

BLUE RIBBON COMMISSION ON AMERICA'S
NUCLEAR FUTURE

+ + + + +

MEETING

+ + + + +

MONDAY,
NOVEMBER 15, 2010

+ + + + +

The Commission convened at 8:30 a.m. in Salons B, C and D of the Marriott Metro Center at 775 Twelfth Street, Northwest, Washington, DC, Lee Hamilton and Brent Scowcroft, Co-Chairs, presiding.

MEMBERS PRESENT:

LEE HAMILTON, Chair
BRENT SCOWCROFT, Chair
MARK AYERS

VICKY BAILEY
ALBERT CARNESALE
SUSAN EISENHOWER
JONATHAN LASH
ALLISON MacFARLANE
RICHARD MESERVE
ERNIE MONIZ

PER PETERSON
PHIL SHARP

ALSO PRESENT:

TIM FRAZIER, Designated Federal Official

SHUNSUKE KONDO, Japan Atomic Energy
Agency

PIERRE-FRANCK CHEVET, Ministry of

Ecology, Energy, Sustainable
Development and the Sea

KEN NASH, Canadian Nuclear Waste
Management Organization

ROALD SAGDEEV, University of Maryland

MIKE SULLIVAN, former Governor of
Wyoming

CECIL ANDRUS, former Governor of Idaho

REP. JOHN GARAMENDI, former Lieutenant
Governor of California

RUSSELL JIM, Yakama Nation

RICHARD STEWART, New York University

TOM LaTOURRETTE, RAND Corporation

AUDEEN FENTIMAN, Purdue University

C-O-N-T-E-N-T-S

Open Meeting/Review Agenda.4
Opening Remarks4
Overview of Japan's Nuclear Policy for the Back End of the Fuel Cycle.	10
By Dr. Shunsuke Kondo	
Overview of France's Nuclear Policy for the Back End of the Fuel Cycle.	45
By Pierre-Franck Chevet	
An Overview of Canada's Nuclear Policy for the Back End of the Fuel Cycle.	94
By Ken Nash	
An Overview of Russia's Nuclear Policy for the Back End of the Fuel Cycle.132
By Dr. Roald Sagdeev	
Advice on Working with State and Tribal Governments to Craft and Equitable and Enduring Solution160
Mike Sullivan	
Cecil Andrus	
Rep. John Garamendi	
Russell Jim	
Overview of "Fuel Cycle to Nowhere: US Policy on Nuclear Waste"241
By Dr. Richard Stewart	
Overview of RAND Corporation Study "Managing Spent Nuclear Fuel"253
By Dr. Tom LaTourrette	
Overview of American Nuclear Society Study on the Back End of the Fuel Cycle.270
By Dr. Audeen Fentiman	
Panel Discussion.278

1 P-R-O-C-E-E-D-I-N-G-S

2 (8:31 a.m.)

3 MR. FRAZIER: Okay. We're going
4 to go ahead and get started, if I could get
5 Commissioners to take their seats. My name is
6 Tim Frazier. I'm the Designated Federal
7 Officer for the Blue Ribbon Commission on
8 America's Nuclear Future. I'd like to welcome
9 you to this full Commission meeting. It's all
10 day today, half day tomorrow. And with that,
11 Congressman Hamilton, when you're ready, sir.

12 CHAIR HAMILTON: Thank you very
13 much, Tim. Good morning to everyone. Thank
14 you all for coming. This morning, the
15 Commission has a three-fold purpose. First,
16 the Commission will learn more about the fuel
17 cycle policy decisions that several leading
18 nuclear energy nations have made, including
19 the factors that influenced those policy
20 decisions and how the policies are being
21 implemented.

22 Secondly, this afternoon, we'll

1 have a roundtable discussion with several
2 former state and tribal government leaders who
3 can advise on how to work with state and
4 tribal governments to develop an equitable and
5 enduring solution for nuclear waste
6 management. Third, later this afternoon and
7 tomorrow morning, we will hear from a variety
8 of individuals and organizations who have
9 studied issues before the Commission and who
10 will share their findings and recommendations.

11 May I take just a moment to
12 reiterate why we are here? Secretary of
13 Energy and the President have asked us to
14 conduct a comprehensive review of policies for
15 managing the back end of the nuclear fuel
16 cycle and recommend a new plan. That's what
17 we intend to do. We are investigating a wide
18 range of issues. These include reactor and
19 fuel cycle technologies, options for safe
20 transport and storage of nuclear waste,
21 options for waste disposal and institutional
22 arrangements for the management of used fuel

1 and high-level waste. We'll also make
2 recommendations regarding the handling of the
3 Nuclear Waste Fund.

4 We are trying, at least, to
5 operate this Commission in an open and
6 inclusive manner. In conducting our work, we
7 have heard and will continue to hear from a
8 broad and diverse range of interested parties.
9 We are very mindful of the erosion of trust in
10 the federal government's ability to meet its
11 waste clean-up obligations. We have
12 appreciated and will continue to appreciate
13 the advice and guidance on restoring trust
14 that we have received from our invited
15 speakers and through public comment, both at
16 our meetings and through our web site.

17 We remind all who are interested
18 in our work that this is not a siting
19 commission. We will not be recommending
20 specific locations for any component of the
21 U.S. nuclear waste management system. Also,
22 the Commission was not asked to make

1 recommendations regarding the future use of
2 nuclear power in the United States. We will,
3 of course, consider a wide range of possible
4 scenarios for the future of nuclear power in
5 the United States to ensure that our
6 recommendations can accommodate a full range
7 of possibilities.

8 We have been charged with
9 submitting a draft report to the Secretary by
10 the end of next July. We intend to meet, if
11 not beat, that deadline.

12 We will now turn to the business
13 at hand. We very much appreciate the time and
14 effort the speakers have put into their
15 presentations and we look forward to hearing
16 what they have to say. Several of them have
17 come many miles to be with us.

18 As a reminder, at the end of
19 tomorrow's session, not today's, we will hear
20 from any member of the audience who wishes to
21 speak. A sign-up sheet for the public comment
22 period will be available tomorrow morning

1 starting at 8 a.m. and closing at 11 a.m. Of
2 course, the amount of time allotted to each
3 speaker will depend on the number of people
4 who wish to speak.

5 With that, I open the floor to
6 Commissioners for any statement or comment
7 that they wish to make before we hear from our
8 first speaker. Are there any such comments?
9 If not, we will proceed.

10 This morning, we will hear from
11 four distinguished speakers who will help the
12 Commission understand the policies of other
13 nations for the back end of the nuclear fuel
14 cycle and the factors that have influenced
15 those policy decisions. Several members of
16 the Commission's Disposal Subcommittee
17 recently visited Finland and Sweden to learn
18 more about their approaches to the back end of
19 the fuel cycle and found their visit to be
20 extremely valuable. The information we are
21 receiving from other nations will be of great
22 help to the Commission as we consider what

1 policies we might recommend be adopted in the
2 United States.

3 We've asked our speakers to keep
4 their remarks to about 20 minutes so we have
5 ample time for discussion. A caution light
6 will come on with two minutes left. A red
7 light comes on at the end of the presentation
8 of 20 minutes.

9 Our first speaker is Dr. Shunsuke
10 Kondo, the Chairman of the Japan Atomic Energy
11 Commission. Dr. Kondo has served as chairman
12 of the Commission since January of 2004. He
13 holds a Doctorate of Engineering in nuclear
14 engineering from the University of Tokyo and
15 served as a professor at the University until
16 his retirement in 2004. He also served as
17 Director of the University's Research
18 Institute for Nuclear Science and Technology.

19 Dr. Kondo, thank you for coming
20 all of the way to help us understand how Japan
21 has chosen to address the many issues before
22 our Commission. We welcome you, sir. We're

1 delighted to have you here, and you may
2 proceed.

3 DR. KONDO: Thank you. Good
4 morning, Co-Chairman Hamilton, Co-Chairman
5 Scowcroft, members of the Blue Ribbon
6 Commission on America's Nuclear Future. Thank
7 you for the opportunity to present you an
8 overview of Japanese nuclear energy policy.

9 CHAIR HAMILTON: Dr. Kondo, you'll
10 have to speak up. I'm not sure that
11 microphone is --

12 DR. KONDO: Okay, okay.

13 CHAIR HAMILTON: Okay. You'll
14 have to speak up. Thank you very much.

15 DR. KONDO: Focusing on the back
16 end of the nuclear fuel cycle. As the
17 particulars of the path Japan has chosen since
18 the establishment of the atomic energy
19 commission, given in the prepared text titled
20 Note on the Back End Policy, Past and Present,
21 I will talk about in this particular
22 presentation just a snapshot of the kind of

1 policy and activities at the back end of the
2 fuel cycle in Japan with some comment on the
3 related topics.

4 First, a few words on nuclear
5 energy and nuclear power generation in Japan.
6 Generally, the power companies currently
7 operating, 54 with light water reactors, thus
8 probably about 30 percent of electricity.
9 They contributed to the reduction of the
10 carbon dioxide emission 200 million tons
11 annually and to the increase in energy self-
12 supply ratio from 4 percent to 16 percent
13 under the assumption that nuclear energy is an
14 indigenous source.

15 Three units have loaded MOX fuel
16 fabricated in Europe and two units are under
17 construction. Three units are under
18 regulatory review for construction, and three
19 units are in the decommissioning phase.

20 The current policy goals Japan is
21 passing to enjoy the benefit of nuclear
22 energy: A, maintain the sound infrastructure

1 for safe, secure, safeguarded and sustainable
2 utilization of nuclear energy; B, reprocess
3 used fuel from light water reactors within the
4 domestically available capability, utilize
5 fissile materials thus recovered in light
6 water reactors for the time being and dispose
7 the vitrified high-level waste from
8 reprocessing process into a deep geologic
9 repository; C, promote nuclear energy research
10 and development efforts, including those
11 aiming at commercializing fast neutron
12 reactors and its fuel cycle technology that
13 can attain better fuel utilization and waste
14 minimization before 2050; D, promote
15 international cooperation and trade for
16 contributing to the assurance of the safe,
17 secure, safeguarded and sustainable
18 utilization of nuclear energy in every part of
19 the world and for pursuing mutual benefit and
20 fulfilling common responsibility among
21 partners.

22 The government recently decided to

1 expect the increase of the share of nuclear
2 power to about 40 percent by 2020 and about 50
3 percent of electricity generation by 2030 as
4 one of the most important actions to combat
5 global warming. Therefore, it's necessary for
6 the Japanese nuclear community to, first,
7 improve the average the plant capacity factor;
8 B, promote construction of new plants,
9 replacing aged plants in some cases; and, C,
10 pursue the understanding of the public on the
11 validity of managerial innovation to be
12 introduced from the viewpoint of safety
13 assurance and for increasing the capacity
14 factor, as well as on the importance of
15 nuclear energy for both assuring energy
16 security and combating global warming.

17 The last point I made because,
18 just show the current recent result of the
19 public opinion survey. This showed that the
20 majority of the Japanese people support the
21 promotion of nuclear energy, but, again, just
22 more than 50 percent of public feel uneasy

1 toward nuclear.

2 Now, on the Japanese policy on the
3 back end of the fuel cycle, since the 1960s,
4 in concert with the international effort of
5 nuclear power generation by electric power
6 company in Japan, the Japanese government has
7 been promoting the research under the ATR and
8 the of the fast neutron reactor that utilize
9 plutonium from the reprocessing of spent fuel
10 by conducting experimental fast neutron
11 reactor JOYO prototype advanced reactor
12 FUGEN, prototype FNR MONJU, and the Tokai
13 Reprocessing Plant, recognizing that for
14 pursuing energy security by way of nuclear
15 energy utilization, it is important to aim at
16 establishing closed fuel cycle.

17 Electric power companies jointly
18 decided in 1970s, sharing such recognition
19 with the government, to invest into the
20 reprocessing business in Europe so as to
21 assure a necessary amount of reprocessing
22 services for the time being and to start the

1 construction of a commercial reprocessing
2 plant in Aomori, that is Rokkasho Reprocessing
3 Plant, by establishing JNFL.

4 In the end of 1990s, after they
5 injected the investment into the construction
6 of demonstration advanced reactor, they
7 decided to start the use of MOX fuel in
8 reactors utilizing the plutonium recovered in
9 Europe for the time being and recovered at the
10 Rokkasho Reprocessing Plant also.

11 Before starting the construction
12 of the Rokkasho Reprocessing Plant,
13 recognizing the importance of assuring
14 international confidence in observing the
15 commitment of nuclear nonproliferation for
16 promoting nuclear fuel cycle activities in
17 Japan based on the recent from the
18 negotiation at the start of the Tokai
19 Reprocessing Plant, Japan started in
20 cooperation with the IAEA, the United States,
21 France, and so on the development of an
22 adequate concept and technologies for the IAEA

1 safeguards to large bulk-plutonium handling
2 facilities. The current IAEA safeguards
3 activities at the Rokkasho Reprocessing Plant
4 are based on the result of these particular
5 activities.

6 Furthermore, to increase
7 transparency, Japan has published annually the
8 quantities and the location of separated
9 plutonium it holds since 1997, and since 2005
10 electric power companies and other
11 organizations have published at the beginning
12 of every fiscal year the objectives of the
13 reprocessing to be executed in the year,
14 namely when and how to use the plutonium
15 recovered, based on the recommendation of my
16 commission.

17 Along with the decision I
18 mentioned, up to now 5,600 tons of used light
19 water reactor fuel and 1,500 tons of used gas-
20 cooled reactor fuel were reprocessed in Europe
21 by contract, and 1,020 tons of used light
22 water reactor fuel were reprocessed at Tokai

1 Reprocessing Plant. In the future, among
2 66,000 tons of spent fuel to be generated
3 before 2046, 32,000 tons will be reprocessed
4 in the Rokkasho Reprocessing Plant, annual
5 capacity is 800 tons, and it should be
6 completed in the near future. In short time,
7 I should say. And the remaining 34,000 tons
8 will be stored at spent fuel storage
9 facilities at reactor or away-from-reactor for
10 the time being and will be reprocessed at the
11 second commercial reprocessing plant in the
12 future. That should be coming in 40 or 50
13 years.

14 As the use of MOX fuel, as the
15 fabrication and introduction of MOX fuel, it
16 has been a major R&D activity of 40 advanced
17 reactor R&D. The FUGEN and JOYO and MONJU
18 have been loaded with MOX fuel fabricated at
19 the so-called Plutonium Fuel Fabrication
20 Facility at Tokai, utilizing plutonium
21 transported from Europe and recovered at the
22 Tokai Reprocessing Plant. On the other hand,

1 the utilities have just started to load MOX
2 fuel in the light water reactors because they
3 decided about ten years before, because of the
4 difficulty in obtaining the understanding of
5 the government.

6 The JNFL started now the
7 construction of the Rokkasho Reprocessing
8 Plant and for spent MOX fuel that should be
9 stored onto fast reactor, it was immediately
10 after we introduced but, quite recently, this
11 month I should say, it just started a
12 preliminary discussion about the management of
13 spent MOX fuel in the context of the so-called
14 second reprocessing plant, when and how this
15 particular plant should be built.

16 The Rokkasho Reprocessing Plant of
17 the JNFL, the completion of the commissioning
18 test has been delayed for several years for
19 particular plant due to a series of troubles
20 in establishing operation procedure of the
21 joule-heated ceramic melter in the high-level
22 waste vitrification line. And the JNFL quite

1 recently announced that it will be completed
2 in two years, based on their analysis of the
3 result of a series of mock-up tests to
4 reproduce the undesirable phenomena in the
5 melter and modeling and simulation activity
6 with a view to establishing the operating
7 procedure.

8 As for financing of this
9 particular reprocessing business in Japan,
10 along with the deregulation of electric
11 industry, the government established in 2005
12 a fund for reprocessing and related
13 activities, including the decommissioning of
14 facilities involved, collecting fees from
15 electricity customers based on the generation
16 of spent fuel. The fee is about 0.3 yen per
17 kilowatt hour or 1 yen per kilowatt hour from
18 the nuclear power plant, which is based on the
19 analysis of life-cycle cost of the activity.

20 Now, on the management of high-
21 level waste vitrified at Rokkasho Reprocessing
22 Plant. In Japan, since 1970s, in parallel

1 with the operation of Tokai Reprocessing
2 Plant, an expert group had discussed the
3 feasibility of disposing a vitrified HLW in
4 the geologic repository, after storing it for
5 30 to 50 years at a surface facility to allow
6 cooling, based on a so-called multi-barrier
7 system in stable geology at a depth greater
8 than 300 meters below ground surface.

9 The group concluded after more
10 than a ten-year study in 1992 that a
11 sufficiently stable deep geological
12 environment to ensure the performance of the
13 multi-barrier system can be found in Japan,
14 even though the country is located in a
15 tectonically active zone and complex geology
16 is expected in most part of the island.

17 Based on this recommendation, the
18 Commission asked the research organizations to
19 start the research and development activities
20 to establish technical basis for high-level
21 waste disposal project and for its safety
22 regulation. The research organization JAEA is

1 developing, among others, integrated methods
2 for characterizing the deep geological
3 environment at two typical geological
4 environments in Japan utilizing two
5 underground research laboratories, one in
6 Mizunami city in crystalline rock and the
7 other in Horonobe city in sedimentary rock.

8 Now, siting is a very difficult
9 program. In 2002, the NUMO, an organization
10 authorized by government to promote the
11 disposal activity, invited mayors of
12 municipalities to apply for site suitability
13 investigation. Although there have been
14 several preliminary moves and one failed
15 application, so far no mayor has successfully
16 applied.

17 Based on these activities and
18 failure, the Commission has asked government
19 and NUMO to strengthen public information
20 activities on the safety and the importance of
21 the disposal facility at both national and
22 municipal levels. This shows the result of

1 opinion poll taken last year. This shows that
2 now the majority of Japanese people think it's
3 our responsibility to decide the site for
4 geologic repository for high-level waste.

5 However, a great majority, I should say, of
6 the public disagree to entertain or accept the
7 repositories in their neighborhood.

8 Therefore, our commission is still
9 encouraging the government and NUMO to
10 continue actions to promote mutual
11 communication with the public patiently,
12 exploring innovative ways for increasing the
13 probability of application and, at the same
14 time, to prepare facilities that demonstrate
15 the concept of the repository and the safety
16 of the disposal, as a picture is worth a
17 thousand words.

18 Finally, I will briefly talk about
19 fast neutron reactor research and development.
20 We start operation of the prototype fast
21 neutron reactor MONJU in 1994. But in 1995,
22 the sodium fire event occurred at MONJU due to

1 a second sodium leak. Due to this event, the
2 local government asked us to stop the
3 operation of MONJU, and we are faced with
4 difficulty in promoting the fast reactor.

5 In 1997, we started the
6 comprehensive review of the program and asked
7 the organization and electric power company
8 and reactor vendors to perform a comprehensive
9 review of fast neutron reactor technology with
10 a view to exploring the promising concept of
11 the system. And receiving a report from these
12 groups, the Commission decided in 2006 to ask
13 the JAEA to step up the activity to promote
14 the research and development of a fast neutron
15 reactor, specifying goals in economy, safety
16 and reliability, waste management,
17 proliferation resistance, and so on from the
18 viewpoint of making it a sustainable energy
19 technology in the future.

20 In response, the JAEA started
21 FaCT, fast neutron cycle technology, project
22 with incorporation with electric power

1 companies, nuclear vendors, and so on to
2 explore technologies, reviewing their
3 effectiveness in innovative fast neutron
4 reactors, in which not only plutonium but also
5 actinides, minor actinides, are recycled, so
6 that should satisfy the goals. And they are
7 expected to propose us a feasible design of
8 the system before 2015. And just this month,
9 we started the review of the activity or
10 intermediate result of the activity in a
11 three-month project.

12 CHAIR HAMILTON: Dr. Kondo, in
13 order to allow time for questions, could you
14 begin to wrap up your remarks?

15 DR. KONDO: Okay. So, finally,
16 I'd like to say that the Commission believes
17 it important to pursue close cooperation with
18 like-minded countries, including the United
19 States, France in particular, in promoting
20 this particular endeavor, as it is a global
21 interest and the duty of major nuclear energy
22 supplier to make nuclear energy more

1 sustainable. Thank you for your attention.

2 CHAIR HAMILTON: Thank you very
3 much, Dr. Kondo. We'll open it up now for
4 questions from Commissioners. Do we have such
5 questions? Per?

6 MEMBER PETERSON: Kondo-sensei,
7 thank you for coming all this way to speak
8 with us and to present about Japan's nuclear
9 fuel cycle decisions. In thinking about
10 differences between United States and Japan,
11 the one that comes to mind is the difference
12 in the availability of natural resources,
13 especially for energy. So I was hoping that
14 you could talk a little bit more about how the
15 situation with natural resources or lack of
16 natural resources affects the decisions that
17 are made in Japan and what the current
18 assessments in Japan are around the
19 availability of uranium this coming century in
20 terms of stability of price and access, again,
21 given that Japan must import. And then maybe
22 also just to comment a little bit on the

1 possibility of obtaining uranium from sea
2 water.

3 DR. KONDO: Thank you. First,
4 natural resources in terms of energy, in the
5 past we have some coal, but it is depleted.
6 As I said, four percent of energy come from
7 domestic. That's from hydro. That's all.
8 And now people are talking about wind, solar,
9 and so on, and we can, by some assumption,
10 sizable amount of energy of course. But as
11 you may know, the Japanese are mostly
12 mountainous, and region is about 20 percent I
13 think, so it's not to so easy to convert whole
14 mountain into solar panels and so on. That's
15 the reason why we choose nuclear as the energy
16 for future back in 1960s.

17 As for uranium, in our case, we
18 have no uranium resource in our country, so it
19 must be purchased from abroad. And your
20 question is Japanese view of the global
21 uranium availability, we're not appropriate
22 person to talk about it, but we rely on

1 several estimates estimated by NEA or other
2 guys. We know that there is some significant
3 amount of uranium in the world. But, again,
4 the program is for us to think about
5 everything from the viewpoint of energy
6 security. We know that in the past years
7 we've seen a sudden jump of price of uranium
8 and so on, so we believe that it's prudent for
9 us to assure the on the foreign suppliers.
10 That's current thinking.

11 CHAIR HAMILTON: Richard?

12 MEMBER MESERVE: Dr. Kondo, it's
13 nice to see you again. In your presentation,
14 you indicated that you collect a fee of 1 yen
15 per kilowatt hour, and I'm not completely
16 clear on the exchange rate, but I think that's
17 about one cent per kilowatt hour which is
18 about ten times what we collect in the U.S.
19 You indicated it's based on an analysis but
20 that it also includes the cost of
21 reprocessing. Do you know what segment of
22 that fee is for storage and disposal and what

1 portion of it is allocated for your
2 reprocessing activities?

3 DR. KONDO: Yes. I think we have
4 some viewgraph on this particular point, but,
5 to be precise, yes, but general. It's the
6 users, customers. And it's going to be
7 converted into the kilowatt hour electricity
8 from nuclear, 1 yen per kilowatt hour. And I
9 think 0.6 yen come from reprocessing, 60
10 percent or something like that, yes. And the
11 remaining hours is waste disposal and some
12 other activity related to disposal activities.

13 So this is a breakdown of the
14 cost. Reprocessing and six others are there.
15 Okay. And in terms of, this particular slide
16 is a part of our study at the occasion of the
17 dispute on the needs for start of the Tokai
18 Reprocessing Plant. We have made a very
19 detailed study in the public domain, and we
20 summarize at the bottom. You can see at the
21 bottom that the recycle option is about ten
22 percent or higher than that of disposal cases

1 in terms of electricity generation.

2 CHAIR HAMILTON: Al and then Ernie
3 and then Allison.

4 MEMBER CARNESALE: Thank you, Dr.
5 Kondo. A couple of questions about
6 reprocessing. As you indicated, the decision
7 to reprocess was made in the 1970s and first
8 in Europe and then in Japan. At the time, the
9 1970s, people expected a much more rapid
10 growth of nuclear energy and much more
11 depleted source of uranium and much higher
12 prices. If you were making the decision
13 today, if you did not already have
14 reprocessing capability, what do you think you
15 would do?

16 DR. KONDO: Good question. That
17 was, of course, included in this particular
18 exercise, but the scenario one is the use of
19 Rokkasho Processing Plant and continue the
20 recycling business. Scenario two is just
21 operate Rokkasho and after that we dispose of
22 every spent fuel, and scenario three just

1 abandon Rokkasho Reprocessing Plant and use
2 the direct disposal and so on.

3 At that time, we decided, based on
4 this and other aspects, that we should
5 continue to use Rokkasho. So your question is
6 then if we have no Rokkasho Reprocessing Plant
7 then what should we, what do you think about
8 for future. It's a good question. It's not
9 so easy to answer. We can answer but just
10 from my personal viewpoint. We know that the
11 future, if we'd like to use the nuclear energy
12 for a long time, that's the key. If we'd like
13 to do so, then we should think about the
14 reprocessing. So at this moment, that's all
15 I can say.

16 MEMBER CARNESALE: Can I follow
17 up?

18 CHAIR HAMILTON: Sure, go ahead.

19 MEMBER CARNESALE: Thank you. A
20 second question also about reprocessing. You
21 indicate that, thus far, you've reprocessed
22 about 8,000 tons of spent fuel, if I'd just

1 add up the numbers, and you'd expect that by
2 2046 an additional 32 tons of spent fuel will
3 be reprocessed. Now, when we think about
4 reprocessing around the world, we only think
5 about the Japan and the United States. I'm
6 just wondering, thus far, roughly, what is the
7 total stockpile of plutonium now, what is,
8 roughly, the plutonium unaccounted for now,
9 and when you reprocess 32,000 tons of spent
10 fuel what do you expect to be the unaccounted
11 for mass of plutonium? Is it one percent, is
12 it one-tenth of one percent?

13 DR. KONDO: Okay. The number is
14 here.

15 MEMBER CARNESALE: Yes, that's
16 where my numbers came.

17 DR. KONDO: Yes, yes. And you're
18 talking about the so-called --

19 MEMBER CARNESALE: Stockpiles of
20 plutonium and the unaccounted for amount of
21 plutonium.

22 DR. KONDO: Now, as I said, before

1 starting with the construction of the Rokkasho
2 Reprocessing Plant, we paid due attention to
3 the problem of the safe reliability of the
4 plant, and we, of course, inviting the United
5 State and IAEA and so on, we make a review of
6 the technology available and finally concluded
7 that we should now utilize the approach to not
8 just talk about the math but to review the
9 plant comprehensively from the viewpoint of
10 the diversion. And we introduced several
11 innovative ideas, technologies in the plant.

12 So I now would like to keep quiet,
13 talk about just only the material unaccounted
14 for. That's my position. Of course, if you
15 would like to calculate it, assuming that one-
16 percent number, you can easily obtain the
17 number.

18 MEMBER CARNESALE: Yes, that's the
19 point of my question. That's right. And,
20 finally, if I may, again, in the 1970s, you
21 indicated that you felt that people were quite
22 confident that after 30 to 50 years of surface

1 storage you would be able to safely store it
2 in a geological repository. The 30 to 50
3 years is rapidly running out. What is your
4 current estimate of when you would expect to
5 be able to store it safely in a repository?

6 DR. KONDO: Okay. Just to be
7 precise, in starting from the 1970s, they
8 started a discussion and studies of such kind
9 of business, and they concluded in 1992 that,
10 in principle, we can do it in Japan,
11 irrespective of the rather -- geological
12 unstable island that has many complexities.
13 And we decided to go this way in 2000. And we
14 asked, we think about how to obtain the site.
15 My commission decided that to open it is the
16 most democratic way, and so we just explain
17 current policy. And we've spent ten years, 80
18 years from the start, and now we are talking
19 about this is the, we couldn't wait anymore.
20 So we should discuss new ways to approach to
21 the public. And the opinion poll results show
22 that now the people has a general

1 understanding of necessity of having a
2 repository but the point is the understanding
3 of the safety or other matters related to
4 these particular procedures.

5 So we are talking with these guys
6 about what should be the common ground to
7 discuss the matters, and we are now talking
8 about the equity of benefit, the benefit to
9 the nation, and somehow these benefits should
10 be equalized. That means, as a nation, we
11 should do many things to the particular
12 disparities. And then the question comes,
13 hey, you want to buy the site by money, so how
14 to respond to this kind of ethical question in
15 good way. And the solution is just ask them
16 to give us their idea of the future of their
17 society from the viewpoint of equity of
18 benefit.

19 CHAIR HAMILTON: Okay. Ernie and
20 then Allison.

21 MEMBER MONIZ: Actually, first, a
22 comment for Commissioner Meserve to bring him

1 up to date, 1 yen per kilowatt hour is now
2 much more than one cent. Chairman Kondo, this
3 actually follows Al's question. I think Japan
4 has unquestionably been a real leader in terms
5 of transparency, safeguards, integration of
6 this into the Rokkasho design, et cetera. But
7 one thing really disturbs me, and it is this
8 annual publication of quantities and locations
9 of separated plutonium. It just seems to me,
10 in an age of terrorism, this is a policy that
11 deserves reexamination, and I'd like to get
12 your view on that, whether that is happening,
13 that reexamination. And, third, what is the
14 general security posture and is that being
15 upgraded in terms of protection of stockpiles?

16 DR. KONDO: Thank you. Good
17 question. Our policy is transparency, but,
18 obviously, in the case of Chairman Meserve,
19 the security and the transparency, we're also
20 starting to make balance. But in the sense,
21 in the sense, the information, public
22 information, and what we are doing just to

1 identify the companies or factories.

2 Obviously, the facility should have something
3 from the viewpoint of the public, so the point
4 is that the quantity adds value from sites.

5 And I don't think we caused a huge difference
6 between no announcement or announcement from
7 the viewpoint of the people.

8 Of course, this is related to the
9 second question, of course the security is
10 nowadays an important issue, the same as the
11 safety. So we put our huge resources on this
12 particular aspect. As you know, the now
13 international community are in the process of
14 finalizing and we follow the particular
15 international on these particular activities.
16 We have very close operation, and I think this
17 particular -- yesterday or the day after
18 yesterday, President Obama meeting, the
19 necessity or the importance of joint activity
20 on the nuclear security.

21 CHAIR HAMILTON: Allison?

22 MEMBER MACFARLANE: Good morning.

1 Thank you, Mr. Chairman, very much for your
2 remarks. I have a couple of questions related
3 to MOX and plutonium. So tell me if I've got
4 this right. My understanding is that the
5 original plan for reprocessing was to use the
6 plutonium in fast reactors. Is that correct?

7 DR. KONDO: Fast reactor and
8 advanced reactor, yes.

9 MEMBER MACFARLANE: Okay. And so
10 at some point in time, a decision was made to
11 use plutonium, as in MOX, instead for light
12 water reactors, and I want to try to
13 understand how that decision was made because
14 that's sort of important in how we're thinking
15 about different fuel cycles in the future. So
16 can you shed any light on that or give us your
17 personal views? And then I have a couple more
18 questions.

19 DR. KONDO: In 1995, I think the
20 utility companies looking into the design of
21 the demonstrated advanced reactor, they
22 rejected the investment in this particular

1 project due to the economic reasons. And
2 since they have already invested in
3 reprocessing activities in Europe and also the
4 construction of the Rokkasho Reprocessing
5 Plant, it's quite reasonable for us to hold
6 them to think about the use of this particular
7 plutonium in their light water reactors. Not
8 so difficult but as a simple decision from my
9 viewpoint and from their viewpoint. They have
10 no choice at the particular moment.

11 MEMBER MACFARLANE: Well, you
12 could decide to just keep the plutonium around
13 and wait until you get your fast reactor
14 program going. I'm interested in the
15 difference there. But, anyway, so in the
16 Japanese program do all 54 reactors plan to
17 use MOX in the future, or is it just going to
18 be a subset of those? And then how long will
19 it take to work through the stockpile of
20 separated plutonium, which I think right now
21 is over 40 metric tons between what's in Japan
22 and what's in France?

1 DR. KONDO: Okay. The utilities
2 decide to use MOX fuel in just one-third of
3 their reactors.

4 MEMBER MACFARLANE: One-third.
5 Okay.

6 DR. KONDO: Yes, yes, 16 to 18
7 they said. It's quite logical balance of the
8 plutonium, yes. And we, of course, use the
9 plutonium for fast neutron reactor program, of
10 course. At present, most of the plutonium are
11 in Europe. In Japan, we have not enough even
12 to supply fast neutron reactor projects. We
13 are wondering how to make fuel for these
14 activities. If we just rely on the Rokkasho
15 Reprocessing Plant, in 20 or 30 years, we end
16 the supply, the whole plutonium, in the form
17 of spent fuel. So that's the reason why we
18 just started a discussion of this second
19 reprocessing plant, including the how to
20 manage the spent MOX fuel.

21 CHAIR HAMILTON: Vicky?

22 MEMBER BAILEY: Thank you. Thank

1 you, Dr. Kondo, and welcome and good to see
2 you here. I think a great deal of your
3 research and technology has contributed
4 greatly to our understanding of nuclear energy
5 issues here in this country and around the
6 world, and I've had the opportunity to visit
7 some of these areas in which you are talking
8 about today. So maybe I'd like to explore two
9 or three areas and one technical area. You
10 mentioned MONJU, the sodium fire. And I saw
11 the diagram and what have you, but have you
12 pinpointed exactly the cause and can you move
13 forward from there is one of my questions,
14 technically, from the standpoint of safety.
15 And I'd also like to understand the reaction
16 of the community when this happened, how you
17 were able to move forward from there.

18 DR. KONDO: First, the cause of
19 the leakage was completely understood, yes.
20 Just the root cause is the top management of
21 the engineering design brought the attention
22 to the detailed part of the component.

1 MEMBER BAILEY: You said it was an
2 engineering design issue?

3 DR. KONDO: Yes. I should say, as
4 you know, the devils lie in the details. So
5 engineers, design teams should pay due
6 attention to even the very detailed part of
7 the system. Often, in many occasions, you
8 know the cause isn't always the lack of
9 attention to the details. So it's the same as
10 in the case of Monju.

11 MEMBER BAILEY: I think it goes to
12 the point, though, of you look at recycling,
13 you look at the issue of separation of
14 plutonium and uranium, this goes to some of
15 the concerns we have in this country as it
16 relates to that technology and the feasibility
17 here.

18 DR. KONDO: And we've learned many
19 things from the lessons learned in the past,
20 especially in the case of safety. And now we
21 are, as probably you know quite well,
22 introduced the so-called defense in depth

1 philosophy. Okay. We cannot completely any
2 defect in the design, but we review in detail
3 from the viewpoint of public risk. From this
4 viewpoint, as in the case of the Monju
5 incident, was no incidents, no public impact,
6 just psychological impact was there because
7 the people are talking about there's no chance
8 of the sodium leak in this particular plant.
9 From my view, it's not good. But as they are
10 talking in that way, they are talking in that
11 way, this has some psychological impact upon
12 the people around the site. And it's the
13 reason why they took three, four, or five
14 years to accept the start of the Monju. So we
15 are talking about this particular incident
16 taught us many lessons about the management of
17 the facilities that can be regarded by the
18 public.

19 MEMBER BAILEY: You also talk
20 about, we're not a siting commission, but from
21 the standpoint of looking permanent
22 repositories and geological areas, I notice

1 you have a, was it the NUMO group and mayors
2 are able to make applications to this group
3 and so far you said no mayor has successfully.
4 Is it because of the areas, the geological,
5 you know, the fact that a lot of the tectonic
6 activity in those areas? What are some of the
7 issues why?

8 DR. KONDO: We asked the
9 organization to site survey, so mayors is not
10 necessarily to know anything about their
11 geological conditions. But just we asked them
12 to apply for a site survey. We made a three-
13 step approach, starting from the regional
14 survey and site survey and detailed design and
15 the safety. And each step we must ask the
16 opinion of the mayor of the area, and we are
17 now we want to enter the fast stage. Still
18 they are talking about, how to say, the impact
19 on the local industry due to the existence of
20 the particular facility. The psychological
21 matters should be taken care of very carefully
22 with direct communication and making a good

1 demonstration and inviting these guys to the
2 underground research laboratories 200 meters
3 below the surface. We invite young guys and
4 the people from the municipalities. We invite
5 public to these underground research
6 laboratories and give them some feeling of the
7 safety, hopefully, of the facilities.

8 CHAIR HAMILTON: Are there further
9 questions?

10 (No response.)

11 CHAIR HAMILTON: Dr. Kondo, thank
12 you very much for your excellent presentation.
13 We're most grateful to you.

14 Our next speaker is Mr. Pierre-
15 Franck Chevet, the Executive Director for
16 Energy and Climate in the French Department
17 for Ecology, Energy, Sustainable Development
18 and the Sea. In this role, he's responsible
19 for green technologies and international
20 climate change negotiations. Mr. Chevet is a
21 state representative of the French government,
22 of GDF Suez Board and a member of the GDF Suez

1 Strategy and Investment Committee. He is a
2 representative of the French government on the
3 supervisory board of AREVA and is a government
4 commissioner with AREVA NC, Andra, and the
5 French Energy Regulatory Committee. He also
6 is a member of the French Green Industry
7 Strategic Committee.

8 Mr. Chevet, it's a great pleasure
9 to have you with us this morning, and you may
10 proceed.

11 MR. CHEVET: Thank you, Mr.
12 Chairman, honorable members of the Commission,
13 ladies and gentlemen. It's a real pleasure
14 for me to be here and to have the opportunity
15 to make a short presentation, I will try to be
16 short, on the fuel cycle's back end. I've got
17 slides. They can be made public, obviously.
18 We also have prepared a small note dedicated
19 to the end of fuel cycle. It's an official
20 note. It can also be made public. We will
21 just review that at the end of my
22 presentation. And you will ask questions. If

1 I don't have the answer, it's possible I'm
2 quite a generalist, we will note the question
3 and send you the answer by written procedure.
4 It's very clear for me.

5 Just a few words about the general
6 context of nuclear energy in France, why we
7 have chosen more than 30 years ago to develop
8 nuclear energy. The answer was basically at
9 that time for energy independence and security
10 of supply reason. Now, the reasons are more
11 developed. It's the same, energy independence
12 and security of supply, but it's also a good
13 way to reduce CO2 emissions. It was not the
14 initial reason, but it's now a good reason
15 also. And there's also another reason: the
16 competitiveness of energy. We consider this
17 is a result of our situation that the price of
18 nuclear energy is quite competitive, at least
19 in our country but I think it's general.

20 And we are also willing to help
21 countries that wish to develop also peaceful
22 uses of nuclear energy, obviously provided the

1 highest standards of safety, of proliferation,
2 and environmental protection for two main
3 reasons. First, France wants to promote
4 climate change mitigation action plan at the
5 international level, so that's consistent with
6 our policy, nuclear energy policy and climate
7 policy. And also for a more selfish reason,
8 that is to say, if there is an accident
9 elsewhere in the world, we depend from 80
10 percent of our electricity production from
11 nuclear energy, so we don't want to have an
12 accident elsewhere in the world, so we are
13 willing to help on each area of the nuclear
14 development of nuclear energy.

15 About the opinion polls, we also
16 have regularly opinion polls organized every
17 six months until the beginning, I think, of
18 the 80s. And on the upper part of this slide,
19 if you can't read it I'm very sorry, we asked
20 the question, do you consider that nuclear has
21 more advantages than drawbacks. You see it's
22 not, do you fully approve. It's a more

1 mitigated question. And you see the part of
2 this slide show that a rather positive opinion
3 is dominant. It's roughly in between from 45
4 percent to 50 percent of French citizens that
5 you see that the relative negative opinion is
6 increasing in the time. I don't know if it's
7 a good or bad result. It's a result. I think
8 that the good result in that slide is that
9 there are no opinion part of that slide is
10 we're using in the time. I think that it's
11 one of the result of our strong policy about
12 transparency to explain what is nuclear,
13 what's wrong, what's good, and what happens.
14 And the result is this decrease on the long-
15 term issue when you look at this slide. But
16 you cannot consider that France is clearly in
17 favor of nuclear. We have strong debates, and
18 we still have strong debates about nuclear.

19 And we tried to develop a policy
20 to take into account the various different
21 timescale. Obviously, we're working now on
22 the extension of the current fleet lifetime.

1 We've got a big fleet, a nuclear plant fleet.
2 We tried to keep open the nuclear option
3 beyond 2020. We have decided to build two new
4 reactor of Generation 3 reactor in France.
5 And we are preparing actively the future of
6 those reactors, and we've got, we'll speak
7 about that later, a lot of R&D on Gen 4 and
8 especially about fast breeder for after 2020
9 on other activities. And also thinking about
10 the future, we always try to have an active
11 policy on spent fuel and radioactive waste
12 management.

13 There is a lot of players in the
14 field of nuclear energy. One detail that I
15 will speak specifically about is how we are
16 organized about the radioactive waste
17 management. We've got a dedicated public
18 agency on that point until now roughly 20
19 years which operate all the programs, the
20 industrial programs and our R&D programs on
21 that point. It's a very efficient tool for
22 the government.

1 This is a schematic view of the
2 French nuclear fuel cycle with all the
3 aspects. As you can see, that's part of this
4 fuel cycle. On the main part of the slide is
5 the present situation, and we have tried to
6 figure the Generation-4 system on the right
7 part of the slide to figure what will be in
8 the future, what could be in the future to
9 complete your cycle.

10 We've got a lot of acts about
11 nuclear energy. We've got the last one about
12 radioactive material. It is quite a recent
13 act. It was in 2006, four years ago. And
14 just to quote what has been in the act, it's
15 dedicated to the sustainable management of
16 radioactive material and waste. Both terms
17 are very important: sustainable management and
18 radioactive material and waste. We try to
19 deal not only with waste, on high-level waste,
20 but we try to deal with all the stuff of the
21 material in radioactive waste.

22 We have introduced a

1 classification, a very precise classification
2 of waste, especially on the right part of the
3 slide, dividing them on one side on activity
4 from very low level of activity on the
5 country, on high level activity, and dividing
6 them with the second pyramid, the life of the
7 waste from very short-lived and long-lived
8 waste.

9 And every three years we try to
10 have a complete inventory of all the waste
11 classified using this classification. Every
12 three years, we publish a complete inventory
13 of where, how many waste we have in each cases
14 of this diagram and where they are precisely
15 and so on. And this report, we've got copies
16 of this report in English, a few copies of
17 this report in English, if you're interested.
18 And every three years, we readjust this
19 inventory and make it public.

20 Well, just some points of the
21 important point of this act of the waste
22 management. Obviously, transparency and the

1 requirements, we got a lot of commission,
2 public commission, open commission with all
3 stakeholder which are involved about the
4 inventory of radioactive material I just
5 mentioned. We've got the national commission
6 on that point. We've got the scientific
7 commission on those aspects, everything being
8 basically public.

9 And we've got this special
10 mechanism, I would like to mention it. We
11 have created the obligation that utilities
12 have to create dedicated assets for
13 decommissioning and for radioactive waste
14 management. They've got to put the money on
15 a given place. They've got to manage this
16 money to invest correctly, just the amount of
17 the money does have to correspond to the cost
18 of the end of the fuel cycle and of the
19 dispensing of the installation. So they've
20 got to place this money somewhere and manage
21 it quite well.

22 And we've got a special financing

1 of R&D on research radioactive waste
2 management, which is based on a tax for
3 nuclear facilities. It's on nuclear
4 facilities, not on the cost of electricity
5 compared to the system we just mentioned.

6 And we also have a dedicated
7 public body, Andra, which is a national
8 centralized public responsible for the
9 operation of present disposal centers but
10 which is also responsible for R&D and also
11 responsible for regular inventory of
12 radioactive waste and so on. And this public
13 body is mainly funded by the utilities,
14 directly funded by the utilities. There is a
15 small amount off public budget in this agency
16 just to cope with off-fund waste. But,
17 basically, it's funded by utility.

18 Some facts about the French fuel
19 cycle. We've got EDF, Electricity De France,
20 is the world's leading nuclear operator. It's
21 the biggest fleet in the world with operator.
22 We've got, roughly, 60 nuclear power plant in

1 operation, basically all of the same type.

2 It's BWR. So it's policy choice to have a
3 standardization. We tried to operate in
4 France.

5 EDF produces more than 1,000 ton
6 of spent fuel every year, that figure is here,
7 and 22 reactors currently have the
8 authorization to use MOX fuel and four other
9 reactors are currently authorized to use
10 reprocessed fuel. We've got those from the
11 main player, which is AREVA, which is not only
12 supplier but which is also an operator in the
13 full fuel cycle and rendering back end
14 services. And just to mention two major
15 installation, La Hague and Melox plant, which
16 have more than 20 years of operation. And the
17 current capacity of the system for recycling
18 is 1,700 tons per year, which has to be
19 compared to the prediction of spent fuel by
20 EDF.

21 We got various management routes
22 for each kind which are under research,

1 especially for the high-level and medium-level
2 but long-lived waste. And we are studying
3 final disposal in argillite. It's 200 or 300
4 kilometers from Paris. We have identified a
5 zone for the possible location of the future
6 waste disposal facility, and we are now in the
7 process to have a very precise investigation
8 on a limited area with geological researches,
9 which is now 15 square kilometers. And we've
10 got a precise time schedule, which is clearly
11 mentioned precisely in the act of 2006 that I
12 have already mentioned.

13 The license we will have in 2013.
14 It's not written. A big public debate on the
15 main option of this kind of final repository.
16 There will be a license application expected
17 at the end of the next following year, that is
18 to say 2014. We will have to define also at
19 that time conditions of reversibility. The
20 present law is a law of 2006, as I said. It
21 was a result of a personal public debate that
22 we got to introduce the possibility of

1 reversibility in 100 years for disposal. So
2 at that time, we'll have to define the
3 conditions of reversibility and the final
4 operation which is expected in 2025.

5 So some comments about recycling
6 or no recycling. While recycling we consider
7 that there is some technical advantages. The
8 first one already mentioned by my colleague is
9 the security of supply. We consider that
10 recycling, we'll get a better use of energy
11 resources which are still in spent fuel. At
12 the presentation to the French system, which
13 is what I have described just before, we
14 recycle. We can set up using our system up to
15 25 percent of natural uranium consumption with
16 MOX fuel in our NPPs. Alpha dose gain of 25
17 percent is coming from the use of MOX fuel and
18 is coming from the enrichment of reprocessed
19 uranium.

20 We do consider also a recycling
21 participate in the security of supply. As
22 part of also as of diversification of

1 supplies, we apply this kind of principle not
2 only on the uranium. We also apply this kind
3 of principle in gas, on oil also. We don't
4 have gas, we don't have oil, but we try to
5 have a diversification of the sources and the
6 road for all the resources so it's very
7 consistent to have the same type of approach,
8 obviously, with uranium.

9 And we consider also that
10 recycling is an advantage. We consider that
11 it is with the long-term use of nuclear. It
12 provide a stock of recyclable uranium and also
13 with the fact that we are in the process of
14 studying Gen 4. I will speak about that just
15 after.

16 And about Gen 4, we are clearly
17 focusing on especially fast neutron reactors
18 as a way to use natural resources to burn
19 plutonium in a more efficient way and, thus,
20 to achieve the base use of natural resource.
21 There is a figure. We can reconvert at least
22 100 times higher with a fast neutron reactor

1 than with the present system.

2 And we've got also on that point a
3 very precise time schedule. We are starting
4 a prototype which is called ASTRID. We're
5 studying that, which could be started in the
6 beginning of the 2020s. And we've got an
7 intermediate rendezvous in 2012, so in two
8 years on that point to decide or not to pursue
9 to build this prototype.

10 About recycling, although the
11 technical advantages, we consider that this
12 recycling has significant advantage for the
13 disposal of radioactive waste, especially
14 adequate condition for storage and disposal,
15 for the final storing and disposal. It's
16 quite more easy, vitrified waste, they are
17 quite more easy to render and transport and to
18 store. It's quite more flexible.

19 Globally speaking, we speak about
20 that before, we consider that if reduced
21 volume and loading of the system compared to
22 the open cycle, so it facilitates the

1 disposal. We considered that there is a
2 positive impact on the disposal cost of using
3 the closed cycle, and it also reduce footprint
4 for storage and disposal facilities. I've got
5 a more detailed slide on that point. And also
6 I may add that we considered that it is a
7 mature technology, not an R&D technology but
8 mature technology with decades of experience,
9 like I think it began its operation in the 60s
10 so more than 40 years ago without any major
11 problem.

12 If you try to compare the
13 recycling option and open cycle, in terms of
14 footprint calculation with the same amount of
15 spent fuel to cope with, your figure is 5.5
16 square kilometers for the closed cycle and
17 it's more than two or three times this figure
18 for an open cycle, so there is a problem of
19 size of footprint of various options. And
20 there is also another problem, which is very
21 important, that the waste you're putting the
22 final disposal on, in the first option, on our

1 first option I'd say, the closed cycle, you
2 inject minor actinides and fission products.
3 But when it's an open cycle, you inject also
4 directly uranium and plutonium. And at the
5 end, in some years, at the end we are
6 fundamentally creating a new mine of
7 plutonium, a possible new mine of plutonium.
8 So for us, it's also a very important
9 consideration, considering the
10 nonproliferation aspects.

11 We considered that there is a
12 diagram trying to express, the sources of the
13 diagram is OECD calculations. Basically, fuel
14 costs, that's a very common figure, fuel costs
15 in nuclear operation we present to be 20
16 percent of the total cost. Globally speaking,
17 global fuel costs and the back end cost only,
18 we present only 5 percent of the total cost of
19 electricity generation. And we'll have some
20 comparison about open cycle and the closed
21 cycle, but the order of magnitude about 5
22 percent of impact on the price of electricity

1 is roughly the same in the two options. So,
2 okay, we can have a lot of discussion, but
3 what we would like to insist that this figure
4 is quite low. Only 5 percent of impact,
5 globally speaking, of the end of fuel, and
6 there are differences in between the two
7 options of, well, let's say 10 percent. Ten
8 percent of five percent is a very minor
9 impact, so we don't consider that there is a
10 clear conclusion based on economic aspects.
11 Basically, that's largely that nuclear energy
12 is competitive with or without recycling. And
13 we do consider but we understand that
14 recycling reduces the exposure to especially
15 uncertainties, which is very important
16 economically speaking, especially in
17 certainties of the final disposal, which is
18 probably the main issue of the back end fuel
19 cycle.

20 CHAIR HAMILTON: Sir, can I ask
21 you to wrap up your presentation so we'll have
22 time for questions, if you would, please? MR.

1 CHEVET: Okay. I will try to do that. Very
2 quick quote about nonproliferation aspect.
3 First, to say that our recycling facilities
4 are very good track record. Also that
5 recycling MOX fuel consumes roughly one-third
6 of the plutonium, which will reduce the stock.
7 Another very important point is that when you
8 do that you degrade the composition of the
9 remaining plutonium and, thus, the potential
10 for future attractiveness for non-peaceful
11 usage. That's very important.

12 And the last point is that we
13 recycle, our recycling is fundamentally driven
14 by the needs for our NPP to minimize the stock
15 of separated plutonium in France, so driven by
16 the predictions that we are not creating a lot
17 of plutonium reserve. When we create
18 plutonium, it's to have an immediate, very
19 short-term use in our NPPs.

20 Okay. I'll try to speed my
21 presentation. Just a political comment about
22 political issue: political acceptance. I've

1 spoken about security of supply and so on and
2 so on. But, basically, we have to demonstrate
3 our capacity to find a final solution for the
4 waste. And that is to say that, in France at
5 least, that the fact that we leave the burdens
6 on future generation, we've never before
7 considered to be acceptable in France, both by
8 the parliament. They want to have, they want
9 us to propose a solution and to have a
10 solution now. We cannot say that, okay, in
11 France at least, we can wait, we'll study on
12 that. They want to have a solution because
13 when we make opinion poll, I've seen for
14 Japanese people that safety was of the major
15 point, and you have the same question in
16 France, the question of the waste. The final
17 treatment of waste is a big question, and the
18 people in France want to have answers, a
19 precise answer. And for us, it will be
20 impossible to say that we will leave the
21 question for the next 10, 20, 50 years. It
22 will be impossible because the question is

1 asked now.

2 And we consider that nuclear
3 materials and waste have to be dealt with in
4 sustainable development approach, the same
5 terms that are used by the French, with the
6 idea of recycling. Recycling, meaning
7 minimization and conditioning of the waste,
8 and that we have mentioned elsewhere. I used
9 to work on classical waste also in the past.
10 Recycling is a big question. We try to answer
11 it on environmental policy, classical
12 environmental policy about separation. People
13 please separate your real waste, and we will
14 try after that to recycle. That basic
15 principle we tried to use on classical and
16 environmental matters. So the idea is very
17 known, very well known by French people. And
18 they ask us exactly the same question on
19 nuclear matters.

20 Well, one principle, it's back in
21 policy, we have to demonstrate now our
22 capacity to find a final solution for the

1 waste and to avoid leaving the burdens on
2 future generations is the basic principle.
3 Second principle for us is that nuclear
4 materials and waste have to be dealt with in
5 a sustainable development approach. Recycling
6 achieve the general principle we applied in
7 the classical industry. Those are the main
8 points I tried to focus my presentation on.

9 We also already have some
10 cooperation between U.S. and France in the
11 fuel cycle, with AREVA action especially,
12 cooperation on Gen 4. We have a lot of
13 technical exchange on radioactive waste, but
14 we considered that this cooperation could be
15 pursued because we are discussing a very
16 important matter, especially concerning,
17 obviously, back end of the nuclear fuel cycle.
18 We are interested also in discussing
19 especially about the liabilities of newcomers
20 concerning the spent fuel and waste. It's a
21 very important matter when we are, perhaps, in
22 a time of nuclear renaissance, rebirth -- I

1 don't know the exact term. And that we would
2 obviously be happy to provide any further
3 information on our policy, and we can also on
4 recycling, on waste management, on economical
5 issues. I mentioned economical issues, which
6 are important. We would be happy to organize,
7 if you please, possibly a workshop in the next
8 month if you want in France or here if you'd
9 like on a more detailed subject I do not have
10 the time to mention here in my presentation.

11 Okay. I tried to shorten my
12 presentation, but it was too long. Sorry.

13 CHAIR HAMILTON: Thank you very
14 much, Dr. Chevet, for a very thorough
15 presentation. We'll open it up for questions
16 now. Are there questions from the -- Allison,
17 we'll begin with you.

18 MEMBER MACFARLANE: Thank you.
19 Thank you very much for your presentation this
20 morning. I have a couple of questions. And
21 I apologize. I think some of them are kind of
22 technical, so maybe they're for later. But,

1 anyway, let me just go ahead. Do you know if
2 you intend to recycle all of your spent fuel,
3 or will there be some stockpile of spent fuel
4 that you won't recycle?

5 MR. CHEVET: Basically, I've
6 spoken about the MOX production is driven by
7 the need we have and, basically, we have to
8 reuse it. Basically, with the system, I
9 mentioned that we have 22 reactors using MOX
10 fuel and six are using --

11 MEMBER MACFARLANE: Recycled
12 uranium.

13 MR. CHEVET: Yes. And we are near
14 the equilibrium point. I was talking on they
15 can confirm that we're near the point of
16 equilibrium --

17 MEMBER MACFARLANE: Between
18 production of --

19 MR. CHEVET: Yes, reuse of MOX.
20 But when we have used MOX fuel, we produce
21 spent MOX fuel, and this is the final
22 production of our system, the spent MOX fuel,

1 which is not recycled again. So that creates
2 a quantity of non-recycled spent fuel, which
3 is, roughly, 1,000 ton of spent MOX fuel per
4 year. I can confirm the precise figure --

5 MEMBER MACFARLANE: Yes, that
6 would be --

7 MR. CHEVET: -- to have a complete
8 --

9 MEMBER MACFARLANE: Absolutely.
10 And so this brings me to my other questions,
11 so great answer. So what is the plan for the
12 spent MOX fuel? Are you going to reprocess it
13 at some point in time in the future
14 eventually? If so, do you need to build a new
15 reprocessing facility or certainly modify the
16 existing ones?

17 MR. CHEVET: So spent MOX fuel?

18 MEMBER MACFARLANE: Yes. And
19 where is the spent MOX fuel now? It's at the
20 reactors?

21 MR. CHEVET: Basically, it's in La
22 Hague.

1 MEMBER MACFARLANE: Oh, it's in La
2 Hague?

3 MR. CHEVET: La Hague. It's a
4 very beautiful country on the --

5 MEMBER MACFARLANE: Yes, I know.
6 I know, I know, I know.

7 MR. CHEVET: You know? Okay. So
8 everything is in La Hague.

9 MEMBER MACFARLANE: And all the
10 spent MOX fuel is there?

11 MR. CHEVET: Yes.

12 MEMBER MACFARLANE: And the plan
13 for the spent MOX fuel is?

14 MR. CHEVET: What is it? Sorry?

15 MEMBER MACFARLANE: What are you
16 going to do with the spent MOX fuel?

17 MR. CHEVET: So at that time we
18 store it. It's not a very big quantity, 100.
19 It's a quantity we got to cope with clearly
20 with safety, but it's using mainly pools, are
21 in pools waiting for 100 -- spent MOX fuel
22 barrier is not a big quantity. We've got

1 discussion. We have at least enough room to
2 go to 2020, and if we want to go further
3 waiting for Gen 4, especially, reactors which
4 could be used at that time, if we got them to
5 reuse spent MOX fuel. We can, obviously,
6 build a new pool in La Hague. We've got
7 space. It's not a technical problem, not as
8 much difficult as the final disposal is for
9 the new pool.

10 MEMBER MACFARLANE: Right. So you
11 mentioned also that you're reaching
12 equilibrium between the amount of plutonium
13 produced and the amount of MOX consumed, and,
14 at the same time, you have a stockpile of
15 separated plutonium of over 40 metric tons.
16 So how are you going to catch up?

17 MR. CHEVET: There is plutonium
18 content in classical spent fuel in the MOX
19 fuel, and you didn't mention this and you
20 mention -- there's no stock of plutonium, not
21 at MOX fuel. This stock, roughly, not 40
22 small, in between 20, but we can have the

1 precise figure. It's between 20 cubic meter
2 and 30 cubic meter -- no? Tons. Sorry.
3 Tons. Which is what we need to have time to,
4 when we fabricate MOX fuel we need to have
5 just a small reserve, a minimum technical
6 reserve to prepare the new assembly. So that
7 when I was saying that the process was driven
8 by the MOX fuel need, it is that. That in
9 order to build new assembly, MOX assembly, we
10 need to just have a small reserve --

11 MEMBER MACFARLANE: But it's not
12 small.

13 MR. CHEVET: -- already in La
14 Hague, but it's not, in France it's like La
15 Hague, which is a very complex, protected
16 installation.

17 MEMBER MACFARLANE: Okay. One
18 final question, and maybe this is a technical
19 question that you can tell me the number
20 later, but I'm interested in the quantity in
21 metric tons, not volume, of intermediate-level
22 waste that will require a geologic repository

1 that you have right now and that you have in
2 the processing plant.

3 MR. CHEVET: I'm sure, we have
4 mentioned that we have a plan, a very precise
5 inventory. So we --

6 MEMBER MACFARLANE: Sure. You can
7 get that to me later. That's fine.

8 MR. CHEVET: Okay.

9 MEMBER MACFARLANE: Okay, thank
10 you.

11 MR. CHEVET: We give you the
12 summary of this plan.

13 CHAIR HAMILTON: Okay. We have
14 four Commissioners seeking recognition. I
15 think that's probably about all we'll have
16 time for before the break. Al, Jonathan, Per,
17 and Ernie. Al?

18 MEMBER CARNESALE: Thank you, Mr.
19 Chevet. I have two questions. One is very
20 brief. On one of your slides, you said the
21 conditions of reversibility for the geological
22 repository are to be defined by law. That's

1 a very important point whether it's to be
2 reversible or not. When do you anticipate
3 that that decision will be made?

4 MR. CHEVET: So we have organized
5 on that very important subject a lot of public
6 debate. The last one before the law of 2006,
7 and one of the conclusions coming from the
8 public, but one of the conclusions was that
9 people prefer that we have, at least at the
10 beginning of the operation of the final
11 storage, that we organize all the technical
12 aspects in order to be able in 100 years to be
13 precise to make it reversible if we have
14 another solution. That was the conclusion of
15 the public debate, and we have decided to take
16 into account of this conclusion in the law,
17 the French law.

18 And we've got a time schedule,
19 there are some elements in my slide, for the
20 final disposal near Paris to be short. When
21 they will have to the license and the file,
22 they will have to define the precise

1 reversibility condition: what will we do in
2 100 years? And we will have a discussion in
3 the Parliament about the general principle of
4 this reversibility in 2014, so in four years.
5 In between that, there will be another public
6 debate. After that, Andra will have to take
7 into account of the principles fixed by the
8 Parliament, and we will have to apply that
9 into the license. We will leave to Andra to
10 operate this final waste. And at the end, in
11 100 years, I won't be there probably, we'll
12 have to, whether we have a new solution in
13 between or something else, no reversibility or
14 reversibility, but I cannot anticipate of this
15 time period.

16 But, basically, coming from the
17 public debate, it was the idea that we got at
18 that time to conceive a reversible final
19 disposal, which is not completely positive
20 when we speak about safety. When you are
21 doing irreversible things you reduce the
22 probability of having an external enter in the

1 final disposal. When it's irreversible, it's
2 much more easy to protect the final waste.
3 But reversibility was asked for by the public.
4 We can manage that for 100 years, but for a
5 very more longer period it won't be a good
6 solution. But for so short-term a period, we
7 considered that it was quite a good question.

8 MEMBER CARNESALE: I'll make my
9 second question brief. You had a number of
10 slides that had why recycling, and it's a
11 brief for recycling.

12 MR. CHEVET: Yes.

13 MEMBER CARNESALE: Now, I
14 understand that's what the French do. Of
15 course, the United States is going to have to
16 face the question should we reprocess and
17 recycle and, if so, when? If you're already
18 reprocessing, the argument for recycling is
19 quite different than if you're not
20 reprocessing. But what do you consider, if
21 you're going to consider the advantages and
22 disadvantages, understanding that France

1 considers the advantages to outweigh the
2 disadvantages, in your experience what do you
3 consider to the principal disadvantages of
4 reprocessing and recycling?

5 MR. CHEVET: The basic drawback of
6 an open cycle is the fact that you produce a
7 bigger quantity of final waste and that you
8 need to have a bigger final disposal. So the
9 size of the final disposal you are looking for
10 is bigger. And in France at least, I don't
11 know about your situation, we have more spaces
12 in the States than France for the fact that
13 our territory is smaller, the public thinks
14 sometimes it's not so good with this kind of
15 installation. I don't know for you, but for
16 us it was difficult for nuclear waste but to
17 look also for classical waste.

18 The idea to minimize the final
19 disposal for the high-level waste it's very
20 important, you know, to find at the end the
21 solution because if we arrive in debate saying
22 we've not made any effort to reduce the

1 quantity of waste, which is the classical
2 requirement to try to reduce the quantity of
3 waste, and we will now put in operation an
4 installation near your house, it's impossible.
5 Politically speaking, for us it would be
6 impossible. I'm not speaking about security
7 of supply, you see. I'm speaking about public
8 accidents just to apply the classical
9 principle.

10 And for us, you asked a question
11 about what is a situation, would you do again
12 the same choice now you have done in the 70s
13 or in the 80s, I would say I'm not sure. I'm
14 not the administer in charge. I think that
15 probably we would do the same choice, not for
16 the situation of uranium market which is quite
17 good now. We're not sure about the future.
18 I'm not mentioning that I think the best
19 argument, probably the best argument, our most
20 important argument is probably the public
21 accidents just in France of those kind of
22 final waste installation, nuclear or non-

1 nuclear.

2 CHAIR HAMILTON: We have time for
3 three more questions. Jonathan, then Per, and
4 then Ernie. Jonathan?

5 MEMBER LASH: I'm going to ask
6 three, Mr. Chairman. Does that mean I'm
7 taking away -- I'll ask three very short ones.
8 They're all related. I have three questions,
9 Mr. Chevet, about your map of the players in
10 France, which I found extremely useful. The
11 first, you said that Andra, which has the
12 basic responsibilities of public body, and I'm
13 interested in how the decision was made to
14 have a public body rather than a private
15 entity managed by the utilities.

16 Second, I'm interested in the
17 process for community consent, buy-in, opt-
18 out, how do you manage that process? And,
19 third, which of these entities makes the
20 decisions about siting criteria and operating
21 standards for the facility?

22 MR. CHEVET: Okay. So, basically,

1 we decided, we tried to cope with this in
2 France. We tried to achieve a waste aspects
3 in the end of the 70s and beginning of the
4 80s. And we had at that time a lot of
5 difficulty to find a good solution. And,
6 basically, at that time, with the idea that
7 both utilities can join together. It was a
8 good idea, but we didn't succeed in doing
9 that, especially because that for radioactive
10 waste installations it's a very public
11 service, I would say, as a common public
12 service. So it was not possible to do that,
13 so we created a public body but basically
14 funded by the utility. It was in the very
15 early 90s. I don't know the precise date, but
16 very early 80s. We got this public body, but
17 with a fundamentally with a private funding
18 with a direct mechanism. But the idea that it
19 could be directly private sectors all together
20 having the same ideas about the future and so
21 on, it became a very long-term aspect. That's
22 why we've created such a public body, but we

1 can have, I think you can have an alteration
2 in between the percentage of public and
3 private. Those are our choices. But I think
4 you need to have part of public and money
5 obviously coming from the private sector, but
6 they've got the responsibility of the final
7 waste. That's the first point.

8 You mentioned opt-out --

9 MEMBER LASH: Second is what form
10 of consent by the communities, and the third
11 is who sets the standards and the criteria?

12 MR. CHEVET: About standards and
13 criteria, Andra is working like an operator,
14 another operator. They propose something,
15 they make geological researches and so on, and
16 they have to produce a safety files. But
17 after that, which is in charge to say okay,
18 it's okay or not, basically. So that's the
19 classical standard applied to a public
20 operation, Andra in the French case.

21 But the second question I didn't
22 understand you so --

1 MEMBER LASH: When Andra selects a
2 community for possible siting of a facility,
3 do they have to consent to that selection, the
4 community?

5 MR. CHEVET: The consent, they are
6 okay with you mean? Yes, and it's always
7 difficult to say everybody is okay with such
8 kind of installation. But we have had, I
9 don't know how to say, a converging process.
10 We at first tried to include positive
11 geological area, very vast area, very large
12 area. But after that, we tried to select, to
13 converge to obtain the base localization. And
14 we are now in the process, a very converging
15 process. We are exploring a very short area,
16 a small area. I mentioned 15 square
17 kilometers. It's a very precise value, very
18 rough to have a strong with the public.

19 There is an incentive measures
20 which has been put in place. We inject some
21 money to help the local development, the
22 technical development of the community

1 concerned and so on. We've got, obviously, a
2 local commission for transparency and so on
3 just to facilitate the process of public
4 acceptance, local public acceptance. Not sure
5 if I fully answered your question but . . .

6 CHAIR HAMILTON: Two final
7 questions. Per and then Ernie. Per?

8 MEMBER PETERSON: I will compress
9 my questions into two very specific ones. The
10 first very important one relates to the fact
11 that the cost of managing spent fuel
12 reprocessing and the disposal are fully
13 internalized into the cost of electricity, I
14 believe; but I'd like, more specifically, you
15 mentioned R&D costs are paid by a tax on
16 nuclear facilities. Does that include R&D on
17 fast spectrum reactors? And then, more
18 specifically, for the costs of reprocessing
19 and disposal, how are those charged? Is it on
20 electricity, or is it on a tax on facilities,
21 or what's the specific way that it's charged?

22 MR. CHEVET: It depends. So for

1 Gen 4, basically it's paid by the state
2 through the CEA, the French Commissariat a
3 l'Energie Atomique, which is in charge to
4 develop these projects which is considered as
5 an R&D project so mainly funded by public fund
6 with the help, I think, of industry as part
7 of, the operators inject a little money. But,
8 basically, it's public funding, but it's R&D.

9 Specifically about waste
10 management, there is two aspects. Andra is
11 funded mainly by tax on its R&D activities.
12 It's for R&D. It's tax directly paid by the
13 utility. For industrial activities, just to
14 operate existing waste management
15 installation, we've got a lot of already, so
16 it's a contractual operation in between
17 utilities and Andra. We don't interfere with
18 that. They've got to discuss it together.

19 And I mentioned that at the end
20 the price of electricity got to take into
21 account all the type of costs, including the
22 cost of the final end of the fuel cycle, the

1 end, the dismantling. So we have created, you
2 have seen in one of my slides, an obligation
3 for each utility to have dedicated assets
4 covering exactly the cost estimate for the end
5 of the cycle, including dismantling. I'm in
6 charge to certify that they are doing their
7 job, that the utilities are doing their job,
8 that they have created dedicated assets and
9 they are managing this fund correctly, safely.
10 And at the end, they say that we've got this
11 cost, financial cost as to be incorporated
12 into the final price of electricity, and it
13 is. I'm not sure it's completely clear.

14 MEMBER PETERSON: That's actually,
15 it's very helpful. The next question relates
16 to spent fuel, managing spent fuel in
17 countries that are starting new nuclear
18 programs. For example, United Arab Emirates.
19 The United States 123 Agreement that was
20 recently signed pre-authorizes UAE to send
21 U.S. origin spent fuel to France for
22 reprocessing, which is important in terms of

1 the capability to make sure that we don't have
2 spent fuel building up in places where perhaps
3 it could present long-term security problems.
4 High-level waste would be returned to UAE, but
5 could you discuss how plutonium from the
6 reprocessing of the spent fuel would be
7 managed?

8 MR. CHEVET: So considering those
9 kind of situations, United Arab Emirates, the
10 French, we do consider that recycling met by
11 serious countries, like Japan or like you if
12 you decide on that, is a positive thing. But,
13 again, when we propose for a newcomer to a
14 recycle issue, we consider that is in charge
15 because it is a responsible, also a
16 responsible country, it has got to deal with
17 the final waste coming from this, which is a
18 result of this recycling. So we don't accept
19 on our territory those kind of final, it's
20 forbidden by law, the French law. We cannot
21 store of a final disposal of foreign waste on
22 our territory. It's a problem also of public

1 accident, but it's a law, so we are obliged to
2 do that. So at the end, we consider it's a
3 good thing to recycling, but they've got to
4 deal with the final waste.

5 We are ready to help them, as I
6 mentioned Andra, we are ready to propose an
7 Andra addendum to find an interim storage
8 first because you cannot find directly a final
9 storage. We are not able to do that, so we
10 can help them to -- but the idea is if they
11 are sufficiently responsible for the new NPP
12 they must also be responsible for finding a
13 solution for the final waste, taking into
14 account the fact that I mentioned that when
15 you recycle, the final waste are not
16 plutonium. They are not under high IAEA.
17 It's not the same type, it's not spent fuel,
18 classical spent fuel. It's less, it's much
19 more better for nonproliferation aspects. So
20 that's why our position is, okay, is that the
21 French do say we cannot store final waste
22 coming from outside but to go back. But

1 concerning plutonium and uranium, we do
2 consider that those are not waste just to be
3 consistent with the fact that we are recycling
4 them. So for plutonium and uranium, those
5 kind of products, the ownership of these
6 products is the ownership -- we do consider
7 that we can and it's better to store it, to
8 sell it, to reuse it in MOX fuel somewhere
9 else. It could be in France, but it could be
10 elsewhere. Everybody is having MOX fuel
11 usage.

12 MEMBER PETERSON: So you do not
13 return the plutonium? You can use it
14 domestically and --

15 MR. CHEVET: Domestically or I've
16 said that La Hague is not functioning only for
17 internal purposes. We are doing recycling for
18 other country. We are also fabricating MOX
19 for Japan, for a lot of other countries, or we
20 can reuse it if the owner is okay, and I think
21 it's better we can reuse it in a very safe
22 manner. It's our point of view.

1 CHAIR HAMILTON: The final
2 question will be by Ernie.

3 MEMBER MONIZ: Well, given the
4 time, we will not be able to go through a
5 bunch of issues. I must say, I will at least
6 state for the record I believe that virtually
7 every reason given for the waste management
8 advantages of the current reprocessing scheme
9 are dramatically overstated. Volume, mass,
10 you name it, waste form. And these are very
11 serious issues. In fact, following on Per's
12 statement, I see no end to the logical
13 statement just made about what happens to the
14 plutonium because even if you use it
15 domestically then you have used MOX fuel and
16 is that going to go back to the UAE in its
17 form then? The waste management advantages
18 for the country with a small program have not
19 been articulated in any way that is very
20 convincing.
21 Nevertheless, minor actinides are still going
22 back, et cetera. But that's, I guess, for a

1 different time to debate. Let me go to a more
2 precise question.

3 I was actually quite stunned by
4 your graph of the public opinion in France and
5 its trends, and I'm wondering two things.
6 One, do you have a correlation of the positive
7 and negative responses with proximity to
8 nuclear facilities? And, secondly, is that
9 upturn recently, do you know, is it associated
10 with more visible discussions of waste
11 management in the public?

12 My next and last question would
13 be, first, as an observation, in your slide 15
14 you talk about the advantages of MOX for, to
15 quote you, which minimizes the stock of
16 separated plutonium. I guess I would argue
17 not reprocessing at all would minimize the
18 stock of separated plutonium, and it just
19 seems to me indicative, as Al suggested, one
20 has locked in a pathway over 30 years ago and
21 the discussions are around variations of that
22 pathway as opposed to going back to a more --

1 bigger reconsideration, and I'm curious
2 whether that kind of de novo reevaluation is
3 in the cards.

4 MR. CHEVET: Well, about your two
5 questions about this slide, this diagram, if
6 I understand your question, is there a
7 difference of results if you are near an
8 installation or far, this is a national
9 opinion poll, so these are the average value
10 at the French level. I don't have here but we
11 can find some more local opinion poll which
12 has been made. I think that, generally
13 speaking, we have better results on very
14 local, on very local than 20 kilometers around
15 the installation, nuclear installation. And
16 after that, I believe all of the department,
17 you find classically this kind of result. But
18 we can have a look if we've got more detail.
19 Local results varied around near installation.

20 You had a second question on that?
21 The question was how can I explain which
22 trend?

1 MEMBER MONIZ: It was whether the
2 increased public discussion about waste
3 management is known to affect those trends or
4 not. Has that led to more negatives,
5 basically?

6 MR. CHEVET: It's difficult to, my
7 only comment, I'm not quite sure about that,
8 is that the good news is that no opinion
9 result is decreasing. There is an increase of
10 negative position. I don't know how to
11 explain that. I think that we tried to be
12 transparent. When you try to be transparent,
13 you explain what's wrong, what's bad. So you
14 see at the end, well, you tend, I think, with
15 a more classical result.

16 We do consider that to have this
17 on nuclear is normal, and the fact that we are
18 now 50/50, well, it's quite normal for me. I
19 mean, I'm not engaging my government on that
20 point.

21 Second point is that you see, but
22 it's a very political comment, too much

1 political comment. You see that there is
2 already a reduction in the positive, the
3 comparative advantage of the positive value.
4 In 2002 and 2007, it's presidential campaign.
5 We got a lot of debates also in France, and in
6 those debates there is also nuclear. But if
7 I remember, the two last presidential
8 campaign, the men are questioned was not about
9 waste management, to be clear. But the main,
10 at the political level, the main issue of the
11 political debates were focused on the safety,
12 on the fact we've got to build new NPP. So
13 we've got to wait for the Gen 3. It was more
14 safety than waste management, so I don't think
15 directly link in the median and long-term to
16 that point.

17 And you mentioned slide 15. When
18 I --

19 CHAIR HAMILTON: Dr. Chevet, I
20 think our time has expired, and we thank you
21 very, very much for your presentation. We'll
22 take a break. Ten minutes, please. Return

1 for the final two speakers this morning.

2 Thank you.

3 (Whereupon, the foregoing matter
4 went off the record at 10:29 a.m. and resumed
5 at 10:40 a.m.)

6 MR. FRAZIER: Okay. If everyone
7 could take their seats. Commissioners, come
8 on in. Grab a chair, preferably the one
9 behind your name. Congressman?

10 CHAIR HAMILTON: I ask once again,
11 if the Commissioners would please take their
12 seats we will get underway for the third
13 speaker this morning. Okay. Our third
14 speaker is Mr. Ken Nash, President of Canada's
15 Nuclear Waste Management Organization. He has
16 served in this role since 2006. Mr. Nash is
17 a founding director of the Nuclear Waste
18 Management Organization and was the immediate
19 past chair of the Organization's Board of
20 Directors. Prior to joining the Nuclear Waste
21 Management Organization, he held a number of
22 management positions at Ontario Hydro and

1 Ontario Power Generation in the areas of
2 finance, engineering, and environmental
3 management.

4 Mr. Nash, thank you very much for
5 joining us. We look forward to your
6 presentation. I ask you to keep your remarks
7 to the 20 minutes, and then we'll have time
8 for questions. Mr. Nash?

9 MR. NASH: Thank you and good
10 morning. It is indeed a pleasure to be here.
11 I hope my remarks will be of value and
12 assistance to the Commission. I understand
13 the Commission does have available to it a
14 written submission that we did make earlier,
15 so I'll be drawing most of my remarks from
16 that submission.

17 The end point of Canada's nuclear
18 fuel cycle requires eventual safe isolation of
19 used fuel in a suitable geologic formation
20 where it will be monitored and it could be
21 retrieved, if necessary. It also requires the
22 facility to be located in a willing host

1 community that is fully informed. I will
2 explain how we arrived at this policy and
3 reviewed progress on its implementation.

4 First of all, in Canada,
5 electricity energy choices are the purview of
6 provincial governments. Nuclear energy and
7 the management of nuclear waste are regulated
8 by the federal government. Work on used fuel
9 disposal was initiated in the 1980s after the
10 1978 Ontario Royal Commission on Electric
11 Power Planning. This commission recommended
12 that nuclear waste capacity be capped pending
13 progress on nuclear waste disposal. This led
14 to the governments of Ontario and Canada
15 establishing the Canadian Nuclear Fuel Waste
16 Management Program where Atomic Energy Canada
17 Limited federal Crown corporation was assigned
18 the responsibility for developing geological
19 disposal.

20 In 1989, in response to public
21 concern about repository siting activities,
22 the concept of geologic disposal was referred

1 to a federal environmental assessment panel
2 and a moratorium was placed on siting
3 activities. That federal panel conducted a
4 dedicated long process, very comprehensive, of
5 ACL's disposal concept. In its 1998 report,
6 the panel said that technical safety of
7 geological disposal had been demonstrated at
8 a conceptual level. However, public support
9 had not been demonstrated and there was
10 insufficient social acceptability to proceed.

11 The panel made a total of 52
12 recommendations that were largely translated
13 into the 2002 Nuclear Fuel Waste Act, a new
14 framework of responsibility and decision-
15 making. The 2002 Nuclear Fuel Waste Act
16 established clear roles and responsibilities.
17 The Act requires Canada's nuclear energy
18 corporations to establish the NWMO, Nuclear
19 Waste Management Organization. The Act
20 requires NWMO to appoint an advisory council
21 with a diversity of expertise and that that
22 council provide independent comment to the

1 government on NWMO's work.

2 The Act established NWMO's
3 mandate. Our first mandate was to undertake
4 a three-year study of options of the long-term
5 management of used fuel. Following selection
6 of the management approach by the federal
7 government, NWMO is to implement that
8 approach. The Act requires NWMO to provide an
9 annual report to the federal government
10 through the Ministry of Natural Resources and
11 the Ministry to table this report in both
12 Houses of Parliament. NWMO is required to
13 submit a report every three years on its
14 progress and a strategic plan for the next
15 five years.

16 The Act stipulates that the major
17 waste owners provide funding for all aspects
18 of the long-term management of used fuel.
19 Waste owners must establish trust funds and
20 make annual deposits to those funds. The
21 funds may only be accessed by NWMO and may
22 only be used for the purpose of long-term

1 waste management and may only be used after a
2 construction license has been issued by the
3 Canadian Nuclear Safety Commission.

4 In accordance with the
5 requirements of the Nuclear Fuel Waste Act,
6 significant progress has been made since 2002.
7 The NWMO was formed with a mission to develop
8 and implement a socially-acceptable,
9 technically-sound, environmentally-
10 responsible, and economically-feasible plan
11 for Canada's used fuel. An advisory council
12 chaired by the Honorable David Crombie, the
13 former federal cabinet minister, was formed.
14 Trust funds have been established by the used
15 fuel owners with balances that now exceed \$5
16 billion. NWMO completed a study of
17 alternative storage and disposal options and
18 submitted a recommendation to the government
19 in 2005. A governmental decision was made in
20 2007 to accept the NWMO recommendation.

21 NWMO went on to publish an
22 implementation plan in 2008. More recently,

1 NWMO initiated a process for selecting the
2 site earlier this year.

3 During the three-year study of
4 alternatives, significant efforts were made to
5 address the societal aspects of used fuel
6 management. NWMO's study was led in phases,
7 inviting Canadians to help shape the study and
8 assessments at each point. As a starting
9 point, national dialogues were convened to
10 identify those values that Canadians believe
11 should apply to the long-term management of
12 nuclear waste. NWMO led 120 information and
13 discussion sessions that were held in all
14 provinces and territories. Expert workshops
15 and roundtables and web-based activities took
16 place. Aboriginal organizations designed and
17 delivered their own dialogues. The study of
18 options and development of the plan involved
19 18,000 Canadians, including 2500 Aboriginal
20 people, and contributions from 500 experts.

21 Not surprisingly, there was a wide
22 diversity of views. However, there was common

1 ground. Safety and security is a top
2 priority. This generation must take action
3 now to manage the waste that we have created.
4 We must take advantage of best international
5 practice. And because of the long time frames
6 involved, the approach must be adaptable to
7 allow for changes in technology and society's
8 priorities.

9 NWMO's recommendation, which we
10 call adaptive phase management, emerged as the
11 approach that would best meet the priorities
12 and values of Canadians. This is the plan
13 that was approved by the Government of Canada
14 in 2007. This plan is both a technical method
15 and a management system. The technical method
16 is isolation in a deep geological formation
17 where used fuel can be monitored and retrieved
18 if need be. This method, we believe, is
19 aligned with international practice.

20 However, equally important is how
21 we get there. And this is specifically
22 tailored to Canadian values and priorities.

1 It requires flexibility in the pace and the
2 manner of implementation and responsiveness to
3 new developments and traditional Aboriginal
4 knowledge. Openness, transparency, and staged
5 decision-making with the involvement of
6 Canadians at every step of the way. It
7 requires the facility to be located in an
8 informed and willing host community.

9 The government accepted NWMO's
10 recommendation in June 2007, and NWMO is now
11 responsible for implementing what we consider
12 to be a national infrastructure project that
13 will involve an investment in excess of \$16
14 billion by the owners of used fuel. It will
15 be a high-technology project with skilled
16 employment for hundreds over many decades, and
17 it will operate as a center of international
18 collaboration. It will involve a long-term
19 partnership between the NWMO and the
20 community, and it will foster community well
21 being. Of course, it will be highly regulated
22 with strict scientific and technical criteria

1 to assure safety.

2 Since 2008, NWMO has annually
3 published an implementation plan after public
4 consultation. The plan charts direction and
5 milestones against seven key objectives:
6 building long-term relationships with
7 interested Canadians, further developing
8 repository designs in safety cases,
9 collaboratively developing and then
10 implementing a process for site selection,
11 updating the funding formula for trust fund
12 deposits to ensure that those that benefit
13 from nuclear energy pay for its long-term
14 costs, research into alternative technology
15 and technical methods and societal
16 expectations to ensure that our plans are
17 adapted as necessary, continuous improvement
18 in our governance and continuous improvement
19 in our organizational capability.

20 Building relationships and
21 involving interested Canadians in decision-
22 making is a fundamental part of our plan. We

1 very much see ourselves as working on behalf
2 on Canadians to implement adaptive phase
3 management and that we can only succeed if we
4 maintain the social license to proceed. We've
5 established several mechanisms to achieve this
6 in a systematic way, including a forum of
7 Aboriginal elders from across Canada and
8 projects with several Aboriginal groups, a
9 forum of municipal association leaders, and
10 frequent dialogues with the leaders of
11 reactive communities.

12 The diversity of engagement
13 methods. Multi-party dialogues, citizens
14 panels and government roundtables, dialogues
15 led by Aboriginal organizations, public
16 information sessions, and briefings on request
17 are several of the mechanisms that we use.
18 And, of course, ongoing provincial and federal
19 government briefings. We use these mechanisms
20 on a frequent basis to seek input to our
21 implementation plans and, more recently, on
22 our site selection process.

1 Probably the most challenging task
2 is selecting the site for a used fuel
3 repository. In 2008 and 9, using the
4 mechanisms that I just described, we held two
5 rounds of public dialogues that focused first
6 on the principles and then a draft process for
7 site selection. Throughout those dialogues,
8 Canadians continued to express the values and
9 principles they expect to see guide the siting
10 process: safety first; consistent with
11 international standards; the need for this
12 generation to take action; adherence to the
13 principle of informed and willing host; a
14 commitment to community well being; and the
15 importance of a fair, inclusive, and
16 transparent process involving all those that
17 may be affected.

18 In May this year, we initiated the site
19 selection process and have been actively
20 building awareness to the process since then.

21 Capacity building program offers
22 communities an opportunity to learn more about

1 the project. Several communities in
2 Saskatchewan and Ontario have taken advantage
3 of that program. The full site selection
4 process involves a series of progressively
5 more detailed studies to evaluate candidate
6 sites for both technical safety and social
7 acceptability. For a final site selection, it
8 will, of course, be necessary for NWMO to
9 demonstrate a robust safety case against
10 regulatory requirements and for the community
11 to demonstrate strong support.

12 So in summary, following the
13 introduction of the legislative framework in
14 2002, Canada's plan for the long-term
15 management of used fuel has moved forward.
16 Governance is in place to oversee the plan's
17 implementation. Trust funds and mechanisms
18 are in place to ensure that the financial
19 burdens will not be passed to future
20 generations. The plan for used fuel
21 management has been developed that reflects
22 the priorities of many Canadians. The plan is

1 moving forward in the spirit of collaboration.
2 Interested individuals and organizations shape
3 the design of the site selection process, and
4 communities are beginning to learn more about
5 the project.

6 Canada, together with its
7 international partners, does have the
8 technology for the safe, long-term isolation
9 of any geologic formation. And as a result of
10 successive reviews, extensive dialogue, and of
11 government decision-making over the past 25
12 years, NWMO now has a mandate that is
13 consistent with the expectations of Canadians
14 that expect to see action taken. Thank you.

15 CHAIR HAMILTON: Mr. Nash, thank
16 you very much. We'll turn now to questions
17 from the Commissioners. Mr. Sharp first and
18 Allison.

19 MEMBER SHARP: Thank you very
20 much, Mr. Nash. It appears to be a very
21 impressive process you folks have gone through
22 and which I know a number of our, especially

1 one of our subcommittees has focused very
2 heavily on. Let me ask you a couple of
3 questions. I wasn't quite clear on who
4 initiates the interest. In other words, does
5 the federal government or the provincial
6 government sort of say these broad areas
7 appear to be technically appropriate and then
8 people within that area decide whether they
9 want to pursue this, or is this strictly a
10 matter of a tribe, a local community, a
11 county, or a provincial government stepping
12 forward and saying we'd like to discuss this?

13 MR. NASH: It's definitely the
14 latter.

15 MEMBER SHARP: I mean, well,
16 that's --

17 MR. NASH: That's the short
18 answer.

19 MEMBER SHARP: No, no, no, that's
20 --

21 MR. NASH: Certainly, the
22 community, whether it's an Aboriginal

1 community or a non-Aboriginal community, hears
2 about the project, has its own internal
3 discussion, and then decides to step forward
4 to learn more about the project. And a very
5 important component of this is the assurance
6 and the trust on behalf of the community that
7 it can exit at any point in time.

8 MEMBER SHARP: Right. No, I
9 understand that. They don't get themselves
10 entangled if they step forward with interest
11 is, I'm sure, a major principle here. One of
12 my questions, however, about that is in your
13 country, as well as in ours, we have vast
14 areas in which populations are spread thin,
15 and this ought to be viewed or has been
16 historically viewed, perhaps incorrectly so,
17 as an asset in terms of where we might put
18 this stuff, that we can have less impact
19 certainly on established communities because
20 we have all this territory. But then the
21 question becomes so what's a community? And
22 I don't know if you've defined that. So if

1 we're in a rural area, is it a -- we use
2 counties. I don't know if you use counties.
3 I know you use provincial governments. Is
4 that sort of a community, or is this just
5 we're waiting to see who steps forward?

6 MR. NASH: Yes. Certainly, the
7 question of what is a community has been
8 discussed quite extensively and does continue
9 to be discussed, and there is certainly no one
10 neat definition of a community. The process
11 that we have requires this expression to learn
12 more to come from an authorized community,
13 such as a town council. It could, in fact, be
14 a county, and it could be the leadership of a
15 First Nation, a bona fide First Nation. And
16 one of the first things that we would do is to
17 ensure that the expression to learn more comes
18 from a body such as that.

19 MEMBER SHARP: Then perhaps this
20 answers my next question, which is what
21 constitutes a willing host and whether you
22 define that or not? In other words, is it a

1 formal act of the local leadership, the
2 provincial government, the tribal council, or
3 whatever the nature of the governing body is?

4 I mean --

5 MR. NASH: Well, perhaps, I'll
6 provide two points in response to that. First
7 of all, the community, in our definition of
8 community, although it is not a strictly
9 defined definition, but it does include not
10 only the municipality for instance but it
11 could also include any First Nation or
12 Aboriginal group that was in the general area.
13 It could include neighbors. So it is based on
14 the region, so there's a host community but
15 then we also, as we move forward, would
16 consider the region.

17 MEMBER SHARP: But I'm assuming
18 you're sticking with constitutional and
19 legitimate government authorities as opposed
20 to there has to be an 80-percent agreement
21 within a community. I'm operating on the
22 presumption there is no where in the world

1 that you're going to get universal consent to
2 anything but especially for a nuclear waste
3 site, so somebody has to make a formal
4 decision. And are you saying that what
5 constitutes a legitimate willing host is when
6 a formal decision comes at some point in the
7 process? I realize you've got a lot of
8 negotiations to get there.

9 MR. NASH: This question of what
10 constitutes a decision by the community and a
11 strong demonstrate of support, because that's
12 what we're looking for to make such a huge
13 investment over a long period of time, we do
14 believe it would have to be a certain strength
15 in support. Specifically what that strength
16 is is yet to be determined and the extent to
17 which we would look for support in a region is
18 a question that is yet to be addressed. But
19 of course, we need strong support in the host
20 community, and we would need a significant
21 degree of acceptance in the region.

22 MEMBER SHARP: And I'm assuming

1 that, excuse me, Mr. Chairman, for carrying
2 on, but one of our difficulties so far to date
3 has been we may have a willing community but
4 we don't have a willing state or vice versa,
5 or we have a willing community but the
6 communities surrounding it are not so willing,
7 and you get this issue of how far do you go.
8 Indeed, I think there's a serious question of
9 we may have a willing state but the
10 neighboring state that has to have it
11 transported through them are not so willing.
12 So I'm just trying to get at whether you, I
13 assume you're assuming layered approval with
14 all the levels of government, or is the
15 provincial government, will they make this
16 determination?

17 MR. NASH: Yes, regarding
18 provincial governments, that is definitely a
19 very important part of the process. And we've
20 made significant efforts to ensure that
21 provincial governments are fully aware of what
22 we're doing and also have had full opportunity

1 for the input to the siting process and when
2 and how it's launched. We have not asked for
3 provincial governments who said that they are
4 willing provinces, but we do recognize that if
5 a community does come forward in a particular
6 province that, at some point, the provincial
7 government would have to be involved in the
8 process.

9 MEMBER SHARP: So you're actually
10 working directly with the communities and
11 hoping over time through just general
12 information at first the provincial government
13 does not step in, as we've had in this country
14 where the state government steps in and says,
15 wait a minute, we're not interested; that
16 tribe may be interested but we're not. I
17 mean, would that stop the process pretty
18 quickly if you had a vote in the provincial
19 parliament --

20 MR. NASH: We would hope the
21 process would not result in a vote in a
22 provincial parliament. So for instance, if

1 interested communities do come forward to
2 learn more and there's a resolution passed for
3 instance or the First Nation government, one
4 of the first things we do is to inform the
5 provincial government to make sure that they
6 hear about this as soon as possible. And
7 prior to that, we have had discussions with
8 provincial governments that are aware of our
9 process. And as we go forward, provincial
10 governments are going to be integral to the
11 process.

12 CHAIR HAMILTON: The Chair has
13 four Commissioners asking questions. Allison,
14 Jonathan, Richard, and Per. Allison?

15 MEMBER MACFARLANE: Great. Thank
16 you very much. So I'll try to keep this as
17 brief as I can. I noted in the write-up that
18 you gave us somewhere, on page six at the
19 bottom you say these high-level screenings
20 that are now underway are going to inform the
21 communities as to whether there are known
22 technical or geological factors for excluding

1 the areas from further consideration. So one
2 of my questions is do you or have you already
3 established a short list of exclusionary
4 criteria?

5 MR. NASH: Yes. There's a listing
6 in our siting document, and that was part of
7 the public consultation that we held over the
8 past --

9 MEMBER MACFARLANE: Okay. So we
10 could get a hold of those --

11 MR. NASH: Absolutely.

12 MEMBER MACFARLANE: -- criteria --

13 MR. NASH: Yes, that's on our web
14 site.

15 MEMBER MACFARLANE: That would be
16 really helpful. Okay. So that's one
17 question. Another question is about the
18 trust fund. How is it assessed, or is this up
19 to each utility?

20 MR. NASH: Initially, in 2002,
21 when the Act was passed, there was a schedule
22 of deposits that were required to be made by

1 the individual utilities. Shortly after the
2 federal government made the decision on the
3 specifics of the plan in 2007, we were
4 required by legislation to provide an
5 estimated cost of executing that plan and
6 proposals for future deposits by the
7 utilities, and that was done in 2008 and
8 approved by the federal government in 2009.

9 MEMBER MACFARLANE: And so how
10 were they assessing these funds?

11 MR. NASH: Well, we estimated the
12 total cost of building a repository, and
13 there's a schedule of payments that are made
14 over a period of time to make sure that by the
15 time we start construction of repository those
16 funds are available to build it.

17 MEMBER MACFARLANE: Okay.

18 CHAIR HAMILTON: Jonathan?

19 MEMBER LASH: Thank you. Mr.
20 Nash, thank you very much. The subcommittee
21 that I'm a member of heard from Elizabeth
22 Dowdeswell, and we were enormously struck by

1 the kind of process that you went through to
2 ascertain Canadian values and used those to
3 construct the process. I have two very
4 specific questions. The first is do you
5 provide any kind of financial assistance to
6 either communities or civil society groups to
7 participate in the process?

8 MR. NASH: Yes, indeed. That's
9 been part of our program since its inception.
10 For instance, during the study phase, we did
11 provide quite substantial funds to Aboriginal
12 organizations to do their own dialogues.
13 During the course of when we initiated this
14 site selection process, communities learning
15 more, there's funding for them to hire their
16 independent experts, and one community has
17 taken advantage of that. There's funding for
18 communities to go and visit facilities that
19 already exist and store waste. Communities
20 have taken advantage of that. And there's
21 also a funding, for instance, to go and visit
22 the Canadian Nuclear Safety Commission to get

1 an independent view on the regulators'
2 perspective on this. So, yes, it's a very
3 important part of the program.

4 MEMBER LASH: One other question.
5 In your opening statement, you mentioned that
6 one of the objectives is to provide for
7 retrievable disposal. And I thought that I
8 remembered when we heard from Liz Dowdeswell
9 that the initial findings of the NWMO process
10 were that the public was concerned about
11 security and leaning toward permanent
12 disposal. And I'm just wondering about the
13 definition. Is this during the adaptive
14 period, or do you foresee long-term
15 reversibility?

16 MR. NASH: There's no question
17 that public are concerned about security. But
18 I would say there is a strong demand for
19 continued monitoring and a strong demand for
20 the ability to retrieve. The general public
21 asks questions about the recycling option, and
22 there is a faith out there that there will

1 someday be a technology that will come along
2 that would provide, perhaps, a better solution
3 than a deep geologic repository. So for a
4 number of reasons, there appears to us to be
5 a strong preference for retrievability and,
6 certainly, when we tested the plan that we
7 drafted that came through strong and clear
8 that it will be important to include the
9 option of retrievability and build that into
10 our planning.

11 CHAIR HAMILTON: Richard?

12 MEMBER MESERVE: Thank you. It's
13 a very interesting presentation. You haven't
14 said very much, if anything, about the
15 regulatory environment within this decision is
16 to be made. You indicated that there were
17 some exclusionary standards that came out of
18 the dialogue, but is there a whole regulatory
19 framework that's been put in place by the
20 CNSC, or is that all awaiting and going to be
21 developed in parallel with some communities
22 coming forward?

1 MR. NASH: Yes, the requirements
2 that I've discussed so far in the program that
3 we've implemented since 2002 is in accordance
4 with the Nuclear Fuel Waste Act, which is
5 specific to use nuclear fuel in Canada. We,
6 like the United States, do have a nuclear
7 regulator that's got very well-developed
8 regulatory processes. The regulatory process
9 in our program would officially start when we
10 have a particular project and a specific site,
11 and we make a regulatory submission to
12 construct a facility on a particular site.

13 However, let's call it pre-
14 licensing activities of the Canadian Nuclear
15 Safety Commission, they are involved in our
16 program. We have a memorandum of
17 understanding with the Canadian Nuclear Safety
18 Commission. And they have, through the normal
19 course of business, established regulatory
20 standards for deep geologic repositories, and
21 these are consistent with the equivalent IAEA
22 standards so we know what standards we have to

1 achieve. Another feature of the interface
2 that we have with the Canadian Nuclear Safety
3 Commission, we're in the process of submitting
4 repository designs and safety case at a
5 conceptual level for their review to assess
6 whether the technology we're developing is
7 going to, has the potential to meet their
8 regulatory requirements.

9 So in summary, the actual
10 regulatory process does not start until we
11 have an informed and willing host community
12 and we're ready to initiate the regulatory
13 process. But the recent interface between
14 ourselves and the Canadian Nuclear Safety
15 Commission -- in fact, I think on the 9th of
16 December we will be making an update
17 presentation to a meeting of the Commission.

18 MEMBER MESERVE: If I understand
19 you correctly, there is a whole regulatory
20 system that's in place, standards that --

21 MR. NASH: Yes, absolutely,
22 waiting for the day when we initiate the

1 regulatory process.

2 MEMBER MESERVE: You didn't have
3 any litigation over those standards in Canada?

4 MR. NASH: No. Not so far. It's
5 a different country.

6 CHAIR HAMILTON: Per?

7 MEMBER PETERSON: Thank you. We,
8 I think, look upon Canada as providing an
9 important role model, particularly around
10 governance of this process of trying to
11 develop disposal capability. I chair an
12 academic department at a large university that
13 I'll leave nameless at this point where
14 there's no decision that is too minor not to
15 be made by centralized management, so what I
16 find breathtaking about the Canadian approach
17 is that your organization has been given a
18 substantial responsibility and the
19 breathtaking part is the amount of authority
20 that you've also been provided to develop the
21 process and to be in control of the process
22 for trying to execute it. And so I'm very

1 enamored with the courage that it takes for
2 political leadership to actually delegate
3 authority along with responsibility.

4 I'd just be curious are there any
5 problems that have emerged that we should be
6 aware of from having delegated this amount of
7 authority to the organization? It seems to me
8 that there's very large positives to having
9 done that.

10 MR. NASH: I would say the main
11 challenge of this is that the way that this is
12 structured, which is different from the
13 situation you saw in France where Andra is a
14 government agency. When this question first
15 came up in the mid 90s, both industry and
16 government studied this question. And it's
17 clear, to make progress on something like
18 this, trust is a very important ingredient,
19 and so that weighed quite heavily in the
20 government decision to structure things this
21 way. And if one looks internationally where
22 these models are drawn from, and the

1 government and industry did look
2 internationally in the mid 90s, the ones that
3 are making the best progress and are able to
4 develop the most trust in the system are the
5 ones that are structured like this. For
6 instance, Finland, Sweden, perhaps
7 Switzerland, they're structured like this
8 where it is the utilities that form the
9 organization and it's under government policy,
10 direction, and regulation.

11 The challenge is the question of
12 trust is constantly challenged and can we be
13 trusted because of our ownership, and that is
14 a continuous challenge. But I can say that
15 from our board of directors, which is
16 appointed by the utilities, those folks are
17 definitely able to separate this question of
18 managing nuclear waste in accordance with the
19 mandate and the mission of the organization is
20 to solely focus on managing waste and not be
21 influenced by other factors in their decision-
22 making. But it is a question. I'd say that's

1 probably one of the biggest challenges of
2 this, but it's the question of trust. But my
3 own opinion on that, it will take time to see
4 whether and fully prove that this is a
5 trustworthy organization, and I believe that
6 time will prove that.

7 MEMBER SHARP: Could I ask a
8 follow-up?

9 MEMBER PETERSON: Thank you.

10 MEMBER SHARP: Just a quick
11 follow-up on that. Are there organized groups
12 in the civil society who actually have
13 challenged that ownership, that organization,
14 and have said up-front we find this
15 intolerable? I mean, I can imagine that
16 happening here. That's why I'm asking. Right
17 off the bat, you've got a whole set of
18 opponents.

19 MR. NASH: I mentioned earlier
20 there were 52 recommendations from the
21 environmental assessment panel that were
22 largely incorporated into legislation. One of

1 the recommendations of the panel was that it
2 be a government-established agency with a
3 governance body appointed from different parts
4 of civil society, and that recommendation was
5 not accepted by the government and did not
6 find its way into the Nuclear Fuel Waste Act.
7 And as far as I understand, there are folks
8 there that would like to see that. We think
9 that's a better formulation.

10 CHAIR HAMILTON: A question by Al.

11 MEMBER CARNESALE: It would appear
12 that, having seen our country and perhaps some
13 others going through a process that was quite
14 different, namely identifying which appeared
15 the best places technically and then seeing
16 what might be acceptable politically. Canada
17 has swung the pendulum the other way: what
18 would be most acceptable politically and
19 socially, and can we find a place not only
20 where the people will be willing to accept it
21 but would actually be a very good site
22 technically?

1 So my question is really two
2 parts. One, is it the case that Canada has so
3 many good sites that it really doesn't matter
4 much and you could do that? And, secondly,
5 how confident are you that this process will
6 converge on one of them?

7 MR. NASH: You know, first of all,
8 I'd like to state that we're never going to
9 compromise on safety, no matter what degree of
10 social acceptance there is in a particular
11 site. That is not negotiable. Another point
12 that's perhaps helpful is that, as we designed
13 this site selection process, a lot of the
14 participants did ask for the, you know, let's
15 produce where technically it could work and
16 then we don't have to worry about all the
17 others, and that was certainly a question that
18 came forward. However, practically speaking,
19 that's not really practical to do that in
20 Canada. We do need to look at the particular
21 location, and that is why we have something
22 called an early screening where the community

1 comes forward, they learn about the process,
2 and we look at the available data. And if
3 there's any reason against this criteria why
4 this site doesn't have a chance, then we kind
5 of tell the community right up-front that you
6 shouldn't really go any further with this
7 process.

8 Back to your last question, what
9 degree of probability do I think exists in a
10 willing host community, the majority of
11 Canadians do believe this is the right
12 process. We do have some interested
13 communities, and we do have the time to move
14 forward with this process of a willing host,
15 and we have flexibility on the timing. And so
16 I think those are the strengths and that,
17 eventually, we will find a willing host. It
18 may take time.

19 CHAIR HAMILTON: Ernie?

20 MEMBER MONIZ: Yes, just a follow-
21 up on this question of a willing host.
22 Actually, earlier, Chairman Kondo for Japan

1 made a very nice understated statement that no
2 mayor has successfully applied yet. And also
3 I think that this first law of nuclear waste,
4 that waste tends to stay where it is,
5 retrievability may have a, you know, limited
6 value in the sense that if there were a
7 problem it would be even more likely to stay
8 where it is.

9 So in that context, I guess one of
10 the issues, and maybe I missed this, is what
11 is the Canadian law with regard to long-term
12 ownership and liability assignment for spent
13 fuel? If there is a transfer to the
14 government at some point, when and where does
15 that occur? And if there is not, what
16 assurance should any community have that there
17 would be a willing and responsible party in
18 the long term to match their short-term
19 willingness?

20 MR. NASH: Yes. The ownership of
21 the fuel is clearly with the current waste
22 owners, the people who produced it. And there

1 is no set date when that transfer will occur
2 or could occur. There are examples in Canada
3 where uranium mining projects have run their
4 natural life, and these have been turned over
5 eventually to the federal government.
6 However, there's no decision been made
7 regarding used fuel management.

8 Back to your question about what
9 assurance does a community have, they have the
10 assurance that, under the Nuclear Fuel Waste
11 Act, we are required to be in existence by law
12 and, by law, there must be funds from the
13 waste producers who are actually owned by
14 provincial governments to actually pay for
15 this. So those are the level of assurances
16 that --

17 MEMBER MONIZ: But is there, so
18 there's no principle that it will ultimately -
19 -

20 MR. NASH: That's correct.

21 MEMBER MONIZ: -- to the
22 government? Okay, thank you.

1 CHAIR HAMILTON: All right. Any
2 further questions? If not, Mr. Nash, we thank
3 you for your very good presentation, and we
4 turn now to our final speaker of the morning,
5 Dr. Roald Sagdeev, distinguished professor of
6 physics at the University of Maryland;
7 Director of SLCSAT, a telecommunications
8 project utilizing small satellites. He is
9 also director emeritus of the Space Research
10 Institute, the Moscow-based center of the
11 Russian space exploration program which he
12 headed for 15 years. He was one of the
13 youngest scientists ever elected a full
14 academician of the Russian Academy of
15 Sciences. He served as a summit advisor to
16 Mikhail Gorbachev and Eduard Shevardnadze at
17 three summits in the 1980s. It's a pleasure
18 to have him with us today to help us learn
19 more about Russia's nuclear fuel cycle.

20 Dr. Sagdeev, we are pleased to
21 have you. You may proceed.

22 DR. SAGDEEV: Thank you, esteemed

1 Commissioners. First of all, I would like to
2 thank you for inviting me but a disclaimer.
3 I'm not representing official or even
4 unofficial of Russian government or nuclear
5 energy's sector of the country. What I'm
6 going to talk about is my own independent
7 assessment gathered over a long period. Early
8 in my career, I started, actually, at
9 Kurchatov Institute under direct guidance from
10 Igor Kurchatov, even served as advisor to him
11 for a brief moment before he passed.

12 Later on, I changed my science
13 interest and was involved in space activity.
14 So from time to time, I participate in nuclear
15 gatherings. During the last several years, I
16 hosted at University of Maryland several small
17 workshops related to different potential
18 techniques of transmutation of the nuclear
19 waste. Can I move to the next slide?

20 Okay. So let me say a few words
21 where Russia is standing now on nuclear
22 energy. It's recovered from Chernobyl

1 syndrome and current share of electricity
2 generated by nuclear is 16 percent, and they
3 are planning to, at least declaring to
4 increase it until one-quarter of all overall
5 output by 2025. Everything is controlled by
6 state. There is a vertical integrative
7 structure run by RosAtom, the national nuclear
8 agency successor to Ministry of Medium
9 Machine- Building. Recently, it was given
10 state-owned corporation. It accounts for 20
11 percent of new reactors under construction
12 worldwide and about 17 percent of global
13 nuclear fuel fabrication.

14 In last year, 2009, the nuclear
15 sector generated a little bit more than 163
16 billion kilowatt-hour. The majority of it was
17 generated by light water reactors, the Russian
18 VVER, but still a considerable amount, almost
19 more than 40 percent, is coming from graphite-
20 moderated LBM reactors, the same type as in
21 famous Chernobyl reactor. And the plans to
22 retire this series of reactors go beyond to

1 2025. However, safety standards were
2 increased, according to Russian claims,
3 tremendously, even for graphite-moderated, at
4 the expense of reducing burn-up of the fuel
5 and other measures. And the modern versions
6 of Light Water VVERs are estimated by some
7 Russian experts as already three and a half
8 generations in terms of the safety.

9 So approved plans would add that
10 much in new capacity of upgraded VVERs by
11 2030. In addition, the Russians already
12 embarked on designing in publication first
13 several floating nuclear power stations in the
14 category of 100 megawatt. So they're already
15 in production. They will have a lifetime of
16 about 30 years and would need refurbishing
17 once in every about ten years.

18 So talking about the closed fuel
19 cycle. Russia, in many ways, is following the
20 steps of France and Japan. There's a time
21 lack largely associated with a need to
22 recuperate after Chernobyl accident. They are

1 talking about the reuse of plutonium,
2 experience they are gaining in extracting
3 plutonium mostly based on their Cold War
4 experience in getting plutonium for military
5 stockpile.

6 Under pressure from international
7 community, they are moving now to use some of
8 the plutonium in energy of nuclear power
9 stations, and the first use of MOX fuels will
10 come after beyond 2015. That is a lot of
11 experience are gaining from France, and there
12 is some limited cooperation also with Japan on
13 such issues.

14 So future of comprehensive nuclear
15 fuel cycle is connected in Russia in the view
16 of majority of Russian nuclear science elite
17 associated with the fast neutron reactors.
18 This is considered in Russia as one of their
19 advantages. They have a series of different
20 reactors functioning already for more than 40
21 years from the beginning of program of fast
22 reactors.

1 There is a routinely functioning
2 BN-600 in the Urals, which is actually
3 delivering electricity and thermal energy to
4 local communities, and it is considered as one
5 of the most perfectly functioning in those
6 terms, compared even to light water reactors,
7 in terms of the watt factor. At the same
8 time, BN-600 has a special compartment which
9 provides excess of different test materials to
10 run experiments to study specifics of
11 functioning fast neutron reactors related to
12 resistance of different materials on enhanced
13 fluence of fast neutrons, which is critically
14 important for future of fast neutron reactors
15 and their economic justification.

16 They are planning to construct a
17 larger version, it's already under
18 construction, BN-800, and would be introduced
19 fully according to plan in 2014. And in
20 competition with this sodium-cooled reactors,
21 they are planning to start investment in
22 already existing engineering design of BREST-

1 300 reactor, which is going to function on
2 liquid lead coolant. Some of the Russian
3 experts can see the lead-cooled BREST
4 generation of reactors eventually to become
5 fifth generation of reactors capable to serve
6 also as burner reactors to incinerate
7 plutonium and minor actinides.

8 So this is the timescale of
9 development in fast reactors. It's started
10 with this well-known BN-350 on the Caspian.
11 Now this particular land is sovereignty of
12 Republic of Kazakhstan.

13 There is a BOR-60, the very
14 earliest research reactor, 60-megawatt
15 reactor, functioning in Dimitrovgrad in a
16 major reactor functioning still now. BN-600
17 already mentioned, BN-800 under construction,
18 and there is a discussion of BN-1200 or 800 as
19 a future conceptual reactor which would be
20 economically competitive visa existing and
21 future reactors.

22 So this slide describes the major

1 research center in reactor engineering and
2 science on Volga. And they host BOR-60
3 reactors.

4 And I have a number of material describing
5 work on this existing research reactor for
6 many years. It's a workshop in the University
7 of Maryland, and there is a plan, there are
8 preliminary talks about hosting some
9 international foreign experiment on using this
10 neutron fluency in fast neutron and conditions
11 close for operational conditions of future
12 sodium-cooled reactors. One particular use is
13 planned, according to recent negotiations, by
14 new American company, you've probably already
15 heard of it, TerraPower, supported by Bill
16 Gates. The company which is planning to use
17 a different concept of fast neutron reactors
18 called Traveling Wave Reactor. Apparently,
19 the idea of Traveling Wave Reactor which
20 claimed to leave absolutely no dangerous spent
21 fuel materials. The idea was also coming from
22 Kurchatov Institute at the late 50s during

1 actually my early tenure at Kurchatov
2 Institute.

3 So that's a brief description what
4 kind of research was going on and could be
5 done on this particular reactor, BOR-60. I'm
6 not going to bother you with the details of
7 all of these things.

8 Similarly, we had a detailed
9 discussion with Russian experts here at
10 Maryland a couple of years ago on how one can
11 use BN-600 reactor capability to carry
12 research with special insert modeled on
13 routine fuel used for BN-600 reactors. So
14 this is a sketch of the BN-600 reactor.

15 The initial protocols at that time
16 was ready to sign with Russians on the use of
17 this facility to accelerate our own pace of
18 research related to fast neutron reactors.
19 Now I think it depends largely on future
20 chance for one to see agreement to be ratified
21 by U.S. Congress.

22 So it describes the interior of

1 BN-600 reactors. You see the structure of the
2 fuel rods with a few parameters related to
3 internal functioning of BN-600 reactor.

4 Starting from burn-up percentage
5 rate, about 6 percent, which was typical for
6 BOR-60 and then BN-350 on Caspian. The
7 current reactor, BN-600, already reached 11
8 percent but still is not enough for future
9 routine fast neutron reactors. One of the
10 limitation of the burn-up is resistance,
11 insufficient resistance of the material
12 enveloping fuel under the flux of energetic
13 neutrons in these reactors. But Russian
14 experts are looking optimistic to the future
15 of this research.

16 So this is what the Russians are
17 thinking about the future of sodium-cooled
18 fast neutron reactors. Today's capital, of
19 course, is about twice of what you would
20 expect for standard thermal light water
21 reactors. However, there are indications,
22 according to Russian projections, that economy

1 of scale which would permit to move to higher
2 power fast neutron sodium-cooled reactors
3 would be able to reduce relative capital
4 costs. You see the last figure at the bottom
5 on the right is 0.45. So at the moment, about
6 1800 or so megawatts, they will catch up with
7 the economics of thermal nuclear reactors.

8 So I mentioned that some Russians,
9 at least, can see the BREST as a candidate to
10 become a fifth generation reactor. So liquid
11 lead coolant, plus full plutonium reproduction
12 in the core of reactor without the use of the
13 blanket. Transportation of most hazardous
14 long-lived actinides as part of fuel and
15 fission products plans to be done outside of
16 the core in the blanket using the radiation by
17 fast neutrons. And then some other measures
18 are discussed to be introduced in this final
19 generation of BREST reactors.

20 However, it is not yet the end of
21 the game. There is very touch competition
22 between sodium-cooled and ideas to introduce

1 BREST reactors. So we will see what will
2 happen in the second half to the next decade.

3 So this is a brief sketch of the
4 BREST reactor complex. I'm not going to
5 comment. I don't think it's necessary for
6 today.

7 So in recent discussions in
8 Russia, nuclear energy elite came to
9 conclusion that comprehensive closed cycle
10 based purely on the use of fast neutron
11 reactors would not provide sufficient budget
12 of neutrons for that closed cycle, including
13 transmutation. So as a result of this
14 discussion and the figure of the deficit of
15 the neutrons in this budget is about 5
16 percent, but different groups in Russia are
17 giving different numbers.

18 So the final decision was to open
19 R&D to add outside source of neutrons.
20 RosAtom already started to finance system
21 analysis and early engineering designs for
22 hybrid fusion-fission systems.

1 So future timeline, I already
2 mentioned BREST and the next step after BN-
3 800. It probably might be even BN-1200.
4 There is a firm decision to build multi-
5 function fast research reactor by 2070. It
6 would be in Dimitrovgrad, and Russian
7 government already invited international
8 community to first participate, to co-invest,
9 or to prepare to use this fast neutron multi-
10 function research reactor. So if BREST-300 in
11 the second half of next decade would provide
12 valuable data, then there will be discussion
13 of moving to the next target, operational
14 BREST-1200 reactor.

15 Russia is somewhat behind France
16 in Japan in introducing the structure for
17 handling radioactive waste and fuel. So
18 what's happening now? There are three laws
19 working independent on radioactive waste. The
20 draft is ready for adoption by state Duma.
21 They claim it might happen by the end of this
22 year. As the radioactive waste, they

1 categorize about 500 million tons of all the
2 waste including slight radioactive, what is
3 left after mining, enrichment, and so on. So
4 according to this particular draft, they are
5 planning to establish to create national
6 operator to take care of this radioactive
7 waste. It might be even independent of
8 RosAtom. It's a proposal of RosAtom to move
9 it, so perhaps they will do something like
10 French did with Andra, the special agency.
11 And they're planning to have seven geological
12 repository to deposit this type of radioactive
13 waste.

14 Much more difficult issue will be
15 the next one: law on spent nuclear fuel. And
16 I haven't seen a draft. Nobody is talking
17 about it, but they claim that they will come
18 soon with the first draft for the discussion.

19 And then the final law, the third
20 one, would be law on retiring of the old
21 nuclear reactors, which would have been
22 portfolio for state Duma in 2011. Perhaps one

1 in the same national operator would handle all
2 these three issues.

3 So I had a chance to have a few
4 interviews with leading experts. One of them
5 is deputy speaker of state Duma. He was a
6 chair of energy committee. In the past, he
7 was a nuclear engineer at one of the
8 facilities in Urals. So this is what he said
9 very recently, last week actually, we are on
10 the threshold of the world nuclear
11 renaissance. What should the technological
12 platform for future nuclear energy? My
13 answer: this is closed nuclear cycle on the
14 basis of fast nuclear reactors. Russia
15 provides a unique place in the world. Nobody
16 has experience to run such reactors. We
17 control 40 percent of the world market for
18 enrichment of uranium and 16 percent on
19 construction of atomic reactors. Presently,
20 we have the tenders for 16 blocks abroad. It
21 is clear that in second half of this century
22 the share of nuclear energy will be 12 to 15

1 percent. Actually, even for such optimist, I
2 would say it's a little brought down. But it
3 will be in the different scale of energy
4 sector, which will be twice bigger.

5 So there are, of course, critics
6 of Russian approach to nuclear energy, but
7 they do not have much impact on the decision-
8 making.

9 CHAIR HAMILTON: Dr. Sagdeev, may
10 I suggest you begin to wrap up so we can have
11 time for questions?

12 DR. SAGDEEV: Yes. Last three
13 slides. So some critics show that even
14 despite a lot of promises, Russia is behind
15 the rest of the world in lot parameter of
16 existing stations, so you see how far it is
17 behind. Perhaps it is not so critical for the
18 country as far as looking for fast reactors as
19 a future.

20 Another group of critics, not very
21 large clout, but I saw that an interesting
22 suggestion: waste to be sent in Kremlin.

1 Interesting suggestion for repository. Okay.

2 Expansion in the international
3 sphere is tremendous. Everyone knows about
4 Bushehr. Russia is doing a lot in China. In
5 particular, there is almost agreement about
6 construction of two fast neutron BN-800s in
7 China. A lot of activity in India. Recent
8 trip to Vietnam by President Medvedev brought
9 contract with Vietnam reactor, and there is
10 discussion almost ready agreement about
11 building at the station in Bulgaria. I will
12 show Putin before signing agreement in Sofia.

13 Visits of president and prime
14 minister is actually working. All the foreign
15 trips are used to promote Russian nuclear
16 energy services. So all these countries, one
17 of the interesting suggestions Russian even
18 made to some of the countries, Argentina and
19 Italy, they said that they can create it, even
20 invest in construction of nuclear reactor.

21 And I already mentioned traveling
22 wave by TerraPower of Bill Gates. Thorium

1 Power, the old name of American company,
2 agreed a rather obscure Russian nuclear energy
3 company, Red Star, to design fuel rods which
4 would be using thorium and plutonium. The
5 original idea was following the idea of so-
6 called Radkovsky reactor, and they wanted to
7 compete with MOX fuel in trying to incinerate
8 bulk of Russian weapons-grade plutonium. But
9 we will see.

10 Red Star is known abroad,
11 especially to Canadians. Forty years ago,
12 they started nuclear reactors in space. One
13 of them in late 70s was delivered to Arctic
14 areas of Canada.

15 Okay. So let me show activity of
16 Russian. This is not a joke. This is a
17 little party which Bulgarian prime minister
18 delivered to Putin before the signed agreement
19 on the cost of the Russian investment in
20 Bulgaria. I was trying to figure out similar
21 fresh photograph illustrating activity of
22 Medvedev in promoting Russian nuclear

1 services.

2 So you will recognize a face next
3 to -- however, Russians claim that it is not,
4 there is nothing new. Venezuela apparently
5 was operating American-built research reactor
6 from 1960 to 1992. Thank you.

7 CHAIR HAMILTON: Thank you very
8 much, Dr. Sagdeev. Are there questions for
9 Dr. Sagdeev? Ernie?

10 MEMBER MONIZ: I have a couple of
11 very narrow kind of questions and a couple of
12 broader ones. The more narrow ones is did I
13 understand on the BREST that your target is a
14 conversion-ratio-1 reactor without blankets?
15 That's the idea?

16 DR. SAGDEEV: Yes.

17 MEMBER MONIZ: Okay. On the BN-
18 600, so far has that been uranium-fueled or
19 plutonium-fueled or --

20 DR. SAGDEEV: It is uranium oxide
21 fuel --

22 MEMBER MONIZ: Uranium oxide fuel.

1 DR. SAGDEEV: -- right now, and
2 they are planning to start production of MOX
3 fuel at Mayak facility, but there are some
4 delays.

5 MEMBER MONIZ: And what's the load
6 factor then? You said it was higher than
7 LWRs? The load factor. You said it was
8 higher than LWRs.

9 DR. SAGDEEV: Yes. I think they
10 claim that they reached 75 percent for the
11 load factor so an average for nuclear
12 industry, and they say that they BN-600 is
13 better. So I would assume it's probably 80 or
14 a little bit higher.

15 MEMBER MONIZ: Okay. So the
16 broader question is going back ten or twelve
17 years, some of us were interacting with what
18 was then a very immature regulatory agency.
19 Can you say how has that evolved? Is there
20 developing a strong regulator independent of
21 the certain political pressures?

22 DR. SAGDEEV: I would say that

1 discipline, of course, is strengthened now in
2 Russia, and RosAtom is functioning as a
3 vertical integrated structure. But I don't
4 think they are ready yet to have independent
5 agency similar to NRC in Russia. Perhaps,
6 with new legislation, we will see something
7 like that.

8 CHAIR HAMILTON: Are there further
9 questions? Susan?

10 MEMBER EISENHOWER: I'd like to
11 know a little bit more about these seven
12 repositories. I mean, this is a rather
13 stunning number. Can you say something about
14 where they are in their development and what
15 kind of geological formations they are
16 planning to use? And also the nature -- well,
17 anyway, why don't you answer those two
18 questions? That would be helpful.

19 DR. SAGDEEV: My interpretation
20 about this figure seven is most likely is
21 associated with old, now abandoned uranium
22 mines, as would be natural. And it is not

1 very critical because the level of
2 radioactivity for that type of radioactive
3 waste is not very high.

4 CHAIR HAMILTON: Per and then
5 Richard.

6 MEMBER PETERSON: Thank you.
7 Could you discuss briefly the current status
8 of Russian policy on importing spent fuel from
9 other countries?

10 DR. SAGDEEV: At the beginning of
11 Putin's tenure in early 2000, Russia had a
12 huge campaign to open its spent fuel sites for
13 foreign customers, and there was even special
14 legislation by state Duma. However, what
15 happened nobody, in addition to old customers
16 who were the clients of Russian nuclear
17 sector, came with offers. So gradually the
18 whole campaign kind of degraded, and I would
19 expect that in case of success of one to three
20 Russia would probably relaunch its call for
21 new customers.

22 A few months ago, I had a brief

1 conversation with Sergey Kirienko, head of
2 RosAtom. I asked a specific question. It was
3 a moment when lost competition to South
4 Koreans to construct nuclear reactors in any
5 rate. And I remember talking to Koreans at
6 our workshop. They said that if they would
7 have a chance to find a place of what to do
8 with the waste, they will expand much more
9 their nuclear sector. So I thought what are
10 they going to do with the waste which
11 eventually will come from this newly-built
12 future nuclear compound in Middle East. And
13 Kirienko said that they are talking to Koreans
14 about this issue. The latest news I heard a
15 few days ago that Medvedev's picture of
16 nuclear joint venture with Korea when he was
17 a few days ago was not successful.

18 CHAIR HAMILTON: Final question
19 will be from Richard.

20 MEMBER MESERVE: Just a quick
21 follow-up to Per's question. My understanding
22 with regard to the Bushehr reactor was that

1 the understanding with the Iranians is that
2 the spent fuel was going to be returned to
3 Russia, which is good. And I would have
4 thought that would be very attractive for the
5 Russians as they make their agreements with
6 the many other countries, new entrance
7 countries, as well who don't have any capacity
8 to deal with the spent fuel, and to get it out
9 of there would be a great competitive feature
10 for them.

11 DR. SAGDEEV: This is absolutely
12 right. I think Russians refer to Americans,
13 its idea came from the United States, and now
14 is leasing the fuel, not selling it. So it
15 would be Russian property, even if it would be
16 operating on facilities outside of Russia.

17 MEMBER MESERVE: I have one
18 question, though, that I wanted to ask. You
19 indicated that in 2015 the Russians intend to
20 introduce MOX fuel, presumably in light water
21 reactors. And I'm puzzled, given that they
22 have the intention to go very quickly to a

1 large number of fast reactors, why they don't
2 want to save the plutonium to use for the
3 initial cores.

4 DR. SAGDEEV: I think calculations
5 I heard from Russian experts was that in
6 future science fiction plutonium economy, in
7 order to start up a big number of reactors,
8 each new reactor to activate would need about
9 five tons of plutonium. So Russia said if we
10 have 250 metric tons of plutonium, so it would
11 help us to start 50 new big fast neutron
12 reactor blocks. I don't know if this view has
13 changed right now.

14 CHAIR HAMILTON: Ernie, did you
15 have a follow up?

16 MEMBER MONIZ: Just to Dick's
17 first comment. I mean, the fuel leasing was,
18 indeed, introduced in a U.S./Russia
19 negotiating channel some years back without
20 success in the end. But my understanding then
21 and still now that the Russian law is
22 fundamentally the same as the French one that,

1 in the end, except for the former Soviet Union
2 states, that reprocessed spent fuel would have
3 to return to the country that used the fuel.

4 Is that still correct?

5 DR. SAGDEEV: The law may be still
6 correct, but the contract with Iran and maybe
7 to some other future clients states that this
8 particular fuel is Russian property and has to
9 be returned to Russia. That's all.

10 CHAIR HAMILTON: Dr. Sagdeev, we
11 thank you very much. We understand yours was
12 not an official presentation, but it was very
13 informative indeed. We thank you.

14 MEMBER MONIZ: One more question.

15 CHAIR HAMILTON: One more
16 question. Ernie, this will be your third
17 round.

18 MEMBER MONIZ: But this is a very
19 important, I think, distinction because it's
20 also the case that the original deal with Iran
21 required lifetime supply of Russian-origin
22 fuel, and that seems to have possibly changed.

1 DR. SAGDEEV: I don't think so. I
2 haven't seen any indication that Iranian
3 government would refer with their own fuel to
4 Bushehr.

5 CHAIR HAMILTON: Dr. Sagdeev,
6 thank you very, very much. Okay. That
7 concludes the morning session. We'll meet at
8 1:00 for the afternoon working with state and
9 tribal governments to craft an equitable and
10 enduring solution. We stand adjourned until
11 1:00.

12 (Whereupon, the foregoing matter
13 went off the record at 12:02 p.m. and resumed
14 at 1:02 p.m.)

15 CHAIR SCOWCROFT: All right. If
16 we could all begin. I think we had a very
17 productive meeting this morning on our
18 exploration of fuel cycle choices that have
19 been made by other nations. Of course, each
20 country is faced with a different set of
21 circumstances which shape both the options
22 that can be selected and the way in which the

1 selected options are implemented.

2 In the U.S., the need to work
3 within our federal system of government is
4 often cited as a particular challenge to
5 finding solutions at the back end of the
6 nuclear fuel cycle. So we will now turn our
7 focus to the question of how to work
8 effectively with state and tribal governments
9 to craft an equitable and enduring solution to
10 our nuclear waste challenges.

11 With us this afternoon are Russell
12 Jim, manager of the Yakama Nation's
13 Environmental Restoration and Waste Management
14 program. We had the pleasure of hearing from
15 Mr. Jim during our visit to Hanford, and we
16 greatly appreciate having you back with us.

17 We have the Honorable Mike
18 Sullivan, former U.S. Ambassador to Ireland.
19 Mr. Sullivan served as governor of Wyoming
20 from 1987 to 1995. At the time, the U.S.
21 Office of Nuclear Waste negotiator was
22 attempting to find a volunteer site for a

1 monitored retrievable storage facility.

2 The Honorable Cecil Andrus, former
3 U.S. Secretary of the Interior. Mr. Andrus
4 served as governor of Idaho from 1971 to 1977
5 and again from 1987 to 1995. He has a long
6 history of dealing with the federal government
7 on nuclear waste issues at the Idaho National
8 Laboratory.

9 And, finally, Congressman John
10 Garamendi. Congressman Garamendi represents
11 California's 10th congressional district, the
12 home of DOE's Lawrence Livermore National
13 Laboratory. Mr. Garamendi served as
14 lieutenant governor of California from 2007 to
15 2009 and as Deputy Secretary of the Interior
16 from 1995 to 1998.

17 Gentlemen, it's a pleasure to have
18 all of you with us today. This session we
19 have structured as a roundtable because we
20 want to devote most of our time to a free-
21 wheeling discussion of the major
22 considerations when working with state and

1 tribal governments.

2 Before we start the roundtable
3 discussion, we'd be pleased to hear from any
4 opening statements that any of you may wish to
5 make. Are there such opening statements?
6 Governor Sullivan?

7 MR. SULLIVAN: I don't have a
8 formal opening statement. I just have some
9 remarks to develop during the roundtable. But
10 let me just, by way of background, say that I
11 was last governor in 1995 and that was
12 essentially my last involvement with the issue
13 that you're charged with facing today. I was
14 asked to be on this panel because we undertook
15 the process on monitored retrievable storage
16 in Wyoming, and I vetoed and terminated the
17 process after phase one. One of the
18 interesting things to me is, like Yogi Berra
19 said, this is deja vu all over again. I
20 haven't been at the issue for 18 years. And
21 as near as I can tell, nothing has changed.

22 But I do, as a result of that

1 experience, and that's the only portfolio for
2 which I have any credibility appearing before
3 here, have ideas about where the process was
4 wrong, about where we may need to go in the
5 future. And interestingly enough, those ideas
6 which I've developed during the course of
7 preparing for this roundtable, you've heard of
8 all of those ideas as recently as this
9 morning. And those are societal acceptance of
10 the science and solution through collaborative
11 processes, which was missing; independence of
12 the body proposing the answers; voluntary
13 participation and fair incentives to all
14 stakeholders, and the stakeholders are
15 significant and broad regionally, not
16 statewide and certainly not countywide; trust;
17 and stability, not political uncertainty.
18 Those are the areas where I think the emphasis
19 has to be based upon the experience that we
20 had.

21 I wrote a letter in 1992 that
22 expressed all of the opinions I had at that

1 time, and not many of them have changed. And
2 some of them even seem to be prescient. Thank
3 you very much for having me.

4 CHAIR SCOWCROFT: That was a
5 remarkable letter and still is.

6 MR. SULLIVAN: Actually, it was
7 one of the most enjoyable letters I wrote
8 because as a western governor it's fun to bash
9 the federal government and, two, it was an
10 interesting mix of politics, science, and
11 intellectual reasoning. And that issue still
12 has that very mix.

13 CHAIR SCOWCROFT: Yes, yes, yes,
14 it does.

15 MR. SULLIVAN: Well, that's the
16 outside intellect. We don't have any in
17 Wyoming.

18 CHAIR SCOWCROFT: Mr. Secretary,
19 do you want to make a --

20 MR. ANDRUS: Thank you, Mr.
21 Chairman, congressman, distinguished members
22 of the Committee. Yes, sir, I'll take about

1 five or six minutes of opening comment, if I
2 might. I would just share what I've heard
3 here already today that the U.S. failure to
4 devise or adopt a plan to safely handle
5 nuclear waste in America is one of the
6 greatest failures of the last 50 years and a
7 significant failure in that. As a nation,
8 both scientifically and politically, I think
9 we all recognize that we have spent our time,
10 efforts, money to devise advanced technology
11 in the area of making a bigger bomb or a more
12 efficient reactor for electrical energy
13 without any consideration whatsoever for the,
14 well, very little consideration for the back-
15 end policy. It's a lot like building a new
16 house and failing to hook up the bathroom to
17 the plumbing system. Now you can't drain the
18 bathtub and you can't flush the toilet, and
19 that's not a bit different from what we face
20 in this situation.

21 I don't envy your job. The
22 Committee has got to come up with some

1 recommendations. Let me just give you a
2 little bit of reason to reinforce what I've
3 heard already here that you can't trust DOE.
4 Their word is no good, and it doesn't have
5 anything to do with political affiliation of
6 any party. It's consistent right down the
7 line.

8 I was first elected governor in
9 November of 1970. I took the oath of office
10 in January of `71. One of the first things
11 that we had to face was the gigantic dumping
12 of nuclear waste in the state of Idaho. For
13 20 years, they dug ditches out there with a
14 bulldozer and put mixed waste, transuranic,
15 low-level and some high-level indiscriminately
16 into the ditches and covered it up. I went to
17 then Dixy Lee Ray, who was head of the Atomic
18 Energy Commission, and she said, oh, Governor,
19 you just don't understand. That's just
20 interim storage. We're going to take that out
21 of there. Well, that interim storage went on
22 and on and on. Yes, you know the story.

1 That's the first edition.

2 In '77, Jim Schlesinger, well, we
3 created DOE in '77, and Jim Schlesinger became
4 the first secretary. I went to Jim and I
5 said, Jim, does that commitment that the
6 waste, and I still had that letter from Dixy
7 Lee Ray where she said we'll have it out of
8 there by the end of this decade. Anyway, I
9 said does that commitment still stand? Oh,
10 yes, you bet, Cec. That still stands. Oh,
11 lied to again.

12 Then we had an Admiral Watkins and
13 then we had an Admiral DeMars and the list
14 goes on and on, and DeMars made the public
15 statement. He was head of the propulsion
16 group in America, as I recall, in charge of
17 refueling the battleships and aircraft
18 carriers and what have you. And he publically
19 said, we'll just send that waste out to a
20 remote place in America. Well, the place he
21 selected was just west of Idaho Falls in the
22 state of Idaho on a 50-mile footprint. There

1 was about 350,000 people. But just beneath it
2 640 feet, there's the largest fresh water
3 aquifer in North America. And DeMars and I
4 obviously didn't agree on very many things.

5 And then I would just finally say
6 two things. In 1995, we created an agreement
7 where the only state that has an agreement
8 with the federal government that says you'll
9 take out by a certain date, 2035, and if you
10 don't there will be substantial financial
11 remunerations and fines to go for. Well, the
12 ink wasn't even dry on that document until DOE
13 and Justice said all doesn't mean all, and I
14 said, I beg your pardon. Well, all doesn't
15 mean all. We ended up in the federal district
16 court. The federal district judge ruled in
17 favor of the state. DOE and Justice
18 immediately appealed to the 9th Circuit. It
19 came back again. And once again, the state
20 did win the decision.

21 I have to say for the first time
22 that I can say on the transuranic waste, they

1 started doing a pretty good job right now.
2 High-level, we still got a little over 900,000
3 gallons of high-level waste in single-wall
4 tanks buried underground. Sodium
5 contaminated, that's another issue. That's
6 enough examples, Mr. Chairman, to say you
7 can't trust DOE. They have no credibility.
8 I would submit to you that what this group
9 should recommend is that a separate entity be
10 created by the Congress of the United States
11 with the singular authority to locate and
12 create a high-level nuclear waste.

13 Trust. I heard trust this
14 morning. I heard a question, first of all,
15 about remote areas. I don't buy that. I
16 believe you asked that question. Because if
17 you ask that again, we're going to unload on
18 you. But it's a situation where I heard Mr.
19 Nash use the word trust several times, and my
20 colleague here used it a moment ago, and
21 that's part of it.

22 I would say that you've got four

1 things that you've got to do, Mr. Chairman,
2 and that's to create, first of all, that
3 separate entity. Secondly, you've got to
4 address a responsible fashion of reprocessing
5 the waste we have to reduce the volume and
6 salvage the energy that is there. That
7 doesn't necessarily have to be in the same
8 area as the repository, but that has to be
9 there. Third, we've got to admit as a nation
10 that significant, significant, substantial
11 financial incentive be extended to that
12 location that you choose as a possible site.
13 It comes back to trust. I would say that, cut
14 this short by saying that if you were to make
15 Congressman Hamilton a benevolent dictator for
16 a short period of time and he asked me what to
17 do, I'd say the first thing I believe that
18 you've got to do is to find a spokesperson.
19 Go to U.S. Geological Survey and determine
20 which states have the capability of being a
21 potential site, and then find a proper
22 spokesperson to visit in those states and make

1 sure that, politically, it would be
2 acceptable. The difference between the
3 transuranic waste facility in Carlsbad, New
4 Mexico and Yucca Mountain is that they didn't
5 have that trust. They didn't have that
6 agreement.

7 Mr. Chairman, I made several trips
8 to Carlsbad visiting with them about that.
9 That has been a success. One of your members
10 who I see is not present here today, the
11 former senator from New Mexico, can tell you.
12 He was a supporter. The governor was a
13 supporter. Bill Richardson, well, Bill's
14 position was that he was, some of his friends
15 were for it and some of his friends were
16 against it, and he was with his friends. Lee
17 is smiling. He remembers. But that's okay.
18 I take that better than an opposition. He
19 went to doing other things, and Carlsbad is
20 there and it's functioned well. You've got to
21 do the same thing, and you've got to have
22 somebody that's trusting to go to those

1 various states, whether it's Michigan, Kansas,
2 New Mexico, Wyoming, wherever, and see if it's
3 successful.

4 I'll stop there. That's longer
5 than six minutes, and I apologize. But I've
6 come a long ways to get that off my chest.
7 But you simply absolutely cannot trust DOE.
8 They're too large with too much responsibility
9 to focus, so it's easy to just, you know, push
10 it off to one side. I yield the rest of my
11 time to the Congressman.

12 CHAIR SCOWCROFT: That's very
13 helpful. Mr. Congressman?

14 MR. GARAMENDI: To the
15 distinguished panel here, thank you for the
16 opportunity to be here. I am honored to sit
17 next to these three gentlemen and to share
18 with you some experiences and perhaps some
19 insights into what's going on here.

20 I was in the California
21 legislature when Three Mile Island happened,
22 and I suspect I had as much to do as anybody

1 in the West Coast in shutting down the nuclear
2 power industry's growth at that time. We were
3 concerned about the safety of the facilities.
4 In my own district, we had Rancho Seco which
5 was the twin of Three Mile Island. And we
6 also had this little issue of waste: what are
7 we going to do with the nuclear waste material
8 from the reactors? And there was no solution
9 then. You've just heard from the two
10 gentlemen to my right. They also dealt with
11 this somewhat differently and that they were
12 dealing with the laboratories and the nuclear
13 weapons facilities. But, nonetheless, the
14 issue was similar. There was no real solution
15 at that time for the waste issue.

16 And so for the intervening 30
17 years now, I've held the position that, you
18 know, we couldn't go forward with nuclear
19 power until we solved those two issues.
20 During that period of time, the safety issue
21 is pretty well resolved. These plants, the
22 new modern light water reactors around the

1 world operate safely. But the waste issue
2 remains, and to this moment there is not a
3 solution. That's what you're all about, and
4 I'm sure there are millions of Americans and
5 policymakers, perhaps in smaller numbers, that
6 are keenly interested in what you propose.

7 My second tour of duty on this
8 issue occurred when I was the Deputy Secretary
9 for the Department of Interior. Secretary
10 Babbitt at that time, I'm sure Secretary
11 Andrus didn't do this, handed the hot potato
12 off to me and said, you deal with Ward Valley,
13 which was the preferred dump for low-level
14 radioactive waste for California and two other
15 states, one of which was Idaho.

16 So we had the U.S. Geological
17 Survey do their work, which they're required
18 by law to do. And we took a look at it, and
19 there were some problems, a migration problem
20 particularly of tritium. And I spent the next
21 two years on that matter. Ultimately, that
22 dump did not take place because of the issues

1 of securing the waste material.

2 Something interesting happened
3 after, I guess, I was responsible for stopping
4 that process. About two years later, the
5 principal component of material to be dumped
6 at that location, tritium, turned out to be
7 not a waste product but rather a valuable
8 product. And the industries, all of its
9 various pieces, began to retrieve that
10 particular material and to use it and reuse
11 it.

12 Since that time, and more recently
13 as I've continued my work on climate change
14 and energy issues, I've come to a different
15 conclusion than I had 30 years ago, and that
16 is that we have to move forward with nuclear
17 energy, that we really have no choice in this
18 world but to do so. However, to do so
19 requires us to deal with the safety issue and
20 the waste issue. Fortunately, the U.S.
21 government, through the 70s and 80s and into
22 the early 90s, worked diligently on a

1 mechanism to deal with the waste issue, and it
2 was pretty simple. It's not a waste, it's
3 actually a valuable energy source. Most
4 reactors today will use a few percentage
5 points of the energy in uranium, and the rest
6 has been considered to be a waste. But the
7 U.S. government figured out what to do with it
8 and during that period of time developed a
9 mechanism, a reprocessing mechanism, a reuse
10 mechanism, a reactor that actually, over time
11 and through continued recycling, can consume
12 nearly all of the waste and do away with the
13 most dangerous -- excuse me, I used the wrong
14 word -- the most long-lived of those elements.

15 And as I've looked at that, I'm
16 going a-ha. John, maybe it's time to
17 reconsider, reconsider that if, in fact, there
18 is a viable way of re-using, recycling the
19 heretofore waste and instead of consider it to
20 be a waste consider it to be a valuable energy
21 source, that we can move forward with an
22 essential element, that is essential

1 mechanism, to deal with the energy issues of
2 America and the climate change issues of this
3 world. And so the Generation 4 reactor
4 systems, processing, IFR, other things, they
5 actually happened and they actually work and
6 they actually prove that it did work and to
7 work without proliferation issues.

8 And so I bring to you today the
9 years of experience, concerned initially about
10 safety and waste products and the disposal of
11 them and then over the years learning that
12 there was a solution and that if we pursue
13 that solution we can move forward with an
14 extraordinarily important part of our future.
15 So I'm happy to be here and answer whatever
16 questions and engage you in a dialogue. And
17 thank you so very much for the opportunity.
18 Thank you.

19 CHAIR SCOWCROFT: Thank you very
20 much. Mr. Jim, would you like to make a few -
21 -

22 MR. JIM: Yes, I would. Thank you

1 very much, Mr. Chairman, members of the
2 Commission. I appreciate this opportunity to
3 be on this panel. As a recovering councilman,
4 I should fit right in. I hope the methods
5 that I bring today will help address the
6 problems that we all have in regard to
7 America's nuclear future.

8 The main issues are many for the
9 Yakama Nation whom land is situated right
10 there at the most contaminated site in the
11 country, the land of which the Yakama Nation
12 at one time had exclusive use to that land,
13 water, and all the resources. And the
14 underlying problem here, as I see, to go
15 forward would be the participants out there,
16 whether it be the Department of Energy, the
17 Interior, or EPA, as this term of trust
18 responsibility. That is misunderstood at
19 times, and I think the newer generations that
20 are coming in to represent the federal
21 agencies do not fully understand that term.

22 The highest courts in this land

1 have interpreted, for instance, that any major
2 decisions, borderline decisions, must be made
3 in favor of the Indian nations because when
4 those treaties were made we didn't understand
5 the English language, and that seems to be
6 misunderstood today. And I hope it isn't just
7 being pushed off into the side, the wayside.

8 We have a considerable problem
9 relative to the trust responsibility, plus the
10 trust issue. How can you trust a federal
11 agency that does a study, for instance, with
12 a fish commission and determines out of that
13 study that if I eat the salmon and the fish,
14 other fish, out of the Hanford Reach I will
15 have 1 chance in 50 of getting the fatal
16 cancer. That's a long way from ten to the
17 minus four.

18 So based on that, the federal
19 agency that did the study, we approached them
20 and said, what are you going to do now. and
21 they said, we're sorry. We don't have any
22 money to do anything. And to this day, I

1 don't understand the comment when they said,
2 you should be more concerned about the
3 contaminated strawberries coming out of
4 Nicaragua. The strawberries out of Nicaragua
5 are not natural food to the Yakama.
6 And while we're on that subject, the natural
7 foods that are there in that Hanford area,
8 some only grow to a certain elevation.

9 My point is they're part of my DNA
10 historically. My consumption of that food
11 that we have been utilizing for millennia I
12 believe is preventive medicine, and without
13 that understanding and the evidences within
14 the fact that we have some of the highest
15 rates of diabetes because of Burger King,
16 Kentucky Fried, and et cetera, that's another
17 problem, but we do have a very high rate of
18 cancer. And the health and welfare is
19 paramount in our treaty, and it is part of
20 this trust responsibility that the federal
21 agencies have as a fiduciary obligation, and
22 it is being misunderstood further and further

1 as time goes on.

2 And so we oftentimes find
3 ourselves on the periphery of some of the
4 major issues that are being addressed. And as
5 the president from Ronald Reagan this way
6 said, we must deal with these tribes on a
7 government-to-government basis of sovereign
8 nations, that has not fully being understood.
9 And although a federal official in the
10 Department of Energy last year pounded on the
11 podium and said, we will comply with treaty
12 rights, that message needs to get through the
13 field office.

14 So that is the basis of my
15 introductory remarks, and I'll gladly take any
16 questions. Thank you.

17 CHAIR SCOWCROFT: Thank you very
18 much. I think we've established a good basis
19 for discussions. I would now open the floor
20 to questions from the Commissioners. If you
21 want to direct your question to a particular
22 member of the panel, fine. If not, just in

1 general. Jonathan?

2 MEMBER LASH: I'm particularly
3 interested, Governor Sullivan and Governor
4 Andrus, in how you would construct the process
5 so communities and states can be effective
6 participants, and is it practical to ask
7 states to approve a process, give them a veto,
8 and think that we can come out the other end
9 with a site, assuming that communities are
10 given the right to opt out?

11 MR. ANDRUS: I'll take the first
12 shot at that, Mr. Lash, and say that, no, I
13 don't think that you want to hand the state or
14 an independent nation veto power. But if
15 you've got any political smarts at all, you
16 simply will not go into the state after your
17 initial contact to find out do we have a
18 spokesperson, the governor or somebody who has
19 the bully pulpit to be able to talk to people.
20 But you have to be prepared to find out
21 whether you have the acceptance, like we had
22 in New Mexico on Carlsbad. If they had gone

1 the other way, it would have been very
2 difficult to achieve. We would not have. So
3 you have to establish that we have, but you've
4 got to give that spokesperson something to
5 sell. It's simple politics, ladies and
6 gentlemen. You all understand that. You've
7 got to give them something to say, yes, we've
8 got to do our share of this but, by the same
9 token, the process is going to create this
10 many jobs on a permanent basis and we're going
11 to give you a substantial remuneration that is
12 equal to your cost of higher education or some
13 incentive. Now, it doesn't have to be that,
14 but it has to be an incentive that that person
15 can say that this is what we will receive.

16 But if there is strong political
17 opposition, then don't waste your time. Go to
18 your other potential sites because look at
19 Yucca Mountain and just compare Yucca Mountain
20 and Carlsbad, the two situations. That will
21 tell you the story. Michael?

22 MR. SULLIVAN: It must be your

1 federal background, Cec. I'm shocked to hear
2 you say you shouldn't give a veto power to the
3 state. I can't imagine siting a facility
4 without state participation and acceptance,
5 and I believe it is possible to get that. But
6 I think we may have missed two or three steps
7 in the process. Nuclear power, at least now,
8 seems to me to be a subject that can be
9 discussed in political circles. It wasn't
10 some years back. But the experience that we
11 had with the MRS clarifies for me the raw
12 emotion of this issue because of the lack of
13 education and because of the lack of a
14 national consensus.

15 I mentioned last night in
16 discussing with some of the staff one of my
17 great disappointments from the MRS study was
18 that about five months after issuing my letter
19 terminating the process I said to my staff, we
20 have those boxes of letters on this issue.
21 Would you retrieve them? because I think they
22 would be good historically and for any future

1 process because they weren't check-the-box
2 letters or sign off on this petition. They
3 were handwritten letters from every
4 demographic in our society, both pro and con.
5 I got word two days later that my staff, in
6 its rush of efficiency, threw them out about
7 two weeks before that.

8 But the nature of the response was
9 so dramatic, and it was both sides. We had
10 people in Wyoming, we were suffering
11 economically, and there was a large part of
12 our society that felt this was the answer to
13 our future economic circumstances. So it was
14 a divided state. I concluded we didn't have
15 the energy to face this issue, no pun
16 intended, given the circumstances that we were
17 faced of the uncertainty, the lack of a
18 national consensus, the lack of a clear
19 understanding of what the science was.

20 I think this is like a pyramid,
21 and the foundation has to be a national
22 understanding of the critical need and the

1 safety and the voluntary process. And I fear
2 we're in a situation, and I hope that you
3 would share the fear, that we can't have
4 instant gratification. We can't go out and
5 find somebody who wants it and then let them
6 wrestle with the problem without the
7 educational background that's needed to
8 explain so that you can at least get some kind
9 of support and reasonable discussion of the
10 issues. And I think that has to take place on
11 a national basis before you start looking for
12 sites. It wasn't there with Yucca Mountain.
13 It wasn't there with the MRS process. And
14 until it's conducted, I think then you get raw
15 emotion responding instead of thoughtful,
16 considered process.

17 MR. GARAMENDI: Let me add just
18 briefly to that. My experience at Ward Valley
19 is exactly the opposite. The state of
20 California did want to use Ward Valley as a
21 dump site for low-level radioactive waste,
22 some of which happened to be extremely

1 dangerous and quite migratory. It turned out
2 that the federal government actually stopped
3 it for reasons of safety and for inappropriate
4 mechanisms of dumping or technique of
5 disposing of the material, you know, like
6 steel barrels dumped in a trench and covered
7 over and walk away.

8 So I think we need to look at this
9 in a different way here. I think we need to
10 consider the material: what is it; can it be
11 transformed in one way or another to reduce
12 the nature of it, and that can be done; and
13 also the educational point that was made by
14 Governor Sullivan is absolutely correct. It
15 was a big, big issue in California. It turned
16 out that the lack of education was actually
17 with the state government, and the public, at
18 least those that were advocates against the
19 dump, had far better knowledge than the state
20 did on the matter.

21 Anyway, it's very complex. But
22 education, knowledge, and then, to the extent

1 possible, transform the material so as to
2 reduce the dangerousness of it, the length of
3 life of it, and to reuse what is potentially
4 reusable, and there's a lot of potential in
5 that.

6 CHAIR SCOWCROFT: All right.
7 Phil?

8 MEMBER SHARP: Yes. Governor
9 Andrus, I wanted to ask you several questions
10 about trust and try to desperately reestablish
11 my own. I will never again refer to
12 remoteness. I come from Indiana, and that
13 seemed like it was, it seemed like a
14 reasonable proposition in the past but not for
15 the future. And also let me quickly say my
16 grandfather homesteaded in Coeur d'Alene,
17 Idaho, so I'm a great admirer of the frontier.
18 I just wanted to open it up a little bit here.

19 But let me say, you know, the
20 issue of trust, obviously, there's no magic to
21 it. It's a very hard to regain once it's lost
22 kind of proposition, so I'm sort of toying

1 with obviously there are a number of steps you
2 both have already referred to that need to be
3 taken in consultation and things of that sort.
4 What I want to get it is is there any value
5 and can we place any value in legitimate
6 agreements between local, state, and federal
7 government that goes stage by stage and,
8 therefore, nobody is committed to anything but
9 that stage?

10 Ronald Reagan always said about
11 dealing with the Soviet Union, trust but
12 verify. John Dingell, who was one of my
13 mentors in the House of Representatives,
14 always said his pappy said, trust but cut the
15 cards. And what I'm wondering is if the
16 technique of, in a sense, having an agreement
17 between the federal and the state government,
18 you have an agreement that you believe is
19 enforceable in the courts. Governor
20 Sullivan's letter suggest the supremacy clause
21 and the general behavior of the U.S. Congress
22 suggests you can't keep these agreements. But

1 I'm just suggesting is there a way which you
2 can have an agreement about phase one that
3 doesn't lock the community or the state into
4 phase two if you have multiple phases? I
5 don't know what those are. I'm just asking do
6 you see this as a technique that has value in
7 staging and steps forward in building trust?

8 MR. ANDRUS: If I may use again
9 the example of Congressman Hamilton being a
10 benevolent dictator, whomever headed up this
11 agency that we are going to create in the
12 Congress of the United States, that that
13 person is yet to be politically astute enough
14 to know, yes, you're going to go to a certain
15 level. Let's say that it's this subterranean
16 salt of Kansas is the attractive place. Okay,
17 that's an example. Then that new agency has
18 to go to the governor of Kansas, whomever he
19 or she might be, and say this is a situation
20 we'd like to at least discuss with you, and it
21 becomes a first stage. And if they throw the
22 bum out, then it comes back to it may not be

1 an institutionalized veto power but it turns
2 out that you're not going to fight that
3 battle. But that's phase one.

4 But my colleague here is
5 absolutely correct that you have got to do the
6 educational aspect at that state level. But
7 when you're created brand new, you're a new
8 agency, that's a perfect opportunity for
9 education at the national level, and that's
10 where some of your first bucks should go.

11 Now, we haven't asked yet about the financial
12 incentives that I alluded to earlier in my
13 comments, but somebody is going to get to that
14 in a little bit. But, yes, I think that it's
15 a level situation, but it's pretty hard to
16 draw those lines. You've got to have small
17 cadre at the top of people with the experience
18 and the knowledge of our two co-chairman of
19 this blue ribbon committee, for example, to
20 say, woops, Kansas is no longer a potential
21 but Michigan is or something and go again.

22 Yes, you've got to go a step at a

1 time. You don't turn loose the dogs until
2 you're pretty sure that you're ready to go to
3 stage three.

4 MEMBER SHARP: Well, one of my
5 concerns is that obviously it's unlikely in
6 anybody's tour of duty at that agency or in
7 that governor's position that all of these
8 issues get resolved. In other words, we have
9 no experience that would suggest, not from
10 WIPP, certainly not from Yucca Mountain, that
11 in the two to four-year period we would end up
12 getting a final decision. So we're into
13 multi-generations of leaders at the state and
14 local level, so they changed at the local
15 level, as well as the federal level, kind of
16 propositions.

17 So what I'm trying to think about
18 is I certainly take your advice as well
19 heeded how these people must behave who are
20 there, but we're going to have a turnover.
21 You know, the general and the congressmen are
22 going to move on to other functions and a

1 different administration is going to come in.
2 So I'm thinking can we have a series of staged
3 agreements that kind of bind to that level and
4 then, of course, they don't bind beyond a
5 certain set of functions you perform. And
6 then you've got another treaty, which I know
7 Russell Jim is not likely to find this
8 reassuring that we would sign a treaty with
9 anybody since our history on that score is
10 very poor.

11 But I just didn't know, I'm trying
12 to think of what can take us behind the
13 generational problem. And certainly getting
14 a new agency that starts out fresh, that
15 starts with superior talent, and is committed
16 to these things, but it has to function that
17 way over a 10-year or 15-year period. I think
18 it does.

19 MR. SULLIVAN: The only comment I
20 would make is you keep talking about an
21 agency, and I think that's a part of the
22 problem. I think we need an independent body,

1 whether it's quasi-governmental or not.
2 Canada's presentation this morning illustrated
3 that, and I think appropriately because the
4 political uncertainty, the change of
5 administration, political will, and everything
6 else, is what causes the generational issues.
7 And as long as they're there, the issues that
8 I faced, how do we trust -- I'm sitting here
9 thinking about wolves in the West, and if you
10 get back into siting them solely in the West
11 wolves are going to be a big issue because
12 that's what the federal government does to
13 you. And that is the problem, and I think the
14 trust needs to come from an independent long-
15 term corporation, if not quasi-judicial or
16 quasi-governmental function, that has long-
17 lasting, accountable, contractually obligated
18 to fulfill the needs.

19 MEMBER SHARP: And who would they
20 be accountable to?

21 MR. SULLIVAN: Well, that's beyond
22 my expertise, but I am convinced that, in the

1 infinite wisdom of Congress, they can figure
2 out how to do this because it seems to me --
3 and you need the utility participation.
4 They've got to embrace, it seems to me, some
5 of this issue as well that this is a national
6 issue that needs resolution, and it takes
7 innovative ideas to make it last as long as
8 the waste material is likely to last.

9 MEMBER SHARP: Governor, I was
10 with you up until you got to the infinite
11 wisdom of Congress. I spent 20 years there,
12 and I was for 20 years a member of that
13 chamber, and there are a lot of extraordinary
14 individuals there. But the collective wisdom
15 sometimes is not as much as the individual
16 wisdom.

17 MR. SULLIVAN: I reserve any
18 comment.

19 CHAIR SCOWCROFT: Well, I would
20 like to add just a point. There are two sides
21 to this, and let's suppose you, as the
22 governor in Idaho, say, fine, go ahead. An

1 election is held, a new governor comes in and
2 says, no, I don't like it. What do you do in
3 that circumstance? Because what you're doing
4 is committing here to a long-range plan, and
5 how do you do that in an elective system with
6 the local level, the state level or what have
7 you?

8 MR. ANDRUS: That's why I
9 mentioned earlier about no veto power, that
10 you're setting yourself up for that example
11 that you just pointed out. But I would say to
12 you that you have to have an understanding
13 within the Congress and an agreement within
14 the Congress of the importance of this. What
15 the Congressman said a moment ago about the
16 future of nuclear energy being created,
17 whether it's 20 percent of our output now, and
18 it is a very important resource and it's going
19 to be in the future, but I would just submit
20 to you that you've got to have an
21 understanding within the Congress. And I'm
22 not prepared to write it out, but I'm the

1 eternal optimist. I think you could work it
2 out with that provision of trust.

3 You're right. Long-term, you've
4 got to work your way around that. It's very
5 necessary. But that's the danger of veto
6 power is what you just spoke of.

7 MR. JIM: Thank you. Mr. Sharp,
8 it's the Treaty of 1855 that is supposed to be
9 inviolable as long as the suns will shine and
10 the grass shall grow and the rivers flow. I
11 had the opportunity and the honor to work with
12 Morris Udall to help create this Nuclear Waste
13 Policy Act in which the tribes do have veto
14 power. And so the point being that we strive
15 to become part of the solution. And if the
16 Treaty of 1855 would be adhered to, it covers
17 everything from health to environment, et
18 cetera, it would be protective of all future
19 generations, not just the Yakama. And I know
20 that's a very difficult issue, as I've
21 witnessed for the past 30 years. But I think
22 that, in the creation of any body to address

1 this issue in the future, you will find
2 consistency from the Yakama that this land
3 needs to be clean in order to be utilized for
4 future generations.

5 And our term is that we must preserve and
6 protect the land and resources for those
7 children yet unborn.

8 And I think that if we could
9 create this better understanding of what the
10 treaty rights mean and the coordination
11 between the state and the federal agencies, we
12 would all get along much, much better looking
13 for a solution to what the future holds for
14 the nuclear future. And I know there are many
15 opportunities.

16 Perhaps, as I asked when I managed
17 the first nuclear program that was looking for
18 a repository, it took me four and a half years
19 to convince that Hanford was not technically
20 a place to put the high-level waste. But
21 having said that, the next step is how do we
22 resolve all of these issues and maintain a

1 good working relationship with the states and
2 federal government and et cetera? And as I
3 stated a bit ago, if there is going to be an
4 organization, you're going to have to figure
5 out how the tribes may be involved in that.

6 And so when all of this is going
7 to be addressed in the next few years and
8 coupled with the development of all these new
9 nuclear power plants, I asked in the first
10 program I managed I'll give you back all the
11 money you have provided to me if you will give
12 me a design for a nuclear power plant; I think
13 the Yakama Nation will need one one day. And
14 I hope that research and development can
15 establish a safer way of operating these
16 plants. There may be not as much dangerous
17 waste. But first we have to resolve the
18 legacy that has befriended us up to now.
19 Thank you.

20 MEMBER MONIZ: Thank you, Mr.
21 Chairman. I have two questions. The first is
22 for the governors and congressmen. Governor

1 Andrus, you specifically brought up the issue
2 of the new organization, and I would agree.
3 In fact, an MIT report this year endorsed, as
4 well, the idea of a quasi-government
5 organization. However, it came with a
6 condition that such an organization's creation
7 would be unlikely to, frankly, have much
8 difference unless it were given authorities
9 that do not currently exist with anyone, like
10 the ability to manage the Waste Fund which
11 Congress has not authorized anyone to do. The
12 authority to negotiate with facility owners
13 about when waste is moved was stuck in an old
14 contract mode and can't move from
15 decommissioned reactors, et cetera. There's
16 a whole list of authorities that would have to
17 be given, so the question then is what between
18 governors, Congress can one see to not simply
19 have the feel-good step of creating a new
20 organization but of creating one with the
21 authorities required: a governors'
22 association, working with industry, Congress,

1 administration? That's the first question:
2 how can we actually move to an organization
3 with the authorities required to make an
4 impact?

5 Second question for Congressman
6 Garamendi. You presented this vision of the
7 solution in the future fuel cycle that,
8 roughly speaking, utilizes and burns up all of
9 the transuranics, the minor actinides, and dot
10 dot dot. Let's not worry about factors of
11 two, but, certainly, our estimate is that, to
12 reach that kind of a possible solution, we're
13 talking about the order of a billion dollars
14 a year for the order of 20 years of RD&D. And
15 the question is where's the money? Should
16 this be another mil per kilowatt hour on
17 nuclear power? That's 800 million a year, for
18 example. How do we ask to get an RD&D program
19 of the scale to do this?

20 MR. GARAMENDI: We've started at
21 the other side of this table. I'll take a
22 shot at it. The new organization. Let me put

1 these two questions together. I don't see a
2 solution with the new organization or an
3 existing organization until you change the
4 nature of the game. If the nature of the game
5 is how do we dispose of the waste that we
6 presently have without changing that waste
7 isn't going to work. There's just going to be
8 opposition because you're looking at a time
9 frame of several tens of thousands or more
10 years with very dangerous materials. Where
11 are you going to put them? Well, not in my
12 backyard, thank you. But we'll try Idaho or
13 maybe Wyoming, but not my backyard.

14 So you've got to change the game,
15 and I think there is a game change that is
16 available for much of this. Not all of it but
17 for much of it. I think that we need to be
18 very creative, we've talked about the research
19 and development, with regard to those waste
20 materials that are not easily transformed or
21 maybe cannot be transformed because of the
22 nature and where they came from and so forth.

1 However, for many of the other
2 waste materials, I think we need to change the
3 game. They're not waste, they're a resource,
4 a resource that can be used to provide energy.
5 And in doing that, reusing, recycling over
6 time, and it may be a lengthy period of time,
7 a hundred years, maybe more, to recycle and
8 recycle, you wind up with a waste at the end
9 of the process that may be very short-lived
10 and by comparison very short-lived and more
11 easily handled.

12 I think that's what we need to
13 focus on here. And if we do that, you've
14 changed the nature of this problem in that
15 your waste is now an asset. It's a valuable
16 product, a resource to be used.

17 Now, what's it take to do that?
18 In my opening statement, I said the U.S.
19 government spent 20 years looking at this
20 issue and came up with a solution, actually
21 did it. They developed a reactor, they
22 developed a process of recycling, reusing,

1 pyroprocessing, and a reactor to IFR, sodium-
2 based reactor, and it worked. It worked for
3 more than a decade, almost two decades, until
4 decided that there was a proliferation
5 problem. It turns out you take a look at the
6 proliferation problem and you go, hmm, maybe
7 it wasn't carefully analyzed and that,
8 depending upon how you do things, how you
9 recycle, you may not have a significant or
10 even a serious proliferation problem.

11 So by doing that, how much money
12 is it going to take? It's estimated that to
13 build a pyroprocessing facility, demonstration
14 facility, that is take it beyond what was done
15 15 years ago and build a new one, you're
16 talking something less than a billion dollars,
17 700, okay? A lot of money, but in terms of
18 what we're talking about here not much. And
19 to build a reactor to a demonstration, IFR
20 reactor, a couple billion dollars. How long
21 would it take? Less than a decade if we put
22 our minds to it, perhaps even less than that

1 if we really put our mind to it.

2 You then have changed the game.

3 The nuclear material, the used nuclear
4 material at your various power plants suddenly
5 becomes not a waste product but a resource to
6 be used at some time in the future. So now
7 we're talking about an interim storage,
8 perhaps for, I don't know, a hundred years.
9 Maybe some of it will be used next year,
10 others will be used ten years or 50 or 100
11 years from now. So you've taken that and
12 you've built that into a valuable asset.

13 The material that is plaguing
14 Idaho and a few other sites around the nation
15 where we had nuclear weapons research going
16 on, that's somewhat different. It needs to be
17 handled differently. Some of that can be
18 recycled and reused. Others cannot for a
19 variety of reasons. So I'm not speaking to
20 that specifically.

21 What we're talking about for a, I
22 don't know, let's say on the outside \$3

1 billion or \$4 billion investment over the next
2 five years to prove that we could do this.
3 I'm new to Congress, okay? And I don't have
4 infinite wisdom, may not even have collective
5 wisdom. But I ask questions, and I asked the
6 question in the Armed Services Committee, how
7 much money are we spending protecting the flow
8 of oil out of the Persian Gulf. Get back to
9 you, sir. I asked the RAND Corporation. I
10 figured they would actually get back to me.
11 Not that the Pentagon wouldn't, but they
12 didn't yet. Fifteen to seventeen, eighteen
13 percent of the total defense budget, which is
14 over \$700 billion. Do the math. Over a \$120
15 or \$130 billion a year for that energy source.
16 So we take a small piece of that or a small
17 piece of the wars or whatever you want and
18 move to something that could be a game-changer
19 so that your waste is a resource, not a waste
20 to be disposed of in somebody's backyard
21 forever but rather to be put aside in a safe
22 temporary -- temporary meaning long-term, not

1 talking ten years. It will probably be
2 somewhat longer than that. You change the
3 game, and it's not expensive in terms of what
4 we spend our money on here in this nation.

5 MR. ANDRUS: I have just one
6 footnote I would add. In my opening
7 statement, I said there were four things that
8 my benevolent dictator should do, and the
9 second thing was reprocessing for the very
10 reasons. The Congressman articulated it very,
11 very well, so I don't think there's any need
12 to carry it on any further. But is that cost
13 extreme when you look at the situation of the
14 way we're spending now and what we'll get as
15 an end result? Absolutely not.

16 MR. SULLIVAN: If I might just
17 make one addition. I don't have the science
18 that John has, but it still seems to me you
19 have the same problem. You've got to put
20 whatever you got somewhere. And as a game-
21 changer, and this goes back to Chairman
22 Scowcroft's question earlier, how do you do it

1 when you've got two political lives going on
2 at the same time? I think you need to change
3 the game with the education and collaborative
4 processes first on a serious long-term basis
5 and then couple that with incentives,
6 attractive incentives to the governmental
7 agency that's willing to come in and make a
8 bid for this so that you end up with something
9 that's attractive to more than one
10 governmental agency and not a threat because
11 you've convinced them of the safety and the
12 national need and a general consensus. And
13 then you let the process, if you don't want it
14 we've got somebody else who will take it, and
15 you end up with not having a political issue
16 but an economic issue.

17 The MRS process had, it seemed to
18 me, some very good aspects to it. It just
19 needed a five-year foundation to put it in a
20 place where it would work.

21 MEMBER MONIZ: Could we have a
22 reaction to the question of how to get an

1 organization with sufficient authorities?

2 MR. GARAMENDI: Well, I don't
3 think you'll get there, I don't know how you
4 could get there in the current circumstance
5 because nobody is going to trust anybody to
6 solve this problem because it may somehow
7 impact them. You think Congress is going to
8 give you guys the authority without some
9 oversight and some opportunity to pull you
10 back and rein you in or something? It isn't
11 going to happen in my view, not that I've been
12 around Congress long enough but I've been
13 around government for 35 years, almost as long
14 as the gentleman to my left or my right here
15 and my left.

16 So I think the organization is
17 going to have to work within the reality of
18 the ultimate authority is going to lie with
19 Congress and the President over time. And so
20 you need to set a mechanism that leads you in
21 the direction where you have a solution,
22 recognizing that the benevolent dictator may

1 exist in other countries but not around here.

2 MEMBER BAILEY: Thank you. Thank
3 you all for this panel. Let me pursue this
4 line of comments, and since I have the
5 opportunity to have a sit-in congressman here
6 before me let's pursue this idea of a separate
7 entity. And my questions go along pretty much
8 some of the same as Commissioner Moniz. Who
9 should be involved in this separate entity?
10 Do I need to amend the Nuclear Waste Power
11 Act? And how do I get the money to this new
12 entity? How do I get the funds that are
13 already there and have been stored in the
14 Nuclear Waste Fund? What would be my
15 mechanism? What kind of process would I need
16 to set up?

17 Recognizing that, obviously, as
18 you have articulated quite well, this is going
19 to be difficult, but I've got to get beyond
20 that. You know, I appreciate the history and
21 the history of the negative experiences help
22 to inform how I can go forward, but I've got

1 to go beyond that. And really my questions
2 go, if I can fill in those blocks, if I can
3 fill in those pieces of the puzzle and put
4 four corners on this, I also need to know
5 who's the best person, who has the
6 credibility, the gravitas to articulate the
7 need and, if you agree with this, that we do
8 have a nuclear future, who can articulate that
9 position? In our travels to Sweden and
10 Finland, there was one afternoon where we were
11 quite impressed with a community that
12 articulated quite well the fact that they
13 recognized that they have a responsibility to
14 do something with this spent fuel. You can
15 call it a dump, you can call it a waste, you
16 can call it what you want, but there's a
17 certain responsibility that lies with each and
18 every one of us. And no matter how diverse
19 and fragmented and dysfunctional DOE or
20 Congress or whomever may be, there still lies
21 this responsibility, and we've got to move
22 forward.

1 So I need answers. I need
2 something to help me make this decision and
3 help me write this report. So I'd like to
4 hear your comments on what are the components
5 of this decision-making process here, and how
6 do I get the money? Money is a big issue of
7 it. How do I get that? Congress is not going
8 to be an entity that's going to say, oh, okay,
9 we're going to allow this new entity now to
10 have all this money, and take it out of our
11 treasury and put it over here and that kind of
12 thing. So I pose that to all the panelists.

13 MR. GARAMENDI: I liked your last
14 sentence best, and it was, all the panel. How
15 to deal with it? I've said this. I don't
16 want to become boring, but in the current
17 circumstance I don't see a good solution and
18 I don't see any entity that's going to be
19 trusted over time to solve this problem. The
20 educational piece that has been discussed by
21 Governor Sullivan is really important. We
22 really need to understand. Certainly,

1 Congress and others who are engaged in this
2 need to understand what it is we're actually
3 dealing with here. I've divided in my own
4 mind, and this may be incorrect, but you've
5 got, a word you use, spent nuclear fuel.
6 Mostly we're talking here from power plants.
7 I would use a different term. I'd use used
8 nuclear fuel. You've got the waste material
9 from the various laboratories which is
10 somewhat different. Some of it's the same and
11 some of it is quite different. So I think we
12 need to have a good understanding of what
13 exactly we're dealing with.

14 With regard to the spent or used
15 nuclear fuel, there is a solution available.
16 You've heard from France. They've got a
17 partial solution where they recycle using an
18 aqueous process of recycling. It has certain
19 troubles associated with it, very complex,
20 very expensive, and has the potential with a
21 little tweaking of the chemistry to wind up
22 making some really bad stuff like plutonium.

1 There are other mechanisms to recycle, but I
2 think what the game change here is to think of
3 this material as being a resource.

4 Now, how can we use that resource
5 in a way that gives us something of value?
6 And it is. I mean, you're looking at, I don't
7 know, using three or four percent maximum of
8 the energy in that material. And we figured
9 it out. America figured out what to do here.
10 We spent, I don't know, billions of dollars
11 over 20 years, and we figured it out. And
12 then we dumped it. As near as I could tell
13 from my studies we dumped it because we were
14 fearful of proliferation. Well, guys, hey,
15 there is proliferation. And there's a whole
16 bunch of terrorists out there that don't need
17 to proliferate, they just need to steal.

18 So we need a game change here, and
19 the game change is what is this stuff? Is it
20 an asset, a resource, or is it a waste?
21 America proved that this is a resource, not a
22 waste. If we go down that path, then we can

1 find a solution to the question you raised,
2 which is an entity that has the ability over
3 time to move us from a waste to a resource,
4 and that's your Generation 4 reactors. You
5 can debate for some time. I've reached my own
6 conclusion about which mechanism to use in
7 recycling.

8 We have money that's been set
9 aside for, I don't know, three decades by the
10 nuclear power industry. It's sitting
11 someplace, God knows where, probably close to
12 where the Social Security trust fund is. But
13 let's assume it's somewhere. A pile of money.
14 I don't know how many billions of dollars. In
15 that context, could you use that money to
16 change the game? Is the industry willing to
17 use that, allow that money to be used to
18 change the game? That is to prove in a
19 demonstration program that we can not have a
20 waste but we can have a resource. Three, four
21 billion dollars over five, maybe ten years
22 maximum. We change the game.

1 Now, certain waste, and this is a
2 particular problem from our friend at the
3 Yakama tribe and Yakama Nation and certain
4 other laboratories around the nation, you've
5 got a somewhat different problem. And I'm
6 dividing the issue here. And I think that if
7 we think about changing the game and we think
8 about this in a different way and then develop
9 the mechanisms to do that, which is basically
10 building a demonstration facility, and an
11 entity in that modality is the easier entity
12 to build than one that deals with something
13 that has to last for 200,000 years and is very
14 dangerous. Thank you. CHAIR SCOWCROFT:

15 Susan?

16 MEMBER EISENHOWER: Maybe this is
17 the perfect segue. I was going to initially
18 make an observation and ask a question, but
19 maybe the congressman has just gone a long way
20 to making one of the points I wanted to probe.
21 First of all, in hearing about these
22 violations of trust over the years, it strikes

1 me that many of the most egregious acts of
2 this occurred during the Cold War and this is
3 part of our legacy that we were in the middle
4 of a national emergency, that we probably took
5 a lot of shortcuts and let the American people
6 down across this country. But we are now in
7 a new era. I think it's fair to say we're
8 maybe even in the post-Cold War period, and I
9 think it's now just beginning to dawn on this
10 country that we're in a new environment, a new
11 global environment.

12 And so I was going to ask the
13 panel about how to talk about this issue in
14 the new set of circumstances, and I think the
15 congressman has gone a very long way in
16 answering my question.

17 I'd like to point out that I was
18 born in Fort Knox, and that was the gold
19 repository for this country. And I actually
20 would like to associate myself with your
21 comments because I think that taking spent
22 fuel to call it used fuel is a step, but it

1 should be called partially used fuel, not used
2 fuel because used fuel sounds like it, too, is
3 spent. I mean, we're all on the same page on
4 that one. I think if we had called this
5 repository a national nuclear strategic
6 reserve it would feel a lot more like Fort
7 Knox than it would Yucca Mountain.

8 And so given this new nuclear
9 political environment we're in which is one
10 that's full of potential and hope because the
11 Cold War is behind us, it's also a period of
12 deep uncertainty and kind of collective angst
13 in this country. So let me just re-frame this
14 question for the whole panel. What cautions
15 and opportunities would you see for us in
16 framing these issues today in the current
17 political environment in which we are living?

18 CHAIR SCOWCROFT: Governor
19 Sullivan, you already did it in your opening
20 statement.

21 MR. SULLIVAN: But not with regard
22 to the current political climate of which I am

1 basically unfamiliar or on the wrong side of
2 the fence. But I think it's a very good
3 question. Going back to the limited
4 experience I have, the angst, the anger, the
5 fear that I saw generated because of a lack of
6 information and a lack of a common solution,
7 agreed-upon solution. And I think the current
8 political situation makes that just that much
9 more problematic and, thereby, makes the
10 educational -- and I'm repeating myself and I
11 apologize for that -- the educational
12 component, the collaborative process component
13 -- just like technology has advanced over the
14 years, so has our ability to have
15 collaborative process and understand how we
16 inform people so that they view it as a
17 responsibility as well as a part of our
18 strategic energy answer. I think there is
19 good opportunity to inform and educate and,
20 based upon what John says here today, I think
21 part of that information and education has to
22 be we need a separate entity. So it may be

1 informing Congress, as well. But I would be
2 concerned about the current uncertainty and
3 angst.

4 MR. ANDRUS: I think I would agree
5 that you have to be concerned about the political
6 element that we face today in the Congress,
7 but that's not your job as a blue ribbon
8 committee. You've got to come up with,
9 irregardless of what you think might be
10 happening out there, you've got to come up
11 with something that you think would work. And
12 I think that you've got to do what the
13 congressman has suggested here, but you come
14 back to Ms. Bailey's question about how do you
15 get the money and that's the very ingredient
16 that you have to have to make the agency work
17 or to do the reprocessing that we're endorsing
18 here today. And I believe that the first step
19 from that agency or that entity is created
20 that there is an appropriation, or an
21 authorization if you can, if that two and a
22 half billion dollars of money is still out

1 there some place -- Congressman, I doubt that.

2 I think it's been sucked up --

3 MR. GARAMENDI: It's in a trust
4 fund. Not to worry.

5 MR. ANDRUS: Oh, it's a trust
6 fund. I'm sorry. I didn't know that. I
7 don't want to go there. Anyway, that amount
8 of money could be utilized. If not, an
9 appropriation to start it up taken from some
10 other source such as the congressman outlined
11 here, the cost of protecting the hydrocarbon
12 fuels that we ship into this country or some
13 means. And then as you get working over that
14 period of time, that money from the industry
15 that is allegedly going into that trust fund
16 should be directed right directly into your
17 agency. It can be funded from the number of
18 people that pay their utility bills, but
19 you've got to start and the Congress has to
20 either authorize or appropriate, whichever is
21 the proper means.

22 CHAIR SCOWCROFT: Allison?

1 MEMBER MACFARLANE: Thanks. Okay.

2 I guess I want to go back to this issue --
3 sorry? Did you want to make a comment? I'm
4 sorry.

5 MR. JIM: To follow up on that
6 issue, it took us years to try and get the
7 education curriculums to teach about treaties
8 in public school systems. Only within the
9 last three years that has passed in the state
10 of Washington, but signed by the governor with
11 the proviso that only schools are on or near
12 reservations would be allowed to teach about
13 treaties. And the education process that's
14 been mentioned is very important. I call it
15 the logic of the uninformed, especially about
16 treaty rights. And to prevent down the road,
17 in the future, this consistency of litigious
18 people. I would hope one day that the
19 education curriculum on a nationwide basis be
20 allowed to teach about treaties. It would
21 provide a venue for your grandchildren or my
22 grandchildren to grow up and understand each

1 other and not be so litigious or
2 confrontational because of the issue of being
3 uninformed about treaty rights. Thank you.

4 MR. GARAMENDI: You asked about
5 the political. I've been in Congress now 375
6 days, so I have a great reservoir of
7 historical knowledge. But obviously there's
8 a significant political change afoot. For
9 this issue, it seems to me that it's not an
10 irretrievable but rather an opportunistic
11 time. Generally speaking, there are far more
12 folks on the republican side that are
13 interested in nuclear power than on the
14 democratic side. I use far more, not
15 necessarily stronger advocates or better
16 advocates but more numerous, at least judging
17 from the nuclear caucus, if you will.

18 So I think that there are some
19 opportunities here, but the opportunity will
20 not bear fruit as long as we are considering,
21 and I'm going to talk here about nuclear
22 energy waste or partially-spent fuel, as long

1 as it's considered to be a waste, it isn't
2 going to get resolved. So this is the game
3 change I'm talking about.

4 As to money, obviously, the
5 deficit hawks are about to gain control. Not
6 that they haven't for the last seven or eight
7 months, but, nonetheless, there is money
8 that's supposed to be spent on this issue.
9 How you access that money, whether the
10 industry is willing to involve itself in a
11 way, it seems to me that it's possible to do
12 something here, and I see an opportunity.
13 That's where the nuclear power industry, let's
14 just say the energy, well, I won't say that,
15 the nuclear power industry has an interest in
16 building additional nuclear power plants.
17 It's part of our national energy policy now.
18 It has been for five or six years. But it
19 can't overcome this issue of what are you
20 going to do with the waste?

21 But if we transform this from a
22 waste to a partially-used fuel, that it's in

1 a retrievable storage place that's sufficient
2 for retrieval, and you couple that with
3 Generation 4 reactors and a recycling system
4 that deals with your proliferation problem,
5 we've done a move to a completely different
6 plateau from which to discuss this issue. And
7 I think it's viable politically. What does it
8 take? It takes the nuclear power industry.
9 I'm referring to the manufacturers. It takes
10 the research that we have spent billions of
11 dollars on in previous years, decades
12 actually. And to use that research, the
13 nuclear power industry, the electrical energy
14 industry, and the general public coming to an
15 understanding that there is a path that we can
16 follow.

17 Would Congress do this? I think
18 the answer is yes. I know that in the Science
19 and Technology Committee, some of us that are
20 on this path, we were able to insert a piece
21 of legislation that's now passed the House and
22 may get to the President in the lame duck

1 session, or if not then it will be recycled
2 next year, in which the Generation 4 path is
3 laid out and funded, at least authorized
4 funding. Now, the dollars are not there, but
5 this is where the industry can come in and say
6 maybe we're not going to have to store this
7 stuff in our nearby swimming pool -- well, I
8 guess that's not a swimming pool. Let's just
9 say pool of water forever, but we can store it
10 temporarily. We can recycle it in a
11 mechanism.

12 So I think what has to be done
13 here is to understand those recycling
14 mechanisms very, very well, and there are
15 basically two: the pyroprocessing and the
16 aqueous processing, and the reactors that
17 would then be able to use that recycled
18 material. If we understand that, then I think
19 there's a pretty clear path for us to move on.
20 And I believe the political will would be
21 there. And if the industry is on board, that
22 is the nuclear power industry is on board,

1 then there's a funding source. Now, that
2 would require a mechanism, and I'll just work
3 with this for a second, a mechanism made up of
4 the industry representatives, pick and choose.
5 I'd have a few advocates. Russell Jim would
6 be a great person to put on it speaking for
7 future generations, as he has so eloquently
8 done.

9 I don't know about DOE. A lot of
10 emotion from my colleagues here about DOE, but
11 it's pretty hard to ignore DOE in this
12 process. But I would recommend a separate
13 mechanism apart from -- and, ultimately, it's
14 got to be responsible to the President and to
15 Congress. I mean, you just don't do that.
16 You cannot do otherwise in America. So you
17 can put in installation, you know, various
18 installations report back and leave us alone
19 and a funding source that is not cut off, as
20 often happens and has happened repeatedly in
21 renewable energy.

22 CHAIR HAMILTON: May I interrupt

1 here? All of us are really wrestling with
2 this question of organization, and you all
3 stress or most of you do your dislike of the
4 DOE and the necessity of setting up an
5 independent quasi-government group, as you've
6 indicated. And I've been sitting here asking
7 myself what's the analogy? We have an
8 independent group. We call it the Federal
9 Reserve. It doesn't call upon the Congress
10 for money, at least for the most part. It
11 generates its own. But it's generally
12 independent of the Executive and of the
13 Congress.

14 Now, it has its own sources of
15 money. It generates its own money, and that
16 may be a big difference there. If you have an
17 organization dependent upon the Congress and
18 the President, you can bet they're going to
19 exercise oversight and probably should. But
20 can you set up an organization that is
21 independent, like the Federal Reserve? Then
22 you'd have genuine independence. Now, I'm

1 told you've got \$23 billion in the Treasury
2 generated by fees, I guess, from the nuclear
3 power industry that might give us a measure of
4 independence here.

5 So when you talk about an
6 independent quasi-government organization, I
7 presume you're talking about a board of
8 directors. Who appoints the board? In the
9 Federal Reserve case, the President appoints
10 the Board, even though it's independent of the
11 President to some degree. So does the analogy
12 of the Federal Reserve make sense to you, or
13 do you have a lesser idea of independence?
14 The only way you're going to have genuine
15 independence is to not be dependent upon the
16 Congress and the President for money. As long
17 as you're dependent upon them for money, you
18 don't have independence. I'm wrestling with
19 that.

20 MR. GARAMENDI: I'd like to defer
21 to my learned colleagues on both sides here.
22 The analogy that you used is an interesting

1 one in that even as independent as the Federal
2 Reserve is, they're often called before
3 Congress for an explanation of what they're
4 doing and, in some cases, beaten up and maybe
5 they modify their activities and maybe they
6 don't. But, you know, you still have
7 oversight, and if Congress and the President
8 really get upset, as Mr. Paul is presently
9 upset, we're going to audit them. Fine, okay.

10 CHAIR HAMILTON: No, but you've
11 got a lot more clout if you've got money.

12 MR. GARAMENDI: The money issue I
13 addressed a moment ago, and I didn't realize
14 it was \$23 billion, but if there is I'm even
15 more excited about the potential. And we've
16 seen the money issue over and over,
17 Congressman Hamilton. We've seen it over and
18 over again. You talk about the renewable
19 energy issues in the United States. They're
20 usually good for two or three congresses, and
21 then the money ceases and the whole industry
22 dies. You can take a look at what I've been

1 talking about here, the Generation 4 IFR
2 pyroprocessing. Twenty-years of research. It
3 worked, and then it died because the Clinton
4 Administration decided that it was somehow
5 proliferating. It actually wasn't but,
6 nonetheless, that was a decision that was
7 made.

8 So, yes, you need something that
9 has longevity, a long period of time, because
10 we're talking about something that goes on for
11 a long while here. A high-level of
12 independence. I do think you need to involve
13 on the board, if you would. Key players. You
14 can't do this without the electric energy
15 industry. They're going to have to be
16 involved. They have most of the waste,
17 although it's stored in their facility now.
18 I don't know who owns it. That's a question
19 that can go on for a while; but, nonetheless,
20 it's there.

21 CHAIR HAMILTON: You can get a
22 measure of independence by long-term

1 appointments. You give a ten-year appointment
2 to the FBI director, for example. Now, that's
3 a very different organization than what we're
4 thinking about here, but you do get a measure
5 of independence if the President appointed a
6 member of this organization we're talking
7 about for an extended term far beyond his own
8 term. Well, the FBI director is subject to
9 Senate confirmation. I don't think you'll
10 ever be able to not have that. You're going
11 to have probably the President making the
12 appointment, probably Senate confirmation.
13 They are going to be called before the
14 Congress, as they should be it seems to me, to
15 answer questions.

16 But I'm really struggling
17 personally and I think most of us are on what
18 kind of an organization we can put together
19 here that would be most effective in dealing
20 with this very difficult problem.

21 MR. ANDRUS: I think you're
22 awfully close -- excuse me just briefly. I

1 think you're awfully close when you say terms
2 of office. We were talking up here behind the
3 mics a moment ago that terms of office with
4 staggered terms type of situation we use in
5 corporate boards of directors all the time,
6 that would give you some continuity, of
7 course. But I think that's about the only way
8 you can go.

9 MR. SULLIVAN: And I would simply
10 say that when we speak of independence, I
11 don't think any of us are naive enough to
12 think that you're going to have total
13 independence. You get independence by having
14 your own money. That seems to me to be one of
15 the major issues when dealing with the federal
16 government is they've got control of the first
17 strings, so you can't do anything with it.
18 Oversight brings transparency, and
19 transparency in this issue is of ultimate
20 importance it seems to me. So I think your
21 suggestion has some staying power.

22 CHAIR SCOWCROFT: We are now badly

1 over time. I'm going to adopt, we're going to
2 call out the questions. Allison, Per, and Al,
3 and then the panel can answer all three of
4 them.

5 MEMBER MACFARLANE: I just want to
6 remind Governor Sullivan that in his letter he
7 stated that he did not trust the federal
8 government or the nuclear industry to assure
9 the interests of the state, and so I think
10 that's something, I wonder if you still feel
11 that way? And then in terms of the states or
12 tribes that are affected or that would host
13 such a facility, I'm interested in how much
14 control the state or tribe should have over
15 the process.

16 MEMBER PETERSON: My question is
17 also related to trust. Thinking about it from
18 the technical and operational dimensions of
19 what should one prioritize for early actions,
20 and we've spent some time debating this. I'd
21 be curious about thoughts about some things
22 that might be prioritized that can be done at

1 smaller scale, yet demonstrate the capacity to
2 do what's needed subsequently at larger scale,
3 looking at the example of where we started
4 with true waste, now we're starting to do
5 remotely handled. So a couple of options
6 would include, for example, prioritizing
7 centralized storage to spent fuel from
8 decommissioned reactor sites. Another might
9 be prioritizing early disposal activities to
10 be for defense high-level waste where there's
11 no controversy about the potential that it
12 might have future economic value. That's a
13 couple of examples of things that could be
14 done technically at smaller scale to
15 demonstrate capacities that, in the longer
16 term, could be implemented at larger scale.

17 CHAIR SCOWCROFT: Al?

18 MEMBER CARNESALE: Congressman,
19 mine is a little more of a very brief speech
20 that ends with a what do you think of that
21 because it relates to -- so the history here
22 is credibility problems, to cheap to meter,

1 waste isn't a problem. Too cheap to meter
2 gone. And climate change really since it
3 includes a social cost, this is really
4 competitive, not economically otherwise but
5 worth subsidizing because of that. Waste
6 still a problem. Yucca Mountain wasn't the
7 solution. It was a small step in the solution
8 but indicated that we had a plan, we knew
9 where we were going. Now it's clear we don't.
10 We don't have a plan, and we don't know where
11 we're going. We need a plan.

12 How's about recycling and
13 reprocessing, really rethinking used nuclear
14 fuel? That was the plan. That was the plan
15 40 years ago. Anybody that studied nuclear
16 engineering, it was wasteful to do anything
17 other than that. It turned out not
18 economical. Industry wasn't interested. They
19 were only interested if the government would
20 pay. Also, it presented proliferation
21 problems, but those come second.

22 The notion that the plan is going

1 to be sodium-cooled reactors, try citing
2 those. Sodium-cooled reactors with
3 reprocessing plants and, trust me, that's
4 going to make it cheaper and it's going to
5 reduce the proliferation problem.

6 I think we're dead if we don't
7 have something that takes into account that we
8 need geological repositories, and we've got a
9 lot of spent fuel that is not going to wind up
10 in some other kind of reactor. Nobody has a
11 scenario that makes use of all that fuel. And
12 the recycling that's taking place now is once-
13 through, right? MOX -- doesn't really help.
14 So I think we've got to be very careful not to
15 sound like, trust me, it will be too cheap to
16 meter and the waste won't be a problem.

17 So what do you think of that?

18 CHAIR SCOWCROFT: That's a good
19 way to make up for our being over time.

20 MR. GARAMENDI: I'm going to be
21 very, very quick about this. I never for a
22 moment indicated there doesn't need to be a

1 permanent repository. Certainly, some of
2 these materials are absolutely going to have
3 to be in a permanent repository of some sort
4 somewhere. I'm not suggesting Yucca Mountain
5 or any other place. You'll make your
6 suggestions on that.

7 But what I am saying is the fuel
8 that's currently being used in our nuclear
9 energy industry is an extraordinary asset that
10 should not be locked up in a permanent
11 repository but rather in a retrievable
12 situation where we can then use that fuel once
13 again in an advanced reactor system. That
14 makes sense to me.

15 It also gets us past what I think
16 is an extraordinarily important issue here,
17 and that is what are we going to do about the
18 energy for America? What are we going to do?
19 Are we going to continue on the path of where
20 we are today, coal and oil; or are we going to
21 transform and do what has been discussed for
22 more than 40 years? It's time for us to get

1 on with it.

2 One thing, and you mentioned the
3 cost issue here, you mentioned the economics,
4 the economics of the nuclear energy is pretty
5 well understood and is usually or almost
6 always calculated when we want to take the
7 next step. What does it cost us to dispose of
8 the waste? What does it cost us to build a
9 reactor? What does it cost us to build a
10 Generation 4 reprocessing system? Those costs
11 are always understood. Earlier, I said very
12 categorically that the cost of oil is not
13 understood. \$120 billion a year to protect
14 the flow of oil out of the Persian Gulf is not
15 calculated, nor is the cost to the environment
16 of carbon in the atmosphere. Those costs are
17 not calculated. If they were, we'd be on
18 nuclear, we'd be on solar and wind in half a
19 nanosecond.

20 MEMBER CARNESALE: I agree.
21 That's what I was saying about climate change
22 is change the calculation because of the

1 social cost.

2 CHAIR SCOWCROFT: Other comments
3 from the panel?

4 MR. SULLIVAN: I would just
5 respond to your question as I haven't changed
6 my mind any. I think plan and education and
7 a separate entity would resolve my concern.
8 I don't hate DOE. I just have a general
9 distrust for the ebbs and flows of political
10 decision-making.

11 MR. JIM: Mr. Chairman, I, too,
12 would like to echo that, as we've said,
13 funding is a very important issue, and the
14 tribes particularly are dependent upon the
15 federal government for their participation
16 with the funding. But we always have to take
17 care to be careful about putting those line
18 items or wherever it may come from because as
19 of '95 the new Congress came in and under the
20 logic of the uninformed, what's all this money
21 for Indian tribes? They took it out. We had
22 to fight months to get it back in there.

1 So OMB also needs to be educated
2 about what the trust responsibility means
3 because they are a very important segment when
4 it comes to funding. And if they don't
5 understand trust responsibility, even though
6 they're not a federal agency, they make a very
7 important decision. Thank you.

8 MR. ANDRUS: I will just say in
9 conclusion that we appreciate the opportunity
10 to share with you our thoughts. None of us
11 have an absolute perfect blueprint for the
12 future, but I would submit to this blue ribbon
13 committee that if we continue to go forward
14 without a plan and actuality of what we can
15 accomplish then we're being irresponsible. We
16 simply have no right to continue to produce it
17 if we don't have plan to properly manage it.
18 And that puts an awful burden on you, Mr.
19 Chairman, and your colleagues, but that's
20 absolutely what we have to do.

21 Thank you very much for having us
22 today, sir.

1 CHAIR SCOWCROFT: Thank you very
2 much. I want to thank all of the panelists
3 for helping us get to the heart of the issues
4 that we're all grappling with. We greatly
5 appreciate your contribution and being with
6 us. Thank you very much.

7 We'll now take a ten-minute break.

8 (Whereupon, the foregoing matter
9 went off the record at 2:42 p.m. and resumed
10 at 2:55 p.m.)

11 CHAIR SCOWCROFT: I'd like to
12 begin now our final session of the day. It
13 will consist of presentations and a panel
14 discussion with three experts who have studied
15 various aspects of the issues before this
16 Commission. We've asked the three presenters
17 to keep their remarks to about 15 minutes a
18 piece.

19 We will hear first from Dr.
20 Richard Stewart, University Professor and John
21 Edward Sexton Professor of Law at New York
22 University School of Law. Dr. Stewart is in

1 the process of publishing a book on U.S.
2 nuclear waste policy, and we have asked him to
3 deliver a summary of his findings. Dr.
4 Stewart, please proceed.

5 DR. STEWART: Thank you very much,
6 Mr. Chair. I am a law professor at New York
7 University where I teach environmental and
8 regulatory administrative law, and I've worked
9 with the Consortium for Risk-Based Evaluation
10 with Stakeholder Participation, CRESP. You've
11 heard from Charles Power of that organization.
12 And as Chair mentioned, my wife, Jane Stewart,
13 who is an environmental lawyer, and I recently
14 sent to the publisher the first comprehensive
15 history and account of U.S. nuclear waste law,
16 regulation, and policy, and that will be out
17 in the spring.

18 And I should just mention, as an
19 autobiographical addendum, I was the Assistant
20 Attorney General for Environment and Natural
21 Resources in the George H. W. Bush
22 Administration where I worked with Admiral

1 Watkins and the Energy Department facilities.
2 And I actually argued the case before the 9th
3 Circuit where Nevada unsuccessfully challenged
4 the constitutionality of the Nuclear Waste
5 Policy Act amendments of 1987.

6 Our book, I think, has some key
7 lessons that I'll try to distill at this
8 point. First thing to be said is I think we
9 need to move on for a beginning a process to
10 site a new repository. Given the
11 uncertainties over the future of Yucca, there
12 is a possibility the WIPP's mission could be
13 enlarged to include other waste. But given
14 those uncertainties and the fact that we may
15 need several repositories, especially if we
16 have a pilot approach to the first one to see
17 if there are start-up issues. So we ought to
18 begin now, and we ought to begin with at least
19 one consolidated storage facility for spent
20 nuclear fuel to deal at least with fuel from
21 the decommissioned reactors. There's broad
22 consensus on that and I think some additional

1 fuel to show that we can succeed at this
2 enterprise.

3 Both of these involve siting
4 challenges. And if we look over the history,
5 we can see a variety of techniques or
6 strategies that we've followed in this country
7 to site nuclear waste storage or disposal
8 facilities. One is what we're going to call
9 the top-down technocratic approach. That was
10 the 1982 Nuclear Waste Policy Act. The top-
11 down political approach. That was the '87
12 amendments. And the low-level radioactive
13 waste legislation. Congress had a situation
14 of interstate compacts to site new facilities.
15 We've had some experience with private siting
16 in the early days with low-level waste and,
17 more recently, with the private fuel storage
18 facility in Utah. And then what I'm going to
19 call government host state and local host
20 negotiation, which is the WIPP. And all of
21 these, except the last, have failed. And the
22 WIPP, it's very difficult to generalize

1 because we only have one case study and all
2 the studies are limited in extent. But the
3 lesson thus far suggests that a system of
4 negotiation with local and state host assent
5 to these facilities is critical to the success
6 of the process.

7 Now, the Nuclear Waste Policy Act
8 imposed these top-down approaches because it
9 assumed that we had to bury the waste as soon
10 as possible. There was a rush. We couldn't
11 afford securing local assent. The current
12 generation had to deal with this accumulated
13 problem that had been neglected. That was 25
14 years ago or more at this point, and the whole
15 strategy that emerged out of the initiatives
16 of the late 70s and early 80s is pretty much
17 collapsed at this point. And the Commission,
18 you, have an opportunity to rebuild, to start
19 with a new approach which is an opportunity,
20 and I hope you'll seize it in the fullest
21 degree with a sort of top-to-bottom re-
22 examination and a fresh start.

1 The ethical premise of the Nuclear
2 Waste Policy Act, building on the interagency
3 review group from the Carter Administration,
4 was that the current generation had to deal
5 with the waste as soon as possible. I think
6 that's overly simplistic. It couldn't burden
7 future generations. I think that's an over-
8 simplistic ethical premise, and I think we now
9 realize that, as Tom Isaacs has said, that we
10 need a more sophisticated approach that leaves
11 options open to future generations without
12 unduly burdening them in the process. And I
13 think that means, one, that it's going to take
14 time for a repository to open, especially if
15 we site a new one as I think we need to; and
16 we're going to need to acknowledge need for
17 interim storage, at least to some limited
18 degree, maybe to a greater degree.

19 Under the Nuclear Waste Policy
20 Act, interim storage and a repository were
21 seen as enemies, so Congress put strict limits
22 on sort of any interim storage. And now I

1 think we have to see them as compliments.
2 Starting with an interim storage facility can
3 show, at least one, maybe several if
4 geographic equity is an important
5 consideration, to get into the siting process,
6 to deal with local and state host
7 constituencies; and successful siting of an
8 interim storage facility can be the next step
9 for successful siting and opening of a
10 repository. So they should work together, not
11 across purposes as I think the Waste Policy
12 Act presumes.

13 Starting with an interim storage
14 facility, that could be located at a DOE site.
15 It wouldn't have to be necessarily constructed
16 by DOE, depending on your new institutional
17 arrangements. All of these are linked to some
18 extent. It could be leased land on DOE sites.
19 There's a precedent, you know. There's a
20 private reactor at the Hanford site. I think
21 the possibility of private facilities is
22 something that the government ought to allow

1 for and encourage if it's suitably regulated.

2 The future siting efforts have to,
3 I think, learn from the failure of the
4 strategies other than securing host assent
5 and, specifically the failure of Yucca and the
6 success of WIPP. Forcing a site on the state
7 doesn't work. Collaboration that gives state
8 and local hosts a real say can work. That
9 means host assent, probably regulatory
10 authority as New Mexico has over the facility.
11 The override of state regulatory authority in
12 the Waste Policy Act is totally at odds with
13 the Federal Facility Compliance Act that says
14 federal facilities should be subject to state
15 environmental regulation.

16 It has to proceed step by step,
17 not sort of one fait accompli. There has to
18 be full disclosure. The state and the local
19 community have to have independent technical
20 capacity that's funded by the federal
21 government. There have to be significant
22 long-run economic benefits, not just for the

1 locality but the state, and a variety of
2 regulatory and other assurances. That seems
3 to be the lesson so far in the way forward.

4 Now, our book goes into greater
5 detail on the low-level waste situation, which
6 is, in many ways of course, less pressing but
7 still serious. The Low-Level Radioactive
8 Waste Policy Act I think has failed. We have
9 a serious problem of B and C waste. We have
10 an orphan problem of greater than Class C
11 waste. And those need to be addressed front
12 and center, and I would respectfully suggest
13 the Commission do so.

14 The institutional and financial
15 issues were being aired in the last panel. My
16 own view is that we need at least two new
17 institutions other than DOE. One is the
18 siting process. I think the legacy of
19 distrust of DOE is significant on the siting
20 issue. And I guess my own view is something
21 like an independent commission that is multi-
22 member, three to five members, that has a

1 base, a sort of political base of different
2 sorts with different constituencies can work
3 well with states and locality and the Congress
4 and the Administration to develop new storage
5 and repository facilities that are needed and
6 then, on the other hand, the operational
7 management of the actual handling, treatment,
8 storage, disposal of waste is a long-term
9 operational responsibility. I think it's
10 rather different than the work of the Federal
11 Reserve but one that I think should be outside
12 of a regular department with all the political
13 push and pull, and it should have an assured
14 funding source. That was discussed in the
15 last panel.

16 Just what that might be, I think
17 there are a variety of options, but we need to
18 move more to a business model, probably a
19 government corporation very probably with the
20 private industry involvement in some way and
21 representation in the governance structure of
22 which is done in Europe. And the financial

1 element has to involve some resolution of the
2 government's liabilities under the Nuclear
3 Waste Policy Act for not taking spent nuclear
4 fuel beginning in 1998.

5 I mean, it's sort of a scandal I
6 think that this problem has been festered and
7 been left to the lawyers and the utility
8 industry and in DOE and in the Justice
9 Department. I think it's obscured a lot of
10 openness. The DOE lawyers I think have
11 clamped down on getting information I found in
12 researching my book. It's not a healthy
13 process.

14 So we need to somehow liquidate
15 and transform the government's obligations.
16 It's obviously got to be an important funding
17 source given its backlog of obligations, along
18 with funding from the industry and, depending
19 on the model, of funding from the government
20 for the defense part of the waste. And that
21 all has to be rearranged.

22 Finally, I want to urge the

1 Commission to also put on the table for the
2 national agenda our existing system of waste
3 classification and regulation, which is grown
4 up patchwork without, you know, higgledy-
5 piggedy over time, over 40 years, with no
6 consistent approach to the classification of
7 waste. Some waste are classified by their
8 origin, some are classified by their
9 characteristics, some are classified by
10 whether they're civilian or defense. And this
11 has led to excessive regulatory burdens in
12 some cases, like certain reprocessing waste
13 streams, and inadequate regulation for others,
14 like sealed sources that are currently
15 classified as low-level waste or greater than
16 Class C. And I think we need to make a fresh
17 start. That doesn't mean, you know, a
18 revolution all at once. There has to be maybe
19 some orderly transition. But I think that's
20 a key part of dealing with our waste.

21 Finally, let me just say on the
22 debate on reprocessing or the discussion that

1 just occurred, I think my own view is we ought
2 to make some investment in R&D, but it
3 wouldn't be prudent to bet our future on
4 reprocessing at this point. But I think the
5 idea of both consolidated storage, at least
6 one start with it, and a repository are
7 consistent with those are going to take time,
8 they're going to be phased, they're going to
9 take decades, not as the Waste Policy Act
10 pretended, you know, 16 years from start to
11 finish. And in that time I think decisions
12 can be made on the results of R&D and an
13 ongoing evaluation of the role that
14 reprocessing might play. So I think that
15 scenario outline is compatible with a range of
16 decisions on the reprocessing issue.

17 Thank you very much.

18 CHAIR SCOWCROFT: Thank you very
19 much, Dr. Stewart. Our next presenter is Dr.
20 Tom LaTourrette of the RAND Corporation. Dr.
21 LaTourrette and his colleagues at RAND
22 recently published a study entitled Managing

1 Spent Nuclear Fuel, which he will summarize
2 for us today. Thanks for being with us, Dr.
3 LaTourrette.

4 DR. LATOURRETTE: Thank you. On
5 behalf of myself and my colleagues, thank you
6 to the Commission for inviting us to speak
7 here today. I've got some slides. Okay. I
8 don't have a clicker, so can I have it? Thank
9 you.

10 So the objective of the work I'm
11 going to present is to look at how different
12 technical approaches to managing spent fuel
13 can be combined to create different overall
14 strategies and then to try to develop a way to
15 help think about how to distinguish those
16 different strategies. In the end, we don't
17 make specific recommendations. The idea is to
18 identify a range of feasible options for
19 dealing with spent fuel and then how we might
20 think about choosing among them.

21 Just very briefly about RAND and
22 this study. RAND, for those of you who are

1 not familiar, is a non-profit independent
2 institution that helps improve policy and
3 decision-making through research and analysis.
4 And this study is part of an -- we have an
5 energy program. This is part of our ongoing
6 energy work, and it was a modest internally-
7 funded effort, so there's no external client
8 with this work.

9 So this just gives us a brief
10 outline. We tried to use both technical and
11 social considerations to distinguish, well, to
12 design and then distinguish spent fuel
13 management strategies. So we first looked at
14 what are the opportunities and limitations as
15 sort of a qualitative evaluation of different
16 technical approaches to managing spent fuel.
17 Then we also looked briefly at how the current
18 institution framework has performed. I won't
19 be able to take time to talk about that,
20 although I could raise some points in
21 discussion. Suffice it to say, we didn't find
22 anything inconsistent with what's been

1 discussed already.

2 And then, finally, to what extent
3 are different spent fuel management strategies
4 consistent with different societal priorities?
5 That's the sort of measure we use to try and
6 distinguish them.

7 So I'm just going to very briefly
8 step through the technologies. You're all
9 aware of these. We have on-site storage in
10 pools or in dry casks. We've got centralized
11 interim storage which is technically, more or
12 less, exactly the same thing as dry cask
13 storage on-site but you, of course, have to
14 transport the fuel there. The third is
15 permanent disposal in a deep geological
16 repository, which is, of course, required in
17 any strategy. No matter what recipe you come
18 up with, this is part of it for sure. And
19 then the fourth is I guess what we call semi-
20 generic advanced fuel cycle. There are, of
21 course, a lot of different advanced fuel cycle
22 schemes. This is just a schematic eye crib

1 from the web. It's not meant to be specific
2 to what we're envisioning. We don't really
3 consider most details, other than the waste is
4 essentially only fission products and that it
5 allows multiple recycles. From a waste
6 management perspective, those are the
7 important components.

8 And we evaluated these
9 technologies according to a bunch of criteria:
10 safety, security, technical obstacles, the
11 impact of the waste characteristics, cost, and
12 public acceptance. And some of the most
13 important findings I'll just list here.

14 So from everything we've been able
15 to gather, dry cask storage, it works. It's
16 feasible, safe, secure, and low cost. There
17 are concerns having to do with repackaging:
18 when would you have to do it, how often would
19 you have to do it. And it's certainly, of the
20 things we could do today, it's the most
21 acceptable because we're doing it now, but
22 it's certainly not perfectly acceptable,

1 particularly at decommissioned sites. There
2 is some urgency to remove spent fuel from
3 decommissioned sites where it's preventing
4 redevelopment of the site.

5 The second point: technical
6 obstacles to geological repository. They
7 appear surmountable. This is, of course, a
8 bit tricky because we still haven't completely
9 settled the question of how good is good
10 enough, what should we expect a repository to
11 do, and what should we design it for. And, of
12 course, the performance depends a lot on the
13 details of the geology and the engineering
14 barriers involve. But I think there's a broad
15 consensus that we can build geological
16 repositories that meet technical regulatory
17 safety requirements. The greater challenge is
18 gaining public acceptance and trust.

19 Then the third is advanced fuel
20 cycle. I'll only spend a minute on this.
21 These have the potential to greatly reduce
22 repository capacity needs and uranium

1 consumption. And by repository capacity
2 needs, it, of course, can decrease the volume
3 of waste but, more important in terms of
4 repository capacity is the heat load of the
5 waste. And there are versions, schemes you
6 can come up with where if you wait a
7 sufficient cooling period of a hundred or two-
8 hundred years, you can actually greatly reduce
9 the repository capacity needs by decreasing
10 the heat load. This doesn't account for the
11 fact that there's going to be ancillary long-
12 lived intermediate level waste that will also
13 need permanent disposal, although perhaps not
14 in the same type of environment as the spent
15 fuel itself or the high-level waste.

16 Of course, the transition is going
17 to take several decades I think it's fair to
18 say. And another important point is, while it
19 could greatly reduce the repository capacity
20 requirements, it may not offer much benefit in
21 terms of reducing the environmental risk. And
22 the reason is the environmental risk stems

1 from the dose, not the radiation level. So it
2 can reduce the radiation level by getting rid
3 of a lot of the long-lived actinides, but the
4 dose to the biosphere is a function of the
5 amount of stuff there, so the radioactivity as
6 well as the performance of the repository and
7 the mobility of the elements. And the fission
8 product elements are far more mobile in
9 general than the actinides. So even getting
10 rid of the actinides, you're still keeping the
11 dose level quite high by having those fission
12 products in the repository, so it may not
13 reduce the dose level very much at all. So
14 you may still need to have this thing as safe
15 as you can for hundreds of thousands of years.

16 And detail this result, it's
17 important since we don't have advanced fuel
18 cycles yet, it depends on a few things. It
19 depends on how the fuel cycle is designed.
20 You could remove the offending fission
21 products from the waste chain separately. It
22 also depends a lot on the geology. This

1 includes bias towards Yucca Mountain, which is
2 a very oxidizing environment. You can go to
3 a reducing environment. In fact, fission
4 products are a lot less mobile, and you could
5 actually start to reduce the dose level. But,
6 again, that raises the question of how
7 important the geology is.

8 Okay. So those are just some of
9 the, I don't want to take too much time on
10 that. I know you've heard a lot about these
11 before.

12 So what we did then is we took
13 those four technical pieces and combined them
14 in different ways to create what turned out to
15 be also four different strategies, overall
16 strategies for managing spent nuclear fuel.
17 And I'm presenting these in terms of a
18 notional timeline, but it's obviously highly
19 uncertain and the timeline really only acts as
20 a framework just to present the different
21 elements of each strategy.

22 So the first is what we call

1 expeditiously proceed with Yucca Mountain. We
2 recognize that particular siting of a
3 repository is not the purview of this
4 commission but, nonetheless, we included this
5 particular site because so much work has
6 already been done and we felt it was important
7 to include it to be complete. So that
8 includes maintaining on-site storage and then,
9 at some point, we don't know exactly when,
10 maybe ten years, maybe more, we license a
11 repository and begin to place spent fuel. And
12 the important point is we continue to maintain
13 on-site storage for decades afterwards just to
14 clear this backlog of spent fuel.

15 The next, what we call the
16 strategy, is a two-part strategy where we
17 develop centralized interim storage in
18 conjunction with restarting the site selection
19 process for a new permanent geologic
20 repository. In this case, again, we're
21 maintaining on-site storage. In some number
22 of years, we're able to site license and open

1 a centralized interim storage facility and
2 begin to transfer spent fuel, and that buys us
3 more time to take a measured staged approach
4 to select a new permanent geologic repository
5 and then begin to place spent fuel there.

6 The third strategy is what we
7 simply call aggressively pursue advanced fuel
8 cycles. In this case, we're maintaining on-
9 site or probably eventually develop
10 centralized interim storage, maintaining
11 surface storage anyway, for several years,
12 maybe several decades while we work out the
13 bugs and the research and demonstrate and then
14 eventually commercialize advanced reprocessing
15 for advanced fuel cycles. Off to the right
16 would be a permanent geological repository as
17 well, but it's so far in the future it's not
18 explicitly considered in this strategy.

19 And then the fourth is what we call wait and
20 see, maintaining extended on-site storage
21 which is self explanatory.

22 So given these different

1 strategies, which we feel span -- there are
2 certainly an infinite number of variations of
3 these and combinations of them, but we feel
4 they span pretty much a range of things that
5 are seriously being discussed. So the next
6 step was to think about how to distinguish
7 among them. Given that they're all, more or
8 less, technically feasible, we could do it,
9 how do we decide what to do? And so what we
10 did is we examined some of the key social
11 priorities or values that often come up in
12 discussions of nuclear energy and dealing with
13 nuclear waste, and for each we asked which
14 strategy is most consistent with this
15 priority? And this exercise is intended to
16 help with the question, you know, how do we
17 distinguish among them, given that they're all
18 doable and they all, I think, have
19 constituencies.

20 So the first one that we often
21 hear about is we need to solve the spent fuel
22 disposal problem quickly. We just heard about

1 that. We've heard about it on and off for
2 years. And this stems, I guess there's really
3 two reasons. Generational equity. That is,
4 we have a responsibility, those of us who have
5 benefitted from spent nuclear fuel can't leave
6 the disposal problem to the future. But
7 there's another slant on this that you might
8 say it's irresponsible to proceed with nuclear
9 power until we've demonstrated the feasibility
10 of the entire fuel cycle.

11 In any case, for whatever reason,
12 if this is our priority, then you want to
13 proceed with Yucca Mountain. That's the
14 fastest way. If you really want to close this
15 out, that's the fastest way to do it.

16 The next priority that I want to
17 discuss in discussions of nuclear energy is,
18 of course, paving the way for nuclear power
19 growth. We all know nuclear power has not
20 grown nearly at the rate we expected 40 years
21 ago or even 20 years ago. And I don't want to
22 oversimplify this. There's a lot of reasons

1 for that. It's complicated. Spent fuel and
2 the inability to dispose of spent fuel is one
3 element to that. And, certainly, utilities
4 have been reluctant to invest in the nuclear
5 power, partly for the reason that they can't
6 get rid of the spent fuel.

7 There's another reason that's more
8 pragmatic. It's, in many cases, illegal to
9 expand nuclear power until we come up with
10 satisfactory solutions to spent fuel disposal.
11 California, Oregon, Wisconsin, several states
12 have different versions of this sort of law
13 that makes it illegal. So if that's our top
14 priority, then either of those two solutions,
15 expeditiously proceeding with Yucca Mountain
16 or the centralized interim storage in
17 conjunction with a new geologic disposal site.
18 Both would get the spent fuel off the utility
19 sites, demonstrate good faith that the federal
20 government can take possession and begin to
21 dispose of the fuel or make arrangements for
22 disposal of the fuel. So that, conceivably,

1 would contribute to pave the way to nuclear
2 power growth.

3 A third one. If we've heard
4 anything today it's that there's been an
5 erosion of trust and credibility in the
6 process of pursuing Yucca Mountain. And so if
7 the priority really is to regain that
8 credibility and trust and increase confidence
9 in the decision-making process and the
10 decision consensus, then you don't want to
11 necessarily rush ahead with Yucca Mountain.
12 You want to slow down, start over. But at the
13 same time, you want to do something. So in
14 that case, the centralized interim storage is
15 really the way to go. It solves the immediate
16 problem of the federal government making good
17 on the contracts, taking possession of the
18 spent fuel, and, at the same time, doesn't
19 rush us into anything where you don't have a
20 lot of trust and confidence in the decision.

21 You can come at this from a very
22 different perspective. Equally valid is that

1 we're very confident that nuclear energy is
2 going to increase dramatically and become the
3 dominant source of electricity in the country
4 and perhaps the world. In that case, you may
5 really want to start worrying about repository
6 capacity and perhaps uranium resources,
7 although that has less to do with spent fuel
8 management. And of course, if that's the
9 case, really the only way to really reduce the
10 repository capacity requirements is to
11 aggressively pursue advanced fuel cycles.

12 And then, finally, what we call,
13 you know, the priority would be to wait and
14 see. And I'm not sure all the reasons this
15 would come up, but one is simply that if
16 there's a sense that current options are just
17 too uncertain to warrant doing anything now.
18 There is a voice that argues for this and, of
19 course, if that's your priority you want to
20 maintain extended on-site storage.

21 So that's really the gist of the
22 presentation. I can summarize now in a couple

1 of slides what we found. So aggressively
2 pursuing advanced fuel cycles is attractive if
3 constrains on repository capacity or uranium
4 resources are really your top priority. This
5 entails great investment and great
6 uncertainty.

7 Maintaining extended on-site
8 storage is attractive really only if all other
9 options are unacceptable. And I think, in
10 addition to not helping pave the way for
11 nuclear power, it could, in fact, be quite
12 detrimental by deliberately stating our plans
13 to do nothing. I think that could make
14 licensing quite difficult.

15 And then that leaves Yucca
16 Mountain or this two-phase centralized storage
17 with a reopening the site selection process
18 for a new permanent geologic repository. That
19 would facilitate the growth of nuclear power.
20 It would not leave the spent fuel disposal
21 problem for future generations. And really
22 either of them would satisfy those priorities,

1 and the real decision of which to choose
2 depends on how important it is to increase our
3 confidence in the decision-making process.

4 Thank you.

5 CHAIR SCOWCROFT: Thank you very
6 much, Dr. LaTourrette, for your presentation.
7 The third and final presenter is Dr. Audeen
8 Fentiman, Associate Dean of Engineering and
9 Professor of nuclear engineering at Purdue
10 University. Dr. Fentiman chaired a recent
11 study by the American Nuclear Society of
12 options for managing the back end of the fuel
13 cycle. Dr. Fentiman, we appreciate your being
14 with us today.

15 DR. FENTIMAN: Mr. Chairman and
16 Commissioners, thank you very much for the
17 opportunity to present the results of our
18 study. In the spring of 2010, the then
19 President of the American Nuclear Society, Dr.
20 Tom Sanders, formed a special committee to
21 explore options for managing used nuclear fuel
22 and asked me to serve as its chair. The

1 committee's charge was to prepare a report for
2 members of the general public who want to
3 understand the basics of used nuclear fuel and
4 also for policy managers who must choose a
5 path forward.

6 The report will describe currently
7 feasible used fuel management options and
8 explore the advantages and disadvantages of
9 each, including consideration of
10 environmental, economic, and social factors,
11 as well as proliferation risks. It was not
12 the committee's charge, nor its intent, to
13 identify the correct storage treatment or
14 disposal method. Rather, the committee
15 focused on presenting the options and
16 discussing the factors relevant to selecting
17 the methods for storage, treatment, or
18 disposal.

19 Now, clearly, the methods selected
20 will depend, in part, on the number and types
21 of nuclear power plants operating in the
22 United States for the remainder of this

1 century. Committee members did not attempt to
2 predict the mix of the nuclear power plants
3 but, rather, we defined two bounding
4 scenarios.

5 Now, the lower bound is a no-
6 growth scenario in which all existing nuclear
7 power plants operate for 60 years and then
8 shut down with no nuclear power plants being
9 built. The upper bound is a growth scenario
10 in which half of the growth in U.S.
11 electricity met demand between 2010 and 2100
12 is supplied by nuclear power.

13 We will complete our report in
14 January of 2011. However, we have identified
15 our major conclusions, and I'd like to present
16 those today.

17 The first and foremost, the U.S.
18 fuel cycle policy must be guided by stable and
19 long-term program direction. Whether
20 America's nuclear future is the orderly
21 closure of the current nuclear plants or
22 expansion of the nation's nuclear capacity

1 with advanced technologies, a long-term stable
2 nuclear energy policy with clear objectives
3 and milestones is critical. Utilities, used
4 fuel program managers, contractors, and, most
5 importantly, the communities considering
6 hosting any used fuel management facility must
7 have confidence that they can make long-term
8 plans.

9 The ANS and many others support
10 the concept of an independent entity to manage
11 the back end of the fuel cycle. There are
12 some who suggest that perhaps Congress and DOE
13 can find a way to do it themselves. Either
14 way, something needs to change.

15 Second, the committee concluded
16 that a geological repository will be needed
17 under any conceivable scenario. It will be
18 required for reprocessing wastes if the U.S.
19 decides to recycle used fuel and for the used
20 fuel itself if we don't. In addition, it will
21 be needed for the defense waste. The
22 committee agreed that Yucca Mountain, salt

1 formations, and deep boreholes are all
2 feasible options for geologic disposal that
3 pose no technological showstoppers, just
4 different engineering challenges.

5 Third, the committee concluded,
6 rather obviously, that interim storage will be
7 required. We are already storing used fuel at
8 the reactor sites in pools and dry storage
9 casks, and the NRC has recently ruled that it
10 will be safe there for 60 years after the
11 reactor's license expires. The committee felt
12 that if a deep geologic repository is licensed
13 or used fuel reprocessing commences in the
14 next, perhaps, couple of decades, there may be
15 no need for a separate centralized storage
16 facility. But if not, the centralized interim
17 storage will almost certainly be needed, but,
18 again, it should present no technological
19 challenges.

20 Reprocessing may make economic
21 sense at some stage. The decision needs to be
22 made with a long-term perspective that

1 considers the prospects of fast reactor
2 deployment and the possibility of taking back
3 used fuel from other nations.

4 We looked at the two reprocessing
5 options. Option one is limited reprocessing
6 and recycling of used fuel into light water
7 reactors with reprocessing waste permanently
8 disposed of in an underground geologic
9 repository. And option two is full recycling
10 of used nuclear fuel using fast reactors,
11 again with fission products and other waste
12 permanently disposed of underground. The
13 committee felt that, while MOX fuel was of
14 limited use in light water reactors, it's much
15 more valuable in fast reactors where it can be
16 recycled multiple times. Option one should,
17 therefore, be considered as an interim step
18 towards option two, full recycling in fast
19 reactors.

20 It may be worthwhile to develop
21 reprocessing capabilities to develop
22 reprocessing capability and begin building an

1 inventory of MOX fuel while the U.S. reactor
2 fleet consists primarily of light water
3 reactors if it is clear that fast reactors
4 will be coming online in the near future. The
5 United States could also decide to pursue
6 option one if providing used fuel reprocessing
7 services to other countries appears to be a
8 way to avoid nuclear proliferation.

9 Aqueous reprocessing has been used
10 worldwide for decades, and advanced aqueous
11 reprocessing technologies are under
12 development, primarily motivated by the
13 recovery of other minor actinides to reduce
14 the toxicity of the remaining waste and to
15 enhance proliferation resistance.

16 Pyroprocessing is another reprocessing
17 technique that is being investigated for metal
18 fuels and may have some applications for oxide
19 fuel.

20 If and when fast reactors are in
21 place, there will be a strong incentive for
22 full actinide recycling. Used fuel from fast

1 reactors has as much or more fuel value than
2 the fresh fuel put into the reactor, but it
3 must be reprocessed.

4 Since option two requires the use
5 of fast reactors, evaluation of this option
6 must include consideration of capital costs
7 associated with the development of fast
8 reactors. A cradle-to-grave cost/benefit
9 analysis will have to take into account the
10 total impacts of uranium enrichment, fuel
11 fabrication, fuel recycling, reactor
12 construction and operation and waste disposal.

13 Again, I must point out that for
14 both limited and full recycle options, high-
15 level waste will be produced from reprocessing
16 and will require a permanent disposal
17 facility. Numerous studies have been
18 conducted on the impacts of reprocessing on
19 repository performance. In general, as the
20 radiotoxicity of waste are reduced in
21 reprocessing, the potential releases from the
22 repository and impacts on humans and the

1 environment will be reduced.

2 As I was preparing this testimony,
3 one of my colleagues asked me, but what is the
4 big news in this report. My answer was, the
5 big news is that there is no news. For 50
6 years plans for developing nuclear power have
7 included interim storage facilities, deep
8 geologic repositories, and sometimes
9 reprocessing and recycling facilities. This
10 isn't rocket science. The main obstacles to
11 a rational fuel cycle policy are political,
12 financial, social, not necessarily
13 technological. We, therefore, urge the
14 Commission to focus on the management
15 mechanisms needed to create a stable, durable
16 fuel cycle policy, and I'm highly confident
17 that the men and women in the American nuclear
18 community can take care of the rest. Thank
19 you very much.

20 CHAIR SCOWCROFT: Thank you, Dr.
21 Fentiman. Questions? Richard?

22 MEMBER MESERVE: I'd like to thank

1 all of the panelists for their thoughtful
2 presentations. I have a few questions,
3 however, I'd like to direct at Professor
4 Stewart. You made the case, as had the
5 previous panel, I think most of us appreciate
6 the need for state and local collaboration and
7 asset in establishing a repository. And I
8 think that it would not be surprising that
9 it's necessary but perhaps not sufficient, and
10 I think we can look at the example that you
11 didn't have time to discuss but our experience
12 with low-level waste, about its insufficiency.
13 That's a statute that allows or requires the
14 states to find a means to handle the low-level
15 waste, allow them to make agreements among
16 themselves for how to do it. And over the
17 course of 30 years, I think we have
18 established exactly zero low-level waste sites
19 under a situation where the states have
20 control.

21 And I wonder whether you could
22 just spend a minute about why that situation

1 where the states were, in fact, given the
2 responsibility and they still couldn't
3 proceed. It seems a little bit inconsistent
4 with the assertion that assent will help to
5 solve the problem. It may be necessary, but
6 it may not be sufficient. And then I have
7 another question when you finish that.

8 DR. STEWART: All right. Thank
9 you. There has to be strong federal
10 leadership. That was the recommendation of
11 the interagency review group on low-level
12 waste that the federal government really had
13 to take a major lead in promoting the siting,
14 and I think they envisaged, you know, federal
15 financial support for hosts, which certainly
16 came out of the negotiation with New Mexico.
17 The facility itself may provide enough local
18 benefits for a community, but in our federal
19 system, unlike in Finland or Sweden, the
20 states are a key part of our governance
21 system, and you have to provide sufficient
22 incentives for them, which I think include not

1 just money but maybe research institutions,
2 infrastructure, and so forth.

3 The problem with the Low-Level
4 Waste Radioactive Policy Act was it left it to
5 these compacts. The compact commissions were
6 supposed to do the siting when there was no
7 agreement. They were very weak. They're
8 part-time employees put together. They had no
9 financial resources, and the thing collapsed.
10 We do actually have, though, a new facility.
11 It's up and running or will be soon in Texas,
12 but that's not in the compact framework.
13 Texas sort of has a gerrymandered compact with
14 Vermont. They want it, and they're hoping to
15 get a lot of market benefit out of it.

16 But we can't just leave it to
17 states and localities. The federal government
18 has got to take a lead.

19 MEMBER MESERVE: My second
20 question is directed at an item you also
21 didn't have a chance to cover. As you know,
22 under the Nuclear Waste Policy Act, there's a

1 fractured regulatory system where the
2 standards are established by EPA and the
3 licensing is done by the Nuclear Regulatory
4 Commission. And I wonder if you have any
5 views about the regulatory side of the issue
6 as we go forward, whether the notion of
7 divided regulatory responsibility is
8 appropriate as something we should continue or
9 whether it should be a single regulatory. You
10 may have thought more deeply about what the
11 various issues are about the regulatory side
12 of the question.

13 DR. STEWART: You know, I'm of two
14 minds on that question. I put my professor
15 hat on and I say it doesn't make sense to
16 have, you know, two regulators, the NRC and
17 EPA both regulating. I can say, wow, we don't
18 maybe trust the NRC, we need another
19 regulatory. That way lies, you know, an
20 infinite number of regulators since who's
21 going to watch over the next one?

22 On the other hand, I guess my more

1 pragmatic side says this is now sort of an
2 accepted part of the process. It seems to
3 work not terrifically but reasonably well. So
4 I think the notion of trust that's been spoken
5 of here suggests that, despite my, say,
6 academic misgivings or more than academic,
7 that probably we ought to go forward with the
8 system we have. I don't think it's so broken
9 that we should give it up.

10 CHAIR SCOWCROFT: Per?

11 MEMBER PETERSON: I have a
12 question for the panel members that arises out
13 of some of the information that comes from the
14 RAND study. Dr. LaTourrette, you had pointed
15 out that the impacts of advanced fuel cycles
16 can sometimes be a bit counterintuitive. That
17 is, the improvement for long-term performance
18 of a repository is a more complex type of
19 question than simplistically reducing the
20 inventory of radioactive material. You noted,
21 for example, that reducing the amount of
22 transuranics may have a fairly modest effect.

1 However, a benefit of reprocessing may be the
2 capability to immobilize fission products in
3 a form which is more intrinsically stable in
4 a repository environment. Likewise, we do
5 have this question about repository capacity
6 and whether it would be sufficient. And this
7 is really, I would say, a pretty complex
8 optimization problem to try to figure out what
9 types of technologies should be developed and
10 commercialized and deployed.

11 There's basically two ways, I
12 guess, of trying to achieve these goals. One
13 is to have the government, I guess, pick the
14 correct technologies. The other would be to
15 try to put in place some type of market
16 incentives such as moving from charging a
17 Waste Fund fee that's based on electricity
18 generation maybe to something that would be
19 more directly related to the cost and
20 difficulty of waste disposal.

21 So I'd be interested in thoughts
22 about whether a more market-based approach to

1 try to drive the behavior of waste generators
2 versus a command-and-control approach, which
3 might be more effective and desirable.

4 DR. LATOURRETTE: Well, I wish my
5 economist colleague was here. I'm not
6 certain, but I think that the answer to the
7 last part of your question, if we're worried
8 about paying for a repository we ought to
9 charge by the cubic, you know, volume, not by
10 electricity, not by the kilowatt. That would
11 create an incentive if there was a market for
12 reducing the volume of waste or the mass or
13 the volume of the repository. But I think
14 before you get to those kind of arguments,
15 there's an important question of just deciding
16 why do you want to do advanced fuel cycles.
17 There needs to be a policy check here, and I
18 think there are a little bit of a mismatch.
19 I don't think it's particularly new, but I
20 think we start hearing more and more often
21 that we want to design an advanced fuel cycle
22 around the spent fuel optimization. I'm not

1 sure it ever started that way, but I think
2 that question has always been in there. But
3 it's certainly not the only question. It's a
4 complicated thing because it interacts the
5 entire front, middle, and back of the fuel
6 cycle.

7 So I think the first thing you
8 need to do is decide why are we doing an
9 advanced fuel cycle, what do we want to get
10 out of it, and then you can decide on an
11 incentive structure. I'm not at all opposed
12 to market-driven. That makes sense but not
13 until you kind of decide what you want it to
14 do.

15 CHAIR SCOWCROFT: Allison?

16 MEMBER MACFARLANE: Great. My
17 question is for Professor Stewart. I was very
18 interested in your suggestion that we needed
19 two new institutions, not one. And it's an
20 issue that I brought up and I don't have an
21 opinion on, a strong one anyway. I have
22 opinions on everything. Poor Jonathan. But

1 I'm curious about this and I want you to
2 explore it a little more because I don't think
3 there are any other countries with the
4 relatively advanced siting programs that have
5 two institutions. They all seem to just have
6 one, and I wonder why you suggest two. Is
7 there something unique to the United States
8 where two is necessary?

9 DR. STEWART: Well, what's
10 different about the United States? Well, in
11 part is our federal system. France, Sweden,
12 Finland --

13 MEMBER MACFARLANE: Canada?

14 DR. STEWART: Canada is still, you
15 know, remains to be seen. We're at a very
16 early stage of their planning, and they do
17 have what we call stakeholder representation
18 in their NWMO entity. And, you know, I think,
19 given the sort of complicated politics in this
20 country, that the sort of what you need to
21 manage the waste is a long-term business type
22 strategy with adequate assured financing,

1 long-term capital planning. That's one sort
2 of an enterprise. And a process of discussion
3 with many different hosts working through
4 exchange of information, that's a different
5 sort.

6 And I think in the DOE thing,
7 besides all the overlay of the budget and
8 political process, those have been at war.
9 We've got to find a way to bury this waste and
10 we're going to move forward with it and, you
11 know, that has undermined the sensitivity, I
12 think, to the concerns of hosts and
13 localities. And, actually, the WIPP story was
14 the story over 30 years. It sort of was
15 serendipitous. There was no plan. DOE would
16 have just as soon, yes, all right, we're going
17 to dig it and bury it, but the state fought
18 back with litigation, through its
19 congressional delegation and all sorts of ways
20 and really forced the government to sort of
21 come to the bargaining table. My own instinct
22 is that a more broad-based organization like

1 an independent commission would be well suited
2 for our particular circumstances.

3 MEMBER MACFARLANE: And who
4 decides who the commission members are?

5 DR. STEWART: These would be
6 appointed by the President and --

7 MEMBER MACFARLANE: So then it's -
8 -

9 DR. STEWART: -- confirmed by the
10 Senate, like any other independent commission.

11 CHAIR SCOWCROFT: Phil?

12 MEMBER SHARP: Yes, I want to go
13 back to sort of the issue trying to get at
14 this issue of the history of what caused
15 failure. There are obviously multiple things,
16 and we're speaking as if we can get the
17 institution and the strategy right we'll get
18 a result, and I'm a little more deeply
19 suspicious that we've learned a lot. But that
20 doesn't guarantee anything. It's the
21 leadership at the time and the individuals
22 involved and the political nature that's going

1 on that has a great deal of influence here.

2 And so I just want to suggest that
3 we be careful that we don't fight the last
4 war. Generals were always accused of making
5 the mistake of fighting the last war and only
6 to discover the new war is different kind of
7 proposition. So I guess I believe these
8 lessons are important.

9 One that I would like for the
10 staff, I think could be really important in
11 our report, to do is to identify all of the
12 techniques over the last 25 years that we have
13 developed and utilized in the state of
14 Washington, South Carolina, Idaho, Nevada, and
15 New Mexico to allow for participation. And
16 they're different. Some of them are imposed
17 by courts, some were imposed by federal-state
18 agreements, some were imposed by federal law.
19 But they involve how different groups can
20 function, how they get funded on either
21 technical information development or even
22 participation. Even things like paying in

1 lieu of taxes, how much is Nevada winning or
2 losing at the local levels as this decision
3 changes. If we could, I think this would be
4 valuable. So how many earmarks went into the
5 20-year WIPP thing that actually paid off.
6 And we never had a grand deal, as I understand
7 it, in WIPP, but we had multiple ways because
8 of the skill of the representation in
9 Washington of making that work.

10 And I think it would be useful
11 because some of those techniques we've
12 actually learned a lot, and they're very well
13 in helping DOE. I'm not defending that we
14 keep DOE in charge. So we shouldn't lose that
15 kind of proposition.

16 One of the advantages I see that
17 hasn't been articulated of a presidentially-
18 appointed commission to do siting in this
19 particular case is it would be genuinely high
20 level. One of the things that is that the
21 governors and others are talking about is who
22 are we dealing with? If we're dealing with

1 three and four tiers down in the Department of
2 Energy and a secretary who's got 20 minutes to
3 spend on this because he's spending all the
4 time before 40 committees of Congress
5 testifying on everything under the sun, it
6 means you can't develop the kind of consistent
7 focus and relationship. And so it seems to me
8 that's one value that we ought to be focused
9 on is giving them a clear and singular focus,
10 but they've got to be high level enough that
11 when you're dealing with them you know you're
12 dealing with somebody who can make a decision.

13 I didn't mean to make a speech,
14 but I got inspired. So let me ask you if you
15 make the statement in your preface I read,
16 which, by the way, I think the manuscript, all
17 I've read so far is the preface but you've
18 shared them with us, is really powerful in
19 bringing stuff together. The other report is
20 very helpful, too, and so I'm looking forward
21 to reading the rest of it because it gets it
22 in one place that lesser beings have a chance

1 to understand.

2 But what I didn't know is whether
3 you went back and examined with, you make the
4 case, as is often made, about Yucca Mountain
5 as a failure that the implacable, you didn't
6 use the word implacable but opposition is like
7 it's going to go on as long as nuclear waste
8 goes on. But I guess I want to challenge that
9 just a little bit, and I don't know if anybody
10 has gone in the sampled opinion and whatnot.
11 But is there a reason for us to expect that
12 that opposition will sustain itself over the
13 next decade? The reason I say that is we have
14 people testifying here at various times from
15 the local and county communities and saying,
16 hey, we've come to accommodate this. Now that
17 we understand the game, now that we understand
18 the economics and things like this, we can
19 live with this. That hasn't been the position
20 of state government or the Majority Leader of
21 the Senate, but my point being that maybe
22 we're just on the cusp and this political

1 situation may be changing at a time that they
2 decided. This is not the function of this
3 Commission, and I'm not trying to take a
4 position, but I'm just curious whether you
5 actually updated the politics there or not.

6 DR. STEWART: On lessons from the
7 past and being careful, as I mentioned we have
8 a very small sample. But I guess my belief is
9 that this notion of host jurisdictions, local
10 and state, meaningful engagement, and assent
11 is a necessary but not sufficient condition.
12 And Congress in the Waste Policy Act did put
13 some provisions for independent technical
14 review of funding the state, some sort of
15 engagement by the state. But looming was the
16 sense it's all a fait accompli.

17 Now, where the politics are in
18 Nevada, where they might be going, I have no
19 special insight. I think things could
20 conceivably change if it's a more open game.
21 At least I think there might be some chance.
22 There are certain localities that see a

1 benefit here. But what we see from public
2 surveys is that the localities, particularly
3 if there's already some sort of nuclear
4 facility, a reactor or DOE site, tend to see
5 the risks as much lower than the general
6 population and, of course, they're familiar
7 with it and they also get some economic
8 benefit. You move 50 miles away and further
9 and suddenly the risks are higher than the
10 average public perceives it, and that
11 translates in the WIPP case that reaction in
12 Albuquerque and Santa Fe and certainly in Las
13 Vegas. So whether that will ever be overcome,
14 I don't know.

15 CHAIR SCOWCROFT: Jonathan?

16 MEMBER LASH: Thank you.

17 Commissioner Meserve, as a former Vermont
18 environmental regulator who discovered, to my
19 horror, that I was also responsible for
20 managing low-level radioactive waste from
21 Vermont Yankee, I have to say I thought it was
22 exceptionally clever of a little state whose

1 value proposition is clean and green to cut a
2 deal with Texas. We could all learn.

3 I do want to follow up on
4 Commissioner Meserve's question about
5 regulation. Professor Stewart, you answered,
6 well, being pragmatic, the current system
7 probably makes sense and seems to work. But
8 I want to ask about two other aspects of
9 regulation. First, siting criteria. Should
10 Congress establish the criteria, or should
11 there also be an agency that is responsible
12 for setting site screening criteria? And
13 should there be site screening considerations,
14 or should there be some absolute hurdles?
15 That's one.

16 Second, you, I think, endorsed the
17 idea of the application of conventional
18 environmental regulations as in the case of
19 WIPP, and at that Vermont Yankee plant we had
20 to issue a waste order permit every five
21 years. It wasn't actually even that big of a
22 deal, but it helped establish the

1 relationship. Tell us a little bit more about
2 how that would work, how you can have states
3 applying RCRA and the Clean Air Act and the
4 Clean Water Act at the same time as EPA and
5 NRC are regulating and licensing facilities.

6 DR. STEWART: Well, I'm sorry,
7 your first question? I was so attentive to
8 your second I forgot --

9 MEMBER LASH: The first one was
10 about siting criteria.

11 DR. STEWART: Oh, siting criteria.
12 Yes. Well, I think that Congress, obviously,
13 it's going to have to meet the environmental
14 technical requirements. I mean, that's
15 obviously fundamental. And beyond that, I
16 think some general criteria about, you know,
17 transportation, population, et cetera, but at
18 a very general level, and I think it has to be
19 left to whatever entity is going to manage
20 that process.

21 And on the second one, well, we
22 have as part of our, we do have the experience

1 of WIPP that really gave the state the
2 confidence that it had effective control about
3 what was going in there and was going to be
4 assured it could raise its concerns with not
5 only DOE but they could take them to EPA,
6 which had to certify the facility. And the
7 Defense Department works under this regime, so
8 why should there be something special here?
9 And state requirements can be more rigorous
10 than the federal requirements. That's a
11 familiar part of our federal system. It may
12 give the state an effective veto, but that may
13 be the price of getting the confidence over
14 the long-term safety and appropriateness of
15 this facility.

16 Now, maybe that's a total block
17 and you have to come back to force majeure,
18 but I don't think that's worked so far. So
19 I'm prepared to go with the limited experience
20 we have at WIPP.

21 MEMBER LASH: Which statute turned
22 out to be the most important? Was it --

1 DR. STEWART: The RCRA statute
2 because a lot of the waste, the TRU that was
3 going into WIPP was mixed waste and,
4 therefore, within the RCRA authority of the
5 state.

6 MEMBER PETERSON: Actually, my
7 question is very closely related to the one
8 that Jonathan just posed because the question
9 of the regulatory authority that the state has
10 for activities that are required for operation
11 of facilities is clearly an important one.
12 I'd be curious, you mentioned that these
13 regulatory, the regulatory authority the state
14 has, actually, in some sense, constitutes an
15 effective veto capability. That is, those
16 regulations can be used to essentially
17 immobilize a project, if needed.

18 This raises two questions. The
19 first is is there any wisdom to having federal
20 statute preempt state regulatory authority or
21 is that counterproductive? And then the
22 second would be since state regulation

1 actually does constitute something that looks
2 like a veto, might it be a sufficient veto?
3 That is, a local community that can get all of
4 the necessary, you know, can arrange and get
5 all the necessary permits, as with any other
6 facility, is that essentially a sufficient
7 mechanism for the state to exercise some
8 control over the process to assure that it
9 meets the needs of the state? Does that make
10 sense?

11 DR. STEWART: Well, on the first
12 one, I would point out, you know, that the
13 Atomic Energy Act has been interpreted, at
14 least consistently by the courts, not
15 explicit, to preempt state regulation of
16 radiological hazards. So the Federal Facility
17 Compliance Act is really going to go to air,
18 water, hazardous waste --

19 MEMBER PETERSON: Right. But all
20 of these facilities require additional state
21 permit.

22 DR. STEWART: Yes, exactly.

1 MEMBER PETERSON: Everything from
2 the emergency diesel generators down to --

3 DR. STEWART: Water permits --

4 MEMBER PETERSON: -- water --

5 DR. STEWART: Yes, absolutely.

6 But I wasn't clear on your second question.

7 MEMBER PETERSON: The second
8 question I guess is, since the state does have
9 control over permits, and I guess legislatures
10 can actually pass legislation saying that
11 issuing this permit would not be in the
12 interest of the state.

13 DR. STEWART: Well, it would have
14 to be non-discriminatory. It can't
15 discriminate against . . .

16 MEMBER PETERSON: Okay. Would
17 that be a sufficient effective veto, or does
18 one need something that's more explicit?

19 DR. STEWART: Well, it would
20 depend on the situation. I mean, maybe it
21 would just take the mixed waste. I mean, some
22 waste forms might not be classified as, some

1 radioactive waste forms might not be vitrified
2 high-level waste. That would be a technical
3 issue. So, yes, you might need and maybe you
4 would want to say, if you're going to go down
5 this road a little further, say the state has
6 to assent to the facility.

7 CHAIR SCOWCROFT: Any questions?

8 Yes?

9 MEMBER CARNESALE: On the RAND
10 study, as I look at the conclusion in here
11 that, you know, it depends on society's
12 objectives is what it is, and when I look at
13 the ones you identify, solve the spent fuel
14 disposal problem quickly, that's one of the
15 objectives. All right. They've got multiple,
16 but that's one. People are really eager to do
17 that. Pave the way for nuclear power growth,
18 that's another one. A lot of people want to
19 do that, especially now in light of climate
20 change. So the first one has you
21 expeditiously proceed with Yucca Mountain, but
22 politics, for the moment, say that's an

1 interesting proposition however, dot dot dot.

2 Pave the way for nuclear power
3 growth leads you to both decentralize interim
4 storage but also extend on-site storage.
5 Nobody is talking about taking all of the fuel
6 from the reactor sites and moving it to
7 centralized storage, right?

8 So with that objective, you need
9 on-site storage at reactor sites and you
10 probably need some centralized storage if for
11 no other reason other than the plants that are
12 going to be deactivated or are deactivated.
13 Increase competence in repository performance
14 and decision consensus. Well, certainly after
15 Yucca Mountain people are going to insist upon
16 that. Decreasing the demand for repository
17 capacity, probably Yucca Mountain wasn't there
18 was too much stuff. It was we don't want any.

19 So the only one, as I read these,
20 everything of the three strategies you
21 recommend, there's a strong push for each of
22 them except for advanced fuel cycle. There's

1 nobody -- I mean, I wouldn't say nobody. The
2 industry cares. Analysts care about the
3 demand for repository capacity, but our
4 problem in the near term is that the capacity
5 is zero.

6 So I know you guys didn't make a
7 recommendation, but what were reactions to
8 what you did have to say in the end to these -
9 -

10 DR. LATOURRETTE: Well, we haven't
11 talked about this much. I mean, the report is
12 just out, so I'm getting them now. I think
13 you're right. Of all the difficulties about
14 spent nuclear management, maybe the one thing
15 that has never come up is the amount of spent
16 fuel. Nobody has ever said if we'd only had
17 a tenth of the amount, gosh, all of our
18 problems would be solved. A lot of countries
19 have only a tenth or less than what we have,
20 and that has not proved to make their life any
21 easier.

22 So in that respect, from a purely

1 waste management perspective, maybe there's
2 not a convincing case. But, you know,
3 advanced fuel cycles are complicated. They
4 differ from these other approaches because
5 they affect much more than waste management.

6 MEMBER CARNESALE: No, I was only
7 talking about your study. I agree. There are
8 other that has to do with conservation of
9 resources, a whole bunch of other arguments
10 for advanced fuel cycles. But it sounds like
11 from what you did that's the one where there
12 is no pressure other than --

13 DR. LATOURRETTE: Well, I don't
14 know. I mean, there are a lot of, I think
15 there are a lot of people who are convinced
16 that nuclear power is going to grow
17 dramatically that we really do have to worry
18 about siting. Maybe not volume in the sort of
19 space on the Earth sense, but capacity in the
20 sense that we can't go through this siting
21 process every six weeks.

22 MEMBER CARNESALE: No, just have

1 the least pressure. I don't mean the least,
2 it's not the same as the least important.

3 MEMBER PETERSON: Could I do just
4 a quick follow-on to that? Actually, in
5 contrast to what Al said, are there any cases
6 where we've developed a waste disposal
7 facility where we haven't placed societal
8 capacity limits? Yucca Mountain has a 70,000
9 cap. WIPP has a cap. In the end, are there
10 any cases where communities and states have
11 been willing to sign on to an infinite amount
12 of stuff that might be disposed in a facility?

13 MEMBER MACFARLANE: Per, the Yucca
14 Mountain capacity limit was to force a second
15 repository.

16 MEMBER PETERSON: It was societal
17 demanded. I'm just wondering if there's any -
18 -

19 MEMBER CARNESALE: Per, that's the
20 opposite of what I'm saying. I'm saying if
21 you suddenly said you only have to take
22 10,000. Oh, well, send it here, right?

1 That's my point, not that it's infinite.

2 DR. LATOURRETTE: I don't know the
3 answer to your question, whether there's any
4 repository with no limit. Maybe Richard? I
5 doubt it.

6 DR. STEWART: No. And even I'm
7 not sure about some of the low-level waste
8 facilities, but the Nuclear Regulatory
9 Commission is considering this down-blending
10 issue where B and C waste would be mixed with
11 A waste, and that would be shipped to the
12 facility in Utah. And Utah is now unhappy
13 because they want to keep the capacity for the
14 future, and they don't want it to be used up
15 and they don't want to be, there's a limit to
16 how much of the dumping ground.

17 CHAIR SCOWCROFT: Dr. Fentiman,
18 you've escaped relatively unscathed. Is there
19 any last comments you'd like to make?

20 DR. FENTIMAN: I think the key
21 point that we want to make is that there needs
22 to be a stable long-term policy and a group

1 managing that policy. No one is going to make
2 decisions about how much or where things are
3 going to go until they're sure that there's a
4 long-term policy that they can count on.

5 CHAIR SCOWCROFT: Thank you very
6 much, all of you, for a very valuable
7 contribution to our understanding. We
8 appreciate you being with us very much. That
9 concludes our meeting today. We will convene
10 again tomorrow morning at 8:30. Thank you
11 very much.

12 (Whereupon, the foregoing matter
13 was concluded at 4:07 p.m.)
14
15
16
17
18
19
20
21
22

A				
abandon 30:1	accepted 101:9 126:5 282:2	action 47:4 65:11 100:2 104:12 106:14	addressed 111:18 179:4 197:7 228:13 248:11	132:10 advisory 96:20 98:11
abandoned 151:21	access 25:20 222:9	actions 13:4 22:10 232:19	adds 36:4	advocates 185:18 221:15,16 225:5
ability 6:10 118:20 198:10 213:2 217:14	accessed 97:21	activate 155:8	adequate 15:22 58:14 286:22	affect 91:3 304:5
able 33:1,5 40:17 43:2 73:12 86:9 88:4 124:3,17 141:3 180:19 223:20 224:17 230:10 254:19 256:14 261:22	accident 47:8,12 86:1 134:22	active 20:15 49:10	adhered 195:16	affiliation 164:5
Aboriginal 99:16 99:19 101:3 103:7 103:8,15 107:22 110:12 117:11	accidents 77:8,21	actively 49:5 104:19	adherence 104:12	afford 244:11
abroad 26:19 145:20 148:10	accommodate 7:6 292:16	activities 11:1 15:16 16:3,5 19:13 20:19 21:17 21:20 28:2,12 36:15 38:3 39:14 49:9 83:11,13 95:21 96:3 99:15 120:14 228:5 233:9 298:10	adjourned 157:10	afoot 221:8
absolute 239:11 295:14	accompli 247:17 293:16	activity 17:16 19:5 19:19 21:11 23:13 24:9,10 28:12 36:19 43:6 51:3,4 51:5 132:13 147:7 148:15,21	administer 77:14	afternoon 4:22 5:6 157:8 158:11 209:10
absolutely 68:9 115:11 121:21 138:20 154:11 170:7 185:14 189:5 205:15 236:2 239:20 300:5	accomplish 239:15	acts 50:10 215:1 260:19	administration 191:1 192:5 199:1 229:4 241:22 245:3 249:4	age 35:10
academic 122:12 282:6,6	account 48:20 73:16 74:7 83:21 86:14 235:7 241:15 258:10 276:9	actual 121:9 249:7	administrative 241:8	aged 13:9
academician 131:14	accountable 192:17 192:20	actuality 239:14	Admiral 165:12,13 241:22	agencies 176:21 178:21 196:11
Academy 131:14	accounts 133:10	adaptable 100:6	admirer 186:17	agency 2:5 49:18 53:15 123:14 126:2 133:8 144:10 150:18 151:5 177:11,19 188:11,17 189:8 190:6 191:14,21 206:7,10 218:16 218:19 219:17 239:6 295:11
accelerate 139:17	accumulated 244:12	adapted 102:17	admit 168:9	agenda 3:2 251:2
accept 22:6 42:14 85:18 98:20 126:20	accused 289:4	adaptive 100:10 103:2 118:13	adopt 163:4 232:1	aggressively 262:7 267:11 268:1
acceptability 96:10 105:7	achieve 57:20 65:6 79:2 103:5 121:1 181:2 283:12	add 31:1 59:6 134:9 142:19 184:17 193:20 205:6	adopted 9:1	ago 46:7 50:13 59:10 89:20 139:10 148:11 152:22 153:15,17 167:20 173:15 194:15 197:3 202:15 228:13 231:3 234:15 244:14 264:21,21
acceptable 63:7 126:16,18 169:2 256:21,22	ACL's 96:5	addendum 86:7 241:19	adoption 143:20	agree 166:4 198:2 209:7 218:4 237:20 304:7
acceptance 62:22 82:4,4 111:21 127:10 161:9 180:21 182:4 256:12 257:18	act 50:13,14 51:21 55:11 96:13,15,17 96:19 97:2,8,16 98:5 110:1 115:21 120:4 126:6 130:11 195:13 208:11 242:5 243:10 244:7 245:2,20 246:12 247:12,13 248:8 250:3 252:9 280:4 280:22 293:12 296:3,4 299:13,17	addition 134:11 152:15 205:17 268:10 272:20	advanced 14:11 15:6 17:16 37:8 37:21 163:10 217:13 236:13 255:20,21 257:19 259:17 262:7,14 262:15 267:11 268:2 272:1 275:10 282:15 284:16,21 285:9 286:4 302:22 304:3,10	agreed 148:2 272:22
	actinide 275:22	additional 31:2 222:16 242:22 299:20	advantage 57:10 58:12 92:3 100:4 105:2 117:17,20	agreed-upon 217:7
	actinides 24:5,5 60:2 88:21 137:7 141:14 199:9 259:3,9,10 275:13	address 9:21 99:5 168:4 176:5 195:22	advantages 47:21 56:7 58:11 75:21 76:1 88:8,17 89:14 135:19 270:8 290:16	agreement 84:19 110:20 139:20 147:5,10,12

148:18 166:6,7 169:6 187:16,18 188:2 194:13 280:7 agreements 154:5 187:6,22 191:3 278:15 289:18 ahead 4:4 30:18 67:1 193:22 266:11 aim 14:15 aiming 12:11 air 296:3 299:17 aircraft 165:17 aired 248:15 AI 29:2 72:16,17 89:19 126:10 232:2 233:17 305:5 ALBERT 1:17 Albuquerque 294:12 aligned 100:19 allegedly 219:15 Allison 1:18 29:3 34:20 36:21 66:16 106:18 114:13,14 219:22 232:2 285:15 allocated 28:1 allotted 8:2 allow 20:5 24:13 100:7 210:9 213:17 246:22 278:15 289:15 allowed 220:12,20 allows 256:5 278:13 alluded 189:12 Alpha 56:16 alteration 80:1 alternative 98:17 102:14 alternatives 99:4 Al's 35:3 Ambassador 158:18	amend 208:10 amendments 242:5 243:12 America 163:5 165:16,20 166:3 175:2 212:9,21 225:16 236:18 American 3:22 138:14 148:1 215:5 269:11,19 277:17 Americans 154:12 172:4 American-built 149:5 America's 1:1 4:8 10:6 176:7 271:20 amount 8:2 14:21 26:10 27:3 31:20 52:16 53:15 59:14 70:12,13 122:19 123:6 133:18 219:7 259:5 282:21 303:15,17 305:11 ample 9:5 analogy 226:7 227:11,22 analysis 19:2,19 27:19 142:21 254:3 276:9 Analysts 303:2 analyzed 202:7 ancillary 258:11 Andra 45:4 53:7 74:6,9 78:11 80:13,20 81:1 83:10,17 86:6,7 123:13 144:10 Andrus 2:16 3:15 159:2,3 162:20 172:11 180:4,11 186:9 188:8 194:8 198:1 205:5 218:4 219:5 230:21 239:8 anger 217:4	angst 216:12 217:4 218:3 announced 19:1 announcement 36:6,6 annual 17:4 35:8 97:9,20 annually 11:11 16:7 102:2 ANS 272:9 answer 30:9,9 46:1 46:3,8 63:19 64:10 68:11 107:18 145:13 151:17 175:15 183:12 217:18 223:18 230:15 232:3 277:4 284:6 306:3 answered 82:5 295:5 answering 215:16 answers 63:18 109:20 161:12 210:1 anticipate 73:2 74:14 anybody 170:22 191:9 207:5 234:15 292:9 anybody's 190:6 anymore 33:19 anyway 38:15 67:1 151:17 165:8 185:21 219:7 262:11 285:21 Aomori 15:2 apart 225:13 apologize 66:21 170:5 217:11 apparently 138:18 149:4 appealed 166:18 appear 107:7 126:11 257:7 appeared 126:14 appearing 161:2	appears 106:20 119:4 275:7 application 21:15 22:13 55:16 295:17 applications 43:2 275:18 applied 21:16 65:6 80:19 129:2 apply 21:12 43:12 57:1,2 74:8 77:8 99:11 applying 296:3 appoint 96:20 appointed 124:16 126:3 230:5 288:6 290:18 appointment 230:1 230:12 appointments 230:1 appoints 227:8,9 appreciate 6:12 7:13 158:16 176:2 208:20 239:9 240:5 269:13 278:5 307:8 appreciated 6:12 approach 32:7 33:20 43:13 57:7 64:4 65:5 97:6,8 100:6,11 122:16 146:6 242:16 243:9,11 244:19 245:10 251:6 262:3 283:22 284:2 approached 177:19 approaches 8:18 244:8 253:12 254:16 304:4 appropriate 26:21 107:7 219:20 281:8 appropriately 192:3 appropriateness	297:14 appropriation 218:20 219:9 approval 112:13 approve 47:22 180:7 approved 100:13 116:8 134:9 aqueous 211:18 224:16 275:9,10 aquifer 166:3 Arab 84:18 85:9 Arctic 148:13 area 40:9 43:16 47:13 55:8 81:11 81:11,12,15,16 107:8 109:1 110:12 163:11 168:8 178:7 areas 40:7,9 42:22 43:4,6 94:1 107:6 108:14 115:1 148:14 161:18 167:15 AREVA 45:3,4 54:11 65:11 Argentina 147:18 argillite 55:3 argue 89:16 argued 242:2 argues 267:18 argument 75:18 77:19,19,20 arguments 284:14 304:9 arises 282:12 Armed 204:6 arrange 299:4 arrangements 5:22 246:17 265:21 arrive 76:21 arrived 95:2 articulate 209:6,8 articulated 88:19 205:10 208:18 209:12 290:17 ascertain 117:2
--	--	--	--	---

aside 204:21 213:9	269:8	Audeen 2:22 3:23	back 3:5,7,9,12,22	61:10 110:13
asked 5:13 6:22 9:3	associated 89:9	269:7	5:15 8:13,18	135:3 142:10
20:18 21:18 23:2	134:21 135:17	audience 7:20	10:15,20 11:1	161:19 177:18
23:6 33:14 43:8	151:21 211:19	audit 228:9	14:3 26:16 45:16	202:2 217:20
43:11 47:19 64:1	276:7	authorities 110:19	54:13 60:17 61:18	283:17
75:3 77:10 113:2	association 103:9	198:8,16,21 199:3	64:20 65:17 86:22	bash 162:8
153:2 160:14	198:22	207:1	88:16,22 89:22	basic 64:14 65:2
167:16 168:16	assume 112:13	authority 122:19	128:8 130:8	76:5 78:12
189:11 196:16	150:13 213:13	123:3,7 167:11	150:16 155:19	basically 46:8 52:8
197:9 204:5,9	assumed 244:9	198:12 207:8,18	158:5,16 163:14	53:17 54:1 60:13
221:4 240:16	assuming 32:15	247:10,11 298:4,9	166:19 168:13	61:11 63:2 67:5,7
241:2 263:13	110:17 111:22	298:13,20	182:10 188:22	67:8 68:21 74:16
269:22 277:3	112:13 180:9	authorization 54:8	192:10 197:10	78:22 79:6,13
asking 114:13	assumption 11:13	218:21	204:8,10 205:21	80:18 83:1,8 91:5
125:16 188:5	26:9	authorize 219:20	207:10 217:3	214:9 217:1
226:6	assurance 12:16	authorized 21:10	218:14 220:2	224:15 283:11
asks 118:21	13:13 108:5	54:9 109:12	225:18 238:22	basics 270:3
aspect 36:12 62:2	129:16 130:9,10	198:11 224:3	269:12 272:11	basis 20:20 103:20
79:21 189:6	assurances 130:15	autobiographical	274:2 285:5	145:14 179:7,14
aspects 30:4 50:3	248:2	241:19	287:18 288:13	179:18 181:10
52:7 60:10 61:10	assure 14:21 27:9	availability 25:12	292:3 297:17	184:11 206:4
73:12 79:2 83:10	102:1 232:8 299:8	25:19 26:21	background	220:19
86:19 97:17 99:5	assured 249:13	available 7:22 12:4	160:10 182:1	bat 125:17
206:18 240:15	286:22 297:4	32:6 94:13 116:16	184:7	bathroom 163:16
295:8	assuring 13:15	128:2 200:16	backlog 250:17	bathtub 163:18
assembly 71:6,9,9	15:13	211:15	261:14	battle 189:3
assent 244:4,11	ASTRID 58:4	average 13:7 90:9	backyard 200:12	battleships 165:17
247:4,9 279:4	astute 188:13	150:11 294:10	200:13 204:20	bear 221:20
293:10 301:6	atmosphere 237:16	avoid 65:1 275:8	bad 48:7 91:13	beat 7:11
assertion 279:4	atomic 2:4 9:10	awaiting 119:20	211:22	beaten 228:4
assess 121:5	10:18 95:16	aware 112:21 114:8	badly 231:22	beautiful 69:4
assessed 115:18	145:19 164:17	123:6 255:9	BAILEY 1:16	befriended 197:18
assessing 116:10	299:13	awareness 104:20	39:22 41:1,11	beg 166:14
assessment 96:1	Atomique 83:3	away-from-react...	42:19 208:2	began 59:9 173:9
125:21 132:7	ATR 14:7	17:9	Bailey's 218:14	beginning 16:11
assessments 25:18	attain 12:13	awful 239:18	balance 35:20 39:7	47:17 58:6 73:10
99:8	attempt 271:1	awfully 230:22	balances 98:15	79:3 106:4 135:21
asset 108:17 201:15	attempting 158:22	231:1	bargaining 287:21	152:10 215:9
203:12 212:20	attention 25:1 32:2	AYERS 1:15	barrels 185:6	242:9 250:4
236:9 278:7	40:21 41:6,9	a-ha 174:16	barrier 69:22	behalf 103:1 108:6
assets 52:12 84:3,8	attentive 296:7	a.m 1:9 4:2 8:1,1	barriers 257:14	253:5
assigned 95:17	Attorney 241:20	93:4,5	base 57:20 81:13	behave 190:19
assignment 129:12	attractive 154:4		249:1,1	behavior 187:21
assistance 94:12	188:16 206:6,9	B	based 15:17 16:4	284:1
117:5	268:2,8	B 1:10 12:2 13:8	16:15 19:2,15,18	beings 291:22
Assistant 241:19	attractiveness	248:9 306:10	20:6,17 21:17	belief 293:8
associate 215:20	62:10	Babbitt 172:10	27:19 30:3 53:2	believe 27:8 82:14

88:6 90:16 99:10 100:18 111:14 125:5 128:11 167:16 168:17 178:12 182:5 187:18 218:18 224:20 289:7 believes 24:16 beneath 166:1 benefit 11:21 12:19 34:8,8,18 102:12 258:20 280:15 283:1 294:1,8 benefits 34:9 247:22 279:18 benefitted 264:5 benevolent 168:15 188:10 205:8 207:22 Berra 160:18 best 77:18,19 100:4 100:11 124:3 126:15 209:5 210:14 bet 165:10 226:18 252:3 better 12:13 56:10 86:19 87:7,21 90:13 119:2 126:9 150:13 169:18 185:19 196:9,12 221:15 beyond 49:3 133:22 135:10 191:4 192:21 202:14 208:19 209:1 230:7 296:15 bias 260:1 bid 206:8 big 49:1 55:14 63:17 64:10 69:18 69:22 155:7,11 185:15,15 192:11 210:6 226:16 277:4,5 295:21 bigger 76:7,8,10	90:1 146:4 163:11 biggest 53:21 125:1 Bill 138:15 147:22 169:13 billion 98:16 101:14 133:16 199:13 202:16,20 204:1,1,14,15 213:21 218:22 227:1 228:14 237:13 billions 212:10 213:14 223:10 bills 219:18 Bill's 169:13 bind 191:3,4 biosphere 259:4 bit 25:14,22 133:15 150:14 151:11 163:19 164:2 186:18 189:14 197:3 257:8 279:3 282:16 284:18 292:9 296:1 blanket 141:13,16 blankets 149:14 block 297:16 blocks 145:20 155:12 209:2 blue 1:1 4:7 10:5 189:19 218:7 239:12 blueprint 239:11 BN 143:2 149:17 BN-1200 137:18 143:3 BN-350 137:10 140:6 BN-600 136:2,8 137:16 139:11,13 139:14 140:1,3,7 150:12 BN-800 136:18 137:17 BN-800s 147:6 board 44:22 45:3 93:19 124:15	224:21,22 227:7,8 227:10 229:13 boards 231:5 body 53:7,13 78:12 78:14 79:13,16,22 109:18 110:3 126:3 161:12 191:22 195:22 bomb 163:11 bona 109:15 book 241:1 242:6 248:4 250:12 borderline 177:2 boreholes 273:1 boring 210:16 born 215:18 BOR-60 137:13 138:2 139:5 140:6 bother 139:6 bottom 28:20,21 114:19 141:4 bound 271:5,9 bounding 271:3 boxes 182:20 brand 189:7 break 72:16 92:22 240:7 breakdown 28:13 breathtaking 122:16,19 breeder 49:8 Brent 1:11,15 BREST 136:22 137:3 141:9,19 142:1,4 143:2 149:13 BREST-1200 143:14 BREST-300 143:10 brief 72:20 75:9,11 114:17 132:11 139:3 142:3 152:22 233:19 254:9 briefings 103:16,19 briefly 22:18 152:7 184:18 230:22	253:21 254:17 255:7 bring 34:22 175:8 176:5 bringing 291:19 brings 68:10 231:18 broad 6:8 107:6 161:15 242:21 257:14 broader 149:12 150:16 broad-based 287:22 broken 282:8 brought 40:21 146:2 147:8 198:1 285:20 bucks 189:10 budget 53:15 142:11,15 204:13 287:7 bugs 262:13 build 49:3 58:9 68:14 70:6 71:9 92:12 116:16 119:9 143:4 202:13,15,19 214:12 237:8,9 257:15 building 85:2 102:6 102:20 104:20,21 116:12 133:9 147:11 163:15 188:7 214:10 222:16 245:2 274:22 built 18:15 203:12 271:9 Bulgaria 147:11 148:20 Bulgarian 148:17 bulk 148:8 bulk-plutonium 16:1 bulldozer 164:14 bully 180:19	bum 188:22 bunch 88:5 212:16 256:9 304:9 burden 239:18 245:6 burdening 245:12 burdens 63:5 65:1 105:19 251:11 Burger 178:15 buried 167:4 burn 57:18 burner 137:6 burns 199:8 burn-up 134:4 140:4,10 bury 244:9 287:9 287:17 Bush 241:21 Bushehr 147:4 153:22 157:4 business 7:12 14:20 19:9 29:20 33:9 120:19 249:18 286:21 buy 34:13 167:15 buys 262:2 buy-in 78:17 BWR 54:2
<hr/> C <hr/>				
C 1:10 12:9 13:9 248:9,10 251:16 306:10 cabinet 98:13 cadre 189:17 calculate 32:15 calculated 237:6,15 237:17 calculation 59:14 237:22 calculations 60:13 155:4 California 2:18 159:14 170:20 172:14 184:20 185:15 265:11 California's 159:11				

call 100:10 120:13 152:20 209:15,15 209:16 215:22 220:14 226:8,9 232:2 243:8,19 255:19 260:22 261:15 262:7,19 267:12 286:17	capacity 13:7,13 17:5 54:17 63:3 64:22 95:12 104:21 134:10 154:7 233:1 247:20 257:22 258:1,4,9,19 267:6,10 268:3 271:22 283:5 302:17 303:3,4 304:19 305:8,14 306:13	80:20 105:9 121:4 127:2 152:19 156:20 227:9 242:2 244:1 261:20 262:8 264:11 266:14 267:4,9 278:4 290:19 292:4 294:11 295:18 304:2	century 25:19 145:21 271:1 ceramic 18:21 certain 111:14 150:21 166:9 178:8 188:14 191:5 209:17 211:18 214:1,3 251:12 284:6 293:22	186:6 193:19 214:14 216:18 219:22 225:22 228:10 229:21 231:22 233:17 235:18 238:2 240:1,11 241:6,12 252:18 269:5,22 277:20 282:10 285:15 288:11 294:15 301:7 306:17 307:5
called 58:4 127:22 138:18 148:6 216:1,4 228:2 230:13	capital 140:18 141:3 276:6 287:1	cases 13:9 28:22 51:13 102:8 228:4 251:12 265:8 305:5,10	certainly 68:15 107:21 108:19 109:6,9 119:6 127:17 161:16 190:10,18 191:13 199:11 210:22 236:1 256:19,22 263:2 265:3 273:17 279:15 285:3 294:12 302:14	chaired 98:12 269:10
campaign 92:4,8 152:12,18	capped 95:12	cask 255:12 256:15	107:21 108:19 109:6,9 119:6 127:17 161:16 190:10,18 191:13 199:11 210:22 236:1 256:19,22 263:2 265:3 273:17 279:15 285:3 294:12 302:14	chairman 9:10,11 35:2,18 37:1 45:12 78:6 112:1 128:22 162:21 167:6 168:1 169:7 176:1 197:21 205:21 238:11 239:19 269:15
Canada 95:4,14,16 100:13 103:7 106:6 120:5 122:3 122:8 126:16 127:2,20 130:2 148:14 286:13,14	carbon 11:10 237:16	casks 255:10 273:9	190:10,18 191:13 199:11 210:22 236:1 256:19,22 263:2 265:3 273:17 279:15 285:3 294:12 302:14	Chairs 1:12
Canada's 3:9 93:14 94:17 96:17 98:11 105:14 192:2	cards 90:3 187:15	Caspian 137:10 140:6	certainties 61:17	challenge 123:11 124:11,14 158:4 257:17 292:8
Canadian 2:10 95:15 98:3 100:22 117:2,22 120:14 120:17 121:2,14 122:16 129:11	care 43:21 144:6 238:17 277:18 303:2	catch 70:16 141:6	certify 84:6 297:6	challenged 124:12 125:13 242:3
Canadians 99:7,10 99:19 100:12 101:6 102:7,21 103:2 104:8 105:22 106:13 128:11 148:11	career 132:8	categorically 237:12	cetera 35:6 88:22 178:16 195:18 197:2 198:15 296:17	challenges 125:1 158:10 243:4 273:4,19
cancer 177:16 178:18	careful 235:14 238:17 289:3 293:7	category 134:14	chain 259:21	challenging 104:1
candidate 105:5 141:9	carefully 43:21 202:7	caucus 221:17	chair 1:14,15 4:12 10:9,13 24:12 25:2 27:11 29:2 30:18 34:19 36:21 39:21 44:8,11 61:20 66:13 72:13 78:2 82:6 88:1 92:19 93:8,10,19 106:15 114:12,12 116:18 119:11 122:6,11 126:10 128:19 131:1 145:6 146:9 149:7 151:8 152:4 153:18 155:14 156:10,15 157:5 157:15 162:4,13 162:18 170:12 175:19 179:17	chamber 193:13
cap 305:9,9	cares 303:2	cause 40:12,18,20 41:8	causes 36:5 288:14	chance 42:7 128:4 139:20 145:3 153:7 177:15 280:21 291:22 293:21
capabilities 274:21	Carlsbad 169:3,8 169:19 180:22 181:20	caused 36:5 288:14	causes 192:6	change 44:20 47:4 173:13 175:2 192:4 200:3,14,15 201:2 205:2 206:2 212:2,18,19 213:16,18,22 221:8 222:3 234:2 237:21,22 272:14 293:20 301:20
capability 12:4 29:14 85:1 102:19 122:11 139:11 168:20 274:22 283:2 298:15	CARNESALE 1:17 29:4 30:16 30:19 31:15,19 32:18 72:18 75:8 75:13 126:11 233:18 237:20 301:9 304:6,22 305:19	caution 9:5	causes 192:6	
capable 137:5	Carolina 289:14	CEA 83:2	cautions 216:14	
capacities 233:15	carriers 165:18	ceases 228:21	CEA 83:2	
	carry 139:11 205:12	Cec 165:10 182:1	causes 192:6	
	carrying 112:1	Cecil 2:16 3:15 159:2	causes 192:6	
	Carter 245:3	cent 27:17 35:2	causes 192:6	
	case 26:17 35:18 41:10,20 42:4	center 1:10 101:17 131:10 138:1 248:12	causes 192:6	
		centers 53:9	causes 192:6	
		centralized 53:8 122:15 233:7 255:10 261:17 262:1,10 265:16 266:14 268:16 273:15,16 302:7 302:10	causes 192:6	

changed 132:12 155:13 156:22 160:21 162:1 190:14 201:14 203:2 238:5	China 147:4,7	clause 187:20	101:18 106:1 247:7 278:6	282:13
changer 205:21	choice 38:10 54:2 77:12,15 173:17	clean 196:3 295:1 296:3,4	collaborative 161:10 206:3 217:12,15	coming 4:14 9:19 17:12 25:7,19 56:17,18 73:7 74:16 80:5 85:17 86:22 119:22 133:19 138:21 176:20 178:3 223:14 275:4
changes 100:7 290:3	choices 80:3 95:5 157:18	clean-up 6:11	collaboratively 102:9	command-and-c... 284:2
changing 200:6 214:7 293:1	choose 26:15 168:12 225:4 269:1 270:4	clear 27:16 46:4 61:10 84:13 92:9 96:16 107:3 119:7 123:17 145:21 183:18 224:19 234:9 261:14 272:2 275:3 291:9 300:6	collapsed 244:17 280:9	commences 273:13
channel 155:19	choosing 253:20	clearly 48:16 55:10 57:16 69:19 129:21 270:19 298:11	colleague 56:8 167:20 189:4 284:5	comment 6:15 7:21 8:6 11:2 25:22 34:22 62:21 91:7 91:22 92:1 96:22 142:5 155:17 163:1 178:1 191:19 193:18 220:3
characteristics 251:9 256:11	chosen 9:21 10:17 46:7	client 254:7	colleagues 225:10 227:21 239:19 252:21 253:5 277:3	commences 273:13
characterizing 21:2	Circuit 166:18 242:3	clients 152:16 156:7	collect 27:14,18	comment 6:15 7:21 8:6 11:2 25:22 34:22 62:21 91:7 91:22 92:1 96:22 142:5 155:17 163:1 178:1 191:19 193:18 220:3
charge 77:14 80:17 83:3 84:6 85:14 165:16 270:1,12 284:9 290:14	circumstance 194:3 207:4 210:17	climate 44:16,20 47:4,6 173:13 175:2 216:22 234:2 237:21 301:19	collecting 19:14	comments 8:8 56:5 189:13 208:4 210:4 215:21 238:2 306:19
charged 7:8 82:19 82:21 160:13	circumstances 157:21 183:13,16 215:14 288:2	clicker 253:8	collective 193:14 204:4 216:12	commercial 15:1 17:11
charging 283:16	cited 158:4	client 254:7	combat 13:4	commercialize 262:14
Charles 241:11	citing 235:1	clients 152:16 156:7	combating 13:16	commercialized 283:10
charts 102:4	citizens 48:4 103:13	Clinton 229:3	combinations 263:3	commercializing 12:11
cheap 233:22 234:1 235:15	city 21:6,7	close 24:17 36:16 138:11 213:11 230:22 231:1 264:14	combined 253:13 260:13	Commissariat 83:2
cheaper 235:4	civil 117:6 125:12 126:4	closed 14:16 59:3 59:16 60:1,20 134:18 142:9,12 145:13	come 7:17 9:6 26:6 28:9 93:7 109:12 113:5 114:1 119:1 135:10 144:17 153:11 163:22 170:6 173:14 180:8 186:12 191:1 192:14 206:7 218:8,10,13 224:5 234:21 238:18 255:17 258:6 263:11 265:9 266:21 267:15 287:21 292:16 297:17 303:15	commission 1:1,9 4:7,9,15,16 5:9 6:5,19,22 8:12,22 9:11,12,22 10:6 10:19 16:16 20:18 21:18 22:8 23:12 24:16 33:15 42:20 45:12 52:1,2,2,5,7 82:2 94:12,13 95:10,11 98:3 117:22 120:15,18 121:3,15,17 164:18 176:2 177:12 240:16
check 284:17	civilian 251:10	closure 271:21	comes 9:7 25:11 34:12 109:17 111:6 128:1 168:13 188:22 194:1 239:4	
check-the-box 183:1	claim 143:21 144:17 149:3 150:10	clout 146:21 228:11		
chemistry 211:21	claimed 138:20	CNSC 119:20		
Chernobyl 132:22 133:21 134:22	claims 134:2	coal 26:5 236:20		
chest 170:6	clamped 250:11	Coast 171:1		
Chevet 2:6 3:8 44:15,20 45:8,11 62:1 66:14 67:5 67:13,19 68:7,17 68:21 69:3,7,11 69:14,17 70:17 71:13 72:3,8,11 72:19 73:4 75:12 76:5 78:9,22 80:12 81:5 82:22 85:8 87:15 90:4 91:6 92:19	clarifies 182:11	Coeur 186:16		
children 196:7	Class 248:10 251:16	Cold 135:3 215:2 216:11		
	classical 64:9,11,15 65:7 70:18 76:17 77:1,8 80:19 86:18 91:15	collaboration		
	classically 90:17			
	classification 51:1 51:1,11 251:3,6			
	classified 51:11 251:7,8,9,15 300:22			

244:17 248:13,21 251:1 253:6 261:4 277:14 281:4 288:1,4,10 290:18 293:3 306:9 commissioner 34:22 45:4 208:8 294:17 295:4 Commissioners 4:5 8:6 25:4 72:14 93:7,11 106:17 114:13 132:1 179:20 269:16 commissioning 18:17 commissions 280:5 Commission's 8:16 commitment 15:15 104:14 165:5,9 committed 187:8 191:15 committee 45:1,5,7 145:6 162:22 163:22 189:19 204:6 218:8 223:19 239:13 269:20 270:14 271:1 272:15,22 273:5,11 274:13 committees 291:4 committee's 270:1 270:12 committing 194:4 common 12:20 34:6 60:14 79:11 99:22 217:6 communication 22:11 43:22 communities 80:10 103:11 104:22 105:1 106:4 108:19 112:6 113:10 114:1,21 117:6,14,18,19 119:21 128:13 136:4 180:5,9 272:5 292:15	305:10 community 13:6 36:13 40:16 78:17 81:2,4,22 95:1 101:8,20,20 104:14 105:10 107:10,22 108:1,1 108:6,21 109:4,7 109:10,12 110:7,8 110:14,21 111:10 111:20 112:3,5 113:5 117:16 121:11 127:22 128:5,10 129:16 130:9 135:7 143:8 188:3 209:11 247:19 277:18 279:18 299:3 compact 280:5,12 280:13 compacts 243:14 280:5 companies 11:6 14:17 16:10 24:1 36:1 37:20 company 14:6 23:7 138:14,16 148:1,3 comparative 92:3 compare 59:12 181:19 compared 53:5 54:19 58:21 136:6 comparison 60:20 201:10 compartment 136:8 compatible 252:15 compete 148:7 competence 302:13 competition 136:20 141:21 153:3 competitive 46:18 61:12 137:20 154:9 234:4 competitiveness 46:16 complete 50:9	51:10,12 68:7 261:7 271:13 completed 17:6 19:1 98:16 completely 27:15 40:19 42:1 74:19 84:13 223:5 257:8 completion 18:17 complex 20:15 71:15 142:4 185:21 211:19 282:18 283:7 complexities 33:12 Compliance 247:13 299:17 complicated 265:1 285:4 286:19 304:3 compliments 246:1 comply 179:11 component 6:20 40:22 108:5 173:5 217:12,12 components 210:4 256:7 composition 62:8 compound 153:12 comprehensive 5:14 23:6,8 96:4 135:14 142:9 241:14 comprehensively 32:9 compress 82:8 compromise 127:9 con 183:4 conceivable 272:17 conceivably 265:22 293:20 conceive 74:18 concept 15:22 22:15 23:10 95:22 96:5 138:17 272:10 conceptual 96:8 121:5 137:19 concern 95:21	238:7 concerned 82:1 118:10,17 171:3 175:9 178:2 218:2 218:5 concerning 65:16 65:20 87:1 concerns 41:15 190:5 256:17 287:12 297:4 concert 14:4 concluded 20:9 32:6 33:9 183:14 272:15 273:5 307:13 concludes 157:7 307:9 conclusion 61:10 73:14,16 142:9 173:15 213:6 239:9 301:10 conclusions 73:7,8 271:15 condition 58:14 74:1 198:6 293:11 conditioning 64:7 conditions 43:11 55:19 56:3 72:21 138:10,11 conduct 5:14 conducted 96:3 184:14 276:18 conducting 6:6 14:10 confidence 15:14 266:8,20 269:3 272:7 297:2,13 confident 32:22 127:5 267:1 277:16 confirm 67:15 68:4 confirmation 230:9 230:12 confirmed 288:9 confrontational 221:2 Congress 139:21	167:10 187:21 188:12 193:1,11 194:13,14,21 198:11,18,22 204:3 207:7,12,19 209:20 210:7 211:1 218:1,6 219:19 221:5 223:17 225:15 226:9,13,17 227:16 228:3,7 230:14 238:19 243:13 245:21 249:3 272:12 291:4 293:12 295:10 296:12 congresses 228:20 congressional 159:11 287:19 congressman 4:11 93:9 159:9,10 162:21 168:15 170:11,13 188:9 194:15 199:5 205:10 208:5 214:19 215:15 218:13 219:1,10 228:17 233:18 congressmen 190:21 197:22 conjunction 261:18 265:17 connected 135:15 consensus 182:14 183:18 206:12 242:22 257:15 266:10 302:14 consent 78:17 80:10 81:3,5 111:1 conservation 304:8 consider 7:3 8:22 46:16 47:20 48:16 56:6,9,20 57:9,10 58:11,20 61:9,13 64:2 75:20,21 76:3 85:10,14
--	---	---	---	--

86:2 87:2,6 91:16 101:11 110:16 174:19,20 185:10 256:3 considerable 133:18 177:8 consideration 60:9 115:1 163:13,14 246:5 270:9 276:6 considerations 159:22 254:11 295:13 considered 59:1,6 60:11 63:7 65:14 75:7 83:4 135:18 136:4 174:6 184:16 222:1 262:18 274:17 considering 60:9 85:8 221:20 272:5 306:9 considers 76:1 274:1 consist 240:13 consistency 196:2 220:17 consistent 47:5 57:7 87:3 104:10 106:13 120:21 164:6 251:6 252:7 255:4 263:14 291:6 consistently 299:14 consists 275:2 consolidated 242:19 252:5 Consortium 241:9 constantly 124:12 constituencies 246:7 249:2 263:19 constitute 299:1 constitutes 109:21 111:5,10 298:14 constitutional 110:18 constitutionality	242:4 constrains 268:3 construct 117:3 120:12 136:16 153:4 180:4 constructed 246:15 construction 11:17 11:18 13:8 15:1,5 15:11 18:7 32:1 38:4 98:2 116:15 133:11 136:18 137:17 145:19 147:6,20 276:12 consultation 102:4 115:7 187:3 consume 174:11 consumed 70:13 consumes 62:5 consumption 56:15 178:10 258:1 contact 180:17 contaminated 167:5 176:10 178:3 content 70:18 context 18:13 46:6 129:9 213:15 continue 6:7,12 22:10 29:19 30:5 109:8 236:19 239:13,16 261:12 281:8 continued 104:8 118:19 173:13 174:11 continuity 231:6 continuous 102:17 102:18 124:14 contract 16:21 147:9 156:6 198:14 contractors 272:4 contracts 266:17 contractual 83:16 contractually 192:17 contrast 305:5	contribute 266:1 contributed 11:9 40:3 contributing 12:16 contribution 240:5 307:7 contributions 99:20 control 122:21 145:17 222:5 231:16 232:14 278:20 297:2 299:8 300:9 controlled 133:5 controversy 233:11 convene 307:9 convened 1:9 99:9 conventional 295:17 converge 81:13 127:6 converging 81:9,14 conversation 153:1 conversion-ratio-1 149:14 convert 26:13 converted 28:7 convince 196:19 convinced 192:22 206:11 304:15 convincing 88:20 304:2 coolant 137:2 141:11 cooled 16:20 cooling 20:6 258:7 cooperation 12:15 15:20 24:17 65:10 65:12,14 135:12 coordination 196:10 cope 53:16 59:15 69:19 79:1 copies 51:15,16 core 141:12,16 cores 155:3 corners 209:4	corporate 231:5 corporation 2:21 3:20 95:17 133:10 192:15 204:9 249:19 252:20 corporations 96:18 correct 37:6 130:20 156:4,6 185:14 189:5 270:13 283:14 correctly 52:16 84:9 121:19 correlation 89:6 correspond 52:17 cost 19:19 27:20 28:14 52:17 53:4 59:2 60:16,17,18 82:11,13 83:22 84:4,11,11 116:5 116:12 148:19 181:12 205:12 219:11 234:3 237:3,7,8,9,12,15 238:1 256:11,16 283:19 costs 60:14,14,17 82:15,18 83:21 102:14 141:4 237:10,16 276:6 cost/benefit 276:8 council 96:20,22 98:11 109:13 110:2 councilman 176:3 count 307:4 counterintuitive 282:16 counterproductive 298:21 counties 109:2,2 countries 24:18 46:21 84:17 85:11 87:19 147:16,18 152:9 154:6,7 208:1 275:7 286:3 303:18 country 20:14	26:18 40:5 41:15 46:19 51:5 69:4 85:16 87:18 88:18 108:13 113:13 122:5 126:12 132:5 146:18 156:3 157:20 176:11 215:6,10 215:19 216:13 219:12 243:6 267:3 286:20 county 107:11 109:14 292:15 countywide 161:16 couple 29:5 37:2,17 66:20 107:2 139:10 149:10,11 202:20 206:5 223:2 233:5,13 267:22 273:14 coupled 197:8 courage 123:1 course 7:3 8:2 26:10 29:17 32:4 32:14 36:8,9 39:8 39:10 75:15 101:21 103:18 105:8 111:19 117:13 120:19 140:19 146:5 151:1 157:19 161:6 191:4 231:7 248:6 255:13,16 255:21 257:7,12 258:2,16 264:18 267:8,19 278:17 294:6 court 166:16 courts 176:22 187:19 289:17 299:14 cover 280:21 covered 164:16 185:6 covering 84:4 covers 195:16 co-chairman 10:4
---	---	---	---	---

10:4 189:18	current 11:20	cycle's 45:16	deals 214:12 223:4	266:10,20 269:1
co-invest 143:8	13:18 16:2 25:17	C-O-N-T-E-N-T-S	dealt 64:3 65:4	273:21 290:2
CO2 46:13	27:10 33:4,17	3:1	171:10	291:12 302:14
cradle-to-grave	48:22 54:17 88:8		Dean 269:8	decisions 4:17,20
276:8	129:21 133:1	D	debate 55:14,21	8:15 25:9,16
craft 3:14 157:9	140:7 152:7 207:4	D 1:10 12:14	73:6,15 74:6,17	78:20 177:2,2
158:9	210:16 216:16,22	danger 195:5	76:21 89:1 213:5	252:11,16 307:2
create 52:12 62:17	217:7 218:2	dangerous 138:20	251:22	decision-making
144:5 147:19	244:11 245:4	174:13 185:1	debates 48:17,18	101:5 106:11
167:12 168:2	254:17 267:16	197:16 200:10	92:5,6,11	210:5 238:10
181:9 188:11	271:21 295:6	214:14	debating 232:20	254:3 266:9 269:3
195:12 196:9	currently 11:6 54:7	dangerousness	decade 142:2	declaring 133:3
253:13 260:14	54:9 198:9 236:8	186:2	143:11 165:8	decommissioned
277:15 284:11	251:14 270:6	data 128:2 143:12	202:3,21 292:13	198:15 233:8
created 52:11	curriculum 220:19	date 35:1 79:15	decades 59:8	242:21 257:1,3
79:13,22 84:1,8	curriculum s 220:7	112:2 130:1 166:9	101:16 202:3	decommissioning
100:3 165:3 166:6	cus p 292:22	David 98:12	213:9 223:11	11:19 19:13 52:13
167:10 189:7	customers 19:15	dawn 215:9	252:9 258:17	decrease 48:14
194:16 218:19	28:6 152:13,15,21	day 4:10,10 36:17	261:13 262:12	258:2
creates 68:1	cut 168:13 187:14	121:22 177:22	273:14 275:10	decreasing 91:9
creating 60:6 62:16	225:19 295:1	197:13 220:18	December 121:16	258:9 302:16
198:19,20	cycle 3:5,7,9,12,18	240:12	decentralize 302:3	dedicated 45:18
creation 195:22	3:22 4:17 5:16,19	days 153:15,17	decide 22:3 38:12	49:17 50:15 52:12
198:6	8:14,19 10:16	183:5 221:6	39:2 58:8 85:12	53:6 84:3,8 96:4
creative 200:18	11:2 12:12 14:3	243:16	107:8 263:9 275:5	deep 12:8 20:11
credibility 161:2	14:16 15:16 23:21	DC 1:11	285:8,10,13	21:2 100:16 119:3
167:7 209:6	25:9 45:19 50:2,4	de 53:19 90:2	decided 12:22	120:20 216:12
233:22 266:5,8	50:9 52:18 53:19	deactivated 302:12	14:18 15:7 18:3	255:15 273:1,12
CRESP 241:10	54:13 58:22 59:3	302:12	23:12 30:3 33:13	277:7
crib 255:22	59:13,16,18 60:1	dead 235:6	33:15 49:3 73:15	deeply 281:10
criteria 78:20	60:3,20,21 61:19	deadline 7:11	79:1 202:4 229:4	288:18
80:11,13 101:22	65:11,17 76:6	deal 40:2 50:19,20	293:2	defect 42:2
115:4,12 128:3	83:22 84:5 94:18	85:16 86:4 154:8	decides 108:3	defending 290:13
256:9 295:9,10,12	131:19 134:19	156:20 172:12	272:19 288:4	defense 41:22
296:10,11,16	135:15 142:9,12	173:19 174:1	23:12 30:3 33:13	204:13 233:10
critical 146:17	145:13 157:18	175:1 179:6	33:15 49:3 73:15	250:20 251:10
152:1 183:22	158:6 199:7	210:15 242:20	79:1 202:4 229:4	272:21 297:7
244:5 272:3	255:20,21 257:20	244:12 245:4	293:2	defer 227:20
critically 136:13	259:19 264:10	246:6 289:1 290:6	decides 108:3	deficit 142:14
critics 146:5,13,20	269:13 271:18	295:2,22	272:19 288:4	222:5
Crombie 98:12	272:11 277:11,16	dealing 159:6	23:12 30:3 33:13	define 55:18 56:2
Crown 95:17	284:21 285:6,9	171:12 187:11	33:15 49:3 73:15	73:22 109:22
crystalline 21:6	302:22	211:3,13 230:19	79:1 202:4 229:4	defined 72:22
cubic 71:1,2 284:9	cycles 37:15 259:18	231:15 251:20	293:2	108:22 110:9
curious 90:1 123:4	262:8,15 267:11	253:19 263:12	decides 108:3	271:3
232:21 286:1	268:2 282:15	290:22,22 291:11	272:19 288:4	definitely 107:13
293:4 298:12	284:16 304:3,10	291:12	29:12 37:10,13	112:18 124:17
			38:8 73:3 78:13	
			96:14 98:19	
			102:21 111:4,6,10	
			116:2 119:15	
			122:14 123:20	
			124:21 130:6	
			142:18 143:4	
			146:7 166:20	
			190:12 210:2	
			229:6 239:7	

definition 109:10 110:7,9 118:13	depend 8:3 47:9 270:20 300:20	detail 42:2 49:14 90:18 248:5	51:14 60:12,13 90:5	230:20 243:22 268:14
degrade 62:8	dependent 226:17 227:15,17 238:14	259:16	dialogue 106:10 119:18 175:16	difficulties 112:2 303:13
degraded 152:18	depending 202:8 246:16 250:18	detailed 28:19 40:22 41:6 43:14	dialogues 99:9,17 103:10,13,14	difficulty 18:4 23:4 79:5 283:20
degree 111:21 127:9 128:9 227:11 244:21 245:18,18	depends 82:22 139:19 257:12 259:18,19,22 269:2 301:11	59:5 66:9 105:5 139:8	104:5,7 117:12	dig 287:17
deja 160:19	depleted 26:5 29:11	details 41:4,9 139:6 256:3 257:13	Dick's 155:16	diligently 173:22
delayed 18:18	deployed 283:10	determination 112:16	dictator 168:15 188:10 205:8 207:22	dimensions 232:18
delays 150:4	deployment 274:2	determine 168:19	died 229:3	Dimitrovgrad 137:15 143:6
delegate 123:2	deposit 144:12	determined 111:16	dies 228:22	Dingell 187:12
delegated 123:6	deposits 97:20 102:12 115:22 116:6	determines 177:12	diesel 300:2	dioxide 11:10
delegation 287:19	depth 20:7 41:22	detrimental 268:12	differ 304:4	direct 30:2 43:22 79:18 132:9 179:21 278:3
deliberately 268:12	deputy 145:5 159:15 172:8	develop 5:4 46:7,21 48:19 83:4 98:7 122:11,20 124:4 160:9 214:8 249:4 253:14 261:17 262:9 274:20,21 291:6	difference 25:11 36:5 38:15 90:7 169:2 198:8 226:16	directed 219:16 280:20
delighted 10:1	deregulation 19:10	developed 46:11 105:21 119:21 161:6 174:8 201:21,22 283:9 289:13 305:6	differences 25:10 61:6	direction 102:4 124:10 207:21 271:19
deliver 241:3	describe 270:6	developing 21:1 95:18 102:7,9 121:6 150:20 277:6	different 37:15 48:20 75:19 89:1 122:5 123:12 126:3,14 132:17 135:19 136:9,12 138:17 142:16,17 146:3 157:20 163:19 173:14 185:9 191:1 203:16 211:7,10 211:11 214:5,8 223:5 230:3 249:1 249:2,10 253:11 253:13,16 254:15 255:3,4,21 260:14 260:15,20 262:22 265:12 266:22 273:4 286:10 287:3,4 289:6,16 289:19	directly 53:14 60:4 79:19 83:12 86:8 92:15 113:10 219:16 283:19
delivered 99:17 148:13,18	described 56:13 104:4	development 2:9 12:10 15:21 20:19 22:19 23:14 44:17 47:14 64:4 65:5 81:21,22 99:18 137:9 151:14 197:8,14 200:19 275:12 276:7 289:21	difficult 21:8 38:8 70:8 76:16 81:7 91:6 144:14 181:2 195:20 208:19	director 9:17 44:15 93:17 131:7,9 230:2,8
delivering 136:3	describes 137:22 139:22	developments 101:3		directors 93:20 124:15 227:8 231:5
demand 118:18,19 271:11 302:16 303:3	describing 138:4	devils 41:4		disadvantages 75:22 76:2,3 270:8
demanded 305:17	description 139:3	devise 163:4,10		disagree 22:6
DeMars 165:13,14 166:3	deserves 35:11	devote 159:20		disappointments 182:17
democratic 33:16 221:14	design 24:7 35:6 37:20 40:21 41:2 41:5 42:2 43:14 106:3 136:22 148:3 197:12 254:12 257:11 284:21	diabetes 178:15		discipline 151:1
demographic 183:4	designated 2:3 4:6	diagram 40:11		disclaimer 132:2
demonstrate 22:14 63:2 64:21 105:9 105:11 111:11 233:1,15 262:13 265:19	designed 99:16 127:12 259:19			disclosure 247:18
demonstrated 37:21 96:7,9 264:9	designing 134:12			discover 289:6
demonstration 15:6 44:1 202:13 202:19 213:19 214:10	designs 102:8 121:4 142:21			discovered 294:18
department 44:16 90:16 122:12 172:9 176:16 179:10 242:1 249:12 250:9 291:1 297:7	desirable 284:3			discriminate 300:15
	desperately 186:10			discuss 33:20 34:7 83:18 85:5 107:12 152:7 188:20
	despite 146:14 282:5			

223:6 264:17 278:11 discussed 20:2 109:8,9 120:2 141:18 182:9 210:20 236:21 249:14 255:1 263:5 discussing 65:15,18 182:16 270:16 discussion 3:24 5:1 9:5 18:12 33:8 39:18 61:2 70:1 74:2 91:2 99:13 108:3 137:18 139:9 142:14 143:12 144:18 147:10 159:21 160:3 184:9 240:14 251:22 254:21 287:2 discussions 89:10 89:21 114:7 142:7 179:19 263:12 264:17 dislike 226:3 dismantling 84:1,5 disparities 34:12 dispensing 52:19 disposal 5:21 8:16 20:21 21:11,21 22:16 27:22 28:11 28:12,22 30:2 53:9 55:3,6 56:1 58:13,14,15 59:1 59:2,4,22 61:17 70:8 73:20 74:19 75:1 76:8,9,19 82:12,19 85:21 95:9,13,19,22 96:5,7 98:17 118:7,12 122:11 175:10 233:9 243:7 249:8 255:15 258:13 263:22 264:6 265:10,17,22	268:20 270:14,18 273:2 276:12,16 283:20 301:14 305:6 dispose 12:6 29:21 200:5 237:7 265:2 265:21 disposed 204:20 274:8,12 305:12 disposing 20:3 185:5 dispute 28:17 distill 242:7 distinction 156:19 distinguish 253:15 254:11,12 255:6 263:6,17 distinguished 8:11 131:5 162:21 170:15 district 159:11 166:15,16 171:4 distrust 238:9 248:19 disturbs 35:7 ditches 164:13,16 diverse 6:8 209:18 diversification 56:22 57:5 diversion 32:10 diversity 96:21 99:22 103:12 divided 183:14 211:3 281:7 dividing 51:3,5 214:6 Dixy 164:17 165:6 DNA 178:9 doable 263:18 Doctorate 9:13 document 115:6 166:12 DOE 164:3 165:3 166:12,17 167:7 170:7 209:19 225:9,10,11 226:4 238:8 246:14,16	246:18 248:17,19 250:8,10 272:12 287:6,15 290:13 290:14 294:4 297:5 DOE's 159:12 dogs 190:1 doing 35:22 74:21 79:8 84:6,7 87:17 112:22 147:4 167:1 169:19 194:3 201:5 202:11 228:4 256:21 267:17 285:8 dollars 199:13 202:16,20 212:10 213:14,21 218:22 223:11 224:4 domain 28:19 domestic 26:7 domestically 12:4 87:14,15 88:15 dominant 48:3 267:3 dose 56:16 259:1,4 259:11,13 260:5 dot 199:9,10,10 302:1,1,1 doubt 219:1 306:5 Dowdeswell 116:22 118:8 down-blending 306:9 Dr 3:5,12,19,21,23 9:9,11,19 10:3,9 10:12,15 24:12,15 25:3 26:3 27:12 28:3 29:4,16 31:13,17,22 33:6 35:16 37:7,19 39:1,6 40:1,18 41:3,18 43:8 44:11 66:14 92:19 131:5,20,22 146:9 146:12 149:8,9,16 149:20 150:1,9,22	151:19 152:10 154:11 155:4 156:5,10 157:1,5 240:19,22 241:3,5 252:19,19,20 253:2,4 269:6,7 269:10,13,15,19 277:20 279:8 281:13 282:14 284:4 286:9,14 288:5,9 293:6 296:6,11 298:1 299:11,22 300:3,5 300:13,19 303:10 304:13 306:2,6,17 306:20 draft 7:9 104:6 143:20 144:4,16 144:18 drafted 119:7 drain 163:17 dramatic 183:9 dramatically 88:9 267:2 304:17 draw 189:16 drawback 76:5 drawbacks 47:21 drawing 94:15 drawn 123:22 drive 284:1 driven 62:13,15 67:6 71:7 dry 166:12 255:10 255:12 256:15 273:8 duck 223:22 due 18:19 22:22 23:1 32:2 38:1 41:5 43:19 dug 164:13 Duma 143:20 144:22 145:5 152:14 dump 172:13,22 184:21 185:19 209:15 dumped 173:5	185:6 212:12,13 dumping 164:11 185:4 306:16 durable 277:15 duty 24:21 172:7 190:6 dysfunctional 209:19 d'Alene 186:16
E				
eager 301:16 earlier 94:14 99:2 125:19 128:22 189:12 194:9 205:22 237:11 earliest 137:14 early 79:15,16 127:22 132:7 139:1 142:21 152:11 173:22 232:19 233:9 243:16 244:16 286:16 earmarks 290:4 Earth 304:19 easier 214:11 303:21 easily 32:16 200:20 201:11 East 153:12 easy 26:13 30:9 58:16,17 75:2 170:9 eat 177:13 ebbs 238:9 echo 238:12 Ecology 2:8 44:17 economic 38:1 61:10 136:15 183:13 206:16 233:12 247:22 270:10 273:20 294:7 economical 66:4,5 234:18 economically 61:16				

137:20 183:11 234:4	elders 103:7	encourage 247:1	enforceable 187:19	21:3 119:15
economically-fea...	elected 131:13	encouraging 22:9	engage 175:16	195:17 215:10,11
98:10	164:8	endeavor 24:20	engaged 211:1	216:9,17 237:15
economics 141:7	election 194:1	ended 166:15	engagement 103:12	241:20 258:14
237:3,4 292:18	elective 194:5	endorsed 198:3	293:10,15	260:2,3 277:1
economist 284:5	electric 14:5,17	295:16	engaging 91:19	283:4
economy 23:15	16:10 19:10 23:7	endorsing 218:17	engineer 145:7	environmental
140:22 155:6	23:22 95:10	ends 233:20	engineering 9:13	47:2 64:11,12,16
EDF 53:19 54:5,20	229:14	enduring 3:14 5:5	9:14 40:21 41:2	94:2 96:1 125:21
edition 165:1	electrical 163:12	157:10 158:9	94:2 136:22 138:1	158:13 241:7,13
Eduard 131:16	223:13	enemies 245:21	142:21 234:16	247:15 258:21,22
educate 217:19	electricity 11:8	energetic 140:12	257:13 269:8,9	270:10 294:18
educated 239:1	13:3 19:15 28:7	energy 2:4,8 4:18	273:4	295:18 296:13
education 181:12	29:1 47:10 53:4	5:13 9:10 10:8,18	engineers 41:5	environmentally
182:13 185:16,22	53:19 60:19,22	11:5,11,13,22	English 51:16,17	98:9
189:9 206:3	82:13,20 83:20	12:2,9,18 13:15	177:5	environmets 21:4
217:21 220:7,13	84:12 95:5 133:1	13:15,21 14:14,15	enhance 275:15	envisaged 279:14
220:19 238:6	136:3 267:3	23:18 24:21,22	enhanced 136:12	envisioning 256:2
educational 184:7	271:11 283:17	25:13 26:4,6,10	enjoy 11:21	envy 163:21
185:13 189:6	284:10	26:15 27:5 29:10	enjoyable 162:7	EPA 176:17 281:2
210:20 217:10,11	element 174:22	30:11 40:4 44:16	enlarged 242:13	281:17 296:4
Edward 240:21	218:6 250:1 265:3	44:17 45:5 46:6,8	enormously 116:22	297:5
effect 282:22	elements 73:19	46:9,11,16,18,22	enrichment 56:18	equal 181:12
effective 180:5	174:14 259:7,8	47:6,11,14 49:14	144:3 145:18	equalized 34:10
230:19 284:3	260:21	50:11 56:10 61:11	276:10	equally 100:20
297:2,12 298:15	elevation 178:8	95:5,6,16 96:17	ensure 7:5 20:12	266:22
300:17	elite 135:16 142:8	102:13 132:22	102:12,16 105:18	equilibrium 67:14
effectively 158:8	Elizabeth 116:21	135:8 136:3 142:8	109:17 112:20	67:16 70:12
effectiveness 24:3	eloquently 225:7	145:6,12,22 146:3	entails 268:5	equitable 3:14 5:4
efficiency 183:6	embarked 134:12	146:6 147:16	entangled 108:10	157:9 158:9
efficient 49:21	embrace 193:4	148:2 163:12	enter 43:17 74:22	equity 34:8,17
57:19 163:12	emerged 100:10	164:18 168:6	enterprise 243:2	246:4 264:3
effort 7:14 14:4	123:5 244:15	173:14,17 174:3,5	287:2	equivalent 120:21
76:22 254:7	emergency 215:4	174:20 175:1	entertain 22:6	era 215:7
efforts 12:10 99:4	300:2	176:16 179:10	entire 264:10 285:5	Ernie 1:19 29:2
112:20 163:10	emeritus 131:9	183:15 194:16	entities 78:19	34:19 72:17 78:4
247:2	Emirates 84:18	201:4 204:15	entitled 252:22	82:7 88:2 128:19
egregious 215:1	85:9	212:8 217:18	entity 78:15 167:9	149:9 155:14
eight 222:6	emission 11:10	221:22 222:14,17	168:3 208:7,9,12	156:16
eighteen 204:12	emissions 46:13	223:13 225:21	210:8,9,18 213:2	erosion 6:9 266:5
EISENHOWER	emotion 182:12	228:19 229:14	214:11,11 217:22	escaped 306:18
1:17 151:10	184:15 225:10	236:9,18 237:4	218:19 238:7	especially 25:13
214:16	emphasis 161:18	242:1 254:5,6	272:10 286:18	41:20 49:8 51:2
either 117:6 219:20	employees 280:8	263:12 264:17	296:19	55:1 57:17 58:13
265:14 268:22	employment	267:1 272:2 291:2	entrance 154:6	61:14,16 65:11,16
272:13 289:20	101:16	299:13	enveloping 140:12	65:19 70:3 79:9
	enamored 123:1	energy's 132:5	environment 20:12	106:22 111:2

148:11 220:15 242:15 245:14 301:19 essential 174:22,22 essentially 160:12 256:4 298:16 299:6 establish 20:20 96:18 97:19 144:5 181:3 197:15 295:10,22 established 19:11 96:16 97:2 98:14 103:5 108:19 115:3 120:19 179:18 278:18 281:2 establishing 14:16 15:3 18:20 19:6 95:15 278:7 establishment 10:18 esteemed 131:22 estimate 33:4 84:4 199:11 estimated 27:1 116:5,11 134:6 202:12 estimates 27:1 et 35:6 88:22 178:16 195:17 197:2 198:15 296:17 eternal 195:1 ethical 34:14 245:1 245:8 Europe 11:16 14:20 15:9 16:20 17:21 29:8 38:3 39:11 249:22 evaluate 105:5 evaluated 256:8 evaluation 241:9 252:13 254:15 276:5 event 22:22 23:1 eventual 94:18	eventually 68:14 128:17 130:5 137:4 153:11 262:9,14 everybody 81:7 87:10 evidences 178:13 evolved 150:19 exact 66:1 exactly 40:12 64:18 84:4 184:19 211:13 255:12 261:9 278:18 299:22 examination 244:22 examined 263:10 292:3 example 84:18 188:9,17 189:19 194:10 199:18 230:2 233:3,6 278:10 282:21 examples 130:2 167:6 233:13 exceed 98:15 excellent 44:12 exceptionally 294:22 excess 101:13 136:9 excessive 251:11 exchange 27:16 65:13 287:4 excited 228:15 excluding 114:22 exclusionary 115:3 119:17 exclusive 176:12 excuse 112:1 174:13 230:22 execute 122:22 executed 16:13 executing 116:5 Executive 44:15 226:12 exercise 29:18	226:19 263:15 299:7 exist 117:19 198:9 208:1 existence 43:19 130:11 existing 68:16 83:14 136:22 137:20 138:5 146:16 200:3 251:2 271:6 exists 128:9 exit 108:7 expand 153:8 265:9 expansion 147:2 271:22 expect 13:1 31:1,10 33:4 104:9 106:14 140:20 152:19 257:10 292:11 expectations 102:16 106:13 expected 20:16 24:7 29:9 55:16 56:4 264:20 expeditiously 261:1 265:15 301:21 expense 134:4 expensive 205:3 211:20 experience 59:8 76:2 135:2,4,11 145:16 161:1,19 175:9 182:10 184:18 189:17 190:9 217:4 243:15 278:11 296:22 297:19 experiences 170:18 208:21 experiment 138:9 experimental 14:10 experiments 136:10 expert 20:2 99:14 expertise 96:21	192:22 experts 99:20 117:16 134:7 137:3 139:9 140:14 145:4 155:5 240:14 expired 92:20 expires 273:11 explain 33:16 48:12 90:21 91:11 91:13 95:2 184:8 explanation 228:3 explanatory 262:21 explicit 299:15 300:18 explicitly 262:18 exploration 131:11 157:18 explore 24:2 40:8 269:21 270:8 286:2 exploring 22:12 23:10 81:15 exposure 61:14 express 60:12 104:8 expressed 161:22 expression 109:11 109:17 extend 302:4 extended 168:11 230:7 262:20 267:20 268:7 extension 48:22 extensive 106:10 extensively 109:8 extent 111:16 185:22 244:2 246:18 255:2 external 74:22 254:7 extracting 135:2 extraordinarily 175:14 236:16 extraordinary 193:13 236:9 extreme 205:13	extremely 8:20 78:10 184:22 eye 255:22 <hr/> F <hr/> fabricate 71:4 fabricated 11:16 17:18 fabricating 87:18 fabrication 17:15 17:19 133:13 276:11 face 75:16 149:2 163:19 164:11 183:15 218:6 faced 23:3 157:20 183:17 192:8 facilitate 82:3 268:19 facilitates 58:22 facilities 16:2 17:9 19:14 22:14 42:17 44:7 53:3,4 59:4 62:3 82:16,20 89:8 117:18 145:8 154:16 171:3,13 242:1 243:8,14 244:5 246:21 247:14 249:5 277:7,9 296:5 298:11 299:20 306:8 facility 17:20 20:5 21:21 36:2 43:20 55:6 68:15 78:21 81:2 94:22 101:7 120:12 139:17 150:3 159:1 169:3 182:3 198:12 202:13,14 214:10 229:17 232:13 242:19 243:18 246:2,8,14 247:10 247:13 262:1 272:6 273:16 276:17 279:17 280:10 294:4
---	--	--	---	--

297:6,15 299:6,16 301:6 305:7,12 306:12 facing 160:13 fact 23:21 43:5 57:13 63:5 76:6 76:12 82:10 86:14 87:3 88:11 91:17 92:12 109:13 121:15 174:17 178:14 198:3 209:12 242:14 258:11 260:3 268:11 275:3 279:1 factor 13:7,14 136:7 150:6,7,11 factories 36:1 factors 4:19 8:14 114:22 124:21 199:10 270:10,16 facts 53:18 failed 21:14 243:21 248:8 failing 163:16 failure 21:18 163:3 163:7 247:3,5 288:15 292:5 failures 163:6 fair 104:15 161:13 215:7 258:17 fairly 282:22 fait 247:17 293:16 faith 118:22 265:19 Falls 165:21 familiar 254:1 294:6 297:11 famous 133:21 far 21:15 30:21 31:6 43:3 90:8 112:2,7 120:2 122:4 126:7 146:16,18 149:18 185:19 221:11,14 230:7 244:3 248:3 259:8 262:17 291:17 297:18	fashion 168:4 fast 12:11 14:8,10 18:9 22:19,20 23:4,9,14,21 24:3 37:6,7 38:13 39:9 39:12 43:17 49:8 57:17,22 82:17 135:17,21 136:11 136:13,14 137:9 138:10,17 139:18 140:9,18 141:2,17 142:10 143:5,9 145:14 146:18 147:6 155:1,11 274:1,10,15,18 275:20,22 276:5,7 fastest 264:14,15 fatal 177:15 favor 48:17 166:17 177:3 FBI 230:2,8 Fe 294:12 fear 184:1,3 217:5 fearful 212:14 feasibility 20:3 41:16 264:9 feasible 24:7 253:18 256:16 263:8 270:7 273:2 feature 121:1 154:9 federal 2:3 4:6 6:10 95:8,17 96:1,3 97:6,9 98:13 103:18 107:5 116:2,8 130:5 158:3 159:6 162:9 166:8,15,16 176:20 177:10,18 178:20 179:9 182:1 185:2 187:6 187:17 190:15 192:12 196:11 197:2 226:8,21 227:9,12 228:1 231:15 232:7 238:15 239:6 247:13,14,20	249:10 265:19 266:16 279:9,12 279:14,18 280:17 286:11 289:18 297:10,11 298:19 299:16 federal-state 289:17 fee 19:16 27:14,22 283:17 feel 13:22 216:6 232:10 263:1,3 feeling 44:6 feel-good 198:19 fees 19:14 227:2 feet 166:2 felt 32:21 183:12 261:6 273:11 274:13 fence 217:2 Fentiman 2:22 3:23 269:8,10,13 269:15 277:21 306:17,20 festered 250:6 fiction 155:6 fide 109:15 fiduciary 178:21 field 49:14 179:13 Fifteen 204:12 fifth 137:5 141:10 fight 189:2 238:22 289:3 fighting 289:5 figure 50:6,7 54:6 57:21 59:15,17 60:14 61:3 68:4 71:1 141:4 142:14 148:20 151:20 193:1 197:4 283:8 figured 174:7 204:10 212:8,9,11 file 73:21 files 80:16 fill 209:2,3 final 55:3,15 56:3 58:15 59:22 61:17	63:3,16 64:22 67:21 70:8 71:18 73:10,20 74:10,18 75:1,2 76:7,8,9,18 77:22 80:6 82:6 83:22 84:12 85:17 85:19,21 86:4,8 86:13,15,21 88:1 93:1 105:7 131:4 141:18 142:18 144:19 153:18 190:12 240:12 269:7 finalizing 36:14 finally 22:18 24:15 32:6,20 159:9 166:5 250:22 251:21 255:2 267:12 finance 94:2 142:20 financial 84:11 105:18 117:5 166:10 168:11 189:11 248:14 249:22 277:12 279:15 280:9 financing 19:8 52:22 286:22 find 63:3 64:22 76:20 79:5 86:7,8 90:11,17 122:16 125:14 126:6,19 128:17 153:7 158:22 168:18,21 179:2 180:17,20 184:5 191:7 196:1 213:1 254:21 272:13 278:14 287:9 finding 86:12 158:5 findings 5:10 118:9 241:3 256:13 fine 72:7 179:22 193:22 228:9 fines 166:11 finish 252:11 279:7	Finland 8:17 124:6 209:10 279:19 286:12 fire 22:22 40:10 firm 143:4 first 4:15 8:8 9:9 11:4 13:6 26:3 29:7 34:21 40:18 47:3 56:8 59:22 60:1 62:3 78:11 80:7 81:10 82:10 86:8 89:13 95:4 97:3 104:5,10 106:17 109:15,15 109:16 110:6,11 113:12 114:3,4 117:4 123:14 127:7 129:3 132:1 134:12 135:9 143:8 144:18 155:17 164:8,10 165:1,4 166:21 167:14 168:2,17 180:11 188:21 189:10 196:17 197:9,17,21 199:1 206:4 214:21 218:18 231:16 240:19 241:14 242:8,16 254:13 260:22 263:20 271:17 285:7 295:9 296:7,9 298:19 299:11 301:20 fiscal 16:12 fish 177:12,13,14 fissile 12:5 fission 60:2 141:15 256:4 259:7,11,20 260:3 274:11 283:2 fit 176:4 five 42:13 61:8 97:15 155:9 163:1 182:18 204:2 213:21 222:18
---	--	---	---	--

248:22 295:20	force 297:17 305:14	176:15 188:7	frankly 198:7	84:16,21 85:2,6
five-year 206:19	forced 287:20	208:22 209:22	Frazier 2:3 4:3,6	86:17,18 87:8,10
fixed 74:7	Forcing 247:6	239:13 248:3	93:6	88:15 94:18,19
fleet 48:22 49:1,1 53:21 275:2	foregoing 93:3 157:12 240:8 307:12	270:5 281:6 282:7 287:10 291:20	free 159:20	95:8,15 96:13,15
flexibility 101:1 128:15	foreign 27:9 85:21 138:9 147:14 152:13	foster 101:20	French 44:16,21 45:2,5,6 48:4 50:2 53:18 56:12 64:5 64:17 73:17 75:14 80:20 83:2 85:10 85:20 86:21 90:10 144:10 155:22	97:5,18 98:5,11 98:15 99:5 100:17 101:14 104:2 105:15,20 120:4,5 126:6 129:13,21 130:7,10 131:19 133:13 134:4,18 135:15 138:21 139:13 140:2,12 141:14 143:17 144:15 148:3,7 149:21,22 150:3 152:8,12 154:2,8 154:14,20 155:17 156:2,3,8,22 157:3,18 158:6 199:7 209:14 211:5,8,15 215:22 215:22 216:1,2,2 221:22 222:22 233:7 234:14 235:9,11 236:7,12 242:20,20 243:1 243:17 250:4 253:1,12,19 254:12,16 255:3 255:14,20,21 257:2,19 258:15 259:17,19 260:16 261:11,14 262:2,5 262:7,15 263:21 264:5,10 265:1,2 265:6,10,18,21,22 266:18 267:7,11 268:2,20 269:12 269:21 270:3,7 271:18 272:4,6,11 272:19,20 273:7 273:13 274:3,6,10 274:13 275:1,6,19 275:22 276:1,2,10 276:11 277:11,16 282:15 284:16,21
flexible 58:18	foremost 271:17	fought 287:17	fresh 148:21 166:2 191:14 244:22 251:16 276:2	
floating 134:13	foresee 118:14	found 8:19 20:13 78:10 250:11 268:1	frequent 103:10,20	
floor 8:5 179:19	forever 204:21 224:9	foundation 183:21 206:19	Fried 178:16	
flow 195:10 204:7 237:14	form 39:16 80:9 88:10,17 124:8 283:3	founding 93:17	friend 214:2	
flows 238:9	forgot 296:8	four 8:11 26:6 42:13 50:13 54:8 72:14 74:4 114:13 167:22 177:17 196:18 205:7 209:4 212:7 213:20 260:13,15 291:1	friends 169:14,15 169:16	
fluence 136:13	formal 110:1 111:3 111:6 160:8	fourth 255:19 262:19	front 248:11 285:5	
fluency 138:10	formation 94:19 100:16 106:9	four-year 190:11	frontier 186:17	
flush 163:18	formations 151:15 273:1	fractured 281:1	fruit 221:20	
flux 140:12	formed 98:7,13 269:20	fragmented 209:19	fuel 3:5,7,9,12,18 3:21,22 4:16 5:15 5:19,22 8:13,19 10:16 11:2,15 12:3,12,13 14:3,9 14:16 15:7,16 16:19,20,22 17:2 17:8,14,15,18,19 18:2,8,13 19:16 25:9 29:22 30:22 31:2,10 37:15 39:2,13,17,20 45:16,19 49:11 50:2,4 52:18 53:18 54:6,8,10 54:13,19 56:11,16 56:17 59:15 60:13 60:14,17 61:5,18 62:5 65:11,17,20 67:2,3,10,20,21 67:22 68:2,3,12 68:17,19 69:10,13 69:16,21 70:5,18 70:19,21 71:4,8 82:11 83:22 84:16	
FNR 14:12	former 2:13,16,17 5:2 98:13 156:1 158:18 159:2 169:11 294:17	frame 200:9		
focus 65:8 124:20 158:7 170:9 201:13 277:14 291:7,9	forms 300:22 301:1	frames 100:5		
focused 92:11 104:5 107:1 270:15 291:8	formula 102:11	framework 96:14 105:13 119:19 254:18 260:20 280:12		
focusing 10:15 57:17	formulation 126:9	framing 216:16		
folks 106:21 124:16 126:7 221:12	Fort 215:18 216:6	France 15:21 24:19 38:22 46:6 47:3 48:16 49:4 53:19 54:4 62:15 63:4,7 63:11,16,18 65:10 66:8 71:14 75:22 76:10,12 77:21 78:10 79:2 84:21 87:9 89:4 92:5 123:13 134:20 135:11 143:15 211:16 286:11		
follow 30:16 36:14 128:20 155:15 220:5 223:16 295:3	forth 200:22 280:2	France's 3:6		
followed 243:6	Fortunately 173:20	Franck 44:15		
following 55:17 88:11 97:5 105:12 134:19 148:5	Forty 148:11			
follows 35:3	forum 103:6,9			
follow-on 305:4	forward 7:15 40:13 40:17 94:5 105:15 106:1 107:12 108:3,10 109:5 110:15 113:5 114:1,9 119:22 127:18 128:1,14 171:18 173:16 174:21 175:13			
follow-up 125:8,11 153:21				
food 178:5,10				
foods 178:7				
footnote 205:6				
footprint 59:3,14 59:19 165:22				
forbidden 85:20				

284:22 285:5,9 301:13 302:5,22 303:16 304:3,10 fuels 135:9 219:12 275:18 FUGEN 14:12 17:17 fulfill 192:18 fulfilling 12:20 full 4:9 7:6 54:13 105:3 112:22 131:13 141:11 216:10 247:18 274:9,18 275:22 276:14 fullest 244:20 fully 47:22 82:5,12 95:1 112:21 125:4 136:19 176:21 179:8 fun 162:8 function 137:1 143:5,10 191:16 192:16 259:4 289:20 293:2 functioned 169:20 functioning 87:16 135:20 136:1,5,11 137:15,16 140:3 151:2 functions 190:22 191:5 fund 6:3 19:12 83:5 84:9 102:11 115:18 198:10 208:14 213:12 219:4,6,15 283:17 fundamental 102:22 296:15 fundamentally 60:6 62:13 79:17 155:22 funded 53:13,14,17 79:14 83:5,11 219:17 224:3 247:20 254:7 289:20	funding 79:17 83:8 97:17 102:11 117:15,17,21 224:4 225:1,19 238:13,16 239:4 249:14 250:16,18 250:19 293:14 funds 97:19,20,21 98:14 105:17 116:10,16 117:11 130:12 208:12 further 44:8 66:2 70:2 102:7 115:1 128:6 131:2 151:8 178:22,22 205:12 294:8 301:5 Furthermore 16:6 fusion-fission 142:22 future 1:2 4:8 7:1,4 10:6 17:1,6,12 23:19 26:16 30:8 30:11 34:16 37:15 38:17 49:5,10 50:8,8 55:5 62:10 63:6 65:2 68:13 77:17 79:20 105:19 116:6 135:14 136:14 137:19,21 138:11 139:19 140:8,14 140:17 143:1 145:12 146:19 153:12 155:6 156:7 161:5 175:14 176:7 182:22 183:13 186:15 194:16,19 195:18 196:1,4,13 196:14 199:7 203:6 209:8 220:17 225:7 233:12 239:12 242:11 245:7,11 247:2 252:3 262:17 264:6 268:21 271:20	275:4 306:14 <hr/> G <hr/> gain 56:16 222:5 gaining 135:2,11 257:18 gallons 167:3 game 141:21 200:4 200:4,14,15 201:3 203:2 205:3,20 206:3 212:2,18,19 213:16,18,22 214:7 222:2 292:17 293:20 game-changer 204:18 Garamendi 2:17 3:16 159:10,10,13 170:14 184:17 199:6,20 207:2 210:13 219:3 221:4 227:20 228:12 235:20 gas 16:19 57:3,4 Gates 138:16 147:22 gather 256:15 gathered 132:7 gatherings 132:15 GDF 44:22,22 Gen 49:7 57:14,16 65:12 70:3 83:1 92:13 general 28:5 33:22 35:14 46:5,19 65:6 74:3 110:12 113:11 118:20 180:1 187:21 190:21 206:12 223:14 238:8 241:20 259:9 270:2 276:19 294:5 296:16,18 generalist 46:2 generalize 243:22 generally 11:6 90:12 221:11	226:11 Generals 289:4 generated 17:2 133:2,15,17 217:5 227:2 generates 226:11 226:15 generation 11:5 13:3 14:5 19:15 29:1 49:4 60:19 63:6 94:1 100:2 104:12 137:4,5 141:10,19 175:3 213:4 223:3 224:2 229:1 237:10 244:12 245:4 283:18 generational 191:13 192:6 264:3 generations 65:2 105:20 134:8 176:19 195:19 196:4 225:7 245:7 245:11 268:21 Generation-4 50:6 generators 284:1 300:2 generic 255:20 gentleman 207:14 gentlemen 45:13 159:17 170:17 171:10 181:6 genuine 226:22 227:14 genuinely 290:19 geographic 246:4 geologic 12:8 20:4 22:4 71:22 94:19 95:22 106:9 119:3 120:20 261:19 262:4 265:17 268:18 273:2,12 274:8 277:8 geological 20:11 21:2,3 33:2,11 42:22 43:4,11	55:8 72:21 80:15 81:11 95:18 96:7 100:16 114:22 144:11 151:15 168:19 172:16 235:8 255:15 257:6,15 262:16 272:16 geology 20:7,15 257:13 259:22 260:7 George 241:21 gerrymandered 280:13 getting 135:4 177:15 190:12 191:13 250:11 259:2,9 297:13 303:12 gigantic 164:11 gist 267:21 give 34:16 37:16 44:6 72:11 164:1 180:7 181:4,7,11 182:2 197:10,11 207:8 227:3 230:1 231:6 282:9 297:12 given 10:19 25:21 52:15 88:3,7 122:17 133:9 154:21 180:10 183:16 198:8,17 216:8 242:10,13 250:17 262:22 263:7,17 279:1 286:19 gives 212:5 247:7 254:9 giving 142:17 291:9 gladly 179:15 global 13:5,16 24:20 26:20 60:17 133:12 215:11 globally 58:19 60:16 61:5
--	---	--	---	--

go 4:4 30:18 33:13 67:1 70:2,2 86:22 88:4,16 89:1 112:7 114:9 117:18,21 128:6 133:22 154:22 161:4 166:11 168:19 169:22 171:18 176:14 180:16 181:17 184:4 188:14,18 189:10,21,22 190:2 193:22 202:6 208:7,22 209:1,2 212:22 219:7 220:2 229:19 231:8 239:13 260:2 266:15 281:6 282:7 288:12 292:7 297:19 299:17 301:4 304:20 307:3	191:1 192:11 194:18 197:3,4,6 200:7,7,11 202:12 203:15 206:1 207:5,7,11,17,18 208:18 210:7,8,9 210:18 214:17 215:12 217:3 219:15 221:21 222:2,20 224:6 226:18 227:14 228:9 229:15 230:10,13 231:12 232:1,1 234:9,11 234:22 235:4,4,9 235:20 236:2,17 236:18,19,20 243:8,18 245:13 245:16 252:7,8,8 253:11 255:7 258:11,16 267:2 281:21 287:10,16 288:22 292:7 293:18 296:13,19 297:3,3 298:3 299:17 301:4 302:12,15 304:16 307:1,3	governance 102:18 105:16 122:10 126:3 249:21 279:20 governing 110:3 government 5:2 12:22 14:6,19 18:5 19:11 21:10 21:18 22:9 23:2 44:21 45:2,3 49:22 91:19 95:8 97:1,7,9 98:18 100:13 101:9 103:14,19 106:11 107:5,6,11 110:2 110:19 112:14,15 113:7,12,14 114:3 114:5 116:2,8 123:14,16,20 124:1,9 126:5 129:14 130:5,22 132:4 143:7 157:3 158:3 159:6 162:9 166:8 173:21 174:7 185:2,17 187:7,17 192:12 197:2 201:19 207:13 231:16 232:8 234:19 238:15 243:19 246:22 247:21 249:19 250:19 265:20 266:16 279:12 280:17 283:13 287:20 292:20 governmental 98:19 206:6,10 governments 3:14 5:4 95:6,14 109:3 112:18,21 113:3 114:8,10 130:14 157:9 158:8 160:1 government's 6:10 250:2,15 government-esta... 126:2	government-to-g... 179:7 governor 2:13,16 2:18 158:19 159:4 159:14 160:6,11 162:8 164:8,18 169:12 180:3,3,18 185:14 186:8 187:19 188:18 193:9,22 194:1 197:22 210:21 216:18 220:10 232:6 governors 197:22 198:18,21 290:21 governor's 190:7 Grab 93:8 gradually 152:17 grand 290:6 grandchildren 220:21,22 grandfather 186:16 graph 89:4 graphite 133:19 graphite-modera... 134:3 grappling 240:4 grass 195:10 grateful 44:13 gratification 184:4 gravitas 209:6 great 8:21 22:5 40:2 45:8 68:11 114:15 154:9 182:17 186:17 221:6 225:6 268:5 268:5 285:16 289:1 greater 20:7 245:18 248:4,10 251:15 257:17 greatest 163:6 greatly 40:4 158:16 240:4 257:21 258:8,19 green 44:19 45:6	295:1 ground 20:8 34:6 100:1 306:16 group 20:2,9 43:1,2 110:12 146:20 165:16 167:8 226:5,8 245:3 279:11 306:22 groups 23:12 103:8 117:6 125:11 142:16 289:19 grow 178:8 195:10 220:22 304:16 grown 251:3 264:20 growth 29:10 171:2 264:19 266:2 268:19 271:6,9,10 301:17 302:3 guarantee 288:20 guess 88:22 89:16 129:9 173:3 220:2 224:8 227:2 248:20 255:19 264:2 281:22 283:12,13 289:7 292:8 293:8 300:8 300:9 guidance 6:13 132:9 guide 104:9 guided 271:18 Gulf 204:8 237:14 guys 27:2 34:5 44:1 44:3 207:8 212:14 303:6
<hr/> H <hr/>				
H 241:21 Hague 54:15 68:22 69:2,3,8 70:6 71:14,15 87:16 half 4:10 134:7 142:2 143:11 145:21 196:18 218:22 237:18 271:10				

Hamilton 1:11,14 4:11,12 10:4,9,13 24:12 25:2 27:11 29:2 30:18 34:19 36:21 39:21 44:8 44:11 61:20 66:13 72:13 78:2 82:6 88:1 92:19 93:10 106:15 114:12 116:18 119:11 122:6 126:10 128:19 131:1 146:9 149:7 151:8 152:4 153:18 155:14 156:10,15 157:5 168:15 188:9 225:22 228:10,17 229:21	hat 281:15 hate 238:8 hawks 222:5 hazardous 141:13 299:18 hazards 299:16 head 153:1 164:17 165:15 headed 131:12 188:10 health 178:18 195:17 healthy 250:12 hear 5:7 6:7 7:19 8:7,10 114:6 160:3 182:1 210:4 240:19 263:21 heard 6:7 116:21 118:8 138:15 153:14 155:5 161:7 163:2 164:3 167:13,14,18 171:9 211:16 241:11 260:10 263:22 264:1 266:3	helpful 84:15 115:16 127:12 151:18 170:13 291:20 helping 240:3 268:10 290:13 helps 254:2 heretofore 174:19 hey 34:13 212:14 292:16 higgledy 251:4 high 19:20 51:5 86:16 152:3 178:17 259:11 276:14 290:19 291:10 higher 28:22 29:11 57:22 141:1 150:6 150:8,14 181:12 294:9 highest 47:1 176:22 178:14 highly 101:21 260:18 277:16 high-level 6:1 12:7 18:21 20:20 22:4 50:19 55:1 76:19 85:4 114:19 164:15 167:2,3,12 196:20 229:11 233:10 258:15 301:2	home 159:12 homesteaded 186:16 honor 195:11 honorable 45:12 98:12 158:17 159:2 honored 170:16 hook 163:16 hope 94:11 113:20 176:4 177:6 184:2 197:14 216:10 220:18 244:20 hopefully 44:7 hoping 25:13 113:11 280:14 Horonobe 21:7 horror 294:19 host 94:22 101:8 104:13 109:21 110:14 111:5,19 121:11 128:10,14 128:17,21 138:2 232:12 243:19,19 244:4 246:6 247:4 247:9 293:9 hosted 132:16 hosting 138:8 272:6 hosts 247:8 279:15 287:3,12 hot 172:11 hour 19:17,17 27:15,17 28:7,8 35:1 199:16 hours 28:11 house 77:4 163:16 187:13 223:21 Houses 97:12 How's 234:12 huge 36:5,11 111:12 152:12 humans 276:22 hundred 201:7 203:8 258:7,8 hundreds 101:16 259:15	hurdles 295:14 hybrid 142:22 hydro 26:7 93:22 hydrocarbon 219:11 <hr/> I <hr/> IAEA 15:20,22 16:2 32:5 86:16 120:21 Idaho 2:16 159:4,7 164:12 165:21,22 172:15 186:17 193:22 200:12 203:14 289:14 idea 34:16 64:6,16 74:17 76:18 79:6 79:8,18 86:10 138:19,21 148:5,5 149:15 154:13 198:4 208:6 227:13 252:5 253:17 295:17 ideas 32:11 79:20 141:22 161:3,5,8 193:7 identified 55:4 271:14 identify 36:1 99:10 253:18 270:13 289:11 301:13 identifying 126:14 IFR 175:4 202:1,19 229:1 ignore 225:11 Igor 132:10 illegal 265:8,13 illustrated 192:2 illustrating 148:21 imagine 125:15 182:3 immature 150:18 immediate 62:18 93:18 266:15 immediately 18:9 166:18 immobilize 283:2
---	---	--	--	---

298:17	importantly 272:5	125:22	individuals 5:8	180:17
impact 42:5,6,11	importing 152:8	incorporation	106:2 193:14	initially 115:20
43:18 59:2 60:22	imposed 244:8	23:22	288:21	175:9 214:17
61:4,9 108:18	289:16,17,18	incorrect 211:4	industrial 49:20	initiate 121:12,22
146:7 199:4 207:7	impossible 63:20	incorrectly 108:16	83:13	initiated 95:9 99:1
256:11	63:22 77:4,6	increase 11:11 13:1	industries 173:8	104:18 117:13
impacts 276:10,18	impressed 209:11	16:6 91:9 133:4	industry 19:11	initiates 107:4
276:22 282:15	impressive 106:21	266:8 267:2 269:2	43:19 45:6 65:7	initiatives 244:15
implacable 292:5,6	improve 13:7 254:2	302:13	83:6 123:15 124:1	inject 60:2,3 81:20
implement 97:7	improvement	increased 91:2	150:12 198:22	83:7
98:8 103:2	102:17,18 282:17	134:2	213:10,16 219:14	injected 15:5
implementation	inability 265:2	increasing 13:13	222:10,13,15	ink 166:12
95:3 98:22 101:2	inadequate 251:13	22:12 48:6	223:8,13,14 224:5	innovation 13:11
102:3 103:21	inappropriate	independence 46:9	224:21,22 225:4	innovative 22:12
105:17	185:3	46:11 161:11	227:3 228:21	24:3 32:11 193:7
implemented 4:21	incentive 81:19	226:22 227:4,13	229:15 232:8	input 103:20 113:1
120:3 158:1	168:11 181:13,14	227:15,18 229:12	234:18 236:9	insert 139:12
233:16	275:21 284:11	229:22 230:5	249:20 250:8,18	223:20
implementing	285:11	231:10,13,13	303:2	insight 293:19
101:11 102:10	incentives 161:13	independent 96:22	industry's 171:2	insights 170:19
import 25:21	189:12 206:5,6	117:16 118:1	infinite 193:1,10	insist 61:3 302:15
importance 13:14	279:22 283:16	132:6 143:19	204:4 263:2	inspired 291:14
15:13 21:20 36:19	inception 117:9	144:7 150:20	281:20 305:11	installation 52:19
104:15 194:14	incident 42:5,15	151:4 180:14	306:1	54:15 71:16 76:15
231:20	incidents 42:5	191:22 192:14	influence 289:1	77:4,22 81:8
important 13:4	incinerate 137:6	226:5,8,12,21	influenced 4:19	83:15 90:8,15,15
14:15 24:17 36:10	148:7	227:6,10 228:1	8:14 124:21	90:19 225:17
37:14 50:17 51:21	include 5:18 81:10	247:19 248:21	inform 114:4,20	installations 79:10
59:21 60:8 61:15	82:16 110:9,11,13	254:1 272:10	208:22 217:16,19	225:18
62:7,11 65:16,21	119:8 233:6	288:1,10 293:13	information 8:20	instance 110:10
66:6 73:1,5 76:20	242:13 261:7	India 147:7	21:19 35:21,22	113:22 114:3
77:20 82:10 84:22	276:6 279:22	Indian 177:3	66:3 99:12 103:16	117:10,21 124:6
100:20 108:5	included 29:17	238:21	113:12 217:6,21	177:1,11
112:19 118:3	261:4 277:7	Indiana 186:12	250:11 282:13	instant 184:4
119:8 122:9	includes 27:20	indicate 30:21	287:4 289:21	instinct 287:21
123:18 136:14	234:3 260:1 261:8	indicated 27:14,19	informative 156:13	Institute 9:18
156:19 175:14	including 4:18	29:6 32:21 119:16	informed 95:1	131:10 132:9
194:18 210:21	12:10 19:13 24:18	154:19 226:6	101:8 104:13	138:22 139:2
220:14 236:16	39:19 83:21 84:5	234:8 235:22	121:11	institution 254:2
238:13 239:3,7	99:19 103:6	indication 157:2	informing 218:1	254:18 288:17
246:4 250:16	142:12 144:2	indications 140:21	infrastructure	institutional 5:21
256:7,13 258:3,18	270:9	indicative 89:19	11:22 101:12	246:16 248:14
259:17 260:7	inclusive 6:6	indigenous 11:14	280:2	institutionalized
261:6,12 269:2	104:15	indiscriminately	ingredient 123:18	189:1
284:15 289:8,10	inconsistent 254:22	164:15	218:15	institutions 248:17
297:22 298:11	279:3	individual 116:1	initial 46:14 118:9	280:1 285:19
305:2	incorporated 84:11	193:15	139:15 155:3	286:5

insufficiency 278:12	261:17 262:1,10 265:16 266:14	72:5 275:1 282:20	island 20:16 33:12 170:21 171:5	J
insufficient 96:10 140:11	273:6,16 274:17 277:7 302:3	invest 14:19 52:16 147:20 265:4	isolation 94:18 100:16 106:8	JAEA 20:22 23:13 23:20
integral 114:10	interior 139:22	invested 38:2	issue 36:10 41:2,13 48:15 61:18 62:22	Jane 241:12
integrated 21:1 151:3	159:3,15 172:9 176:17	investigated 275:17	85:14 92:10 112:7 144:14 153:14	January 9:12 164:10 271:14
integration 35:5	intermediate 24:10 58:7 258:12	investigating 5:17	160:12,20 162:11 167:5 171:6,14,15	Japan 2:4 9:10,20 10:17 11:2,5,20
integrative 133:6	intermediate-level 71:21	investigation 21:13 55:7	171:20 172:1,8 173:19,20 174:1	14:6 15:17,19 16:7 19:9,22
intellect 162:16	internal 87:17 108:2 140:3	252:2 268:5	177:10 182:12,20 183:15 185:15	20:13 21:4 25:10 25:17,18,21 29:8
intellectual 162:11	internalized 82:13	inviolable 195:9	186:20 192:11 193:5,6 195:20	31:5 33:10 35:3 38:21 39:11 85:11
intend 5:17 7:10 67:2 154:19	internally 254:6	invite 44:3,4	196:1 198:1 201:20 206:15,16	87:19 128:22 134:20 135:12
intended 183:16 263:15	international 12:15 14:4 15:14 36:13	invited 6:14 21:11 143:7	210:6 214:6 215:13 220:2,6	143:16 Japanese 10:8 13:6
intent 270:12	36:15 44:19 47:5 100:4,19 101:17	inviting 32:4 44:1 99:7 132:2 253:6	221:2,9 222:8,19 223:6 228:12,16	13:20 14:2,6 22:2 26:11,20 38:16
intention 154:22	104:11 106:7 135:6 138:9 143:7	involve 101:13,18 222:10 229:12	231:19 236:16 237:3 238:13	26:11,20 38:16 63:14
interacting 150:17	internationally 123:21 124:2	243:3 250:1 257:14 289:19	248:20 252:16 281:5 285:20	Japan's 3:4 25:8
interacts 285:4	interpretation 151:19	222:10 229:12 243:3 250:1	288:13,14 295:20 301:3 306:10	Jim 2:19 3:17 158:12,15 165:2,3
interagency 245:2 279:11	interpreted 177:1 299:13	257:14 289:19	issued 98:2	165:4,5 175:20,22 191:7 195:7 220:5
interest 24:21 107:4 108:10	interrupt 225:22	involved 19:14 52:3 99:18 100:6	231:19 236:16 237:3 238:13	225:5 238:11
132:13 222:15 300:12	interstate 243:14	113:7 120:15 132:13 197:5	248:20 252:16 281:5 285:20	JNFL 15:3 18:6,17 18:22
interested 6:8,17 38:14 51:17 65:18	intervening 171:16	208:9 229:16 288:22	288:13,14 295:20 301:3 306:10	job 84:7,7 163:21 167:1 218:7
71:20 78:13,16 102:7,21 106:2	interviews 145:4	involvement 101:5 160:12 249:20	issues 5:9,18 9:21 40:5 43:7 66:5,5	167:1 218:7
113:15,16 114:1 128:12 172:6	intolerable 125:15	involves 105:4	88:5,11 129:10 135:13 145:2	jobs 181:10
180:3 221:13 232:13 234:18,19	intrinsically 283:3	involving 102:21 104:16	159:7 171:19 172:22 173:14	John 2:17 3:16 159:9 174:16
283:21 285:18	introduce 55:22 141:22 154:20	Iran 156:6,20	175:1,2,7 176:8 179:4 184:10	187:12 205:18 217:20 240:20
interesting 119:13 146:21 147:1,17	introduced 13:12 18:10 32:10 41:22	Iranian 157:2	190:8 192:6,7 196:22 216:16	join 79:7
160:18 162:10 173:2 227:22	50:22 136:18 141:18 155:18	Iranians 154:1	228:19 231:15 240:3,15 242:17	joining 93:20 94:5
302:1	introducing 143:16	Ireland 158:18	248:15 281:11	joint 36:19 153:16
interestingly 161:5	introduction 17:15 105:13	irregardless 218:9	issuing 182:18 300:11	jointly 14:17
interests 232:9	introductory 179:15	irrespective 33:11	Italy 147:19	joke 148:16
interface 121:1,13	inventory 51:10,12 51:19 52:4 53:11	irresponsible 239:15 264:8	item 280:20	Jonathan 1:18 72:16 78:3,4
interfere 83:17		irretrievable 221:10	items 238:18	114:14 116:18 180:1 285:22
interim 86:7 164:20,21 203:7		irreversible 74:21 75:1		294:15 298:8
245:17,20,22 246:2,8,13 255:11		Isaacs 245:9		joule-heated 18:21

JOYO 14:11 17:17	191:3 199:12	91:3 114:21	largely 61:11 96:12	145:4
judge 166:16	208:15 210:11	148:10	125:22 134:21	leads 207:20 302:3
judging 221:16	216:12 230:18	knows 147:3	139:19	lead-cooled 137:3
July 7:10	235:10 284:14	213:11	larger 136:17	leak 23:1 42:8
jump 27:7	285:13 289:6	Knox 215:18 216:7	233:2,16	leakage 40:19
June 101:10	290:15 291:6	Kondo 2:4 3:5 9:10	largest 166:2	leaning 118:11
jurisdictions 293:9	King 178:15	9:11,19 10:3,9,12	Las 294:12	learn 4:16 8:17
Justice 166:13,17	Kirienko 153:1,13	10:15 24:12,15	Lash 1:18 78:5	104:22 106:4
250:8	knew 234:8	25:3 26:3 27:12	80:9 81:1 116:19	108:4 109:11,17
justification 136:15	know 26:11 27:2,6	28:3 29:5,16	118:4 180:2,12	114:2 128:1
	27:21 30:10 36:12	31:13,17,22 33:6	294:16 296:9	131:18 247:3
	41:4,8,21 43:5,10	35:2,16 37:7,19	297:21	295:2
K	48:6 66:1 67:1	39:1,6 40:1,18	lasting 192:17	learned 41:18,19
Kansas 170:1	69:5,6,6,6,7 76:11	41:3,18 43:8	late 138:22 148:13	227:21 288:19
188:16,18 189:20	76:15,20 79:15	44:11 128:22	244:16	290:12
Kazakhstan 137:12	81:9 89:9 91:10	Kondo-sensei 25:6	latest 153:14	learning 117:14
keenly 172:6	106:22 108:22	Korea 153:16	LaTOURRETTE	175:11
keep 9:3 32:12	109:2,3 120:22	Koreans 153:4,5,13	2:21 3:21 252:20	leased 246:18
38:12 49:2 94:6	127:7,14 129:5	Kremlin 146:22	252:21 253:3,4	leasing 154:14
114:16 187:22	151:11 155:12	Kurchatov 132:9	269:6 282:14	155:17
191:20 240:17	164:22 170:9	132:10 138:22	284:4 303:10	leave 63:5,20 74:9
290:14 306:13	171:18 185:5	139:1	304:13 306:2	122:13 138:20
keeping 259:10	186:19 188:5,14		launched 113:2	225:18 264:5
Ken 2:10 3:10	190:21 191:6,11		law 55:20,20 72:22	268:20 280:16
93:14	195:19 196:14	L	73:6,16,17 85:20	leaves 245:10
Kentucky 178:16	203:8,22 207:3	La 54:15 68:21	85:20 86:1 129:3	268:15
key 30:12 102:5	208:20 209:4	69:1,3,8 70:6	129:11 130:11,12	leaving 65:1
229:13 242:6	212:7,10 213:9,14	71:13,14 87:16	144:15,19,20	led 91:4 95:13 99:6
251:20 263:10	219:6 223:18	laboratories 21:5	155:21 156:5	99:12 103:15
279:20 306:20	225:9,17 228:6	44:2,6 171:12	172:18 240:21,22	251:11
kilometers 55:4,9	229:18 234:10	211:9 214:4	241:6,8,15 265:12	Lee 1:11,14 164:17
59:16 81:17 90:14	246:19 251:4,17	Laboratory 159:8	289:18	165:7 169:16
kilowatt 19:17,17	252:10 260:10	159:13	Lawrence 159:12	left 9:6 144:3
27:15,17 28:7,8	261:9 263:16	lack 25:15 41:8	laws 143:18	207:14,15 250:7
35:1 199:16	264:19 267:13	134:21 182:12,13	lawyer 241:13	280:4 296:19
284:10	279:14 280:21	183:17,18 185:16	lawyers 250:7,10	legacy 197:18
kilowatt-hour	281:13,16,19	217:5,6	layered 112:13	215:3 248:18
133:16	284:9 286:15,18	ladies 45:13 181:5	LBM 133:20	legislation 116:4
kind 10:22 33:8	287:11 291:11	laid 224:3	lead 137:2 141:11	125:22 151:6
34:14 54:22 55:15	292:2,9 294:14	lame 223:22	279:13 280:18	152:14 223:21
57:1,2 66:21	296:16 299:4,12	land 137:11 176:9	leader 35:4 292:20	243:13 300:10
76:14 77:21 81:8	301:11 303:6	176:11,12,22	leaders 5:2 103:9	legislative 105:13
85:9,19 87:5 90:2	304:2,14 306:2	196:2,6 246:18	103:10 190:13	legislature 170:21
90:17 117:1,5	knowledge 101:4	language 177:5	leadership 109:14	legislatures 300:9
128:4 139:4	185:19,22 189:18	large 16:1 81:11	110:1 123:2	legitimate 110:19
149:11 151:15	221:7	122:12 123:8	279:10 288:21	111:5 187:5
152:18 184:8	known 64:17,17	146:21 155:1	leading 4:17 53:20	length 186:2
186:22 190:15		170:8 183:11		

lengthy 201:6	159:14	211:21 233:19	129:18 132:7	200:8 201:19
lesser 227:13	life 51:6 130:4	279:3 284:18	159:5 170:6	212:6 233:3
291:22	186:3 303:20	286:2 288:18	177:16 192:7,14	291:20
lesson 244:3 248:3	lifetime 48:22	292:9 294:22	192:16 193:7	looks 123:21 299:1
lessons 41:19 42:16	134:15 156:21	296:1 301:5	195:9 202:20	looming 293:15
242:7 289:8 293:6	life-cycle 19:19	live 292:19	207:12,13 214:19	loose 190:1
letter 161:21 162:5	light 9:5,7 11:7	lived 258:12	215:15 221:20,22	lose 290:14
165:6 182:18	12:3,5 16:18,21	Livermore 159:12	227:16 229:9,11	losing 290:2
187:20 232:6	18:2 37:11,16	lives 206:1	258:11 292:7	lost 153:3 186:21
letters 162:7	38:7 133:17 134:6	living 216:17	longer 75:5 170:4	lot 43:5 49:7,13
182:20 183:2,3	136:6 140:20	Liz 118:8	189:20 205:2	50:10 52:1 61:2
let's 61:7 120:13	154:20 171:22	load 18:1 150:5,7	233:15	62:16 65:12 73:5
127:14 188:15	274:6,14 275:2	150:11 258:4,10	longevity 229:9	79:4 83:15 87:19
193:21 199:10	301:19	loaded 11:15 17:18	long-lived 51:7	92:5 111:7 127:13
203:22 208:6	liked 210:13	loading 58:21	55:2 141:14	135:10 146:14,15
213:13 222:13	Likewise 283:4	local 23:2 43:19	174:14 259:3	147:4,7 163:15
224:8	like-minded 24:18	81:21 82:2,4	long-range 194:4	186:4 193:13
level 19:21 47:5	limit 305:14 306:4	90:11,14,14,19	long-run 247:22	202:17 215:5
51:4,5 90:10	306:15	107:10 110:1	long-term 57:11	216:6 225:9
92:10 96:8 121:5	limitation 140:10	136:4 187:6	79:21 85:3 92:15	228:11 235:9
130:15 152:1	limitations 254:14	190:14,14 194:6	97:4,18,22 99:11	250:9 255:21
188:15 189:6,9,15	limited 55:8 95:17	243:19 244:4,11	101:18 102:6,13	257:12 259:3,22
190:14,15,15	129:5 135:12	246:6 247:8,18	105:14 106:8	260:4,10 264:22
191:3 194:6,6	217:3 244:2	278:6 279:17	118:14 129:11	266:20 280:15
258:12 259:1,2,11	245:17 274:5,14	290:2 292:15	195:3 204:22	288:19 290:12
259:13 260:5	276:14 297:19	293:9 299:3	206:4 229:22	298:2 301:18
276:15 290:20	limits 245:21 305:8	localities 280:17	249:8 271:19	303:18 304:14,15
291:10 296:18	line 18:22 164:7	287:13 293:22	272:1,7 273:22	low 51:4 61:4
levels 21:22 112:14	208:4 238:17	294:2	282:17 286:21	256:16
290:2	lines 189:16	locality 248:1	287:1 297:14	lower 271:5 294:5
liabilities 65:19	link 92:15	249:3	306:22 307:4	low-level 164:15
250:2	linked 246:17	localization 81:13	look 7:15 41:12,13	172:13 184:21
liability 129:12	liquid 137:2 141:10	locate 167:11	48:15 76:17 90:18	243:12,16 248:5,7
license 55:13,16	liquidate 250:14	located 20:14 94:22	94:5 111:17 122:8	251:15 278:12,14
73:21 74:9 98:2	list 115:3 165:13	101:7 246:14	124:1 127:20	278:18 279:11
103:4 261:10,22	198:16 256:13	location 16:8 55:5	128:2 172:18	280:3 294:20
273:11	listing 115:5	127:21 168:12	181:18 185:8	306:7
licensed 273:12	litigation 122:3	173:6	202:5 205:13	LWRs 150:7,8
licensing 120:14	287:18	locations 6:20 35:8	228:22 243:4	l'Energie 83:3
268:14 281:3	litigious 220:17	lock 188:3	253:11 278:10	
296:5	221:1	locked 89:20	301:10,12	M
lie 41:4 207:18	little 25:14,22 83:7	236:10	looked 174:15	MacFARLANE
lied 165:11	133:15 146:2	logic 220:15 238:20	254:13,17 274:4	1:18 36:22 37:9
lies 209:17,20	148:17 150:14	logical 39:7 88:12	looking 37:20	38:11 39:4 66:18
281:19	151:11 163:14	long 30:12 38:18	42:21 76:9 111:12	67:11,17 68:5,9
lieu 290:1	164:2 167:2 171:6	48:14 66:12 96:4	140:14 146:18	68:18 69:1,5,9,12
lieutenant 2:17	186:18 189:14	100:5 111:13	184:11 196:12,17	69:15 70:10 71:11

71:17 72:6,9 114:15 115:9,12 115:15 116:9,17 220:1 232:5 285:16 286:13 288:3,7 305:13 Machine 133:9 magic 186:20 magnitude 60:21 main 47:2 50:4 54:11 55:15 61:18 65:7 92:9,10 123:10 176:8 277:10 maintain 11:22 103:4 196:22 261:12 267:20 maintaining 261:8 261:21 262:8,10 262:20 268:7 majeure 297:17 major 17:16 24:21 54:14 59:10 63:14 97:16 108:11 137:16,22 159:21 177:1 179:4 231:15 271:15 279:13 majority 13:20 22:2,5 128:10 133:16 135:16 292:20 making 23:18 29:12 43:22 96:15 102:22 121:16 124:3,22 146:8 163:11 211:22 214:20 230:11 266:16 289:4 290:9 manage 39:20 52:15,20 75:4 78:18 100:3 198:10 239:17 272:10 286:21 296:19 managed 78:15	85:7 196:16 197:10 management 2:11 5:6,22 6:21 18:12 19:20 23:16 40:20 42:16 49:12,17 50:15,17 51:22 52:14 53:2 54:21 66:4 83:10,14 88:7,17 89:11 91:3 92:9,14 93:15,18,21,22 94:3 95:7,16 96:19 97:5,6,18 98:1 99:6,11 100:10,15 103:3 105:15,21 122:15 130:7 158:13 249:7 254:13 255:3 256:6 267:8 270:7 272:6 277:14 303:14 304:1,5 manager 158:12 managerial 13:11 managers 270:4 272:4 managing 3:20 5:15 82:11 84:9 84:16 124:18,20 252:22 253:12 254:16 260:16 269:12,21 294:20 307:1 mandate 97:3,3 106:12 124:19 manner 6:6 87:22 101:2 manufacturers 223:9 manuscript 291:16 map 78:9 MARK 1:15 market 77:16 145:17 280:15 283:15 284:11 market-based	283:22 market-driven 285:12 Marriott 1:10 Maryland 2:12 131:6 132:16 138:7 139:10 mass 31:11 88:9 284:12 match 129:18 material 32:13 50:12,16,18,21 52:4 138:4 140:11 171:7 173:1,5,10 185:5,10 186:1 193:8 203:3,4,13 211:8 212:3,8 224:18 282:20 materials 12:5 64:3 65:4 136:9,12 138:21 200:10,20 201:2 236:2 math 32:8 204:14 matter 65:16,21 93:3 107:10 127:3 127:9 157:12 172:21 185:20 209:18 240:8 255:17 307:12 matters 34:3,7 43:21 64:16,19 mature 59:7,8 maximum 212:7 213:22 Mayak 150:3 mayor 21:15 43:3 43:16 129:2 mayors 21:11 43:1 43:9 mean 78:6 81:6 91:19 107:15 110:4 113:17 125:15 151:12 155:17 166:13,15 196:10 212:6 216:3 225:15 250:5 251:17	291:13 296:14 300:20,21 303:1 303:11 304:14 305:1 meaning 64:6 204:22 meaningful 293:10 means 34:10 219:13,21 239:2 245:13 247:9 278:14 291:6 meant 256:1 measure 227:3 229:22 230:4 255:5 measured 262:3 measures 81:19 134:5 141:17 mechanism 52:10 79:18 174:1,9,9 174:10 175:1 207:20 208:15 213:6 224:11 225:2,3,13 299:7 mechanisms 103:5 103:17,19 104:4 105:17 185:4 212:1 214:9 224:14 277:15 median 92:15 medicine 178:12 Medium 133:8 medium-level 55:1 Medvedev 147:8 148:22 Medvedev's 153:15 meet 6:10 7:10 100:11 121:7 157:7 257:16 296:13 meeting 1:4 4:9 36:18 121:17 157:17 307:9 meetings 6:16 Meeting/Review 3:2 meets 299:9	megawatt 134:14 megawatts 141:6 Melox 54:15 melter 18:21 19:5 member 7:20 25:6 27:12 29:4 30:16 30:19 31:15,19 32:18 34:21 36:22 37:9 38:11 39:4 39:22 41:1,11 42:19 44:22 45:6 66:18 67:11,17 68:5,9,18 69:1,5,9 69:12,15 70:10 71:11,17 72:6,9 72:18 75:8,13 78:5 80:9 81:1 82:8 84:14 87:12 88:3 91:1 106:19 107:15,19 108:8 109:19 110:17 111:22 113:9 114:15 115:9,12 115:15 116:9,17 116:19,21 118:4 119:12 121:18 122:2,7 125:7,9 125:10 126:11 128:20 130:17,21 149:10,17,22 150:5,15 151:10 152:6 153:20 154:17 155:16 156:14,18 179:22 180:2 186:8 190:4 192:19 193:9,12 197:20 206:21 208:2 214:16 220:1 230:6 232:5 232:16 233:18 237:20 248:22 277:22 280:19 282:11 285:16 286:13 288:3,7,12 294:16 296:9 297:21 298:6 299:19 300:1,4,7
--	--	--	---	---

300:16 301:9 304:6,22 305:3,13 305:16,19 members 1:13 8:15 10:5 45:12 162:21 169:9 176:1 248:22 270:2 271:1 282:12 288:4 memorandum 120:16 men 92:8 277:17 mention 52:10 54:14 66:10 70:19 70:20 241:18 mentioned 16:18 40:10 52:5 53:5 55:11,12 56:8 64:8 66:5 67:9 70:11 72:4 80:8 81:16 82:15 83:19 86:6,14 92:17 118:5 125:19 137:17 141:8 143:2 147:21 182:15 194:9 220:14 237:2,3 241:12 293:7 298:12 mentioning 77:18 mentors 187:13 Meserve 1:19 27:12 34:22 35:18 119:12 121:18 122:2 153:20 154:17 277:22 280:19 294:17 Meserve's 295:4 message 179:12 met 85:10 271:11 metal 275:17 meter 71:1,2 233:22 234:1 235:16 meters 20:8 44:2 method 100:14,15 100:18 270:14	methods 21:1 102:15 103:13 176:4 270:17,19 metric 38:21 70:15 71:21 155:10 Metro 1:10 Mexico 169:4,11 170:2 180:22 247:10 279:16 289:15 Michael 181:21 Michigan 170:1 189:21 microphone 10:11 mics 231:3 mid 123:15 124:2 middle 153:12 215:3 285:5 migration 172:19 migratory 185:1 Mike 2:13 3:15 158:17 Mikhail 131:16 mil 199:16 Mile 170:21 171:5 miles 7:17 294:8 milestones 102:5 272:3 military 135:4 millennia 178:11 million 11:10 144:1 199:17 millions 172:4 mind 25:11 203:1 211:4 238:6 mindful 6:9 minds 202:22 281:14 mine 60:6,7 233:19 mines 151:22 minimization 12:14 64:7 minimize 62:14 76:18 89:17 minimizes 89:15 minimum 71:5 mining 130:3 144:3	minister 98:13 147:14 148:17 Ministry 2:6 97:10 97:11 133:8 minor 24:5 60:2 61:8 88:21 122:14 137:7 199:9 275:13 minus 177:17 minute 113:15 257:20 278:22 minutes 9:4,6,8 92:22 94:7 163:1 170:5 240:17 291:2 misgivings 282:6 mismatch 284:18 missed 129:10 182:6 missing 161:11 mission 98:7 124:19 242:12 mistake 289:5 misunderstood 176:18 177:6 178:22 MIT 198:3 mitigated 48:1 mitigation 47:4 mix 162:10,12 271:2 mixed 164:14 298:3 300:21 306:10 Mizunami 21:6 mobile 259:8 260:4 mobility 259:7 mock-up 19:3 modality 214:11 mode 198:14 model 122:9 249:18 250:19 modeled 139:12 modeling 19:5 models 123:22 moderated 133:20 modern 134:5	171:22 modest 254:6 282:22 modify 68:15 228:5 moment 5:11 30:14 38:10 132:11 141:5 153:3 167:20 172:2 194:15 228:13 231:3 235:22 301:22 MONDAY 1:6 money 34:13 52:14 52:16,17,20 80:4 81:21 83:7 163:10 177:22 197:11 199:15 202:11,17 204:7 205:4 208:11 210:6,6,10 213:8,13,15,17 218:15,22 219:8 219:14 222:4,7,9 226:10,15,15 227:16,17 228:11 228:12,16,21 231:14 238:20 280:1 monitored 94:20 100:17 159:1 160:15 monitoring 118:19 Moniz 1:19 34:21 88:3 91:1 128:20 130:17,21 149:10 149:17,22 150:5 150:15 155:16 156:14,18 197:20 206:21 208:8 Monju 14:12 17:17 22:21,22 23:3 40:10 41:10 42:4 42:14 month 18:11 24:8 66:8 months 47:17 152:22 182:18 222:7 238:22	moratorium 96:2 morning 4:13,14 5:7 7:22 8:10 10:4 36:22 45:9 66:20 93:1,13 94:10 131:4 157:7 157:17 161:9 167:14 192:2 307:10 Morris 195:12 Moscow-based 131:10 motivated 275:12 mountain 26:14 169:4 181:19,19 184:12 190:10 216:7 234:6 236:4 260:1 261:1 264:13 265:15 266:6,11 268:16 272:22 292:4 301:21 302:15,17 305:8,14 mountainous 26:12 move 40:12,17 110:15 128:13 132:19 141:1 144:8 173:16 174:21 175:13 190:22 198:14 199:2 204:18 209:21 213:3 223:5 224:19 242:9 249:18 287:10 294:8 moved 105:15 198:13 moves 21:14 moving 106:1 135:7 143:13 283:16 302:6 MOX 11:15 15:7 17:14,15,18 18:1 18:8,13 37:3,11 38:17 39:2,20 54:8 56:16,17 62:5 67:6,9,19,20
--	--	--	--	---

67:21,22 68:3,12 68:17,19 69:10,13 69:16,21 70:5,13 70:18,21 71:4,8,9 87:8,10,18 88:15 89:14 135:9 148:7 150:2 154:20 235:13 274:13 275:1 multi 143:4,9 248:21 multiple 188:4 256:5 274:16 288:15 290:7 301:15 multi-barrier 20:6 20:13 multi-generations 190:13 Multi-party 103:13 municipal 21:22 103:9 municipalities 21:12 44:4 municipality 110:10 mutual 12:19 22:10	130:20 131:2 167:19 nation 2:19 34:9,10 109:15,15 110:11 114:3 163:7 168:9 176:9,11 180:14 197:13 203:14 205:4 214:3,4 national 21:21 52:5 53:7 90:8 99:9 101:12 133:7 144:5 145:1 159:7 159:12 182:14 183:18,21 184:11 189:9 193:5 206:12 215:4 216:5 222:17 251:2 nations 4:18 8:13 8:21 157:19 177:3 179:8 274:3 nationwide 220:19 nation's 158:12 271:22 natural 25:12,15 25:16 26:4 56:15 57:18,20 97:10 130:4 151:22 178:5,6 241:20 nature 110:3 151:16 183:8 185:12 200:4,4,22 201:14 288:22 NC 45:4 NEA 27:1 near 17:6 67:13,15 73:20 77:4 90:7 90:19 160:21 212:12 220:11 275:4 303:4 nearby 224:7 nearly 174:12 264:20 neat 109:10 necessarily 43:10 168:7 221:15 246:15 266:11	277:12 necessary 13:5 14:21 94:21 102:17 105:8 142:5 195:5 278:9 279:5 286:8 293:11 299:4,5 necessity 34:1 36:19 226:4 need 67:7 68:14 71:3,4,8,10 76:8 80:4 100:18 104:11 111:19,20 127:20 134:16,21 155:8 158:2 161:4 183:22 185:8,9 187:2 191:22 193:3 197:13 200:17 201:2,12 205:11 206:2,12 207:20 208:10,15 209:4,7 210:1,1 210:22 211:2,12 212:16,17,18 217:22 229:8,12 234:11 235:8,22 242:9,15 245:10 245:15,16,16 248:11,16 249:17 250:14 251:16 258:13 259:14 263:21 273:15 278:6 281:18 285:8 286:20 300:18 301:3 302:8,10 needed 184:7 206:19 233:2 249:5 272:16,21 273:17 277:15 285:18 298:17 needs 28:17 62:14 179:12 192:14,18 193:6 196:3 203:16 239:1 257:22 258:2,9 272:14 273:21	284:17 299:9 306:21 negative 48:5 89:7 91:10 208:21 negatives 91:4 neglected 244:13 negotiable 127:11 negotiate 198:12 negotiating 155:19 negotiation 15:18 243:20 244:4 279:16 negotiations 44:20 111:8 138:13 negotiator 158:21 neighborhood 22:7 neighboring 112:10 neighbors 110:13 neutron 12:11 14:8 14:10 22:19,21 23:9,14,21 24:3 39:9,12 57:17,22 135:17 136:11,14 138:10,10,17 139:18 140:9,18 141:2 142:10 143:9 147:6 155:11 neutrons 136:13 140:13 141:17 142:12,15,19 Nevada 242:3 289:14 290:1 293:18 never 63:6 127:8 186:11 235:21 290:6 303:15 Nevertheless 88:21 new 2:20 5:16 13:8 33:20 49:3 60:6,7 68:14 70:6,9 71:6 71:9 74:12 84:17 86:11 92:12 96:13 101:3 133:11 134:10 138:14 149:4 151:6	152:21 154:6 155:8,11 163:15 169:3,11 170:2 171:22 180:22 188:17 189:7,7 191:14 194:1 197:8 198:2,19 199:22 200:2 202:15 204:3 208:11 210:9 215:7,10,10,14 216:8 238:19 240:21 241:6 242:10 243:14 244:19 245:15 246:16 247:10 248:16 249:4 261:19 262:4 265:17 268:18 279:16 280:10 284:19 285:19 289:6,15 newcomer 85:13 newcomers 65:19 newer 176:19 newly-built 153:11 news 91:8 153:14 277:4,5,5 Nicaragua 178:4,4 nice 27:13 129:1 night 182:15 non 77:22 nonproliferation 15:15 60:10 62:2 86:19 non-Aboriginal 108:1 non-discriminato... 300:14 non-peaceful 62:10 non-profit 254:1 non-recycled 68:2 normal 91:17,18 120:18 North 166:3 Northwest 1:10 note 10:20 45:18,20
<hr/> N <hr/>				
naive 231:11 name 4:5 88:10 93:9 148:1 nameless 122:13 nanosecond 237:19 narrow 149:11,12 Nash 2:10 3:10 93:14,16 94:4,8,9 106:15,20 107:13 107:17,21 109:6 110:5 111:9 112:17 113:20 115:5,11,13,20 116:11,20 117:8 118:16 120:1 121:21 122:4 123:10 125:19 127:7 129:20				

46:2	130:10 131:19	number 8:3 31:13	obtaining 18:4 26:1	81:6,7 86:20
noted 114:17	132:4,14,18,21	32:16,17 71:19	obviously 35:18	87:20 93:6,13
282:20	133:2,7,13,14	75:9 93:21 106:22	36:2 45:17 46:22	115:9,16 116:17
notice 42:22	134:13 135:8,14	119:4 138:4	48:21 51:22 57:8	130:22 132:20
notion 234:22	135:16 141:7	151:13 155:1,7	65:17 66:2 70:5	147:1 148:15
281:6 282:4 293:9	142:8 144:15,21	187:1 219:17	80:5 82:1 166:4	149:17 150:15
notional 260:18	145:7,10,12,13,14	261:21 263:2	186:20 187:1	157:6 169:17
November 1:7	145:22 146:6	270:20 281:20	190:5 208:17	188:16 202:17
164:9	147:15,20 148:2	numbers 31:1,16	221:7 222:4	204:3 210:8 220:1
novo 90:2	148:12,22 150:11	142:17 172:5	250:16 260:18	228:9 253:7 260:8
nowadays 36:10	152:16 153:4,9,12	numerous 221:16	273:6 288:15	300:16
NPP 62:14 86:11	153:16 158:6,10	276:17	296:12,15	old 144:20 148:1
92:12	158:21 159:7	NUMO 21:9,19	occasion 28:16	151:21 152:15
NPPs 56:16 62:19	163:5 164:12	22:9 43:1	occasions 41:7	198:13
NRC 151:5 273:9	167:12 171:1,7,12	NWMO 96:18,20	occur 129:15 130:1	OMB 239:1
281:16,18 296:5	171:18 173:16	97:7,8,12,21 98:7	130:2	once 93:10 134:17
nuclear 1:2 2:10	176:7 182:7	98:16,20,21 99:1	occurred 22:22	166:19 186:21
3:4,6,9,11,18,21	194:16 195:12	99:12 101:10,19	172:8 215:2 252:1	235:12 236:12
3:22 4:8,18 5:5,15	196:14,17 197:9	102:2 105:8	odds 247:12	251:18
5:20 6:3,21 7:2,4	197:12 199:17	106:12 118:9	OECD 60:13	ones 68:16 78:7
8:13 9:13,18 10:6	203:3,3,15 208:10	286:18	offending 259:20	82:9 124:2,5
10:8,16 11:4,5,13	208:14 209:8	NWMO's 97:1,2	offer 258:20	149:12,12 301:13
11:21 12:2,9,18	211:5,8,15 213:10	99:6 100:9 101:9	offers 104:21	one-quarter 133:4
13:1,6,15,21 14:1	216:5,8 221:13,17		152:17	one-tenth 31:12
14:5,14 15:15,16	221:21 222:13,15	O	office 158:21 164:9	one-third 39:2,4
19:18 24:1,21,22	222:16 223:8,13	oath 164:9	179:13 231:2,3	62:5
25:8 26:15 28:8	224:22 227:2	Obama 36:18	Officer 4:7	ongoing 103:18
29:10 30:11 36:20	232:8 234:13,15	objective 253:10	official 2:3 45:19	252:13 254:5
40:4 46:6,8,18,22	236:8 237:4,18	302:8	132:3 156:12	online 275:4
47:6,11,13,14,20	241:2,15 242:4,20	objectives 16:12	179:9	Ontario 93:22 94:1
48:12,17,18 49:1	243:7,10 244:7	102:5 118:6 272:2	officially 120:9	95:10,14 105:2
49:2,14 50:2,11	245:1,19 250:2,3	301:12,15	off-fund 53:16	on-site 255:9,13
53:3,3,20,22	253:1 260:16	obligated 192:17	oftentimes 179:2	261:8,13,21
57:11 60:15 61:11	263:12,13 264:5,8	obligation 52:11	oh 69:1 164:18	262:20 267:20
64:2,19 65:3,17	264:17,18,19	84:2 178:21	165:9,10 210:8	268:7 302:4,9
65:22 76:16 77:22	265:4,9 266:1	obligations 6:11	219:5 296:11	open 3:2 6:5 8:5
78:1 82:16 84:17	267:1 268:11,19	250:15,17	305:22	25:3 33:15 49:2
89:8 90:15 91:17	269:9,11,19,21	obliged 86:1	oil 57:3,4 204:8	52:2 58:22 59:13
92:6 93:15,17,20	270:3,21 271:2,6	obscure 148:2	236:20 237:12,14	59:18 60:3,20
94:17 95:6,7,12	271:8,12,20,21,22	obscured 250:9	okay 4:3 10:12,12	66:15 76:6 142:18
95:13,15 96:13,15	272:2 274:10	observation 89:13	10:13 24:15 28:15	152:12 179:19
96:17,18 98:3,5	275:8 277:6,17	214:18	31:13 33:6 34:19	186:18 245:11,14
99:12 102:13	280:22 281:3	observing 15:14	37:9 39:1,5 42:1	261:22 293:20
111:2 117:22	292:7 294:3	obstacles 256:10	61:2 62:1,20	opening 3:3 118:5
120:4,5,6,14,17	301:17 302:2	257:6 277:10	63:10 66:11 69:7	160:4,5,8 163:1
121:2,14 124:18	303:14 304:16	obtain 32:16 33:14	71:17 72:8,9,13	201:18 205:6
126:6 129:3	306:8	81:13	78:22 80:17,18	216:19 246:9

openness 101:4 250:10	opposed 89:22 110:19 285:11	287:22	owned 130:13	80:4 83:6 102:22
operate 6:5 29:21 49:19 54:3 74:10	opposite 184:19 305:20	organizational 102:19	owner 87:20	112:19 115:6
83:14 101:17	opposition 169:18 181:17 200:8	organizations 5:8 16:11 20:18 99:16	owners 97:17,19 98:15 101:14	117:9 118:3
172:1 271:7	292:6,12	103:15 106:2	129:22 198:12	122:19 141:14
operating 11:7 19:6 78:20 110:21	opt 78:17 180:10	117:12	ownership 87:5,6 124:13 125:13	167:21 175:14
149:5 154:16	optimist 146:1 195:1	organization's 93:19 198:6	129:12,20	178:9,19 183:11
197:15 270:21	optimistic 140:14	organize 66:6 73:11	owns 229:18	191:21 195:15
operation 18:20 20:1 22:20 23:3	optimization 283:8 284:22	organized 47:16 49:16 73:4 125:11	oxide 149:20,22 275:18	215:3 217:17,21
36:16 53:9 54:1	option 28:21 49:2 55:15 59:13,22	origin 84:21 251:8	oxidizing 260:2	222:17 226:10
54:16 56:4 59:9	60:1 118:21 119:9	original 37:5 148:5 156:20	<hr/> P <hr/>	250:20 251:20
60:15 73:10 77:3	274:5,9,16,18	orphan 248:10	pace 101:1 139:17	254:4,5 255:18
80:20 83:16	275:6 276:4,5	ought 108:15 242:17,18 246:22	page 114:18 216:3	270:20 279:20
276:12 298:10	options 5:19,21 59:19 61:1,7 97:4	252:1 282:7 284:8 291:8	paid 32:2 82:15 83:1,12 290:5	282:2 284:7
operational 138:11 143:13 232:18	98:17 99:18	outline 252:15 254:10	panel 3:24 96:1,3,6 96:11 125:21	286:11 296:22
249:6,9	157:21 158:1	outlined 219:10	126:1 160:14	297:11
operator 53:20,21 54:12 80:13,14	233:5 245:11	output 133:5 194:17	170:15 176:3	partial 211:17
144:6 145:1	249:17 253:18	outside 86:22 141:15 142:19	179:22 208:3	partially 216:1
operators 83:7	267:16 268:9	154:16 162:16	210:14 215:13	partially-spent 221:22
opinion 13:19 22:1 33:21 43:16 47:15	269:12,21 270:7	203:22 249:11	216:14 232:3	partially-used 222:22
47:16 48:2,5,9	270:15 273:2	outweigh 76:1	238:3 240:13	participants 127:14 176:15
63:13 89:4 90:9	274:5 276:14	overall 133:4 253:13 260:15	248:15 249:15	180:6
90:11 91:8 125:3	opt-out 80:8	overcome 222:19 294:13	278:5 282:12	participate 56:21 117:7 132:14
285:21 292:10	order 24:13 60:21 71:9 73:12 155:7	Oregon 265:11	panelists 210:12 240:2 278:1	143:8
opinions 161:22 285:22	196:3 199:13,14	organization 2:11 20:22 21:9 23:7	panels 26:14 103:14	participation 161:13 182:4
opponents 125:18	295:20	43:9 93:15,18,21	pappy 187:14	193:3 238:15
opportunistic 221:10	orderly 251:19 271:20	96:19 122:17	parallel 19:22 119:21	241:10 289:15,22
opportunities 196:15 216:15	Oregon 265:11	123:7 124:9,19	parameter 146:15	particular 10:21 16:4 18:15,19
221:19 254:14	organization 2:11 20:22 21:9 23:7	125:5,13 197:4	parameters 140:2	19:9 24:19,20
opportunity 10:7 40:6 45:14 104:22	43:9 93:15,18,21	198:2,5,20 199:2	paramount 178:19	28:4,15 29:17
112:22 170:16	96:19 122:17	199:22 200:2,3	pardon 166:14	34:4,11 36:12,14
175:17 176:2	123:7 124:9,19	207:1,16 226:2,17	Paris 55:4 73:20	36:15,17 37:22
189:8 195:11	125:5,13 197:4	226:19 228:7	parliament 63:8 74:3,8 97:12	38:6,10 42:8,15
207:9 208:5	198:2,5,20 199:2	231:18	113:19,22	43:20 113:5
217:19 221:19	199:22 200:2,3	oversimplify 264:22	part 12:18 20:16 28:16 40:22 41:6	120:10,12 127:10
222:12 239:9	207:1,16 226:2,17	overstated 88:9	47:18 48:1,9 50:3	127:20 137:11
244:18,19 269:17	226:20 227:6	overview 3:4,6,9,11 3:18,20,22 10:8	50:4,7 51:2 56:22	138:12 139:5
	230:3,6,18 241:11			144:4 147:5 156:8
				158:4 173:10
				179:21 214:2
				261:2,5 288:2
				290:19

particularly 122:9 172:20 180:2 238:14 257:1 284:19 294:2	126:20 129:22 166:1 180:19 183:10 189:17 190:19 215:5 217:16 219:18 220:18 292:14 301:16,18 302:15 304:15	262:4,16 268:18 276:16	pieces 173:9 209:3 260:13	268:12 272:8 277:6
particulars 10:17	perceives 294:10	permanently 274:7 274:12	Pierre 44:14	plant 13:7 14:13 15:2,3,10,12,19 16:3 17:1,4,11,22 18:8,14,15,16,19 19:18,22 20:2 28:18 29:19 30:1 30:6 32:2,4,9,11 38:5 39:15,19 42:8 49:1 53:22 54:15 72:2 197:12 295:19
parties 6:8	percent 11:8,12,12 13:2,3,22 26:6,12 28:10,22 31:11,12 32:16 47:10 48:4 48:4 56:15,17 60:16,18,22 61:4 61:7,8,8 133:2,11 133:12,19 140:5,8 142:16 145:17,18 146:1 150:10 194:17 204:13 212:7	permit 141:1 295:20 299:21 300:11	Pierre-Franck 2:6 3:8	plants 13:8,9 171:21 197:9,16 203:4 211:6 222:16 235:3 270:21 271:2,7,8 271:21 302:11
partly 265:5	percentage 80:2 140:4 174:4	permits 299:5 300:3,9	piggledy 251:5	plan's 105:16
partners 12:21 106:7	perfect 189:8 214:17 239:11	Persian 204:8 237:14	pile 213:13	plateau 223:6
partnership 101:19	perfectly 136:5 256:22	person 26:22 181:14 188:13 209:5 225:6	pilot 242:16	platform 145:12
parts 126:3 127:2	perform 23:8 191:5	personal 30:10 37:17 55:21	pinpointed 40:12	play 252:14
party 129:17 148:17 164:6	performance 20:12 257:12 259:6 276:19 282:17 302:13	personally 230:17	place 52:15,20 81:20 99:16 105:16,18 119:19 121:20 126:19 145:15 153:7 165:20,20 172:22 184:10 187:5 188:16 196:20 206:20 219:1 223:1 235:12 236:5 261:11 262:5 275:21 283:15 291:22	player 54:11
part-time 280:8	period 7:22 74:15 75:5,6 111:13 116:14 118:14 132:7 168:16 171:20 174:8 190:11 191:17 201:6 215:8 216:11 219:14 229:9 258:7	perspective 118:2 256:6 266:22 273:22 304:1	placed 96:2 305:7	players 49:13 78:9 229:13
pass 300:10	performed 254:18	Per's 88:11 153:21	places 85:2 126:15	please 61:22 64:13 66:7 92:22 93:11 241:4
passed 105:19 114:2 115:21 132:11 220:9 223:21	perish 179:3	PETERSON 1:21 25:6 82:8 84:14 87:12 122:7 125:9 152:6 232:16 282:11 298:6 299:19 300:1,4,7 300:16 305:3,16	plaguing 203:13	pleased 131:20 160:3
passing 11:21	permanent 42:21 118:11 181:10 236:1,3,10 255:15 258:13 261:19	petition 183:2	plan 5:16 37:5 38:16 47:4 68:11 69:12 72:4,12 97:14 98:10,22 99:18 100:12,14 102:3,4,22 105:14 105:20,22 116:3,5 119:6 136:19 138:7 163:4 194:4 234:8,10,11,14,14 234:22 238:6 239:14,17 287:15	pleasure 45:8,13 94:10 131:17 158:14 159:17
patchwork 251:4		phase 11:19 100:10 103:2 117:10 160:17 188:2,4 189:3	planned 138:13	plumbing 163:17
path 10:17 212:22 223:15,20 224:2 224:19 236:19 270:5		phased 252:8	planning 95:11 119:10 133:3 136:16,21 138:16 144:5,11 150:2 151:16 286:16 287:1	plus 141:11 177:9
pathway 89:20,22		phases 99:6 188:4	plans 102:16 103:21 133:21 134:9 141:15	plutonium 14:9 15:8 16:9,14 17:19,20 24:4 31:7,8,11,20,21 35:9 37:3,6,11 38:7,12,20 39:8,9 39:10,16 41:14 57:19 60:4,7,7 62:6,9,15,17,18 70:12,15,17,20 85:5 86:16 87:1,4
patiently 22:11		phenomena 19:4		
Paul 228:8		Phil 1:22 186:7 288:11		
pave 266:1 268:10 301:17 302:2		philosophy 42:1		
paving 264:18		photograph 148:21		
pay 41:5 102:13 130:14 219:18 234:20		physics 131:6		
paying 284:8 289:22		pick 225:4 283:13		
payments 116:13		picture 22:16 153:15		
peaceful 46:21		piece 204:16,17 210:20 223:20 240:18		
pending 95:12				
pendulum 126:17				
Pentagon 204:11				
people 8:3 13:20 22:2 26:8 29:9 32:21 33:22 36:7 42:7,12 44:4 63:14,18 64:12,17 73:9 99:20 107:8				

87:13 88:14 89:16 89:18 135:1,3,4,8 137:7 141:11 148:4,8 155:2,6,9 155:10 211:22 plutonium-fueled 149:19 podium 179:11 point 13:17 28:4 32:19 34:2 36:3 37:10 41:12 49:18 49:21 51:21 52:6 58:2,8 59:5 62:7 62:12 63:15 67:14 67:15 68:13 73:1 80:7 87:22 91:20 91:21 92:16 94:17 99:8,9 108:7 111:6 113:6 122:13 127:11 129:14 178:9 185:13 193:20 195:14 215:17 242:8 244:14,17 252:4 257:5 258:18 261:9,12 276:13 292:21 299:12 306:1,21 pointed 194:11 282:14 points 51:20 65:8 110:6 174:5 214:20 254:20 policies 4:20 5:14 8:12 9:1 policy 3:4,6,9,11,18 4:17,19 8:15 10:8 10:20 11:1,20 14:2 33:17 35:10 35:17 47:6,6,7 48:11,19 49:11 54:2 64:11,12,21 66:3 95:2 124:9 152:8 163:15 195:13 222:17 241:2,16 242:5 243:10 244:7	245:2,19 246:11 247:12 248:8 250:3 252:9 254:2 270:4 271:18 272:2 277:11,16 280:4,22 284:17 293:12 306:22 307:1,4 policymakers 172:5 political 62:21,22 62:22 91:22 92:1 92:10,11 123:2 150:21 161:17 164:5 180:15 181:16 182:9 192:4,5 206:1,15 216:9,17,22 217:8 218:5 221:5,8 224:20 238:9 243:11 249:1,12 277:11 287:8 288:22 292:22 politically 77:5 126:16,18 163:8 169:1 188:13 223:7 politics 162:10 181:5 286:19 293:5,17 301:22 poll 22:1 33:21 63:13 90:9,11 polls 47:15,16 pool 70:6,9 224:7,8 224:9 pools 69:20,21 255:10 273:8 poor 191:10 285:22 population 294:6 296:17 populations 108:14 portfolio 144:22 161:1 portion 28:1 pose 210:12 273:3 posed 298:8 position 32:14	86:20 91:10 169:14 171:17 190:7 209:9 292:19 293:4 positions 93:22 positive 48:2 59:2 74:19 81:10 85:12 89:6 92:2,3 positives 123:8 possession 265:20 266:17 possibilities 7:7 possibility 26:1 55:22 242:12 246:21 274:2 possible 7:3 46:1 55:5 60:7 79:12 81:2 114:6 168:12 182:5 186:1 199:12 222:11 244:10 245:5 possibly 66:7 156:22 posture 35:14 post-Cold 215:8 potato 172:11 potential 62:9 121:7 132:17 168:21 181:18 186:4 189:20 211:20 216:10 228:15 233:11 257:21 276:21 potentially 186:3 pounded 179:10 power 7:2,4 11:5,6 13:2 14:5,5,17 16:10 19:18 23:7 23:22 53:22 94:1 95:11 134:13 135:8 141:2 148:1 171:2,19 180:14 182:2,7 189:1 194:9 195:6,14 197:9,12 199:17 203:4 208:10 211:6 213:10	221:13 222:13,15 222:16 223:8,13 224:22 227:3 231:21 241:11 264:9,18,19 265:5 265:9 266:2 268:11,19 270:21 271:2,7,8,12 277:6 301:17 302:2 304:16 powerful 291:18 practical 127:19 180:6 practically 127:18 practice 100:5,19 pragmatic 265:8 282:1 295:6 pre 120:13 precedent 246:19 precise 28:5 33:7 51:1 55:7,10 58:3 63:19 68:4 71:1 72:4 73:13,22 79:15 81:17 89:2 precisely 51:14 55:11 predict 271:2 prediction 54:19 predictions 62:16 preempt 298:20 299:15 preface 291:15,17 prefer 73:9 preferably 93:8 preference 119:5 preferred 172:13 preliminary 18:12 21:14 138:8 premise 245:1,8 prepare 22:14 71:6 143:9 270:1 prepared 10:19 45:18 180:20 194:22 297:19 preparing 49:5 161:7 277:2 prescient 162:2	present 1:13 2:2 10:7,20 25:8 39:10 50:5 53:9 55:20 58:1 60:15 60:18 85:3 169:10 253:11 260:20 269:17 271:15 273:18 presentation 9:7 10:22 27:13 44:12 45:15,22 56:12 61:21 62:21 65:8 66:10,12,15,19 92:21 94:6 119:13 121:17 131:3 156:12 192:2 267:22 269:6 presentations 7:15 240:13 278:2 presented 199:6 234:20 presenter 252:19 269:7 presenters 240:16 presenting 260:17 270:15 presently 145:19 200:6 228:8 preserve 196:5 president 5:13 36:18 93:14 147:8 147:13 179:5 207:19 223:22 225:14 226:18 227:9,11,16 228:7 230:5,11 269:19 288:6 presidential 92:4,7 presidentially 290:17 presiding 1:12 pressing 248:6 pressure 135:6 304:12 305:1 pressures 150:21 presumably 154:20 presume 227:7
--	---	--	---	--

presumes 246:12	private 78:14 79:17	131:21 241:4	129:22 276:15	proliferate 212:17
presumption	79:19 80:3,5	247:16 261:1	producers 130:13	proliferating 229:5
110:22	243:15,17 246:20	264:8,13 279:3	produces 54:5	proliferation 23:17
pretended 252:10	246:21 249:20	301:21	product 173:7,8	47:1 175:7 202:4
pretty 113:17	pro 183:4	proceeding 265:15	201:16 203:5	202:6,10 212:14
167:1 171:21	probability 22:13	process 12:8 36:13	259:8	212:15 223:4
174:2 189:15	74:22 128:9	55:7 57:13 71:7	production 47:10	234:20 235:5
190:2 208:7	probably 11:8	78:17,18 81:9,14	67:6,18,22 134:15	270:11 275:8,15
224:19 225:11	41:21 61:18 72:15	81:15 82:3 96:4	150:2	promises 146:14
237:4 244:16	74:11 77:15,19,20	99:1 102:10	productive 157:17	promising 23:10
263:4 283:7	104:1 125:1	103:22 104:6,10	products 60:2 87:5	promote 12:9,14
prevent 220:16	138:14 143:3	104:16,19,20	87:6 141:15	13:8 21:10 22:10
preventing 257:3	150:13 152:20	105:4 106:3,21	175:10 256:4	23:13 47:3 147:15
preventive 178:12	205:1 213:11	109:10 111:7	259:12,21 260:4	promoting 14:7
previous 223:11	215:4 226:19	112:19 113:1,8,17	274:11 283:2	15:16 23:4 24:19
278:5	230:11,12 247:9	113:21 114:9,11	professor 9:15	148:22 279:13
pre-authorizes	249:18,19 262:9	117:1,3,7,14	131:5 240:20,21	promotion 13:21
84:20	282:7 295:7	118:9 120:8 121:3	241:6 269:9 278:3	proper 168:21
price 25:20 27:7	302:10,17	121:10,13 122:1	281:14 285:17	219:21
46:17 60:22 83:20	probe 214:20	122:10,21,21	295:5	properly 239:17
84:12 297:13	problem 32:3	126:13 127:5,13	program 21:9 23:6	property 154:15
prices 29:12	59:11,18,20 70:7	128:1,7,12,14	27:4 38:14,16	156:8
primarily 275:2,12	85:22 129:7	160:15,17 161:3	39:9 88:18 95:16	proposal 144:8
prime 147:13	172:19 176:14	173:4 180:4,7	104:21 105:3	proposals 116:6
148:17	177:8 178:17	181:9 182:7,19	117:9 118:3 120:2	propose 24:7 63:9
principal 76:3	184:6 191:13,22	183:1 184:1,13,16	120:9,16 131:11	80:14 85:13 86:6
173:5	192:13 201:14	201:9,22 206:13	135:21 158:14	172:6
principle 33:10	202:5,6,10 205:19	206:17 208:15	196:17 197:10	proposing 161:12
57:1,3 64:15,20	207:6 210:19	210:5 211:18	199:18 213:19	proposition 186:14
65:2,3,6 74:3 77:9	214:2,5 223:4	217:12,15 220:13	254:5 271:19	186:22 289:7
104:13 108:11	230:20 234:1,6	225:12 232:15	272:4	290:15 295:1
130:18	235:5,16 244:13	241:1 242:9 244:6	programs 49:19,20	302:1
principles 74:7	248:9,10 250:6	245:12 246:5	49:20 84:18 286:4	propositions
104:6,9	263:22 264:6	248:18 250:13	progress 95:3,13	190:16
prior 93:20 114:7	266:16 268:21	261:19 266:6,9	97:14 98:6 123:17	propulsion 165:15
priorities 100:8,11	279:5 280:3 283:8	268:17 269:3	124:3	prospects 274:1
100:22 105:22	301:14 303:4	282:2 287:2,8	progressively	protect 75:2 196:6
255:4 263:11	problematic 217:9	296:20 299:8	105:4	237:13
268:22	problems 85:3	304:21	project 20:21 23:21	protected 71:15
prioritize 232:19	123:5 172:19	processes 120:8	24:11 38:1 83:5	protecting 204:7
prioritized 232:22	176:6 233:22	161:11 206:4	101:12,15 105:1	219:11
prioritizing 233:6	234:21 303:18	processing 29:19	106:5 108:2,4	protection 35:15
233:9	procedure 18:20	72:2 175:4 224:16	120:10 131:8	47:2
priority 100:2	19:7 46:3	produce 67:20 76:6	298:17	protective 195:18
263:15 264:12,16	procedures 34:4	80:16 127:15	projections 140:22	protocols 139:15
265:14 266:7	proceed 8:9 10:2	239:16	projects 39:12 83:4	prototype 14:11,12
267:13,19 268:4	45:10 96:10 103:4	produced 70:13	103:8 130:3	22:20 58:4,9

prove 125:4,6 175:6 204:2 213:18 proved 212:21 303:20 provide 57:12 66:2 96:22 97:8,17 110:6 116:4 117:5 117:11 118:6 119:2 142:11 143:11 201:4 220:21 279:17,21 provided 46:22 122:20 197:11 provides 136:9 145:15 providing 122:8 275:6 province 113:6 provinces 99:14 113:4 provincial 95:6 103:18 107:5,11 109:3 110:2 112:15,18,21 113:3,6,12,18,22 114:5,8,9 130:14 provision 195:2 provisions 293:13 proviso 220:11 proximity 89:7 prudent 27:8 252:3 psychological 42:6 42:11 43:20 public 6:15 7:21 13:10,19,22 21:19 22:6,11 28:19 33:21 35:21 36:3 42:3,5,18 44:5 45:17,20 49:17 51:19 52:2,8 53:7 53:8,12,15 55:14 55:21 73:5,8,15 74:5,17 75:3 76:13 77:7,20 78:12,14 79:10,11 79:13,16,22 80:2	80:4,19 81:18 82:3,4 83:5,8 85:22 89:4,11 91:2 95:20 96:8 102:3 103:15 104:5 115:7 118:10,17,20 165:14 185:17 220:8 223:14 256:12 257:18 270:2 294:1,10 publically 165:18 publication 35:8 134:12 publish 51:12 98:21 published 16:7,11 102:3 252:22 publisher 241:14 publishing 241:1 pull 207:9 249:13 pulpit 180:19 pun 183:15 purchased 26:19 Purdue 2:22 269:9 purely 142:10 303:22 purpose 4:15 97:22 purposes 87:17 246:11 pursue 13:10 24:17 58:8 107:9 175:12 208:3,6 262:7 267:11 275:5 pursued 65:15 pursuing 12:19 14:14 266:6 268:2 purview 95:5 261:3 push 170:9 249:13 302:21 pushed 177:7 put 7:14 36:11 52:14 77:3 81:20 108:17 119:19 164:14 196:20 199:22 200:11 202:21 203:1	204:21 205:19 206:19 209:3 210:11 225:6,17 230:18 245:21 251:1 276:2 280:8 281:14 283:15 293:12 Putin 147:12 148:18 Putin's 152:11 puts 239:18 putting 59:21 238:17 puzzle 209:3 puzzled 154:21 pyramid 51:6 183:20 pyroprocessing 202:1,13 224:15 229:2 275:16 P-R-O-C-E-E-D-... 4:1 p.m 157:13,14 240:9,10 307:13	88:2 89:2,12 90:6 90:20,21 108:21 109:7,20 111:9,18 112:8 115:17,17 118:4,16 123:14 123:16 124:11,17 124:22 125:2 126:10 127:1,17 128:8,21 130:8 150:16 153:2,18 153:21 154:18 156:14,16 158:7 167:14,16 179:21 198:17 199:1,5,15 204:6 205:22 206:22 213:1 214:18 215:16 216:14 217:3 218:14 226:2 229:18 232:16 238:5 257:9 260:6 263:16 279:7 280:20 281:12,14 282:12,19 283:5 284:7,15 285:2,3 285:17 295:4 296:7 298:7,8 300:6,8 306:3 questioned 92:8 questions 24:13 25:4,5 29:5 37:2 37:18 40:13 44:9 45:22 61:22 66:15 66:16,20 68:10 72:19 78:3,8 82:7 82:9 90:5 94:8 106:16 107:3 108:12 114:13 115:2 117:4 118:21 131:2 146:11 149:8,11 151:9,18 175:16 179:16,20 186:9 197:21 200:1 204:5 208:7 209:1 230:15 232:2 277:21 278:2	298:18 301:7 quick 62:2 125:10 153:20 235:21 305:4 quickly 113:18 154:22 186:15 263:22 301:14 quiet 32:12 quite 18:10,22 32:21 38:5 39:7 41:21 46:2,18 50:12 52:21 58:16 58:17,18 61:4 75:7,19 77:16 89:3 91:7,18 107:3 109:8 117:11 123:19 126:13 185:1 208:18 209:11,12 211:11 259:11 268:11,14 quote 50:14 62:2 89:15
Q				
qualitative 254:15 quantities 16:8 35:8 quantity 36:4 68:2 69:18,19,22 71:20 76:7 77:1,2 quasi-government 198:4 226:5 227:6 quasi-governme... 192:1,16 quasi-judicial 192:15 question 26:20 29:16 30:5,8,20 32:19 34:12,14 35:3,17 36:9 46:2 47:20 48:1 63:15 63:16,17,21,22 64:10,18 71:18,19 75:7,9,16 77:10 80:21 82:5 84:15	radiation 141:16 259:1,2 radioactive 49:11 49:16 50:12,16,18 50:21 52:4,13 53:1,12 58:13 65:13 79:9 143:17 143:19,22 144:2,6 144:12 152:2 172:14 184:21 243:12 248:7 280:4 282:20 294:20 301:1 radioactivity 152:2 259:5 radiological 299:16 radiotoxicity 276:20 Radkovsky 148:6 raise 254:20 297:4 raised 213:1 raises 260:6 298:18			
R				

Rancho 171:4	174:10 175:3	247:8 269:1	149:2 163:9 261:2	recycling 29:20
RAND 2:21 3:20	201:21 202:1,2,19	reality 207:17	recognized 209:13	41:12 54:17 56:5
204:9 252:20,21	202:20 233:8	realize 111:7	recognizing 14:13	56:6,6,10,20
253:21,22 282:14	235:10 236:13	228:13 245:9	15:13 207:22	57:10 58:10,12
301:9	237:9 246:20	really 35:7 115:16	208:17	59:13 61:12,14
range 5:18 6:8 7:3	273:8 274:1 275:1	127:1,3,19 128:6	recommend 5:16	62:3,5,13 64:6,6
7:6 252:15 253:18	276:2,11 294:4	173:17 203:1	9:1 167:9 225:12	64:10 65:5 66:4
263:4	302:6,9	209:1 210:21,22	302:21	75:10,11,18 76:4
rapid 29:9	reactors 11:7 12:3	211:22 226:1	recommendation	85:10,18 86:3
rapidly 33:3	12:6,12 15:8 18:2	228:8 230:16	16:15 20:17 98:18	87:3,17 118:21
rate 27:16 140:5	24:4 37:6,12 38:7	234:2,3,13 235:13	98:20 100:9	174:11,18 201:5
153:5 178:17	38:16 39:3 49:6	256:2 260:19	101:10 126:4	201:22 211:18
264:20	54:7,9 57:17 67:9	264:2,14 266:7,15	279:10 303:7	213:7 223:3
rates 178:15	68:20 70:3 82:17	267:5,9,9,21	recommendations	224:13 234:12
ratified 139:20	133:11,17,20,22	268:4,8,21 279:12	5:10 6:2 7:1,6	235:12 274:6,9,18
ratio 11:12	135:17,20,22	283:7 287:20	96:12 125:20	275:22 276:11
rational 277:11	136:6,11,14,20	289:10 291:18	126:1 164:1	277:9
raw 182:11 184:14	137:4,5,6,9,21	297:1 299:17	253:17	red 9:6 148:3,10
Ray 164:17 165:7	138:3,12,17	301:16 304:17	recommended	redevelopment
RCRA 296:3 298:1	139:13,18 140:1,9	rearranged 250:21	95:11	257:4
298:4	140:13,18,21	reason 26:15 39:17	recommending	reduce 46:13 59:3
RD&D 199:14,18	141:2,7,19 142:1	42:13 46:10,14,14	6:19	62:6 74:21 76:22
reach 177:14	142:11 144:21	46:15 47:7 88:7	reconsider 174:17	77:2 141:3 168:5
199:12	145:14,16,19	128:3 164:2	174:17	185:11 186:2
reached 140:7	146:18 148:12	258:22 264:11	reconsideration	235:5 257:21
150:10 213:5	153:4 154:21	265:5,7 292:11,13	90:1	258:8,19 259:2,13
reaching 70:11	155:1,7 171:8,22	302:11	reconvert 57:21	260:5 267:9
reaction 40:15	174:4 198:15	reasonable 38:5	record 62:4 88:6	275:13
206:22 294:11	213:4 223:3	184:9 186:14	93:4 157:13 240:9	reduced 58:20
reactions 303:7	224:16 235:1,2	reasonably 282:3	recovered 12:5	276:20 277:1
reactive 103:11	242:21 274:7,10	reasoning 162:11	15:8,9 16:15	reduces 61:14
reactor 5:18 14:8	274:14,15,19	reasons 38:1 46:10	17:21 132:22	reducing 134:4
14:11,11 15:6	275:3,3,20 276:1	47:3 119:4 185:3	recovering 176:3	258:21 260:3
16:19,20,22 17:9	276:5,8	203:19 205:10	recovery 275:13	282:19,21 284:12
17:17 18:9 22:19	reactor's 273:11	264:3,22 267:14	recuperate 134:22	reduction 11:9
22:21 23:4,8,9,15	read 47:19 291:15	reassuring 191:8	recyclable 57:12	92:2
37:7,8,21 38:13	291:17 302:19	rebirth 65:22	recycle 28:21 56:14	reestablish 186:10
39:9,12 49:4,4	reading 291:21	rebuild 244:18	62:13 64:14 67:2	reevaluation 90:2
57:22 133:21	readjust 51:18	recall 165:16	67:4 75:17 85:14	reexamination
137:1,14,15,16,19	ready 4:11 86:5,6	receive 181:15	86:15 201:7,8	35:11,13
138:1,5,18,19	121:12 139:16	received 6:14	202:9 211:17	refer 154:12 157:3
139:5,11,14 140:3	143:20 147:10	receiving 8:21	212:1 224:10	186:11
140:7 141:10,12	151:4 190:2	23:11	272:19 276:14	referred 95:22
142:4 143:5,10,14	Reagan 179:5	recipe 255:17	recycled 24:5 67:11	187:2
147:9,20 148:6	187:10	recognition 14:18	68:1 203:18 224:1	referring 223:9
149:5,14 153:22	real 35:4 45:13	72:14	224:17 274:16	reflects 105:21
155:8,12 163:12	64:13 171:14	recognize 113:4	recycles 256:5	refueling 165:17

refurbishing 134:16	rein 207:10	remove 257:2 259:20	259:12 261:3,11 261:20 262:4,16	276:15,18,21 277:9 283:1
regain 186:21 266:7	reinforce 164:2	remuneration 181:11	267:5,10 268:3,18 272:16 273:12	reproduce 19:4
regard 129:11 153:22 176:6 200:19 211:14 216:21	reiterate 5:12	remunerations 166:11	274:9 276:19,22 278:7 282:18	reproduction 141:11
regarded 42:17	related 11:3 19:12 28:12 34:3 36:8 37:2 78:8 132:17 136:11 139:18 140:2 232:17 283:19 298:7	renaissance 65:22 145:11	283:4,5 284:8,13 302:13,16 303:3 305:15 306:4	Republic 137:12
regarding 6:2 7:1 112:17 130:7	relates 41:16 82:10	render 58:17	represent 176:20	republican 221:12
regime 297:7	relationship 197:1 291:7 296:1	rendering 54:13	representation 249:21 286:17 290:8	request 103:16
region 26:12 110:14,16 111:17 111:21	relationships 102:6 102:20	renedvous 58:7	representative 44:21 45:2	require 71:22 225:2 276:16 299:20
regional 43:13	relative 48:5 141:3 177:9	renewable 225:21 228:18	representatives 187:13 225:4	required 97:12 115:22 116:4 130:11 156:21 172:17 198:21 199:3 255:16 272:18 273:7 298:10
regionally 161:15	relatively 286:4 306:18	reopening 268:17	representing 132:3	requirement 77:2
regular 53:11 249:12	relaunch 152:20	Rep 2:17 3:16	represents 159:10	requirements 52:1 98:5 105:10 120:1 121:8 257:17 258:20 267:10 296:14 297:9,10
regularly 47:16	releases 276:21	repackaging 256:17	reprocess 12:2 29:7 31:9 68:12 75:16	requires 94:18,21 96:17,20 97:8 101:1,7 109:11 173:19 276:4 278:13
regulated 95:7 101:21 247:1	relevant 270:16	repeatedly 225:20	reprocessed 16:20 16:22 17:3,10 30:21 31:3 54:10 56:18 156:2 276:3	research 9:17 12:9 14:7 20:18,19,22 21:5 22:19 23:14 40:3 44:2,5 53:1 54:22 102:14 131:9 137:14 138:1,5 139:4,12 139:18 140:15 143:5,10 149:5 197:14 200:18 203:15 223:10,12 229:2 254:3 262:13 280:1
regulating 281:17 296:5	reliability 23:16 32:3	repeating 217:10	reprocessing 12:8 14:9,13,20,21 15:1,2,10,12,19 16:3,13 17:1,4,11 17:22 18:7,14,16 19:9,12,21 20:1 27:21 28:2,9,14 28:18 29:6,14 30:1,6,14,20 31:4 32:2 37:5 38:3,4 39:15,19 68:15 75:18,20 76:4 82:12,18 84:22 85:6 88:8 89:17 168:4 174:9 205:9 218:17 234:13 235:3 237:10 251:12,22 252:4 252:14,16 262:14 272:18 273:13,20 274:4,5,7,21,22 275:6,9,11,16	researches 55:8 80:15
regulation 20:22 124:10 241:16 247:15 251:3,13 295:5,9 298:22 299:15	reluctant 265:4	report 7:9 23:11 51:15,16,17 96:5 97:9,11,13 198:3 210:3 225:18 270:1,6 271:13 277:4 289:11 291:19 303:11	reprocess 12:2 29:7 31:9 68:12 75:16	reservations 220:12
regulations 295:18 298:16	rely 26:22 39:14	repositories 22:7 42:22 120:20 151:12 235:8 242:15 257:16 277:8	reprocessed 16:20 16:22 17:3,10 30:21 31:3 54:10 56:18 156:2 276:3	
regulator 120:7 150:20 294:18	remainder 270:22	repository 12:9 20:4 22:4,15 33:2 33:5 34:2 55:15 71:22 72:22 95:21 102:8 104:3 116:12,15 119:3 121:4 144:12 147:1 168:8 196:18 215:19 216:5 236:1,3,11 242:10 245:14,20 246:10 249:5 252:6 255:16 257:6,10,22 258:1 258:4,9,19 259:6	reprocessed 16:20 16:22 17:3,10 30:21 31:3 54:10 56:18 156:2 276:3	
regulators 118:1 281:16,20	remaining 17:7 28:11 62:9 275:14	repositories 22:7 42:22 120:20 151:12 235:8 242:15 257:16 277:8	reprocessing 12:8 14:9,13,20,21 15:1,2,10,12,19 16:3,13 17:1,4,11 17:22 18:7,14,16 19:9,12,21 20:1 27:21 28:2,9,14 28:18 29:6,14 30:1,6,14,20 31:4 32:2 37:5 38:3,4 39:15,19 68:15 75:18,20 76:4 82:12,18 84:22 85:6 88:8 89:17 168:4 174:9 205:9 218:17 234:13 235:3 237:10 251:12,22 252:4 252:14,16 262:14 272:18 273:13,20 274:4,5,7,21,22 275:6,9,11,16	
regulatory 11:18 45:5 105:10 119:15,18 120:8,8 120:11,19 121:8 121:10,12,19 122:1 150:18 241:8 247:9,11 248:2 251:11 257:16 281:1,3,5 281:7,9,11,19 298:9,13,13,20 306:8	remains 172:2 286:15	repository 12:9 20:4 22:4,15 33:2 33:5 34:2 55:15 71:22 72:22 95:21 102:8 104:3 116:12,15 119:3 121:4 144:12 147:1 168:8 196:18 215:19 216:5 236:1,3,11 242:10 245:14,20 246:10 249:5 252:6 255:16 257:6,10,22 258:1 258:4,9,19 259:6	reprocessing 12:8 14:9,13,20,21 15:1,2,10,12,19 16:3,13 17:1,4,11 17:22 18:7,14,16 19:9,12,21 20:1 27:21 28:2,9,14 28:18 29:6,14 30:1,6,14,20 31:4 32:2 37:5 38:3,4 39:15,19 68:15 75:18,20 76:4 82:12,18 84:22 85:6 88:8 89:17 168:4 174:9 205:9 218:17 234:13 235:3 237:10 251:12,22 252:4 252:14,16 262:14 272:18 273:13,20 274:4,5,7,21,22 275:6,9,11,16	
	remarkable 162:5			
	remarks 3:3 9:4 24:14 37:2 94:6 94:11,15 160:9 179:15 240:17			
	remember 92:7 153:5			
	remembered 118:8			
	remembers 169:17			
	remind 6:17 232:6			
	reminder 7:18			
	remote 165:20 167:15			
	remotely 233:5			
	remoteness 186:12			

reserve 62:17 71:5 71:6,10 193:17 216:6 226:9,21 227:9,12 228:2 249:11	281:7	154:2 156:9	262:15 279:8 287:16 288:17 299:19 301:15 302:7 303:13 305:22	161:7
reservoir 221:6	responsible 44:18 53:8,10,11 85:15 85:16 86:11,12 98:10 101:11 129:17 168:4 173:3 225:14 294:19 295:11	reusable 186:4	rights 179:12 196:10 220:16 221:3	roundtables 99:15 103:14
resistance 23:17 136:12 140:10,11 275:15	responsiveness 101:2	reuse 67:8,19 70:5 87:8,20,21 135:1 173:10 174:9 186:3	risk 42:3 258:21,22	routes 54:21
resolution 114:2 193:6 250:1	rest 146:15 170:10 174:5 277:18 291:21	reused 203:18	risks 270:11 294:5 294:9	routine 139:13 140:9
resolve 196:22 197:17 238:7	restarting 261:18	reusing 201:5,22	Risk-Based 241:9	routinely 136:1
resolved 171:21 190:8 222:2	Restoration 158:13	reversibility 55:19 56:1,3 72:21 74:1 74:4,13,14 75:3 118:15	rivers 195:10	Royal 95:10
resource 26:18 57:20 194:18 201:3,4,16 203:5 204:19 212:3,4,20 212:21 213:3,20	restoring 6:13	reversible 73:2,13 74:18	road 57:6 220:16 301:5	ruled 166:16 273:9
resources 25:12,15 25:16 26:4 36:11 56:11 57:6,18 97:10 176:13 196:6 241:21 267:6 268:4 280:9 304:9	result 13:18 16:4 19:3 21:22 24:10 46:17 48:7,7,8,11 48:14 55:21 85:18 90:17 91:9,15 106:9 113:21 142:13 160:22 205:15 259:16 288:18	review 5:14 11:18 23:6,9 24:9 32:5,8 42:2 45:21 121:5 245:3 279:11 293:14	Roald 2:12 3:12 131:5	run 130:3 133:7 136:10 145:16
respect 303:22	results 33:21 90:7 90:13,19 252:12 269:17	reviewed 95:3	robust 105:9	running 33:3 280:11
respectfully 248:12	resumed 93:4 157:13 240:9	reviewing 24:2	rock 21:6,7	rural 109:1
respond 34:14 238:5	rethinking 234:13	reviews 106:10	rocket 277:10	rush 183:6 244:10 266:11,19
responding 184:15	retire 133:22	revolution 251:18	rods 140:2 148:3	Russell 2:19 3:17 158:11 191:7 225:5
response 23:20 44:10 95:20 110:6 183:8	retiring 144:20	re-frame 216:13	Rokkasho 15:2,10 15:12 16:3 17:4 18:7,16 19:21 29:19,21 30:1,5,6 32:1 35:6 38:4 39:14	Russia 132:21 134:19 135:15,18 142:8,16 143:15 145:14 146:14 147:4 151:2,5 152:11,20 154:3 154:16 155:9,18 156:9
responses 89:7	retrievability 119:5 119:9 129:5	re-using 174:18	role 44:18 93:16 122:9 252:13	Russian 131:11,14 132:4 133:17 134:2,7 135:16 137:2 139:9 140:13,22 143:6 146:6 147:15,17 148:2,8,16,19,22 152:8,16 154:15 155:5,21 156:8
responsibilities 78:12 96:16	retrievable 118:7 159:1 160:15 223:1 236:11	ribbon 1:1 4:7 10:5 189:19 218:7 239:12	roles 96:16	Russians 134:11 139:16 140:16 141:8 149:3 154:5 154:12,19
responsibility 12:20 22:3 80:6 95:18 96:14 122:18 123:3 170:8 176:18 177:9 178:20 209:13,17,21 217:17 239:2,5 249:9 264:4 279:2	retrieval 223:2	Richard 1:19 2:20 3:19 27:11 114:14 119:11 152:5 153:19 240:20 277:21 306:4	Ronald 179:5 187:10	Russian-origin 156:21
	retrieve 118:20 173:9 182:21	Richardson 169:13	room 70:1	Russia's 3:11 131:19
	retrieved 94:21 100:17	rid 259:2,10 265:6	root 40:20	R&D 17:16,17 49:7 49:20 53:1,10 59:7 82:15,16
	return 87:13 92:22 156:3	right 32:19 37:4 38:20 50:6 51:2 70:10 72:1 108:8 125:16 128:5,11 131:1 141:5 150:1 154:12 155:13 157:15 164:6 167:1 171:10 176:4,9 180:10 186:6 195:3 207:14 219:16 235:13 239:16	RosAtom 133:7 142:20 144:8,8 151:2 153:2	
	returned 85:4		rough 81:18	
			roughly 31:6,8 48:3 49:18 53:22 61:1 62:5 68:3 70:21 199:8	
			round 156:17	
			rounds 104:5	
			roundtable 5:1 159:19 160:2,9	

83:5,8,11,12 142:19 252:2,12	Saskatchewan 105:2 satellites 131:8 satisfactory 265:10 satisfy 24:6 268:22 save 155:2 saw 40:10 123:13 146:21 217:5 saying 71:7 76:21 107:12 111:4 168:14 236:7 237:21 292:15 300:10 305:20,20 says 113:14 166:8 194:2 217:20 247:13 282:1 scale 141:1 146:3 199:19 233:1,2,14 233:16 scandal 250:5 scenario 29:18,20 29:22 235:11 252:15 271:6,9 272:17 scenarios 7:4 271:4 schedule 55:10 58:3 73:18 115:21 116:13 schematic 50:1 255:22 scheme 88:8 schemes 255:22 258:5 Schlesinger 165:2 165:3 school 220:8 240:22 schools 220:11 science 9:18 132:12 135:16 138:2 155:6 161:10 162:10 183:19 205:17 223:18 277:10 Sciences 131:15 scientific 52:6 101:22	scientifically 163:8 scientists 131:13 score 191:9 Scowcroft 1:11,15 10:5 157:15 162:4 162:13,18 170:12 175:19 179:17 186:6 193:19 214:14 216:18 219:22 231:22 233:17 235:18 238:2 240:1,11 252:18 269:5 277:20 282:10 285:15 288:11 294:15 301:7 306:17 307:5 Scowcroft's 205:22 screening 127:22 295:12,13 screenings 114:19 sea 2:9 26:1 44:18 sealed 251:14 seats 4:5 93:7,12 Seco 171:4 second 17:11 18:14 23:1 30:20 36:9 39:18 51:6 65:3 75:9 78:16 80:9 80:21 90:20 91:21 142:2 143:11 145:21 172:7 199:5 205:9 225:3 234:21 257:5 272:15 280:19 295:16 296:8,21 298:22 300:6,7 305:14 secondly 4:22 89:8 127:4 168:3 secretary 5:12 7:9 159:3,15 162:18 165:4 172:8,9,10 291:2 sector 80:5 132:5 133:15 146:4 152:17 153:9	sectors 79:19 secure 12:1,17 256:16 securing 173:1 244:11 247:4 security 13:16 14:14 27:6 35:14 35:19 36:9,20 46:9,12 56:9,21 63:1 77:6 85:3 100:1 118:11,17 213:12 256:10 sedimentary 21:7 see 27:13 28:20 40:1 47:21 48:1,5 50:3 77:7 88:12 91:14,21 92:1 103:1 104:9 106:14 109:5 125:3 126:8 137:3 139:20 140:1 141:4,9 142:1 146:16 148:9 151:6 169:10 170:2 176:14 188:6 198:18 200:1 210:17,18 216:15 222:12 242:16 243:5 246:1 262:20 267:14 290:16 293:22 294:1,4 seeing 126:15 seek 103:20 seeking 72:14 seen 27:7 63:13 84:2 126:12 144:16 157:2 228:16,17 245:21 286:15 segment 27:21 239:3 segue 214:17 seize 244:20 select 81:12 262:4 selected 157:22 158:1 165:21	270:19 selecting 99:1 104:2 270:16 selection 81:3 97:5 102:10 103:22 104:7,19 105:3,7 106:3 117:14 127:13 261:18 268:17 selects 81:1 self 11:11 262:21 selfish 47:7 sell 87:8 181:5 selling 154:14 semi 255:19 Senate 230:9,12 288:10 292:21 senator 169:11 send 46:3 84:20 165:19 305:22 sense 35:20,21 129:6 187:16 227:12 236:14 267:16 273:21 281:15 285:12 293:16 295:7 298:14 299:10 304:19,20 sensitivity 287:11 sent 146:22 241:14 sentence 210:14 separate 64:13 124:17 167:9 168:3 208:6,9 217:22 225:12 238:7 273:15 separated 16:8 35:9 38:20 62:15 70:15 89:16,18 separately 259:21 separation 41:13 64:12 serendipitous 287:15 Sergey 153:1 series 18:19 19:3 105:4 133:22
---------------------------------	---	--	--	--

135:19 191:2	192:19 193:9	161:15 163:7	181:18 184:12	89:13 90:5 92:17
serious 85:11 88:11	195:7 288:12	168:10,10 202:9	203:14 233:8	132:19 137:22
112:8 202:10	shed 37:16	221:8 247:21	246:18 257:1,3	slides 45:17 72:20
206:4 248:7,9	sheet 7:21	248:19	265:19 273:8	75:10 84:2 146:13
seriously 263:5	Shevardnadze	signing 147:12	278:18 302:6,9	253:7 268:1
serve 137:5 269:22	131:16	sign-up 7:21	siting 6:18 21:8	slight 144:2
served 9:11,15,16	shine 195:9	similar 148:20	42:20 78:20 81:2	slow 266:12
93:16 131:15	ship 219:12	151:5 171:14	95:21 96:2 104:9	small 45:18 53:15
132:10 158:19	shipped 306:11	Similarly 139:8	113:1 115:6 182:3	70:22 71:5,10,12
159:4,13	shocked 182:1	simple 38:8 174:2	192:10 243:3,15	81:16 88:18 131:8
service 79:11,12	short 17:6 45:15,16	181:5	246:5,7,9 247:2	132:16 189:16
services 14:22	73:20 78:7 81:15	simplistic 245:6,8	248:18,19 261:2	204:16,16 234:7
54:14 147:16	107:17 115:3	simplistically	279:13 280:6	293:8
149:1 204:6 275:7	168:14,16	282:19	286:4 290:18	smaller 76:13
session 7:19 157:7	shortcuts 215:5	simply 170:7	295:9 296:10,11	172:5 233:1,14
159:18 224:1	shorten 66:11	180:16 198:18	304:18,20	smarts 180:15
240:12	Shortly 116:1	231:9 239:16	sitting 192:8	smiling 169:17
sessions 99:13	short-lived 51:7	262:7 267:15	213:10 226:6	snapshot 10:22
103:16	201:9,10	simulation 19:5	situated 176:9	social 96:10 103:4
set 56:14 125:17	short-term 62:19	single 281:9	situation 25:15	105:6 127:10
130:1 157:20	75:6 129:18	single-wall 167:3	46:17 50:5 76:11	213:12 234:3
191:5 207:20	shot 180:12 199:22	singular 167:11	77:11,16 123:13	238:1 254:11
208:16 213:8	show 13:18 33:21	291:9	163:20 167:18	263:10 270:10
215:14 226:20	48:2 146:13	sir 4:11 9:22 61:20	184:2 188:19	277:12
sets 80:11	147:12 148:15	162:22 204:9	189:15 205:13	socially 126:19
setting 194:10	243:1 246:3	239:22	217:8 231:4	socially-acceptable
226:4 295:12	showed 13:19	sit 170:16	236:12 243:13	98:8
settled 257:9	shows 21:22 22:1	site 6:16 21:12 22:3	248:5 278:19,22	societal 99:5
seven 102:5 144:11	showstoppers	33:14 34:13 42:12	293:1 300:20	102:15 161:9
151:11,20 222:6	273:3	43:9,12,14 99:2	situations 85:9	255:4 305:7,16
seventeen 204:12	Shunsuke 2:4 3:5	102:10 103:22	181:20	society 3:22 34:17
Sexton 240:21	9:9	104:2,7,18 105:3	sit-in 208:5	117:6 125:12
shape 99:7 106:2	shut 271:8	105:7 106:3 111:3	six 28:14 47:17	126:4 183:4,12
157:21	shutting 171:1	115:14 117:14	67:10 114:18	269:11,19
share 5:10 13:1	side 51:3 170:10	120:10,12 126:21	163:1 170:5	society's 100:7
133:1 145:22	177:7 199:21	127:11,13 128:4	222:18 304:21	301:11
163:2 170:17	217:1 221:12,14	158:22 168:12,21	sizable 26:10	sodium 22:22 23:1
181:8 184:3	281:5,11 282:1	176:10 180:9	size 59:19 76:9	40:10 42:8 167:4
239:10	sides 183:9 193:20	184:21 242:10	sketch 139:14	202:1
shared 291:18	227:21	243:7,14 245:15	142:3	sodium-cooled
sharing 14:18	sign 139:16 183:2	246:14,20 247:6	skill 290:8	136:20 138:12
Sharp 1:22 106:17	191:8 305:11	257:4 261:5,18,22	skilled 101:15	140:17 141:2,22
106:19 107:15,19	signed 84:20	262:9 265:17	slant 264:7	235:1,2
108:8 109:19	148:18 220:10	268:17 294:4	SLCSAT 131:7	Sofia 147:12
110:17 111:22	significant 27:2	295:12,13	slide 28:15 47:18	solar 26:8,14
113:9 125:7,10	58:12 98:6 99:4	sites 36:4 105:6	48:2,8,9,15 50:4,7	237:18
186:8 190:4	111:20 112:20	127:3 152:12	51:3 59:5 73:19	solely 124:20

192:10	247:17 249:1	225:6 288:16	232:20 233:7	140:20
solution 3:14 5:5	250:5 254:15	special 52:9,22	235:9 242:19	standardization
34:15 63:3,9,10	255:5 265:12	136:8 139:12	250:3 253:1,12,19	54:3
63:12 64:22 73:14	280:13 282:1	144:10 152:13	254:12,16 255:3	standards 47:1
74:12 75:6 76:21	286:19,20 287:1,5	269:20 293:19	257:2 258:14	78:21 80:11,12
79:5 86:13 119:2	287:14,20 288:13	297:8	260:16 261:11,14	104:11 119:17
157:10 158:9	293:14 294:3	specific 6:20 82:9	262:2,5 263:21	120:20,22,22
161:10 171:8,14	304:18	82:21 117:4 120:5	264:5 265:1,2,6	121:20 122:3
172:3 175:12,13	sorts 249:2 287:19	120:10 153:2	265:10,18 266:18	134:1 281:2
195:15 196:13	sound 11:22 235:15	253:17 256:1	267:7 268:20	standing 132:21
199:7,12 200:2	sounds 216:2	specifically 49:15	284:22 301:13	standpoint 40:14
201:20 207:21	304:10	82:14,18 83:9	303:14,15	42:21
210:17 211:15,17	source 11:14 29:11	100:21 111:15	sphere 147:3	stands 165:10
213:1 217:6,7	142:19 174:3,21	198:1 203:20	spirit 106:1	Star 148:3,10
234:7,7	204:15 219:10	247:5	spoke 195:6	start 14:22 15:7,18
solutions 158:5	225:1,19 249:14	specifics 116:3	spoken 63:1 67:6	20:19 22:20 28:17
265:10,14	250:17 267:3	136:10	282:4	33:18 42:14
solve 207:6 210:19	sources 57:5 60:12	specifying 23:15	spokesperson	116:15 120:9
263:21 279:5	226:14 251:14	spectrum 82:17	168:18,22 180:18	121:10 136:21
301:13	South 153:3 289:14	speech 233:19	181:4	150:2 155:7,11
solved 171:19	sovereign 179:7	291:13	spread 108:14	160:2 184:11
303:18	sovereignty 137:11	speed 62:20	spring 241:17	219:9,19 244:18
solves 266:15	Soviet 156:1	spend 205:4 257:20	269:18	244:22 251:17
somebody 111:3	187:11	278:22 291:3	square 55:9 59:16	252:6,10 260:5
169:22 180:18	so-called 17:19	spending 204:7	81:16	266:12 267:5
184:5 189:13	18:13 20:6 31:18	205:14 291:3	stability 25:20	284:20
206:14 291:12	41:22	spent 3:21 14:9	161:17	started 4:4 15:19
somebody's 204:20	space 70:7 131:9,11	17:2,8 18:8,13	stable 20:7,11	18:1,6,11 23:5,20
someday 119:1	132:13 148:12	19:16 29:22 30:22	271:18 272:1	24:9 33:8 39:18
someplace 213:11	304:19	31:2,9 33:17	277:15 283:3	58:5 132:8 137:9
somewhat 143:15	spaces 76:11	39:17,20 49:11	306:22	142:20 148:12
171:11 203:16	span 263:1,4	54:6,19 56:11	staff 182:16,19	167:1 199:20
205:2 211:10	speak 7:21 8:4	59:15 65:20 67:2	183:5 289:10	233:3 285:1
214:5	10:10,14 25:7	67:3,21,22 68:2,3	stage 43:17 187:7,7	starting 8:1 15:11
soon 114:6 144:18	49:6,15 57:14	68:12,17,19 69:10	187:9 188:21	32:1 33:7 35:20
244:9 245:5	58:19 74:20	69:13,16,21 70:5	190:3 273:21	43:13 58:3 84:17
280:11 287:16	231:10 253:6	70:18 82:11 84:16	286:16	99:8 140:4 233:4
sophisticated	speaker 8:3,8 9:9	84:16,21 85:2,6	staged 101:4 191:2	246:2,13
245:10	44:14 93:13,14	86:17,18 129:12	262:3	starts 191:14,15
sorry 47:19 66:12	131:4 145:5	138:20 144:15	staggered 231:4	start-up 242:17
69:14 71:2 177:21	speakers 6:15 7:14	152:8,12 154:2,8	staging 188:7	state 3:13 5:2,3
219:6 220:3,4	8:11 9:3 93:1	156:2 163:9	stakeholder 52:3	32:5 44:21 83:1
296:6	speaking 58:19	172:20 193:11	241:10 286:17	88:6 112:4,9,10
sort 37:14 107:6	60:16 61:5,16	201:19 209:14	stakeholders	113:14 127:8
109:4 186:22	77:5,6,7 90:13	211:5,14 212:10	161:14,14	133:6 143:20
187:3 236:3	127:18 199:8	215:21 216:3	stand 157:10 165:9	144:22 145:5
244:21 245:22	203:19 221:11	222:8 223:10	standard 80:19	152:14 157:8

158:8 159:22	stations 134:13	27:22 33:1 58:14	strengths 128:16	stunned 89:3
164:12 165:22	135:9 146:16	59:4 73:11 86:7,9	stress 226:3	stunning 151:13
166:7,17,19	status 152:7	98:17 159:1	strict 101:22	subcommittee 8:16
180:13,16 182:3,4	statute 278:13	160:15 164:20,21	245:21	116:20
183:14 184:19	297:21 298:1,20	203:7 223:1 233:7	strictly 107:9 110:8	subcommittees
185:17,19 187:6	stay 129:4,7	242:19 243:7,17	strikes 214:22	107:1
187:17 188:3	staying 231:21	245:17,20,22	strings 231:17	subject 66:9 73:5
189:6 190:13	steal 212:17	246:2,8,13 249:4	strive 195:14	178:6 182:8 230:8
194:6 196:11	steel 185:6	249:8 252:5 255:9	strong 48:11,17,18	247:14
220:9 232:9,14	stems 258:22 264:2	255:11,13 256:15	81:18 105:11	submission 94:14
243:19 244:4	step 23:13 43:13,15	261:8,13,17,21	111:11,19 118:18	94:16 120:11
246:6 247:6,7,11	101:6 108:3,10	262:1,10,11,20	118:19 119:5,7	submit 97:13 167:8
247:14,18 248:1	113:13 143:2	265:16 266:14	150:20 181:16	194:19 239:12
278:6 287:17	189:22 196:21	267:20 268:8,16	275:21 279:9	submitted 98:18
289:13 292:20	198:19 215:22	270:13,17 273:6,8	285:21 302:21	submitting 7:9
293:10,14,15	218:18 234:7	273:15,17 277:7	stronger 221:15	121:3
294:22 297:1,9,12	237:7 246:8	302:4,4,7,9,10	struck 116:22	subsequently 233:2
298:5,9,13,20,22	247:16,16 255:8	store 33:1,5 58:18	structure 123:20	subset 38:18
299:7,9,15,20	263:6 274:17	69:18 85:21 86:21	133:7 140:1	subsiding 234:5
300:8,12 301:5	stepping 107:11	87:7 117:19 224:6	143:16 151:3	substantial 117:11
stated 197:3 232:7	steps 109:5 113:14	224:9	249:21 285:11	122:18 166:10
statement 8:6	134:20 182:6	stored 17:8 18:9	structured 123:12	168:10 181:11
88:12,13 118:5	187:1 188:7	208:13 229:17	124:5,7 159:19	subterranean
129:1 160:8	Stewart 2:20 3:19	storing 20:4 58:15	struggling 230:16	188:15
165:15 201:18	240:20,22 241:4,5	273:7	stuck 198:13	succeed 79:8 103:3
205:7 216:20	241:12 252:19	story 164:22	studied 5:9 123:16	243:1
291:15	278:4 279:8	181:21 287:13,14	234:15 240:14	success 152:19
statements 160:4,5	281:13 285:17	strategic 45:7	studies 33:8 105:5	155:20 169:9
states 7:2,5 9:2	286:9,14 288:5,9	97:14 216:5	212:13 244:2	244:5 247:6
15:20 24:19 25:10	293:6 295:5 296:6	217:18	276:17	successful 153:17
31:5 75:15 76:12	296:11 298:1	strategies 243:6	study 3:20,22 20:10	170:3 246:7,9
84:19 120:6	299:11,22 300:3,5	247:4 253:14,16	28:16,19 63:11	successfully 21:15
154:13 156:2,7	300:13,19 306:6	254:13 255:3	97:4 98:16 99:3,6	43:3 129:2
167:10 168:20,22	sticking 110:18	260:15,16 263:1	99:7,17 117:10	successive 106:10
170:1 172:15	stipulates 97:16	302:20	136:10 177:11,13	successor 133:8
180:5,7 188:12	stock 57:12 62:6,14	strategy 45:1	177:19 182:17	sucked 219:2
197:1 228:19	70:20,21 89:15,18	244:15 255:17	244:1 252:22	sudden 27:7
232:11 249:3	stockpile 31:7	260:21 261:16,16	253:22 254:4	suddenly 203:4
265:11 270:22	38:19 67:3 70:14	262:6,18 263:14	269:11,18 282:14	294:9 305:21
275:5 278:14,19	135:5	286:22 288:17	301:10 304:7	Suez 44:22,22
279:1,20 280:17	stockpiles 31:19	strawberries 178:3	studying 55:2	suffering 183:10
286:7,10 296:2	35:15	178:4	57:14 58:5	Suffice 254:21
305:10	stop 23:2 113:17	streams 251:13	stuff 50:20 108:18	sufficient 142:11
statewide 161:16	170:4	Street 1:10	211:22 212:19	207:1 223:1 258:7
state-owned 133:10	stopped 185:2	strength 111:14,15	224:7 259:5	278:9 279:6,21
stating 268:12	stopping 173:3	strengthen 21:19	291:19 302:18	283:6 293:11
station 147:11	storage 5:20 17:8	strengthened 151:1	305:12	299:2,6 300:17

sufficiently 20:11 86:11	39:16 46:10,12 56:9,21 63:1 77:7 156:21	swung 126:17	297:5 300:21 305:21	81:22 96:6 100:14 100:15 101:22 102:15 105:6 114:22 232:18 247:19 253:12 254:10,16 256:10 257:5,16 260:13 289:21 293:13 296:14 301:2
suggest 146:10 187:20 190:9 248:12 272:12 286:6 289:2	support 13:20 96:8 105:11 111:11,15 111:17,19 184:9 272:9 279:15	syndrome 133:1	taken 22:1 43:21 105:2 106:14 117:17,20 187:3 203:11 219:9	254:10,16 256:10 257:5,16 260:13 289:21 293:13 296:14 301:2
suggested 89:19 218:13	supported 138:15	system 6:21 20:7 20:13 23:11 24:8 41:7 50:6 53:5 54:17 56:12,14 58:1,21 67:8,22 100:15 121:20 124:4 142:20 158:3 163:17 194:5 223:3 236:13 237:10 244:3 251:2 279:19,21 281:1 282:8 286:11 295:6 297:11	takes 123:1 193:6 223:8,9 235:7	technically 40:14 107:7 126:15,22 127:15 196:19 233:14 255:11 263:8
suggesting 188:1 236:4	supporter 169:12 169:13	systematic 103:6	talent 191:15	technically-sound 98:9
suggestion 146:22 147:1 231:21 285:18	suppose 193:21	systems 142:22 175:4 220:8	talk 10:21 22:18 25:14 26:22 32:8 32:13 42:19 89:14 132:6 180:19 215:13 221:21 227:5 228:18 254:19	technique 185:4 187:16 188:6 275:17
suggestions 147:17 236:6	supposed 195:8 222:8 280:6		talking 26:8 31:18 33:18 34:5,7 40:7 42:7,10,10,15 43:18 67:14 134:18 135:1 144:16 153:5,13 191:20 199:13 202:16,18 203:7 203:21 205:1 211:6 222:3 227:7 229:1,10 230:6 231:2 290:21 302:5 304:7	techniques 132:18 243:5 289:12 290:11
suggests 187:22 244:3 282:5	supremacy 187:20	T	talks 138:8	technocratic 243:9
suitability 21:12	sure 10:10 30:18 72:3,6 77:13,17 82:4 84:13 85:1 91:7 108:11 114:5 116:14 169:1 172:4,10 190:2 255:18 267:14 285:1 306:7 307:3	table 97:11 199:21 251:1 287:21	tanks 167:4	technological 145:11 273:3,18 277:13
suitable 94:19	surface 20:5,8 32:22 44:3 262:11	tailed 100:22	target 143:13 149:13	technologies 5:19 15:22 24:2 32:11 44:19 255:8 256:9 272:1 275:11 283:9,14
suitably 247:1	surmountable 257:7	take 4:5 5:11 38:19 48:20 73:15 74:6 83:20 92:22 93:7 93:11 100:2,4 104:12 125:3 128:18 144:6 162:22 164:20 166:9 169:18 172:22 179:15 180:11 184:10 190:18 191:12 199:21 201:17 202:5,12,14,21 204:16 206:14 210:10 223:8 228:22 237:6 238:16 240:7 245:13 252:7,9 254:19 258:17 260:9 262:3 265:20 276:9 277:18 279:13 280:18 293:3	task 104:1	technology 9:18 12:12 23:9,19,21 32:6 40:3 41:16 59:7,7,8 100:7 102:14 106:8 119:1 121:6 163:10 217:13 223:19
suted 288:1	survey 13:19 43:9 43:12,14,14 168:19 172:17		taught 42:16	272:1 275:11 283:9,14
Sullivan 2:13 3:15 158:18,19 160:6,7 162:6,15 180:3 181:22 185:14 191:19 192:21 193:17 205:16 210:21 216:19,21 231:9 232:6 238:4	surveys 294:2		tax 53:2 82:15,20 83:11,12	tectonic 43:5
Sullivan's 187:20	Susan 1:17 151:9 214:15		taxes 290:1	tectonically 20:15
summarize 28:20 253:1 267:22	suspect 170:22		teach 220:7,12,20 241:7	telecommunicati... 131:7
summary 72:12 105:12 121:9 241:3	suspicious 288:19		teams 41:5	tell 37:3 71:19 128:5 160:21 169:11 181:21 212:12 296:1
summit 131:15	sustain 292:12		technical 20:20 40:9 56:7 58:11 65:13 66:22 70:7 71:5,18 73:11	
summits 131:17	sustainable 2:8 12:1,17 23:18 25:1 44:17 50:15 50:17 64:4 65:5			
sun 291:5	Sweden 8:17 124:6 209:9 279:19 286:11			
suns 195:9	swimming 224:7,8			
superior 191:15	Switzerland 124:7			
supervisory 45:3				
supplied 271:12				
supplier 24:22 54:12				
suppliers 27:9				
supplies 57:1				
supply 11:12 39:12				

temporarily 224:10	tests 19:3	139:7 160:18	219:2 221:18	thoughtful 184:15
temporary 204:22	Texas 280:11,13	164:10 166:4,6	223:7,17 224:12	278:1
204:22	295:2	168:1 169:19	224:18 229:12	thoughts 232:21
ten 18:3 27:18	text 10:19	175:4 187:3	230:9,17,21 231:1	239:10 283:21
28:21 33:17 61:7	thank 4:12,13 9:19	191:16 202:8	231:7,11,12,20	thousand 22:17
92:22 134:17	10:3,6,14 25:1,2,7	205:7 232:21	232:9 233:20	thousands 200:9
150:16 177:16	26:3 29:4 30:19	233:13 256:20	235:6,14,17	259:15
203:10 205:1	35:16 37:1 39:22	259:18 263:4	236:15 238:6	threat 206:10
213:21 261:10	39:22 44:11 45:11	288:15 289:22	242:6,8,22 245:5	three 11:15,17,18
tend 91:14 294:4	66:13,18,19 72:9	290:20 292:18	245:7,8,13,15	29:22 40:9 42:13
tenders 145:20	72:18 92:20 93:2	293:19 307:2	246:1,11,20 247:3	43:12 51:9,12,18
tends 129:4	94:4,9 106:14,15	think 22:2 26:13	248:8,18 249:9,11	59:17 78:3,6,7,8
tens 200:9	106:19 114:15	27:4,16 28:3,9	249:16 250:6,9,10	97:13 131:17
tenth 303:17,19	116:19,20 119:12	29:14 30:7,13	251:16,19 252:1,4	134:7 143:18
tenure 139:1	122:7 125:9	31:3,4 33:14 35:3	252:11,14 253:15	145:2 146:12
152:11	130:22 131:2,22	36:5,16 37:19	253:20 257:14	152:19 170:17,21
ten-minute 240:7	132:2 149:6,7	38:6,20 40:2	258:17 263:6,18	171:5 182:6 190:3
ten-year 20:10	152:6 156:11,13	41:11 46:19 47:17	268:9,13 278:5,8	212:7 213:9,20
230:1	157:6 162:2,20	48:7,10 59:9	278:10,17 279:14	220:9 228:20
term 48:15 66:1	170:15 175:17,18	66:21 72:15 77:14	279:22 282:4,8	232:3 240:14,16
129:18 176:17,21	175:19,22 179:16	77:18 80:1,3 83:6	284:6,13,18,19,20	248:22 291:1
192:15 196:5	179:17 195:7	87:20 90:12 91:11	285:1,7 286:2,18	302:20
211:7 230:7,8	197:19,20 200:12	91:14 92:14,20	287:6,12 289:10	three-fold 4:15
233:16 303:4	208:2,2 214:14	112:8 121:15	290:3,10 291:16	three-month 24:11
terminated 160:16	221:3 239:7,21	122:8 126:8 128:9	293:19,21 295:16	three-year 97:4
terminating 182:19	240:1,2,6 241:5	128:16 129:3	296:12,16,18	99:3
terms 25:20 26:4	252:17,18 253:4,5	139:19 142:5	297:18 303:12	threshold 145:10
28:15 29:1 35:4	253:8 269:4,5,16	150:9 151:4	304:14 306:20	threw 183:6
35:15 50:16 59:13	277:18,20,22	154:12 155:4	thinking 25:9	throw 188:21
64:5 84:22 108:17	279:8 294:16	156:19 157:1,16	27:10 37:14 49:9	tiers 291:1
134:8 136:6,7	307:5,10	161:18 163:8	140:17 191:2	Tim 2:3 4:6,13
202:17 205:3	Thanks 220:1	176:19 179:18	192:9 230:4	time 7:13 8:2 9:5
231:1,3,4 232:11	253:2	180:8,13 182:6,21	232:17	12:6 14:22 15:9
258:3,21 260:17	thermal 136:3	183:20 184:10,14	thinks 76:13	17:6,10 22:14
TerraPower	140:20 141:7	185:8,9 189:14	third 5:6 35:13	24:13 29:8 30:3
138:15 147:22	thin 108:14	190:17 191:12,17	78:19 80:10 93:12	30:12 37:10 46:9
terrifically 282:3	thing 35:7 85:12	191:21,22 192:3	93:13 144:19	48:6,10 55:10,19
territories 99:14	86:3 168:17	192:13 195:1,21	156:16 168:9	56:2 58:3 61:22
territory 76:13	169:21 205:9	196:8 197:12	255:14 257:19	65:22 66:10 68:13
85:19,22 108:20	210:12 237:2	200:15,17 201:2	262:6 266:3 269:7	69:17 70:4,14
terrorism 35:10	242:8 255:12	201:12 205:11	273:5	71:3 72:16 73:18
terrorists 212:16	259:14 280:9	206:2 207:3,7,16	thorium 147:22	74:15,18 78:2
test 18:18 136:9	285:4,7 287:6	211:11 212:2,2	148:4	79:4,6 88:4 89:1
tested 119:6	290:5 303:14	214:6,7,7 215:7,9	thorough 66:14	92:20 94:7 100:5
testifying 291:5	things 34:11 41:19	215:14,21 216:4	thought 118:7	108:7 111:13
292:14	74:21 89:5 109:16	217:2,7,18,20	153:9 154:4	113:11 116:14,15
testimony 277:2	114:4 123:20	218:4,9,11,12	281:10 294:21	125:3,6 128:13,18

132:14,14 134:20	Tokai 14:12 15:18	185:11 200:20,21	tribes 179:6 195:13	253:14 255:5
136:8 139:15	16:22 17:20,22	transition 251:19	197:5 232:12	283:8,15 284:1
146:11 158:20	20:1 28:17	258:16	238:14,21	trying 6:4 60:12
159:20 162:1	token 181:9	translated 96:12	tricky 257:8	112:12 122:10,22
163:9 166:21	Tokyo 9:14	translates 294:11	tried 48:19 49:2	148:7,20 190:17
168:16 170:11	told 227:1	transmutation	50:5 54:3 64:15	191:11 283:12
171:2,15,20	Tom 2:21 3:21	132:18 142:13	65:8 66:11 79:1,2	288:13 293:3
172:10 173:12	245:9 252:20	transparency 16:7	81:10,12 91:11	turn 7:12 106:16
174:8,10,16	269:20	35:5,17,19 48:12	254:10	131:4 158:6 190:1
176:12 179:1	tomorrow 4:10 5:7	51:22 82:2 101:4	trip 147:8	turned 130:4 173:6
181:17 190:1	7:22 307:10	231:18,19	trips 147:15 169:7	185:1,15 234:17
200:8 201:6,6	tomorrow's 7:19	transparent 91:12	tritium 172:20	260:14 297:21
203:6 206:2	ton 54:5 68:3	91:12 104:16	173:6	turnover 190:20
207:19 210:19	tons 11:10 16:18,19	transport 5:20	troubles 18:19	turns 189:1 202:5
213:3,5 219:14	16:21 17:2,3,5,7	58:17 255:14	211:19	tweaking 211:21
221:11 229:9	30:22 31:2,9	transportation	TRU 298:2	Twelfth 1:10
231:5 232:1,20	38:21 54:18 70:15	141:13 296:17	true 233:4	twelve 150:16
235:19 236:22	71:2,3,21 144:1	transported 17:21	trust 6:9,13 97:19	Twenty-years
245:14 251:5	155:9,10	112:11	98:14 102:11	229:2
252:7,11 254:19	tool 49:21	transuranic 164:14	105:17 108:6	twice 140:19 146:4
260:9 262:3	top 40:20 100:1	166:22 169:3	115:18 123:18	twin 171:5
266:13,18 278:11	189:17 243:10	transuranics 199:9	124:4,12 125:2	two 9:6 11:16 19:2
288:21 291:4	265:13 268:4	282:22	161:16 164:3	21:3,4 29:20 40:8
293:1 296:4	topics 11:3	traveling 138:18,19	167:7,13,13,19	47:2 49:3 54:14
timeline 143:1	top-down 243:9	147:21	168:13 169:5	58:7 59:17 61:1,6
260:18,19	244:8	travels 209:9	170:7 176:17	72:19 82:6,9
times 27:18 57:22	top-to-bottom	treasury 210:11	177:9,10,10	83:10 89:5 90:4
59:17 167:19	244:21	227:1	178:20 186:10,20	92:7 93:1 104:4
176:19 274:16	total 31:7 60:16,18	treaties 177:4	187:11,14 188:7	110:6 117:3 127:1
292:14	96:11 116:12	220:7,13,20	192:8,14 195:2	147:6 151:17
timescale 48:21	204:13 231:12	treatment 63:17	207:5 213:12	162:9 166:6 171:9
137:8	276:10 297:16	249:7 270:13,17	214:22 219:3,5,15	171:19 172:14,21
timing 128:15	totally 247:12	treaty 178:19	232:7,17 235:3,15	173:4 181:20
titled 10:19	touch 141:21	179:11 191:6,8	239:2,5 257:18	182:6 183:5,7
today 4:10 29:13	tour 172:7 190:6	195:8,16 196:10	266:5,8,20 281:18	188:4 189:18
40:8 131:18 142:6	town 109:13	220:16 221:3	282:4	190:11 193:20
159:18 160:13	toxicity 275:14	tremendous 147:3	trusted 124:13	197:21 199:11
163:3 169:10	toying 186:22	tremendously	210:19	200:1 202:3 206:1
174:4 175:8 176:5	track 62:4	134:3	trusting 169:22	218:21 224:15
177:6 216:16	trade 12:15	trench 185:6	trustworthy 125:5	228:20 248:16
217:20 218:6,18	traditional 101:3	trend 90:22	try 37:12 45:15	258:7 264:3
236:20 239:22	transfer 129:13	trends 89:5 91:3	49:10 50:18,20	265:14 271:3
253:2,7 256:20	130:1 262:2	tribal 3:13 5:2,4	51:9 57:4 59:12	274:4,9,18 276:4
266:4 269:14	transform 186:1	110:2 157:9 158:8	62:1,20 64:10,14	281:13,16 283:11
271:16 307:9	222:21 236:21	160:1	77:2 91:12 114:16	285:19 286:5,6,8
today's 7:19 140:18	250:15	tribe 107:10 113:16	186:10 200:12	295:8 298:18
toilet 163:18	transformed	214:3 232:14	220:6 235:1 242:7	two-part 261:16

two-phase 268:16	270:3 290:6 292:1	unload 167:17	151:16 155:2	271:10,17 272:18
type 54:1 57:7	292:17,17	unofficial 132:4	167:19 173:10	275:1
83:21 86:17	understanding	unquestionably	174:4 176:12	
133:20 144:12	13:10 18:4 34:1,2	35:4	184:20 188:8	V
152:2 231:4	37:4 40:4 75:22	unscathed 306:18	211:5,7,7 212:4	valid 266:22
258:14 282:18	120:17 153:21	unstable 33:12	213:6,15,17	validity 13:11
283:15 286:21	154:1 155:20	unsuccessfully	221:14 223:12	Valley 172:12
types 270:20 283:9	178:13 183:19,22	242:3	224:17 231:4	184:18,20
typical 21:3 140:5	194:12,21 196:9	update 121:16	235:11 236:12	valuable 8:20
	211:12 223:15	updated 293:5	254:10 255:5	143:12 173:7
U	307:7	updating 102:11	274:14 276:4	174:3,20 201:15
UAE 84:20 85:4	understated 129:1	upgraded 35:15	292:6	203:12 274:15
88:16	understood 40:19	134:10	useful 78:10 290:10	290:4 307:6
Udall 195:12	179:8 237:5,11,13	upper 47:18 271:9	users 28:6	value 36:4 81:17
ultimate 207:18	undertake 97:3	upset 228:8,9	uses 46:22	90:9 92:3 94:11
231:19	undertook 160:14	upturn 89:9	usually 228:20	129:6 187:4,5
ultimately 130:18	underway 93:12	up-front 125:14	237:5	188:6 212:5
172:21 225:13	114:20	128:5	Utah 243:18	233:12 276:1
unacceptable 268:9	undesirable 19:4	Urals 136:2 145:8	306:12,12	291:8 295:1
unaccounted 31:8	unduly 245:12	uranium 25:19	utilities 18:1 39:1	values 99:10
31:10,20 32:13	uneasy 13:22	26:1,17,18,21	52:11 53:13,14	100:12,22 104:8
unborn 196:7	unfamiliar 217:1	27:3,7 29:11	78:15 79:7 83:17	117:2 263:11
uncertain 260:19	unhappy 306:12	41:14 56:15,19	84:7 116:1,7	variations 89:21
267:17	uninformed 220:15	57:2,8,12 60:4	124:8,16 265:3	263:2
uncertainties 61:15	221:3 238:20	67:12 77:16 87:1	272:3	varied 90:19
242:11,14	Union 156:1	87:4 130:3 145:18	utility 37:20 53:17	variety 5:7 203:19
uncertainty 161:17	187:11	149:20,22 151:21	79:14 83:13 84:3	243:5 248:1
183:17 192:4	unique 145:15	174:5 257:22	115:19 193:3	249:17
216:12 218:2	286:7	267:6 268:3	219:18 250:7	various 48:20
268:6	United 7:2,5 9:2	276:10	265:18	54:21 59:19 170:1
underground 21:5	15:20 24:18 25:10	uranium-fueled	utilization 12:2,13	173:9 203:4 211:9
44:2,5 167:4	31:5 32:4 75:15	149:18	12:18 14:15	225:17 240:15
274:8,12	84:18,19 85:9	urge 250:22 277:13	utilize 12:4 14:8	281:11 292:14
underlying 176:14	120:6 154:13	urgency 257:2	32:7	vast 81:11 108:13
undermined	167:10 188:12	usage 62:11 87:11	utilized 196:3	Vegas 294:13
287:11	228:19 270:22	use 7:1 15:7 16:14	219:8 289:13	vendors 23:8 24:1
understand 8:12	275:5 286:7,10	17:14 29:18 30:1	utilizes 199:8	Venezuela 149:4
9:20 37:13 40:15	units 11:15,16,17	30:5,11 37:5,11	utilizing 15:8 17:20	venture 153:16
61:13 75:14 80:22	11:19	38:6,17 39:2,8	21:4 131:8 178:11	venue 220:21
90:6 94:12 108:9	universal 111:1	54:8,9 56:10,17	U.S 6:21 27:18	verify 187:12
121:18 126:7	2:22 9:14,15	57:11,18,20 62:19	65:10 84:21	Vermont 280:14
149:13 156:11	122:12 131:6	64:15 87:13 88:14	139:21 155:18	294:17,21 295:19
164:19 176:21	132:16 138:6	103:17,19 109:1,2	158:2,18,20 159:3	versa 112:4
177:4 178:1 181:6	240:20,22 241:7	109:3 120:5 135:7	163:3 168:19	version 136:17
210:22 211:2	269:10	135:9 138:12,16	172:16 173:20	versions 134:5
217:15 220:22	University's 9:17	139:11,16 141:12	174:7 187:21	258:5 265:12
224:13,18 239:5		142:10 143:9	201:18 241:1,15	versus 284:2

vertical 133:6 151:3	184:1	warrant 267:17	165:19 166:22	water 11:7 12:3,6
veto 180:7,14 182:2 189:1 194:9 195:5 195:13 297:12 298:15 299:2,2 300:17	volunteer 158:22	wars 204:17	167:3,12 168:5	16:19,22 18:2
vetoed 160:16	vote 113:18,21	Washington 1:10	169:3 171:6,7,15	26:2 37:12 38:7
via 174:18 223:7	vu 160:19	220:10 289:14	172:1,14 173:1,7	133:17 134:6
vice 112:4	VVER 133:18	290:9	173:20 174:1,2,6	136:6 140:20
Vicky 1:16 39:21	VVERs 134:6,10	wasn't 107:3	174:12,19,20	154:20 166:2
Vietnam 147:8,9		166:12 182:9	175:10 181:17	171:22 176:13
view 19:6 23:10	W	184:12,13 202:7	184:21 193:8	224:9 274:6,14
26:20 35:12 42:9	W 241:21	229:5 234:6,18	195:12 196:20	275:2 296:4
50:1 87:22 118:1	wait 33:19 38:13	295:21 300:6	197:17 198:10,13	299:18 300:3,4
135:15 155:12	63:11 92:13	302:17	200:5,6,19 201:2	Watkins 165:12
207:11 217:16	113:15 258:6	waste 2:10 3:18 5:5	201:3,8,15 203:5	242:1
248:16,20 252:1	262:19 267:13	5:20,21 6:1,3,11	204:19,19 208:10	watt 136:7
viewed 108:15,16	waiting 69:21 70:3	6:21 12:7,13	208:14 209:15	wave 138:18,19
viewgraph 28:4	109:5 121:22	18:22 19:21 20:21	211:8 212:20,22	147:22
viewpoint 13:12	walk 185:7	22:4 23:16 28:11	213:3,20 214:1	way 9:20 14:14
23:18 27:5 30:10	want 34:13 37:12	49:11,16 50:16,18	221:22 222:1,20	25:7 33:13,16
32:9 34:17 36:3,7	43:17 47:11 63:8	50:19,19,21 51:2	222:22 229:16	34:15 42:10,11
38:9,9 42:3,4	63:8,12,18 66:8	51:7,8,10,13,21	233:4,10 234:1,5	46:13 57:18,19
views 37:17 99:22	70:2 107:9 155:2	52:13 53:1,12,16	235:16 237:8	82:21 88:19 101:6
281:5	159:20 162:19	55:2,6 58:13,16	241:2,15 242:4,13	103:6 123:11,21
violations 214:22	179:21 180:13	59:21 63:4,16,17	243:7,10,13,16	126:6,17 157:22
virtually 88:6	184:20 187:4	64:3,7,9,13 65:1,4	244:7,9 245:2,5	160:10 174:18
visa 137:20	204:17 206:13	65:13,20 66:4	245:19 246:11	177:16 179:5
visible 89:10	209:16 210:16	71:22 74:10 75:2	247:12 248:5,8,9	181:1 185:9,11
vision 199:6	219:7 220:2,3	76:7,16,17,19	248:11 249:8	188:1 191:17
visit 8:19 40:6	232:5 237:6 240:2	77:1,3,22 79:2,10	250:3,20 251:2,7	195:4 197:15
117:18,21 158:15	250:22 260:9	80:7 83:9,14 85:4	251:7,12,15,20	205:14 212:5
168:22	264:12,14,16,21	85:17,21 86:4,13	252:9 256:3,5,11	214:8,19 215:15
visited 8:17	266:10,12,13	86:15,21 87:2	258:3,5,12,15	222:11 227:14
visiting 169:8	267:5,19 270:2	88:7,10,17 89:10	259:21 263:13	231:7 232:11
Visits 147:13	280:14 284:16,21	91:2 92:9,14	272:21 274:7,11	235:19 248:3
vitrification 18:22	285:9,13 286:1	93:15,17,20 95:7	275:14 276:12,15	249:20 253:14
vitrified 12:7 19:21	288:12 289:2	95:12,13,15 96:13	276:20 278:12,15	264:14,15,18
20:3 58:16 301:1	292:8 295:3,8	96:15,19 97:17,19	278:18 279:12	266:1,15 267:9
voice 267:18	301:4,18 302:18	98:1,5 99:12	280:4,22 283:17	268:10 272:13,14
Volga 138:2	306:13,14,15,21	100:3 111:2	283:20 284:1,12	275:8 281:19
volume 58:21	wanted 148:6	117:19 120:4	286:21 287:9	285:1 287:9
71:21 88:9 168:5	154:18 186:9,18	124:18,20 126:6	292:7 293:12	291:16 301:17
258:2 284:9,12,13	214:20	129:3,4,21 130:10	294:20 295:20	302:2
304:18	wants 47:3 184:5	130:13 132:19	298:2,3 299:18	ways 22:12 33:20
voluntary 161:12	war 135:3 215:2,8	143:17,19,22	300:21,22 301:1,2	134:19 170:6
	216:11 287:8	144:2,7,13 146:22	304:1,5 305:6	248:6 260:14
	289:4,5,6	152:3 153:8,10	306:7,10,11	283:11 287:19
	Ward 172:12	158:10,13,21	wasteful 234:16	290:7
	184:18,20	159:7 163:5	wastes 272:18	wayside 177:7
	warming 13:5,16	164:12,14 165:6	watch 281:21	weak 280:7

weapons 171:13 203:15	205:14 210:9 211:2,6,13 215:7 215:10 216:3,9 218:17 224:6 228:9 229:10 230:3,6 232:1 233:4 234:11 235:6 239:15 240:4 243:8 245:16 256:2,21 261:20,22 262:8 267:1 284:7 286:15 287:10,16 288:16 290:22 292:22	111:5 112:3,4,5,6 112:9,11 113:4 121:11 126:20 128:10,14,17,21 129:17 206:7 213:16 222:10 305:11	173:13 175:5,6,7 195:1,4,11 200:7 206:20 207:17 218:11,16 225:2 246:10 247:7,8 249:2,10 253:10 254:6,8 261:5 262:12 282:3 290:9 295:7 296:2	146:10 wrestle 184:6 wrestling 226:1 227:18 write 194:22 210:3 write-up 114:17 written 46:3 55:14 94:14 wrong 48:13 91:13 161:4 174:13 217:1 wrote 161:21 162:7 Wyoming 2:14 158:19 160:16 162:17 170:2 183:10 200:13
web 6:16 115:13 256:1	230:3,6 232:1 233:4 234:11 235:6 239:15 240:4 243:8 245:16 256:2,21 261:20,22 262:8 267:1 284:7 286:15 287:10,16 288:16 290:22 292:22	willingness 129:19 win 166:20 wind 26:8 201:8 211:21 235:9 237:18 winning 290:1 WIPP 190:10 243:20,22 247:6 287:13 290:5,7 294:11 295:19 297:1,20 298:3 305:9	worked 173:22 202:2,2 229:3 241:8,22 297:18 working 3:13 48:21 80:13 103:1 113:10 143:19 147:14 157:8 159:22 197:1 198:22 219:13 287:3 works 256:15 297:7 workshop 66:7 138:6 153:6 workshops 99:14 132:17 world 12:19 27:3 31:4 40:6 47:9,12 53:21 110:22 145:10,15,17 146:15 172:1 173:18 175:3 267:4 worldwide 133:12 275:10 world's 53:20 worried 284:7 worry 127:16 199:10 219:4 304:17 worrying 267:5 worth 22:16 234:5 worthwhile 274:20 wouldn't 204:11 246:15 252:3 303:1 wow 281:17 wrap 24:14 61:21	wrote 161:21 162:7 Wyoming 2:14 158:19 160:16 162:17 170:2 183:10 200:13
web-based 99:15	we've 9:3 27:7 33:17 41:18 49:1 49:6,17 50:10,11 51:15 52:5,6,9,22 53:19,22 54:10 55:9 58:2,6 63:6 69:22 70:6 73:18 76:22 79:22 82:1 83:15 84:10 90:18 92:12,13 103:4 112:19 113:13 120:3 168:9 179:18 181:7 199:20 200:18 206:14 209:21 223:5 228:15,17 232:20 235:8,14 238:12 240:16 243:6,15 255:10 256:14 264:1,9 266:3 287:9 288:19 290:11 292:16 305:6	WIPP's 242:12 Wisconsin 265:11 wisdom 193:1,11 193:14,16 204:4,5 298:19 wish 8:4,7 46:21 160:4 284:4 wishes 7:20 witnessed 195:21 wolves 192:9,11 women 277:17 wonder 232:10 278:21 281:4 286:6 wondering 31:6 39:13 89:5 118:12 187:15 305:17 woops 189:20 word 164:4 167:19 174:14 183:5 211:5 292:6 words 11:4 22:17 46:5 107:4 109:22 132:20 190:8 work 5:3 6:6,18 38:19 64:9 95:8 97:1 127:15 138:5 158:2,7 172:17	working 3:13 48:21 80:13 103:1 113:10 143:19 147:14 157:8 159:22 197:1 198:22 219:13 287:3 works 256:15 297:7 workshop 66:7 138:6 153:6 workshops 99:14 132:17 world 12:19 27:3 31:4 40:6 47:9,12 53:21 110:22 145:10,15,17 146:15 172:1 173:18 175:3 267:4 worldwide 133:12 275:10 world's 53:20 worried 284:7 worry 127:16 199:10 219:4 304:17 worrying 267:5 worth 22:16 234:5 worthwhile 274:20 wouldn't 204:11 246:15 252:3 303:1 wow 281:17 wrap 24:14 61:21	Y Yakama 2:19 158:12 176:9,11 178:5 195:19 196:2 197:13 214:3,3 Yankee 294:21 295:19 year 16:12,13 22:1 54:6,18 55:17 68:4 99:2 104:18 133:14 143:22 179:10 198:3 199:14,17 203:9 204:15 224:2 237:13 years 17:13 18:3,18 19:2 20:5 27:6 32:22 33:3,17,18 39:15 42:14 46:7 49:19 50:13 51:9 51:12,18 54:16 56:1 58:8 59:10 60:5 63:21 73:12 74:2,4,11 75:4 89:20 97:13,15 106:12 131:12 132:15 134:16,17 135:21 138:6 139:10 148:11
well-developed 120:7	we've 9:3 27:7 33:17 41:18 49:1 49:6,17 50:10,11 51:15 52:5,6,9,22 53:19,22 54:10 55:9 58:2,6 63:6 69:22 70:6 73:18 76:22 79:22 82:1 83:15 84:10 90:18 92:12,13 103:4 112:19 113:13 120:3 168:9 179:18 181:7 199:20 200:18 206:14 209:21 223:5 228:15,17 232:20 235:8,14 238:12 240:16 243:6,15 255:10 256:14 264:1,9 266:3 287:9 288:19 290:11 292:16 305:6	winning 290:1 WIPP 190:10 243:20,22 247:6 287:13 290:5,7 294:11 295:19 297:1,20 298:3 305:9	worked 173:22 202:2,2 229:3 241:8,22 297:18 working 3:13 48:21 80:13 103:1 113:10 143:19 147:14 157:8 159:22 197:1 198:22 219:13 287:3 works 256:15 297:7 workshop 66:7 138:6 153:6 workshops 99:14 132:17 world 12:19 27:3 31:4 40:6 47:9,12 53:21 110:22 145:10,15,17 146:15 172:1 173:18 175:3 267:4 worldwide 133:12 275:10 world's 53:20 worried 284:7 worry 127:16 199:10 219:4 304:17 worrying 267:5 worth 22:16 234:5 worthwhile 274:20 wouldn't 204:11 246:15 252:3 303:1 wow 281:17 wrap 24:14 61:21	Y Yakama 2:19 158:12 176:9,11 178:5 195:19 196:2 197:13 214:3,3 Yankee 294:21 295:19 year 16:12,13 22:1 54:6,18 55:17 68:4 99:2 104:18 133:14 143:22 179:10 198:3 199:14,17 203:9 204:15 224:2 237:13 years 17:13 18:3,18 19:2 20:5 27:6 32:22 33:3,17,18 39:15 42:14 46:7 49:19 50:13 51:9 51:12,18 54:16 56:1 58:8 59:10 60:5 63:21 73:12 74:2,4,11 75:4 89:20 97:13,15 106:12 131:12 132:15 134:16,17 135:21 138:6 139:10 148:11
well-known 137:10	we've 9:3 27:7 33:17 41:18 49:1 49:6,17 50:10,11 51:15 52:5,6,9,22 53:19,22 54:10 55:9 58:2,6 63:6 69:22 70:6 73:18 76:22 79:22 82:1 83:15 84:10 90:18 92:12,13 103:4 112:19 113:13 120:3 168:9 179:18 181:7 199:20 200:18 206:14 209:21 223:5 228:15,17 232:20 235:8,14 238:12 240:16 243:6,15 255:10 256:14 264:1,9 266:3 287:9 288:19 290:11 292:16 305:6	WIPP's 242:12 Wisconsin 265:11 wisdom 193:1,11 193:14,16 204:4,5 298:19 wish 8:4,7 46:21 160:4 284:4 wishes 7:20 witnessed 195:21 wolves 192:9,11 women 277:17 wonder 232:10 278:21 281:4 286:6 wondering 31:6 39:13 89:5 118:12 187:15 305:17 woops 189:20 word 164:4 167:19 174:14 183:5 211:5 292:6 words 11:4 22:17 46:5 107:4 109:22 132:20 190:8 work 5:3 6:6,18 38:19 64:9 95:8 97:1 127:15 138:5 158:2,7 172:17	worked 173:22 202:2,2 229:3 241:8,22 297:18 working 3:13 48:21 80:13 103:1 113:10 143:19 147:14 157:8 159:22 197:1 198:22 219:13 287:3 works 256:15 297:7 workshop 66:7 138:6 153:6 workshops 99:14 132:17 world 12:19 27:3 31:4 40:6 47:9,12 53:21 110:22 145:10,15,17 146:15 172:1 173:18 175:3 267:4 worldwide 133:12 275:10 world's 53:20 worried 284:7 worry 127:16 199:10 219:4 304:17 worrying 267:5 worth 22:16 234:5 worthwhile 274:20 wouldn't 204:11 246:15 252:3 303:1 wow 281:17 wrap 24:14 61:21	Y Yakama 2:19 158:12 176:9,11 178:5 195:19 196:2 197:13 214:3,3 Yankee 294:21 295:19 year 16:12,13 22:1 54:6,18 55:17 68:4 99:2 104:18 133:14 143:22 179:10 198:3 199:14,17 203:9 204:15 224:2 237:13 years 17:13 18:3,18 19:2 20:5 27:6 32:22 33:3,17,18 39:15 42:14 46:7 49:19 50:13 51:9 51:12,18 54:16 56:1 58:8 59:10 60:5 63:21 73:12 74:2,4,11 75:4 89:20 97:13,15 106:12 131:12 132:15 134:16,17 135:21 138:6 139:10 148:11
went 93:4 98:21 117:1 157:13 164:16,21 165:4 169:19 240:9 290:4 292:3	we've 9:3 27:7 33:17 41:18 49:1 49:6,17 50:10,11 51:15 52:5,6,9,22 53:19,22 54:10 55:9 58:2,6 63:6 69:22 70:6 73:18 76:22 79:22 82:1 83:15 84:10 90:18 92:12,13 103:4 112:19 113:13 120:3 168:9 179:18 181:7 199:20 200:18 206:14 209:21 223:5 228:15,17 232:20 235:8,14 238:12 240:16 243:6,15 255:10 256:14 264:1,9 266:3 287:9 288:19 290:11 292:16 305:6	WIPP's 242:12 Wisconsin 265:11 wisdom 193:1,11 193:14,16 204:4,5 298:19 wish 8:4,7 46:21 160:4 284:4 wishes 7:20 witnessed 195:21 wolves 192:9,11 women 277:17 wonder 232:10 278:21 281:4 286:6 wondering 31:6 39:13 89:5 118:12 187:15 305:17 woops 189:20 word 164:4 167:19 174:14 183:5 211:5 292:6 words 11:4 22:17 46:5 107:4 109:22 132:20 190:8 work 5:3 6:6,18 38:19 64:9 95:8 97:1 127:15 138:5 158:2,7 172:17	worked 173:22 202:2,2 229:3 241:8,22 297:18 working 3:13 48:21 80:13 103:1 113:10 143:19 147:14 157:8 159:22 197:1 198:22 219:13 287:3 works 256:15 297:7 workshop 66:7 138:6 153:6 workshops 99:14 132:17 world 12:19 27:3 31:4 40:6 47:9,12 53:21 110:22 145:10,15,17 146:15 172:1 173:18 175:3 267:4 worldwide 133:12 275:10 world's 53:20 worried 284:7 worry 127:16 199:10 219:4 304:17 worrying 267:5 worth 22:16 234:5 worthwhile 274:20 wouldn't 204:11 246:15 252:3 303:1 wow 281:17 wrap 24:14 61:21	Y Yakama 2:19 158:12 176:9,11 178:5 195:19 196:2 197:13 214:3,3 Yankee 294:21 295:19 year 16:12,13 22:1 54:6,18 55:17 68:4 99:2 104:18 133:14 143:22 179:10 198:3 199:14,17 203:9 204:15 224:2 237:13 years 17:13 18:3,18 19:2 20:5 27:6 32:22 33:3,17,18 39:15 42:14 46:7 49:19 50:13 51:9 51:12,18 54:16 56:1 58:8 59:10 60:5 63:21 73:12 74:2,4,11 75:4 89:20 97:13,15 106:12 131:12 132:15 134:16,17 135:21 138:6 139:10 148:11
weren't 183:1	we've 9:3 27:7 33:17 41:18 49:1 49:6,17 50:10,11 51:15 52:5,6,9,22 53:19,22 54:10 55:9 58:2,6 63:6 69:22 70:6 73:18 76:22 79:22 82:1 83:15 84:10 90:18 92:12,13 103:4 112:19 113:13 120:3 168:9 179:18 181:7 199:20 200:18 206:14 209:21 223:5 228:15,17 232:20 235:8,14 238:12 240:16 243:6,15 255:10 256:14 264:1,9 266:3 287:9 288:19 290:11 292:16 305:6	WIPP's 242:12 Wisconsin 265:11 wisdom 193:1,11 193:14,16 204:4,5 298:19 wish 8:4,7 46:21 160:4 284:4 wishes 7:20 witnessed 195:21 wolves 192:9,11 women 277:17 wonder 232:10 278:21 281:4 286:6 wondering 31:6 39:13 89:5 118:12 187:15 305:17 woops 189:20 word 164:4 167:19 174:14 183:5 211:5 292:6 words 11:4 22:17 46:5 107:4 109:22 132:20 190:8 work 5:3 6:6,18 38:19 64:9 95:8 97:1 127:15 138:5 158:2,7 172:17	worked 173:22 202:2,2 229:3 241:8,22 297:18 working 3:13 48:21 80:13 103:1 113:10 143:19 147:14 157:8 159:22 197:1 198:22 219:13 287:3 works 256:15 297:7 workshop 66:7 138:6 153:6 workshops 99:14 132:17 world 12:19 27:3 31:4 40:6 47:9,12 53:21 110:22 145:10,15,17 146:15 172:1 173:18 175:3 267:4 worldwide 133:12 275:10 world's 53:20 worried 284:7 worry 127:16 199:10 219:4 304:17 worrying 267:5 worth 22:16 234:5 worthwhile 274:20 wouldn't 204:11 246:15 252:3 303:1 wow 281:17 wrap 24:14 61:21	Y Yakama 2:19 158:12 176:9,11 178:5 195:19 196:2 197:13 214:3,3 Yankee 294:21 295:19 year 16:12,13 22:1 54:6,18 55:17 68:4 99:2 104:18 133:14 143:22 179:10 198:3 199:14,17 203:9 204:15 224:2 237:13 years 17:13 18:3,18 19:2 20:5 27:6 32:22 33:3,17,18 39:15 42:14 46:7 49:19 50:13 51:9 51:12,18 54:16 56:1 58:8 59:10 60:5 63:21 73:12 74:2,4,11 75:4 89:20 97:13,15 106:12 131:12 132:15 134:16,17 135:21 138:6 139:10 148:11
west 165:21 171:1 192:9,10	we've 9:3 27:7 33:17 41:18 49:1 49:6,17 50:10,11 51:15 52:5,6,9,22 53:19,22 54:10 55:9 58:2,6 63:6 69:22 70:6 73:18 76:22 79:22 82:1 83:15 84:10 90:18 92:12,13 103:4 112:19 113:13 120:3 168:9 179:18 181:7 199:20 200:18 206:14 209:21 223:5 228:15,17 232:20 235:8,14 238:12 240:16 243:6,15 255:10 256:14 264:1,9 266:3 287:9 288:19 290:11 292:16 305:6	WIPP's 242:12 Wisconsin 265:11 wisdom 193:1,11 193:14,16 204:4,5 298:19 wish 8:4,7 46:21 160:4 284:4 wishes 7:20 witnessed 195:21 wolves 192:9,11 women 277:17 wonder 232:10 278:21 281:4 286:6 wondering 31:6 39:13 89:5 118:12 187:15 305:17 woops 189:20 word 164:4 167:19 174:14 183:5 211:5 292:6 words 11:4 22:17 46:5 107:4 109:22 132:20 190:8 work 5:3 6:6,18 38:19 64:9 95:8 97:1 127:15 138:5 158:2,7 172:17	worked 173:22 202:2,2 229:3 241:8,22 297:18 working 3:13 48:21 80:13 103:1 113:10 143:19 147:14 157:8 159:22 197:1 198:22 219:13 287:3 works 256:15 297:7 workshop 66:7 138:6 153:6 workshops 99:14 132:17 world 12:19 27:3 31:4 40:6 47:9,12 53:21 110:22 145:10,15,17 146:15 172:1 173:18 175:3 267:4 worldwide 133:12 275:10 world's 53:20 worried 284:7 worry 127:16 199:10 219:4 304:17 worrying 267:5 worth 22:16 234:5 worthwhile 274:20 wouldn't 204:11 246:15 252:3 303:1 wow 281:17 wrap 24:14 61:21	Y Yakama 2:19 158:12 176:9,11 178:5 195:19 196:2 197:13 214:3,3 Yankee 294:21 295:19 year 16:12,13 22:1 54:6,18 55:17 68:4 99:2 104:18 133:14 143:22 179:10 198:3 199:14,17 203:9 204:15 224:2 237:13 years

150:17 155:19	<hr/> \$ <hr/>	160 3:14	2002 21:9 92:4	<hr/> 3 <hr/>
160:20 163:6	\$120 204:14 237:13	163 133:15	96:13,15 98:6	3 49:4 92:13
164:13 171:17	\$130 204:15	17 133:12	105:14 115:20	30 11:8 20:5 32:22
172:21 173:4,15	\$16 101:13	18 39:6 160:20	120:3	33:2 39:15 46:7
175:9,11 182:10	\$23 227:1 228:14	18,000 99:19	2004 9:12,16	71:2 89:20 134:16
193:11,12 195:21	\$3 203:22	1800 141:6	2005 16:9 19:11	171:16 173:15
196:18 197:7	\$4 204:1	1855 195:8,16	98:19	195:21 278:17
199:14 200:10	\$5 98:15	1960 149:6	2006 23:12 50:13	287:14
201:7,19 202:15	\$700 204:14	1960s 14:3 26:16	55:11,20 73:6	300 20:8 55:3 137:1
203:8,10,11 204:2	<hr/> 0 <hr/>	1970 164:9	93:16	32 31:2
205:1 207:13	0.3 19:16	1970s 14:18 19:22	2007 92:4 98:20	32,000 17:3 31:9
212:11 213:21	0.45 141:5	29:7,9 32:20 33:7	100:14 101:10	34,000 17:7
214:13,22 217:14	0.6 28:9	1971 159:4	116:3 159:14	35 207:13
220:6,9 222:18	<hr/> 1 <hr/>	1977 159:4	2008 98:22 102:2	350,000 166:1
223:11 234:15	1 19:17 27:14 28:8	1978 95:10	104:3 116:7	375 221:5
236:22 244:14	35:1 177:15	1980s 95:9 131:17	2009 116:8 133:14	<hr/> 4 <hr/>
251:5 252:10	1,000 54:5 68:3	1982 243:10	159:15	4 3:2,3 11:12 49:7
258:8 259:15	1,020 16:21	1987 158:20 159:5	2010 1:7 269:18	57:14,16 65:12
261:10,22 262:11	1,500 16:19	242:5	271:11	70:3 83:1 175:3
264:2,20,21 271:7	1,700 54:18	1989 95:20	2011 144:22 271:14	213:4 223:3 224:2
273:10 277:6	1:00 157:8,11	1990s 15:4	2012 58:7	229:1 237:10
278:17 287:14	1:02 157:14	1992 20:10 33:9	2013 55:13	4:07 307:13
289:12 295:21	10 3:5 61:7 63:21	149:6 161:21	2014 55:18 74:4	40 13:2 17:12,16
yen 19:16,17 27:14	10th 159:11	1994 22:21	136:19	38:21 59:10 70:15
28:8,9 35:1	10,000 305:22	1995 22:21 37:19	2015 24:8 135:10	70:21 133:19
yesterday 36:17,18	10-year 191:17	158:20 159:5,16	154:19	135:20 145:17
yield 170:10	10:29 93:4	160:11 166:6	2020 13:2 49:3,8	234:15 236:22
Yogi 160:18	10:40 93:5	1997 16:9 23:5	70:2	251:5 264:20
York 2:20 240:21	100 56:1 57:22	1998 96:5 159:16	2020s 58:6	291:4
241:6	69:18,21 73:12	250:4	2025 56:4 133:5	45 3:7 48:3
young 44:3	74:2,11 75:4	<hr/> 2 <hr/>	134:1	<hr/> 5 <hr/>
youngest 131:13	134:14 203:10	2:42 240:9	2030 13:3 134:11	5 60:18,21 61:4
Yucca 169:4	11 8:1 140:7	2:55 240:10	2035 166:9	142:15
181:19,19 184:12	12 145:22	20 9:4,8 26:12	2046 17:3 31:2	5,600 16:18
190:10 216:7	12:02 157:13	39:15 49:18 54:16	2050 12:14	5.5 59:15
234:6 236:4	120 99:12	60:15 63:21 70:22	2070 143:5	50 13:2,22 17:12
242:11 247:5	123 84:19	71:1 90:14 94:7	2100 271:11	20:5 32:22 33:2
260:1 261:1	132 3:12	133:10 164:13	22 54:7 67:9	48:4 63:21 155:11
264:13 265:15	15 1:7 55:9 81:16	193:11,12 194:17	241 3:18	163:6 177:15
266:6,11 268:15	89:13 92:17	199:14 201:19	25 56:15,16 106:11	203:10 277:5
272:22 292:4	131:12 145:22	212:11 264:21	244:13 289:12	294:8
301:21 302:15,17	202:15 240:17	291:2	250 155:10	50s 138:22
305:8,13	15-year 191:17	20-year 290:5	2500 99:19	50-mile 165:22
<hr/> Z <hr/>	16 11:12 39:6 133:2	200 11:10 44:2 55:3	253 3:21	50/50 91:18
zero 278:18 303:5	145:18,20 252:10	200,000 214:13	270 3:22	500 99:20 144:1
zone 20:15 55:5		2000 33:13 152:11	278 3:24	

<p>52 96:11 125:20 54 11:7 38:16</p> <hr/> <p style="text-align: center;">6</p> <p>6 140:5 60 28:9 53:22 271:7 273:10 60s 59:9 60-megawatt 137:14 600 149:18 640 166:2 66,000 17:2</p> <hr/> <p style="text-align: center;">7</p> <p>70s 77:12 79:3 148:13 173:21 244:16 70,000 305:8 700 202:17 71 164:10 75 150:10 77 165:2,3 775 1:10</p> <hr/> <p style="text-align: center;">8</p> <p>8 8:1 8,000 30:22 8:30 1:9 307:10 8:31 4:2 80 33:17 47:9 150:13 80s 47:18 77:13 79:4,16 173:21 244:16 80-percent 110:20 800 17:5 137:18 143:3 199:17 87 243:11</p> <hr/> <p style="text-align: center;">9</p> <p>9 104:3 9th 121:15 166:18 242:2 90s 79:15 123:15 124:2 173:22 900,000 167:2 94 3:9</p>	<p>95 238:19</p>			
---	-------------------------	--	--	--

C E R T I F I C A T E

This is to certify that the foregoing transcript

In the matter of: Blue Ribbon Commission on
America's Nuclear Future

Before: n/a

Date: 11-15-10

Place: Washington, DC

was duly recorded and accurately transcribed under
my direction; further, that said transcript is a
true and accurate record of the proceedings.



Court Reporter

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701