"Nuclear Power: Its Role in Our Future"

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FRED YOUNG [MODERATOR]: OK, it's a few minutes after. I would like to go ahead and begin with the introductions. On my far left, I would like to introduce to you Sandra Kiefer; she is with Westinghouse Electric Corporation. She has a bachelor of science in chemistry from the University of Pittsburgh; she also has a master's degree in nuclear engineering from Carnegie Mellon University. She is currently a senior scientist working on the nuclear design for the Surrey nuclear power plants, which are located in Virginia.

On her right is Dave Ferg, also with Westinghouse. He has a B.S. in electrical engineering from Valparaiso University; he has a Ph.D. in electrical engineering from the University of Arizona. He has also studied and worked at the University of Stuttgart in West Germany; he has worked for Jet Propulsion Laboratory in Pasadena, and he has also worked as—currently he is for Westinghouse Electric—as a senior engineer for technical operations and licensing programs, research construction, and operating license for Westinghouse. He’s given papers before the German Nuclear Society, the American Nuclear Society, and the American Institute of Aeronautics and Aerospace.

On my immediate left is Betsy MacInness. She is currently the media coordinator for the Oregonians for Nuclear Safeguards. She has served in the past, for sixteen months, as administrative assistant to the state Department for Energy Conservation and Allocation; she
has helped develop a state energy management program and prepared a family energy watch calendar. Her interests are with the basic energy question that is, “Do we really need additional energy or power sources?” She is also concerned with basic ethical questions of saddling future generations with nuclear wastes.

To my immediate right is Professor Rudi Nussbaum. He has a Ph.D. in experimental nuclear physics; he is presently a professor of physics here at Portland State University. He is also the university’s radiation safety officer. He is concerned primarily with the socioeconomic implications of nuclear power.

To Rudi’s immediate right and on the far right of the table is Tom Davis. He has a B.A. in political science from the University of Southern California; he also has a law degree from Duke. He presently has a fellowship at Lewis & Clark College to study atomic energy law; he teaches a course in atomic energy law. He considers himself an environmentalist and he is very much concerned with the relationship of the atomic energy law to the public interests.

My name is Fred Young. I will moderate the panel; I am with the Department of Engineering and Applied Science here at Portland State University. The format of our panel discussion this afternoon will basically be: we will start with a brief presentation from both the Westinghouse representatives and from representatives of the environmental groups. These presentations will about four minutes each. We will then have an opportunity for the panels to ask each other questions at that point; we will take approximately twenty minutes for that. At the conclusion of this twenty-minute period we’ll have about two minutes for each side to sum the conclusions to that point; then we will open the floor for about another twenty minutes of questions from the audience, at which time it will be approximately one o’clock. I realize that there are many people here that have appointments and other obligations after one o’clock. Our panel has agreed to stay with us on an informal basis for about another 45 minutes and then some of them have other obligations, so you will have the opportunity to meet with the people and informally discuss your concerns.

I think we all realize that the nuclear power question is not one of very limited scope with very simple issues and simple answers. It is one that perhaps concerns every segment of our society and of our science. To give you a brief introduction, at this time I will ask Betsy MacInness to give you an opening statement. Betsy?

BETSY MACINNESS: Hello. My name is Betsy MacInness, and I am the media coordinator for Oregonians for Nuclear Safeguards, a statewide organization working to pass Ballot Measure #9. This measure requires that the energy industry prove to the satisfaction of the Oregon
legislature that 1) emergency safety systems in nuclear power plants will perform when needed; 2) that radioactive waste can be successfully stored for the thousands of years necessary with no reasonable chance of escape; and 3) that utilities agree to become fully liable for damage to our selves and our property in the event of a nuclear accident. On the basis of my research, I believe enough evidence has been gathered which clearly demonstrates that nuclear power is not a safe technology and that very serious problems still lack solutions.

I do have some opinions on what constitutes minimum human morality. The nuclear power program poses incalculable risks to the health and safety of our generation and thousands of generations yet unborn. I have grave doubts about the wisdom or the morality of any program which has such high disregard for those who shall inhabit the earth after us. Power companies and the atomic industry are now waging a nationwide public relations effort to sell the people of Oregon and the United States the myth that our entire economic, social, and political future rests on the rapid construction of hundreds of nuclear power plants.

This myth can be dispelled. Study after study of the energy used in the United States indicates that we have a vast and as yet untapped potential for conservation. The World Watch Institute recently conducted an energy study for the federal energy administration; the report concludes that presently half of the energy in the U.S. budget is wasted, and that a vigorous conservation program would permit us to bridge the next 25 years without becoming hooked on either hazardous energy technologies or unreliable sources of supply. The U.S. uses more energy per person than almost any other country in the world. Sweden’s per capita energy use is 49% of that of the U.S.; Japan’s is 28%, and New Zealand’s, 25%. Opportunities for saving energy exist in every segment of our society. West Germany uses only half as much energy per capita as the United States. The U.S. uses at least 40% more energy for industry in relation to output as West Germany.

Standard Oil of California funded a two-year study of residential energy conservation measures; in the Portland home study, an energy savings of 27% was realized during the first year of the program. The savings resulted from the addition of ceiling insulation, thermostat setback, and modern improvements in furnace efficiency. Added wall insulation, storm windows, and weather stripping will save more energy in the second year. The case for conservation is clear. The major obstacle is the widely assumed need for energy growth in the electric supply industry. The fact is that electrical energy growth rates in the United States and Oregon have not increased as rapidly as forecast by power planners. Conservation is the number one energy option for Oregon in the next 25 years. Instead of building new nuclear power plants, we need to stop wasting the power we have, and concentrate on maximizing our energy efficiency. Conservation doesn’t mean going without; it means going farther with what we have.
We cannot expect those industries whose livelihoods and financial security depends on the sale of energy to be forerunners of innovative and full-scale conservation programs. Rapid development of nuclear power benefits only a small elite group with vested interests. Conservation benefits us all. With conservation, we can continue to maintain a viable and strong economy, maintain our standard of living, improve the quality of our environment, provide new employment, and avoid becoming hooked on dead-end energy sources. Finally, conservation will give us the time and the money to develop truly permanent, safe sources of power. Thank you.

YOUNG: Thank you, Betsy. At this time I would like to call on Dave Ferg for an initial statement from Westinghouse. Dave?

DAVE FERG: Thank you first of all for letting us be here today. I want to thank everybody for showing up this afternoon and allowing us to present what we see as a side of nuclear power. Before I address some of the energy concerns and nuclear power specifically, I would like to explain why Sandy and I are here in Oregon. We are young engineers; we have no managerial responsibilities at all at Westinghouse. However, others like us have proposed an idea, seeing a lack of industry effort to go to the universities and speak with students on nuclear power, we asked for a chance to do that. Approximately forty or fifty engineers in Westinghouse like Sandy and I offered to go of their own free will. We were interviewed, and a number—five or six of us—were chosen. I feel very strongly that I’m fortunate that I was chosen to be able to go out to some of the different campuses in the United States and talk to students on nuclear power. I am not being paid by Westinghouse to be here. I have a full-time job back at Westinghouse. When I go back, I have to spend extra time, I guess, so to speak, and catch up. So this is not my job to come out and talk to students on nuclear power, and it’s not Sandy’s job. We’re here because we want to be here.

Being a nuclear engineer, I feel... I’m exposed to the industry. I’ve been involved in designing nuclear power plants; I’m familiar with nuclear power plants. I can sort out a lot of the facts involved with nuclear power and I can see a lot of the emotional issues. I’m here today to discuss with you, and Sandy will also discuss with you, facts, and I’m willing to discuss the philosophical points of nuclear power, the charge that it’s a small elitist group. I’ll address that. We’ll talk about no growth. I’d like to get down into specifics. I’d like to discuss just exactly what nuclear power is doing in this country today, the fact that it is generating electricity in a safe, reliable, economical, and environmentally sound—I think the environmental aspects of nuclear power are extremely important, at least to Oregonians [they] should be.
The situation in this country right now with respect to energy is this. We are getting approximately 75% of our energy needs from oil and gas. You can go to the U.S. Geological Survey; they’ve made predictions of when the resources would begin to decline in the United States about ten or fifteen years ago. Those predictions have come true. We’re declining... the production of oil and gas in the United States is declining. I have no doubt that in my lifetime we’ll see oil and gas disappear in this country, or in this world, as a viable natural resource. In fact, the known reserves of oil and gas will be gone by approximately 1990, based on predictions right now from the U.S. Geological Survey. We have a lot of coal, a fossil fuel, that can generate electricity, but you have to be able to... If we’re going to talk about using coal or using nuclear, we should put nuclear in perspective with all the other sources of power.

Coal has some very definite environmental penalties. Consider, for example, the use of hydropower. Oregonians get most of their electricity from hydropower, yet the places for locating dams and creating an environmental penalty are such that those... that potential or possibility to expand in hydropower in Oregon will probably not come about.

Now, we would like to discuss the aspects of the initiative here before Oregonians, and make it very clear what the initiative means, or will mean for those in this state. If the initiative is passed, that will essentially ban nuclear power in this state. There will be no more nuclear power plants constructed in the state of Oregon. That removes an option from the people of Oregon, and sometime ten or fifteen years from now that option may be needed. Oregon is a growing state. We’ve heard stories about how the people in Oregon tell people, “Come visit, but don’t live here.” But you are growing; you’re a growing state. You have a beautiful state. Other people want to share that with you. So your energy needs will be increasing.

I would like to, I guess, ask you, if you’re going to vote and pass the initiative, that’s your choice. That’s a choice that Oregonians will make, and should make. But the people that are supporting and pushing the initiative should have the respon... should take the responsibility to inform people of the state of Oregon just exactly what the consequences are if that option is removed. It’s easy to... it’s a painless situation. I can vote for or against the initiative and it won’t affect me today. But people ought to look at what the consequences are, ten, fifteen years from now, what it will mean for Oregonians if they have to go to a less-desirable form of energy production. So I would like to hear some alternatives today; I would like to hear how Oregonians intend to get their electrical power that they may need in the next ten or fifteen years, or let’s address the no-growth philosophy and talk about it.
I think I can get into some of the specifics that I heard in your speech during the question and answer period, but I think that covers why I’m here and what I hope to accomplish. I’d like to hear a dialogue, really, from the audience though.

YOUNG: OK. Thank you, Dave. I think at this time we will begin entertaining questions from the panel, directed primarily to panel members, and to open the questioning I would like Dr. Nussbaum to start the questions.

RUDI NUSSBAUM: Thank you, Fred. Before I would like to get into the more controversial issues which have not been touched upon by Dave, I would like to mention one thing, that there have been several myths that have been created by the proponents of nuclear power. One of those myths is that you have to be a member of a selective, secret club called the nuclear club to understand the implications of nuclear power, to understand the intricacies of the technical questions. I happen to be reasonably close to that club because I’ve made a serious scientific study of it, and therefore I can raise that question. But I would like to say in the outset that every citizen has the ability, given the motivation and the will to spend some effort on it, to inform himself- or herself on these issues. And therefore you should never be impressed by any attack on your qualifications to have judgements on the question of nuclear power. You do not have to have a Ph.D. in nuclear physics to make decisions like that. One way that anybody can get an insight into the background of the development of nuclear power is by reading a book that just recently appeared; it’s called We Almost Lost Detroit, which contains the story of the accidents with various reactors and particularly a commercial or at least a planned commercial […] reactor near Detroit, and besides that, it gives the history of the atomic power industry.

To go to the issues, the issues are enormous, and I have to make a choice. I will choose primarily, since this is one question that is going to be part of the ballot measure, is the safety of the nuclear reactors that we have now, and the nuclear reactors that are going to be dotting our countryside. Now, I presume that as a proponent of the nuclear power program, Dave and Sandra, that you are aware of the statements made by the power companies, the utility companies and so forth, that this industry is the safest of all industries; that the public has nothing to fear from the development of nuclear power, nor of the existing power plants. I would like you to react to a number of facts that I will now randomly choose.

One is, how do you explain that the Atomic Energy Commission, which has been originally authorized by Congress to both safeguard the public from accidents and abuse and at the same time to promote the sale of commercial nuclear power? How do you explain that also the existence of the Atomic Energy Commission… this regulatory agency has deliberately misled and deceived the public and also the scientific community not directly involved with it in terms
of what the actual threats of fallout and nuclear radiation and the chances for nuclear accidents were? I wonder whether it couldn’t be one of the reasons for that that they didn’t want the public to know that there have been, already, between 1957 and 1975 in the United States, Canada, and Great Britain, eight major reactor accidents. None went to the catastrophic dimension of actually blowing up and destroying a nearby city, but if you read exactly what happened then you will see by what pure chance and luck this did not happen. Or, could it be that the Atomic Energy Commission was afraid to publicize the results of its own investigation of the dangers of accidents, when, in 1964-65, it appointed a very high-powered scientific panel at Brookhaven National Laboratory to investigate the possible results of a catastrophic accident at a nuclear power plant? Could it be that the Atomic Energy Commission didn’t want those numbers released, which by now we have forced through the new legislation to come out, at a time that people might have become so concerned that further construction of power plants at that time would have been stopped?

FERG: First of all, I would like to address this thing about “you need to belong to a nuclear club.” That’s exactly why I’m here. Being a nuclear engineer, I’ve heard the spokespersons in the industry and the terms they use and the technical jargon, whatever you want to call it, and I haven’t agreed with that. I believe that nuclear power can be understood. It’s not that complicated, not that complex, and it can be presented and discussed in terms that everyone can understand. That’s exactly why I’m here, because I’m willing to talk in those terms. Now, I don’t…

SANDRA KIEFER: You brought up a lot of points, Dr. Nussbaum. First of all, the Atomic Energy Commission does not exist today. The Atomic Energy Commission has been replaced by the Nuclear Regulatory Commission and the ERDA organization, so there is no organization which both promotes and regulates nuclear power. The Nuclear Regulatory Commission regulates nuclear power; the ERDA promotes the study of it through funding research programs. It’s true that in the past the industry and the regulatory commission has been lax in informing the public; I don’t think that they really misled the public. They haven’t presented a lot of information which they should have done. That’s why Dave and I are here today. We felt that it certainly was time that people got out and presented what the true facts on nuclear power are.

You mentioned some reactor accidents. There have been incidents at power plants; there are incidents at every kind of power plant. There are things which… industrial accidents which do occur. I might point out that the nuclear industry has had power plants operating for 20 years; there are 58 plants operating today; no member of the public has ever been injured; there’s never been a loss of life resulting from any of those incidences. Nuclear power plants are designed to the most stringent standards, probably the only industry that has developed where
failures have been hypothesized before the plant was built and the necessary actions and equipment are put in those plants to take care of possible failures. There are very strict safeguards built into those plants.

The study which you cited in 1964, I believe, only addressed consequences. It did not hypothesize how failures could happen; it only conjured up the worst possible thing that could happen and talked about consequences. It wasn’t a realistic study of events that could happen.

FERG: That Wash… 740 report… and you know that that is true. The opposition to nuclear power has constantly cited that report as truly a safety study that indicates what the risk to the public is from a nuclear power plant. And the risk to the public is not the consequences, it’s how likely or what is the probability that first of all some kind of an accident is going to happen, and then coupled with whatever the consequences are. And that study… to point out what it did, it assumed, it asked a question like… Take an ocean liner, and assume that it’s in a gale of hurricane force in the North Atlantic, someone takes and severs, instantaneously removes the bottom of the ocean liner, there are no life boats or life rafts, there’s no warning, it emits no warning to other ships in the vicinity, and then it asked itself, “What’s going to happen to that boat?” That was the kind of study that was done. This thing has been brought up many many times over the last four or five years.

KIEFER: A recent report, the Rasmussen report, is a more realistic study and considers failure modes and then talks about the probability of accidents, and from that report you’ll find that the probability of a serious accident has about the same likelihood as the probability of a meteor striking a city. So you can see it’s a highly unlikely event.

TOM DAVIS: I’d like to respond to a couple things here. There have been three studies done by the Atomic Energy Commission regarding the consequences of a possible accident. The first study was done in ’57, called Wash 740. The second study was done in 1964—began in 1964—and concluded that the worst possible case would be $17 billion of damage and 27,000 immediate deaths from a power plant accident. Now, that report did not contain a section which discussed the likelihood of that accident, and the reason for that was that at that time the scientists felt—and I think there are still some who feel that—the technicians who were doing the report within the Atomic Energy Commission felt that a study of that kind was impossible; that it would be inaccurate, and therefore they couldn’t do it. And for that reason...

FERG: It also had nothing to do with reality, either. It had nothing to do with the fact that it was a credible kind of an accident, and asked what would the accident be? It merely assumed that
half of all the fission products in the core were released to the atmosphere, and it said, now what’s the damage? It identified absolutely no way for that to happen...

KIEFER: The Rasmussen report really takes...

FERG: [speaking simultaneously] ...an engineer, there is no way.

YOUNG: Why don’t we let Tom finish with his statement, and then we’ll come back.

DAVIS: Ah, let’s see. Where was I? So that report, the ’64 and ’65 report, was never released, because they couldn’t show whether this type of accident was likely or unlikely. Then the Rasmussen report, which we’ve heard about, was begun—I don’t know when it was begun—but released in... last year, and this report sets forth certain numbers discussing the likelihood of a power plant accident. These numbers fit with what the AEC wanted to hear and therefore this report was released. A second thing that Sandy talked about was that the Atomic Energy Commission was abolished. That is true; it was abolished in 1974 by the Energy Reorganization Act. Two new agencies were created, but these two new agencies employ the former employees of the AEC, with the same promotional bias that exists. And ERDA, or the Energy Research and Development Administration, is now responsible for energy research. If you take a look at its recent budget proposals, you’ll find that that promotional bias in favor of nuclear power still exists, with over 50% of their non-military budget going to nuclear power development, as opposed to optional forms of power development like solar, geothermal, or any others.

KIEFER: I’d just like to...

YOUNG: OK. Sandra, would you like to reply?

KIEFER: Yeah. I’d just like to make a statement about ERDA. It’s true that ERDA supports all energy forms as far as funding research, and it’s also true that large portions of that go to the nuclear industry. The reason for that is that the nuclear industry is an industry which is here today; they’re progressing beyond the current types of reactors and doing... well, a large portion of their budget is going to the [...] reactor they’re actually building a prototype right now. If you look at their budget compared to last year and projections for next year, you’ll find that all other energy forms are receiving large increases in their budgets. They’re not getting as much money as the nuclear funding because there are certain developments that need to be made as far as engineering breakthroughs in some areas, and until those breakthroughs are made, any increase in the amount of money is not going to increase progress.
FERG: I can be somewhat more specific. When you talk about allocating money for nuclear research and development, which was referred to, you talk about the fusion program and you’re talking about the past [...] program. But if you look at what the light water reactor, which are the reactors that are in operation today, that are generating electricity, approximately 10% of this country’s electricity, those are getting very little money comparatively speaking. I think that if you look at the list, and I have it right here—I’m willing to go right down that list—and I’ll show that solar power, for example, is getting more than light water reactor technology. The reason the [...] reactor is getting a lot of money today, or in this year, is because they’re buying components to build the [...] River demonstration plant. They’re actually buying valves, pumps, whatever, pipes, to build that plant. The same with the fusion, the [...] reactor, where they’re going to try to demonstrate the scientific feasibility of the fusion process, is buying equipment, going out and buying components. And that’s the reason why these dollar figures are very large, as Sandy pointed out.

Solar is getting a lot of money now, but that’s mainly paper studies. And when those paper studies come to the point where they can build a solar power plant to demonstrate that feasibility, you’re going to see huge dollars being spent for that because its time will be there. Suppose Sandy and I promote that? I promote conservation, I promote solar, I promote geothermal. I’ll promote any of those sources of power. I’m not so blind and narrow that I think nuclear power is the only answer, and should be the only alternative. That’s not the situation.

YOUNG: Rudi, I believe you had a question?

NUSSBAUM: I’d like to respond to the statement made about the Rasmussen report. I’m perfectly aware of the fact that the Rasmussen report attempts to set... to add to the maximum possible accident probability factors. However, I am aware of it, and you are aware of it, that first of all, the basis of those probabilistic studies is very weak. It has been seriously criticized. One arm of the U.S. government, namely the Environmental Protection Agency, came out and said that the estimates of the probability for the Rasmussen report are at least a factor of ten too low. There has been an independent study by the American Physical Society of highly-respected physicists, many of them part of the industrial power club in advisory capacity one way or another, who have criticized seriously the Rasmussen report’s assumptions. Professor Rasmussen was poised to revise some of his estimates by quite a bit. I’m pointing this out to simply show that juggling around numbers... one of our professors here in the math department recently gave a public talk that was titled, “How to Lie with Statistics.” These statistics are so uncertain because they’re not yet based on a solid knowledge of all the factors that go into it. Primarily, the area of human error. I brought in these eight reactor accidents
because if you study exactly what happened in every single case, the actual cause of the accident was human error, which in none of your probabilistic studies by Rasmussen or anybody else has ever been numerically included. There is no way that you can include that.

KIEFER: But Dr. Rasmussen assumes human error wherever there can be human error. He assumes it in his report.

FERG: He assumes the operator is going to do it...

NUSSBAUM: I’m sorry to say that Rasmussen’s conclusions have been seriously attacked by people in the field...

KIEFER: And all of his... all of the comments made by...

YOUNG: If we may, let’s let Professor Nussbaum finish his statement, and then we’ll come back again.

NUSSBAUM: Then I would like to bring in that fact that just recently, within the last two or three weeks, four people in high positions, managerial positions, and one of the managers of the Nuclear Regulatory Commission resigned, exactly over the issue of the safety of nuclear power. Robert Pollard, for instance, who is one of the officials of the Nuclear Regulatory Commission—he was a project manager directing the safety evaluation of seven power plants—says, “I believe that the Indian Point nuclear power station (which is just one that I’ll pick out) constitutes an unconscionable threat to the health and safety of the millions of people who live in the metropolitan New York area.” Dale Bridenbaugh, one of three engineers in high managerial positions from the General Electric, your main competitor in the field of the nuclear power industry, writes, “In my recent assignment as the project manager of the Mark I containment assessment, I have become increasingly alarmed at the shallowness of understanding that has formed the basis for many of the current reactor designs. I am no longer convinced of the technical safety of nuclear power, and I fear the high risk of political and human factors that will ultimately lead to the misuse of its by-products.” Richard Hubbard, another man—this Bridenbaugh has 23 years of experience in nuclear power plant design safety regulations; any aspect of the game that you want—Mr. Hubbard has 16 years as an employee with General Electric. “After my experience, I am now convinced that businesses and individuals can no longer take the risk of contaminating our environment, upsetting the ecological balance, or take any other steps which could irreversibly affect future generations. The limited comprehension of the present technology, coupled with the technological requirement for 100% human perfection, is a situation I can no longer rationalize as responsible
or acceptable.” I could go on. These are statements from the letters of resignation; I have the complete testimony of these three gentlemen before the joint Committee on Atomic Energy, eighty pages long, with detailed technical summaries of facts, of safety issues of existing power plants. It would be much too detailed to get into that, but I question the validity of the statements that you are making.

YOUNG: Dave, would you care... or Sandra, would you care to respond?

KIEFER: Well, first of all, I’d like to respond to... there’s more than one question here. As far as the Rasmussen report goes, the reviews by the Environmental Protection Agency and the American Physical Society, all of their comments were incorporated into the Rasmussen report. He revised some of his numbers and the final report was issued last fall, and there has been no question on his final report. The American Physical Society and the Environmental Protection Agency have accepted his conclusions.

NUSSBAUM: After revision.

FERG: With respect to the numbers in the Rasmussen report, you know, this was a study that involved... it’s a huge volume of work, all right? And there’s letters in there that state what kind of tools he used to do that probabilistic analysis. And the reason he had to do it using numbers was because we just... we have no accidents that have caused public consequences. So he had to draw using predictive mathematical tools to do that. It’s being used in England and there’s letters in there, in the report itself, from NASA, which indicates that they endorse using those techniques and they were used successfully in predicting failures of pumps and pipes and valves and things like that. Now, there’s a broad, a very very broad spectrum of accidents that were considered in the Rasmussen report, and too many times the public believes there’s only one accident, and when that accident happens, there’s going to be all these consequences of property damage and loss of life and that. But let me tell you, the most likely core melt accident, which is the only accident which can hurt or jeopardize the public health and safety, was calculated to have the following consequences. And this accident would occur once every... if there were a hundred reactors operating, it would occur once every two hundred years. Assuming a hundred nuclear power plants, this accident would occur once every two hundred years. It’s much more likely to happen, all right? And that accident says that one person may or may not be killed. And the property damage outside of the power plant would amount to one million dollars. This is realistically—once every two hundred years—that’s the kind of accident we are talking about. When you go down through the numbers that Mr... or Dr. Nussbaum is talking about, they mean very little when I’m talking about an accident once every 300 million years.
KIEFER: Compare that with health effects from coal-fired plants, where a million dollars a year is spent by the government subsidizing individuals who have black lung disease.

NUSSBAUM: I would like to put this ...

KIEFER: You said I have another question we haven’t responded to.

YOUNG: If I may...

FERG: I think we should be allowed to respond to the GE and Mr. Pollard’s resignation. I can sit here in front of you and in all seriousness go into the game like counting [...] so to speak. Here’s a guy that left the industry, here’s a guy that was a critic and now is working in the industry. But that’s really not the issue for the people of Oregon. If you look at that testimony which Dr. Nussbaum has referred to, these people were asked whether or not—by the joint committee in Congress—whether or not there was anything of these concerns that could not be changed or improved upon or eliminated. And they said everything that they were concerned about in specific instances with respect to improving safety of nuclear power plants could be eliminated. Now that doesn’t... if it was something that couldn’t be eliminated, then I would seriously look at the situation and ask myself, “Should we get rid of nuclear power plants?” But if they can be eliminated and addressed, or removed, that... this will be considered in the reviews of plants. Now with respect to saying “I believe” or “I have a gut feeling that this is going to happen” or “Sometime in the next hundred years I really think that Indian Point 3 is going to have a serious accident” or... hypothesize, you don’t have to be a nuclear engineer to do that. Everybody is entitled to their own value judgement. Any one of us in this room can say to ourselves, “I suspect” or “I think” or “I have a gut feeling that this is going to happen.”

KIEFER: And those are just four people out of an industry of thousands that are still supporting the industry, and they have raised no new questions.

YOUNG: At this point, I’m going to cut short the summation and save the time instead for questions from the audience. If we have time at the end, we’ll come back and give each side a chance to summarize the points that they think have been made today. We have a question right back over here.

AUDIENCE MEMBER [off-microphone, in background]: Yeah. Ms. MacInness, I was wondering if you feel that Proposition 9 is a ban on nuclear power?
MACINNESS: I think that we need to... we can look at the conditions of the act, and it says that the emergency safety systems in the plant should be tested successfully. Now, if that’s a ban on nuclear power, we need to know why. Why is it that that can’t be done? These wastes will be toxic for 500,000 years, some of them. We need to assure our generation and our children’s generation that there is a safe method, a reasonable method of storing those wastes. Now, if that’s not there, we need to ask the industry why. Why can’t the nuclear industry convince the Oregon state legislature that such a method exists? And then we talk about the insurance. We are told by the industry that nuclear power is actually one of the safest industries that we have around. But we need to ask why we can’t receive full insurance coverage. Why are utility companies unwilling to put their own assets on the line?

KIEFER: Can I also respond to that question? If you read the words of the initiative, it requires insurance against acts of God. I don’t know of any legislature that’s going to come up with a two-thirds majority in deciding on what acts of God are going to be.

MACINNESS: With a reasonable chance of escape...

KIEFER: [still talking] So in that sense it’s a ban. It says, “acts of God.”

MACINNESS: Due to acts of God. That’s right.

KIEFER: Can you make any insurance against an act of God?

FERG: Tell me what that means. Suppose I was a legislator right now, and you were there and you were going to tell me what a reasonable chance from acts of God means.

MACINNESS: OK. Let me pose it just another way. If you were a citizen and they were going to have a waste storage disposal site next to your house, you’re going to want to know that they have a pretty certain way of storing the waste. You’re going to want to say to them, “Well, what in case of... what are the geologic events that can happen in a piece of earth over a period of 500,000 years?” You’re going to want to know that they have a pretty reasonable way of storing those wastes.

KIEFER: And we have that way.

FERG: You still haven’t told me what is reasonable and what is not reasonable. If I take... Take radioactive waste, which is an extremely small volume of waste. A power plant that would operate one year and provide electricity for 750,000 people would generate a volume of waste
of approximately a four-foot cube on a side. That waste can be solidified, placed in a ceramic glass-like substance, placed in a metal container, deposited some 2,000 feet in stable geological formations...

MACINNESS: Have they found those stable geologic formations?

KIEFER: They’ve been stable for millions of years...

MACINNESS: But have they found it?

KIEFER: Yes, they have.

YOUNG: Before we get off on an issue like this, we’ve got many, many people with questions out here.

KIEFER: [But it] happened to hit the big one...

NUSSBAUM: May I just touch on the way—

YOUNG: ...Really want to dis—

NUSSBAUM: On the small volume of waste. The General Accounting Office made an estimate that by the year 2000, we will have 1,000,000,000 cubic feet of nuclear waste. That’s a very small quantity. [laughter and a smattering of applause] Enough to cover... Enough...

KIEFER: But that’s not high level... it’s not high level...

NUSSBAUM: It scares me. That’s an official estimate from the General Accounting Office.

YOUNG: OK, would you care to respond?

KIEFER: [already talking over YOUNG] It’s not high-level waste and it’s similar to medical and wastes that come from hospitals and research laboratories right now. The same kind of thing.

FERG: [talking simultaneously, in background] And hospital waste, and weapons waste...

YOUNG: OK. I think we’ve addressed that issue. Question?
AUDIENCE MEMBER: Yes. A question was asked of Ms. MacInness a moment ago whether this was a ban or not, and she avoided the issue. I’d like to ask her a similar question. Why is it on the day that your group filed a petition with the Secretary of State for validation, your own spokesman, Chris Thomas, when asked whether this was a ban, said, “If our facts are correct there will be no more new nuclear power plants.” Now, that’s a ban. Could you explain that in terms other than safeguards?

MACINNESS: That was the statement that was made and I will make that statement again. To our knowledge, ERDA, the Energy Research and Development Administration, has no long-term storage plans for the radioactive waste. They are very concerned about that. They recognize that that’s one of the biggest problems that they have yet not solved. So what we are saying is yes, in all likelihood, because there is no solution to that problem, there will be a delay in nuclear power construction until it is solved. Last year...

AUDIENCE MEMBER: Excuse me, you’re not answering the question. I asked you whether when Chris Thomas said, “If our facts are correct, there will be no more nuclear plants.” Now that’s a ban. That has nothing to do with safety. You’re going right around the edge of it again, now address my question.

YOUNG: I believe the answer was that she believes that yes, in fact, it’s a ban because the safeguards do not exist as are required by this initiative.

MACINNESS: The initiative does not say “We ban nuclear power plants.” The initiative says “Let’s meet these safeguards, and then we can go ahead and construct new nuclear plants in Oregon.”

FERG: But there is no waste right now to be stored in geological formations.

[voices rise in audience]

KIEFER: We also...

NUSSBAUM: Unbelievable. There are sixty tons of it standing at a reprocessing plant...

FERG: From commercial nuclear power plants.

NUSSBAUM: I don’t know, they are not [...]

KIEFER: None of the waste is... none of... [sighs as many people start talking at once]

NUSSBAUM: They’re from weapons, probably, and commercial nuclear power plants.

KIEFER: There’s waste right now that is on plant sites in small quantities, but the plant... nuclear wastes are always stored in the fuel assembly for some time before they are reprocessed. So they’re not at a stage right now where there is much to be reprocessed.

NUSSBAUM: How many reprocessing plants are operating?

KIEFER: Well there are none right now, but that’s because... it’s only because the facility is being expanded. It’s not because there isn’t means... there are means to reprocess it; there are means to store it. ERDA hasn’t made a final decision on how they want to store it because there are several options, and right now it’s not a critical thing. They’re taking their time to do a thorough study, so when they do make their decision they can have the best possible means of storing waste.

DAVIS: If the waste problem is solved, then, this won’t be a ban on nuclear power plants, and all the industry has to do is go before the legislature and explain the facts, if they exist, and you will have your nuclear power plants.

KIEFER: But if you require safety from acts of... you know, require insurance against acts of God, who’s going to make a decision on something like that?

DAVIS: That requirement is merely that the wastes that have to be stored be placed in a geologically safe place on the Earth, or sent away from the Earth by some means.

YOUNG: OK. Could we take time now to field another question, and get another issue going? I noticed we have a question right here.

AUDIENCE MEMBER [in background, partly inaudible]: I’d like to know whether... nature knows better how to do things than we, because nature has plenty of uranium in the earth, and surely there is a lot of radioactive material that goes into pollution and endangers life, and couldn’t waste also be [...]... and it’s only the short-lived ones that are immediately dangerous, and the long-lived, we could be able to make them as safe as nature has uranium deposits.

MACINNESS: The wastes that are created in a nuclear power plant, many of them do not occur naturally. Plutonium 239 is a substance that man creates, so it’s essentially foreign to our...
KIEFER [interrupting]: It’s also [...] and won’t be used, it won’t be thrown away as waste.

[pause; faint laughter in background]

YOUNG: Did that answer the question?

FERG: That’s a decision that hasn’t been made. If there’s... if you can make conservation...

KIEFER: Technically, it can be used.

FERG: If you can implement conservation, if we can decide in this country how much energy we need and how we are going to conserve energy, if we can develop solar power, if we can make it economical, safe, and prove that it’s environmentally acceptable, possibly you’re right, you’re absolutely right. Maybe we won’t need plutonium, or use plutonium as a fuel. But it can be used to generate electricity.

KIEFER: I don’t think you want to close off the option of being able to use it.

FERG: As far as the... developing, this thing about having radioactivity in the ground, what actually happens with a nuclear power plant is that the ore that’s mined is radioactive. After you generate nuclear fuel and use the nuclear fuel to produce electricity, you have a concentrated source of radioactivity similar to the radioactivity that was in the ground originally.

NUSSBAUM: All the fission products never existed before we started having fission reactions. That’s simply not a true statement.

FERG: Dr. Nussbaum, if you recall, the amount... the only stable element is lead. Everything above lead is being used up in a radioactive or nuclear sense. It’s decaying to lead...

NUSSBAUM: Excuse me, this is technical question.

FERG: If you go back billions of years, you will find... there’s geological formations where natural fission reactions took place. They’ve identified a region in Africa, in Gabon, where the amount of the uranium 235 in the ore was approximately 3% some billions of years ago, and they’ve seen the fission products there, where this reaction due to neutrons from the sun created a chain reaction that occurred by nature.
NUSSBAUM: I know that our whole chemical scale of elements was produced by a fantastic fireball, at least that’s what we assume now, where all these reactions took place. What has that to do… ? Are you saying that the radioactive waste materials, the fission products, are all decaying to lead?

FERG: Yeah, they are, they’re being used up...

NUSSBAUM: I’m sorry to say that as a nuclear physicist I can’t accept that kind of nonsense. Because iodine 131 or cesium 137 doesn’t decay to lead, it decays to other elements.

KIEFER: [interrupting] And many of these things have a lot of other uses. Cesium can be used in sewage treatment, plutonium can be used in pacemakers...

NUSSBAUM: [interrupting] Radioactively? In a radioactive form?

KIEFER: Yes, it can. Yes it can.

NUSSBAUM: Good luck.

YOUNG: OK. I have another question over here in the back. Yes, you.

AUDIENCE MEMBER: [barely audible] I have several questions I’d like to address… [...] the panel, [...] back and forth and answer the question… [laughter] I’d like to know… I’m understanding that you have stated that there have been some […] incidents. I’d like to know where they occurred, what happened, why they occurred. [...] Furthermore I’d like some examples of [...] 

YOUNG: I’m sorry, we didn’t hear that last question.

AUDIENCE MEMBER: What have […] [inaudible]

YOUNG: OK. I think we’ve got plenty of issues to deal with there. Would you care to… ?

NUSSBAUM: I can just simply read off that we had, in 1952, a reactor in Shark River Canada which was caused by human error, it had 900 devices for shutting it off and still we were only a few devices away from a blow-up of the core. In November ’55, the first […] reactor had a core meltdown, the […], it was caused by an unpredictable human error; in the summer of ’56 the
AEC suppressed the report on the... the first report on the [...] reactor. That’s your second question. I think it would take too long to go down. I would refer you to this book.

FERG: But every incident that you’ve named so far is not...

YOUNG: No, no, please let the panel answer. Go ahead, Dave.

FERG: I just wanted to ask Dr. Nussbaum if those reactors that he mentioned are like the reactors that are being built and licensed in the United States to generate electricity? Are they experimental, or are they commercial nuclear power plants?

YOUNG: Do you care to respond to that, Rudi?

NUSSBAUM: Would you tell me then what the [...] reactor was? Was that a reactor built to produce power, or was it an experimental reactor for the pleasure of some scientists?

FERG: It was an experimental reactor to demonstrate that you could build a fast [...] liquid metal reactor and produce electricity. It was certainly not the prototype nuclear power plant.

NUSSBAUM: What happened to the reactor?

FERG: Why are they building [...] River, then?

KIEFER: But the reactor was shut down and no one was hurt in that incident.

NUSSBAUM: How long is it going to sit there as monument to this generation, to not be...

YOUNG: OK, at this point I think it’s time to field another question. I think we’re getting...

KIEFER: I’d like to answer this other gentleman’s question, because it’s a good point. I think I stressed the point that no member of the public has ever been injured from a commercial nuclear power plant. Certainly there were some unfortunate incidences which happened in experimental reactors, and the development of the nuclear industry has been such to provide a lot of safeguards on commercial nuclear power plants. If you look at other industries—take the airline industry for example—certainly there were people killed in the beginning, during the...

AUDIENCE MEMBER: I asked you a question, though. The question is, when does a person no longer become a member of the public? That’s the question.
KIEFER: Everybody’s a member of the public.

AUDIENCE MEMBER: Well then there have been deaths...

KIEFER: Not in commercial power plants. I’m talking about in experimental reactors, there have been. As there were death in the experimental stage of the airline industry, for example, and in just about every other industry. But in the commercial industry, there have been no deaths.

YOUNG: I would like to field one more question from the audience and then give the panel a chance to sum the points that they think have been made. Let’s see, let’s take one question over here at the door.

AUDIENCE MEMBER: All right. My question really relates to the discussion of the Rasmussen report and a couple of points I’d like to make to lead into this. Number one, the idea that no one has been harmed by a commercial nuclear reactor is a nice idea, but we’re involved in the evolution of the human experiment, and the data that we’re getting is coming from the process of this experiment carrying itself on. When we find out when people are going to get injured from nuclear reactors is when we find out what the concentrations of radioactive gases released from commercial reactors are and from reprocessing plants. That’s when we find out as the process moves along whether there’s going to be an accident or not. We’ll do it in thirty years and we’re going to be doing it a lot longer if we go along with the industry.

Now, the Rasmussen report. Everybody argues about the Rasmussen report, and the two prior reports. Why were those reports done even to begin with? Think about it for a moment. Why did we ever even get involved in the hassle of why, you know, how many people are going to get hurt from accidents? The only reason we had to look at it is because the private sector of the insurance industry would not touch the idea of insuring nuclear reactors. The government was going to touch it, but they didn’t know how much they would have to credibly carry in the way of insurance coverage, and that’s the reason why all these studies got done, right? So we’re right back into this point where the government, the taxpayers, all of us that are the ones that are supposed to prop up the industry so everything will keep on flowing, right? OK. And the third thing is that...

YOUNG: I would appreciate it if you would get to the question.

AUDIENCE MEMBER: The Rasmussen report itself [...] [inaudible]
YOUNG: The question?

AUDIENCE MEMBER: [indistinct, in background] ... It was done by a fault-finding technique that was developed by the NASA administration, right, which they themselves later refuted and said that they no longer wanted to go along with it.

FERG: That’s not true. There’s a letter in the report from James Webb... Anders, who specifically addresses that comment. It’s in the public document...

AUDIENCE MEMBER: What’s not true? The first three portions, or...?

YOUNG: Let’s get to the question. I think you were just about to ask... [audio goes silent briefly]

FERG: First of all, there’s the thing about the experiment. Do you feel that the fact that radioactivity has been with man essentially since the Earth evolved or whatever, so small compared to things like television sets, moving from one floor of a house to the second floor, you know... I don’t understand the concern in perspective.

AUDIENCE MEMBER: I’ll say how I can ask you that. Because of this known fact alone. In the process of releasing this radioactivity, and over the period of time that it is involved with natural background radiation, any geneticist will tell you that we already bear a certain amount of burden from the background radiation that we already have. Now you say to me they only release a small amount of radiation, but the longevity of that radiation, its half-life, means that it’s going to be around for a certain period of time, some number of years, right? Over the period of time that the nuclear plants are going to operate and the reprocessing facilities are going to operate and the enrichment plants are going to operate and the talings from the enrichment plants are going to be on this Earth, all that radioactivity builds up and concentrates in nature. Right, just last week on the TV, what’d we see? New Hope Ontario. What happened? The radon gases coming from the radiant...

YOUNG: I think we’re getting a little carried away here. I think we’ll give our guests from Westinghouse a chance to respond and then I’m going to ask the panel to summarize the points that have been made.

FERG: I want to at least address this question that’s been raised about radioactivity. There’s nothing that indicates that natural levels of background are harmful. It’s assumed... now, look. It’s assumed through studies with radioactivity, when they subject extremely large doses of radioactivity they see perceived medical effects. They assume that that’s linear down into the
background level. Down into the level that we normally get from living on this Earth. But as far as I know over the last thousand years man has always had a head, fingers, arms, legs, toes. As far as the genetic damage is... genetic damage due to radioactivity, it has not been perceived.

AUDIENCE MEMBER: You can have genetic defects over a period of time and you ask any [...] geneticist, I've talked to some myself...

FERG: But is it due... [talking simultaneously]

AUDIENCE MEMBER: And they themselves—there’s a whole argument about this—they themselves are arguing about it. Just what amount of damage comes from natural radiation...

FERG: The argument is because they can not... they assume that that is the situation; it’s not because they see it and they demonstrate it scientifically that levels of natural background radiation cause genetic damage, cause anything. They haven’t...

YOUNG: OK. At this point...

FERG: ...perceived, they haven’t observed that.

YOUNG: At this point, I’m going to ask... No. At this point I’m going to ask Dr. Nussbaum to summarize briefly the points he thinks have been made, and then I’ll ask Sandra to do likewise. Hopefully it’ll give you some time afterward so that you can informally meet with the panelists and express to them on a personal basis what your concerns are. Dr. Nussbaum?

NUSSBAUM: Before I give you my personal assessment, which is a personal statement, I’d like to deal with some scientific questions that were raised, because I think they are important for the information of the public. First of all, let me ask... let me raise the question again what it means to say the probability of a reactor accident is once every 200 years. I think Dave knows about the definition of radioactive half-life, which is of the same kind, it’s a probability number. It says that over a large number of radioactive atoms, there is a chance—if I have a 200-year half-life—there is a chance that within the 200 years, only 50% will be left. Now, I would ask Dave—and that’s just as an illustration—suppose he would take a radioactive isotope that has a 200-year half-life, and it would wire it in such a way that when the thing decays it would instantly kill him. Now that is about the same as saying there’s a chance of one in 200 of a nuclear power plant to suddenly erupt. Would he walk around with the atom of 200 years half-life in his pocket? Because he couldn’t tell when and at what instant that decay occurs. That puts things somewhat in proportion. Yes, there is a chance, and I won’t even quibble with the
200 years, but that’s the meaning. You don’t know when. It doesn’t say 200 years from now. This is absolute nonsense.

Secondly, let me also say that one of these big statements that are made by GE, PG&E, here, and again you find them in all the literature, is that no member of the public has ever been hurt, ever been injured. Now, what are the effects of radiation quite apart from the long-term effects of genetics, which we just had a discussion here. They produce cancers, among other things. It is well-known that it takes anywhere between five to forty years before a cancer caused by poisoning of the environment or radiation will actually be visible, and when it is visible, it doesn’t carry a little name tag saying, “I was produced by DDT,” or “I was produced by nuclear radiation.” [slight applause in background] Therefore the statement even though it is true is a lie. That’s one of those issues that we face. We have these things that can be both true and totally untrue. They are a lie because to the untutored layman it sounds like there’s nothing to worry about, but if you know really what radiation effects are, then this gives you a false feeling of security. Nobody knows. These people don’t know. Nobody knows how many people already have been hurt. The fact that the companies who do the nuclear fuel recycling hire every year several hundred poor people—students, among other people—to come in and clean up the mess, so that they get paid for half-days of work for one minute or one and a half minutes of actual decontamination, because by that time their total whole-body burden that is allowed by law is made up: that raises some serious questions. Are these people maybe not members of the public? And who will say that they have been hurt or have not been hurt? Nobody can make that decision.

I would like to now make my personal conclusion of this discussion, and that’s opinionated; it’s not a scientific statement. On the basis of my own personal understanding and reading of the evidence, I came to the same conclusion as Mr. Bridenbaugh, the engineer who worked for 23 years at GE, that the nuclear fission power production as we can do it now, with the present existing plants and the technology that is being used, is a monster that nobody seems to be in control of. That the salesmen of safe and economical nuclear power have totally lost their credibility. Already now the nuclear commitment in the form of radioactivity produced is several billions of curies—I’d like to remind you that’s the equivalent of... one curie is the equivalent of one gram of radium, and any hospital that has a gram of radium keeps it very safely stored away in heavy lead containers. The commitment that we already made with the 53 present nuclear reactors is awesome in itself. The questions raised about their safety only underscore this. The people must demand that this madness be curbed by such measures as our measure in Oregon. That the presently operating plants which do not even comply, some of them, as the testimony showed, with the existing Nuclear Regulatory Commission regulations, should be shut down immediately, because they don’t even comply to our present lawful
regulations. That new plants can only go into operation after the problems of loss of coolant, accidents, seismic instabilities, fuel reprocessing, waste storage, and the liability of the companies to the public with their assets have fully been resolved.

So we must, therefore, meet the false propaganda of the prophets of nuclear fission power head-on with the truth, and we must redirect our financial, technical, and scientific resources to develop alternative power sources with minimal further deterioration of our planet and our environment. We must insist that we would drastically have to reduce our squandering away of energy. I remind you of the statement made that the per capita use of energy in this country is twice what the Swedes have, and their standard of living is recognized internationally as being even higher than that of the average American.

YOUNG: I hope you are going to conclude very soon?

NUSSBAUM: Yes. I will. At stake is not the survival of an industry and its concomitant government bureaucracy. Rather, what is at stake is the survival of mankind on this planet.

YOUNG: Dave, would you or Sandra care at this time to make a response? We won’t ask you to be so brief; you’ll take a while, I take it, to respond to all of that.

KIEFER: Well, we probably will be brief. It’s difficult to respond to all of that in a few minutes. Unfortunately I didn’t get a chance to ask the panel any questions. I particularly had some for Betsy because she brought up some good points about conservation, and I would certainly like to see more conservation in this country. Unfortunately it is a thing that’s difficult to implement. I, for example, recycle all my bottles and cans; it requires a few minutes to wash off the labels and I have to make a trip to the recycle center occasionally, but not too many of my neighbors do that, because they need some kind of incentive to do it and I don’t, right now, know just what that incentive is. Certainly, something has to be done in the future to provide that incentive.

Even if one supports conservation and does his part to conserve, there is still energy needed in this country. Right now there are eight million people that are unemployed; there are many people in this country that live with a sub-standard of living. Certainly around the Pittsburgh area we see people in Appalachia who have a very poor standard of living. I don’t understand why the people that support conservation want to close a viable energy option, which is nuclear power. Right now we need all kinds of sources of energy. Certainly we don’t want to continue to be dependent on foreign oil as we have been in the past. We want to use our resources. We have lots of coal; we have reserves of uranium. Hopefully in the future we’ll see
solar energy being used, but solar energy and some of the other sources are not energy
alternatives that are here today. Today we do have nuclear power, and if you compare it to
other energy sources you’ll see that it comes out ahead on a lot of points. Certainly
environmentally it’s cleaner than coal, requires much less land use than coal does. We can talk
about what the health effects are from nuclear power plants and again, you’ll see that they are
much less than coal because of air pollution and mining. We can also talk about nuclear power
plants in terms of economics, and again, we’ll find out right now that they economically come
out ahead of other sources. Certainly, they come out better than oil-fired plants. In some areas,
it may be true that they are not cheaper than coal, but they’re certainly competitive. In the East
where I come from they are... it is cheaper to generate power with nuclear power plants than it
is with coal because of the high sulfur content of coal there.

So, what do you want to leave for your future and for future generations? Do you want to leave
a future with no energy? Do you want to close an energy source which can be used today? Do
you want to see people continually unemployed? Do you want to see people living at a sub-
standard of living because some people have more money and can afford to buy the oil and
natural gas that will continue to increase in price? All I’m asking is that you look at all the
energy options that are available, compare them as far as environment, as far as safety, as far
as economics go, and make a decision with an open mind and after you’ve looked at all the
facts. Thank you.

YOUNG: If you came today looking for simple issues and simple answers, you can see they’re
not available to you. We have extremely learned individuals, I think, here with us today and in
the audience, and you can see that they hold in many cases diametrically opposed views and
they hold them very strongly. I would like to thank you for taking the time of coming and
listening today, and I would like to thank all of our panelists for coming. [applause]

The panelists will remain if you care to talk with them for a few minutes afterwards.

[program ends following about 30 seconds of silence]