Lecture by
Herbert F. York
Pat Ledden Memorial Seminar

October 12, 2005
University of California, San Diego

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Introductory Remarks by host not transcribed:

Herbert York: I do know this inspiration for this particular talk, and it was the death of Hans Bethe within the year. One of your board members knew that I knew him for many, many years and suggested I might talk a little bit about him. In addition to that, within the last year there have been four books, four biographies of Robert Oppenheimer. One of them will be the definitive biography for a long time [Kai Bird and Martin Sherwin, *American Prometheus: The Triumph and Tragedy of J. Robert Oppenheimer,* Knopf, 2005]. And so what I'm going to do is talk about Bethe and Oppenheimer, but also about six of their colleagues. Whenever you get a book on Bethe or Oppenheimer, you look in the index. There are a group of people whose names take up most of it, and there are Fermi and Rabi, Teller, Ernest Lawrence, John Von Neumann, and John Wheeler. So I'm going to talk about these eight people, and I'm going to talk about how they related to each other.

They all knew each other very well and they were very closely connected. They were all very much alike. They were all the same age: they were all born between '00 and 1910. They were all great scientists: four of them had Nobel Prizes. They were, all of them, interested in the world around them as well as in science. They all had the same essential history as far as the political environment they grew up in, with some special variants. They all experienced World War I as children. They were young adults just starting their careers and in college during the interwar years. They were all very much aware of the rise of the terror in Europe: Hitler, Mussolini, and Stalin. They all began their careers during the Great Depression, were influenced

by that. They all participated in World War II, in the science of World War II, all except Rabi in the nuclear program, and Rabi at the very end was there with his best friend **[00:05:00]** Robert Oppenheimer, at the time of the first test in New Mexico. And then they all were involved in a central way in the next step, which was the hydrogen bomb. So they were very much alike.

One difference is that four of them were born in Europe and four of them were born here. The ones born in Europe were here as refugees, and so they were more highly sensitized to the problems that were being raised over there perhaps than the Americans were, but nevertheless they saw things pretty much the same.

The big difference between them was that four of them thought the hydrogen bomb was a good idea, and four of them thought it was a terrible idea. It wasn't some abstract idea off on the side that they happened to be interested in. This issue was central to their lives, and yet they differed entirely on their conclusions about it; to me that's an interesting conundrum, and I'm going to try and present it just that way. Why did these very similar, very smart people come down on opposite sides of one of the central issues of their lives?

I should say I knew some of them very well; I knew some of them more distantly. Right after the war I was a student at [the University of California] Berkeley. I worked in Lawrence's laboratory. I took some of Robert Oppenheimer's classes, not really realizing what he was doing back in Washington [D.C.] and New York at the United Nations [UN]. At one point Robert Oppenheimer, who was given to similar statements, hand-wringing statements, said, "In some crude sense that no understatement, no humor can deny, the physicists have known sin." When Lawrence heard that he said, `I'm a physicist. I have never done anything in physics that has caused me to know sin.` And I'm going to elaborate on that kind of difference.

I knew Robert Oppenheimer was involved in postwar issues: what to do about the bomb, the arms race; he spoke occasionally and I read at Berkeley. We were all huge crowds. And he wrote about it. And if I dared to mention it to Lawrence, Lawrence would say, Being a physicist at the Radiation Laboratory is the greatest opportunity any young person could have. Don't blow it. Keep your nose to the grindstone. And I did. I listened to Oppenheimer but I never joined in any of the groups that became active at the time, trying to do something about it.

Just four years after the end of the war, the Soviets exploded the first atomic bomb. And it was a terrible shock. It was not a surprise. It's sometimes painted as a surprise, but in 1945 the common estimate both of the nuclear scientists and of the CIA was that it would take the Russians about four years, which is exactly what happened. There were three important deviations. Winston Churchill said no, it'll only take three, and Vannevar Bush and General [Leslie R.] Groves said it'll take twenty. Vannevar Bush covered the bases by saying, unless they give it the highest priority. But Vannevar Bush saw the Soviets as being in such a bad state that he didn't think they would. But General Groves—it was the typical gruff idea—he said, they're Asiatics. They just can't do it.

Now because it was such a terrible shock and a surprise to people who hadn't been thinking about it, there was a lot of reaction, of course. And the reaction, a substantial number of scientists, and of the ones I'm talking about here today, Lawrence and Teller particularly, who felt that we just had to do something. I mean this was a real crisis. We had to do something, had to do it fast and without any equivocating, and the ideas that they came up with about how we should react were the natural ones. The hydrogen bomb was one of them.

[00:10:00] Teller had been interested in the hydrogen bomb since 1942 less seven years, had been in fact arguing with Oppenheimer about it in various ways in all of that time. Oppenheimer

considered Teller's interest in the hydrogen bomb to be a diversion during World War II and set off in isolation, and Bethe felt the same, so this had been an issue between them for quite some time. But Teller's solution to the Russian atomic bomb was simple, precise, and very definite even to the point of being frantic: the hydrogen bomb is the answer to the first Soviet atomic bomb. And when they said "hydrogen bomb" they were talking about an increase in the explosive power of a thousand times—a hundred to a thousand times—and that was what people had in mind: it's a thousand times as big as what had gone before. That's as big a difference as the atomic bomb was compared to ordinary explosives. One was willing to make that same factor one more time.

Lawrence had a more general view. He supported Teller's ideas about the hydrogen bomb, but more than that, like many war veterans, the ones who survived, many war veterans regard the war, their experiences in it, as one of the most exciting times of their lives. It's common to all kinds of veterans, Lawrence was part of that, was in that group. And so he just wanted to get involved. I mean, "Somehow or other we've got reenlist," that was the idea. "We have to remobilize science the way we had mobilized it during World War II," and in reversing the demobilization which had been general: troops, scientists, and everybody. We had to reverse that and he came up with a number of ideas. He tried to break into the reactor business to make plutonium, but there were already too many people who had been—he couldn't do it. So he began inventing other schemes for supporting Teller and other military programs based on the brute force production of lots and lots of neutrons which could be then used to produce plutonium and tritium, which Lawrence believed were both in extremely short supply, something which our future security depended on great increases in the production rates of these materials.

Now the agency responsible for decisions in this area was the Atomic Energy Commission [AEC], now called the Department of Energy [DOE]. And the Atomic Energy Commission then chaired by David Lilienthal depended for advice on all these issues on a committee called the General Advisory Committee, which was chaired by Robert Oppenheimer. It had eight members. Two others are on the list of names I gave: Fermi and Rabi. It also included Glenn Seaborg from the University of California, James Conant from Harvard, and some others.

They were handed this question: What should we do? And they made a lot of recommendations which are positive in the nuclear sense. They said we should expand the production of atomic bombs, we should design a greater variety of atomic bombs, and we should expand the exploration for uranium and to make sure we have enough of it under our own geographic control, et cetera, et cetera.

And then they turned to the hydrogen bomb because that was the key issue. And the first part of their report that they wrote—all this happened just in two or three days. These days it would take a month of hearings and so forth, but it all happened in two or three days. It was a different world, and importantly different in those days. And they turned to the hydrogen bomb and wrote a technical report which said, we don't really know how to do it, which was the simple technical fact. What was known at that time was that the conditions produced by an atomic bomb, the temperatures produced by an atomic bomb, were sufficient to ignite hydrogen isotopes in a fusion reaction. A fusion reaction is similar to those taking place in the sun. But that's all. I mean the idea was that the conditions are there, the temperature is there, but no one knew how to configure it, and they knew they didn't know. They were trying to look for **[00:15:00]** ideas, and what the Oppenheimer Committee said is that we don't know; they emphasized that. They said it

probably would divert a lot of people and a lot of material if we did have a big program, a crash program, which is what was being called for by Teller and Lawrence and the military generally. But they said a concerted program, a concerted effort would probably produce success in five years. And I emphasize that because it's often said that they were pessimistic and they didn't get it right, but in fact it took three years, so three, they were a little pessimistic, but they had it right, a concerted program did produce a bomb in three years; they said it would do it within five.

But then they took up with the question, Should we do it? That's the more difficult and more important question. And they couldn't quite agree among themselves. They all agreed that it shouldn't be done, but they question of why it shouldn't be done and how you should say it was at issue. There were only a couple of things that they actually said. They wrote a report, and about twenty years afterwards I learned—I never saw it at the time—I learned it had become declassified so I asked for it, and then I wrote a book based on getting the report, and the report is in the Appendix. The majority say, the majority which included Oppenheimer, "We believe a super bomb," which is what they called it, "should never be produced. Mankind would be better off not to have a demonstration of the feasibility of such a weapon until the present climate of world opinion changes. And in determining not to develop the super bomb, we see a unique opportunity of providing by example some limitations on the totality of war and thus of limiting the fear and arousing the hopes of mankind." That's pure Oppenheimer, that phraseology and those words. [See York, *The Advisors: Oppenheimer, Teller and the Superbomb:* Stanford University Press, 1989]

Fermi and Rabi found that inadequate. They wanted to say no, for sure, not just now, and not just trying to see what we can do to prevent it. They say, "The fact no limits exist to the destructiveness of this weapon make its very existence and the knowledge of its construction a

danger to humanity as a whole. It is necessarily an evil thing, considered in any light." It's necessarily an evil thing, considered in any light.

So it was all done in secret. When the authorities received that advice, the Atomic Energy Commission, only the chairman thought it was good advice; the others thought it was not. President Truman who had previously met Oppenheimer and been exposed to some of his hand-wringing, and who had said, `I never want to see that man again`, rejected the advice, set up a special committee to consider it, which also rejected it, so it was generally rejected. And Truman then ordered that the program proceed to develop the hydrogen bomb. He used words like "we will continue." When Teller heard that, he thought he'd lost. He didn't want to just continue; he wanted much more than that. When the people against it heard it, they also felt they'd lost.

So nobody was really quite happy with what Truman said, the idea of simply continuing with the development of the hydrogen bomb. But it did turn into a crash program. The Korean War came along and made that absolutely inevitable. Before that, the program might've been—without the Korean War it might've been a slower and more modest program. But the Korean War changed everything in the United States. All kinds of defense research changed and a general remobilization of science took place beginning in 1950, and that included the crash program of the super bomb.

When people heard this report—it was kept secret and it was hard to get, even by some of the principal figures—both Teller and Lawrence, and also Luis Alvarez whom some of you know, took great umbrage; they said that these people are members of the General Advisory Committee, they weren't appointed to the General Advisory Committee because of **[00:20:00]** their ethical expertise. They were there because of their scientific expertise, and what they have

done is they've allowed their views and morality and ethics to influence the technical—they have fudged the technical advice to fit their political and moral views: it was not just that they were wrong in the facts or in the details, they were wrong much more generally than that, the opponents of the hydrogen bomb; and they became very active in supporting the expansion of the work at Los Alamos and recruiting people and so on.

Now, two other interesting cases bearing on that. Hans Bethe was not a member of the [General Advisory] Committee, but he was already becoming influential, and he was very close to the people that were the members of the committee. And he took a third view, you might say. He agreed that it should not be done, and that it would interfere with other very important programs; that is, people needed in other nuclear programs, which they were positive about, would be diverted by the hydrogen bomb, and the production facilities producing plutonium and tritium would have to be diverted from plutonium, which they all thought we needed more of, towards tritium which they didn't think we needed. And Bethe was one of those who rejected it on that kind of technical ground. But then he added, he said, `If you really think you need a big bomb, you know, a hundred times as big as what you've got, I have a better way.` And so Bethe proceeded to—he went to Los Alamos while the ingathering of all the greats began and he devoted himself to designing a very large bomb that did not require hydrogen or fusion, a non-super bomb, just a very big fission bomb. It was eventually built and exploded, and it was still, this bomb of Bethe's, the largest fission bomb by far ever exploded. It was a half-a-megaton, exploded in Enewetak in 1952. [King]

Fermi, who had made this statement, "It's an evil thing in any light," went to Los Alamos to work on the project after Truman said that's what we're going to do, and after the Korean War which as I say did stimulate a lot of rethinking. Fermi's view simply was that unlike Italy, where he had come from as a refugee, this is a democratic society and everybody gets to

decide on the question of whether you should do things like hydrogen bombs or not, and once the political system decides it, that's good enough. I mean that settles it. Even if you don't yourself personally agree, nevertheless the system is adequate and right for deciding this. And so Fermi, with his sidekick [Richard L.] Garwin, immediately went to Los Alamos and began to work on the design.

That's when this episode came up about; I was at lunch with Teller, Fermi, and another man named [Emil] Konopinski when Fermi, from my perspective, out of the blue, said—what he said was, "Don't you ever wonder where everybody is?" And it was perfectly clear to all of us without any further questions he meant the space travelers. And then he proceeded right there at the table to describe in great, great detail what we now know as the Drake equation, which was invented by a man named Drake ten years later, in which you start with an estimate of how many stars and then how many planets and how many of these planets are Earth-like and how many, et cetera, et cetera; Fermi's conclusion was there ought to be a traffic jam out there, given all the possibilities, but he knew there wasn't and so something's wrong. And so that has become known as Fermi's Paradox.

But anyway, they all went down and they worked on the bomb.

[00:25:00] Now, shortly after all of this, there were the Oppenheimer hearings. Oppenheimer's negative advice on not only the bomb, or what was seen as negative advice, and on a lot of other things, the nuclear airplane and other nuclear high-tech, simply had aroused a lot of opposition to him personally. And as I remember Lawrence telling me in those days, he said, You know, it's not enough just to put him off the committee or something like that. He is so influential that he has to be removed. And Alvarez similarly said, When you go to Washington to advise on anything, whenever you open a door to some important office, there's always Oppenheimer right there blocking the way, and we have

to do something about that. So it was not just countering the advice; it was countering the person. And because Lewis Strauss was then the chairman of the Atomic Energy Commission and had become a personal enemy of Robert Oppenheimer—they're both terribly vain and it just simply exploded, the mutual vanity exploded—Strauss became determined to get him out and to remove his clearance; so it's not just, We're going to get him out of the Atomic Energy agency, if we remove his clearance, then nobody else can consult him either, and that's what you've got to do in order to make sure that this bad influence is ended. [See, US Atomic Energy Commission, *In the Matter of J. Robert Oppenheimer: Transcript of Hearing before the Personnel Security Board*, GPO, 1954]

So there were the hearings. It's famously known that Teller gave the decisive testimony against Oppenheimer. He didn't say he was disloyal; he essentially said, I don't trust his judgment, and so I'd rather see these things handled by somebody else. But it was clear what he was up to. And Lawrence was on his way to Washington to testify, and he stopped in Oak Ridge and he was stunned. I saw him both before and after this event. He was stunned to discover that his colleagues at Oak Ridge, Al Weinberg and Clarence Larson, the director, didn't agree that Oppenheimer had to be removed. And Lawrence had colitis, which is one of these diseases that reacts to stress, and indeed he experienced as a result of his surprise and amazement, he experienced a major attack of colitis, leading to rectal bleeding, and cancelled his trip to Washington and never testified. But that's why.

Now Eisenhower had a negative view about nuclear weapons and nuclear war. Even during World War II when Eisenhower first heard about Hiroshima, he said it was wrong and wasn't necessary. He later regretted he'd said that but nevertheless that is his first reaction. When he was later asked about it he said, I missed a good opportunity to keep my mouth

shut. Whether that's regret, I'm not quite sure, but it's very close to it. But from his first days as president, he began to promote the idea of somehow getting the atom under control, of arms control, nuclear arms control. And one of his very first acts in office was his speech called *Atoms for Peace* which then led to the creation of the International Atomic Energy Agency [IAEA]—and to update this talk to this week you will have noticed that UN agency which he called for in 1953 just won the Nobel Peace Prize, and it's director—so that's a consequence of Eisenhower's thinking.

Now at the time, during his first term, his advisors were all from the nuclear world, essentially promoted by Lewis Strauss, and they were reluctant about any kind of limitations on nuclear weapons, which is where Eisenhower was headed. Finally in 1957, the beginning of his second term, Eisenhower in a public press conference said, We've got to do something. I believe it is now possible to move in the direction of a nuclear test ban, and we're going to open talks with the Russians on this subject. When Senator **[00:30:00]** Henry Jackson heard that—he was an extreme opponent of this, and the redoubtable Richard Perle was one of his staffers—Jackson arranged for Lawrence, Teller, and another third physicist, Mark Mills, to brief Eisenhower and tell him this is a bum idea. And essentially it was, as it always is, they said, Not now! We've just got this great idea which we are about to exploit and the test ban will stop us.

Now the great idea was what's called a clean bomb. It was a nuclear weapon, a large nuclear weapon, in which the radioactivity had been greatly reduced. And you can almost see the crocodile tears but anyway, [they said], When we use these big bombs, surely we don't want to have more fallout than we need, and therefore it's a moral obligation to go ahead and develop these clean bombs which will do less long-range damage, the same amount of near damage but less long-range damage than the

bombs which are now being designed and entering the stockpile. And they said, We need more testing in order to do this. And they also said, We all recognize that testing is creating a worldwide problem with fallout. [Andrei] Sakharov had already started talking about it, Linus Pauling was the leading figure in this country, complaining about the damage being done, emphasizing and citing the damage being done to everybody by worldwide fallout from nuclear testing. So they said, We've got an answer to that, too. Test underground. But we're just getting started. We're just getting ready. We have to do this, and a nuclear test ban will stop us from developing this new, safe way for testing. And they made their case, and Eisenhower, at a news conference the next day, he referred back to his remarks earlier about how we're going to negotiate a test ban and said, Well, a test ban is a good idea in the long run, but maybe not now.

So they were in fact influential. They did stop him, but only for a few months. That was in the spring of 1957. In the fall Sputnik went up, and that changed everything, even though it was not nuclear. The big change was that Eisenhower brought in a new set of advisors. That was the big change. And they did not include the nuclear fire eaters. They did not include Robert Oppenheimer, but they did include Hans Bethe and I.I. Rabi who had written this report. And Bethe and Eisenhower essentially in a wonderful symbiotic relationship, they, the two of them, laid the basis for the arms control processes that have continued until this time. Bethe became Eisenhower's principal advisor with respect to all kinds of technical issues that were involved, in detecting explosions in case somebody cheated and on the question of the importance of them, were they needed for safety or other reasons or not, Bethe became the lead scientist on all of these issues, and he and Eisenhower made a wonderful pair. They had very good personal

relationships, and the two of them essentially laid the basis for everything that's gone on in the fifty years since that time.

And one of Eisenhower's biggest disappointments, he said, was that he did not accomplish a comprehensive test ban during his tenure. For a little more than one year, they had a test moratorium, but it collapsed because there was just too much distrust. The negotiations were not able to reach any kind of fruition. Bethe was a major promoter of the negotiations and a participant. Teller was a major participant in saying why these negotiations are wrong, and he invented—Teller was a brilliant inventor—he invented all sorts of ways for the Russians to **[00:35:00]** cheat. And there's a book published, *Our Nuclear Future [Facts, Dangers, and Opportunities*, 1958, Criterion] by Teller and [Albert L.] Latter which describes all the things, and he says, `The Russians will agree maybe, but they'll just cheat, so this is a terrible idea.`

So it failed. But then Kennedy picked it up and finessed the question. One of the most difficult questions was detecting nuclear weapons underground, nuclear shots underground, and Kennedy simply finessed that by leaving them out and having a nuclear test ban for the atmosphere, outer space, and undersea, but allowing nuclear tests underground.

So when the treaty negotiations came up, the Congress called in the usual witnesses and I was among them at that time. And I remember in particular Teller's opposition. One of the questions that they asked him, because many of the members of the committee had grave doubts, they said, `Why? How can it be? Why is Khrushchev agreeing to negotiate a nuclear test ban? That's not like him. That's not like these Russians to put those kinds of inhibitions. Why is he doing that?`

And Teller in a way that became standard with him, he said, `I don't know why. But I can tell you what it might be.` And then he proceeded to describe how the Russians in all

probability had already solved the question of nuclear defense, the ABM [antiballistic missile] defense. And we had not. [Teller said], And that's why he's agreeing. He's got the answer to nuclear deterrence. We don't. And so sure, that's why he's willing to negotiate. It's to get an advantage over us. And that view, which was Teller's view then, was the standard view of many other people—that the Russians in general would only negotiate when they knew in advance that the negotiation would lead to a decisive advantage for them. They might not tell you what that advantage is, they would keep it to themselves, but nevertheless the Russians would never negotiate in the first place if they didn't already know how to get a decisive advantage.

The test ban did pass. The issue continued, and continues on until this day.

One more point about Von Neumann and Bethe, contrasting them. I mentioned Von Neumann, but he was very much in favor [of the super bomb]. He was very influential. The last five years of his life, he was the most influential advisor in the Pentagon, and also a very influential advisor in the White House, and he promoted all kinds of weapons. He was a very strong promoter of intercontinental ballistic missiles [ICBM], missile defense, nuclear weapons of all kinds, and he was much admired by the military in particular, and it was mutual. Johnny got a kick out of associating with the high brass, a personal kick.

At one point in the fifties, everything is on a ramp towards infinity. I mean the mining of uranium, the production of plutonium, the design of bombs, the production of bombs, all these things are increasing at an astounding rate, and eventually produced an American stockpile of 35,000 nuclear weapons. Incidentally, the Russian stockpile topped out at 45,000, something which we did not know at the time but when the Cold War ended they just said it, they just told us, We've got 45,000.

Well, at any rate, this was just starting out. Johnny [Von Neumann] gave a speech. It's published but it was a secret, private speech at the time, in which he said we've been thinking about this wrong. We've got to change our thinking. All of our war planning, all of our training, everything associated with nuclear weapons, nuclear policies assumes that they're rare and precious and that we have to think hard about using them because they're rare and precious **[00:40:00]** and so forth. He said they're not, or rather shortly they will not be, so we should think about nuclear weapons the way we think about any other kind of weapon that's in good supply.

Bethe, not at the same time but years later, speaking at one of the anniversaries at Los Alamos—Bethe was always principal speaker whenever Los Alamos had a twenty-fifth, fortieth, et cetera anniversary, and at one of these anniversaries, with a very plaintive voice, plaintive tone, he said, "We never thought there'd be so many." Johnny said, "There are lots and so we need to change our thinking."

I'll stop for questions in just a moment. I want to bring Rabi back into this at one point. I mentioned Rabi had signed onto the stronger of the anti-bomb memoranda in which he said, "It's an evil thing in any light." He had also worked with Bethe on arms control and so forth. But years later I visited Rabi, and he had wonderful apartment overlooking Riverside Drive [in Manhattan], and he said with great pride and joy, "Robert and I," that is Robert Oppenheimer, "Robert and I invented the Baruch Plan right here in this room." And I have no doubt that that's in fact true. The Baruch Plan, named for Bernard Baruch, was invented by Robert Oppenheimer except for some of the lesser political details but the overall Baruch Plan is Oppenheimer's plan.

But the other thing I then said to Rabi, I said, What did you have in mind when you said "It's an evil thing in any light"? He said, I didn't say that. Well, I had the report with me and I showed it to him. And then he said, You know, it was just a couple

days. It was a weekend coming and we all just told [John] Manley, who was sort of the secretary of the board, we all told Manley what we thought and told him to write it down. That was Rabi's view ten years later.

On the other hand, that was consistent with his general beliefs, although there's a lot of contradiction in Rabi. The illustration of the personal contradiction, he was the vice-chairman of the General Advisory Committee on Atomic Energy at the time of the Oppenheimer hearings, and when Oppenheimer was summarily fired, Rabi, who considered Oppenheimer his best friend, replaced him. And he said specifically, you know, Why did they pick me? I had the same views as Robert. Why did they pick me? And of course he's also saying at the same time, Why did I do it? I'm replacing my best friend after he's been unjustly fired. But he had his explanation. He said, If I had resigned in protest, I would've gotten three lines in the *New York Times* the next day, and I would never have had any further influence over the course of events from then on. Now, given, I'm not sure that's right, but nevertheless that was what he said and that was his personal justification for, as I say, replacing his best friend just after he had been tragically fired.

OK. Questions.

Question 1: *One question. Can you say something about the spies in the group?*

About spies? Well, at the time of Truman's hydrogen bomb decision, it had just been discovered that [Klaus] Fuchs had been a very successful spy at Los Alamos. It was not known that there were more, although the suspicion was there. And then later, Theodore Hall was discovered as having an equivalent role with Fuchs. They even worked together but not as spies because the way the spy world works, you have these very narrow, tight lines and nobody crosses them and nobody knows who the other spies are. But Fuchs and Hall worked together at Los Alamos and gave the same and independent information to the Russians, which of course for **[00:45:00]** the

Russians was a great thing because they knew with two separate sources on the same stuff it was good. My own guess is that probably it accelerated the Russian program by a couple years, but sitting here in 2005, the difference between ’49 and ’51 doesn’t seem dramatic.

Question 2: *The last time I saw Oppenheimer was at a dinner party at his house shortly before he died, and he expressed opposition to the total test ban. He thought that testing was too important, and you’re right, I was a little surprised, but at any rate he expressed a very doubtful opinion.*

Well, the world of experts, both nuclear and then general security experts, has always been divided on the test ban. I mean of the various arms control proposals, the test ban is the least popular. I wasn’t aware of that but persons like Oppenheimer and many others could easily be strongly in favor of arms control and eliminating missiles and so forth, and even eliminating nuclear weapons, but in continuing testing. There was a group that specifically felt that a test ban isn’t the right answer, but there was an equal number who did. Oppenheimer was such a complicated character. The best way to comment on your question is to recommend somebody read the book [*American Prometheus]*. I didn’t find that in there, so I’m a little surprised at what you’re saying but I can believe it.

Question 3: *Can you say something about the security of the stockpiles today?*

Well, I think the security of most of the stockpiles is very, very good. The question is always whether it’s absolutely good enough. And the issue is usually raised with respect to the Russian stockpile because it’s notorious, especially in the early days after the collapse of the Soviet Union, the people who guarded these weapons were not paid. Their method of control, which was to have three separate lines of authority from Moscow—KGB, [Communist] Party, and

military—each of which kept an eye on the other. It kept the Russian weapons under very good control. Only the military is left, and the others are not checking up anymore.

So there is a question about the Russian stockpile, but there's a great deal of attention to the question, and it's one of the things that we work very closely with them. It's not so well known but it's public that both of the UC [University of California] labs, Livermore [National and Los Alamos, have very close relations with both of the Russian labs, and one of the principal things they work on is that question: the safety and the control of the Russian stockpile. So it receives a lot of attention directly and a lot of cooperation with us. We provide money to help make it safer.

And then the international police keep looking for any breach, and the record is that there hasn't been one, and one of the things that protects us is basically criminal fraud because there are. The police find this. The international police multiple times every year they discover somebody who says, `I've got millions of dollars to buy a bomb if you can get me one.` And there's another group of people, and it happens multiple times every year, says, `I can get an atomic bomb if you've got the money to pay for it.` These people have not been able to get together, both because of just the enormous sting operations and everything like that, and the general fraud. Actually most of the people who claim they're ready to buy a bomb aren't, and most of the people who say, `I can get you one`, can't. And the few possibilities that might conceivably work out never make it.

And another thing on that subject, during the Cultural Revolution, the Red Guards broke **[00:50:00]** into one of the Chinese stockpile sites. They didn't do anything because they basically didn't know what to do. Well, they just knew that there were those bombs in there but they didn't know much else. So there are some scare stories.

In the United States, there have been well over a hundred instances in the last four years in which someone has called a mayor or a governor's office and said, I've got a [nuclear] bomb. Here's what I want you to do. And in a good year there's only two or three; in a bad year there's ten. There tends to be copycat going here. There have been well over a hundred in the last forty years. In every case that we know about—who knows what's left over—but in every case everything that's known—the mayors always know to call the FBI [Federal Bureau of Investigation]. It then becomes routine. The FBI gets in touch with the team at Livermore and another team at Los Alamos, tells them everything they know, if there's a recording, they get the recording, everything they said, tone of voice, everything. And then these teams are required within six hours to say whether they think it's probable, improbable, or can't say. And there has never been a case where they concluded a problem. They are required to give a judgment in six hours and another judgment in twenty-four. This system has been exercised well over a hundred times. So there's an enormous amount of attention paid to this problem, which doesn't prove that somehow something can't go wrong.

Question 4: *Assuming that the people who say they have a bomb and do, and people who say they've got money and do, and they get together, what sorts of systems have been developed to try to detect the importation of a device like that?*

Well, again it's a situation in which hundreds of millions of dollars per year are devoted to that question, and people all over, in a great many different laboratories, committees, and so on deal with that question. And the Livermore laboratory and again the Los Alamos laboratory, spend somewhere approaching a hundred million [dollars] a year on that issue: how would you detect an atomic bomb that somebody is trying to sneak in? Or how would you detect it after it's been successfully snuck in? Or what would you do if they were successful and you even knew where

it was? Now what do you do? How do you disarm it? And this is way before 9/11. I mean this is again thirty, forty years. It's at the multiple-hundred-million-dollar-a-year level, and so what they do is, they do both technology and intelligence, technology meaning that at ports of entry they have all kinds of apparatus, they have procedures for where crates have to pass, and people there already. If there's reason to believe that somebody is about to bring one in to San Diego, people can come here and get on the main highways entering town and try and find it. Now it's always iffy, I mean because depending on how hard you try, you might succeed. Most of the methods for detection depend on the fact that they're made of radioactive materials and shielding works to a degree. It never works perfectly, or if it does work perfectly, it's so big it won't move. But I mean it's a problem on both sides, but it's a problem that has received a great deal of attention.

And then there's the ordinary intelligence. I mean at every major shipping center in the world, Hong Kong and every place else, there are the police and there are the intelligence agencies trying to monitor. And frequently you really do know the suspicious people. I mean there's always somebody that comes from an unknown source that might get through. But there's a great effort which has so far worked.

Question 5: *What do you think the possibility of North Korea getting really to first base?* Well, the general consensus is the North Koreans do have a few atomic bombs. There is actually doubt about that, that they even have any, that they're not only lying about what they're doing in **[00:55:00]** the laboratories and so on, they're lying when they say they have atomic bombs, and they lie so freely that that's not implausible. But the general belief is the North Koreans already have a few bombs, but what they would do with them is impossible to guess. It would be suicidal, whatever they did, or it would have to be seen as suicidal.

[00:56:16] End Track 2, Disc 1.

[End of lecture and questions]