korea have been observed. They have been spectacular, and so has their export of this technology to others. Yet the connection of the three is of the essence in this situation.

Having said all of that, obviously the speculation prior to your visit has often been to try to divide these kilograms into how many kilograms it takes to make a bomb—whatever kind of bomb, whatever kind of delivery, whatever kind of system—and, therefore, people have come up with two, three, four, five, six. As you suggest, the 8,000 new rods in this 5-megaton facility, or megawatt facility, are going at it, and so maybe another 6 kilograms has been produced during the past year, or even just as we're sitting here, to be divided by whatever the divisor is, so that the estimates continue to escalate.

Try to give us some context of the deterrent. Were the North Koreans trying to say to you that you have seen the deterrent? You were responding, as I heard you, "No, I haven't, not yet." In other words, please describe these connections of device and connections of delivery.

Now, my question would be, having rebutted that, some would say, well, this is still very dangerous material, and you've indicated that is true. What can you do, with very dangerous material, short of building a pit for a weapon or having a weapon of a size that it could fly out on a missile or on a flatbed truck, for that matter, in a cruder form? In other words, as far as you saw it, what are the worst results that could occur from use by the North Koreans or proliferation of what you saw, the metal in the jar. If it were sent to somebody else, in the jar or whatever form, what could they do with it?

Dr. HECKER. Well, you asked a very involved and complicated question, and let me see how well I can answer that.

First you asked a basic arithmetic question. What does it mean to have 6 kilograms a year, and 25 to 30 kilograms? You noted, I'm sure, in my testimony, that I never converted that to number of weapons.

The CHAIRMAN. I noticed.

Dr. HECKER. And there are a couple of reasons for that. One is, when I say it from Los Alamos, that's a classified number. There are lots of other people, including many officials here in the U.S. Government, that have made a connection, and they can say that. And, in fact—so what I'm going to do——

Senator BIDEN. To be clear, you mean if you were to say how many weapons could be produced from 25 to 30, everyone in the world would know you knew exactly what was needed, and that's classified.

Dr. HECKER. Right.

Senator BIDEN. Is that what you're saying?

Dr. HECKER. Right. And it also would give some indications perhaps——

Senator BIDEN. No, I got it. I'm not asking you to do it. I just want to make sure people understand what you're saying.

Dr. HECKER. That's correct. However, people make this conversion all the time, and it's OK for other people to make that conversion.

Senator BIDEN. Right.

The CHAIRMAN. Who don't know what they're talking about.

Senator BIDEN. That's right.

Dr. HECKER. Right. So I'm going to read you somebody else's conversion.

The CHAIRMAN. Yes.

Dr. HECKER. Here's a Congressional Research Service report, something close and dear to your heart, I'm sure, March 17, 2003. Here, they talk about 7 kilograms of plutonium a year being made in the 8,000 fuel rods. And whether it's six or seven, you know, it depends on what sort of assumptions you make about their reactor operating. It says, and I quote, "About seven kilograms of plutonium annually, enough for the manufacture of a single atomic bomb annually." That's what they say. Then they go on and say the 8,000 fuel rods at Yongbyon, and I quote, "into weapons grade plutonium, and produce five or six atomic bombs." OK? So that gives you a conversion by somebody else.

From my standpoint, as I had indicated, if I give you a specific number, you know, that becomes classified. The other reason I can't do it, quite frankly, is, let's say—even in the classified session, you asked me, how many kilograms for a bomb? And I'd have to ask, what kind of bomb do you want? And it's like asking the question, how much steel do I need to make a car? And I'd have to ask, do you want a Ford Escort or a Hummer?

And the answer is obviously very different.

And so then, to get back to your question, he's——

The CHAIRMAN. There's no evidence they've made anything, because you have indicated you haven't got to the conversion of this metal to a bomb or what have you.

Dr. HECKER. There's still all this——

Senator BIDEN. If they're like the South Koreans, they don't start making cars; there's too much competition.

Dr. HECKER. So, at any rate, the bottom line is, what can you do with 200 grams, for example? The answer is, not much. As we discussed yesterday, and this, one can say in an unclassified setting, certainly one of the things that's received a lot of publicity lately is a so-called "dirty bomb"—is you can take that plutonium and blow it up, with a conventional explosive, and spread it all over.

Senator BIDEN. That's not a nuclear reaction. Would you make——

Dr. HECKER. That's not a nuclear reaction.

Senator BIDEN [continuing]. It clear what a dirty bomb is, versus the nuclear——

Dr. HECKER. What you do is, you spread the plutonium, and then the result of that will be widespread panic, fear, and economic disruption. The people you'll kill are the people who are close enough to be killed by the high explosive. And, quite frankly, that's—for a country, or even for a terrorist, that's a terrible waste of plutonium, because there are many other isotopes that are used in industrial or x-ray sources or other things that you could spread that would not be as valuable, let's say, as plutonium.

So a few hundred grams really don't do you much good, unless you save them up, into these kind of quantities, to where you can make a nuclear device. But then even the nuclear device—and this, I would have to tell you, again, in closed session—depending on how big a bomb, depending on how sophisticated, how you want to

deliver it, whether you want to put it in a truck, or whether you want to put in on a bomber, or whether you want to put it on a missile, that requires different amounts of plutonium, different sophistication, and that's a whole different issue, and that's one that I would not discuss in this setting.

The CHAIRMAN. I'll ask just one more question, then yield to my colleague.

Senator BIDEN. Oh, no, this is good, keep going.

The CHAIRMAN. Essentially, the North Korean officials you talked to were completely in denial of the HEU program. They said, we have no program, we have no weapons, we have no facilities.

Dr. HECKER. The answer is, yes, that's correct. This is the Vice Minister Kim Gye Gwan.

The CHAIRMAN. Now, do you have any idea how the ambiguity, to put it that way, exists? Very clearly, as you have stated, Secretary Kelly, in the fall of 2002, confronted North Koreans during his initial trip on this. Our intelligence, United States intelligence, informed the Secretary. He challenged the North Koreans. As I recall his testimony, in open session—they retreated for the evening and came back. Then late that night or the next day, they indicated, Well, yes, we do. What about it?" in essence. In other words, they maybe issued sort of a challenge. At that point, negotiations, to say the least, didn't break down completely, but they were faltering badly. The difficulty of even reporting this back to Washington or anybody else was considerable, due to our lack of communication facilities in the capital city there. We used British facilities, or some other facilities, as I recall, just to get word that this momentous admission or statement had occurred.

Your testimony today is essentially that that was ambiguous. Maybe our translation, what we heard, what they said, and so forth were ambiguous—because this is a very big issue, as you know. This is why I have asked about the alternative facilities, how verification can proceed with this totally unknown program, unknown location, unknown whatever is there, even if you pin down as specifically as you and the observers that were with you have done at Yongbyon. Can you give us any further enlightenment on that whole area?

Dr. HECKER. As far as the verification is concerned, there are a few telltale things that one would look for, and that's what I imagine our intelligence community looked for. I have not received that intelligence briefing, and so I cannot address that, and I did not address that in North Korea. But I can relate to you what I heard the conversation to be, which addresses the issue of the ambiguity.

And, again, I cannot formulate any judgment, because I wasn't there, and I haven't seen the text. But the conversation went something like this, is the—from the American side, you know, Mr. Pritchard was also there with Assistant Secretary Kelly, and they thought they heard, quite clearly, that the North Koreans had admitted such a program. The North Koreans use a lot of language, from what was said there, about having the right to have any weapons program that they would like, and that they have a much more powerful weapon. Then, later on, they said that that was the unity of their people, for example. And what they said is that they

have a Korean-language transcript from their scribes, of the meeting, and that that transcript presumably shows that they never specifically admitted it, that there is some question of the ambiguity of the language used. And perhaps, again, that was very intentional ambiguity.

Mr. Pritchard then said, "Look, the only way to resolve this is, you have to get the scribes and the translators together, look at both texts, and see what the real situation is." That's where we are today. Professor Lewis does have the Korean-language text from the Korean scribes, and he's made that available, I believe, to the State Department in order to look at that issue.

So that seemed to be the issue, that it was a question of interpretation, and I cannot state any more than that. That's what I heard.

The CHAIRMAN. Very well.

Senator Biden.

Senator BIDEN. Thank you very much.

I really do appreciate the detail you're going into for us. There's a number of things I'd like to talk about, but let me try to touch on a few in this hopefully first round. We have another 28 minutes—or 32 minutes here.

Can you briefly, if you can, explain, not the North Korean program or any classified information, but if you're going to cause a nuclear chain reaction that causes a nuclear explosion, the big mushroom cloud, big or small, what the average America would talk about, the average person on this Earth would talk about—a nuclear explosion, which is a chain reaction that gets started—if you're going to start that chain reaction with the use of plutonium, in broad strokes, what is the mechanism, what are the physics of what has to happen to make it explode and to start this chain reaction? And how's that different with taking a couple pieces of highly enriched uranium and doing whatever you do to push those together, which I'm told is one of the ways to do it, to cause a nuclear reaction?

The reason I ask the question is, I'm very concerned, we're all very concerned, about proliferation. And the key question the Senator asked was—we're told—and we use the phrase, even, many of us—that North Korea, having reprocessed plutonium, presumably, without certainty, becomes the plutonium factory of the world, there's a history of them dealing with terrorist organizations in the past on other fronts, they are proliferators of missile technology and other technology. And so the average Senator, the average policymaker, who's not an expert, the average American, probably thinks, my God, if al-Qaeda gets that chunk that you had in that glass canister—that jelly jar, in effect—they could do great damage and cause a nuclear explosion to take place. So can you tell me, briefly, what are the physics that are required to start a chain reaction using plutonium, and how and if that differs from the physics required—or, no, that causes a nuclear chain reaction from the use of highly enriched uranium?

Dr. HECKER. I will do my best. Let's start with the plutonium.

The idea is that you want to put as many atoms of the fissionable isotope—the preference being 239 in plutonium, 235 in uranium—you want to put as many of those atoms as close together as possible to get this chain reaction. If you do it slowly, and you

can control the chain reaction, you have a nuclear reactor. If you want it to be an explosive, then you not only have to get them close together, but you have to do it very rapidly.

So in plutonium—and the answer to your question is—those were answered back during the Manhattan Project days—and in real time.

Senator BIDEN. Right.

Dr. HECKER. The initial concept was, well, the best way to get those atoms closely together is that you take, let's say, two hemispheres and put them in a gun device and shoot them against each other, and that will bring two subcritical masses together close enough and fast enough that then they'll go and blow up and release that energy catastrophically.

What it turned out—and, you know, the minds that were involved in the Manhattan Project were absolutely extraordinary, so they had thought all this through; but then what they found is, when they got the plutonium that was the reactor product, the initial plutonium had actually been made in very tiny amounts in an accelerator, the first stuff out at University of California at Berkeley, by Glen Seeborg and his colleagues. When the plutonium that was the reactor product—they found, it had some of these other isotypes that I've mentioned before, and one of these isotopes gives up too many neutrons, so that when you're bringing the two masses of plutonium together first, the neutrons begin to trigger the chain reaction prematurely and it fizzles. So it still releases energy, but not in this catastrophic fashion. So the bottom line is, then, for plutonium, they said this gun assembly doesn't work, and they were in a real fix.

And there was a gentleman by the name of Seth Neddermeyer, who developed what's now called the "implosion concept." And the idea there is that you put two hemispheres together right away, but have subcritical mass, and then pack explosive around those hemispheres and light off the explosive so that it brings this enormous compressive force to bear on the plutonium, gets enough of those atoms close together and fast enough that then it would blow up catastrophically.

So the plutonium is only good for this implosion device, and it's quite tricky to design the explosive and the lensing system to do this. And we, at Los Alamos and our colleagues at Livermore have spent lifetimes of people figuring out how to do that in the most efficient and effective way, to pack the least amount of plutonium in the smallest space and mass. And that's the plutonium.

The uranium doesn't have that problem. So in a uranium, the gun assembly works, so you can take the two hemispheres of plutonium, shoot them together. That's a reasonably simple arrangement. You know, you take——

Senator BIDEN. Highly enriched uranium.

Dr. HECKER [continuing]. A gun barrel—it has to be highly enriched uranium. And as far—you could ask how much enriched. The IAEA classifies everything over 20 percent of the 235 isotope as weapons grade, weapons usable. Of course, the more you have, the higher the octane, so to speak. If you have 90, 93 percent highly enriched uranium, you need less of it.

The light water reactor, just to go back to your earlier comments, that only takes 3 to 4 percent, because you're doing it in a controlled fashion.

Senator BIDEN. Three or 4 percent, in the jargon, octane.

Dr. HECKER. Enrichment, yes.

Senator BIDEN. Yes, enrichment.

Dr. HECKER. So the uranium, then, you can do in this gun assembled device, or the uranium will also work in the implosion device.

Senator BIDEN. Right.

Dr. HECKER. But you need more uranium. And so, most modern weapons, the material of choice is plutonium.

Senator BIDEN. Plutonium.

Dr. HECKER. However, if you're looking for the simplest way to make a bomb, and that was really the essence of your question, the way that I understood it——

Senator BIDEN. Right. That's exactly right.

Dr. HECKER [continuing]. Then clearly the highly enriched uranium is the simpler way. And it's interesting that North Korea chose the plutonium route to go to a bomb. On the other hand, you know, it's reported, at least, that Pakistan has taken the uranium route, India has taken the plutonium route.

Senator BIDEN. I know you know the reason I asked the question, but I want to clarify it for the record, is that when we went into Afghanistan and defeated the Taliban, a journalist walked out of a safe house, I believe in Kandahar, with a diagram, a diagram of a rifle device that some scientists said was an attempt at figuring out how to build a nuclear device. There was word that two Pakistani nuclear scientists had met with either bin Laden and/or his principals, and off and running was the race as to what was al-Qaeda about, what were they trying to do. And this device that was depicted and was shown in, I think, U.S. News and World, or one of the papers, turned out to be something that most scientists said didn't get the job done, but the quest seemed to be moving down the road to figuring out to build a rudimentary crude nuclear device that would cause a nuclear reaction—not a dirty bomb that would spread radiation, but would cause the mushroom cloud, the heat, the wave, the implosion, et cetera.

So the question that a lot of us have is, if our greatest concern is—and it's mine, I must tell you—is not whether or not North Korea added—if they have one bomb now, we don't know, but whatever they have—if they added two, three, four, five, six more nuclear devices? That concerns me, but it concerns me less than if the material they have, they could sell and/or export in a form that someone other than a nation-state would find usable to construct a, quote, "homemade nuclear device." Because this is not a classified session, I will not repeat what I told you yesterday, which your colleagues at all the laboratories had done, except to say that it is possible to build—this is not classified—to build, off the shelf, a rifle device, the thing that rams things together rapidly, without having patents or without having access to material that is off limits to someone. Now, what's off limits is, in very, very simplistic terms, sort of, the gunpowder that makes it go boom—that is, the uranium, highly enriched uranium, which, as you explained, if it's

smashed together at sufficient speed, can create a nuclear reaction, chain reaction. That's the hard stuff to get.

So the reason I asked the question is, if this material, if they have these—in effect, spheres of metal that are called plutonium, that are plutonium, metal—you know, turned into the metal form of plutonium—if that got exported to somebody, how much worry do we have about an al-Qaeda or a terrorist organization, as opposed to a nation-state with a much larger infrastructure, being able to take that, put it into a bomb, drop it in a truck, drive it up, or put it in the hold of a ship, and explode it when it's in New York Harbor or the Delaware River, whatever? That's the reason I asked the question. And I know you know that, but I want to make sure I'm articulating what I think a lot of average Americans wonder about, about how dangerous is this potential for proliferating a substance that is able to be turned into a nuclear weapon?

And so it is harder, from a scientific standpoint, I believe, from what I've been told by some of your colleagues, to build a device that implodes plutonium and causes this nuclear reaction, than it is if you have highly enriched uranium, to cause that to be put in a circumstance where it causes a nuclear reaction. Is that—I know that I'm being general, as a layman here, but is that, in a generic sense, a fair statement, that you require more expertise, scientific expertise, and capability to build a nuclear device that was generated by plutonium than highly enriched uranium?

Dr. HECKER. The answer to that is yes. And I'd like to go back and just pick up a couple of threads from what you said, because you explained the situation extremely well; there's just a couple of points I would like to emphasize.

In order to make a device—let's say, whether rogue nation or terrorist—there are a few things that you need. First you need the knowledge of how to build this. Quite frankly, that knowledge, for primitive devices, is out there. All you have to do is go on the Internet. You know, that was developed 60 years ago, and so that's clearly understood. The knowledge is there. And so you see those drawings, and no matter how crude—you know, they could have done much better by looking on the Internet—the knowledge is there. You cannot stop that anymore.

The second part is, you need the material. And the good news is, it's not easy to make plutonium, and it's not easy to enrich uranium. And thank God for that. However, Senator Lugar has fought the battle for the last 12 years trying to make sure that people don't steal this stuff, because that's, by far, the easiest. And I have worked under that umbrella for 12 years, working what we both considered was the biggest danger 12 years ago, when the Soviet Union broke up, and working this issue of Russian nuclear materials. And I know, Senator Biden, you have also made that a cause.

Then the third piece is, can you fabricate it and put it in some sort of delivery vehicle? There, the answer to your question is, the uranium is a lot easier than the plutonium. Plutonium is not that easy. I mean, that's not easy to make in a garage someplace, for the terrorists. The uranium is easier, but still not an absolute slam dunk for a terrorist organization. For a nation like North Korea, in essence you can't make the assumption that they can't make a

primitive device on the basis of everything else that one has seen them be able to do.

So those are the issues. The key, without question, comes down to the nuclear material. That's why the 8,000 fuel rods was such a big deal.

Senator BIDEN. Right.

The CHAIRMAN. Senator Brownback, did you have questions for our witness?

Senator BROWNBACK. Yes, I do. Thank you, Mr. Chairman. And thank you for holding the hearing. I appreciate that.

Dr. Hecker, thank you very much for your testimony. I've found it very interesting and specific, and I appreciated that and appreciate your information you're sharing with us.

Before I get to the question I have, I want to make a brief statement myself. Over the break, I was able to travel to Japan and meet with a number of members of the families of abductees. These are Japanese families, Mr. Chairman, Senator Biden, that have been abducted by North Korea, were abducted by North Korea, that the North Koreans have admitted to. Apparently, there's a big difference between the number that are still missing and how many North Korea has admitted to abducting. But these are people that the North Koreans have admitted to abducting.

And now, after finally 20 years, in some cases, of finally admitting that, yes, they abducted these family members, they're not allowing their children or spouses to come from North Korea to Japan to be with the people that were abducted, which is just mind-boggling, in my estimation, that having once admitted that you've kidnaped, now, a series of people, that you're not going to say, OK, we admit it. We're going to make this whole, and, here, you can go, and your family members with you. They won't let the family members leave to be with their family in Japan. And, instead, the North Korean Government is demanding that those who were abducted must come back to North Korea to get their family members before they can go to Japan. Which reminds me of Saddam Hussein's brother, or son-in-law, that went to Jordan, and Saddam said, "Well, come on back, and we'll make everything right," and he didn't live to tell anything about it afterwards.

And so the people who were abducted are not willing to go back to North Korea to get their family members, because they don't know if they're going to be able to make it out. And I think this is something we really ought to stand with the Japanese Government as pressing very hard. And this is absolutely ridiculous, uncalled for, to kidnap and then not let family members come out. And I met with these family members and spoke with them.

The other thing, Mr. Chairman, I'd like to note and put into the record that applies to North Korea, this is an article from CNN's Web site yesterday on "Food Aid to North Korea Stalls," a report out by Amnesty International[3] about executions taking place because of people stealing food for their families to live—just horrific level of starvation and depravation continuing to take place in North Korea, estimates of over two million having died of starva-

[3] For full text of the Amnesty International report, please go to: "Democratic Republic of North Korea: Starved of Rights: Human Rights and the Food Crisis in the Democratic People's Republic of Korea," http://web.amnesty.org/library/index/engasa240032004

tion and from these political gulag systems since the mid 1990s, and that it continues today. And this is Amnesty International's report that's just out, another current issue regarding North Korea.

[The CNN article referred to follows:]

[From CNN.com—January 20, 2004]

"FOOD AID TO NORTH KOREA STALLS"

WASHINGTON (AP)—American agencies are moving as quickly as possible to arrange for food aid shipments to North Korea, a U.S. State Department official said Tuesday after a U.N. agency said a lack of foreign donations is forcing a delivery cutoff.

In December, the United States promised 60,000 tonnes of food to North Korea. According to the official, efforts are still under way to procure the commodities.

In announcing the food aid cutoff to 2.7 million North Korean women and children, the U.N.'s World Food Program (WFP) said Monday aid promised by the United States, European Union and Australia could take up to three months to arrive.

Aid shortfalls forced the WFP to start cutting food distributions in December to more than half of its 4.2 million "core beneficiaries"—children, pregnant women and elderly people, the WFP said.

Meanwhile, starving North Koreans have been publicly executed for stealing food and others have died of malnutrition in labor camps, Amnesty International said in a report released Tuesday.

The human rights group urged the North Korean government to "ensure that food shortages are not used as a tool to persecute perceived political opponents."

The report—released in Mumbai, Indiaa at the World Social Forum, an international gathering of anti-globalization activists—records the chilling testimony of North Korean refugees interviewed in South Korea and Japan and interviews with international aid groups during 2002 and 2003.

PUBLIC EXECUTIONS

The report accuses the North Korean government of distributing food unfairly, favoring those who are economically active and politically loyal.

"Some North Koreans, who were motivated by hunger to steal food grains or livestock, have been publicly executed," Amnesty International researcher Rajiv Narayan told The Associated Press.

"Public notices advertised the executions, and school children were forced to watch the shootings or hangings," he said.

Public executions were at their highest from 1996 to 1998, when famine gripped North Korea, the report said.

North Korea's isolated Stalinist regime has relied on foreign aid to feed its people since revealing in the mid-1990s that its state-run farming industry had collapsed.

The report appears to confirm fears of the United States and others that food supplies are being diverted to the military or given as rewards to supporters of North Korean leader Kim Jong Il.

Senator BROWNBACK. Two things, Dr. Hecker. One is, Mr. Hwang was here in Washington. He was the highest-level defector to come out of North Korea. He was the head of ideology. He was here 2 months ago. And then a staff member of mine has recently met with him again in South Korea. At the request of another Member of the Senate, I asked him this question in a private session, about, when we entered into the 1994 agreement for them to stop the nuclear weapons processing, did the North Koreans stop developing or attempting to develop nuclear weapons? Mr. Hwang's statement was, "no." Matter of fact, he was then assigned to go to other countries to try to find materials—plutonium—to be able to make nuclear weapons with, after the agreement was signed.

So the issue that you present and talk about, about a verifiable issue afterwards, is absolutely critical. We can't buy this dead horse twice, to go in and say, OK, they agree to stop their nuclear

weapons development, and then going ahead and starting and finding another route into it. For us to be so foolish twice would be terrible.

The second part is, I think you have to tie the human rights portfolio in with this issue of the weapons development, because we've got suffering, on the largest scale of anywhere in the world, taking place today in North Korea, and we just can't continue to turn a blind eye to that. As much as we may want to get at this nuclear piece that's here, which is critically important, Dr. Hecker—and your work and what you're doing and saying is important for us to be able to assess the validity of what they are putting forward, albeit—I mean, it sounds like there's a number of holes still here, that we don't have a good scientific assessment—we've got to get at that, but we cannot any longer deny the human rights portion of this, of the people that are suffering.

And that's why I've put forward the North Korea Freedom Act, that before we would be involved in any sort of financing of an agreement here, that the North Koreans would say, here's the deterrent; we'll give it up, but we want this sort of aid from the United States. We've got to have that human rights portfolio in here, Mr. Chairman. I just think to do otherwise, we're going to let another few million people die in this situation, and when the country finally opens up, when North Korea finally opens up and we learn the level of depravation and death, I think we're going to go, "my gosh," that we allowed that to happen.

Dr. Hecker, we've heard from sources previously about other weapons of mass destruction programs. I presume the North Koreans would refer to this as deterrence. You've talked, at some length, on what you were able to see in the nuclear area. Were you shown, were you able to see, did you gain any information, did you get any insight on other weapons development programs in the biological or chemical field?

Dr. HECKER. The answer is no. Certainly nothing we were shown would allow me to make any conclusions. In the discussions, they were never mentioned directly. The term "weapons of mass destruction" was used only once, and I'm quite convinced that it was used in the spirit of nuclear. And then the term "deterrent," whenever it was used, and they used it often, was clearly—in the discussions I had with them, "nuclear deterrent" was meant. So the issue of other potential weapons of mass destruction—that is, chemical and biological—never came up in our discussions. I never asked that question, because that really was not part of my mission. It's also not my expertise.

Senator Brownback, I'd also like to comment just a bit on the other things that you've mentioned. Of course——

Senator BROWNBACK. I want you to comment, but I want to followup on this. Did anybody——

Dr. HECKER. Sure.

Senator BROWNBACK [continuing]. Else in your delegation bring up the issues of chemical or biological while you were present?

Dr. HECKER. Not in my presence.

Senator BROWNBACK. OK. So there was no discussion, then, at any time, of what you heard, directly or indirectly, on chemical or biological.

Dr. HECKER. That's correct.

Senator BROWNBACK. OK. Please proceed.

Dr. HECKER. The issue of human rights, I cannot address that, because, quite frankly, I'm, sort of, a 1-month expert on North Korea, and so I don't have the background or capabilities to address that.

The only thing I can tell you—Mr. Chairman pointed out, at the top of the hearing, that the two staff experts, Mr. Luse and Mr. Jannuzi, indeed, had that as part of their agenda of their meetings, and I know they had meetings, related to the abductees issue, with North Korean officials, and I know they planned to write that up, and I'm sure they'll be happy to tell you about those meetings. So that was covered by them, but not by me.

And then the issue that you bring up of—the issue of verification, which, as you indicate, is a very important one, and Mr. Chairman asked that question. When it comes to HEU—I've already pointed out that is highly enriched uranium—that will be very, very difficult. And then you've brought up, of course, another issue, and that is the question of stealing this material or getting it through some other mechanism, rather than producing it, which is, as I said, pretty difficult to do, and it leaves some signature. And, therefore, verification, quite frankly, North Korea would have to exhibit a very different level of openness than it has so far. So far, from everything I can tell, that country has really been buttoned up, and any verification would be difficult.

The IAEA example was one where they took one facility, Yongbyon, and began inspections in 1992. Then, as part of Agreed Framework, they had 30 buildings under IAEA inspection. And for those buildings, from everything I can tell, they did an excellent job. But that's Yongbyon, and we don't know whether there was anything in the tunnels anyplace else, and so that verification would still be a challenge, and it would require some coordination and some opening up of North Korea, in my opinion.

Senator BROWNBACK. Dr. Hecker, I've appreciated and thought your testimony was very good and very specific, and I appreciate that.

I'd just like to make the point, Mr. Chairman, in closing on my portion of this, is that as we move down the road in dealing with North Korea—and I know the focus is on nuclear weapons, and there is some wisdom to that, because if we have a narrow, specific focus, that's probably a target we can hit and get something done; administration probably looks so similarly—but I cannot support, and will not be supporting, us providing moneys to North Korea, or aid to North Korea, other than direct food aid to keep people from starving, but of other aid, unless we include the issues of human rights in this bucket of issues. I don't think it's right. I don't think we can, in the moral obligation that we have to the suffering people in North Korea, fail to include that set of issues in the ultimate discussions as we move on forward. And if the Congress is asked to fund or to supply aid of some form of support, as we've done in the past, as North Korea is demanding now, this issue just has to be dealt with. That country has to open up so those people can live and not die of starvation or be manipulated

or trafficked or any number of issues. And I'm going to be pressing very hard for that particular issue.

The CHAIRMAN. I thank the Senator. Let me make a short comment, after which I'll yield to my colleague and we'll conclude the hearing.

As you pointed out, Dr. Hecker, and as I attempted to carry at the beginning of the hearing, the committee's oversight takes very seriously the human rights issues that Senator Brownback has mentioned; likewise, the humanitarian issues.

Food. We've had testimony by Jim Morris, of the U.N. World Food Program, and his colleagues. And the United States has shouldered the majority of the burden, in terms of both money and responsibility for delivering relief. In the process, the United States tried to find out why many provinces of North Korea were not open to inspection by the United Nations, quite apart from the efficiency of the food situation. This is a serious issue.

I think we have also realized that our responsibility is oversight. The Secretary of State finally will have responsibility, as a part of the six-party talks, and he has commended those for our negotiating posture. And we have not tried to substitute ourselves, but we are attempting at least to provide information to him, to the country, to ourselves, so that we will be in a better position to advise and consent, and to play our constitutional role.

Now, just summing up from what I've heard you say, the North Koreans several times said, "you have seen our deterrent," and they used the word "deterrent." And you, of course, have offered the proper skepticism as to how much you had seen, but, nevertheless, the North Koreans—at least as I understood at the beginning—appear to have, as a single-minded devotion, the perpetuation of their state and a fear that there might be dangers to perpetuation of the state. A deterrent to those who might want to change that state is very much on their minds. One reason for which they might have invited Professor Lewis to come, is because the North Koreans did want to demonstrate to Professor Lewis and to you and Mr. Pritchard and to our Senate Foreign Relations staffers that there was a deterrent that we ought to be concerned about in our own calculations. Professor Lewis had been a visitor ten times, as you pointed out, and he then included you as an expert in these areas. As you pointed out, their portfolio was limited, and as you pressed the edges of that, you got either no responses or no people.

At the same time, you stated to them, essentially, as I hear you, the testimony that you gave to us today. They were the first beneficiaries, at least, of your analysis, although it continues, as you pointed out, and may be refined as you speak with more of your colleagues. So there were no surprises, either way.

I think this was a very valuable mission that you and your colleagues have performed, and we appreciate very much the opportunity and, even more so, your lifetime of work in this area, which has enriched all of our understanding today, including precisely what we were talking about, in terms of the developments, the weapons, the dangers of proliferation, these things that swirled off the North Korean project, but likewise, the war against terrorism.

I thank you again, and I yield, for a concluding comment, to my colleague, Senator Biden.

Senator BIDEN. Thank you, Mr. Chairman.

Doctor, with your permission, since time does not permit now, I'd like to ask, in writing—I'm not going to make a lot of work for you here—a few questions about comparative expertise. You have significant experience, dealing with your Russian counterparts and Chinese counterparts. I'm wondering and want to know about how you, the people you ran into in Yongbyon and in Korea compare, if you can compare, to the expertise possessed by their counterparts in Russia and in China.

Second, I think it's important for the record, at some point, we get from you and others an explanation from the scientists about this notion of being able to put a nuclear bomb on the top of a missile and fly it 8,000 miles, and why it's very difficult to do that with a nuclear weapon because it relates to weight. The heavier the nuclear weapon sitting on the nose of a missile, the greater capacity the thrust is needed to propel that missile, that bomb, that nuclear weapon in a direction, and why plutonium devices are—it takes great expertise to miniaturize these things, to get them so you have great explosive capacity and in the smallest package you can get it in. I think Fat Boy weighed tons, if I'm not mistaken, and, as you know, that was the bomb dropped in Hiroshima, and so on. So I'm going to ask you questions about that.

And, last, I'm going to ask you, for the record, about how you produce highly enriched uranium, gas centrifuge systems, the degree of difficulty or the degree of ease with which that can be done. It's easier to hide; is it harder to do? Because I think that's part of the equation. We're going to have to be able to figure out when we're told things by the intelligence community and by the administration, in previous and present administrations.

And the last point I'll make—and conclude with this at 11 o'clock here, Mr. Chairman—is that I agree with the Senator from Kansas that human rights is vitally important. But my grandpop used to have an expression. I'd say something, I'd like to do this, this, this, and this, and my grandfather Finney used to say, "Joey, I'm not sure the horse can carry that sleigh."

If we had the same standard of saying we would not deal with nuclear weapons, we would not deal with this overwhelming threat facing humanity until all other things were dealt with, then we wouldn't be in China right now, we wouldn't be dealing with China. We would have not dealt with Russia 25 years ago. That's not to suggest that we should not pursue, with every means available to us; but I hope we don't decide that because we can't settle all the differences, including human rights questions with regard to North Korea, we would forego, if it were possible, the prospect of the elimination of their nuclear capacity.

Now, that's maybe a bridge too far, but I just want to make the generic point that sometimes this requires some discretion as to how you go about this process.

And, Mr. Chairman, the report coming out from our joint staff will be soon, but I'm told, by Mr. Jannuzi, that there are eight family members of the former abductees living in North Korea, five living abductees are living in Japan. The eight family members are mostly in their 20s and only recently learned about their true Japanese origins. One of the questions that remains is whether or not

these eight family members of the North wish to leave—I presume they do; I don't know—and that our staffs pressed very hard the North Koreans for them being able to leave. And that's not to suggest, in any way, there's not significant deprivation, significant starvation, significant brutality that exists in North Korea. There's not a single doubt in my mind about that, and I will work with the Senator from Kansas to try to deal with that issue.

But I would sincerely hope we don't conclude that there was no benefit to the Agreed Framework. If we had time, I'd ask you what would have happened had there not been an Agreed Framework—where would they be now? And so I just think we should—we're going to have to take this, sort of, bite size, a piece at a time, in order to understand the whole relationship.

But to the extent that we could eliminate and account for the plutonium already made into metal and/or already processed into, you know, an oxalate, to the extent we could shut down their capacity to continue to produce fissionable material, it would be a good thing, and that should be the immediate aim, in my view, of these six-way talks. But that's just one Senator's position.

Thank you, doctor. It's been a great education for us, and we've called on you before, and, unfortunately for you, I'm sure we'll be calling on you again. Thank you very much.

The CHAIRMAN. Dr. Hecker, do you have a final comment?

Dr. HECKER. If I may, just apropos to the last discussions. I won't address this issue of how or if one couples human rights and nuclear-related issues, because, quite frankly, I don't have enough knowledge of the situation. But there is one comment that I want to make that's often forgotten, and that is that we must never forget the horrific consequences of nuclear weapons. Today we only have the distant, but stark reminders of Hiroshima and Nagasaki. But these weapons are weapons of a totally different type. When you release the energy of the nucleus, you're talking about a factor of millions compared to anything that can be done conventionally. So these weapons are instantly destructive. They're more powerful, by this factor of millions, than anything else. They're disastrous, both psychologically and physically.

And I've spent a good part of my professional life dealing with the strengths of the Soviet Union, or the presumed strengths of the Soviet Union and their nuclear complex. And I've spent much of the last 12 years of my life dealing with the potential weaknesses of the new Russia and the issues associated with cooperative threat deduction; and now the last couple of years, dealing with these new problems, much more imminent and potentially much more dangerous, and that is the Pakistans, Irans, and North Koreas. And so, certainly, if I can say anything on this issue is, let's not forget just how devastating nuclear weapons are, how important it is to resolve these issues as quickly as we can.

And I certainly, as a citizen of the United States, appreciate the effort of all of you on this committee to make, not only our country, but the world a safer place.

Thank you, Mr. Chairman.

Senator BROWNBACK. Mr. Chairman, could I make one final comment on that? I appreciate that a nuclear weapon's a horrific thing. I hope we appreciate that two million people dying in North Korea

off of a gulag or a political system or off of starvation is a horrific thing, and that we will press hard to do that, and that 200,000 people currently in a gulag system in North Korea is a horrific thing, and that we will press on that, as well.

I understand how horrific a nuclear weapon is. There is already two million people that have died since the mid 1990s. Two million. We can't let that continue.

Thank you.

The CHAIRMAN. Well, thank you very much, Senator Brownback.

Thank you, again, Dr. Hecker, and we look forward to staying closely in touch with you as our oversight continues.

And the hearing is adjourned.

[Whereupon, at 11:05 a.m., the committee adjourned, to reconvene subject to the call of the Chair.]