

UNITED STATES OF AMERICA  
+ + + + +  
DEFENSE NUCLEAR FACILITIES SAFETY BOARD

+ + + + +

PUBLIC MEETING AND HEARING

+ + + + +

THURSDAY  
OCTOBER 7, 2010

+ + + + +

The Board met in the Three Rivers  
Convention Center, 7016 W. Grandridge  
Boulevard, Kennewick, Washington, Peter S.  
Winokur, Chairman, presiding.

PRESENT:

PETER S. WINOKUR, Chairman  
JESSIE H. ROBERSON, Vice Chair  
JOSEPH F. BADER, Board Member

LARRY W. BROWN, Board Member  
JOHN E. MANSFIELD, Board Member

STAFF PRESENT:

RICHARD AZZARO, General Counsel  
TIMOTHY DWYER, Technical Director

PANEL MEMBERS PRESENT:

GREG ASHLEY, BNI  
DAVID BROCKMAN, DOE-ORP  
DONNA BUSCHE, URS  
STACY CHARBONEAU, DOE-ORP

DAVID DICKEY, Consultant  
DALE KNUTSON, DOE-ORP

PANEL MEMBERS PRESENT: (Cont'd)

DAVID S. KOSSON, CRESP

LONI M. PEURRUNG, PNNL

FRANK RUSSO, BNI

PAUL RUTLAND, WRPS

LEO SAIN, URS

INES TRIAY, DOE-EM

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

Opening Remarks . . . . .4

Chairman Winokur and Board Members

Opening Remarks . . . . . 18

Department of Energy

Panel Discussion: . . . . . 53

1. Pretreatment Facility Safety

Safety-related systems, structures and  
components

Design Complexity

2. Pretreatment Facility Operation

Public Statements

Patrick Pinto . . . . .195

Adjournment . . . . .202

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22

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

(5:00 p.m.)

CHAIRMAN WINOKUR: My name is Peter Winokur. I am Chairman of the Defense Nuclear Facilities Safety Board, and I will preside over this public meeting and hearing.

At this time, I would like to introduce my colleagues on the Safety Board. To my immediate left is Vice Chair Jessie Roberson, and to her left is Mr. Larry Brown. On my right is Dr. John Mansfield. On his right is Mr. Joseph Bader. We five constitute the Board.

The Board's General Counsel, Richard Azzaro, is seated to my far left. The Board's Technical Director, Timothy Dwyer, is seated to my far right. Several members of our staff closely involved with oversight at the Department of Energy's Defense Nuclear Facilities at Hanford are also present.

Today's meeting and hearing was first publicly noticed in the Federal Register

1 on July 26, 2010, and renoticed for a change  
2 of location on September 15, 2010. It is  
3 being held open to the public in accordance  
4 with the provisions of the Government in the  
5 Sunshine Act.

6 The hearing is being broadcast  
7 over internet via video streaming. The link  
8 can be found on the Board's website. A video  
9 recording of the hearing will be made  
10 available on the Board's website as soon as  
11 possible after the hearing is concluded, and  
12 will remain available for at least 60 days.

13 A verbatim written transcript,  
14 together with associated documents, will be  
15 available for viewing and copying in the  
16 Board's public reading room on the 7th floor  
17 of the Board's headquarters in Washington,  
18 D.C.

19 In accordance with the Board's  
20 practice, and as stated in the Federal  
21 Register notice, we will welcome comments from  
22 interested members of the public at the

1 conclusion of testimony for each of the three  
2 sessions comprising this public meeting and  
3 hearing.

4 A list of those speakers who have  
5 contacted the Board is posted at the entrance  
6 to this auditorium. We have listed the people  
7 in the order in which they have contacted us  
8 or, if possible, when they wish to speak. I  
9 will call the speakers in this order and ask  
10 that speakers state their name and title at  
11 the beginning of their presentation.

12 There is also a table at the  
13 entrance to the room with a sign-up sheet for  
14 members of the public who wish to make a  
15 presentation but did not have an opportunity  
16 to sign up previous to this time. They will  
17 follow those who have already registered with  
18 us in the order in which they have signed up.

19 In order to give everyone wishing  
20 to speak an equal opportunity, we ask  
21 presenters to limit their original statements  
22 to five minutes. The chair will then give

1 consideration to additional comments should  
2 time permit. Presentations should be limited  
3 to comments, technical information, or data  
4 concerning the subjects of this meeting and  
5 hearing. The Board members may question  
6 anyone making presentations to the extent  
7 deemed appropriate.

8 The record of this proceeding will  
9 remain open until November 7, 2010. This  
10 Board reserves its right to further schedule  
11 and regulate the course of this hearing, to  
12 recess, reconvene, postpone, or adjourn this  
13 meeting and hearing, and to otherwise exercise  
14 its authority under the Atomic Energy Act of  
15 1954, as amended.

16 Let me now proceed to explain the  
17 Board's statutory authority in inquiring into  
18 the matters that are the subject of this  
19 public meeting and hearing. The Board's  
20 enabling statute, now in effect for more than  
21 20 years, is found in the Atomic Energy Act  
22 beginning in Section 2286 of Title 42.

1                   One section of this defines the  
2 Board's role in the review of facility design  
3 and construction, and I quote, "The Board  
4 shall review the design of a new Department of  
5 Energy Defense Nuclear Facility before  
6 construction of such facility begins, and  
7 shall recommend to the Secretary, within a  
8 reasonable time, such modifications of the  
9 design as the Board considers necessary to  
10 ensure adequate protection of public health  
11 and safety.

12                   "During the construction of any  
13 such facility, the Board shall periodically  
14 review and monitor the construction and shall  
15 submit to the Secretary, within a reasonable  
16 time, such recommendations relating to the  
17 construction of that facility as the Board  
18 considers necessary to ensure adequate  
19 protection of public health and safety.

20                   "An action of the Board, or a  
21 failure to act under this paragraph, may not  
22 delay or prevent the Secretary of Energy from

1 carrying out the construction of such a  
2 facility."

3 The hearing begun this morning  
4 forms a part of the Board's continuing effort  
5 to fulfill this statutory charge with respect  
6 to the waste treatment and immobilization  
7 plant also known as the waste treatment plan.

8 The record of the hearing, both  
9 oral and written, will be used by the Board to  
10 formulate recommendations to the Secretary of  
11 Energy for this critical project. These  
12 recommendations may take the form of a formal  
13 recommendation to the Secretary or may be  
14 transmitted to the Department through letters  
15 or informal exchanges between technical  
16 counterparts.

17 The Board's oversight  
18 responsibilities continue through completion  
19 of construction, testing, operation, and  
20 eventual decommissioning of these facilities.

21 The Board's statutory charter is,  
22 like that given to other agencies operating

1 under the Atomic Energy Act, the protection of  
2 public health and safety, including safety of  
3 the workers.

4 In the case of the waste treatment  
5 plant, however, this statutory charge is made  
6 more complex because proper construction and  
7 operation of the plant is critical to  
8 resolving the underlying health and safety  
9 problem, namely the large volume of toxic and  
10 radioactive waste now stored in underground  
11 tanks at Hanford.

12 Many of these tanks are already  
13 60, 70 years old and would be almost 100 years  
14 old by the end of the projected treatment  
15 mission. Consequently, it is not enough in  
16 this case for the Board to focus solely on  
17 whether the construction of the waste  
18 treatment plant will not suffer accidents  
19 harmful to workers and the public. It must  
20 operate safely and effectively for many  
21 decades to remediate the safety hazard  
22 represented by the tank waste.

1                   The Board has, therefore, inquired  
2                   into many issues that involve a mixture of  
3                   accident risk and successful and efficient  
4                   long-term operations. At this time, I would  
5                   like to provide some additional background on  
6                   the history of the project.

7                   The Hanford high level waste tanks  
8                   began receiving waste in the 1940s. As the  
9                   initial single-shell tanks were being  
10                  constructed, they were designed for about a  
11                  20-year life.

12                  Over the seven decades of  
13                  operation of the tank farms, poor chemical  
14                  configuration control of the waste has created  
15                  a much more challenging problem for  
16                  understanding the chemistry and properties of  
17                  the waste, as well as getting them mobilized,  
18                  than exists at other sites such as the  
19                  Savannah River Site and the Idaho Cleanup  
20                  Project.

21                  Characterization of this waste  
22                  remains problematic. The first time that a

1 single-shell tank was suspected of leaking was  
2 in the mid-1950s. Many single-shell tanks  
3 have been proven leakers since then. The  
4 leakage exacerbates the need to get this waste  
5 out of the tanks and into stable forms  
6 suitable for eventual disposal.

7 The Department of Energy's  
8 solution to removing and stabilizing the waste  
9 to reduce the current and future threats to  
10 health and safety is the waste treatment  
11 plant. The waste treatment plant was  
12 initiated in the mid-1990s. This is the  
13 first-of-a-kind project. The Board's formal  
14 oversight of the project began in earnest  
15 after a privatization effort was abandoned in  
16 2002.

17 The Board has been advising the  
18 Department about our concerns related to  
19 design basis safety requirements and their  
20 potential impact on operational safety  
21 throughout the life of the project.

22 Since initiating the project, the

1 Department has pursued internal and external  
2 reviews of the project, obtaining advice from  
3 experts in academia, the chemical and process  
4 industries, and its national laboratories, to  
5 help inform the design, safe operation, and  
6 performance of the plant over its projected  
7 40-year operational life.

8 It is important to note that the  
9 Department undertook a significant redesign  
10 effort starting in 2009, even though the  
11 design of the plant was more than 70 percent  
12 complete. The redesign of the plant is now  
13 over 80 percent complete, and construction of  
14 its treatment facility is more than 30 percent  
15 complete.

16 Recently, the Department indicated  
17 to the Board that it is transitioning the  
18 waste treatment plant project from a design  
19 and construction project to one of  
20 construction and commissioning. The  
21 Department has referred to this transition as  
22 pivoting.

1                   As such, the Department is  
2                   planning to wrap up its design actions by  
3                   establishing the final design criteria for the  
4                   plant's structures, systems, and components.  
5                   The pivot is intended to provide a defined  
6                   path forward, to finish the design of the  
7                   systems and components that have not been  
8                   finalized, and to resolve any outstanding  
9                   technical issues.

10                   The Board is deeply concerned that  
11                   the plant may be commissioned before several  
12                   key technical issues are fully resolved. Once  
13                   operational and exposed to radioactive waste,  
14                   options for design changes and blackened hot  
15                   cells will be extremely limited, costly, and  
16                   expose workers to hazardous situations. To  
17                   the maximum extent possible, solutions must be  
18                   accommodated before commissioning. A learn-  
19                   as-we-go philosophy does not seem prudent for  
20                   this facility.

21                   Given that the project is now  
22                   pivoting, wrapping up design and focusing on

1 commissioning, it is a crucial time to have  
2 DOE [Department of Energy] explain where they  
3 are, where they are going, what remains to be  
4 done, and in what timeframe. Also implicit in  
5 the Board's statutory mandate is keeping the  
6 public appropriately informed of issues  
7 affecting public health and safety. Those are  
8 the goals of these proceedings.

9           The proceedings began last month  
10 when DOE provided over 200 pages of written  
11 answers to the Board's questions. These  
12 questions and answers are available on the  
13 Board's website and will become a part of the  
14 record of these proceedings. I want to take  
15 a moment to thank the Department for its  
16 timely response to these questions.

17           We began this morning to explore  
18 some of these answers to gain a more complete  
19 understanding. However, because of the large  
20 volume of information that must be discussed,  
21 a lack of further inquiry in this hearing, or  
22 in the near future, should not necessarily be

1 viewed as satisfaction on the part of the  
2 Board with either a previous written or verbal  
3 answer.

4 The Board noted in its transmittal  
5 of questions to DOE in August 2010 that these  
6 questions should be viewed as a starting point  
7 for the discussions that will occur during  
8 this public meeting and hearing.

9 There are several areas of the  
10 waste treatment plant design in which the  
11 Board has concerns with the safety and  
12 ultimate operation for the decades the plant  
13 must operate. These areas include: the  
14 ability of the plant to adequately mix the  
15 waste after they are transferred from the tank  
16 farms into the plant; the hydrogen control  
17 strategy for dealing with a hydrogen gas that  
18 is inevitably generated by the high level  
19 waste; the implementation of safety controls  
20 necessary to implement the hydrogen control  
21 strategy; and the likelihood that limitations  
22 on the plant's operating envelope resulting

1 from the performance of the plant's mixing  
2 systems will result in more demands on the  
3 tank farms to deliver waste that meets  
4 restrictive waste acceptance criteria or the  
5 need to provide alternative processing  
6 capability.

7           The second session of the Board's  
8 hearing, this evening's session, will  
9 concentrate on potential concerns with the  
10 pretreatment facility. These concerns are,  
11 first, the changes that Bechtel National  
12 Incorporated has made to the safety and design  
13 bases of the pretreatment facility in  
14 conjunction with a reduction in the material  
15 at risk; second, the effect of DOE's drive to  
16 reduce the complexity of the pretreatment  
17 facility design; and, third, the safety  
18 strategy for the design of piping and vessels  
19 to confine radioactive waste -- that is to  
20 say, the primary confinement design.

21           As in this morning's session, we  
22 are trying to understand the ability of the

1 plant to safely, effectively, and efficiently  
2 process waste delivered from the tank farms,  
3 so that it can vitrified for eventual  
4 disposal. We have requested that DOE and  
5 Bechtel National Incorporated participate in  
6 this evening's panel discussion.

7 That concludes my opening remarks.  
8 I will now ask my fellow Board members if they  
9 have opening remarks before we begin the  
10 testimony.

11 Hearing no such request, I want to  
12 invite Mr. David Brockman, Manager of DOE's  
13 Office of River Protection, to provide some  
14 introductory remarks.

15 MR. BROCKMAN: Thank you, Mr.  
16 Chairman, Board Members. I welcome the  
17 opportunity to introduce myself to the Board  
18 as a recent appointee to this position and  
19 provide introductory remarks on the subject of  
20 pretreatment facility safety.

21 I have asked my predecessor in  
22 this position, Shirley Olinger, to join me.

1                   As the Office of River Protection  
2                   Manager, I have the delegated authority for  
3                   the waste treatment plant safety basis, a  
4                   responsibility that is independent of the  
5                   waste treatment plant federal project  
6                   director.

7                   This statement conveys my  
8                   perspective on the evolving pretreatment  
9                   safety basis, the chosen control strategy, and  
10                  the view ahead as we plan for transitioning to  
11                  commissioning and operations.

12                  The waste treatment plant  
13                  pretreatment facility is a design-build  
14                  project with approximately 80 percent design,  
15                  approximately 80 percent complete, and  
16                  construction approximately 50 percent  
17                  complete.

18                  The approved safety basis is a  
19                  preliminary documented safety analysis being  
20                  modified for an addendum that addresses  
21                  reduction in material at risk, or MAR  
22                  [Material at Risk], and new criteria for

1 hydrogen and piping in auxiliary vessels known  
2 as HPAV [Hydrogen and Piping in Ancillary  
3 Vessels].

4 In an effort to improve the safety  
5 and operation of the pretreatment facility, a  
6 number of design changes have been  
7 implemented. These includes changes to select  
8 vessel mixing designs and changes to controls  
9 for hydrogen and piping. These changes  
10 represent approximately eight percent of the  
11 facility design.

12 The reduction in MAR aligns a  
13 waste treatment plant pretreatment safety  
14 basis with the existing approved safety basis  
15 for tank farm operations, the source of the  
16 waste treatment plant waste. The reduction  
17 from prior supertank MAR is consistent with  
18 the expected progression of waste treatment  
19 plant design as uncertainties are reduced.

20 Further, a committed specific  
21 administrative control in the tank farms will  
22 ensure the feed to the waste treatment plant

1 is within the assumed waste envelope.

2 Likewise, the changes to HPAV criteria also  
3 reflect reduced uncertainty based on an  
4 experimental evidence collected by the  
5 project's investigation of piping response to  
6 a range of possible hydrogen combustion  
7 events.

8 I view these changes to be  
9 consistent with a normal design progression.  
10 Early project conservatisms are expected to be  
11 refined over time as the design evolves and as  
12 studies and analysis are completed to reduce  
13 the uncertainties.

14 Conversely, in some instances  
15 completed studies or analysis identify the  
16 need to increase design margin, such as vessel  
17 enhancements, to resolve mixing issues.

18 Important safety functions such as  
19 facility confinement and confinement  
20 ventilation approach were addressed early in  
21 the design process, and these strategies have  
22 not been affected by the recent changes in the

1 waste treatment plant facilities.

2           The project safety analysis --  
3 analysis apply control selection and  
4 functional classification criteria for the WTP  
5 [Waste Treatment Plant] safety-related  
6 structures, systems, and components, that  
7 comply with a set of nuclear safety  
8 requirements, provide the framework for the  
9 Department of Energy and its contractors to  
10 design nuclear facilities.

11           Over the past year, numerous  
12 changes and analysis assumptions have been  
13 adopted in response to comments made by the  
14 project's independent experts and the Defense  
15 Nuclear Facilities Safety Board staff.  
16 Examples of issues that are being addressed  
17 with analysis changes or uncertainty  
18 evaluations include entrainment coefficient,  
19 deposition velocity, and spray leak  
20 phenomenology.

21           Pretreatment facility -- the  
22 pretreatment facility is on the critical path

1 for completing construction of the waste  
2 treatment plant and plays an essential role in  
3 assuring accomplishment of the waste treatment  
4 plant mission. Both the MAR change and new  
5 HPAV design approach will yield a superior  
6 design for the waste treatment plant, which  
7 complies with DOE's safety policy.

8 Both DOE and Bechtel National have  
9 high confidence that the project is  
10 procuring/instructing safety-related systems,  
11 structures, and components to the appropriate  
12 requirements and standards and ensuring that  
13 the final documented safety analysis will  
14 support startup and operation of the waste  
15 treatment plant facilities as necessary for  
16 efficient achievement of the critical waste  
17 stabilization mission.

18 I would now like to turn the floor  
19 over to Shirley.

20 MS. OLINGER: Good evening,  
21 Chairman Winokur, other Board members, Board  
22 staff, and members of the public. I, too,

1 welcome an opportunity to address the Board  
2 and provide introductory remarks as the prior  
3 Office of River Protection manager on the  
4 subject of the pretreatment facility safety.

5 My remarks provide a perspective  
6 as both the owner and the nuclear safety  
7 regulator for the Office of River Protection  
8 with respect to the evolving safety control  
9 strategy for the pretreatment facility during  
10 the 2009 to 2010 time period.

11 Bechtel National Incorporated, the  
12 contracted design authority for the waste  
13 treatment plant, developed key changes  
14 affecting the safety bases that were approved  
15 by the Office of River Protection. They  
16 reflect an expected evolution with iteration  
17 between the design and safety analysis  
18 processes to ensure reliable fulfillment of  
19 the facility's mission.

20 I believe the changes will yield a  
21 superior design and improve the overall safety  
22 of the pretreatment facility and comply with

1 DOE's safety policies. In late 2008, I  
2 requested a summary of the design changes that  
3 had been developed to implement conservative  
4 design criteria established in April 2006 to  
5 address hydrogen and piping in ancillary  
6 vessels, HPAV, principally involving the  
7 addition of active preventative safety  
8 controls.

9 That effort identified a  
10 significant number of HPAV safety controls in  
11 the pretreatment facility with the majority  
12 being active controls, such as fresh or vent  
13 systems, pump timers, and over 70 percent of  
14 them functionally classified as safety class,  
15 the highest safety classification.

16 I judge the resulting design  
17 approach to be inconsistent with the general  
18 principle that the design should be kept  
19 simple from an operational perspective to the  
20 extent practical.

21 I understood that these HPAV  
22 controls, and the many safety class controls,

1 were being driven by conservative design  
2 criteria set in prior years to address  
3 uncertainty in the hazard characteristics of  
4 the waste to be processed in the facility,  
5 including both the waste hazard  
6 characteristics referred to as the material at  
7 risk, or MAR, and the generation of  
8 combustible hydrogen in the pretreatment  
9 facility waste piping systems.

10           These conservative requirements  
11 drove an evolving design of increasing  
12 complexity. For example, high point vents on  
13 piping systems involve waste and gas  
14 interfaces that would be difficult to maintain  
15 during operations. And many hazardous waste  
16 components needed to be installed in protected  
17 bulges in the corridors outside the hot cell  
18 walls due to overcrowding in the hot cells.

19           Black cells contain only passive  
20 components, which will not be accessed once  
21 the facility goes operational, while the hot  
22 cells contain the active components, which

1 will be accessed for maintenance via remote  
2 handling equipment. The bulges are designed  
3 to ensure worker protection, but they entail  
4 increased risk of inadvertent worker exposures  
5 to hazardous chemical vapors and radiological  
6 hazards than if they had been included in the  
7 hot cell area as originally intended.

8 I request a comparison with the  
9 most comparable facilities in the EM  
10 [Environmental Management] complex, the  
11 defense waste processing facility, and the  
12 salt waste processing facility at Savannah  
13 River, that has double the curie content of  
14 Hanford's tank waste, and found that while  
15 hazards were generally comparable, neither  
16 facility required a similar large number of  
17 active preventative systems for combustible  
18 gas and piping, or more than a few safety  
19 class systems.

20 I recognize, however, that changes  
21 at this stage of the project must be taken  
22 with due diligence. Therefore, working with

1 Bechtel National, we convened expert teams to  
2 review the waste treatment plant material at  
3 risk, the HPAV design approach, and the  
4 operational implications of such a large  
5 number of controls.

6 The teams were chartered to assess  
7 whether changes were warranted and whether  
8 practical alternatives were available. The  
9 teams recommended changes in the design  
10 specification for the MAR to align with the  
11 waste treatment plant design requirements with  
12 the 2003 tank farms' documented safety bases  
13 assumptions that relied on characterization  
14 data from actual tank waste at the tank farms.

15 The teams also recommended an  
16 alternate strategy for dealing with hydrogen  
17 that is generated when radioactive waste is  
18 present in the pretreatment facility piping  
19 systems. This recommendation drew upon the  
20 results of the project's analysis and testing  
21 program from the 2006 to the 2009 time period.

22 After reviewing the team

1 recommendations, the Office of River  
2 Protection, working with BNI [Bechtel National  
3 Incorporated], required them to prepare the  
4 technical submittals and the safety bases  
5 change package to implement these  
6 recommendations, simplifying the design where  
7 justified, while ensuring a facility that  
8 meets DOE's safety requirements.

9           Following presentation of  
10 initially proposed changes to the Defense  
11 Nuclear Facilities Safety Board in the summer  
12 of 2009, the project incorporated their  
13 feedback, and Bechtel National submitted the  
14 change package to the Office of River  
15 Protection late in 2009.

16           I approved the change in MAR and  
17 functional classification of structures,  
18 systems, and components on November 2, 2009,  
19 and the change in HPAV design criteria on  
20 February 15, 2010. Both bases of approval --  
21 approvals are documented in corresponding  
22 safety evaluation reports.

1                   The approved criteria address  
2           Bechtel National's plan to use quantitative  
3           risk analysis to identify route-specific  
4           loading conditions from potential hydrogen  
5           events for design. The QRA [Quantitative Risk  
6           Analysis], quantitative risk analysis, was  
7           approved as a design tool, recognizing that  
8           the existing safety analysis assumed various  
9           piping boundary failures could occur as a  
10          result of hydrogen combustion and selected  
11          appropriate mitigative controls, namely the C5  
12          boundary and filtered ventilation systems.

13                   The acceptability of the QRA as  
14          part of the methodology for compliance with 10  
15          CFR 830 [Code of Federal Regulations] is  
16          expected to be confirmed. In an effort to  
17          resolve technical issues expressed by the  
18          Board, comprehensive, independent expert-based  
19          review of the safety design strategy for  
20          control of hydrogen pipes was commissioned.  
21          This led to the formation of the HPAV  
22          independent review team.

1                   The HPAV independent review team  
2 endorsed the plan's design approach, subject  
3 to resolution of their findings. Bechtel  
4 National has prepared a closure plan, and the  
5 Department of Energy waste treatment plant has  
6 approved this plan.

7                   Once the findings are addressed,  
8 the HPAV independent review team concludes  
9 that the net result of this approach to design  
10 will be a low probability of pipe failure if  
11 hydrogen explosions occur. One additional  
12 conclusion of the HPAV independent review team  
13 experts was that the austenitic stainless  
14 steel used in the waste treatment plant piping  
15 systems would not fragment explosively, even  
16 if loaded to failure.

17                   Bechtel National experts confirmed  
18 this conclusion for both piping and in-line  
19 components fabricated from austenitic  
20 stainless steel and the Office of River  
21 Protection directed that such fragmentation  
22 should no longer be assumed to be credible.

1                   This change simplifies some  
2 designs permitting the shortening of long dead  
3 legs in the ultrafiltration loop, for example,  
4 and thereby reducing the potential for  
5 significant combustible gas accumulation.

6                   Bechtel National is now resolving  
7 the HPAV independent review team findings and  
8 finalizing the tools to implement the new HPAV  
9 strategy. Only after those tools are applied  
10 will we know the extent to which the piping  
11 design can be simplified, although preliminary  
12 results lead Bechtel National to conclude that  
13 many pipe routes will be shown to meet the new  
14 criteria.

15                  Once the design is complete, the  
16 project will focus on ensuring safe and  
17 reliable facility operation with a resulting  
18 mix of active and passive HPAV controls.

19                  My bases for approval is that both  
20 the MAR change and the new HPAV design  
21 approach will yield a superior design and  
22 improve the overall safety of the pretreatment

1 facility that complies with DOE's safety  
2 policy. Together they ensure the operational  
3 reliability necessary for efficient  
4 achievement of the critical waste  
5 stabilization mission of the facility.

6 Thank you very much for your time.

7 CHAIRMAN WINOKUR: Thank you, Mr.  
8 Brockman and Ms. Olinger, for those comments.

9 The session will continue with  
10 testimony offered by members of the Board  
11 staff. I ask each member who offers testimony  
12 to begin by stating his name and position for  
13 the record.

14 MR. KASDORF: Good evening, Mr.  
15 Chairman, members of the Board. My name is  
16 Roy Kasdorf. With me is Mr. Steven Stokes,  
17 the staff lead for WTP. I am the lead for the  
18 Board's nuclear facilities design and  
19 infrastructure group. I am responsible for  
20 ensuring that staff reviews of the design and  
21 construction of the waste treatment plant, and  
22 the immobilization plant, are completely

1 consistent with the Board's mission.

2 In this evening's meeting, the  
3 Board is considering safety-related aspects of  
4 the pretreatment facilities design and  
5 operation. The staff will discuss the DOE's  
6 changes with the assumed material -- assumed  
7 radioactive material at risk and the resulting  
8 changes in the design and safety basis for the  
9 WTP.

10 As I indicated in this morning's  
11 meeting, for the past eight years the Board  
12 staff has been reviewing the WTP pretreatment  
13 facility design and safety basis development.  
14 The staff recognizes that the operation of the  
15 WTP is vital to the remediation of the Hanford  
16 site.

17 The WTP is the primary means for  
18 reducing the risk resulting from storage of  
19 high level radioactive waste in the Hanford  
20 waste tanks. As such, the Board staff  
21 recognizes that the WTP must operate  
22 efficiently and safely over the entire

1 duration of its multi-decade mission.

2 The staff's concerns fundamentally  
3 relate to safety issues, but many of the  
4 safety issues would result in significant  
5 operational problems, such as the buildup of  
6 material and vessels plugging/bursting the  
7 pipes.

8 There are several unique  
9 challenges in the WTP design and construction  
10 which complicate DOE's design effort and  
11 underlie the staff's safety concerns. First,  
12 the WTP is a one-of-a-kind facility. The  
13 design of this facility is complicated, and  
14 DOE and its contractors have chosen to use  
15 several unproven technologies. For example,  
16 pulse jet mixers are unproven in their ability  
17 to mix the types and variety of wastes that  
18 will be processed in WTP.

19 Second, the chemistry in Hanford's  
20 high level waste is extremely complicated and  
21 variable. The hazards in treatment and  
22 processing of the waste are different from

1 those encountered in storing the waste in the  
2 tank farms, and will remain challenging over  
3 the life of the WTP operation.

4 For example, the WTP wastes are  
5 heated to near boiling to aid in leaching  
6 aluminum, and solids are concentrated to the  
7 maximum extent possible to optimize loading of  
8 the high level waste class logs.

9 Third, characterization of the  
10 Hanford's waste tanks -- tank waste is  
11 difficult and expensive and time-consuming.  
12 The range and distribution of particle size,  
13 density of the high level waste solids are  
14 uncertain, particularly with regard to  
15 plutonium solids. The lack of adequate  
16 characterization of plutonium solids has  
17 complicated the development of WTP's  
18 criticality controls.

19 These challenges lead to increased  
20 uncertainty risk in the design. DOE routinely  
21 accepts and manages risk during design and  
22 construction, but in this case they have

1 accepted risks that will not be resolved until  
2 after WTP has been constructed and is being  
3 operated. For example, waste will not be  
4 retrieved and prequalified by the tank farm's  
5 operating contractor until six months before  
6 the waste batch is due to be shipped to the  
7 waste treatment plant.

8 Some of this risk and uncertainty  
9 was previously accounted for by the DOE's use  
10 of the supertank model to specify the bounding  
11 waste for the basis of WTP's design. But the  
12 supertank design approach has been abandoned  
13 in favor of the reduced MAR strategy.

14 A consequence of abandoning the  
15 supertank design approach is that DOE will be  
16 required to accept more risk due to  
17 uncertainty related to the characterization of  
18 tank waste, which increases the potential that  
19 WTP may not be able to accept all tank waste.

20 DOE elected to begin building the  
21 WTP facilities ahead of completing the final  
22 design. This design approach places

1 additional burden on both the contractor and  
2 DOE and exacerbates problems regarding  
3 management of project risk given uncertain and  
4 incomplete design information.

5           Although DOE and BNI have  
6 developed processes to minimize the impacts  
7 from building the WTP ahead of the design  
8 completion, design and safety-related issues  
9 continue to impact the project's costs and  
10 schedule. This fact places further pressure  
11 on DOE and BNI as they move forward -- move  
12 the design and construction forward and accept  
13 risks that are normally resolved prior to  
14 beginning construction.

15           In late 2008, DOE was becoming  
16 concerned that the plant was going to be too  
17 complex to operate safely. At that time, the  
18 design of the pretreatment facility was more  
19 than two-thirds complete and construction was  
20 about one-fourth complete.

21           In February 2009, DOE informed the  
22 Board that they had concluded that the WTP

1 accident analysis and resulting complexity and  
2 safety-related systems were severely impacting  
3 the potential operability of WTP.

4 The staff has attempted to  
5 understand the basis for DOE's statements  
6 regarding design complexity but has been  
7 unable to substantiate DOE's position. The  
8 staff does not believe complexity issues will  
9 become clearer until the project develops  
10 operating procedures and technical safety  
11 requirements to support its safety basis. At  
12 this time, the project has not developed these  
13 documents.

14 In response to Board questions in  
15 preparation for this meeting, DOE stated that  
16 they did not make a formal determination that  
17 the plant would be too complex to operate.  
18 However, many of the discussions with DOE  
19 surrounding the revised hydrogen control  
20 safety strategy suggests that operational  
21 complexity was and remains a concern for the  
22 project.

1                   DOE initiated an effort to resolve  
2 concerns with complexity of the plant. DOE  
3 believed that they could reduce the assumed  
4 MAR and could eliminate unnecessary  
5 conservatism in the design by reanalyzing the  
6 hazards and reducing unmitigated consequences.

7                   They tasked BNI to eliminate  
8 unnecessary conservatism by reevaluating  
9 selected assumptions and methods used in the  
10 accident analysis for seismic and hydrogen  
11 explosion events for WTP.

12                  Based on the reduction in the  
13 assumed MAR, and the perceived need to reduce  
14 complexity, DOE suggested that all safety  
15 class controls could be removed from the  
16 design. In February 2009, the DOE informed  
17 the Board that a review of the MAR would focus  
18 on removing unnecessary conservatism and that  
19 a revised safety analysis would provide a  
20 fresh look at the accident scenarios, the  
21 accident analysis, and the safety-related  
22 engineered controls.

1           The staff was not concerned with  
2 removing conservatism in the MAR assumptions.  
3 However, the staff did raise a concern that  
4 this could potentially put more requirements  
5 on the tank farm contractor who would now have  
6 to ensure that the waste being received to the  
7 -- delivered to the WTP did not exceed the new  
8 MAR limits, a tighter waste acceptance  
9 criteria.

10           In May 2009, BNI revised the  
11 severity level calculation -- this is BNI's  
12 term for an unmitigated accident analysis --  
13 for the pretreatment facility. The staff  
14 noted that the unmitigated consequences to the  
15 public had decreased well beyond what could be  
16 accounted for by a reduction in the MAR.

17           The staff found that BNI had not  
18 only changed the MAR but had made other  
19 changes to the accident analysis. The Board  
20 communicated its concern to DOE and Congress  
21 in the Board's December 2009 quarterly report  
22 to Congress stating, "While the Board does not

1 question reducing the MAR, the Board's review  
2 found that the contractor made other non-MAR-  
3 related changes to the severity level  
4 calculations that may have inappropriately  
5 reduced the calculated consequences of  
6 accidents."

7           Since that time, the Board staff  
8 and DOE have resolved most of the concerns  
9 identified in May 2009. As a result, DOE has  
10 decided not to reclassify several safety class  
11 systems. DOE realized that they must remain  
12 safety class.

13           Key safety class controls that  
14 remain are the active confinement ventilation  
15 system for the facility and the ventilation  
16 systems for the process vessels.

17           However, several concerns remain  
18 unresolved -- the values selected for  
19 deposition velocity, which is a parameter used  
20 to estimate how much radioactive material  
21 reaches the public following an accidental  
22 release of material, the calculational

1 methodology used in determining consequences  
2 from spray leak -- consequences from piping  
3 system spray leaks, the safety design strategy  
4 for the pretreatment facility primary  
5 confinement, and the design requirements for  
6 mitigation of hydrogen controls in the piping  
7 systems.

8           The Board informed DOE that the  
9 value of deposition velocity established in  
10 DOE guidance is not reasonably conservative  
11 for the Hanford site and the WTP waste. The  
12 result -- this results in underpredicting the  
13 unmitigated doses to the public by about a  
14 factor of four.

15           DOE briefed the Board last month,  
16 indicating they now agree that the specified  
17 deposition velocity of one centimeter per  
18 second used by WTP is not technically correct.  
19 However, DOE asserts that there is sufficient  
20 conservatism in other aspects of the analysis  
21 to offset this lack of conservatism.

22           The staff does not understand the

1 technical basis for this assertion and  
2 continues to believe that the project should  
3 use a reasonably conservative value, between  
4 0.1 centimeter per second and 0.3 centimeters  
5 per second, for deposition velocity.

6 After reviewing WTP's severity --  
7 revised severity level calculations, the Board  
8 staff raised concerns regarding the  
9 calculation methods used to determine the  
10 unmitigated dose consequences due to spray  
11 leaks for the WTP process piping.

12 Subsequently, DOE's experts  
13 acknowledged that DOE's guidelines governing  
14 spray leak analysis may not be conservative  
15 when applied to WTP. As a result, BNI  
16 developed a WTP-specific method for the  
17 analysis of spray leaks.

18 Depending on the input parameters  
19 selected, BNI calculated unmitigated dose  
20 consequences to the public ranged from a few  
21 millirem to 80 rem, well above the WTP  
22 evaluation guideline of five rem used for

1 defining the need for safety class controls.

2 BNI concluded that the unmitigated  
3 dose to the public would be -- would be  
4 expected to be much less than one rem for  
5 spray leaks in the WTP based on what BNI  
6 believes are reasonable input parameters into  
7 their equations.

8 BNI has also concluded that  
9 uncertainties exist in their method --  
10 selected methodology, which could easily cause  
11 the predicted consequences to the public to  
12 approach the five rem WTP evaluation  
13 guideline. However, BNI's analysis did not  
14 consider the lower value of deposition  
15 velocity that the Board believes is justified  
16 for use at WTP.

17 Ultimately, the public doses to  
18 the public -- the potential doses to the  
19 public could rise to be above the five rem WTP  
20 threshold, which would require safety class  
21 controls for protection of the public. DOE  
22 has selected safety class confinement

1 ventilation system and facility structure as  
2 the primary means of protecting the public  
3 from the release of radioactive materials from  
4 process piping and in-line components.

5 When compared to an approach that  
6 credits the integrity of the piping and the  
7 in-line components, DOE's approach would allow  
8 a less robust design for the piping and in-  
9 line components.

10 The Board staff evaluated the  
11 impact of DOE's approach on piping and in-line  
12 components in both the black cells and the hot  
13 cell. In the black cells, the piping and  
14 vessels are all welded construction and are  
15 required to meet the more rigorous seismic  
16 design criteria. In effect, the black cell  
17 design requirements are equivalent to a safety  
18 class design.

19 However, the Board staff believes  
20 that the WTP's design for hot cell piping is  
21 less robust. Further, we do not believe the  
22 design is consistent with DOE's policy on

1 defense in depth identified in DOE's standard  
2 for documented safety analysis, which states  
3 in part, "For high hazards operations, there  
4 are typically multiple layers of defense in  
5 depth. The inner layer of defense in depth  
6 relies upon a high level of design quality, so  
7 that important systems, structures, and  
8 components will perform their required  
9 functions with high reliability and high  
10 tolerance against degradation."

11 We interpret this to mean that the  
12 primary boundary -- the piping system --  
13 should be designed to a high level of design  
14 quality consistent with the safety  
15 classification. This is also consistent with  
16 DOE's Order 420.1, Facility Safety, and its  
17 guides, which specify that the usual safety  
18 function of process equipment is to provide  
19 primary confinement and prevent or mitigate  
20 radioactive material releases, and further  
21 specifies that priority be given to  
22 establishing safety controls closest to the

1 hazard.

2 DOE is conceptually relying on a  
3 single barrier -- the building and its  
4 ventilation system -- to mitigate the  
5 consequences from a spray leak. Further, DOE  
6 has not considered the hazards to the worker  
7 having to clean up and decontaminate the  
8 facility following a significant leak.

9 Typically for new facilities  
10 releases are prevented by designing the  
11 vessels and piping systems to withstand  
12 potential accidents. However, the proposed --  
13 the approach proposed by BNI and DOE would  
14 limit the potential release by isolating the  
15 potentially breached piping system from the  
16 vessels following an accident.

17 While this design approach can be  
18 acceptable, the staff believes it is inferior  
19 to designing the piping system to withstand  
20 possible accidents.

21 DOE's hydrogen controls are  
22 intended to prevent an explosion in process

1 vessels by retaining safety class process  
2 ventilation systems. The process piping and  
3 in-line components, DOE's design criteria, now  
4 specify that hydrogen explosions can be  
5 contained by the process piping or prevented,  
6 but would allow in-line components, which are  
7 part of the primary boundary, to leak.

8 The Board staff believes that DOE  
9 should classify the safety function performed  
10 by the primary piping system boundary based on  
11 potential consequences from a release of  
12 material to the public or the co-located  
13 worker. As I indicated earlier, the Board  
14 staff believes that the design requirements  
15 specified for black cell vessels and piping  
16 system are adequate.

17 However, in the hot cell piping  
18 system, the design requirements are less  
19 robust. They allow permanent deformation of  
20 a pipe due to an explosion, allow some  
21 leakage, and rely upon leak detection to  
22 minimize the consequences of potential

1 failures of piping and components.

2 At this time, the staff has not  
3 been provided any demonstration or analysis  
4 that proves that leaks can be detected  
5 adequately to allow timely mitigation actions,  
6 particularly for leaks involving thick, non-  
7 Newtonian waste. As such, the staff is not  
8 able to determine the leak detection  
9 capabilities will work and a suitable  
10 evaluation of BNI's proposal cannot be  
11 completed.

12 Now I would like to briefly  
13 discuss the incorporation of safety controls  
14 into the preliminary documented safety  
15 analysis, the PDSA [Preliminary Documented  
16 Safety Analysis]. BNI has yet to determine if  
17 the recent changes resulting from the  
18 preliminary -- from the pretreatment safety  
19 control strategy can be effectively  
20 implemented into the PDSA in the form of  
21 technical safety requirements.

22 This concern is particularly

1 applicable to the revised hydrogen design  
2 safety control strategy. The hydrogen  
3 accident scenarios and associated safety  
4 controls will be discussed in depth in  
5 tomorrow morning's meeting and hearing.

6 At issue in today's session is how  
7 safety controls can be implemented into the  
8 PDSA. DOE and BNI have chosen to use a  
9 quantitative risk analysis, a QRA, as both a  
10 design and a safety evaluation tool for piping  
11 systems subject to hydrogen accidents. The  
12 use of the QRA for this purpose is  
13 unprecedented in DOE.

14 DOE and BNI have to date invested  
15 very little effort in ensuring that the  
16 hydrogen control design strategy can be  
17 successfully implemented into the WTP safety  
18 analysis. The Board staff believes that since  
19 the use of QRA for the design of piping  
20 systems is new to DOE, great care must be  
21 taken in its development to ensure that the  
22 resulting PDSA meets DOE requirements.

1                   This demands that the safety-  
2                   related controls related to the use of QRAs be  
3                   developed as soon as possible. This will  
4                   ensure that the requirements for formulation  
5                   of technical safety requirements can be  
6                   implemented.

7                   There are also other issues that  
8                   impact the development of the pretreatment  
9                   facility safety basis. Even though the  
10                  pretreatment facility design is about 80  
11                  percent complete, DOE has not established the  
12                  final flow sheet or completed the  
13                  comprehensive hazards analysis. Both of these  
14                  should have been completed much earlier in the  
15                  design process, particularly considering the  
16                  design-build nature of the WTP project.

17                  BNI and DOE must establish the  
18                  pretreatment facility flow sheet, complete the  
19                  comprehensive hazards analysis, and  
20                  demonstrate that the proposed safety  
21                  strategies can be successfully implemented  
22                  into the PDSA or risk late changes in the

1 pretreatment facility design that will unduly  
2 delay the project.

3 That concludes my prepared  
4 comments, and we will try to answer any  
5 questions the Board may have.

6 CHAIRMAN WINOKUR: Do the Board  
7 members have any questions?

8 (No response.)

9 If not, I now invite the panel of  
10 witnesses from the Department of Energy and  
11 its contractor organizations to take their  
12 seats. These witnesses are -- Dr. Ines Triay  
13 is the Assistant Secretary for Energy for  
14 Environmental Management, Mr. David Brockman  
15 is the Manager of DOE's Office of River  
16 Protection, Mr. Dale Knutson is the Federal  
17 Project Director for the Waste Treatment  
18 Plant, Mr. Frank Russo is the Bechtel Project  
19 Director for the Waste Treatment Plant, Mr.  
20 Greg Ashley is the Bechtel Engineering  
21 Director for the Waste Treatment Plant, Mr.  
22 Leo Sain is the URS Executive Vice President

1 for Performance Assurance and Operations, and  
2 Ms. Donna Busche is the URS Nuclear Safety  
3 Manager for the Waste Treatment Plant.

4 Does any member of the panel wish  
5 to submit written testimony? We have a lot of  
6 material to cover this -- at this hearing.  
7 The Board has chosen these panelists carefully  
8 and requests that panelists alone answer  
9 questions that are directed to them to the  
10 best of their ability.

11 If a panelist would like to take a  
12 question for the record, their answer to that  
13 question will be entered into the record of  
14 this hearing at a later time.

15 Thank you for being here this  
16 evening. And with that, we will begin the  
17 panel session with a question from Ms.  
18 Roberson.

19 VICE CHAIR ROBERSON: Good  
20 evening. I would like to start out -- can you  
21 hear me now?

22 Good evening. I'd like to start

1 out with a question to Ms. Busche. Ms.  
2 Busche, is the preliminary documented safety  
3 analysis and addendums, and the safety  
4 requirements document and the design,  
5 consistently reflecting the same safety  
6 strategy right now?

7 MS. BUSCHE: The current PDSA and  
8 the design are consistent. The PDSA addendum,  
9 which has not been completely approved -- we  
10 had some conditions of approval that were  
11 finalizing just some actions. So the design  
12 has not been modified to reflect any changes  
13 in the PDSA addendum, which I think was the  
14 heart of the MAR and the HPAV lead-in by Mr.  
15 Kasdorf.

16 So it is consistent with the  
17 current approved DOE PDSA and safety  
18 requirements document. But the safety  
19 requirements document did modify some hydrogen  
20 and pipe criteria. That has not gone forward  
21 yet.

22 VICE CHAIR ROBERSON: Okay.

1 MS. BUSCHE: From a design  
2 perspective, is my understanding.

3 VICE CHAIR ROBERSON: But your  
4 organization reviews all of these changes for  
5 impact on safety before they are approved or  
6 submitted to DOE, is that right? Any change  
7 that might affect safety, does your  
8 organization review those and analyze the  
9 impact?

10 MS. BUSCHE: My organization does  
11 review engineering design changes, yes, ma'am.

12 VICE CHAIR ROBERSON: Okay. Okay.  
13 In the context of those changes, I guess I  
14 really need to ask you, from a safety  
15 perspective or an ability to produce a safety  
16 basis for this facility, are there any  
17 specific areas of focus or concern from you as  
18 the project continues on?

19 MS. BUSCHE: In the pretreatment  
20 facility, we have several known technical  
21 issues that have been identified through one  
22 or more of our various processes.

1                   Recently, as we have done just a  
2 routine update to our baseline and some  
3 refined planning, we have identified key  
4 issues like resolution now and implementation  
5 of mixing. Because we have just now completed  
6 M3 [Major Issue 3], that has not been carried  
7 forward into the PDSA addendum, PDSA or design  
8 yet, resolution of HPAV, and some other minor  
9 ones, but it's a pretty substantial effort to  
10 resolve those technical issues.

11                   And some of the planning that my  
12 organization has worked with engineering and  
13 we have put in the hours that we need to  
14 systematically evaluate from an integrated  
15 perspective any of those final design changes  
16 starting with what's the hazards analysis that  
17 would feed and integrate in with that -- with  
18 the next iteration based on how we resolve  
19 those issues.

20                   VICE CHAIR ROBERSON: So other  
21 than mixing and HPAV, are there any others?

22                   MS. BUSCHE: We have other

1 technical issues that didn't rise to that  
2 level, but we know we have to resolve. For  
3 example, C5-V, as identified earlier, is a  
4 safety class structure, system, and component.  
5 Okay?

6           Given the resolution of comments  
7 from the spray leak methodology, we now have  
8 known performance issues based on the  
9 methodology that we have chosen. So we have  
10 identified the technical issue of areas where  
11 we may need to go out and get additional  
12 information to help us demonstrate when we  
13 write Chapter 4 of the final DSA [Documented  
14 Safety Analysis] that that confinement  
15 ventilation system will perform its intended  
16 safety function and how it will do so.

17           VICE CHAIR ROBERSON: Are there  
18 any others?

19           MS. BUSCHE: I think there has  
20 been enough discussion on the project on the  
21 overall confinement strategy. We have --  
22 clearly, we have what is documented in the

1 PDSA and the PDSA addendum, but I think spray  
2 leaks has brought in, due to the results of  
3 that methodology, some questions on the  
4 overall safety design strategy for both the  
5 aerosolized portion of that and the liquid  
6 portion of that.

7 I wouldn't elevate those to the  
8 same level. I think that would be handled  
9 very typically through a normal iteration on  
10 any design-build project.

11 VICE CHAIR ROBERSON: Why is it  
12 appropriate to be completing the comprehensive  
13 risk analysis, hazards analysis, at this  
14 point? What is driving that?

15 MS. BUSCHE: I don't want to  
16 suppose. We have what we call an integrated  
17 safety management process where engineering  
18 and nuclear safety review the hazards analysis  
19 at a certain point in the design. Pretreat is  
20 a very complicated facility, and we have seen  
21 several examples, and they range in degrees  
22 of, you know, I think either complexity or

1 safety significance.

2           But when we looked at the  
3 collective set of that, I think my  
4 organization took pause and worked with  
5 engineering and says, "You know, we may have  
6 individual answers. We myopically analyze  
7 this engineering design and this engineering  
8 design. But we have some discomfort or  
9 uncomfortableness with the ability to have  
10 integrated that across to be able to establish  
11 a final control strategy -- and this is my  
12 terminology -- "that was licensable and  
13 commissionable."

14           So we need to have consistency in  
15 how we analyze hazards and how we structure  
16 that hierarchy and layers of defense in depth,  
17 as Mr. Kasdorf has identified.

18           So a systematic evaluation of  
19 hazards is -- it's on the project. We are  
20 actually planning it, and we are going to be  
21 -- we have started initiating some of the  
22 preliminary work we need to do to actually

1       conduct those hazards analysis.

2                       VICE CHAIR ROBERSON:   Mr.  
3       Brockman, you are the safety basis authority  
4       for WTP and for the tank farms, right?  
5       Correct?

6                       MR. BROCKMAN:   I am.

7                       VICE CHAIR ROBERSON:   Okay.   In  
8       the SER [Safety Evaluation Report] that ORP  
9       [Office of River Protection] approved, and its  
10      owners' perspective attached to it, you  
11      describe the basis for the reduction in  
12      conservatism and why it was warranted.   And  
13      you and Ms. Olinger really just went back  
14      through that in your statement.

15                      I guess what I'd ask you to do is  
16      to categorize what those changes -- not -- I  
17      understand bulges, and I mean bulges are  
18      designed from a safety perspective, but the  
19      drivers for that.   Is that question clear?  
20      One was simplicity; I got that.

21                      MR. BROCKMAN:   Yes.

22                      VICE CHAIR ROBERSON:   Another was

1 for facility reliability. Is that correct?

2 I think that's what --

3 MR. BROCKMAN: That's --

4 VICE CHAIR ROBERSON: -- what you  
5 guys said. Another was to reduce potential  
6 worker safety risk, right? Is that correct?

7 MR. BROCKMAN: Correct.

8 VICE CHAIR ROBERSON: Was there  
9 another that I missed?

10 MR. BROCKMAN: I didn't make those  
11 decisions. But to me, just simply learning  
12 more about the effects of hydrating and when  
13 there is a deflagration or detonation or in  
14 between, it just seems prudent to make sure  
15 that that's well understood. And I think that  
16 the testing that has been done has really  
17 enhanced our understanding of that, and has  
18 allowed us to lead to changes that accomplish  
19 some of those things that you just discussed.

20 VICE CHAIR ROBERSON: Okay. So I  
21 think we are going to -- through the course of  
22 this hearing we will probably deep dive into

1 a lot of those elements that you guys cited in  
2 your opening statement.

3 But what I'd like to do is elevate  
4 a little bit and try to make sure we  
5 understand the managerial decisionmaking  
6 process. Okay. And I'm going to ask you --  
7 you're the safety basis expert here -- I'm  
8 going to ask you to help me through this.

9 When constructing your safety  
10 basis, what are you trying to protect, okay,  
11 generally?

12 MS. BUSCHE: Generally, in  
13 constructing a safety analysis for any nuclear  
14 facility, the intent is to look at the breadth  
15 and depth of potential upset accidents and  
16 operational events, establish a hierarchy of  
17 controls and nuclear safety control strategy  
18 that can be implemented in a set of technical  
19 safety requirements and implemented in the  
20 field for limiting conditions for normal  
21 operations.

22 So you analyze all of the various

1       machinations of what could go wrong, and then  
2       you set controls at a much lower level so that  
3       it really never happens. That's my  
4       vernacular.

5                   VICE CHAIR ROBERSON: So, but you  
6       establish some margin -- and correct me if I'm  
7       wrong -- you have -- you establish -- for  
8       instance, we have spent a lot of time talking  
9       about design parameters today. You establish  
10      your design at some level above what has been  
11      evaluated as failure modes --

12                  MS. BUSCHE: Correct.

13                  VICE CHAIR ROBERSON: -- based on  
14      material or components, right?

15                  MS. BUSCHE: Correct.

16                  VICE CHAIR ROBERSON: And then, at  
17      that design level, you integrate and evaluate  
18      the protection you need and you establish a  
19      safety basis for operating. Is that correct?

20                  MS. BUSCHE: Correct.

21                  VICE CHAIR ROBERSON: Okay. And  
22      so the question I have, when you remove

1 conservatism out of the design, naturally you  
2 remove conservatism out of your --

3 MS. BUSCHE: Correct.

4 VICE CHAIR ROBERSON: -- operating  
5 envelope, is that correct?

6 MS. BUSCHE: Correct.

7 VICE CHAIR ROBERSON: Okay. Is it  
8 -- let me ask this. I think I've already made  
9 this point. So the key parameters of your  
10 safety basis will be designed to protect that  
11 specific operation.

12 MS. BUSCHE: Correct.

13 VICE CHAIR ROBERSON: Okay. So,  
14 Mr. Brockman, generally speaking, you apply  
15 the same thought process in approving the  
16 safety basis for the tank farm and for the  
17 WTP, right? Because DOE safety requirements,  
18 you have used the same --

19 MR. BROCKMAN: I would.

20 VICE CHAIR ROBERSON: You would.

21 MR. BROCKMAN: I have not applied  
22 it. I would.

1                   VICE CHAIR ROBERSON: Right. So  
2 let me just -- and the WTP is being built to  
3 remedy a hazard that now exists in the tank  
4 farm, right?

5                   MR. BROCKMAN: That's correct.

6                   VICE CHAIR ROBERSON: Is that  
7 right? That's the purpose of this --

8                   MR. BROCKMAN: That's correct.

9                   VICE CHAIR ROBERSON: So, Mr. Sain  
10 --

11                  MR. SAIN: Yes, ma'am.

12                  VICE CHAIR ROBERSON: -- I'm going  
13 to say something, and I'm going to ask you --  
14 I don't know how to ask it in a question, and  
15 it's not intended to be provocative. But I  
16 would describe the tank farm as operationally  
17 fragile. Is that an unreasonable  
18 characterization?

19                  MR. SAIN: I don't think so.

20                  VICE CHAIR ROBERSON: Tell me why.

21                  MR. SAIN: Well, it's, you know,  
22 very old. It has been around a long time. We

1 know we have had tanks that have leaked.

2 CHAIRMAN WINOKUR: So you have  
3 agreed with the assertion.

4 VICE CHAIR ROBERSON: Everything  
5 you said.

6 MR. SAIN: Well, I'm not sure what  
7 the assertion is.

8 VICE CHAIR ROBERSON: Okay.

9 CHAIRMAN WINOKUR: That the tank  
10 farm is fragile, the operation. Was that  
11 correct, Ms. Roberson?

12 VICE CHAIR ROBERSON: That's  
13 correct, yes.

14 MR. SAIN: Well, I'm agreeing that  
15 it's a hazard, a high hazard. And we're  
16 dealing with, you know, tanks, as I said, that  
17 have been around a long time. And the real  
18 goal is to go treat that waste on the tanks.

19 VICE CHAIR ROBERSON: Absolutely.  
20 Absolutely.

21 Well, let me say I characterize a  
22 tank farm as historically fragile, and I don't

1 mean five years ago or last year, I mean this  
2 week. I mean, your team is surprised by what  
3 they find, and it found the evaporating within  
4 the last two weeks.

5 You are going through an  
6 improvement plan for conduct of ops, and I  
7 have to say at least the four contractors  
8 before you have gone through the same cycle.  
9 It has a history of operational fragility.

10 The key to my question, my concern  
11 here, is more or less whose job is it, and  
12 what consideration was given? Because it  
13 appears to me when you remove conservatism  
14 from this brand-new facility that you are  
15 designing, and increase the worker  
16 transactions in this 70-year old facility that  
17 is clearly fragile -- that's why we want to  
18 get stuff out -- who -- where does the  
19 decisionmaking occur to balance the  
20 consequences of those decisions? That's my  
21 question.

22 MR. BROCKMAN: I will attempt to

1 give you my response to that, or I will give  
2 you my response to that. That occurs in my  
3 office, and in the new federal project  
4 director's office now we have the integration  
5 person. We are looking to that person.

6 But this mission that the Office  
7 of River Protection is on is to treat that  
8 waste, is a whole mission. It is a system in  
9 itself, and it isn't just tanks and it isn't  
10 just waste treatment plant. And it may  
11 include some additional facilities or systems  
12 that have to be built to accomplish our  
13 mission.

14 And we, my office, as well as the  
15 waste treatment WTP project manager, have to  
16 do what you just described. We have to  
17 balance, because our goal is to treat that  
18 waste and to optimize the life cycle cost and  
19 schedule to treat that waste, doing it safely.

20 VICE CHAIR ROBERSON: And I  
21 understand that is the goal. I guess what I'm  
22 asking is -- it isn't transparent that that

1 occurred, and that's really my question.

2 Clearly, increased transactions in the tank  
3 farm increase the potential for worker risk in  
4 the tank farms.

5 What consideration was given to  
6 balance the decrease in worker risk in WTP to  
7 that in a tank farm? And why was one  
8 considered more valuable or meaningful than  
9 the other?

10 MR. BROCKMAN: Well, I believe  
11 that our tank farm operations can be done  
12 safely. And if we need to do additional  
13 operations, or additional facilities need to  
14 built and operated, that we -- they won't be  
15 operated at an unacceptable level of risk.

16 There is an improvement program  
17 going on in the tank farms. The  
18 infrastructure is old, but we are spending  
19 money to improve that with just exactly that  
20 concept in mind, that the operations over  
21 there have to be done safely. We don't have  
22 room -- that they be done less safe than the

1 waste treatment plant operations.

2 MR. KNUTSON: There has also been  
3 an important part of this conversation that  
4 needs to be very clear for the record, and  
5 that is that there is not an inherent  
6 transition of risk to the tank farm simply  
7 because the natural design progression and  
8 evolution on the waste treatment plant has  
9 reduced conservatism in the control selection  
10 strategy or conservatism of specific elements  
11 of a design. That risk is not inherently  
12 translated directly over onto the tank farms.

13 VICE CHAIR ROBERSON: I don't see  
14 how you could say that if you read the  
15 responses to the questions.

16 MR. KNUTSON: Well, I don't know  
17 from the perspective that you are bringing  
18 what part of the questions you are mixing to  
19 come to the conclusion. I don't intend to  
20 challenge that, but just for the record the  
21 idea that because an inherent iterative  
22 process of design reduces conservatism in a

1 design element and WTP does not inherently  
2 translate to an increased risk statement for  
3 the operation of the tank farms.

4 VICE CHAIR ROBERSON: Well, what

5 --

6 CHAIRMAN WINOKUR: Can I --

7 VICE CHAIR ROBERSON: Yes.

8 CHAIRMAN WINOKUR: -- and you can  
9 go? I think what we heard this morning is,  
10 you know, the WAC [Waste Acceptance Criteria]  
11 in the -- is going to be more restrictive now,  
12 obviously, with the reduction in MAR. And we  
13 discussed a large range of tank farm  
14 operations that can be potentially extremely  
15 challenging, controlling particle size  
16 rheology, additional blending, things of that  
17 nature.

18 You don't believe that translates  
19 into increased risk for the tank farms, which,  
20 as we said, was -- some of the tanks are 60,  
21 70 years old. Transfers aren't particularly  
22 easy in the tank farms. There is the

1 possibility for clogging, problematic events,  
2 but you don't see any relation between those  
3 two?

4 MR. KNUTSON: I can tell you that  
5 we discussed the idea that that is all managed  
6 through an ICD-19 [Interface Control Document  
7 19], and we have accepted no changes to ICD-19  
8 that would result in something that the tank  
9 farms, as characterized, has an inherent  
10 increase in their risk or their operational  
11 risk posture.

12 CHAIRMAN WINOKUR: So nothing  
13 resulted -- and I'll turn it back to Ms.  
14 Roberson -- in additional transfers needed to  
15 be made, operations that are more complex, and  
16 stressful operations that aren't fully defined  
17 right now that you may have to perform, none  
18 of that is represented as a risk?

19 MR. KNUTSON: I guess I don't  
20 understand the premise of your statement. But  
21 the issue is: does ICD-19 control those  
22 physical parameters and the waste feed

1 characteristics that must be met between the  
2 tank farms and WTP? And the answer is yes.

3 Have we modified those in a way  
4 that the tank farm operating contractor and my  
5 counterpart in tank farms have raised concerns  
6 with or have identified as substantially or  
7 significantly different than their current  
8 understanding? The answer is no.

9 DR. TRIAY: If I may, since the --  
10 everything that happens in the authorization  
11 basis phase, the Office of River Protection  
12 receives oversight from the Environmental  
13 Management Headquarters Office, I would like  
14 to make two comments.

15 First, to ensure that we move to  
16 accurately reflect reality in a better  
17 estimate of the material at risk, I don't  
18 believe is correctly described as a reduction  
19 in conservatism. Conservatism is the  
20 selection about a number of supportable  
21 assumptions, not purposely selecting a known  
22 invalid assumption parameter.

1                   The supertank, by definition, by  
2                   its definition, does not exist as a waste  
3                   stream at the tank farm. Regardless of the  
4                   age of the tanks, regardless of any  
5                   operational fragility of the tank farm, the  
6                   supertank is not a waste stream in the tank  
7                   farm. So I believe that moving into  
8                   expressing reality in the material at risk,  
9                   while still being very conservative, does not  
10                  reduce the margin of safety or move risk from  
11                  the waste stream in plant to the tank farm.

12                  The key, in my opinion -- and that  
13                  is why in my role of oversight of the Office  
14                  of River Protection I was supportive of the  
15                  decisions made by the office of River  
16                  Protection manager -- is that a complex  
17                  design, relying on over a thousand active  
18                  controls, would have higher likelihood to have  
19                  an event, like hydrogen deflagration or a  
20                  detonation that active controls were trying to  
21                  prevent, in one case were due to worker  
22                  errors, and the QRA is certainly showing this.

1                   So I truly have to say that I  
2                   don't believe that the Department of Energy is  
3                   moving risk from the waste treatment plant  
4                   into the tank farm. Instead, I do believe  
5                   that the Department of Energy is going to  
6                   implement a superior design in the waste  
7                   treatment plant with higher operational  
8                   reliability than the current parameters  
9                   utilized for the material at risk.

10                  VICE CHAIR ROBERSON: So let me  
11                  say to all of you, I am not challenging your  
12                  intent. But when you look at added process  
13                  requirements in the tank farm, you are clearly  
14                  adding additional operator action in the tank  
15                  farm. You are trying to remove it from WTP.

16                  So my question isn't challenging  
17                  your intent. It is, was that consideration  
18                  given, and where was it given? That's really  
19                  what I'm asking.

20                  DR. TRIAY: I'm sure that you were  
21                  not challenging our intent. My point is that  
22                  it is not a matter of intent. It is a matter

1 or reality. The supertank concept is not a  
2 waste stream in the tank farm. You are not  
3 adding any risk by selecting a material at  
4 risk that is defensible, that is conservative.  
5 That in no way adds any kind of risk to the  
6 tank farm.

7 If you are referring to the fact  
8 that we need to blend or mix waste in the tank  
9 farm, we have to do that regardless of whether  
10 or not we have stayed with the super tank  
11 concept or not. So I don't see where we are  
12 adding risk to the tank farms.

13 VICE CHAIR ROBERSON: So the one  
14 thing we understand from the last section --  
15 session is that ICD-19 is I guess classified  
16 as a living document now, but is changing. So  
17 there are additional requirements being added.  
18 Is that not correct? I thought that's what I  
19 understood from the last session.

20 MR. ASHLEY: Ms. Roberson, if I  
21 could respond to that, there are not  
22 additional requirements being added to ICD-19.

1 One of the requirements has -- is being  
2 modified, and that is the weight percent  
3 solids that is received in the HLWP [High-  
4 Level Waste Plant] receipt vessel. That  
5 change in requirement, though, was made in  
6 concert with the tank farm, number one, to  
7 ensure that we were not adding undue burden  
8 and changing their risk profile, substantially  
9 changing their feed delivery plant. That is  
10 a change in the ICD, but it is a requirement  
11 that was previously a weight percent  
12 requirement, going from 16 weight percent to  
13 10 weight percent.

14 VICE CHAIR ROBERSON: Okay. Mr.  
15 Sain, did you want to respond?

16 MR. SAIN: Please. When I agreed  
17 with you about fragile, I was talking about,  
18 you know, the single-shell tanks. Upgrades  
19 are being made in the tank farm  
20 infrastructure, and to me when you have a  
21 supertank concept that was, in my view,  
22 grossly overconservative, and you bring it

1 down to reasonably conservative, that is not  
2 reducing or adding risk. And, in my view, at  
3 the tank farm it is not driving the tank farm  
4 to higher risk at all.

5 VICE CHAIR ROBERSON: Well, your  
6 DSA was the same. You didn't --

7 MR. SAIN: Sure.

8 VICE CHAIR ROBERSON: -- have a  
9 supertank. I mean, it didn't change anything  
10 in the tank.

11 MR. SAIN: All we've done is  
12 reduce the MAR to the point to balance the  
13 tank farm. So I am confused as to how that  
14 drives a tank farm into having to do more.

15 See, one thing I hear is that,  
16 "Well, you guys now are going to have to go do  
17 a lot more characterization." Well, remember,  
18 I have lived in a tank farm, and you don't  
19 move waste anywhere unless you know what is in  
20 it. So characterizing waste, knowing what you  
21 are going to transfer, we are going to have to  
22 do even if we had stayed with the super tank

1 concept.

2 And, I mean, that's just a fact of  
3 life. That's going to be a requirement.  
4 You're not going to be able to transfer high  
5 level waste somewhere and not know the  
6 constituents of what you've got in it.

7 VICE CHAIR ROBERSON: I fully  
8 understand that.

9 MR. SAIN: Right. So --

10 VICE CHAIR ROBERSON: I actually  
11 have a little process knowledge on this one,  
12 too.

13 MR. SAIN: I know you do.

14 (Laughter.)

15 To say that it's going to impose a  
16 lot more work characterization effort on the  
17 part of the tank farm, I just can't buy that.

18 DR. TRIAY: And we are relying,  
19 Ms. Roberson, on your historical knowledge to  
20 tell you that there are no added process  
21 requirements on the tank farm as a result of  
22 the MAR difference.

1                   VICE CHAIR ROBERSON: Okay. So  
2 let me tell you, one of the things that is  
3 driving it -- one of them is the reality of  
4 the operation of the tank farm that raises  
5 that concern for me.

6                   The other is in the response to  
7 questions. I can't remember how many times  
8 the response we got was, "If but, then this  
9 will be a restriction on waste acceptance  
10 criteria in the tank farm." So I will come  
11 back to those. I want to give the floor over  
12 to somebody else, but I'm probably not done  
13 with this one yet.

14                  DR. TRIAY: Okay.

15                  CHAIRMAN WINOKUR: Did you have a  
16 comment you wanted to make?

17                  MR. KNUTSON: I just wanted to  
18 close on that last point. I think it is  
19 really important that we keep in mind that  
20 this morning's discussion also identified that  
21 we are talking about a very small number of  
22 the overall batches that would result in some

1 modification of the waste acceptance criteria.  
2 And we did talk about that this morning  
3 extensively.

4 CHAIRMAN WINOKUR: Thank you. One  
5 of the things I wanted to get clear about,  
6 because I heard it in your opening statement,  
7 Mr. Brockman and Ms. Olinger, as a result --  
8 and nobody is arguing about the reduction in  
9 MAR -- is that what this led to was a superior  
10 design.

11 And I guess I'd ask you, Ms.  
12 Busche, from a safety perspective, looking at  
13 where we have come with the revised hydrogen  
14 strategy and your need to defend it, is it  
15 obvious to you that this is a superior design  
16 in safety space?

17 MS. BUSCHE: What I can say is the  
18 control strategy has fundamentally really not  
19 changed. What has changed, based on MAR and  
20 the revised HPAV criteria, which will include  
21 fragmentation, is reduction in the functional  
22 classification of certain SSCs, structures,

1 systems, and components.

2 So it may have eliminated  
3 redundancy, but I will still -- when the final  
4 DSA, when we write that for operations, the  
5 control will still be there. The question  
6 will be how to write that control for  
7 implementation. It will still be there.  
8 Going from safety class to safety significant,  
9 the control is still there.

10 So is it a superior design? The  
11 only answer I can offer is I don't know,  
12 because we haven't implemented the QRA. So I  
13 haven't had the opportunity to evaluate any  
14 potential design changes. We're not done yet.  
15 We haven't completed that activity.

16 CHAIRMAN WINOKUR: So it's very  
17 hard to make that judgment, because you don't  
18 know what you need to defend the QRA at this  
19 point, correct, in safety space?

20 MS. BUSCHE: That is correct.  
21 What we do know in running some of the test  
22 cases and examples, the QRA has afforded us an

1 opportunity to identify areas where our design  
2 was probably not the smartest way to do that,  
3 because it created a dead leg and it created  
4 a hazard.

5 So the tool will be used to  
6 eliminate many of those hazards now that we  
7 have -- once it is released to refine that  
8 process. So there are some good elements to  
9 the QRA. It is the integration with nuclear  
10 safety, right, that I will still need to come  
11 to terms with and figure out how to integrate  
12 in that to the final DSA, and then for the  
13 life of the project.

14 CHAIRMAN WINOKUR: Are you  
15 confident that you can support the QRA in a  
16 safety basis, that you will be able to  
17 identify the TSRs [Technical Safety  
18 Requirements] and other kinds of controls you  
19 need to implement that strategy? Are you --  
20 can you definitively say that?

21 MS. BUSCHE: I am -- the QRA is  
22 primarily a design tool, so I would look at

1 the QRA just like I would any other  
2 engineering calculation. Consistent with  
3 3009, Appendix A, I would look at all inputs  
4 and assumptions and determine what must be  
5 protected by a technical safety requirement.  
6 Okay?

7 CHAIRMAN WINOKUR: Do you think  
8 it's more complex than what the hydrogen  
9 control strategy was before the revision took  
10 place?

11 MS. BUSCHE: I absolutely have no  
12 feel for that, because the tool is not done.  
13 I have seen previous versions. So there are  
14 things that are a change to the current PDSA.  
15 If I'm -- because I've written several DSAs  
16 and TSRs, so I can kind of look ahead, that  
17 aren't required today in the control strategy  
18 that may very well be required in the future.  
19 Whether it's more complex or less complex, I  
20 can't answer that question.

21 CHAIRMAN WINOKUR: Well, that is  
22 kind of where I wanted to have an

1 understanding, because when we started this  
2 discussion -- and I guess I will turn to you,  
3 Mr. Brockman, and I think -- why did the  
4 Department, at the end of 2008/2009, why was  
5 it convinced that the design was too complex  
6 to operate reliably?

7 I mean, what was -- I mean, I'm  
8 hearing that we're not sure that we can --  
9 that the safety basis is extremely difficult,  
10 or may be extremely difficult to implement as  
11 a result of some of these design changes. So  
12 how did you make that decision?

13 MR. BROCKMAN: I did not make that  
14 decision. I wasn't there at the time.

15 CHAIRMAN WINOKUR: Well --

16 MR. BROCKMAN: I would like --

17 CHAIRMAN WINOKUR: I'm sorry.

18 MR. BROCKMAN: -- Ines --

19 CHAIRMAN WINOKUR: The Department  
20 -- it wasn't you, you're right. So the  
21 Department, yes.

22 MR. BROCKMAN: And I'm not

1 familiar. I'm going to ask Ines if she would  
2 address that --

3 DR. TRIAY: Okay.

4 MR. BROCKMAN: -- if it's all  
5 right with you.

6 DR. TRIAY: Sure. I'm happy to --

7 CHAIRMAN WINOKUR: Absolutely.  
8 Absolutely.

9 DR. TRIAY: -- happy to address  
10 the question. The Department, and in  
11 particular the previous Office of River  
12 Protection manager, with EM Headquarters as  
13 the oversight of the Office of River  
14 Protection, made a decision not that it was  
15 impossible to operate the waste treatment  
16 plant as -- in the -- within the current  
17 design.

18 What we said, and what I believe  
19 Ms. Olinger has testified to, is that we  
20 believed that we could get to a superior  
21 design because we could remove dead legs,  
22 remove bulges with active components outside

1 the hot cell, remove several high point vents,  
2 remove human error that was very likely given  
3 the very large amount of controls in the  
4 facility.

5 I would like to make absolutely  
6 certain that we separate the discussion that  
7 we have had into several parts. The new  
8 material at risk bounds the tank farm  
9 contents. The change in the material at risk  
10 has not driven new actions in the tank farm.  
11 We have not been driven to any new  
12 requirements, transfers, or anything that  
13 hadn't already been planned.

14 Many of the responses I believe  
15 address the possibility of the waste  
16 acceptance criteria not being met. And then,  
17 we said that this could be fixed by either  
18 waste treatment plant actions or the blending  
19 and dilution in the tank farms. This is not  
20 saying in any way that the tank farm must  
21 assume a large burden.

22 I would like to really ask my

1 colleague, Mr. Leo Sain, because I believe  
2 that he led a team at the request of the  
3 Office of River Protection manager, Ms.  
4 Olinger, to look at specifically this issue of  
5 operability of the waste treatment plant and  
6 the issue of the material at risk as well as  
7 some of these overly conservative parameters  
8 that were used in the design.

9 And it -- the bottom line is that  
10 when you ask, why was the Department convinced  
11 that these changes would lead to more reliable  
12 operation and more effective operation, and  
13 even a safer operation, we relied on expert  
14 judgment by individuals like Mr. Sain.

15 CHAIRMAN WINOKUR: That is  
16 actually not -- I appreciate that very much.  
17 It's not what I asked. I asked if the  
18 Department was convinced at the end of 2008  
19 that this design was too complex to operate  
20 reliably, the design you had for the facility.

21 DR. TRIAY: I believe that my  
22 answer was that the Department was not

1 convinced that it could not operate. The  
2 Department was convinced that it could improve  
3 the design and, therefore, have a more  
4 reliable operation.

5 CHAIRMAN WINOKUR: Okay. And I  
6 appreciate that. This is what it says in the  
7 owners' perspective on changes in the design  
8 basis of the waste treatment and  
9 immobilization plant pretreatment facility.  
10 And I just quote this, "These conservative  
11 design requirements for MAR and hydrogen drove  
12 an evolving design of unforeseen complexity  
13 that led both BNI and ORP to raise concerns  
14 for the reliability and the safety of future  
15 WTP operations."

16 And I'm not trying to criticize  
17 you for reaching this conclusion. I am just  
18 trying to get you to agree that you did reach  
19 that conclusion or -- because it seems to me  
20 it wasn't a matter of improving things. You  
21 were fairly well convinced at the end of 2008  
22 that the plant was too complex to operate

1 reliably.

2 DR. TRIAY: My point being that  
3 what the Department did do was ask individuals  
4 with experience, individuals that had decades  
5 of experience in operating nuclear facilities,  
6 and those individuals, those independent  
7 experts that the Department engaged, they said  
8 that the operation of the facility could be  
9 greatly simplified. And, indeed, in the  
10 expert opinion of many of them, they said that  
11 it was too complex.

12 CHAIRMAN WINOKUR: And who were  
13 these experts? Do we have --

14 DR. TRIAY: As I just said, I --  
15 that's why we wanted --

16 MR. SAIN: Let me jump in here.

17 CHAIRMAN WINOKUR: And now we're  
18 over to you, Mr. Sain.

19 MR. SAIN: I'm glad to be here.

20 (Laughter.)

21 Let me just say that I think it  
22 was November '08 I had gotten a call to come

1 out and do a review of the technical issues.  
2 MAR was not on the list of what we were to  
3 review.

4 I came, had -- as I remember --  
5 this is all on the record, so I'm going from  
6 total memory -- about five or six experts with  
7 me that I handpicked. We came out and started  
8 reviewing the technical issues at the time, M3  
9 being one of them.

10 In the very beginning of the  
11 review, we kept a number of individuals on the  
12 team tripping over MAR, the supertank concept.  
13 And we concluded, after two days of being at  
14 the project, that we were going to add MAR to  
15 the list and do a look at it.

16 And our conclusion was is that the  
17 supertank concept was totally unachievable  
18 and was grossly over-conservative, especially  
19 for a plant that in our opinion was at the  
20 stage that WTP was, you know, significant  
21 design and construction completion.

22 And so our recommendation in that

1 report was that, you know, DOE and the  
2 contractor should go look at the MAR and see  
3 if there were not a more reasonable value of  
4 MAR that would really help the project,  
5 because having been a person that not only has  
6 been in Operations, I, you know, actually  
7 managed safety bases for a number of years,  
8 and I knew that a MAR of that value was  
9 driving controls that, in comparison to a  
10 reasonably conservative value, you would not  
11 have.

12           And when you look at the sheer  
13 size of WTP, someone like me that has this  
14 operational background knew right away  
15 instinctively that this has got to be fairly  
16 complex, and so in our report we said that one  
17 of the main benefits of going and rebooting at  
18 this MAR, and getting back to a reasonably  
19 conservative value, that the safety bases  
20 community across the country would agree was  
21 reasonably conservative, would reduce the  
22 operational complexity.

1                   Now, I will tell you that what I  
2                   have heard all along is, you know, reduce  
3                   operational complexity. I personally -- I  
4                   think this is the first time that I am hearing  
5                   "too complex to operate." I don't know where  
6                   that came from.

7                   CHAIRMAN WINOKUR: It came from --

8                   MR. SAIN: I think --

9                   CHAIRMAN WINOKUR: It came from  
10                  the Department of Energy.

11                  MR. SAIN: You know, I am a person  
12                  that had the challenge of starting up and  
13                  running FB line, and I am convinced that after  
14                  doing that you can operate anything if you've  
15                  got the right leadership and the right  
16                  programs.

17                  So I don't think it's about "too  
18                  complex to operate," but I think it's about  
19                  being reasonable and trying to come up with a  
20                  very large plant with multiple facilities that  
21                  is going to ease the burden on the operators  
22                  so that they can focus on the important things

1 and operate the plant.

2 So it was intuitive, and we said  
3 it in the report, and I think it took off  
4 after people started reading our report as  
5 something very intuitive to individuals that  
6 have been around operating facilities.

7 CHAIRMAN WINOKUR: Well, I think  
8 you might have the sequencing wrong there.  
9 But nobody disagrees with the fact that if  
10 there are fewer controls in a plant it can be  
11 more reliable. That is really not the issue  
12 I am trying to get it.

13 MR. SAIN: Well, more reliable and  
14 easier for operators to operate. I will take  
15 you back to TMI, which I was in Commercial  
16 when that happened. And one of the big things  
17 that came out of TMI was all of the alarms the  
18 operators had to contend with.

19 You know, the Safety Board, I  
20 remember DWPF. One of the comments that the  
21 Safety Board made, which was a good one, was  
22 you guys needs to go reconfigure your alarms

1 on DWPF, because you've got hundreds of alarms  
2 going off simultaneously. It is confusing.

3 It is going to confuse the  
4 operator in a casualty, and so the whole  
5 concept of trying to keep large facilities,  
6 you know, within the required nuclear safety  
7 envelope and reasonably conservative, but  
8 beyond that think about, you know, simplistic  
9 operations, as simple they can be. That's  
10 important.

11 CHAIRMAN WINOKUR: Ms. Roberson?

12 VICE CHAIR ROBERSON: One more  
13 question. I'm going to try this one more  
14 time, and I'm actually going to ask you to  
15 just think about what I'm saying and maybe  
16 respond for the record. I've certainly  
17 listened to what you have say.

18 What I want to say is this is what  
19 we know. We don't have an operating envelope  
20 for WTP yet, which means we can't have our  
21 operating envelope for tank farms yet, because  
22 they connect. They will become one process at

1 some point.

2 I understand from this morning the  
3 project -- tank farms -- has employed PNNL  
4 [Pacific Northwest National Lab] - I don't  
5 know who else -- to help develop a model for  
6 creating the recipe that will meet the MAR.  
7 Right? Is that correct, Mr. Sain?

8 MR. SAIN: Yes.

9 VICE CHAIR ROBERSON: Okay. What  
10 I'm saying is -- what I'm looking for is the  
11 evidence that the approach you just described  
12 -- simpler/safer -- is being applied to the  
13 totality of the process. And also what I'm  
14 saying is the Board will be looking for that  
15 evidence, because by the time -- let me  
16 finish, please -- the waste enters WTP it will  
17 be very sweet. The hard work is in the tank  
18 farm, so --

19 MR. SAIN: But the hard work, as  
20 far as transfers, is there before this.  
21 That's the point I was trying to make earlier.  
22 First and foremost, you are going to do sludge

1 batches here, and always were going to do  
2 sludge batches, just like we do at Savannah  
3 River today.

4 If you're going to do sludge  
5 batches, you've got to absolutely know the  
6 characterization of the waste you're dealing  
7 with, what you're going to add. If it's  
8 supernate, if it's recycled water, you know,  
9 in some cases we add recycled water at  
10 Savannah River coming back from DWPF. You're  
11 going to have to know what the characteristics  
12 of all that stuff is, and it's the expert  
13 engineers that, you know, put that formula  
14 together and come up with that sludge batch.

15 We were going to have do that,  
16 even if we had stayed with the super tank  
17 concept. We were going to have to know what  
18 we were transferring before we send it  
19 anywhere. That is a hard requirement in this  
20 business today, and you're not going to escape  
21 that.

22 So if we would have stayed with

1 the supertank concept, we couldn't have taken  
2 waste out of the tank farm and just sent it to  
3 WTP. We would have had to have characterized  
4 it, would have known what it was, and we would  
5 have had to have validated that it wasn't  
6 going to exceed any of the limits to send it  
7 to, you know, WTP.

8 VICE CHAIR ROBERSON: Okay. Well  
9 --

10 MR. SAIN: I assume WTP will have  
11 an organic limit, just like DWPF does, as an  
12 example.

13 VICE CHAIR ROBERSON: Let me wrap  
14 up by saying the Board hasn't been advocating  
15 the supertank strategy. What I'm saying to  
16 you is, as you make changes in the WTP, we  
17 will be looking at how they affect the tank  
18 farm. I advise you to look at it the same  
19 way.

20 MR. SAIN: Okay.

21 VICE CHAIR ROBERSON: Okay?

22 MR. KNUTSON: I just want to make

1       sure that the position that we discussed this  
2       morning of the tank farm WTP integration role  
3       -- I think I'm finally understanding the  
4       position of the line of questioning.

5                 But one of the primary functions  
6       of that role is to understand the balance  
7       between, is it okay in tank farm space as well  
8       as WTP space, for the criteria that meets  
9       expected conditions? And those expected  
10      conditions have to change from the opening day  
11      of operations, the opening day of  
12      commissioning, through the multiple batches  
13      that have to be processed over the life cycle  
14      of the operating plant.

15                So that mechanism, that new senior  
16      executive service position, is a role that is  
17      actually focused on exactly the question  
18      you're asking. And as Ms. Busche identified,  
19      the evolution of the controls has to be able  
20      to -- has to be taken into the context of both  
21      the WTP operations and tank operations, and  
22      that role is designed to be able to do exactly

1 that.

2 MR. DWYER: Mr. Chairman, if I  
3 could just -- just to put this in a concrete  
4 example, again that we talked about this  
5 morning, we briefly discussed a change to the  
6 balance of design that you subsequently told  
7 us was not going to occur.

8 We talked about a requirement that  
9 you could not send plutonium particles greater  
10 than 10 microns from tank farms to the waste  
11 treatment plant. And when we asked this  
12 morning, "Won't that restrict and place a  
13 greater burden on tank farms?" I believe Mr.  
14 Rutland informed us, "No, that was just in the  
15 draft document. It has since been removed."

16 But that is the type of thing that  
17 if you put something like that into your  
18 restrictions that puts a burden on tank farm,  
19 would you agree? If you tell them, "You can't  
20 send me any plutonium particles greater than  
21 10 microns"?

22 MR. KNUTSON: The hypothetical of

1 "if" such a thing should exist --

2 MR. DWYER: No. I'm agreeing --

3 MR. KNUTSON: -- then perhaps  
4 there would be a response.

5 MR. DWYER: Yes.

6 MR. KNUTSON: It needs to be  
7 balanced by the idea that with the role that  
8 is being envisioned the conversations and the  
9 dialogue and the formalization of expected  
10 condition definition takes place in a far more  
11 integrated fashion than it has to date. And  
12 that was done explicitly.

13 MR. DWYER: And, in fact, you --  
14 you informed us this morning that on further  
15 inspection, "Gee, we can't do that," and you  
16 pulled it out of the draft document. So --

17 MR. ASHLEY: No. Mr. Dwyer, I  
18 would like to clarify what Mr. Rutland said  
19 this morning is the purpose of the basis of  
20 the design is to ensure that we have a  
21 documented basis for the design of the  
22 facility.

1                   And as we went through the M3  
2                   program, we were updating the BOD, the basis  
3                   of design document, and we had a draft, and we  
4                   were clearly updating that for what we had  
5                   tested and what we had verified that the  
6                   vessels would mix, okay, would meet the mixing  
7                   requirements.

8                   What Mr. Rutland said is we have  
9                   worked with him, we have clarified, that is  
10                  not -- that is our basis of design. What Mr.  
11                  Rutland clarified is how they will ensure they  
12                  meet that. Okay? And as he said, the way  
13                  that is going to be met is by control of the  
14                  critical velocity.

15                  The control of the critical  
16                  velocity will ensure that they meet the  
17                  limits, okay, our basis of design for transfer  
18                  of --

19                  MR. DWYER: I --

20                  MR. ASHLEY: So we didn't remove  
21                  -- when you see the final BOD, we did not  
22                  remove those parameters. They are there in

1 the basis of design when it is finally  
2 approved.

3 MR. DWYER: Right. You chose to  
4 approach it a different way.

5 MR. ASHLEY: It -- the control, in  
6 other words --

7 MR. DWYER: Yes.

8 MR. ASHLEY: -- the specific  
9 control, but we didn't -- I wanted to clarify,  
10 we did not remove those specific parameters  
11 from that -- from what will ultimately be the  
12 approved basis of design.

13 MR. SAIN: And I think the good  
14 news with that was someone asked this morning,  
15 "What formal document, Mr. Rutland, did you  
16 get?" Well, he didn't get one. The reason is  
17 the integration. Paul talked to WTP, because  
18 we are integrating, and they resolved this  
19 issue.

20 CHAIRMAN WINOKUR: Okay. I --

21 MR. BROCKMAN: Mr. Chairman?

22 CHAIRMAN WINOKUR: Yes, I'll let

1 -- after you Dr. Mansfield will have some  
2 questions. Go ahead, please.

3 MR. BROCKMAN: Mr. Chairman, I can  
4 assure you that in my turnover -- and that is  
5 the best knowledge I have of my turnover --  
6 the statement that the plant was too complex  
7 to operate was not used for the rationale  
8 behind these reviews of stuff. That was not  
9 used. And I'm interested in, for my  
10 information, where that statement is that --  
11 where we said that. I would like to know --

12 CHAIRMAN WINOKUR: We're going to  
13 put the document, the owners -- we're going to  
14 put it on the record, and it is the owners'  
15 perspective on changes in the design basis of  
16 the waste treatment and immobilization plant  
17 pretreatment facility. And it is a part of  
18 the PDSA addendum. Is that accurate, or --

19 MR. STOKES: It's a part of the  
20 safety evaluation report.

21 CHAIRMAN WINOKUR: Safety  
22 evaluation report. And the timeframe for that

1 was?

2 MR. STOKES: I believe that was  
3 signed in November of 2009.

4 CHAIRMAN WINOKUR: November 2009.  
5 Okay. We'll get that for you.

6 Dr. Mansfield?

7 MEMBER MANSFIELD: I'm going to  
8 ask a series of four or five questions. There  
9 must be a simple answer to this. I could  
10 either ask you, Mr. Sain, but I'm going to ask  
11 Mr. Ashley. In the pretreatment facility,  
12 there are, by the count that I was given, 336  
13 possible transfer routes from tank to tank,  
14 and 65 of them need routine flushing for HPAV  
15 under ordinary conditions.

16 And after several days of  
17 transfer, now what happens? You've shut the  
18 pump off, and then what do you do?

19 MR. ASHLEY: I'm not following the  
20 question.

21 MEMBER MANSFIELD: There's --  
22 you've got a suction dead leg full of waste.

1 If you've got a low point in the discharge  
2 line, you've got that full of waste. What  
3 comes next?

4 MR. ASHLEY: Okay. Routinely in  
5 the operation of the facility, after transfers  
6 they will be followed by a flush.

7 MEMBER MANSFIELD: A flush.

8 MR. ASHLEY: Okay?

9 MEMBER MANSFIELD: How long do you  
10 have to do that?

11 MR. ASHLEY: Okay. One of the  
12 things that we are evaluating, and one of the  
13 advantages of using the quantitative risk  
14 assessment that we will be using -- and we  
15 will talk about that -- I'm sure we'll have  
16 questions --

17 MEMBER MANSFIELD: Tomorrow.

18 MR. ASHLEY: -- on that in  
19 tomorrow's session --

20 MEMBER MANSFIELD: Yes.

21 MR. ASHLEY: -- is that it avails  
22 us the opportunity to look in more detail at

1 our operation to determine what risks that  
2 operation presents, what hazards that  
3 operation might present.

4 MEMBER MANSFIELD: You mean how  
5 long you can leave the path unflushed.

6 MR. ASHLEY: Correct. Correct.

7 MEMBER MANSFIELD: Do you take  
8 gelling and precipitation into account when  
9 you do that?

10 MR. ASHLEY: We take basically --  
11 and I think we will probably get into some of  
12 the -- more of those discussions tomorrow, but  
13 we do look at the rheology of -

14 MEMBER MANSFIELD: This doesn't  
15 have to do with HPAV, so much as it does --

16 MR. ASHLEY: From a -- the waste  
17 transfer perspective and a flush perspective,  
18 we do absolutely take into consideration the  
19 rheology of the materials.

20 MEMBER MANSFIELD: Okay. Now, in  
21 the -- we also -- guys figured out that in the  
22 24 hours you've got about -- in a day --

1                   (Whereupon, the audio system cut  
2 off briefly.)

3                   MEMBER MANSFIELD: So you've got  
4 -- the jumper has a provision for flushing.  
5 It's got valves, it's got -- it's got some  
6 sort of flush liquid provision to the jumper  
7 to get --

8                   MR. ASHLEY: Yes.

9                   MEMBER MANSFIELD: -- to execute  
10 those flushes. Okay. Now let's look at the  
11 total loss of offsite power during a transfer.  
12 The jumper is still there. You have reserved  
13 power to complete that transfer?

14                  MR. ASHLEY: Many of the transfers  
15 are not ITS, okay, which that is a specific  
16 event that is evaluated, what the effect of  
17 that event is. For example, once again you  
18 get into, you know, what is -- what is one of  
19 the hazards of stagnant waste in our piping?

20                  MEMBER MANSFIELD: No, I'm just  
21 saying, do you have power to complete the  
22 transfer, or do you have to leave it --

1 MR. ASHLEY: We may not have power  
2 to complete the transfer.

3 MEMBER MANSFIELD: May not. Under  
4 what conditions might you?

5 MR. ASHLEY: In loss of offsite  
6 power, if the specific -- if that specific  
7 function is not a safety function, then that  
8 pump, to complete that transfer, would not be  
9 available and the waste would become --

10 MEMBER MANSFIELD: So there is no  
11 power --

12 MR. ASHLEY: -- would become  
13 stagnant.

14 MEMBER MANSFIELD: -- loss of  
15 offsite power, there is no power to those  
16 pumps?

17 MR. ASHLEY: That's correct.

18 MEMBER MANSFIELD: Or valves.

19 MR. ASHLEY: Specific pumps, the  
20 specific pumps.

21 MEMBER MANSFIELD: Well, I mean,  
22 all of the hot cells -- all of the hot cell

1 pumps?

2 MR. ASHLEY: You know, actually,  
3 we -- I never say "all." When I talk about  
4 the pretreat facility, the pretreat facility  
5 is a very complex facility, but many of the  
6 pumps are not ITS. And so there would not be  
7 emergency power to those specific -- to many  
8 of the specific pumps.

9 MEMBER MANSFIELD: How long if --  
10 and you will know how long that -- it will  
11 take for that waste to gel up and make -- and  
12 become perhaps next to impossible to pump?

13 MR. ASHLEY: We -- basically, pipe  
14 plugging -- and, actually, that was one of the  
15 FRT issues was the potential for pipe  
16 plugging. That is one of the issues that was  
17 studied.

18 Also, associated with that, and we  
19 did make design changes associated with  
20 resolution of that FRT issue to ensure that we  
21 could flush lines, that we could clear  
22 plugging, we have the ability to do chemical

1 flushes, we have the duty to --

2 MEMBER MANSFIELD: With no offsite  
3 power.

4 MR. ASHLEY: We have the ability  
5 -- when restored, we have the ability --

6 MEMBER MANSFIELD: No, I'm talking  
7 about a day or multi-day -- waste in many  
8 cases begins to gel in a day.

9 MR. ASHLEY: That's correct.

10 MEMBER MANSFIELD: And in a week  
11 it's immovable.

12 MR. ASHLEY: It's not immovable.

13 MEMBER MANSFIELD: Well, it  
14 will --

15 MR. ASHLEY: It's not immovable.

16 MEMBER MANSFIELD: But it --

17 MR. ASHLEY: It's not immovable.

18 MEMBER MANSFIELD: -- enough it's  
19 immovable.

20 MR. ASHLEY: It is not immovable,  
21 and chemical cleaning for these wastes is very  
22 effective. We use a sodium hydroxide and use

1 of dilute nitric acid, which we have that  
2 ability in our systems.

3 MEMBER MANSFIELD: So you have --  
4 but you have a jumper there with a flush line,  
5 and now you have to remove that flush line  
6 with your flush liquid and hook up something  
7 to acids or other chemical things, and that is  
8 not more complicated than flushing -- than  
9 providing emergency power so that you could  
10 flush every line?

11 MR. ASHLEY: We have -- the  
12 flexibility in these systems is -- we have  
13 substantial flexibility in these systems, and  
14 most of these connections are jumpered. The  
15 emergency power -- the emergency power is  
16 supplied to all of those systems that are  
17 required to have emergency power for safety  
18 reasons.

19 MEMBER MANSFIELD: That is just a  
20 C5 ventilation system.

21 MR. ASHLEY: Not just C5, the  
22 mixing systems --

1 MEMBER MANSFIELD: Okay.

2 MR. ASHLEY: We need to continue  
3 to mix the waste in --

4 MEMBER MANSFIELD: But not --

5 MR. ASHLEY: -- our vessels.

6 MEMBER MANSFIELD: -- not the  
7 valves and pumps in the hot cell.

8 MR. ASHLEY: For hot cell, we do  
9 not have power to the pumps in the hot cell.

10 MEMBER MANSFIELD: Right. So it  
11 is less complicated for you to wait until this  
12 thing sets up, and wait until power comes on,  
13 and rig a chemical flush or something like  
14 that, than it is to just turn on the water to  
15 the existing pump flush system by providing  
16 emergency power to the hot cell? I mean, that  
17 just doesn't sound right. This may not be  
18 important to safety, but it is certainly  
19 important to your night's sleep.

20 MR. ASHLEY: Actually, all of  
21 these situations, we have a detailed OR model.  
22 We looked at the availability of this

1 facility. We looked at the impact that these  
2 events have on the facility. We have our  
3 flush tanks, so that we can provide  
4 pressurized flushes.

5 Right now, the design is -- it is  
6 a design to assure that operations is not  
7 interrupted, we do not have substantial  
8 interruptions by line plugging. Line  
9 plugging --

10 MEMBER MANSFIELD: Not when  
11 there's external power.

12 MR. ASHLEY: Line plugging is a  
13 fact of this facility. These are slurry  
14 systems. Lines will plug. It is an important  
15 design feature to be able to clear the lines.

16 MEMBER MANSFIELD: But I -- so far  
17 you haven't convinced me at all that you have  
18 saved any complexity by having to live out a  
19 long, perhaps day long or longer, loss of  
20 offsite power and rig up a chemical flushing  
21 system when all you needed to have was an  
22 emergency power supply to the pumps and valves

1 in the hot cells.

2 MR. ASHLEY: And I want to --

3 MEMBER MANSFIELD: I'm not saying  
4 safety class. I'm just saying don't wreck the  
5 plant.

6 MR. ASHLEY: Right. But I want to  
7 clarify that there are some flushes which are  
8 ITS flushes, and that's why I wanted to make  
9 sure I don't say "all," because in this  
10 facility it is a complex facility.

11 MEMBER MANSFIELD: And I won't say  
12 "immovable."

13 MR. ASHLEY: We do have some of  
14 the flushes which are ITS flushes for our high  
15 solid systems.

16 MEMBER MANSFIELD: And it seems to  
17 me an added benefit to -- following my line of  
18 questioning is if you did this, you wouldn't  
19 have an HPAV problem at all.

20 MR. ASHLEY: Flushes don't resolve  
21 entirely accumulation of hydrogen. Flushes  
22 and purges are not the only solution. Venting

1 is required for elimination of pockets of  
2 hydrogen as well. So flushes are not the only  
3 solution.

4 MEMBER MANSFIELD: So you have  
5 provided vents?

6 MR. ASHLEY: We do currently --  
7 and the design currently has high point vents,  
8 a number of high point vents, as part of the  
9 hydrogen control.

10 MEMBER MANSFIELD: I thought those  
11 were some of the dead legs that were being  
12 removed for complexity purposes.

13 MR. ASHLEY: And the high point  
14 vents, you know, just getting back to -- to  
15 what were the complex aspects of the design,  
16 high point vents that run out of the hot cell  
17 into bulges where the controls are actually in  
18 the bulges. As you can imagine, the height of  
19 the hot cell, those are very long legs that  
20 have to run up to the corridor outside of the  
21 cell.

22 That is part of the design

1 complexity that the previous control strategy  
2 with -- the active controls that we are  
3 currently looking at.

4 MEMBER MANSFIELD: So far you have  
5 explained something that -- it includes more  
6 design complexity, the necessity to rig up a  
7 chemical flush after several days of offsite  
8 power.

9 I'm not getting anywhere with  
10 this, Mr. Chairman. But you can see what I'm  
11 trying to say.

12 CHAIRMAN WINOKUR: I think you can  
13 see that we really are trying to probe the  
14 complexity issue and understand whether -- I  
15 mean, nobody is debating the supertank concept  
16 and the MAR reduction. That's -- you know,  
17 that's understandable and you definitely want  
18 to do that.

19 But there are a lot of aspects of  
20 the safety basis in some of these strategies  
21 that just aren't clear right now that we  
22 really have had a reduction in complexity in

1 the plant. But I will go to Mr. Bader now for  
2 some questions.

3 MEMBER BADER: Well, the first  
4 thing I'd like to say is the reason we are  
5 focusing on this complexity issue is for  
6 nearly two years it was the driver behind a  
7 lot of the discussions we had that affected  
8 safety and operation. And now when we get the  
9 answers to the questions there is a nice  
10 statement in several places in the answer.  
11 It's that too complex to operate was never  
12 determined. So it's -- there's a certain  
13 degree of "wow, gee whiz" to this.

14 Let me go to the question of what  
15 we discussed this morning in terms of the  
16 large scale testing. My memory of the  
17 discussion, Ms. Busche, was that there are a  
18 number of important clarifications that will  
19 come out of that testing that will allow you  
20 to do a number of things including work on the  
21 safety basis, the criticality safety  
22 evaluation report, is that correct?

1 MS. BUSCHE: Correct.

2 MEMBER BADER: We also discussed  
3 the number of -- a number of tests that should  
4 be done in that large scale testing, Mr.  
5 Knutson, and I think by my count what was  
6 enumerated -- and you can break this up  
7 different ways -- was eight major segments of  
8 testing.

9 MR. KNUTSON: There were many. I  
10 don't know what the number was.

11 MEMBER BADER: My concern with all  
12 of this is that at least some of those are  
13 likely to result in surprises in new wishes  
14 being developed. And at that point, I believe  
15 you said you are three years away from hot  
16 functional testing. Is that correct?

17 MR. KNUTSON: Correct.

18 MEMBER BADER: To me the  
19 likelihood that something will go wrong that  
20 results in a function being transferred to the  
21 -- from the waste treatment plant to the tank  
22 farms is pretty high. And that to me is why

1 we needed to have things that are important to  
2 safety, important to efficiency, decided as  
3 soon as possible.

4 Now, let me ask, this new SER --  
5 or, I'm sorry, SES [Senior Executive Service]  
6 -- is this going to be his -- is he going to  
7 be heavily involved in this testing program  
8 from that perspective, looking at the balance  
9 between decisions that have to be made?

10 MR. KNUTSON: There are elements  
11 of commissioning -- training, operator  
12 qualification. There are elements of  
13 simulation. There are elements of controls  
14 evaluation that are all within the scope of  
15 this new individual's responsibilities.

16 In addition to that, there are  
17 specific elements of design and safety that we  
18 have talked about that need to be resolved.  
19 It will be a concerted effort from Bechtel  
20 design individuals, the URS safety  
21 individuals, and this integration role, all  
22 working together to ensure that the necessary

1 elements of the testing program are addressed.

2 MEMBER BADER: Mr. Russo?

3 MR. RUSSO: Yes, sir.

4 MEMBER BADER: Would you like to  
5 comment on that aspect of the decisionmaking  
6 process?

7 MR. RUSSO: Yes, if I may. And  
8 I'm going to go a little bit backwards to come  
9 forward if you don't mind. Many years ago I  
10 built a facility in Canada that was very  
11 different but in some ways very similar to  
12 this one. It was a \$6 billion pitching and  
13 processing facility for Shell up at Fort  
14 Saskatchewan. The feed came from Fort  
15 McMurray through a 500-mile pipeline. It was  
16 a very thick slurry, very caustic. Of course,  
17 it had no radiological characteristics  
18 whatsoever.

19 And in the early stages of that  
20 project, because the ownership of the project,  
21 unlike this, was you had a mining company  
22 owning the mining part of the job and Shell

1       owning the actual processing part of the job,  
2       was there was a great deal of debate about  
3       where something should happen.

4               And there was a similar debate to  
5       what you were talking about, Ms. Roberson, in  
6       terms of, well, the risk of mining versus the  
7       risk of refining have to be somehow  
8       adjudicated and bounded. And initially there  
9       wasn't a method to really modify that, to  
10      control those decisions, and everyone was  
11      making them predicated pretty much on their  
12      self-interest as opposed to the interest of  
13      the holistic project.

14              Shell Solutions out of The Hague  
15      came in, worked with the project team on both  
16      sides, and we made the determination that what  
17      you really needed was, in essence, what Dale  
18      has introduced in terms of the integrated flow  
19      sheet with someone who owns the middle box.

20              So feed comes over. It doesn't  
21      meet the WAC; that goes back on that side.  
22      And the adjudication takes place in that

1 middle box. Feed comes over, I can't process  
2 it properly, I don't send it back to the tank  
3 farm. I have to physically deal with it.

4 But, again, the middle box is  
5 there to provide the oversight and the  
6 governance of determinations as to what is the  
7 best outcome, both in the physical design as  
8 you're designing the plant and as you get into  
9 operation.

10 So when you look at the question  
11 you asked, where will most of that effort come  
12 from, it has got to be in that middle box, and  
13 I'm pretty certain that's where Dale has  
14 determined to put it, meaning when we are  
15 looking at the integrated testing or anything  
16 that talks to the integrated flow sheet, Dale  
17 will obviously have a major say from the point  
18 of view -- when I say "Dale," I mean Mr.  
19 Knutson for the record -- in terms of the  
20 implications on the capital project.

21 Stacy Charboneau will have a great  
22 input in terms of the implications on the tank

1 farm. But that SES position will be the one  
2 that basically provides both sides a balanced  
3 determination as to what is best for the  
4 integrated flow sheet.

5 And I believe that to be the model  
6 that is being adopted, and, you know, Dale  
7 could -- Mr. Knutson can expand on that. But  
8 that is, I believe, critical when you are  
9 dealing with a feed and a facility to process  
10 that feed.

11 MEMBER BADER: Is it fair to say  
12 -- I'll wait until you read that.

13 MR. RUSSO: Let me see what --  
14 okay. Go ahead. I'm ready.

15 MEMBER BADER: If all goes  
16 reasonably well, all this testing will be  
17 finished in three years prior to hot  
18 functional testing.

19 MR. RUSSO: Yes. All the testing  
20 that affects what I need to do to --

21 MEMBER BADER: If it goes  
22 reasonably well.

1                   MR. RUSSO:  -- to build a plant,  
2                   right.

3                   MEMBER BADER:  Are you able to  
4                   develop your control system completely until  
5                   that is finished?

6                   MR. RUSSO:  You can develop the  
7                   control system.  But as I think was originally  
8                   expressed -- and I'll let Greg, you know,  
9                   embellish on this -- the design is an  
10                  iterative process.  And to the point earlier  
11                  in terms of at 80 percent do you want it to be  
12                  iterating as much as it is right now?  
13                  Obviously, the answer to that is no.  But  
14                  that's a fact of life.  It is.  It comes from  
15                  the learnings of many years in terms of what  
16                  you call a one-of-a-kind facility, which is  
17                  correct.

18                  We can get a control system logic  
19                  and a control system design established, and  
20                  then the question becomes, what modifications  
21                  in the final iterations you would have to do?  
22                  If I may, I would like Greg to add to that.

1                   MEMBER BADER: Well, let me --  
2 before you do that --

3                   MR. RUSSO: Yes, sir.

4                   MEMBER BADER: -- let me go -- and  
5 by the way, I'd go back and say my memory was  
6 the first time we met you made a comment to me  
7 that you had never before worked on a project  
8 at this stage of design and construction that  
9 still didn't have a firm process flow sheet.  
10 Is that correct?

11                   MR. RUSSO: Yes, in the -- that is  
12 a correct statement. In the process industry  
13 that I came from -- and, again, it's a totally  
14 -- not totally unfair, but it's an unfair  
15 comparison because it is reality -- those oil  
16 companies particularly, because product to  
17 market, price of that product per unit, was so  
18 important that they would invest a  
19 considerable amount of effort, not a lot of  
20 time by the way, but a considerable amount of  
21 effort, to get their feed defined to the level  
22 that they felt comfortable to go out and make

1 the capital investment, because understanding  
2 the feed had a great implication on how you  
3 line up the equipment, your heat balances,  
4 etcetera, material and heat balances.

5 So you typically would see process  
6 definition fully complete before you get into  
7 design. Now -- you know, final design. Now,  
8 as a reality of this job, as the EFRT came up  
9 and new questions were asked that were  
10 legitimate, reasonable questions, given that  
11 our feed stock isn't chemical but it is  
12 radiological, it really took the entire normal  
13 sequence and put it into a different  
14 parameter. We just have to deal with that.  
15 We understand it.

16 MEMBER BADER: So, but if I  
17 understand what you're telling me, you really  
18 can't determine the complexity of operation,  
19 the complexity of control on this plant until  
20 you get to that point. Is that correct?

21 MR. RUSSO: When you have your  
22 engineered features finally defined, obviously

1 it then allows Donna Busche to go out and  
2 determine what controls need to be applied  
3 around both the engineered and the  
4 administrative controls to ensure you are  
5 staying within the safety envelope.

6 That said, you could look at some  
7 of the design that was in the original HPAV,  
8 and I can compare it to when we first met way  
9 before that at AMWTP. But we took over that  
10 facility, I think as you know, Ms. Roberson,  
11 and there was a lot of design features in  
12 there that on paper looked extremely reliable  
13 and extremely good for the co-located worker.

14 But in reality, in application, we  
15 ended up in some cases, with the Board's  
16 approval in all cases, eliminating some of  
17 those controls, because when you got into  
18 operation they were actually creating  
19 opportunities for me to have to send workers  
20 in in suits to clean up contamination from the  
21 transuranic waste.

22 So until -- and I think this is

1 the "not putting it off" comment, until you  
2 really get to a point where -- and cold  
3 commissioning, by the way, which is before hot  
4 commissioning, should give us some experience  
5 in this area. Until you get into a point when  
6 you actually understand how the facility  
7 interacts with itself, you will always be  
8 questioning that.

9 And I think Donna Busche told me  
10 before -- a couple of days ago that it will be  
11 two or three years into the actual operation  
12 before you finally finalize what those TSRs  
13 really need to be. They will start out  
14 overtly conservative, and then as time and  
15 operating experience comes into play, there  
16 will be, you know, an endeavor to look at  
17 those and reduce them.

18 MEMBER BADER: Greg, do you want  
19 to --

20 CHAIRMAN WINOKUR: Mr. Ashley?

21 MR. ASHLEY: I think, Mr. Bader,  
22 in reference to some of Frank's comments, you

1 know, certainly the large scale integrated  
2 test from a control system completion is very  
3 important for us. And I think we -- you know,  
4 we identified that as part of our strategy.

5 You know, we have our basic design  
6 logics and concepts in terms of how we will  
7 control PJMs [Pulse Jet Mixer]. It is really  
8 important that we run those at full scale  
9 prototypically, so that we can finalize the  
10 control system strategy for the PJMs.

11 The one thing I did want to -- Dr.  
12 Mansfield, I do need to clarify some of the --  
13 in response to your comments, our UFP filter  
14 loop does contain a pressurized flush system,  
15 which is ITS. As you know, our UFP filter  
16 loop is a critical process loop. It is a  
17 large loop where we -- where we, you know,  
18 post leach and concentrate solids. So this is  
19 an area where we are protecting that with an  
20 ITS power flush to ensure that we do not have  
21 line plugging.

22 I also misspoke. Our flushes,

1       which are below the hydrostatic level, can  
2       create dead legs. Our vents can't create dead  
3       legs, so our flushes that are below the  
4       hydrostatic level can create dead legs.

5                Another element in terms of  
6       plugging, particularly avoiding chemical  
7       plugging, as we talked about one of the  
8       issues, the FRT issues, and one -- was the  
9       potential for line plugging, something that we  
10      had to ensure that we were addressing  
11      properly.

12              One of those was to avoid  
13      potential for chemical line plugging. We do  
14      have a report, which I will make sure that the  
15      staff does get, which address how we address  
16      off-normal conditions and the potential for  
17      chemical line plugging. That was all done as  
18      part of the line plugging studies.

19              So this is an area that we have  
20      looked at extensively. We did have PNL do  
21      testing for us relative to critical velocities  
22      to ensure that we don't have plugging, as well

1 as determine what flush velocities were  
2 required to assure that we could remove plugs  
3 from the lines. So I'll make sure that the  
4 staff, if they don't already have this  
5 documentation, that it is available to them.

6 CHAIRMAN WINOKUR: Thank you. I  
7 would like to move to Mr. Brown at this time.

8 MEMBER BROWN: Thank you, Mr.  
9 Chairman. I guess I'm the wrap-up man again.  
10 As I listened to the whole conversation that  
11 has gone on about complexity, I thought back  
12 to the question I asked Mr. Sain earlier this  
13 morning, what -- from a tank farm point of  
14 view, what would be the ideal WAC? And your  
15 answer was --

16 (Laughter.)

17 MR. SAIN: Well, I won't go there  
18 again.

19 (Laughter.)

20 MEMBER BROWN: Well, why not? I  
21 mean, your answer was, whatever you can --  
22 what you can send to the waste treatment

1 plant.

2 MR. SAIN: No. I said -- what I  
3 said was my ideal WAC would be a WAC we can  
4 meet.

5 MEMBER BROWN: Okay.

6 MR. SAIN: And that's what the WAC  
7 is all about is you've got to meet the waste  
8 -- or the -- you know, acceptance criteria  
9 before you transfer waste. So anyway --

10 MEMBER BROWN: And it seems to me  
11 that if -- if you had -- didn't have to do any  
12 blending, if you could send it directly from  
13 the tanks to the waste treatment plant, that  
14 would be an ideal WAC. There would be -- or  
15 maybe an ideal WAC. I mean, there would be  
16 almost -- there would be no requirements for  
17 processing or blending or, etcetera, for you  
18 --

19 MR. SAIN: But --

20 MEMBER BROWN: -- if you could.  
21 That would be the simplest.

22 MR. SAIN: But let me take a

1 little bit different approach. You want to  
2 use blending to your advantage. It's  
3 advantageous to you.

4 MEMBER BROWN: Sure.

5 MR. SAIN: You've got tanks at  
6 both sites that have real problems in the  
7 tanks with what is in there, and other tanks  
8 that, you know, it's not such a problem. And  
9 so by blending you can mix a blend that  
10 eliminates a lot of problems for yourself. So  
11 blending, in my mind, is a very positive  
12 thing. And we have learned that from years of  
13 experience.

14 I think the other thing is that  
15 when you look at stuff like condition of the  
16 sump tanks, and the fact that, you know, most  
17 of the liquid has been taken out of the tanks,  
18 you're going to have to blend. I mean,  
19 regardless of, you know, this issue that we  
20 have all been focused on, blending is going to  
21 be required.

22 And I say, do what we've done in

1 the past, use that to your advantage, and it  
2 will really help you be able to process all of  
3 the waste.

4 MEMBER BROWN: And I'm not an  
5 advocate for supertank or any other particular  
6 solution. What I'm an advocate for is the one  
7 that works best. And -- but it seems to me,  
8 it's not intuitive to me, that doing more  
9 blending or whatever in the tank farms is  
10 going to -- won't increase the chances for a  
11 safety problem. Any time you do more things  
12 and you have more people, more pumps, more  
13 pipes, more valves, it seems to me that you  
14 are more likely to have a problem,  
15 intuitively.

16 And I'm not a particular advocate  
17 for probability PRA [Probabilistic Risk  
18 Analysis] or QRA, but as you -- as you analyze  
19 these various options, it seems to me you need  
20 some sort of metric where you can compare  
21 them. And right now it is basically expert  
22 elicitation, "Well, I think blending will be

1 better here or there," and it seems to me like  
2 there might be some valve in having some  
3 quantification of what these hazards are as  
4 you try and compare, as Ms. Roberson has said,  
5 the totality of the problem, who is going to  
6 get more risk as you get it -- move it from  
7 here to there.

8 Just some thoughts.

9 MEMBER BROWN: Well, do you -

10 DR. TRIAY: If I may for a moment,  
11 I would like to say that there is no question  
12 that the Department of Energy is also looking  
13 at the risk holistically. And we completely  
14 agree with Ms. Roberson and with you, Mr.  
15 Brown.

16 Let me just be completely clear.  
17 The new material at risk does not require for  
18 us to blend the waste. There is no waste  
19 stream that has the concentrations in the  
20 supertank which is a concept involving taking  
21 the highest concentration of every constituent  
22 from the entire tank farm and creating a tank

1 -- a waste stream that does not exist on  
2 paper.

3           So I just want to make absolutely  
4 certain that everybody understands, in order  
5 to meet the new MAR, our current recipes for  
6 tank farm delivery do meet the new material at  
7 risk, and there are no blending requirements  
8 or any new requirements that we have imposed  
9 in the tank farm as a result of the revised  
10 MAR.

11           MR. SAIN: And I want to add one  
12 thing. I said it was intuitive, and I'm a  
13 little bit more thorough than that. And so I  
14 will add to this whole thing about MAR and the  
15 super tank concept that I went and did a  
16 comparison of WTP to DWPF.

17           And, you know, one of the things  
18 that I learned from you guys and ladies was,  
19 you know, we ought to take advantage of what  
20 is out there to learn lessons and compare and  
21 all that kind of stuff. So it's interesting  
22 when you go compare DWPF and what it has as

1 far as controls to the existing WTP today. It  
2 is startling, in my mind.

3 MEMBER BROWN: Thank you. I'd  
4 like to turn attention a little to -- back to  
5 the PDSA, the PDSA addendum, the DSA, the  
6 TSRs, that whole process. Maybe ask, Ms.  
7 Busche, if you could tell me where we are in  
8 that whole train of events. I mean, we have  
9 a PDSA that's approved, we've got an addendum  
10 that is awaiting approval. That is going to  
11 lead to the DSA. Can you explain that whole  
12 timeline and where we are at in it?

13 MS. BUSCHE: Sure. Before I did  
14 that, I was listening to that last exchange,  
15 and I wanted to offer just a couple, because  
16 I -- I think it -- sometimes we are not -- we  
17 are not communicating on our side. And so  
18 what I'd like to offer is it is clearly an  
19 iterative process, and you hear people say  
20 that. Okay?

21 But when you are resolving  
22 technical issues, sometimes that is easier

1       said than done, and it is going to play into  
2       your question, Mr. Brown, as we get into, how  
3       do we move forward? So in just simple terms,  
4       if you reduce the MAR, you could potentially  
5       reduce the functional classification, which  
6       could reduce the number of safety systems.

7                 That does not mean that it  
8       eliminates the layers of defense in depth. It  
9       doesn't mean controls go away. Okay? The  
10      onus is still on us in the final documented  
11      safety analysis to eloquently describe in  
12      Chapter 3 those layers of defense in depth.

13                So I am comfortable that we are  
14      not removing controls that we don't need at  
15      this point in time. As we move forward, okay,  
16      and I think I hinted at some technical  
17      challenges, what we have to do is now iterate  
18      -- come up with realistic accident analysis  
19      where we are with the PDSA addendum is in  
20      unmitigated consequences. They are  
21      postulated, okay?

22                So if you look in safety analysis

1 space, we have not updated Chapter 3 to  
2 reflect the next level of transition into the  
3 accidents which lead into the technical safety  
4 requirements, which will give us a feel for  
5 controls.

6 Now, I answer on the conservative  
7 side of "I don't know," because I haven't done  
8 that work. That doesn't mean that as we have  
9 done our lower level working process of those  
10 integrated safety management system that there  
11 are lots of discussions on high point vent.  
12 Those are not articulated yet in the next  
13 iteration of where we are going to go in the  
14 license or the safety basis document. Okay?

15 So where are we? So that -- I  
16 just -- I was listening to that, and I think  
17 everybody was correct, but it really wasn't I  
18 think getting into some of the questions that  
19 Ms. Roberson started with.

20 So where are we? We have a PDSA  
21 that is currently approved, reflects that  
22 supertank MAR. Okay?

1                   We have made no changes to the  
2                   design yet that reflect the updated MAR, and  
3                   I -- and I am comforted to hear that that's a  
4                   good thing, because from an overall future  
5                   operations from -- and I'll call it hazard,  
6                   crave, or grave -- it is good if those source  
7                   terms line up from the generating facility to  
8                   the processing facility. So writing that  
9                   final DSA, that makes it easy, and so that was  
10                  refreshing for me to hear.

11                  The PDSA addendum did make changes  
12                  to the material at risk. I think Mr. Kasdorf  
13                  identified there were other changes made to  
14                  the analysis methodology. That document was  
15                  approved by the Department. We had conditions  
16                  of approval, and it is a minor point in my  
17                  world, but maintaining configuration  
18                  management of the license is paramount. So  
19                  until we do every element of correspondence  
20                  that has gone back and forth, we will not  
21                  transition to that PDSA addendum.

22                  So we are -- and I don't want to

1 turn around, but we are clearly -- we have had  
2 all of our discussions with the Office of  
3 River Protection. We have resolved their  
4 comments. What we are waiting is final  
5 verification that we have closed their  
6 comments per our agreed-to disposition.

7 So I would suspect I think in here  
8 we said by the end of September. So, but we  
9 are very close to as soon as we send it over  
10 there, then the Department would update their  
11 safety evaluation report and say that the  
12 matter is closed, and then we will begin the  
13 next phase of the next iteration.

14 We need to implement that PDSA  
15 addendum into the PDSA, which will necessitate  
16 changes to Chapter 3 and give us a better  
17 understanding of where the next vision of the  
18 technical safety requirements are going to be.  
19 Okay?

20 So the challenge that we have now  
21 is as we go through those technical issues,  
22 there is going to be a lot of changes

1 throughout the full scope of the 17 chapters.  
2 All right? So we are -- we have not finalized  
3 our plan I think internally.

4 What I am very strongly committed  
5 to now is we need to have an integrated  
6 iteration. It will do me no good, it will do  
7 the project no good, if I answer the mixing  
8 question, but I don't understand the mixing  
9 question with respect to potential HPAV  
10 issues, because they are not unrelated.

11 So that integrated -- we call it a  
12 plan for a plan -- is being kicked off with  
13 preliminary planning sessions, and it will be  
14 approximately 10 months to 12 months to  
15 complete that systematic evaluation of hazards  
16 that integrates it.

17 We've got the pieces and parts.  
18 We need to integrate it, because we are  
19 nearing the end of design, and we need to  
20 understand, are there any new nuclear safety  
21 functional requirements that need to be  
22 addressed?

1 I don't know if that answered your  
2 question, but --

3 MEMBER BROWN: Yes, I think so.

4 Mr. Brockman?

5 MR. RUSSO: May I just add one  
6 clarification, please?

7 MEMBER BROWN: Sure.

8 MR. RUSSO: Thank you. In  
9 recognizing what Ms. Busche said, when we look  
10 at the changes in pretreat, and what we have  
11 to do to keep them under configuration control  
12 and aligned with the PDSA, we took the  
13 approach that we wanted to not touch the P&ID  
14 [Piping and Instrumentation Diagram] more than  
15 one time. We don't want to touch all the  
16 follow-on documentation more than one time.

17 So we went out and redlined  
18 everything and put a complete matrix together  
19 of all of the affected documents, all of the  
20 affected drawings, and then put together a  
21 work unit, so that we can work these all off  
22 at one time. So we can look at the iterations

1 of M3, HPAV, and the other minor changes that  
2 Ms. Busche spoke about, which will facilitate  
3 our environmental and nuclear safety folks to  
4 do that integrated look at it from a PDSA  
5 point of view.

6 MEMBER BROWN: Thank you. Mr.  
7 Brockman, you are the approval authority for  
8 completion of these PDSA addendum issues, is  
9 that correct?

10 MR. BROCKMAN: That's correct.

11 MEMBER BROWN: And do you have  
12 anything you wanted to add to Ms. Busche's  
13 statement?

14 MR. BROCKMAN: Her statement was  
15 accurate. Was are awaiting -- I believe we  
16 are expecting very soon the final  
17 documentation to close the last condition of  
18 approval.

19 MEMBER BROWN: Okay. Thank you.

20 MR. BROCKMAN: And I wanted to  
21 add, if I may, one more thing now or later.  
22 I do have that document in front of me, and

1 I'd like to read the statement. It says, "The  
2 conservative design requirements for MAR and  
3 hydrogen drove an evolving design of  
4 unforeseen complexity that led both BNI and  
5 ORP to raise concerns for the reliability and  
6 the safety of future WTP operations."

7 To me, that says we had concerns,  
8 we raised a question. I don't read in there  
9 at all that we made a declaration it was too  
10 complex to operate.

11 CHAIRMAN WINOKUR: Let me tell you  
12 for the record, as a Board member, and having  
13 come out to Hanford many times in the last few  
14 years and been briefed, that that is my  
15 understanding of what the Department conveyed  
16 to the Board very clearly. And I will just  
17 leave it at that.

18 Thank you.

19 MEMBER BROWN: One of the  
20 statements Mr. Kasdorf made in his opening  
21 statement I wondered if somebody could clarify  
22 for me. And the question is: is the current

1 process ventilation system design undersized  
2 as compared to the current design criteria?  
3 Anybody comment on that?

4 MR. KNUTSON: Greg actually should  
5 probably address that.

6 MR. ASHLEY: I didn't recall that  
7 the comment was that it is undersized. The  
8 process ventilation vessel vent system -- as  
9 part of this process, we had -- it had  
10 previously been classified -- did not have an  
11 active safety function, that vessel vent  
12 system. The system was a passive vessel purge  
13 system.

14 The vent system contains a number  
15 of pieces of equipment, such as a scrubber,  
16 which does not have currently -- or previously  
17 did not have an active safety function. As we  
18 talked about potential reclassification of  
19 that vessel vent system, we then had to look  
20 at the ability of the design to meet what was  
21 then going to be the functional  
22 classification.

1           It has caused us to go back and  
2 talk to the supplier. Basically, in a post-  
3 DBE [Design Basis Event], the sprays in that  
4 -- that scrubber would not be operable. And  
5 so we had to look at, what is the  
6 effectiveness, then, in terms of the removal  
7 of aerosols and aerosols, then, that would end  
8 up on the vessel vent HEPA filters.

9           So when Mr. Kasdorf referred to  
10 that, it is that change in classification that  
11 has caused us to relook at the design to say,  
12 in that upgraded functional requirement,  
13 safety requirement for that system, could the  
14 design comply with that? That's just -- it's  
15 an issue that we are currently looking at.

16           MEMBER BROWN: Thank you. There  
17 has been some talk about the sprays and leaks  
18 question in the hot cells. Can you tell me  
19 what the functional classification of the  
20 piping in the hot cells is today?

21           MS. BUSCHE: By the current PDSA  
22 addendum, because I think we are very close to

1 that, it ranges from safety -- excuse me, no  
2 higher than safety significant, but we reduced  
3 no pipe that wasn't already commercial grade  
4 to commercial grade.

5 So in the revision of our  
6 unmitigated analysis, we actually have said it  
7 wouldn't go any lower than safety significant,  
8 and we have a note in the actual license that  
9 we would -- if we choose or need to find a  
10 solid technical basis, you know, to go to that  
11 next level, we could go back to the Department  
12 and request that.

13 So, and it -- it is really hard to  
14 do generalities when you are talking as much  
15 piping as we have. But I think it is a fair  
16 general -- and I will probably get a note if  
17 I'm wrong -- no lower than safety significant.

18 MEMBER BROWN: Is that the same  
19 classification of the pumps and the valves and  
20 other equipment in the hot cells, that it  
21 would be safety significant, no higher than  
22 safety significant?

1 MS. BUSCHE: That I am  
2 uncomfortable answering without looking at the  
3 actual document itself, because it is a pretty  
4 complicated Table 5 in the addendum, so --

5 CHAIRMAN WINOKUR: Dr. Mansfield  
6 has a clarifying question.

7 MEMBER BROWN: Yes, sir.

8 MEMBER MANSFIELD: On the issue of  
9 valves, the one -- the HPAV-related experiment  
10 we have had a valve failure that would have  
11 sprayed -- had a considerable spray of waste  
12 in the hot cell.

13 MS. BUSCHE: Right.

14 MEMBER MANSFIELD: So I'm going to  
15 reinforce that question. Should the -- for  
16 instance, the valving in the hot cells for  
17 transfer paths be qualified in some way, so  
18 that the possibilities of leaking past gaskets  
19 during shocks of HPAV detonations can be  
20 mitigated? Is that -- would that be -- it  
21 seems to me that would be as much a part of  
22 the safety qualification as making sure that

1 you are using safety significant piping.

2 MS. BUSCHE: I think you're  
3 referring to I think some of Roy's opening  
4 statements with your followup. I --

5 MEMBER MANSFIELD: It is not so  
6 much the piping in the hot cells that I am  
7 worried about for my question. It is the in-  
8 line components in the hot cells that have  
9 more leak paths than the piping has.

10 MS. BUSCHE: I don't know if I  
11 understand that.

12 MR. ASHLEY: Dr. Mansfield, I can  
13 answer that. In terms of in-line components,  
14 when we talk about specific events, in-line  
15 components are qualified. They are safety  
16 requirements. If the requirement is  
17 maintenance of the pressure boundary, the in-  
18 line components will be qualified for  
19 maintenance of the pressure boundary, if it's  
20 HPAV affected.

21 We have not completed -- and I  
22 believe we have discussed this previously with

1 staff -- we have not completed our test  
2 acceptance criteria, our test planning, but  
3 our intent and our requirement, as stated in  
4 our basis of design, is these in-line  
5 components will be component tested, just like  
6 we do seismic qualification, just like we do  
7 environmental qualification. They would be  
8 qualified for the HPAV event. They would be  
9 specific measurable test acceptance criteria  
10 associated with the qualification of those  
11 components.

12 CHAIRMAN WINOKUR: All right. Mr.  
13 Brown? Sorry.

14 MEMBER BROWN: Yes. So in the hot  
15 cells, are we talking -- when we are talking  
16 about defense in depth, are we relying on the  
17 primary waste boundary, which would be the  
18 pipes, in-line components, or are we relying  
19 upon the building and the ventilation system  
20 as the confinement boundary?

21 MS. BUSCHE: If you -- hang on  
22 just a second. If you look at the suite of

1 accidents, okay, we -- there is a lot of  
2 discussion, so when I say "loss of confinement  
3 events," okay, the credited control in the  
4 accident analysis is a confinement boundary,  
5 C5-V, to mitigate the release.

6 The basis for the selection of the  
7 confinement ventilation is -- our experience  
8 is pipes leak, jumpers will leak. Okay?  
9 Especially in hot cells. And I believe it is  
10 a fundamental tenet of the -- when you pick a  
11 credited control, you have to demonstrate it  
12 provides its credited safety function. Okay?

13 So now that doesn't mean we are  
14 done. The next layer of defense in depth that  
15 we will articulate is actually, what is the  
16 quality and the pedigree of the pipes -- and  
17 I'm sure that will go to the in-line  
18 components as well -- as we design that to  
19 protect that transient? There will be several  
20 for loss of confinement.

21 You will get some that are more on  
22 the operator. How do you hook up jumpers so

1 you minimize the potential for misalignment?

2 All the way to you have an HPAV event, and do  
3 you need to provide another control to protect  
4 that boundary?

5 So the QRA will help us with the  
6 HPAV, and I think we will probably deep dive  
7 on that tomorrow morning. But there is much  
8 piping that is safety significant. It is just  
9 not the credited control, because in all cases  
10 we can't demonstrate that it will prevent the  
11 leak.

12 So when I am talking loss of  
13 confinement, I need to pick a control that is  
14 going to either prevent or mitigate it, and we  
15 saw no way, without pipe in pipe, you know --  
16 I mean, you get into some scenarios, if you  
17 want to prevent the leak, we did not feel we  
18 could do that in all cases given the design  
19 with the jumper configuration.

20 MEMBER BROWN: Thank you. Now, we  
21 have talked a bit about the flow sheet in the  
22 pretreatment plant, that it's not final. What

1 safety basis decisions remain unanswered  
2 because the flow sheet isn't final?

3 MS. BUSCHE: It's a little hard to  
4 speculate. As part of our going-forward plan  
5 that I shared just a moment ago, we are  
6 actually -- part of that integrated hazards  
7 analysis, the process flow diagrams will be  
8 updated based on the results of mixing. What  
9 are our capabilities? That will then flow  
10 into an update of our data sheets or our  
11 project models and an update to the P&IDs.

12 Those will work in concert, then,  
13 to systematically evaluate the hazards to  
14 answer that question. I don't expect a lot --  
15 I don't see any showstoppers, but that is  
16 based on my experience in looking at what I  
17 know. But I can't preclude that there will  
18 not be a new control until we follow our  
19 process.

20 So at this point, because we are  
21 nearing the end of the design, we need to pick  
22 a control that can provide the credited safety

1 function, and that -- pick a control that  
2 provides a credited safety function, and I  
3 think I will just leave it at that.

4 Predicting what I don't know, I don't know.

5 MEMBER BROWN: So who can say when  
6 we expect to finish the flow sheet, complete  
7 it?

8 MR. ASHLEY: Mr. Brown, you know,  
9 when you refer to the flow sheet not final,  
10 the flow sheet will undergo revision, because  
11 we are doing some design improvements to the  
12 facility. Particularly, we are doing system  
13 modifications to preclude precipitation of  
14 solids after our ultrafiltration wash and  
15 solids concentration. Particularly, what we  
16 want to do is prevent solids that could plug  
17 our ion exchange column.

18 However, the flow sheet today is a  
19 final flow sheet. It will undergo those  
20 revisions associated with those system  
21 modifications that -- though we won't talk  
22 specifically about what we call the CNP/CXP

1 [Cesium Nitric Acid Recovery Process/Cesium  
2 Ion Exchange Process] modification, but that  
3 is part of the suite of modifications that we  
4 will make to the pretreat facility that Donna  
5 has talked about that will then undergo or go  
6 through the hazards analysis, the ISM process.

7 That is a very important  
8 modification. It allows sodium reduction. It  
9 will allow a reduction in the life cycle of  
10 WTP, and actually will preclude upset events  
11 where we would plug ion exchange, have to stop  
12 the process, have to flush or remove an ion  
13 exchange column and replace it.

14 So there will be some changes, but  
15 I don't -- I don't really know where the  
16 premise that the flow sheet isn't final has  
17 come from. It will undergo changes over the  
18 next year as we implement some beneficial  
19 changes to the facility systems.

20 MR. RUSSO: That CNP/CXP  
21 modification we are talking about is an  
22 example of the Department making a capital

1 investment in the pretreat facility to save  
2 operating expense over the life cycle of the  
3 project. So there were two options. One had  
4 a very minor capital implication but had a  
5 life cycle implication. The one that was  
6 selected had a higher capital implication to  
7 save life cycle costs.

8 MEMBER BROWN: It sounds to me  
9 like ARPMCU. I mean, you are in a constant --  
10 those kinds of issues you are going to be  
11 addressing maybe over the life of this plant.  
12 But the basic flow sheet, you are telling me,  
13 is -- is final. Is that --

14 MR. ASHLEY: Yes. Yes. But as we  
15 -- as we do system changes, beneficial  
16 changes, or identify that we will receive a  
17 lower weight percent solids, those do have  
18 effect, the flow sheet will have to be  
19 updated. But the flow sheet and the mass  
20 balance has -- from the flow sheet has been  
21 completed.

22 MEMBER BROWN: I mean, as I think

1 we talked about this morning with Mr. Rutland,  
2 there may be hundreds of flow sheets that you  
3 have to develop for the different wastes that  
4 you treat. So, but the basic flow sheet for  
5 the pretreatment facility is final.

6 MR. ASHLEY: Yes. When we talk  
7 about the batches, and how the individual  
8 batches are characterized in the  
9 prequalification, that doesn't change the WTP  
10 flow sheet. That changes how we operate the  
11 process. For example, how long do we have to  
12 leach?

13 Depending upon the specific feed,  
14 how will we concentrate that feed? How many  
15 times will we wash that feed as we recirculate  
16 it in the UFP loop?

17 So that isn't a fundamental flow  
18 sheet change. That is how we're going to  
19 operate and how we're going to process that  
20 specific feed.

21 MEMBER BROWN: Thank you. So the  
22 flow sheet issue, Ms. Busche, isn't really

1 slowing you up on safety basis documentation,  
2 or is it?

3 MS. BUSCHE: My job is to verify.  
4 So when we do an update to the hazards  
5 analysis, even if there are minor changes,  
6 design improvements, okay -- I don't disagree  
7 at all with what Mr. Ashley has said -- we are  
8 still obligated to make sure that there is no  
9 impact. So we have configuration management  
10 of the hazards we have analyzed, the controls  
11 we have selected, and a clear path to  
12 transition.

13 So it is -- is it holding me up?  
14 No. But we are in the process of, for  
15 example, mixing. We are evaluating those  
16 vessel assessment summary reports to  
17 understand what those impacts are. Some may  
18 change the process flow diagram. Some may  
19 not.

20 So we are focused more on the  
21 outcome -- I mean, the inputs and assumptions,  
22 and then the output, so that we can update our

1 hazards analysis. But they have to be  
2 consistent before we release it, so --

3 MEMBER BROWN: Okay. Thank you.  
4 In talking about the safety-related aspects of  
5 hydrogen in the pipes design, is the current  
6 WTP design capable of meeting DOE's safety  
7 requirements in 10 CFR 830 and 3009?

8 MS. BUSCHE: Could you be more  
9 specific on what safety requirements? Does  
10 the design currently meet the hazards analysis  
11 methodology of Subpart B? I think that for a  
12 PDSA the answer to that is yes. Does it meet  
13 it for a DSA? The answer to that is no. I've  
14 got lots of work to do as we now finalize the  
15 QRA and mature that into the hazards analysis,  
16 lots of work to do.

17 So at a PDSA stage, we have  
18 information that is supporting design. But I  
19 think a lot of the dialogue in this particular  
20 session is as part of a natural iteration we  
21 have found out new information on hydrogen and  
22 pipes in ancillary vessels and how to

1 integrate that in. It is changing I will call  
2 it the hazards analysis of record, and some of  
3 the design basis of record is changing, right?

4 So it is a natural evolution, but  
5 it is a -- it is a complex facility to try to  
6 explain that. So I believe we are compliant  
7 for a PDSA, but not for a DSA, nor am I  
8 required to be for a DSA at this time.

9 MEMBER BROWN: Is it your  
10 understanding that the hydrogen and pipe  
11 design issues, the QRA will be used as a  
12 safety-related tool or not?

13 MS. BUSCHE: I believe it's a  
14 design tool. But from a compliance to 3009,  
15 Appendix -- 3009, Appendix A, I believe we are  
16 obligated to evaluate the inputs and  
17 assumptions just like any other design calc.  
18 You determine what is an initial condition and  
19 what is an assumption requiring to be  
20 protected by a TSR?

21 So there are some things, when we  
22 go -- the QRA has been through a state of

1 change. There are some things in the QRA that  
2 are obvious. There are some flushes that are  
3 already required that the QRA is going to lead  
4 me to say, "Yep, that's a key thing in the  
5 calculation, so I will continue to protect  
6 that with a TSR."

7 There is others that are -- from a  
8 normal hazards analysis process would be a  
9 safety management program. And we will figure  
10 out how to work that into defense in depth.  
11 Okay?

12 But then, there is others that I  
13 don't know today. Until the QRA is finalized,  
14 and they finish their distribution curves and  
15 they finish that out, we can't complete that  
16 process. I believe we can comply with both  
17 the rule and the safe harbor methodology, but  
18 obligated to evaluate that document just like  
19 any other engineering calc.

20 MEMBER BROWN: Okay. In my simple  
21 mind --

22 MS. BUSCHE: Okay.

1                   MEMBER BROWN:  -- okay, we have  
2                   kind of a bright line -- before QRA was  
3                   brought into this process and after QRA was  
4                   brought into this process.  Do you think that  
5                   the use of QRA is going to simplify or  
6                   complicate meeting DOE requirements, safety  
7                   requirements, 3009, 830?

8                   MS. BUSCHE:  I think the level of  
9                   detail needed for the DSA is approximately the  
10                  same.  Ultimately, we had to have a design  
11                  basis for pipes.  Period.  That work is going  
12                  to be the same no matter what tool they would  
13                  have picked.  It's just the route to get  
14                  there.

15                  Where it may be more complicated  
16                  -- and to be candid, I haven't thought through  
17                  it yet -- is if we adopt this tool, what would  
18                  it mean for the future operations of the  
19                  facility with respect to the unreviewed safety  
20                  question process?  Because it is embedding  
21                  infrequencies, which is not necessarily -- I  
22                  haven't figured out how to use the

1 requirements of the rule, risk bending, for  
2 example. I haven't -- I really haven't  
3 thought through it.

4 We have been more focused on how  
5 are we going to do the first scrub of the QRA  
6 to identify how to develop the DSA and the  
7 controls. But, clearly, that is on my list of  
8 things that has to be resolved as we move  
9 forward to operate the plant. You have to  
10 know how you are going to maintain that  
11 license through routine changes, test, and  
12 experiment.

13 MEMBER BROWN: One of my problems,  
14 a Larry problem, is how to deal with PRA and  
15 QRA when DOE presents a solution to a problem  
16 based on that analysis, because I don't have  
17 a DOE policy upon which to base my judgment.  
18 And so I have to make it up, and I'm not very  
19 good at that. So --

20 DR. TRIAY: If I may, Mr. Brown,  
21 the Deputy Assistant Secretary for Safety and  
22 Operations Oversight, Steve Krohn, is the

1 Chairman of our Technical Authority Board.

2 This is a concept that the environmental  
3 management office adopted several years back,  
4 because we wanted to use concepts that were  
5 best industry practices like the QRA approach.

6 And in the Technical Authority  
7 Board, from the environmental management  
8 program perspective, it is going to be looking  
9 at the QRA, ensuring compliance with all of  
10 the DOE polices and procedures in a very  
11 formal, rigorous, and disciplined manner.  
12 That evaluation is ongoing. And the Chief of  
13 Nuclear Safety, who reports to the  
14 Undersecretary of Energy, is a part of that  
15 process.

16 So the Department of Energy and  
17 the environmental management program will have  
18 a formal evaluation of how the QRA meets all  
19 of the Department of Energy's policies and  
20 standards.

21 MR. DEWEY: Mr. Brown, Mr. Bader  
22 wants just a very quick followup on that.

1 MEMBER BROWN: Okay.

2 MEMBER BADER: Actually, two. We  
3 have been pushing 2009-1 as the recommendation  
4 for a DOE policy on risk. Ms. Busche, do you  
5 believe you need that policy to be out and  
6 agreed -- and approved by the Secretary before  
7 you can complete your QRA analysis?

8 MS. BUSCHE: I would agree that we  
9 need it out before we implement the QRA. I  
10 believe it is an effective tool. It is just,  
11 if you -- when you read 3009, it is not clear  
12 how to use it.

13 MEMBER BADER: At all.

14 MS. BUSCHE: So I believe before  
15 we implement it, yes. Or this determination  
16 that Dr. Triay --

17 DR. TRIAY: That is correct.

18 MS. BUSCHE: I mean, it's one or  
19 the other. It has got to happen, so --

20 DR. TRIAY: That is exactly right,  
21 and that is exactly why I brought up this  
22 comment is because we, in the environmental

1 management program, believe that this  
2 particular QRA application is extremely  
3 beneficial to our nuclear operations.

4 And we intend to use the Technical  
5 Authority Board that has a level of oversight,  
6 all the way to the Chief of Nuclear Safety, in  
7 the Office of the Undersecretary, to do the  
8 formal evaluation with all rigor and  
9 discipline. And that is what Ms. Busche is  
10 going to utilize.

11 So I believe that that will  
12 satisfy the Board's questions with respect to  
13 the Department of Energy's position on the QRA  
14 process.

15 MEMBER BADER: Ms. Busche, one  
16 further question along those lines. Once you  
17 are done in terms of the -- you get approval  
18 and you can implement, do you see the QRA  
19 having to be maintained online during  
20 operation?

21 MS. BUSCHE: Yes. And that goes  
22 back to my USQ. If it is a basis for making

1       some of those design decisions, one of the  
2       fundamental tenets we will have to ask is,  
3       does this change the frequency, as described  
4       in the DSA?

5                       So even though it's not used as a  
6       safety control selection tool, it is clearly  
7       part of the design basis for selected design  
8       features, like the primary boundary and the  
9       pipe. So, yes, I do believe so.

10                      CHAIRMAN WINOKUR: Mr. Brown?

11                      MEMBER BROWN: Thank you. That  
12       takes one question off my list here. Thank  
13       you, Mr. Bader.

14                      (Laughter.)

15                      I am glad to see that Mr. Krohn,  
16       the Chief of EM Safety, and the Chief of  
17       Nuclear Safety, Mr. Lagdon, are both here,  
18       because I think it is important as they  
19       grapple with this subject to understand how  
20       this may be a design tool, but it bleeds over  
21       into safety space. And they need to  
22       understand that and consider that as they

1 grapple with this problem.

2 As I think back to the conference  
3 which EM and the Office of HSS [Health,  
4 Safety, and Security] and DOE recently  
5 sponsored through CRESO on uncertainty, I  
6 recall -- and Mr. Sain mentioned it earlier --  
7 Three Mile Island and how the WASH-1400  
8 report, Rasmussen report, whatever name you  
9 want to attach to it, was very controversial  
10 at the time.

11 It predicted things that nobody  
12 liked, and then Three Mile Island validated  
13 them, which was the loss of flow accident.  
14 And that was found through a QRA or PRA  
15 analysis but was not found through the  
16 traditional deterministic analysis.

17 So I guess my question with that  
18 lead-in, Ms. Busche, is, do you think the use  
19 of QRA will make WTP safer?

20 MS. BUSCHE: I believe it will  
21 provide a technical basis for understanding  
22 where hydrogen in pipes needs to be protected.

1       So by that, I actually look forward to being  
2       able to write that up in the bases of the TSR,  
3       because it will do that for us.

4                Will it make it safer for us? I  
5       am looking at the whole suite of controls that  
6       we have to have for the pretreatment facility,  
7       and this is just one of the design inputs that  
8       we have. We've got many, many, many.

9                So I really don't have a feel and  
10       haven't really thought about it from that  
11       perspective. I don't think it will make us  
12       more unsafe or safer. I just haven't thought  
13       about it.

14               MEMBER BROWN: Well, as I think  
15       about it, the -- if it eliminates some dead  
16       legs --

17               MS. BUSCHE: Oh, yes.

18               MEMBER BROWN: -- that hydrogen  
19       could have accumulated in, and could have  
20       created a problem, then that's a good thing.

21       Now --

22               MS. BUSCHE: Correct.

1                   MEMBER BROWN: Now, that's just  
2 one piece of it. Maybe by eliminating that  
3 dead leg you lose some other safety function.  
4 So it has to be looked at in the whole  
5 context, but it seems to me -- and I hope that  
6 it helps the safety problem, safety -- not  
7 problem, but the safety question at the waste  
8 treatment plant.

9                   Do you have any other concerns  
10 with the use of QRA as related to WTP? And,  
11 if you do, do you have any plans for how you  
12 are going to address them? Anything we  
13 haven't talked about?

14                  MS. BUSCHE: No. At this time, I  
15 am just waiting for -- to see the resolution  
16 of the HPAV independent review team comments,  
17 how they get incorporated into the tool, and  
18 then I could probably more appropriately  
19 answer that. Right now it is -- I need to see  
20 the final product.

21                  MEMBER BROWN: Thank you. If I  
22 could ask Dr. Triay a question about this EM

1       Technical Authority Board. Will they be  
2       developing standards and requirements for  
3       implementation of QRA at WTP? Or is this  
4       going to be a recommendation that you -- that  
5       they make to HSS, and then it gets involved in  
6       the whole DOE bureaucracy? How is that -- how  
7       is that decision going to be made, so that it  
8       can be implemented or not?

9                 DR. TRIAY: I would like to see  
10       whether -- I can either answer the question  
11       myself or if you will allow Dr. Krohn to join  
12       us, would that be --

13                CHAIRMAN WINOKUR: No, I think it  
14       would be best if you answer the question. And  
15       if you're not able to do so, please just state  
16       it for the record.

17                DR. TRIAY: Well, what we intend  
18       to do is make sure that in this particular  
19       tool the QRA is compliant with 10 CFR 830.

20                As you saw in the -- or you heard  
21       Ms. Olinger in her words, you know, to the  
22       Board, whether the QRA is viewed as a design

1 tool or as an element of the safety analysis,  
2 its acceptability as part of the methodology  
3 for compliance with 10 CFR 830 is expected to  
4 be confirmed. It is that confirmation that  
5 will be performed by the Technical Authority  
6 Board.

7 Actually, the waste treatment  
8 plant has been asked to evaluate the  
9 calculations that the QRA supports, determine  
10 3009 requirements and guidance for those  
11 calculations, determine if there are any  
12 inconsistencies, and evaluate the impacts of  
13 any such inconsistencies.

14 The Technical Authority Board will  
15 then review the results of that evaluation.  
16 And with respect to the process, the  
17 environmental management program instituted  
18 the Technical Authority Board so that we could  
19 deal with best nuclear industry practices in  
20 -- without necessarily having to go through  
21 the consensus-building within the entire  
22 Department of Energy in order to press forward

1 with a very good practice such as the  
2 utilization of QRA.

3 We do have the oversight from the  
4 departmental perspective, by having our Chief  
5 of Nuclear Safety formally participate in the  
6 Technical Authority Board process.

7 So between the environmental  
8 management, Technical Authority Board's work,  
9 that is a very disciplined process, and the  
10 oversight from the Chief of Nuclear Safety --  
11 we believe that that will be sufficient for us  
12 to press forward with the QRA approach.

13 I just would like to conclude by  
14 saying that in my opinion the QRA will risk-  
15 inform the design of the waste treatment  
16 plant, and that the HPAV independent review  
17 team has stated that it will make design a lot  
18 better versus a deterministic approach.

19 MEMBER BROWN: So if I understand  
20 it correctly, the EM Technical Review Board  
21 will see where the QRA is consistent. And if  
22 it's not in those areas or situations where

1 it's not consistent with DOE existing orders  
2 and standards, it won't be used.

3 DR. TRIAY: As I was saying  
4 before, we expect the QRA to be compliant with  
5 10 CFR 830. But from the perspective of the  
6 final authority of the Technical Authority  
7 Board, yes, their decision will drive what is  
8 it that is going to be done in the waste  
9 treatment plant.

10 As you know, the pilot  
11 applications of this type of what we consider  
12 a very beneficial best practice of the nuclear  
13 industry are needed to develop new standards,  
14 and this QRA will serve as an important pilot  
15 for perhaps the Department then to develop new  
16 standards.

17 So we think that the work of the  
18 Technical Authority Board will be the final  
19 authority as to what we will do in the waste  
20 treatment plant. And, in addition, this  
21 particular pilot will serve to -- for the  
22 Department to interchange the promulgation of

1 new standards.

2 MEMBER BROWN: I just have one  
3 more question, Mr. Chairman. Going -- since  
4 we're on controversial issues, let me go back  
5 to one other one. How is the question of  
6 deposition velocity going -- how is that  
7 decision making process going, and how will  
8 that be resolved, or when will it be resolved?

9 DR. TRIAY: Again, the Chief of  
10 Nuclear Safety is here, and he is available to  
11 come before you. But if you want me to speak  
12 for him, I will do my best. As we have noted  
13 in our response, for deposition velocity our  
14 Chief of Nuclear Safety is the ultimate  
15 authority as to what kind of parameter we are  
16 going to use in the waste treatment plant.

17 And we have noted, however, that  
18 for the waste treatment plant the safety  
19 classification does not change if we were to  
20 use a value of .1 or 1. I believe those  
21 sensitivity analyses have been performed, and  
22 in the waste treatment plant it doesn't make

1 any difference for the classification of the  
2 safety systems.

3 But with respect to who is the  
4 authority, it would be the Chief of Nuclear  
5 Safety making that determination on behalf of  
6 the Department.

7 CHAIRMAN WINOKUR: But, Madam  
8 Secretary, the Chief of Nuclear Safety has  
9 agreed with the Board's position that the  
10 correct value of deposition velocity is in the  
11 range of 0.1 to 0.3. So what is the rationale  
12 of the Department for not putting a correct  
13 value into the code?

14 DR. TRIAY: As I was stating, for  
15 the waste treatment plant our uncertainty  
16 analysis indicates that there is no different  
17 result whether we use .1 or whether we use 1.  
18 So our Chief of Nuclear Safety will direct the  
19 waste treatment plant to utilize the value  
20 that he believes prudent for the waste  
21 treatment plant, that we will do it.

22 CHAIRMAN WINOKUR: So we're in a

1 situation right now where the incorrect value  
2 is the prudent value to use?

3 DR. TRIAY: I believe that I have  
4 made clear that for the waste treatment plant  
5 it makes no difference, and that we will take  
6 direction in the waste treatment plant from  
7 the Chief of Nuclear Safety. So when he  
8 finishes his work, and I believe that he has  
9 an upcoming review of a paper delineating the  
10 values that he wants us to use for the waste  
11 treatment plant that is going to be peer  
12 reviewed, we will take direction from him.

13 CHAIRMAN WINOKUR: Very  
14 respectfully, I am very surprised that the  
15 Department of Energy would take that approach.  
16 But you have expressed your opinion and your  
17 views. Thank you.

18 Ms. Roberson?

19 VICE CHAIR ROBERSON: Okay. I  
20 want to do one followup on what Mr. Brown was  
21 just asking, and maybe this has changed. My  
22 understanding was the Office of Primary

1 Interest, for whether it's 3009 or 830, is  
2 HSS. Are they a part of the effort to look at  
3 the tool and ensure it is aligned?

4 DR. TRIAY: Yes. Dr. Krohn has  
5 worked closely with our office of HSS. The  
6 point that I was making was that the QRA pilot  
7 will actually serve the Department well in  
8 terms of understanding how a tool of that  
9 nature could actually be utilized Department-  
10 wide.

11 So I think that the Department is  
12 looking at this particular application of the  
13 QRA as a good pilot, and Dr. Krohn, as the  
14 head of the Technical Authority Board and Mr.  
15 Chip Lagdon, as the Chief of Nuclear Safety,  
16 work very closely with HSS.

17 CHAIRMAN WINOKUR: Okay. Mr.  
18 Dwyer, I think you had a question?

19 MR. DWYER: Yes, if I could just  
20 followup with something Ms. Busche was saying.  
21 I believe you indicated when we were talking  
22 about the piping and the hot cell that it

1       wasn't possible to demonstrate that you could  
2       maintain confinement with the piping.  Is that  
3       --

4                   MS. BUSCHE:  Not in all cases  
5       where there is jumpers concerned.

6                   MR. DWYER:  And why is that?

7                   MS. BUSCHE:  From an accident  
8       analysis perspective, around the complex it --  
9       piping systems leak, specifically at  
10      connections.  So we couldn't say we could  
11      prevent all leaks, so we chose an alternative  
12      control -- I mean, a mitigative control  
13      strategy.  That has been the project's control  
14      strategy for leaks and loss of confinement  
15      events from pipes since the beginning PDSA.

16                   MR. DWYER:  So is this a specific  
17      -- I guess a specific characteristic of the  
18      jumper connections?

19                   MS. BUSCHE:  No.  When you  
20      postulate failure, the places that you are  
21      most likely going to get a loss of confinement  
22      event due to the primary boundary is typically

1 going to be a jumper connection. You still  
2 have erosion/corrosion. You have all other  
3 potential initiators.

4 The most credible one is jumper  
5 connections. My experience in working,  
6 unfortunately, in tank farms in years past is  
7 they do leak. I have seen spray leaks, okay?  
8 They do leak.

9 So it is something that we  
10 postulate that it fails, not that it is not  
11 important, not that we're going to design it  
12 with pedigree, but we are postulating in the  
13 accident world that it will fail. And we are  
14 specifically crediting a mitigative strategy  
15 versus a preventive strategy.

16 I understand the rules of how you  
17 should select controls, but I don't believe we  
18 can prevent leaks unless we did pipe in pipe.  
19 I mean, there's multiple ways you could have  
20 done that, but --

21 MR. DWYER: Okay. So I -- let me  
22 try again.

1 MS. BUSCHE: Okay.

2 MR. DWYER: So I thought what you  
3 said is -- I'm sorry. I thought what you said  
4 was that this is not just a characteristic of  
5 there is a jumper in the line, but then you  
6 argued that it is a characteristic that there  
7 is a jumper in the line. Help me out here.

8 MS. BUSCHE: Well, it's -- again,  
9 at an unmitigated accident analysis, where we  
10 are in the severity level assessments, we are  
11 not refined. We don't have the details of the  
12 accident analysis updated yet that looks at  
13 the full suite of different configurations.

14 In the unmitigated -- I call them  
15 scoping calques - you just assume the worst  
16 one. You figure out what is going to fail,  
17 and we just assumed it was going to fail. We  
18 didn't -- it wasn't a real complicated  
19 analysis. We just assumed it failed.

20 MR. DWYER: Okay. And you  
21 couldn't design a system that wouldn't fail?

22 MS. BUSCHE: Oh, it would lead you

1       towards a pipe in pipe type configuration.

2       I'm sure you could, right? But it's -- it

3       wasn't --

4                   MR. DWYER: I'm just curious from  
5       the standpoint of we discussed that the piping  
6       is safety significant, but we never discussed  
7       the seismic characterization. Does that have  
8       anything to do with it?

9                   MS. BUSCHE: Seismic is an  
10       initiator for loss of confinement events from  
11       the primary boundary, yes, it is.

12                  MR. DWYER: Okay. So there is  
13       actually two different categorizations or  
14       classifications of safety significant piping  
15       in the complex that we are talking about  
16       there?

17                  MS. BUSCHE: No.

18                  MR. DWYER: There's not? Are --

19                  MS. BUSCHE: I guess I don't  
20       understand the question, Mr. Dwyer.

21                  MR. DWYER: Okay. One of the  
22       issues that we had was -- let me phrase it a

1 different way. What performance category are  
2 you going to meet with your safety significant  
3 piping?

4 MS. BUSCHE: I can answer that. I  
5 think the most qualified with respect to the  
6 application of the design criteria as  
7 connected to the functional classification is  
8 probably Mr. Ashley. It is functionally  
9 classified as safety significant in most cases  
10 in the hot cell, okay? Most cases. And that  
11 is typically your high activity process lines.  
12 So it's a general statement.

13 From that, the projects design  
14 criteria -- and, Greg, please jump in -- is if  
15 it's safety significant in our world it is  
16 seismic Category 3. It is not the terminology  
17 that you would use, say, from 1189.

18 MR. ASHLEY: That's correct, Mr.  
19 Dwyer. The design criteria has been the  
20 design criteria of the WTP from the beginning,  
21 is safety significant, is seismic Cat 3. Now,  
22 it is a unique categorization relative to the

1 WTP.

2 We do have conditions where we  
3 have designed the piping, even though it is  
4 safety significant, to seismic Cat 1, which is  
5 the highest seismic category for the WTP where  
6 SS, safety significant, is seismic Cat 1.

7 We qualify it to seismic Cat 1 for  
8 all the hot cell piping, the hot -- or not hot  
9 cell, the black cell piping -- the black cell  
10 vessels, and we qualify all the way out to the  
11 isolation valves in the hot cell, and those  
12 isolation valves are on jumpers. So all of  
13 that out to that isolation valve is qualified  
14 to seismic Cat 1.

15 I believe, as Mr. Kasdorf talked  
16 about in his testimony, those isolation valves  
17 there are on a post-DBE or post-seismic event.  
18 Their function is to be able to isolate.  
19 Obviously, our inventory, we don't have  
20 significant inventory in the hot cell. Our  
21 inventory is in our vessels. Our vessels are  
22 in our black cells.

1                   So the function of those isolation  
2 valves is post-DBE through a switch. The  
3 operator has the ability to close those  
4 isolation valves. The switch also terminates  
5 power to non-safety pumps, i.e. we stop  
6 pumping. We'll stop pumping and we'll isolate  
7 the inventory in the black cells.

8                   MR. DEWEY: Okay. And so up to  
9 the isolation valve it's seismic Category 1.

10                  MR. ASHLEY: Cat -- seismic Cat 1.

11                  MR. DEWEY: And on the other side  
12 it's seismic Category 3.

13                  MR. ASHLEY: Seismic Cat 3.

14                  MR. DEWEY: Is that part of the  
15 reason why you can't demonstrate containment?

16                  MS. BUSCHE: No.

17                  MR. DEWEY: Okay.

18                  MS. BUSCHE: It's not. From a  
19 functional classification standpoint, we  
20 wouldn't care what the initiator was. We  
21 would functionally classify it based on the  
22 bounding unmitigated consequence. It's not

1       rocket science.

2                       So we are primarily at this stage  
3       looking at what are the range of transients  
4       that could create a potential loss of  
5       confinement. The easiest one that drives it  
6       is a jumper misalignment. So at the  
7       unmitigated stage it wasn't --

8                       MR. DEWEY:   Okay.

9                       MS. BUSCHE:  -- just picked the  
10       worst one.

11                      MR. ASHLEY:  Just to add on to  
12       that, similar to commercial nuclear  
13       facilities, leaks of that type, spray leaks,  
14       are treated as non-mechanistic. We use  
15       consensus codes and standards for design of  
16       piping and vessels. Regardless of the codes  
17       and standards you use, you still assume non-  
18       mechanistic breaks.

19                      And I believe what Ms. Busche is  
20       talking about is, regardless of what we had  
21       done in design, nuclear safety would still  
22       assume that we have vessel leaks, that we have

1 spray leaks in piping. That is just part of  
2 the safety control strategy that is required.

3 MR. DEWEY: So if you go to the  
4 description that you were just giving of a  
5 reactor, are you saying then that they don't  
6 consider the piping the primary boundary?

7 MR. ASHLEY: Absolutely. We  
8 consider the piping the primary boundary as  
9 well.

10 MR. DEWEY: No, we were just  
11 discussing that the structure in the C5-V is  
12 the primary containment.

13 MR. ASHLEY: We design the piping  
14 to the consensus codes and standards to  
15 maintain that confinement boundary.

16 MR. DEWEY: But you don't credit  
17 it.

18 MS. BUSCHE: Correct. From an  
19 accident analysis, it is a mitigative  
20 strategy. That is irrespective of how you  
21 protect the hazard closest to the source. We  
22 chose not to pick the primary boundary to

1 credit it in the accident analysis. We chose  
2 a mitigative strategy to credit the C5-V.

3 MR. DEWEY: Thanks.

4 MS. BUSCHE: Is still the -- the  
5 pipe is still the primary boundary. That has  
6 not changed.

7 CHAIRMAN WINOKUR: Dr. Mansfield?

8 MEMBER MANSFIELD: From everything  
9 that has been said about the future waste  
10 acceptance criteria, it almost certainly is  
11 going to require blending for -- especially  
12 for the sludge batches. And that is going to  
13 require more sampling, it's going to require  
14 lab work. Somebody even mentioned it might  
15 require grinding of large particles. And it  
16 is certainly going to involve, therefore,  
17 additional risks.

18 And will it involve increasing the  
19 number of batches? Right now you've got --  
20 planned a fixed number of batches, 300 and  
21 something I think, wasn't it? What's going to  
22 happen if you need -- is all of this blending

1 going to require -- blending -- by the way, to  
2 achieve radiological properties that are going  
3 to be required to satisfy the HPAV conditions,  
4 for instance -- are you clear what I mean?

5 If you can't achieve proper shear  
6 strength, for instance, and it's going to  
7 require -- in the sludge waste, and it's going  
8 to require blending to do that, is that going  
9 to require more batches to be dispatched to  
10 the WTP? Or are you going to be able to use  
11 supernate from --

12 MR. ASHLEY: I believe that  
13 currently -- and as Dr. Triay spoke -- the  
14 current system plan already requires blending.  
15 There will be blending to mobilize the  
16 sludges. Those requirements, in terms of, you  
17 know, the rheology of those batches, are  
18 already in the ICD.

19 MR. SAIN: That's correct.

20 MR. ASHLEY: So --

21 MEMBER MANSFIELD: So no  
22 conceivable treatment requirement is going to

1       require more batches.  You're not going to  
2       have to add any volume to the waste stream?

3               MR. ASHLEY:  We are in constant  
4       discussion with the tank farm, as we talked  
5       about in terms of how we control the solids  
6       concentration in HLP-22 [High-level Waste Lag  
7       Storage and Feed Blending Process System], has  
8       a very small effect on the number of batches.  
9       However, that is -- as I said, that is being  
10      communicated and worked with the tank farm.

11              You know, some of the decisions that  
12      are made, they are integrated decisions in  
13      terms of our -- the WTP requirements and will  
14      that have an effect on the mission, on the  
15      mission life, increasing number of batches.  
16      So all of those are considerations as we  
17      discuss what -- you know, the specific  
18      requirements for the WTP.

19              MEMBER MANSFIELD:  I don't have any  
20      questions.

21              CHAIRMAN WINOKUR:  Mr. Bader?

22              MEMBER BADER:  Ms. Busche, I'd like

1 to go back to the deposition velocity. Do you  
2 feel comfortable incorporating in your safety  
3 documents a value that is agreed to be wrong?

4 MS. BUSCHE: Short answer, no.

5 MEMBER BADER: I don't either.

6 Would you like to set the precedent for being  
7 the first in the DOE complex to do that?

8 MS. BUSCHE: No.

9 MEMBER BADER: I wouldn't either.

10 End of questions. I can't believe this. I'm  
11 done.

12 CHAIRMAN WINOKUR: Any others?

13 (No response.)

14 Thank you, Mr. Bader.

15 This concludes testimony from our  
16 staff and that of the Department and its  
17 contractors. Thank you very much. We  
18 appreciate it. We know that you are here late  
19 at night with us, and it has been a very good  
20 exchange. We appreciate that.

21 I will now call on members of the  
22 public who have signed up to speak. As I

1 indicated earlier, I'd ask that each speaker  
2 limit remarks to about five minutes. If time  
3 permits, I will extend time for additional  
4 comments.

5 And we do have one speaker with us  
6 tonight, Mr. Patrick Pinto.

7 MR. PINTO: My name is Patrick  
8 Pinto, and I am a chemical engineer. I have  
9 worked in this DOE nuclear fuels reprocessing  
10 and waste management business for over 35  
11 years.

12 CHAIRMAN WINOKUR: Sir? We're  
13 having a problem with that mic feed.

14 (Whereupon, adjustments were made to  
15 the microphone system.)

16 Mr. Pinto, we'd like you to --  
17 please start at the beginning, sir.

18 MR. PINTO: Okay. My name is  
19 Patrick Pinto. I am a chemical engineer, and  
20 I have worked in the nuclear -- in the DOE  
21 nuclear fuels reprocessing and waste  
22 management business for the last -- over 35

1 years. In fact, I started my working career  
2 here at Hanford in 1973 in the tank farms as  
3 a process engineer working on the sludge  
4 sluicing program, where the sludge was being  
5 sluiced out of the tanks. So I am very  
6 familiar with the nature of these solids.

7 In 1980, I moved to work in the oil  
8 business, because I was tired of the DOE  
9 nuclear fuels work. And the oil business went  
10 caput in 1985 with the oil price falling so  
11 drastically, so I had to seek refuge back in  
12 the nuclear fuels business, and I went to work  
13 at the Idaho National Lab, and I worked there  
14 as a project manager, as a conceptual design  
15 engineer, and as a safety analyst.

16 So, and since 2001, I have been  
17 working on the waste treatment plant design  
18 for Bechtel. I obviously do not speak for  
19 Bechtel, because I am speaking as a private  
20 citizen.

21 Now, we are all concerned about the  
22 two big hazards we have which are the HPAV

1 issue, hydrogen explosion in pipes, and the  
2 plutonium criticality issue. And I would  
3 suggest that keeping the waste constantly  
4 suspended is a very extremely conservative and  
5 costly process to mitigate these hazards.

6 I would rather propose that we let  
7 the solids settle and ventilate the tank  
8 space. To keep the solids constantly  
9 suspended takes a lot of energy, and we have  
10 to use all of these PJMs, and these PJMs are  
11 very compressive air intensive. And if one  
12 were to calculate just the cost of the amount  
13 of compressed air used it is a huge amount,  
14 and you are talking about a large continuing  
15 operating cost for the plant.

16 Now, you can take just a small  
17 fraction of that area you are using to keep  
18 these solids suspended and ventilate the vapor  
19 space of the tank and cause a virtual tornado  
20 in the tank. So you have really gotten rid of  
21 the HPAV issue just by the dilution effect.

22 Now, the other safety concerns I

1 have are with CCN [Correspondence Control  
2 Number] ion exchange and the ultrafiltration  
3 process itself. The CCN ion exchange process  
4 uses CCN ion exchange columns with valve  
5 manifolds. And the valves can leak, and you  
6 have all of these transfers, numerous and  
7 advertent transfers, and the project has  
8 written reports saying all of these leaks  
9 would be in a safe direction, so we don't have  
10 to worry about them.

11 But I don't think that statement  
12 really would hold true, if someone were to --  
13 you know, but there is -- it's not really a  
14 safety issue so much. You know, providing  
15 valves and jumpers is a huge cost. And then,  
16 when the valves leak -- because the design  
17 that is used here is the same design that was  
18 used at West Valley. And, you know, there  
19 were valve leakage problems at West Valley.

20 So I -- in response to these  
21 concerns on valve leakage, I did submit  
22 defensive professional opinion reports where

1 I came up with a very simple system to get rid  
2 of the valves and do a valveless transfer  
3 between columns. And, in fact, the cost  
4 savings were so high that you could totally --  
5 I was planning to use a cartridge system for  
6 the ion exchange, and it would totally get rid  
7 of the present disposal system and the resin  
8 addition system.

9 CHAIRMAN WINOKUR: Mr. Pinto, could  
10 you begin to summarize your comments, and we  
11 will accept what you would like to submit for  
12 the record.

13 MR. PINTO: Okay. Well, I haven't  
14 gotten into the ultrafiltration system yet.  
15 If we accept the premise that we could let the  
16 solids settle -- see, that is the only reason  
17 for using an ultrafiltration system, that we  
18 cannot let the solids settle. We could go  
19 with a gravity clarifier and get much higher  
20 concentration solids than the ultrafiltration  
21 system would yield for you.

22 In fact, the ultrafiltration system

1 -- ultrafiltration is a very inappropriate  
2 technology to use, because it is mainly used  
3 for polishing waste streams with very small  
4 solids content. You cannot use  
5 ultrafiltration to concentrate solids, because  
6 you run into an enthalpy problem. You've got  
7 this tank from where you're pumping the liquid  
8 around, and you're concentrating -- trying to  
9 concentrate the solids in this tank.

10 And as you remove the permeate, the  
11 level in the tank falls, and you've got to  
12 make up the liquid by adding very diluted  
13 solids. So you've got -- you are constantly  
14 adding four percent solids to a 10, 11, 15  
15 percent stream. So you've got a big enthalpy  
16 increase problem.

17 CHAIRMAN WINOKUR: Mr. Pinto, could  
18 you --

19 MR. PINTO: Yes?

20 CHAIRMAN WINOKUR: -- could you  
21 finish up your remarks in about a minute,  
22 please?

1           MR. PINTO: Well, the basic comment  
2           I have is that we are wasting a lot of the  
3           public's money on these -- on using the wrong  
4           technology to do the separation of the solids  
5           from the liquids. If you use gravity  
6           settling, you could separate -- you know, the  
7           batch of ultrafilters, solids, that you are  
8           going to process could be done in one-tenth  
9           the time.

10           So if -- on the basis of that, the  
11           whole pretreatment facility would have to run  
12           10 times longer. And look at all of the  
13           operating costs you are incurring in that  
14           respect.

15           CHAIRMAN WINOKUR: Thank you.

16           MR. PINTO: Well, since you are  
17           hurrying me up, I will end my speech and wish  
18           the project the best of luck.

19           CHAIRMAN WINOKUR: Thank you.  
20           Please submit whatever you would like for the  
21           record. We are happy to accept it.

22           Are there any other members of the

1 public who wish to speak at this time?

2 (No response.)

3 That concludes the public comment  
4 portion of this session, and I will,  
5 therefore, close this session. Anyone who  
6 wishes to submit written testimony should do  
7 so at this time by giving a copy to the  
8 Board's General Counsel, Richard Azzaro.

9 Thank you all for coming. We are  
10 recessing the hearing, and we will reconvene  
11 tomorrow morning at 8:00 a.m.

12 (Whereupon, at 8:25 p.m., the above-  
13 entitled matter went off the record.)

14

15

16

17

18

19

20

21

22

<b>A</b>				
<b>abandoned</b> 12:15 37:12	14:18 <b>accomplish</b> 62:18 69:12	140:19 142:11,21 143:15 146:8 149:22 151:4	<b>advantages</b> 107:13 <b>advertent</b> 198:7 <b>advice</b> 13:2 <b>advise</b> 99:18 <b>advising</b> 12:17 <b>advocate</b> 136:5,6 136:16 <b>advocating</b> 99:14 <b>aerosolized</b> 59:5 <b>aerosols</b> 149:7,7 <b>affect</b> 56:7 99:17 <b>afforded</b> 83:22 <b>age</b> 75:4 <b>agencies</b> 9:22 <b>ago</b> 68:1 122:9 130:10 156:5 <b>agree</b> 43:16 90:18 93:20 101:19 137:14 168:8 <b>agreed</b> 67:3 78:16 168:6 179:9 194:3 <b>agreed-to</b> 143:6 <b>agreeing</b> 67:14 102:2 <b>ahead</b> 19:10 37:21 38:7 85:16 105:2 125:14 <b>aid</b> 36:5 <b>air</b> 197:11,13 <b>alarms</b> 95:17,22 96:1 <b>align</b> 28:10 <b>aligned</b> 145:12 181:3 <b>aligns</b> 20:12 <b>allow</b> 46:7 49:6,19 49:20 50:5 119:19 158:9 174:11 <b>allowed</b> 62:18 <b>allows</b> 129:1 158:8 <b>alternate</b> 28:16 <b>alternative</b> 17:5 182:11 <b>alternatives</b> 28:8 <b>aluminum</b> 36:6 <b>amended</b> 7:15 <b>AMERICA</b> 1:1	<b>amount</b> 88:3 127:19,20 197:12 197:13 <b>AMWTP</b> 129:9 <b>analyses</b> 178:21 <b>analysis</b> 19:19 21:12,15 22:2,3 22:12,17 23:13 24:17 28:20 30:3 30:6,6,8 39:1 40:10,19,21 41:12 41:19 43:20 44:14 44:17 45:13 47:2 50:3,15,16 51:9 51:18 52:13,19 55:3 57:16 58:14 59:13,13,18 61:1 63:13 136:18 140:11,18,22 142:14 150:6 154:4 156:7 158:6 161:5 162:1,10,15 163:2 164:8 166:16 168:7 171:15,16 175:1 179:16 182:8 184:9,12,19 190:19 191:1 <b>analyst</b> 196:15 <b>analyze</b> 56:8 60:6 60:15 63:22 136:18 <b>analyzed</b> 161:10 <b>ancillary</b> 20:2 25:5 162:22 <b>answer</b> 16:3 53:4 54:8,12 74:2,8 83:11 85:20 89:22 106:9 119:10 126:13 133:15,21 141:6 144:7 152:13 156:14 162:12,13 173:19 174:10,14 186:4 194:4 <b>answered</b> 145:1 <b>answering</b> 151:2
<b>ability</b> 16:14 17:22 35:16 54:10 56:15 60:9 111:22 112:4 112:5 113:2 148:20 188:3 <b>able</b> 37:19 50:8 60:10 80:4 84:16 100:19,22 115:15 126:3 136:2 172:2 174:15 187:18 192:10 <b>absolutely</b> 67:19,20 85:11 87:7,8 88:5 98:5 108:18 138:3 190:7 <b>academia</b> 13:3 <b>accept</b> 37:16,19 38:12 199:11,15 201:21 <b>acceptability</b> 30:13 175:2 <b>acceptable</b> 48:18 <b>acceptance</b> 17:4 41:8 72:10 81:9 82:1 88:16 134:8 153:2,9 191:10 <b>accepted</b> 37:1 73:7 <b>accepts</b> 36:21 <b>accessed</b> 26:20 27:1 <b>accident</b> 11:3 39:1 40:10,20,21 41:12 41:19 48:16 51:3 140:18 154:4 171:13 182:7 183:13 184:9,12 190:19 191:1 <b>accidental</b> 42:21 <b>accidents</b> 10:18 42:6 48:12,20 51:11 63:15 141:3 154:1 <b>accommodated</b>	<b>account</b> 108:8 <b>accounted</b> 37:9 41:16 <b>accumulated</b> 172:19 <b>accumulation</b> 32:5 116:21 <b>accurate</b> 105:18 146:15 <b>accurately</b> 74:16 <b>achieve</b> 192:2,5 <b>achievement</b> 23:16 33:4 <b>acid</b> 113:1 158:1 <b>acids</b> 113:7 <b>acknowledged</b> 44:13 <b>act</b> 5:5 7:14,21 8:21 10:1 <b>action</b> 8:20 76:14 <b>actions</b> 14:2 50:5 55:11 88:10,18 <b>active</b> 25:7,12 26:22 27:17 32:18 42:14 75:17,20 87:22 118:2 148:11,17 <b>activity</b> 83:15 186:11 <b>actual</b> 28:14 123:1 130:11 150:8 151:3 <b>add</b> 92:14 98:7,9 126:22 138:11,14 145:5 146:12,21 189:11 193:2 <b>added</b> 76:12 77:17 77:22 80:20 116:17 <b>addendum</b> 19:20 55:8,13 57:7 59:1 105:18 139:5,9	<b>addendums</b> 55:3 <b>adding</b> 76:14 77:3 77:12 78:7 79:2 200:12,14 <b>addition</b> 25:7 121:16 177:20 199:8 <b>additional</b> 7:1 11:5 31:11 38:1 58:11 69:11 70:12,13 72:16 73:14 76:14 77:17,22 191:17 195:3 <b>address</b> 24:1 25:5 26:2 30:1 87:2,9 88:15 132:15,15 148:5 173:12 <b>addressed</b> 21:20 22:16 31:7 122:1 144:22 <b>addresses</b> 19:20 <b>addressing</b> 132:10 159:11 <b>adds</b> 77:5 <b>adequate</b> 8:10,18 36:15 49:16 <b>adequately</b> 16:14 50:5 <b>adjourn</b> 7:12 <b>Adjournment</b> 3:22 <b>adjudicated</b> 123:8 <b>adjudication</b> 123:22 <b>adjustments</b> 195:14 <b>administrative</b> 20:21 129:4 <b>adopt</b> 165:17 <b>adopted</b> 22:13 125:6 167:3 <b>advantage</b> 135:2 136:1 138:19 <b>advantageous</b> 135:3		

<b>answers</b> 15:11,12 15:18 60:6 119:9	19:14,15,16 20:10 144:14 165:9	<b>asserts</b> 43:19	74:10	<b>balances</b> 128:3,4
<b>Anybody</b> 148:3	<b>April</b> 25:4	<b>assess</b> 28:6	<b>auxiliary</b> 20:1	<b>barrier</b> 48:3
<b>anyway</b> 134:9	<b>area</b> 27:7 130:5	<b>assessment</b> 107:14	<b>availability</b> 114:22	<b>base</b> 166:17
<b>appears</b> 68:13	131:19 132:19	161:16	<b>available</b> 5:10,12	<b>based</b> 21:3 40:12
<b>Appendix</b> 85:3	197:17	<b>assessments</b> 184:10	5:15 15:12 28:8	45:5 49:10 57:18
163:15,15	<b>areas</b> 16:9,13 56:17	<b>Assistant</b> 53:13	110:9 133:5	58:8 64:13 82:19
<b>applicable</b> 51:1	58:10 84:1 176:22	166:21	178:10	156:8,16 166:16
<b>application</b> 129:14	<b>argued</b> 184:6	<b>associated</b> 5:14	<b>avails</b> 107:21	188:21
169:2 181:12	<b>arguing</b> 82:8	51:3 111:18,19	<b>avoid</b> 132:12	<b>baseline</b> 57:2
186:6	<b>ARPMCU</b> 159:9	153:10 157:20	<b>avoiding</b> 132:6	<b>bases</b> 17:13 24:14
<b>applications</b>	<b>articulate</b> 154:15	<b>assume</b> 88:21	<b>awaiting</b> 139:10	28:12 29:4,20
177:11	<b>articulated</b> 141:12	99:10 184:15	146:15	32:19 93:7,19
<b>applied</b> 32:9 44:15	<b>Ashley</b> 1:22 53:20	189:17,22	<b>Azzaro</b> 1:19 4:15	172:2
65:21 97:12 129:2	77:20 102:17	<b>assumed</b> 21:1 30:8	202:8	<b>basic</b> 131:5 159:12
<b>apply</b> 22:3 65:14	103:20 104:5,8	31:22 34:6,6 40:3	<b>a.m</b> 202:11	160:4 201:1
<b>appointee</b> 18:18	106:11,19 107:4,8	40:13 184:17,19		<b>basically</b> 108:10
<b>appreciate</b> 89:16	107:11,18,21	<b>assumption</b> 74:22	<b>B</b>	111:13 125:2
90:6 194:18,20	108:6,10,16 109:8	163:19	<b>B</b> 162:11	136:21 149:2
<b>approach</b> 21:20	109:14 110:1,5,12	<b>assumptions</b> 22:12	<b>back</b> 61:13 73:13	<b>basis</b> 12:19 19:3,9
23:5 25:17 28:3	110:17,19 111:2	28:13 40:9 41:2	81:11 93:18 95:15	19:18 20:14,14
31:2,9 32:21	111:13 112:4,9,12	74:21 85:4 161:21	98:10 117:14	34:8,13 37:11
37:12,15,22 45:12	112:15,17,20	163:17	123:21 124:2	39:5,11 44:1 52:9
46:5,7,11 48:13	113:11,21 114:2,5	<b>Assurance</b> 54:1	127:5 133:11	56:16 61:3,11
48:17 97:11 104:4	114:8,20 115:12	<b>assure</b> 105:4 115:6	139:4 142:20	63:7,10 64:19
135:1 145:13	116:2,6,13,20	133:2	149:1 150:11	65:10,16 74:11
167:5 176:12,18	117:6,13 130:20	<b>assuring</b> 23:3	167:3 169:22	84:16 86:9 90:8
180:15	130:21 148:6	<b>as-we-go</b> 14:19	171:2 178:4 194:1	102:19,21 103:2
<b>appropriate</b> 7:7	152:12 157:8	<b>Atomic</b> 7:14,21	196:11	103:10,17 104:1
23:11 30:11 59:12	159:14 160:6	10:1	<b>background</b> 11:5	104:12 105:15
<b>appropriately</b> 15:6	161:7 186:8,18	<b>attach</b> 171:9	93:14	118:20 119:21
173:18	188:10,13 189:11	<b>attached</b> 61:10	<b>backwards</b> 122:8	141:14 149:3
<b>approval</b> 29:20	190:7,13 192:12	<b>attempt</b> 68:22	<b>Bader</b> 1:15 4:12	150:10 153:4
32:19 55:10	192:20 193:3	<b>attempted</b> 39:4	119:1,3 120:2,11	154:6 156:1 161:1
129:16 139:10	<b>asked</b> 18:21 89:17	<b>attention</b> 139:4	120:18 122:2,4	163:3 165:11
142:16 146:7,18	89:17 101:11	<b>audio</b> 109:1	125:11,15,21	169:22 170:7
169:17	104:14 124:11	<b>auditorium</b> 6:6	126:3 127:1,4	171:21 201:10
<b>approvals</b> 29:21	128:9 133:12	<b>August</b> 16:5	128:16 130:18,21	<b>batch</b> 37:6 98:14
<b>approved</b> 19:18	175:8	<b>austenitic</b> 31:13,19	167:21 168:2,13	201:7
20:14 24:14 29:16	<b>asking</b> 69:22 76:19	<b>authority</b> 7:14,17	169:15 170:13	<b>batches</b> 81:22 98:1
30:1,7 31:6 55:9	100:18 180:21	19:2 24:12 61:3	193:21,22 194:5,9	98:2,5 100:12
55:17 56:5 61:9	<b>aspect</b> 122:5	146:7 167:1,6	194:14	160:7,8 191:12,19
104:2,12 139:9	<b>aspects</b> 34:3 43:20	169:5 174:1 175:5	<b>balance</b> 68:19	191:20 192:9,17
141:21 142:15	117:15 118:19	175:14,18 176:6,8	69:17 70:6 79:12	193:1,8,15
168:6	162:4	177:6,6,18,19	100:6 101:6 121:8	<b>Bechtel</b> 17:11 18:5
<b>approving</b> 65:15	<b>assertion</b> 44:1 67:3	178:15 179:4	159:20	23:8 24:11 28:1
<b>approximately</b>	67:7	181:14	<b>balanced</b> 102:7	29:2,13 30:2 31:3
		<b>authorization</b>	125:2	31:17 32:6,12

53:18,20 121:19 196:18,19 <b>becoming</b> 38:15 <b>began</b> 11:8 12:14 15:9,17 <b>beginning</b> 6:11 7:22 38:14 92:10 182:15 186:20 195:17 <b>begins</b> 8:6 112:8 <b>begun</b> 9:3 <b>behalf</b> 179:5 <b>believe</b> 24:20 39:8 44:2 46:21 70:10 72:18 74:18 75:7 76:2,4 87:18 88:14 89:1,21 101:13 106:2 120:14 125:5,8 146:15 152:22 154:9 163:6,13,15 164:16 168:5,10 168:14 169:1,11 170:9 171:20 176:11 178:20 180:3,8 181:21 183:17 187:15 189:19 192:12 194:10 <b>believed</b> 40:3 87:20 <b>believes</b> 45:6,15 46:19 48:18 49:8 49:14 51:18 179:20 <b>bending</b> 166:1 <b>beneficial</b> 158:18 159:15 169:3 177:12 <b>benefit</b> 116:17 <b>benefits</b> 93:17 <b>best</b> 54:10 105:5 124:7 125:3 136:7 167:5 174:14 175:19 177:12 178:12 201:18 <b>better</b> 74:16 137:1 143:16 176:18	<b>beyond</b> 41:15 96:8 <b>big</b> 95:16 196:22 200:15 <b>billion</b> 122:12 <b>bit</b> 63:4 122:8 135:1 138:13 155:21 <b>black</b> 26:19 46:12 46:13,16 49:15 187:9,9,22 188:7 <b>blackened</b> 14:14 <b>bleeds</b> 170:20 <b>blend</b> 77:8 135:9 135:18 137:18 <b>blending</b> 72:16 88:18 134:12,17 135:2,9,11,20 136:9,22 138:7 191:11,22 192:1,8 192:14,15 193:7 <b>BNI</b> 1:22 2:14 29:2 38:5,11 40:7 41:10,17 44:15,19 45:2,5,8 48:13 50:16 51:8,14 52:17 90:13 147:4 <b>BNI's</b> 41:11 45:13 50:10 <b>Board</b> 1:3,10,15,16 1:17 3:3 4:5,8,13 6:5 7:5,10 8:3,9 8:13,17,20 9:9 10:16 11:1 12:17 13:17 14:10 16:2 16:4,11 18:8,16 18:17 22:15 23:21 23:21 24:1 29:11 30:18 33:10,15 34:3,11,20 38:22 39:14 40:17 41:19 41:22 42:7 43:8 43:15 44:7 45:15 46:10,19 49:8,13 51:18 53:5,6 54:7 95:19,21 97:14 99:14 147:12,16 167:1,7 169:5	174:1,22 175:6,14 175:18 176:6,20 177:7,18 181:14 <b>Board's</b> 4:14,16 5:8 5:10,16,17,19 7:17,19 8:2 9:4,17 9:21 12:13 15:5 15:11,13 17:7 33:18 34:1 41:21 42:1 129:15 169:12 176:8 179:9 202:8 <b>BOD</b> 103:2,21 <b>boiling</b> 36:5 <b>bottom</b> 89:9 <b>Boulevard</b> 1:12 <b>boundary</b> 30:9,12 47:12 49:7,10 152:17,19 153:17 153:20 154:4 155:4 170:8 182:22 185:11 190:6,8,15,22 191:5 <b>bounded</b> 123:8 <b>bounding</b> 37:10 188:22 <b>bounds</b> 88:8 <b>box</b> 123:19 124:1,4 124:12 <b>brand-new</b> 68:14 <b>breached</b> 48:15 <b>breadth</b> 63:14 <b>break</b> 120:6 <b>breaks</b> 189:18 <b>briefed</b> 43:15 147:14 <b>briefly</b> 50:12 101:5 109:2 <b>bright</b> 165:2 <b>bring</b> 78:22 <b>bringing</b> 71:17 <b>broadcast</b> 5:6 <b>Brockman</b> 1:22 18:12,15 33:8 53:14 61:3,6,21 62:3,7,10 65:14	65:19,21 66:5,8 68:22 70:10 82:7 86:3,13,16,18,22 87:4 104:21 105:3 145:4 146:7,10,14 146:20 <b>brought</b> 59:2 165:3 165:4 168:21 <b>Brown</b> 1:16 4:10 133:7,8,20 134:5 134:10,20 135:4 136:4 137:9,15 139:3 140:2 145:3 145:7 146:6,11,19 147:19 149:16 150:18 151:7 153:13,14 155:20 157:5,8 159:8,22 160:21 162:3 163:9 164:20 165:1 166:13,20 167:21 168:1 170:10,11 172:14 172:18 173:1,21 176:19 178:2 180:20 <b>build</b> 126:1 <b>building</b> 37:20 38:7 48:3 153:19 <b>buildup</b> 35:5 <b>built</b> 66:2 69:12 70:14 122:10 <b>bulges</b> 26:17 27:2 61:17,17 87:22 117:17,18 <b>burden</b> 38:1 78:7 88:21 94:21 101:13,18 <b>bureaucracy</b> 174:6 <b>Busche</b> 1:23 54:2 55:1,2,7 56:1,10 56:19 57:22 58:19 59:15 63:12 64:12 64:15,20 65:3,6 65:12 82:12,17 83:20 84:21 85:11 100:18 119:17	120:1 129:1 130:9 139:7,13 145:9 146:2 149:21 151:1,13 152:2,10 153:21 156:3 160:22 161:3 162:8 163:13 164:22 165:8 168:4,8,14,18 169:9,15,21 171:18,20 172:17 172:22 173:14 181:20 182:4,7,19 184:1,8,22 185:9 185:17,19 186:4 188:16,18 189:9 189:19 190:18 191:4 193:22 194:4,8 <b>Busche's</b> 146:12 <b>business</b> 98:20 195:10,22 196:8,9 196:12 <b>buy</b> 80:17 <hr/> <b>C</b> <hr/> <b>calc</b> 163:17 164:19 <b>calculate</b> 197:12 <b>calculated</b> 42:5 44:19 <b>calculation</b> 41:11 44:9 85:2 164:5 <b>calculational</b> 42:22 <b>calculations</b> 42:4 44:7 175:9,11 <b>call</b> 6:9 59:16 91:22 126:16 142:5 144:11 157:22 163:1 184:14 194:21 <b>calques</b> 184:15 <b>Canada</b> 122:10 <b>candid</b> 165:16 <b>capabilities</b> 50:9 156:9 <b>capability</b> 17:6 <b>capable</b> 162:6
----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

<b>capital</b> 124:20 128:1 158:22 159:4,6	<b>centimeter</b> 43:17 44:4	195:12 199:9 200:17,20 201:15 201:19	182:17 184:4,6	104:9 116:7 131:12 147:21
<b>caput</b> 196:10	<b>centimeters</b> 44:4	<b>challenge</b> 71:20 94:12 143:20	<b>characteristics</b> 26:3,6 74:1 98:11 122:17	<b>clarifying</b> 151:6
<b>care</b> 51:20 188:20	<b>certain</b> 59:19 82:22 88:6 119:12	<b>challenges</b> 35:9 36:19 140:17	<b>characterization</b> 11:21 28:13 36:9 36:16 37:17 66:18 79:17 80:16 98:6 185:7	<b>class</b> 25:14,22 27:19 36:8 40:15 42:10,12,13 45:1 45:20,22 46:18 49:1 58:4 83:8 116:4
<b>career</b> 196:1	<b>certainly</b> 75:22 96:16 114:18	<b>challenging</b> 11:15 36:2 72:15 76:11 76:16,21	<b>characterize</b> 67:21	<b>classification</b> 22:4 25:15 29:17 47:15 82:22 140:5 148:22 149:10,19 150:19 178:19 179:1 186:7 188:19
<b>carefully</b> 54:7	<b>Cesium</b> 158:1	<b>chances</b> 136:10	<b>characterized</b> 73:9 99:3 160:8	<b>classified</b> 25:14 77:15 148:10 186:9
<b>carried</b> 57:6	<b>CFR</b> 30:15 162:7 174:19 175:3 177:5	<b>change</b> 5:1 23:4 29:5,14,16,19 32:1,20 56:6 78:5 78:10 79:9 85:14 88:9 100:10 101:5 149:10 160:9,18 161:18 164:1 170:3 178:19	<b>characterizing</b> 79:20	<b>classify</b> 49:9 188:21
<b>cartridge</b> 199:5	<b>chair</b> 1:15 4:9 6:22 54:19 55:22 56:3 56:12 57:20 58:17 59:11 61:2,7,22 62:4,8,20 64:5,13 64:16,21 65:4,7 65:13,20 66:1,6,9 66:12,20 67:4,8 67:12,19 69:20 71:13 72:4,7 76:10 77:13 78:14 79:5,8 80:7,10 81:1 96:12 97:9 99:8,13,21 180:19	<b>changed</b> 41:18 82:19,19 180:21 191:6	<b>Charboneau</b> 1:23 124:21	<b>clean</b> 48:7 129:20
<b>case</b> 10:4,16 36:22 75:21	<b>Chairman</b> 1:12,14 3:3 4:3,4 18:16 23:21 33:7,15 53:6 67:2,9 72:6,8 73:12 81:15 82:4 83:16 84:14 85:7 85:21 86:15,17,19 87:7 89:15 90:5 91:12,17 94:7,9 95:7 96:11 101:2 104:20,21,22 105:3,12,21 106:4 118:10,12 130:20 133:6,9 147:11 151:5 153:12 167:1 170:10 174:13 178:3 179:7,22 180:13 181:17 191:7 193:21 194:12	<b>changes</b> 14:14 17:11 20:6,7,8,9 21:2,8,22 22:12 22:17 24:13,20 25:2 27:20 28:7,9 29:10 34:6,8 41:19 42:3 50:17 52:22 55:12 56:4 56:11,13 57:15 61:16 62:18 73:7 83:14 86:11 89:11 90:7 99:16 105:15 111:19 142:1,11 142:13 143:16,22 145:10 146:1 158:14,17,19 159:15,16 160:10 161:5 166:11	<b>charge</b> 9:5 10:5	<b>cleaning</b> 112:21
<b>cases</b> 83:22 98:9 112:8 129:15,16 155:9,18 182:4 186:9,10		<b>Chapter</b> 58:13 140:12 141:1 143:16	<b>charter</b> 9:21	<b>Cleanup</b> 11:19
<b>casualty</b> 96:4		<b>chapters</b> 144:1	<b>chartered</b> 28:6	<b>clear</b> 61:19 71:4 82:5 111:21 115:15 118:21 137:16 161:11 168:11 180:4 192:4
<b>Cat</b> 186:21 187:4,6 187:7,14 188:10 188:10,13		<b>characteristic</b>	<b>chemical</b> 11:13 13:3 27:5 111:22 112:21 113:7 114:13 115:20 118:7 128:11 132:6,13,17 195:8 195:19	<b>clearer</b> 39:9
<b>categorization</b> 186:22			<b>chemistry</b> 11:16 35:19	<b>clearly</b> 58:22 68:17 70:2 76:13 103:4 139:18 143:1 147:16 166:7 170:6
<b>categorizations</b> 185:13			<b>Chief</b> 167:12 169:6 170:16,16 176:4 176:10 178:9,14 179:4,8,18 180:7 181:15	<b>clogging</b> 73:1
<b>categorize</b> 61:16			<b>Chip</b> 181:15	<b>close</b> 81:18 143:9 146:17 149:22 188:3 202:5
<b>category</b> 186:1,16 187:5 188:9,12			<b>choose</b> 150:9	<b>closed</b> 143:5,12 181:16
<b>cause</b> 45:10 197:19			<b>chose</b> 104:3 182:11 190:22 191:1	<b>closest</b> 47:22 190:21
<b>caused</b> 149:1,11			<b>chosen</b> 19:9 35:14 51:8 54:7 58:9	
<b>caustic</b> 122:16			<b>cited</b> 63:1	
<b>CCN</b> 198:1,3,4			<b>citizen</b> 196:20	
<b>cell</b> 26:17 27:7 46:13,16,20 49:15 49:17 88:1 110:22 114:7,8,9,16 117:16,19,21 151:12 181:22 186:10 187:8,9,9 187:9,11,20			<b>clarification</b> 145:6	
<b>cells</b> 14:15 26:18,19 26:22 46:12,13 110:22 116:1 149:18,20 150:20 151:16 152:6,8 153:15 154:9 187:22 188:7			<b>clarifications</b> 119:18	
<b>Center</b> 1:11			<b>clarified</b> 103:9,11	
			<b>clarifier</b> 199:19	
			<b>clarify</b> 102:18	

<b>closure</b> 31:4	199:10	37:21 59:12	153:5,11,18	<b>concerted</b> 121:19
<b>CNP/CXP</b> 157:22	<b>commercial</b> 95:15	<b>completion</b> 9:18	154:18	<b>conclude</b> 32:12
158:20	150:3,4 189:12	38:8 92:21 131:2	<b>comprehensive</b>	176:13
<b>code</b> 30:15 179:13	<b>commissionable</b>	146:8	30:18 52:13,19	<b>concluded</b> 5:11
<b>codes</b> 189:15,16	60:13	<b>complex</b> 10:6 27:10	59:12	38:22 45:2,8
190:14	<b>commissioned</b>	38:17 39:17 73:15	<b>compressed</b> 197:13	92:13
<b>coefficient</b> 22:18	14:11 30:20	75:16 85:8,19,19	<b>compressive</b>	<b>concludes</b> 18:7
<b>cold</b> 130:2	<b>commissioning</b>	86:5 89:19 90:22	197:11	31:8 53:3 194:15
<b>colleague</b> 89:1	13:20 14:18 15:1	91:11 93:16 94:5	<b>comprising</b> 6:2	202:3
<b>colleagues</b> 4:8	19:11 100:12	94:18 105:6 111:5	<b>conceivable</b> 192:22	<b>conclusion</b> 6:1
<b>collected</b> 21:4	121:11 130:3,4	116:10 117:15	<b>concentrate</b> 17:9	31:12,18 71:19
<b>collective</b> 60:3	<b>committed</b> 20:20	119:11 147:10	131:18 160:14	90:17,19 92:16
<b>column</b> 157:17	144:4	163:5 182:8	200:5,9	<b>concrete</b> 101:3
158:13	<b>communicated</b>	185:15 194:7	<b>concentrated</b> 36:6	<b>condition</b> 102:10
<b>columns</b> 198:4	41:20 193:10	<b>complexity</b> 3:14	<b>concentrating</b>	135:15 146:17
199:3	<b>communicating</b>	17:16 26:12 39:1	200:8	163:18
<b>combustible</b> 26:8	139:17	39:6,8,21 40:2,14	<b>concentration</b>	<b>conditions</b> 30:4
27:17 32:5	<b>community</b> 93:20	59:22 90:12 93:22	137:21 157:15	55:10 63:20 100:9
<b>combustion</b> 21:6	<b>companies</b> 127:16	94:3 115:18	193:6 199:20	100:10 106:15
30:10	<b>company</b> 122:21	117:12 118:1,6,14	<b>concentrations</b>	110:4 132:16
<b>come</b> 71:19 81:10	<b>comparable</b> 27:9	118:22 119:5	137:19	142:15 187:2
82:13 84:10 91:22	27:15	128:18,19 133:11	<b>concept</b> 70:20 77:1	192:3
94:19 98:14	<b>compare</b> 129:8	147:4	77:11 78:21 80:1	<b>conduct</b> 61:1 68:6
119:19 122:8	136:20 137:4	<b>compliance</b> 30:14	92:12,17 96:5	<b>conference</b> 171:2
124:11 140:18	138:20,22	163:14 167:9	98:17 99:1 118:15	<b>confidence</b> 23:9
147:13 158:17	<b>compared</b> 46:5	175:3	137:20 138:15	<b>confident</b> 84:15
178:11	148:2	<b>compliant</b> 163:6	167:2	<b>configuration</b>
<b>comes</b> 107:3	<b>comparison</b> 27:8	174:19 177:4	<b>concepts</b> 131:6	11:14 142:17
114:12 123:20	93:9 127:15	<b>complicate</b> 35:10	167:4	145:11 155:19
124:1 126:14	138:16	165:6	<b>conceptual</b> 196:14	161:9 185:1
130:15	<b>complete</b> 13:12,13	<b>complicated</b> 35:13	<b>conceptually</b> 48:2	<b>configurations</b>
<b>comfortable</b>	13:15 15:18 19:15	35:20 36:17 59:20	<b>concern</b> 39:21 41:3	184:13
127:22 140:13	19:17 32:15 38:19	113:8 114:11	41:20 50:22 56:17	<b>confine</b> 17:19
194:2	38:20 52:11,18	151:4 165:15	68:10 81:5 120:11	<b>confinement</b> 17:20
<b>comforted</b> 142:3	109:13,21 110:2,8	184:18	<b>concerned</b> 14:10	21:19,19 42:14
<b>coming</b> 98:10	128:6 144:15	<b>complies</b> 23:7 33:1	38:16 41:1 182:5	43:5 45:22 47:19
202:9	145:18 157:6	<b>comply</b> 22:7 24:22	196:21	58:14,21 153:20
<b>comment</b> 81:16	164:15 168:7	149:14 164:16	<b>concerning</b> 7:4	154:2,4,7,20
122:5 127:6 130:1	<b>completed</b> 21:12	<b>component</b> 58:4	<b>concerns</b> 12:18	155:13 182:2,14
148:3,7 168:22	21:15 50:11 52:12	153:5	16:11 17:9,10	182:21 185:10
201:1 202:3	52:14 57:5 83:15	<b>components</b> 3:13	35:2,11 40:2 42:8	189:5 190:15
<b>comments</b> 5:21 7:1	152:21 153:1	14:4,7 22:6 23:11	42:17 44:8 74:5	<b>confirmation</b> 175:4
7:3 22:13 33:8	159:21	26:16,20,22 29:18	90:13 147:5,7	<b>confirmed</b> 30:16
53:4 58:6 74:14	<b>completely</b> 33:22	31:19 46:4,7,9,12	173:9 197:22	31:17 175:4
95:20 130:22	55:9 126:4 137:13	47:8 49:3,6 50:1	198:21	<b>confuse</b> 96:3
131:13 143:4,6	137:16	64:14 83:1 87:22	<b>concert</b> 78:6	<b>confused</b> 79:13
173:16 195:4	<b>completing</b> 23:1	152:8,13,15,18	156:12	<b>confusing</b> 96:2

<b>Congress</b> 41:20,22	52:15	<b>continuing</b> 9:4 197:14	<b>Convention</b> 1:11	<b>counterparts</b> 9:16
<b>conjunction</b> 17:14	<b>considers</b> 8:9,18	<b>contracted</b> 24:12	<b>conversation</b> 71:3 133:10	<b>country</b> 93:20
<b>connect</b> 96:22	<b>consistency</b> 60:14	<b>contractor</b> 37:5 38:1 41:5 42:2 53:11 74:4 93:2	<b>conversations</b> 102:8	<b>couple</b> 130:10 139:15
<b>connected</b> 186:7	<b>consistent</b> 20:17 21:9 34:1 46:22 47:14,15 55:8,16 85:2 162:2 176:21 177:1	<b>contractors</b> 22:9 35:14 68:7 194:17	<b>Conversely</b> 21:14	<b>course</b> 7:11 62:21 122:16
<b>connections</b> 113:14 182:10,18 183:5	<b>consistently</b> 55:5	<b>control</b> 11:14 16:16 16:20 19:9 20:21 22:3 24:8 30:20 39:19 50:19 51:2 51:16 60:11 63:17 71:9 73:6,21 82:18 83:5,6,9 85:9,17 103:13,15 104:5,9 117:9 118:1 123:10 126:4,7,18,19 128:19 131:2,7,10 145:11 154:3,11 155:3,9,13 156:18 156:22 157:1 170:6 182:12,12 182:13 190:2 193:5 198:1	<b>conveyed</b> 147:15	<b>cover</b> 54:6
<b>consensus</b> 189:15 190:14	<b>constant</b> 159:9 193:3	<b>controlling</b> 72:15	<b>conveys</b> 19:7	<b>co-located</b> 49:12 129:13
<b>consensus-buildi...</b> 175:21	<b>constantly</b> 197:3,8 200:13	<b>controls</b> 16:19 20:8 25:8,10,12,22,22 28:5 30:11 32:18 36:18 40:15,22 42:13 43:6 45:1 45:21 47:22 48:21 50:13 51:4,7 52:2 63:17 64:2 75:18 75:20 84:18 88:3 93:9 95:10 100:19 117:17 118:2 121:13 129:2,4,17 139:1 140:9,14 141:5 161:10 166:7 172:5 183:17	<b>convinced</b> 86:5 89:10,18 90:1,2 90:21 94:13 115:17	<b>create</b> 132:2,2,4 189:4
<b>consequence</b> 37:14 188:22	<b>constituent</b> 137:21	<b>controversial</b> 171:9 178:4	<b>copy</b> 202:7	<b>created</b> 11:14 84:3 84:3 172:20
<b>consequences</b> 40:6 41:14 42:5 43:1,2 44:10,20 45:11 48:5 49:11,22 68:20 140:20	<b>constituents</b> 80:6	<b>Cont'd</b> 2:10	<b>copying</b> 5:15	<b>creating</b> 97:6 129:18 137:22
<b>Consequently</b> 10:15	<b>constitute</b> 4:12	<b>convened</b> 28:1	<b>correct</b> 43:18 61:5 62:1,6,7 64:6,12 64:15,19,20 65:3 65:5,6,12 66:5,8 67:11,13 77:18 83:19,20 97:7 108:6,6 110:17 112:9 119:22 120:1,16,17 126:17 127:10,12 128:20 141:17 146:9,10 168:17 172:22 179:10,12 186:18 190:18 192:19	<b>credible</b> 31:22 183:4
<b>conservatism</b> 40:5 40:8,18 41:2 43:20,21 61:12 65:1,2 68:13 71:9 71:10,22 74:19,19	<b>constructed</b> 11:10 37:2		<b>correctly</b> 74:18 176:20	<b>credit</b> 190:16 191:1 191:2
<b>conservativisms</b> 21:10	<b>constructing</b> 63:9 63:13		<b>correspondence</b> 142:19 198:1	<b>credited</b> 154:3,11 154:12 155:9 156:22 157:2
<b>conservative</b> 25:3 26:1,10 43:10 44:3,14 75:9 77:4 79:1 89:7 90:10 93:10,19,21 96:7 130:14 141:6 147:2 197:4	<b>construction</b> 8:3,6 8:12,14,17 9:1,19 10:6,17 13:13,19 13:20 19:16 23:1 33:21 35:9 36:22 38:12,14,19 46:14 92:21 127:8		<b>corresponding</b> 29:21	<b>crediting</b> 183:14
<b>consider</b> 45:14 170:22 177:11 190:6,8	<b>Consultant</b> 1:24		<b>corridor</b> 117:20	<b>credits</b> 46:6
<b>considerable</b> 127:19,20 151:11	<b>contacted</b> 6:5,7		<b>corridors</b> 26:17	<b>CRESP</b> 2:12 171:5
<b>consideration</b> 7:1 68:12 70:5 76:17 108:18	<b>contain</b> 26:19,22 131:14		<b>cost</b> 69:18 197:12 197:15 198:15 199:3	<b>criteria</b> 14:3 17:4 19:22 21:2 22:4 25:4 26:2 29:19 30:1 32:14 41:9 46:16 49:3 55:20 72:10 81:10 82:1 82:20 88:16 100:8 134:8 148:2 153:2 153:9 186:6,14,19 186:20 191:10
<b>considerations</b> 193:16	<b>contained</b> 49:5		<b>costly</b> 14:15 197:5	<b>critical</b> 9:11 10:7 22:22 23:16 33:4 103:14,15 125:8 131:16 132:21
<b>considered</b> 48:6 70:8	<b>containment</b> 188:15 190:12		<b>costs</b> 38:9 159:7 201:13	<b>criticality</b> 36:18 119:21 197:2
<b>considering</b> 34:3	<b>contains</b> 148:14		<b>Counsel</b> 1:19 4:14 202:8	<b>criticize</b> 90:16
	<b>contamination</b> 129:20		<b>count</b> 106:12 120:5	<b>crucial</b> 15:1
	<b>contend</b> 95:18		<b>counterpart</b> 74:5	<b>curie</b> 27:13
	<b>content</b> 27:13 200:4			<b>curious</b> 185:4
	<b>contents</b> 88:9			<b>current</b> 12:9 55:7
	<b>context</b> 56:13 100:20 173:5			
	<b>continue</b> 9:18 33:9 38:9 114:2 164:5			
	<b>continues</b> 44:2 56:18			

55:17 74:7 76:8 85:14 87:16 138:5 147:22 148:2 149:21 162:5 192:14 <b>currently</b> 117:6,7 118:3 141:21 148:16 149:15 162:10 192:13 <b>curves</b> 164:14 <b>cut</b> 109:1 <b>cycle</b> 68:8 69:18 100:13 158:9 159:2,5,7 <b>C-O-N-T-E-N-T-S</b> 3:1 <b>C5</b> 30:11 113:20,21 <b>C5-V</b> 58:3 154:5 190:11 191:2	<b>debating</b> 118:15 <b>decades</b> 10:21 11:12 16:12 91:4 <b>December</b> 41:21 <b>decided</b> 42:10 121:2 <b>decision</b> 86:12,14 87:14 174:7 177:7 178:7 <b>decisionmaking</b> 63:5 68:19 122:5 <b>decisions</b> 62:11 68:20 75:15 121:9 123:10 156:1 170:1 193:11,12 <b>declaration</b> 147:9 <b>decommissioning</b> 9:20 <b>decontaminate</b> 48:7 <b>decrease</b> 70:6 <b>decreased</b> 41:15 <b>deemed</b> 7:7 <b>deep</b> 62:22 155:6 <b>deeply</b> 14:10 <b>defend</b> 82:14 83:18 <b>defense</b> 1:3 4:4,19 8:5 22:14 27:11 29:10 47:1,4,5 60:16 140:8,12 153:16 154:14 164:10 <b>defensible</b> 77:4 <b>defensive</b> 198:22 <b>defined</b> 14:5 73:16 127:21 128:22 <b>defines</b> 8:1 <b>defining</b> 45:1 <b>definitely</b> 118:17 <b>definition</b> 75:1,2 102:10 128:6 <b>definitively</b> 84:20 <b>deflagration</b> 62:13 75:19 <b>deformation</b> 49:19 <b>degradation</b> 47:10 <b>degree</b> 119:13	<b>degrees</b> 59:21 <b>delay</b> 8:22 53:2 <b>delegated</b> 19:2 <b>delineating</b> 180:9 <b>deliver</b> 17:3 <b>delivered</b> 18:2 41:7 <b>delivery</b> 78:9 138:6 <b>demands</b> 17:2 52:1 <b>demonstrate</b> 52:20 58:12 154:11 155:10 182:1 188:15 <b>demonstration</b> 50:3 <b>density</b> 36:13 <b>Department</b> 3:5 4:19 8:4 9:14 12:7,18 13:1,9,16 13:21 14:1 15:2 15:15 22:9 31:5 53:10 76:2,5 86:4 86:19,21 87:10 89:10,18,22 90:2 91:3,7 94:10 137:12 142:15 143:10 147:15 150:11 158:22 167:16,19 169:13 175:22 177:15,22 179:6,12 180:15 181:7,9,11 194:16 <b>departmental</b> 176:4 <b>Depending</b> 44:18 160:13 <b>deposition</b> 22:19 42:19 43:9,17 44:5 45:14 178:6 178:13 179:10 194:1 <b>depth</b> 47:1,5,5 51:4 60:16 63:15 140:8 140:12 153:16 154:14 164:10 <b>Deputy</b> 166:21 <b>describe</b> 61:11 66:16 140:11	<b>described</b> 69:16 74:18 97:11 170:3 <b>description</b> 190:4 <b>design</b> 3:14 8:2,4,9 12:19 13:5,11,18 14:2,3,6,14,22 16:10 17:12,17,18 17:20 19:14 20:6 20:11,19 21:9,11 21:16,21 22:10 23:5,6 24:12,17 24:21 25:2,4,16 25:18 26:1,11 28:3,9,11 29:6,19 30:5,7,19 31:2,9 32:11,15,20,21 33:18,20 34:4,8 34:13 35:9,10,13 36:20,21 37:11,12 37:15,22,22 38:4 38:7,8,12,18 39:6 40:5,16 43:3,5 46:8,16,17,18,20 46:22 47:6,13 48:17 49:3,14,18 51:1,10,16,19 52:10,15 53:1 55:4,8,11 56:1,11 57:7,15 59:4,19 60:7,8 64:9,10,17 65:1 71:7,11,22 72:1 75:17 76:6 82:10,15 83:10,14 84:1,22 86:5,11 87:17,21 89:8,19 89:20 90:3,7,11 90:12 92:21 101:6 102:20,21 103:3 103:10,17 104:1 104:12 105:15 111:19 115:5,6,15 117:7,15,22 118:6 121:17,20 124:7 126:9,19 127:8 128:7,7 129:7,11 131:5 142:2 144:19 147:2,3	148:1,2,20 149:3 149:11,14 153:4 154:18 155:18 156:21 157:11 161:6 162:5,6,10 162:18 163:3,11 163:14,17 165:10 170:1,7,7,20 172:7 174:22 176:15,17 183:11 184:21 186:6,13 186:19,20 189:15 189:21 190:13 196:14,17 198:16 198:17 <b>designed</b> 11:10 27:2 47:13 61:18 65:10 100:22 187:3 <b>designing</b> 48:10,19 68:15 124:8 <b>designs</b> 20:8 32:2 <b>design-build</b> 19:13 52:16 59:10 <b>detail</b> 107:22 165:9 <b>detailed</b> 114:21 <b>details</b> 184:11 <b>detected</b> 50:4 <b>detection</b> 49:21 50:8 <b>determination</b> 39:16 123:16 125:3 168:15 179:5 <b>determinations</b> 124:6 <b>determine</b> 44:9 50:8,16 85:4 108:1 128:18 129:2 133:1 163:18 175:9,11 <b>determined</b> 119:12 124:14 <b>determining</b> 43:1 <b>deterministic</b> 171:16 176:18 <b>detonation</b> 62:13
--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

75:20	<b>disagrees</b> 95:9	<b>DOE</b> 15:2,10 16:5	191:7 192:13	<b>early</b> 21:10,20
<b>detonations</b> 151:19	<b>discharge</b> 107:1	18:4 23:8 35:14	<b>draft</b> 101:15	122:19
<b>develop</b> 97:5 126:4	<b>discipline</b> 169:9	36:20 37:15,20	102:16 103:3	<b>earnest</b> 12:14
126:6 160:3 166:6	<b>disciplined</b> 167:11	38:2,5,11,15,21	<b>drastically</b> 196:11	<b>ease</b> 94:21
177:13,15	176:9	39:15,18 40:1,2	<b>drawings</b> 145:20	<b>easier</b> 95:14 139:22
<b>developed</b> 24:13	<b>discomfort</b> 60:8	40:14,16 41:20	<b>drew</b> 28:19	<b>easiest</b> 189:5
25:3 38:6 39:12	<b>discuss</b> 34:5 50:13	42:8,9,11 43:8,10	<b>drive</b> 17:15 177:7	<b>easily</b> 45:10
44:16 52:3 120:14	193:17	43:15,19 45:21	<b>driven</b> 26:1 88:10	<b>easy</b> 72:22 142:9
<b>developing</b> 174:2	<b>discussed</b> 15:20	48:2,5,13 49:8	88:11	<b>effect</b> 7:20 17:15
<b>development</b> 34:13	51:4 62:19 72:13	51:8,13,14,20,22	<b>driver</b> 119:6	46:16 109:16
36:17 51:21 52:8	73:5 100:1 101:5	52:11,17 55:17	<b>drivers</b> 61:19	159:18 193:8,14
<b>develops</b> 39:9	119:15 120:2	56:6 65:17 93:1	<b>drives</b> 79:14 189:5	197:21
<b>DEWEY</b> 167:21	152:22 185:5,6	165:6 166:15,17	<b>driving</b> 59:14 79:3	<b>effective</b> 89:12
188:8,11,14,17	<b>discussing</b> 190:11	167:10 168:4	81:3 93:9	112:22 168:10
189:8 190:3,10,16	<b>discussion</b> 3:7 18:6	171:4 174:6 177:1	<b>drove</b> 26:11 90:11	<b>effectively</b> 10:20
191:3	58:20 81:20 86:2	194:7 195:9,20	147:3	18:1 50:19
<b>diagram</b> 145:14	88:6 119:17 154:2	196:8	<b>DSA</b> 58:13 79:6	<b>effectiveness</b> 149:6
161:18	193:4	<b>DOE's</b> 17:15 18:12	83:4 84:12 139:5	<b>effects</b> 62:12
<b>diagrams</b> 156:7	<b>discussions</b> 16:7	23:7 25:1 29:8	139:11 142:9	<b>efficiency</b> 121:2
<b>dialogue</b> 102:9	39:18 108:12	33:1 34:5 35:10	162:13 163:7,8	<b>efficient</b> 11:3 23:16
162:19	119:7 141:11	37:9 39:5,7 44:12	165:9 166:6 170:4	33:3
<b>DICKEY</b> 1:24	143:2	44:13 46:7,11,22	<b>DSAs</b> 85:15	<b>efficiently</b> 18:1
<b>difference</b> 80:22	<b>dispatched</b> 192:9	47:1,16 48:21	<b>due</b> 26:18 27:22	34:22
179:1 180:5	<b>disposal</b> 12:6 18:4	49:3 53:15 162:6	37:6,16 44:10	<b>effort</b> 9:4 12:15
<b>different</b> 35:22	199:7	<b>DOE-EM</b> 2:18	49:20 59:2 75:21	13:10 20:4 25:9
74:7 104:4 120:7	<b>disposition</b> 143:6	<b>DOE-ORP</b> 1:22,23	182:22	30:16 35:10 40:1
122:11 128:13	<b>distribution</b> 36:12	1:25	<b>duration</b> 35:1	51:15 57:9 80:16
135:1 160:3	164:14	<b>doing</b> 69:19 94:14	<b>duty</b> 112:1	121:19 124:11
179:16 184:13	<b>dive</b> 62:22 155:6	136:8 157:11,12	<b>DWPF</b> 95:20 96:1	127:19,21 181:2
185:13 186:1	<b>document</b> 55:4,18	<b>Donna</b> 1:23 54:2	98:10 99:11	<b>EFRT</b> 128:8
<b>difficult</b> 26:14	55:19 73:6 77:16	129:1 130:9 158:4	138:16,22	<b>eight</b> 20:10 34:11
36:11 86:9,10	101:15 102:16	<b>dose</b> 44:10,19 45:3	<b>Dwyer</b> 1:19 4:16	120:7
<b>diligence</b> 27:22	103:3 104:15	<b>doses</b> 43:13 45:17	101:2 102:2,5,13	<b>either</b> 16:2 59:22
<b>dilute</b> 113:1	105:13 141:14	45:18	102:17 103:19	88:17 106:10
<b>diluted</b> 200:12	142:14 146:22	<b>double</b> 27:13	104:3,7 181:18,19	155:14 174:10
<b>dilution</b> 88:19	151:3 164:18	<b>Dr</b> 4:11 53:12 74:9	182:6,16 183:21	194:5,9
197:21	<b>documentation</b>	76:20 80:18 81:14	184:2,20 185:4,12	<b>elected</b> 37:20
<b>direct</b> 179:18	133:5 145:16	87:3,6,9 89:21	185:18,20,21	<b>element</b> 72:1 132:5
<b>directed</b> 31:21 54:9	146:17 161:1	91:2,14 105:1	186:19	142:19 175:1
<b>direction</b> 180:6,12	<b>documented</b> 19:19	106:6 131:11	<b>D.C</b> 5:18	<b>elements</b> 63:1
198:9	23:13 28:12 29:21	137:10 151:5		71:10 84:8 121:10
<b>directly</b> 71:12	47:2 50:14,15	152:12 166:20	<b>E</b>	121:12,13,17
134:12	55:2 58:13,22	168:16,17,20	<b>E</b> 1:17	122:1
<b>director</b> 1:19 4:16	102:21 140:10	173:22 174:9,11	<b>earlier</b> 49:13 52:14	<b>elevate</b> 59:7 63:3
19:6 53:17,19,21	<b>documents</b> 5:14	174:17 177:3	58:3 97:21 126:10	<b>elicitation</b> 136:22
<b>director's</b> 69:4	39:13 145:19	178:9 179:14	133:12 171:6	<b>eliminate</b> 40:4,7
<b>disagree</b> 161:6	194:3	180:3 181:4,4,13	195:1	84:6

<b>eliminated</b> 83:2	102:20 103:11,16	<b>establishing</b> 14:3	26:11 90:12 147:3	<b>experimental</b> 21:4
<b>eliminates</b> 135:10	111:20 121:22	47:22	<b>exacerbates</b> 12:4	<b>expert</b> 28:1 63:7
140:8 172:15	129:4 131:20	<b>estimate</b> 42:20	38:2	89:13 91:10 98:12
<b>eliminating</b> 129:16	132:10,22 181:3	74:17	<b>exactly</b> 70:19	136:21
173:2	<b>ensuring</b> 23:12	<b>etcetera</b> 128:4	100:17,22 168:20	<b>experts</b> 13:3 22:14
<b>elimination</b> 117:1	29:7 32:16 33:20	134:17	168:21	31:13,17 44:12
<b>eloquently</b> 140:11	51:15 167:9	<b>evaluate</b> 57:14	<b>example</b> 26:12 32:3	91:7,13 92:6
<b>EM</b> 27:9 87:12	<b>entail</b> 27:3	64:17 83:13	35:15 36:4 37:3	<b>expert-based</b> 30:18
170:16 171:3	<b>entered</b> 54:13	156:13 163:16	58:3 99:12 101:4	<b>explain</b> 7:16 15:2
173:22 176:20	<b>enters</b> 97:16	164:18 175:8,12	109:17 158:22	139:11 163:6
<b>embedding</b> 165:20	<b>enthalpy</b> 200:6,15	<b>evaluated</b> 46:10	160:11 161:15	<b>explained</b> 118:5
<b>embellish</b> 126:9	<b>entire</b> 34:22 128:12	64:11 109:16	166:2	<b>explicitly</b> 102:12
<b>emergency</b> 111:7	137:22 175:21	<b>evaluating</b> 107:12	<b>examples</b> 22:16	<b>explore</b> 15:17
113:9,15,15,17	<b>entirely</b> 116:21	161:15	59:21 83:22	<b>explosion</b> 40:11
114:16 115:22	<b>entitled</b> 202:13	<b>evaluation</b> 29:22	<b>exceed</b> 41:7 99:6	48:22 49:20 197:1
<b>employed</b> 97:3	<b>entrainment</b> 22:18	44:22 45:12 50:10	<b>exchange</b> 139:14	<b>explosions</b> 31:11
<b>enabling</b> 7:20	<b>entrance</b> 6:5,13	51:10 60:18 61:8	157:17 158:2,11	49:4
<b>encountered</b> 36:1	<b>enumerated</b> 120:6	105:20,22 119:22	158:13 194:20	<b>explosively</b> 31:15
<b>endeavor</b> 130:16	<b>envelope</b> 16:22	121:14 143:11	198:2,3,4 199:6	<b>expose</b> 14:16
<b>ended</b> 129:15	21:1 65:5 96:7,19	144:15 167:12,18	<b>exchanges</b> 9:15	<b>exposed</b> 14:13
<b>endorsed</b> 31:2	96:21 129:5	169:8 175:15	<b>excuse</b> 150:1	<b>exposures</b> 27:4
<b>energy</b> 3:5 7:14,21	<b>environmental</b>	<b>evaluations</b> 22:18	<b>execute</b> 109:9	<b>expressed</b> 30:17
8:5,22 9:11 10:1	27:10 53:14 74:12	<b>evaporating</b> 68:3	<b>executive</b> 53:22	126:8 180:16
15:2 22:9 31:5	146:3 153:7 167:2	<b>evening</b> 23:20	100:16 121:5	<b>expressing</b> 75:8
53:10,13 76:2,5	167:7,17 168:22	33:14 54:16,20,22	<b>exercise</b> 7:13	<b>extend</b> 195:3
94:10 137:12	175:17 176:7	<b>evening's</b> 17:8 18:6	<b>exist</b> 45:9 75:2	<b>extensively</b> 82:3
167:14,16 175:22	<b>envisioned</b> 102:8	34:2	102:1 138:1	132:20
180:15 197:9	<b>equal</b> 6:20	<b>event</b> 75:19 109:16	<b>existing</b> 20:14 30:8	<b>extent</b> 7:6 14:17
<b>Energy's</b> 4:19 12:7	<b>equations</b> 45:7	109:17 149:3	114:15 139:1	25:20 32:10 36:7
167:19 169:13	<b>equipment</b> 27:2	153:8 155:2	177:1	<b>external</b> 13:1
<b>engaged</b> 91:7	47:18 128:3	182:22 187:17	<b>exists</b> 11:18 66:3	115:11
<b>engineer</b> 195:8,19	148:15 150:20	<b>events</b> 21:7 30:5	<b>expand</b> 125:7	<b>extremely</b> 14:15
196:3,15	<b>equivalent</b> 46:17	40:11 63:16 73:1	<b>expect</b> 156:14	35:20 72:14 86:9
<b>engineered</b> 40:22	<b>erosion/corrosion</b>	115:2 139:8	157:6 177:4	86:10 129:12,13
128:22 129:3	183:2	152:14 154:3	<b>expected</b> 20:18	169:2 197:4
<b>engineering</b> 53:20	<b>error</b> 88:2	158:10 182:15	21:10 24:16 30:16	
56:11 57:12 59:17	<b>errors</b> 75:22	185:10	45:4 100:9,9	<b>F</b>
60:5,7,7 85:2	<b>escape</b> 98:20	<b>eventual</b> 9:20 12:6	102:9 175:3	<b>F</b> 1:15
164:19	<b>especially</b> 92:18	18:3	<b>expecting</b> 146:16	<b>fabricated</b> 31:19
<b>engineers</b> 98:13	154:9 191:11	<b>everybody</b> 138:4	<b>expense</b> 159:2	<b>facilitate</b> 146:2
<b>enhanced</b> 62:17	<b>essence</b> 123:17	141:17	<b>expensive</b> 36:11	<b>facilities</b> 1:3 4:5,20
<b>enhancements</b>	<b>essential</b> 23:2	<b>evidence</b> 21:4	<b>experience</b> 91:4,5	9:20 22:1,10,15
21:17	<b>establish</b> 52:17	97:11,15	130:4,15 135:13	23:15 27:9 29:11
<b>ensure</b> 8:10,18	60:10 63:16 64:6	<b>evolution</b> 24:16	154:7 156:16	33:18 34:4 37:21
20:22 24:18 27:3	64:7,9,18	71:8 100:19 163:4	183:5	48:9 69:11 70:13
33:2 41:6 51:21	<b>established</b> 25:4	<b>evolves</b> 21:11	<b>experiment</b> 151:9	91:5 94:20 95:6
52:4 74:15 78:7	43:9 52:11 126:19	<b>evolving</b> 19:8 24:8	166:12	96:5 189:13

<b>facility</b> 3:9,16 8:2,5 8:6,13,17 9:2 13:14 14:20 17:10 17:13,17 18:20 19:13 20:5,11 21:19 22:21,22 24:4,9,22 25:11 26:4,9,21 27:11 27:12,16 28:18 29:7 32:17 33:1,5 34:13 35:12,13 38:18 41:13 42:15 43:4 46:1 47:16 48:8 52:9,10,18 53:1 56:16,20 59:20 62:1 63:14 68:14,16 88:4 89:20 90:9 91:8 102:22 105:17 106:11 107:5 111:4,4,5 115:1,2 115:13 116:10,10 122:10,13 125:9 126:16 129:10 130:6 142:7,8 157:12 158:4,19 159:1 160:5 163:5 165:19 172:6 201:11	<b>falls</b> 200:11 <b>familiar</b> 87:1 196:6 <b>far</b> 4:15,17 97:20 102:10 115:16 118:4 139:1 <b>farm</b> 20:15 41:5 65:16 66:4,16 67:10,22 70:3,7 70:11 71:6 72:13 74:4 75:3,5,7,11 76:4,13,15 77:2,6 77:9 78:6,19 79:3 79:3,13,14,18 80:17,21 81:4,10 88:8,10,20 97:18 99:2,18 100:2,7 101:18 124:3 125:1 133:13 137:22 138:6,9 193:4,10 <b>farms</b> 11:13 16:16 17:3 18:2 20:21 28:12,14 36:2 61:4 70:4,17 71:12 72:3,19,22 73:9 74:2,5 77:12 88:19 96:21 97:3 101:10,13 120:22 136:9 183:6 196:2	193:7 195:13 <b>feedback</b> 29:13 <b>feel</b> 85:12 141:4 155:17 172:9 194:2 <b>fellow</b> 18:8 <b>felt</b> 127:22 <b>fewer</b> 95:10 <b>field</b> 63:20 <b>figure</b> 84:11 164:9 184:16 <b>figured</b> 108:21 165:22 <b>filter</b> 131:13,15 <b>filtered</b> 30:12 <b>filters</b> 149:8 <b>final</b> 14:3 23:13 37:21 52:12 57:15 58:13 60:11 83:3 84:12 103:21 126:21 128:7 140:10 142:9 143:4 146:16 155:22 156:2 157:9,19 158:16 159:13 160:5 173:20 177:6,18 <b>finalize</b> 130:12 131:9 162:14 <b>finalized</b> 14:8 144:2 164:13 <b>finalizing</b> 32:8 55:11 <b>finally</b> 100:3 104:1 128:22 130:12 <b>find</b> 68:3 150:9 <b>findings</b> 31:3,7 32:7 <b>finish</b> 14:6 97:16 157:6 164:14,15 200:21 <b>finished</b> 125:17 126:5 <b>finishes</b> 180:8 <b>firm</b> 127:9 <b>first</b> 4:22 11:22 17:11 35:11 74:15	94:4 97:22 119:3 127:6 129:8 166:5 194:7 <b>first-of-a-kind</b> 12:13 <b>five</b> 4:12 6:22 44:22 45:12,19 68:1 92:6 106:8 195:2 <b>fixed</b> 88:17 191:20 <b>flexibility</b> 113:12 113:13 <b>floor</b> 5:16 23:18 81:11 <b>flow</b> 52:12,18 123:18 124:16 125:4 127:9 155:21 156:2,7,9 157:6,9,10,18,19 158:16 159:12,18 159:19,20 160:2,4 160:10,17,22 161:18 171:13 <b>flush</b> 107:6,7 108:17 109:6 111:21 113:4,5,6 113:10 114:13,15 115:3 118:7 131:14,20 133:1 158:12 <b>flushes</b> 109:10 112:1 115:4 116:7 116:8,14,14,20,21 117:2 131:22 132:3 164:2 <b>flushing</b> 106:14 109:4 113:8 115:20 <b>focus</b> 10:16 32:16 40:17 56:17 94:22 <b>focused</b> 100:17 135:20 161:20 166:4 <b>focusing</b> 14:22 119:5 <b>folks</b> 146:3 <b>follow</b> 6:17 156:18 <b>followed</b> 107:6	<b>following</b> 29:9 42:21 48:8,16 106:19 116:17 <b>followup</b> 152:4 167:22 180:20 181:20 <b>follow-on</b> 145:16 <b>foremost</b> 97:22 <b>form</b> 9:12 50:20 <b>formal</b> 9:12 12:13 39:16 104:15 167:11,18 169:8 <b>formalization</b> 102:9 <b>formally</b> 176:5 <b>formation</b> 30:21 <b>forms</b> 9:4 12:5 <b>formula</b> 98:13 <b>formulate</b> 9:10 <b>formulation</b> 52:4 <b>Fort</b> 122:13,14 <b>forth</b> 142:20 <b>forward</b> 14:6 38:11 38:12 55:20 57:7 122:9 140:3,15 166:9 172:1 175:22 176:12 <b>found</b> 5:8 7:21 27:14 41:17 42:2 68:3 162:21 171:14,15 <b>four</b> 43:14 68:7 106:8 200:14 <b>fraction</b> 197:17 <b>fragile</b> 66:17 67:10 67:22 68:17 78:17 <b>fragility</b> 68:9 75:5 <b>fragment</b> 31:15 <b>fragmentation</b> 31:21 82:21 <b>framework</b> 22:8 <b>Frank</b> 2:14 53:18 <b>Frank's</b> 130:22 <b>frequency</b> 170:3 <b>fresh</b> 25:12 40:20 <b>front</b> 146:22 <b>FRT</b> 111:15,20
-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

132:8  
**fuels** 195:9,21  
 196:9,12  
**fulfill** 9:5  
**fulfillment** 24:18  
**full** 106:22 107:2  
 131:8 144:1  
 184:13  
**fully** 14:12 73:16  
 80:7 128:6  
**function** 47:18 49:9  
 58:16 110:7,7  
 120:20 148:11,17  
 154:12 157:1,2  
 173:3 187:18  
 188:1  
**functional** 22:4  
 29:17 82:21  
 120:16 125:18  
 140:5 144:21  
 148:21 149:12,19  
 186:7 188:19  
**functionally** 25:14  
 186:8 188:21  
**functions** 21:18  
 47:9 100:5  
**fundamental**  
 154:10 160:17  
 170:2  
**fundamentally**  
 35:2 82:18  
**further** 7:10 15:21  
 20:20 38:10 46:21  
 47:20 48:5 102:14  
 169:16  
**future** 12:9 15:22  
 85:18 90:14 142:4  
 147:6 165:18  
 191:9

---

**G**

**gain** 15:18  
**gas** 16:17 26:13  
 27:18 32:5  
**gaskets** 151:18  
**gee** 102:15 119:13  
**gel** 111:11 112:8

**gelling** 108:8  
**general** 1:19 4:14  
 25:17 150:16  
 186:12 202:8  
**generalities** 150:14  
**generally** 27:15  
 63:11,12 65:14  
**generated** 16:18  
 28:17  
**generating** 142:7  
**generation** 26:7  
**getting** 11:17 93:18  
 117:14 118:9  
 141:18  
**give** 6:19,22 69:1,1  
 81:11 130:4 141:4  
 143:16  
**given** 9:22 14:21  
 38:3 47:21 58:6  
 68:12 70:5 76:18  
 76:18 88:2 106:12  
 128:10 155:18  
**giving** 190:4 202:7  
**glad** 91:19 170:15  
**go** 58:11 64:1 67:18  
 72:9 79:16 93:2  
 95:22 105:2 119:1  
 119:14 120:19  
 122:8 125:14  
 127:4,5,22 129:1  
 133:17 138:22  
 140:9 141:13  
 143:21 149:1  
 150:7,10,11  
 154:17 158:5  
 163:22 175:20  
 178:4 190:3 194:1  
 199:18  
**goal** 67:18 69:17,21  
**goals** 15:8  
**goes** 26:21 123:21  
 125:15,21 169:21  
**going** 15:3 38:16  
 60:20 62:21 63:6  
 63:8 66:12,13  
 68:5 70:17 72:11  
 76:5 78:12 79:16

79:21,21 80:3,4  
 80:15 83:8 87:1  
 92:5,14 93:17  
 94:21 96:2,3,13  
 96:14 97:22 98:1  
 98:4,7,11,15,17  
 98:20 99:6 101:7  
 103:13 105:12,13  
 106:7,10 121:6,6  
 122:8 135:18,20  
 136:10 137:5  
 139:10 140:1  
 141:13 143:18,22  
 148:21 151:14  
 155:14 159:10  
 160:18,19 164:3  
 165:5,11 166:5,10  
 167:8 169:10  
 173:12 174:4,7  
 177:8 178:3,6,7  
 178:16 180:11  
 182:21 183:1,11  
 184:16,17 186:2  
 191:11,12,13,16  
 191:21 192:1,2,6  
 192:7,8,10,22  
 193:1 201:8  
**going-forward**  
 156:4  
**good** 23:20 33:14  
 54:19,22 84:8  
 95:21 104:13  
 129:13 142:4,6  
 144:6,7 166:19  
 172:20 176:1  
 181:13 194:19  
**gotten** 91:22  
 197:20 199:14  
**governance** 124:6  
**governing** 44:13  
**Government** 5:4  
**grade** 150:3,4  
**Grandridge** 1:11  
**grapple** 170:19  
 171:1  
**grave** 142:6  
**gravity** 199:19

201:5  
**great** 51:20 123:2  
 124:21 128:2  
**greater** 101:9,13,20  
**greatly** 91:9  
**Greg** 1:22 53:20  
 126:8,22 130:18  
 148:4 186:14  
**grinding** 191:15  
**grossly** 78:22 92:18  
**group** 33:19  
**guess** 56:13 61:15  
 69:21 73:19 77:15  
 82:11 86:2 133:9  
 171:17 182:17  
 185:19  
**guidance** 43:10  
 175:10  
**guideline** 44:22  
 45:13  
**guidelines** 44:13  
**guides** 47:17  
**guys** 62:5 63:1  
 79:16 95:22  
 108:21 138:18

---

**H**

**H** 1:15  
**Hague** 123:14  
**handled** 59:8  
**handling** 27:2  
**handpicked** 92:7  
**Hanford** 4:20  
 10:11 11:7 34:15  
 34:19 43:11  
 147:13 196:2  
**Hanford's** 27:14  
 35:19 36:10  
**hang** 153:21  
**happen** 123:3  
 168:19 191:22  
**happened** 95:16  
**happens** 64:3 74:10  
 106:17  
**happy** 87:6,9  
 201:21  
**harbor** 164:17

**hard** 83:17 97:17  
 97:19 98:19  
 150:13 156:3  
**harmful** 10:19  
**hazard** 10:21 26:3  
 26:5 48:1 66:3  
 67:15,15 84:4  
 142:5 190:21  
**hazardous** 14:16  
 26:15 27:5  
**hazards** 27:6,15  
 35:21 40:6 47:3  
 48:6 52:13,19  
 57:16 59:13,18  
 60:15,19 61:1  
 84:6 108:2 109:19  
 137:3 144:15  
 156:6,13 158:6  
 161:4,10 162:1,10  
 162:15 163:2  
 164:8 196:22  
 197:5  
**head** 181:14  
**headquarters** 5:17  
 74:13 87:12  
**health** 8:10,19 10:2  
 10:8 12:10 15:7  
 171:3  
**hear** 54:21 79:15  
 139:19 142:3,10  
**heard** 72:9 82:6  
 94:2 174:20  
**hearing** 1:5 4:6,21  
 5:6,9,11 6:3 7:5  
 7:11,13,19 9:3,8  
 15:21 16:8 17:8  
 18:11 51:5 54:6  
 54:14 62:22 86:8  
 94:4 202:10  
**heart** 55:14  
**heat** 128:3,4  
**heated** 36:5  
**heavily** 121:7  
**height** 117:18  
**held** 5:3  
**help** 13:5 58:12  
 63:8 93:4 97:5

136:2 155:5 184:7 <b>helps</b> 173:6 <b>HEPA</b> 149:8 <b>hierarchy</b> 60:16 63:16 <b>high</b> 11:7 16:18 23:9 26:12 34:19 35:20 36:8,13 47:3,6,9,9,13 67:15 78:3 80:4 88:1 116:14 117:7 117:8,13,16 120:22 141:11 186:11 199:4 <b>higher</b> 75:18 76:7 79:4 150:2,21 159:6 199:19 <b>highest</b> 25:15 137:21 187:5 <b>High-level</b> 193:6 <b>hinted</b> 140:16 <b>historical</b> 80:19 <b>historically</b> 67:22 <b>history</b> 11:6 68:9 <b>HLP-22</b> 193:6 <b>HLWP</b> 78:3 <b>hold</b> 198:12 <b>holding</b> 161:13 <b>holistic</b> 123:13 <b>holistically</b> 137:13 <b>hook</b> 113:6 154:22 <b>hope</b> 173:5 <b>hot</b> 14:14 26:17,18 26:21 27:7 46:12 46:20 49:17 88:1 110:22,22 114:7,8 114:9,16 116:1 117:16,19 120:15 125:17 130:3 149:18,20 150:20 151:12,16 152:6,8 153:14 154:9 181:22 186:10 187:8,8,8,11,20 <b>hours</b> 57:13 108:22 <b>HPAV</b> 20:2 21:2 23:5 25:6,10,21	28:3 29:19 30:21 31:1,8,12 32:7,8 32:18,20 55:14 57:8,21 82:20 106:14 108:15 116:19 129:7 144:9 146:1 151:19 152:20 153:8 155:2,6 173:16 176:16 192:3 196:22 197:21 <b>HPAV-related</b> 151:9 <b>HSS</b> 171:3 174:5 181:2,5,16 <b>huge</b> 197:13 198:15 <b>human</b> 88:2 <b>hundreds</b> 96:1 160:2 <b>hurrying</b> 201:17 <b>hydrating</b> 62:12 <b>hydrogen</b> 16:16,17 16:20 20:1,2,9 21:6 25:5 26:8 28:16 30:4,10,20 31:11 39:19 40:10 43:6 48:21 49:4 51:1,2,11,16 55:19 75:19 82:13 85:8 90:11 116:21 117:2,9 147:3 162:5,21 163:10 171:22 172:18 197:1 <b>hydrostatic</b> 132:1,4 <b>hydroxide</b> 112:22 <b>hypothetical</b> 101:22 <hr/> <b>I</b> <hr/> <b>ICD</b> 78:10 192:18 <b>ICD-19</b> 73:6,7,21 77:15,22 <b>Idaho</b> 11:19 196:13 <b>idea</b> 71:21 73:5 102:7	<b>ideal</b> 133:14 134:3 134:14,15 <b>identified</b> 25:9 42:9 47:1 56:21 57:3 58:3,10 60:17 74:6 81:20 100:18 131:4 142:13 <b>identify</b> 21:15 30:3 84:1,17 159:16 166:6 <b>imagine</b> 117:18 <b>immediate</b> 4:9 <b>immobilization</b> 9:6 33:22 90:9 105:16 <b>immovable</b> 112:11 112:12,15,17,19 112:20 116:12 <b>impact</b> 12:20 38:9 46:11 52:8 56:5,9 115:1 161:9 <b>impacting</b> 39:2 <b>impacts</b> 38:6 161:17 175:12 <b>implement</b> 16:20 25:3 29:5 32:8 76:6 84:19 86:10 143:14 158:18 168:9,15 169:18 <b>implementation</b> 16:19 57:4 83:7 174:3 <b>implemented</b> 20:7 50:20 51:7,17 52:6,21 63:18,19 83:12 174:8 <b>implication</b> 128:2 159:4,5,6 <b>implications</b> 28:4 124:20,22 <b>implicit</b> 15:4 <b>important</b> 13:8 21:18 47:7 71:3 81:19 94:22 96:10 114:18,19 115:14 119:18 121:1,2 127:18 131:3,8 158:7 170:18	177:14 183:11 <b>impose</b> 80:15 <b>imposed</b> 138:8 <b>impossible</b> 87:15 111:12 <b>improve</b> 20:4 24:21 32:22 70:19 90:2 <b>improvement</b> 68:6 70:16 <b>improvements</b> 157:11 161:6 <b>improving</b> 90:20 <b>inadvertent</b> 27:4 <b>inappropriate</b> 200:1 <b>inappropriately</b> 42:4 <b>include</b> 16:13 22:18 69:11 82:20 <b>included</b> 27:6 <b>includes</b> 20:7 118:5 <b>including</b> 10:2 26:5 119:20 <b>incomplete</b> 38:4 <b>inconsistencies</b> 175:12,13 <b>inconsistent</b> 25:17 <b>incorporated</b> 17:12 18:5 24:11 29:3 29:12 173:17 <b>incorporating</b> 194:2 <b>incorporation</b> 50:13 <b>incorrect</b> 180:1 <b>increase</b> 21:16 68:15 70:3 73:10 136:10 200:16 <b>increased</b> 27:4 36:19 70:2 72:2 72:19 <b>increases</b> 37:18 <b>increasing</b> 26:11 191:18 193:15 <b>incurring</b> 201:13 <b>independent</b> 19:4 22:14 30:18,22	31:1,8,12 32:7 91:6 173:16 176:16 <b>indicated</b> 13:16 34:10 49:13 181:21 195:1 <b>indicates</b> 179:16 <b>indicating</b> 43:16 <b>individual</b> 60:6 160:7 <b>individuals</b> 89:14 91:3,4,6 92:11 95:5 121:20,21 <b>individual's</b> 121:15 <b>industries</b> 13:4 <b>industry</b> 127:12 167:5 175:19 177:13 <b>Ines</b> 2:18 53:12 86:18 87:1 <b>inevitably</b> 16:18 <b>inferior</b> 48:18 <b>inform</b> 13:5 176:15 <b>informal</b> 9:15 <b>information</b> 7:3 15:20 38:4 58:12 105:10 162:18,21 <b>informed</b> 15:6 38:21 40:16 43:8 101:14 102:14 <b>infrastructure</b> 33:19 70:18 78:20 <b>infrequencies</b> 165:21 <b>inherent</b> 71:5,21 73:9 <b>inherently</b> 71:11 72:1 <b>initial</b> 11:9 163:18 <b>initially</b> 29:10 123:8 <b>initiated</b> 12:12 40:1 <b>initiating</b> 12:22 60:21 <b>initiator</b> 185:10 188:20 <b>initiators</b> 183:3
----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

<b>inner</b> 47:5	<b>Interface</b> 73:6	188:9	182:18 183:1,4	156:17 157:4,4,8
<b>input</b> 44:18 45:6	<b>interfaces</b> 26:14	<b>issue</b> 51:6 57:6	184:5,7 189:6	158:15 164:13
124:22	<b>internal</b> 13:1	58:10 73:21 89:4	<b>jumpered</b> 113:14	166:10 174:21
<b>inputs</b> 85:3 161:21	<b>internally</b> 144:3	89:6 95:11 104:19	<b>jumpers</b> 154:8,22	177:10 192:17
163:16 172:7	<b>internet</b> 5:7	111:20 118:14	182:5 187:12	193:11,17 194:18
<b>inquired</b> 11:1	<b>interpret</b> 47:11	119:5 135:19	198:15	198:13,14,18
<b>inquiring</b> 7:17	<b>interrupted</b> 115:7	149:15 151:8	<b>justified</b> 29:7 45:15	201:6
<b>inquiry</b> 15:21	<b>interruptions</b>	160:22 197:1,2,21		<b>knowing</b> 79:20
<b>inspection</b> 102:15	115:8	198:14	<b>K</b>	<b>knowledge</b> 80:11
<b>installed</b> 26:16	<b>introduce</b> 4:8	<b>issues</b> 11:2 14:9,12	<b>Kasdorf</b> 33:14,16	80:19 105:5
<b>instance</b> 64:8	18:17	15:6 21:17 22:16	55:15 60:17	<b>known</b> 9:7 20:1
151:16 192:4,6	<b>introduced</b> 123:18	30:17 35:3,4 38:8	142:12 147:20	56:20 58:8 74:21
<b>instances</b> 21:14	<b>introductory</b> 18:14	39:8 52:7 56:21	149:9 187:15	99:4
<b>instinctively</b> 93:15	18:19 24:2	57:4,10,19 58:1,8	<b>keep</b> 81:19 96:5	<b>Knutson</b> 1:25
<b>instituted</b> 175:17	<b>intuitive</b> 95:2,5	92:1,8 111:15,16	145:11 197:8,17	53:16 71:2,16
<b>Instrumentation</b>	136:8 138:12	132:8,8 139:22	<b>keeping</b> 15:5 197:3	73:4,19 81:17
145:14	<b>intuitively</b> 136:15	143:21 144:10	<b>Kennewick</b> 1:12	99:22 101:22
<b>integrate</b> 57:17	<b>invalid</b> 74:22	146:8 159:10	<b>kept</b> 25:18 92:11	102:3,6 120:5,9
64:17 84:11	<b>inventory</b> 187:19	163:11 178:4	<b>key</b> 14:12 24:13	120:17 121:10
144:18 163:1	187:20,21 188:7	185:22	42:13 57:3 65:9	124:19 125:7
<b>integrated</b> 57:14	<b>invest</b> 127:18	<b>iterate</b> 140:17	68:10 75:12 164:4	148:4
59:16 60:10	<b>invested</b> 51:14	<b>iterating</b> 126:12	<b>kicked</b> 144:12	<b>KOSSON</b> 2:12
102:11 123:18	<b>investigation</b> 21:5	<b>iteration</b> 24:16	<b>kind</b> 77:5 85:16,22	<b>Krohn</b> 166:22
124:15,16 125:4	<b>investment</b> 128:1	57:18 59:9 141:13	138:21 165:2	170:15 174:11
131:1 141:10	159:1	143:13 144:6	178:15	181:4,13
144:5,11 146:4	<b>invite</b> 18:12 53:9	162:20	<b>kinds</b> 84:18 159:10	
156:6 193:12	<b>involve</b> 11:2 26:13	<b>iterations</b> 126:21	<b>knew</b> 93:8,14	<b>L</b>
<b>integrates</b> 144:16	191:16,18	145:22	<b>know</b> 32:10 58:2	<b>lab</b> 97:4 191:14
<b>integrating</b> 104:18	<b>involved</b> 4:18	<b>iterative</b> 71:21	59:22 60:5 66:14	196:13
<b>integration</b> 69:4	121:7 174:5	126:10 139:19	66:21 67:1,16	<b>laboratories</b> 13:4
84:9 100:2 104:17	<b>involving</b> 25:6 50:6	<b>i.e</b> 188:5	71:16 72:10 78:18	<b>lack</b> 15:21 36:15
121:21	137:20		79:19 80:5,13	43:21
<b>integrity</b> 46:6	<b>in-line</b> 31:18 46:4,7	<b>J</b>	83:11,18,21 92:20	<b>ladies</b> 138:18
<b>intend</b> 71:19 169:4	46:11 49:3,6	<b>Jessie</b> 1:15 4:9	93:1,6 94:2,5,11	<b>Lag</b> 193:6
174:17	152:13,14 153:4	<b>jet</b> 35:16 131:7	95:19 96:6,8,19	<b>Lagdon</b> 170:17
<b>intended</b> 14:5 27:7	153:18 154:17	<b>job</b> 68:11 122:22	97:5 98:5,8,11,13	181:15
48:22 58:15 66:15	<b>ion</b> 157:17 158:2,11	123:1 128:8 161:3	98:17 99:7 105:11	<b>large</b> 10:9 15:19
<b>intensive</b> 197:11	158:12 198:2,3,4	<b>John</b> 1:17 4:11	109:18 111:2,10	27:16 28:4 72:13
<b>intent</b> 63:14 76:12	199:6	<b>join</b> 18:22 174:11	117:14 118:16	88:3,21 94:20
76:17,21,22 153:3	<b>irrespective</b> 190:20	<b>Joseph</b> 1:15 4:12	120:10 125:6	96:5 119:16 120:4
<b>interacts</b> 130:7	<b>Island</b> 171:7,12	<b>judge</b> 25:16	126:8 128:7	131:1,17 191:15
<b>interchange</b> 177:22	<b>ISM</b> 158:6	<b>judgment</b> 83:17	129:10 130:16	197:14
<b>interest</b> 123:12	<b>isolate</b> 187:18	89:14 166:17	131:1,3,5,15,17	<b>Larry</b> 1:16 4:10
181:1	188:6	<b>July</b> 5:1	134:8 135:8,16,19	166:14
<b>interested</b> 5:22	<b>isolating</b> 48:14	<b>jump</b> 91:16 186:14	138:17,19 141:7	<b>late</b> 25:1 29:15
105:9	<b>isolation</b> 187:11,12	<b>jumper</b> 109:4,6,12	145:1 150:10	38:15 52:22
<b>interesting</b> 138:21	187:13,16 188:1,4	113:4 155:19	152:10 155:15	194:18

<b>Laughter</b> 80:14 91:20 133:16,19 170:14	<b>legs</b> 32:3 87:21 117:11,19 132:2,3 132:4 172:16	<b>lines</b> 111:21 115:14 115:15 133:3 169:16 186:11	153:22 172:1 181:2 201:12	<b>maintaining</b> 142:17
<b>layer</b> 47:5 154:14	<b>Leo</b> 2:17 53:22	<b>link</b> 5:7	<b>looked</b> 60:2 114:22	<b>maintenance</b> 27:1 152:17,19
<b>layers</b> 47:4 60:16 140:8,12	89:1	<b>liquid</b> 59:5 109:6 113:6 135:17 200:7,12	115:1 129:12 132:20 173:4	<b>major</b> 57:6 120:7 124:17
<b>leach</b> 131:18 160:12	<b>lessons</b> 138:20	<b>liquids</b> 201:5	<b>looking</b> 69:5 82:12 97:10,14 99:17 118:3 121:8	<b>majority</b> 25:11
<b>leaching</b> 36:5	<b>letters</b> 9:14	<b>list</b> 6:4 92:2,15 166:7 170:12	124:15 137:12 149:15 151:2 156:16 167:8 172:5 181:12 189:3	<b>making</b> 7:6 123:11 151:22 158:22 169:22 178:7 179:5 181:6
<b>lead</b> 32:12 33:17,17 36:19 62:18 89:11 139:11 141:3 164:3 184:22	<b>let's</b> 109:10	<b>listed</b> 6:6	<b>looks</b> 184:12	<b>man</b> 133:9
<b>leadership</b> 94:15	<b>level</b> 11:7 16:18 34:19 35:20 36:8 36:13 41:11 42:3 44:7 47:6,13 58:2 59:8 64:2,10,17 70:15 78:4 80:5 127:21 132:1,4 141:2,9 150:11 165:8 169:5 184:10 200:11	<b>listened</b> 96:17 133:10	<b>loop</b> 32:3 131:14,16 131:16,17 160:16	<b>managed</b> 73:5 93:7
<b>lead-in</b> 55:14 171:18	<b>licensable</b> 60:12	<b>listening</b> 139:14 141:16	<b>lose</b> 173:3	<b>management</b> 27:10 38:3 53:14 59:17 74:13 141:10 142:18 161:9 164:9 167:3,7,17 169:1 175:17 176:8 195:10,22
<b>leak</b> 22:19 43:2 44:14 48:5,8 49:7 49:21 50:8 58:7 152:9 154:8,8 155:11,17 182:9 183:7,8 198:5,16	<b>license</b> 141:14 142:18 150:8 166:11	<b>little</b> 51:15 63:4 80:11 122:8 135:1 138:13 139:4 156:3	<b>loss</b> 109:11 110:5 110:14 115:19 154:2,20 155:12 171:13 182:14,21 185:10 189:4	<b>manager</b> 18:12 19:2 24:3 53:15 54:3 69:15 75:16 87:12 89:3 196:14
<b>leakage</b> 12:4 49:21 198:19,21	<b>life</b> 11:11 12:21 13:7 36:3 69:18 80:3 84:13 100:13 126:14 158:9 159:2,5,7,11 193:15	<b>live</b> 115:18	<b>lot</b> 54:5 63:1 64:8 79:17 80:16 118:19 119:7 127:19 129:11 135:10 143:22 154:1 156:14 162:19 176:17 197:9 201:2	<b>managerial</b> 63:5
<b>leaked</b> 67:1	<b>liked</b> 171:12	<b>lived</b> 79:18	<b>lots</b> 141:11 162:14 162:16	<b>manages</b> 36:21
<b>leakers</b> 12:3	<b>likelihood</b> 16:21 75:18 120:19	<b>living</b> 77:16	<b>low</b> 31:10 107:1	<b>mandate</b> 15:5
<b>leaking</b> 12:1 151:18	<b>Likewise</b> 21:2	<b>loaded</b> 31:16	<b>lower</b> 45:14 64:2 141:9 150:7,17 159:17	<b>manifolds</b> 198:5
<b>leaks</b> 43:3 44:11,17 45:5 50:4,6 59:2 149:17 182:11,14 183:7,18 189:13 189:13,22 190:1 198:8	<b>limit</b> 6:21 48:14 99:11 195:2	<b>loading</b> 30:4 36:7	<b>luck</b> 201:18	<b>manner</b> 167:11
<b>learn</b> 14:18 138:20	<b>limitations</b> 16:21	<b>location</b> 5:2		<b>Mansfield</b> 1:17 4:11 105:1 106:6 106:7,21 107:7,9 107:17,20 108:4,7 108:14,20 109:3,9 109:20 110:3,10 110:14,18,21 111:9 112:2,6,10 112:13,16,18 113:3,19 114:1,4 114:6,10 115:10 115:16 116:3,11 116:16 117:4,10 118:4 131:12 151:5,8,14 152:5 152:12 191:7,8 192:21 193:19
<b>learned</b> 135:12 138:18	<b>limited</b> 7:2 14:15	<b>logic</b> 126:18		<b>MAR</b> 19:21 20:12
<b>learning</b> 62:11	<b>limiting</b> 63:20	<b>logics</b> 131:6	<b>M</b>	
<b>learnings</b> 126:15	<b>limits</b> 41:8 99:6 103:17	<b>logs</b> 36:8	<b>M</b> 2:13	
<b>leave</b> 108:5 109:22 147:17 157:3	<b>line</b> 46:9 89:9 94:13 100:4 107:2 113:4 113:5,10 115:8,8 115:12 116:17 128:3 131:21 132:9,13,17,18 142:7 152:8,18 165:2 184:5,7	<b>long</b> 32:2 66:22 67:17 107:9 108:5 111:9,10 115:19 115:19 117:19 160:11	<b>machinations</b> 64:1	
<b>led</b> 30:21 82:9 89:2 90:13 147:4		<b>longer</b> 31:22 115:19 201:12	<b>Madam</b> 179:7	
<b>left</b> 4:9,10,15		<b>long-term</b> 11:4	<b>main</b> 93:17	
<b>leg</b> 84:3 106:22 173:3		<b>LONI</b> 2:13	<b>maintain</b> 26:14 166:10 182:2 190:15	
<b>legitimate</b> 128:10		<b>look</b> 40:20 63:14 76:12 84:22 85:3 85:16 89:4 92:15 93:2,12 99:18 107:22 108:13 109:10 124:10 129:6 130:16 135:15 140:22 145:9,22 146:4 148:19 149:5	<b>maintained</b> 169:19	

20:17 23:4 26:7	165:18 168:18	157:5 159:8,22	123:6	<b>moment</b> 15:15
28:10 29:16 32:20	182:12 183:19	160:21 162:3	<b>minor</b> 57:8 142:16	137:10 156:5
37:13 40:4,13,17	192:4	163:9 164:20	146:1 159:4 161:5	<b>money</b> 70:19 201:3
41:2,8,16,18 42:1	<b>meaning</b> 124:14	165:1 166:13	<b>minute</b> 200:21	<b>monitor</b> 8:14
55:14 72:12 79:12	<b>meaningful</b> 70:8	168:1,2,13 169:15	<b>minutes</b> 6:22 195:2	<b>month</b> 15:9 43:15
80:22 82:9,19	<b>means</b> 34:17 46:2	170:11 172:14,18	<b>misalignment</b>	<b>months</b> 37:5
90:11 92:2,12,14	96:20	173:1,21 176:19	155:1 189:6	144:14,14
93:2,4,8,18 97:6	<b>measurable</b> 153:9	178:2 191:8	<b>missed</b> 62:9	<b>morning</b> 9:3 15:17
118:16 138:5,10	<b>mechanism</b> 100:15	192:21 193:19,22	<b>mission</b> 10:15 23:4	72:9 82:2 97:2
138:14 140:4	<b>mechanistic</b> 189:18	194:5,9	23:17 24:19 33:5	100:2 101:5,12
141:22 142:2	<b>meet</b> 32:13 46:15	<b>members</b> 1:21 2:10	34:1 35:1 69:6,8	102:14,19 104:14
147:2	97:6 103:6,12,16	3:3 4:17 5:22	69:13 193:14,15	119:15 133:13
<b>margin</b> 21:16 64:6	123:21 134:4,7	6:14 7:5 18:8,16	<b>misspoke</b> 131:22	155:7 160:1
75:10	138:5,6 148:20	23:21,22 33:10,15	<b>mitigate</b> 47:19 48:4	202:11
<b>market</b> 127:17	162:10,12 186:2	53:7 194:21	154:5 155:14	<b>morning's</b> 17:21
<b>mass</b> 159:19	<b>meeting</b> 1:5 4:6,21	201:22	197:5	34:10 51:5 81:20
<b>material</b> 17:14	6:2 7:4,13,19 16:8	<b>memory</b> 92:6	<b>mitigated</b> 151:20	<b>move</b> 38:11,11
19:21,22 26:6	34:2,11 39:15	119:16 127:5	<b>mitigation</b> 43:6	74:15 75:10 79:19
28:2 34:6,7 35:6	51:5 162:6 165:6	<b>mentioned</b> 171:6	50:5	133:7 137:6 140:3
42:20,22 47:20	<b>meets</b> 17:3 29:8	191:14	<b>mitigative</b> 30:11	140:15 166:8
49:12 54:6 64:14	51:22 100:8	<b>met</b> 1:10 74:1	182:12 183:14	<b>moved</b> 196:7
74:17 75:8 76:9	167:18	88:16 103:13	190:19 191:2	<b>moving</b> 75:7 76:3
77:3 88:8,9 89:6	<b>member</b> 1:15,16,17	127:6 129:8	<b>mix</b> 16:14 32:18	<b>multiple</b> 47:4 94:20
128:4 137:17	33:11 54:4 106:7	<b>method</b> 44:16 45:9	35:17 77:8 103:6	100:12 183:19
138:6 142:12	106:21 107:7,9,17	123:9	114:3 135:9	<b>multi-day</b> 112:7
<b>materials</b> 46:3	107:20 108:4,7,14	<b>methodology</b> 30:14	<b>Mixer</b> 131:7	<b>multi-decade</b> 35:1
108:19	108:20 109:3,9,20	43:1 45:10 58:7,9	<b>mixers</b> 35:16	<b>myopically</b> 60:6
<b>matrix</b> 145:18	110:3,10,14,18,21	59:3 142:14	<b>mixing</b> 17:1 20:8	<b>M3</b> 57:6 92:8 103:1
<b>matter</b> 76:22,22	111:9 112:2,6,10	162:11 164:17	21:17 57:5,21	146:1
90:20 143:12	112:13,16,18	175:2	71:18 103:6	
165:12 202:13	113:3,19 114:1,4	<b>methods</b> 40:9 44:9	113:22 144:7,8	<b>N</b>
<b>matters</b> 7:18	114:6,10 115:10	<b>metric</b> 136:20	156:8 161:15	<b>name</b> 4:3 6:10
<b>mature</b> 162:15	115:16 116:3,11	<b>mic</b> 195:13	<b>mixture</b> 11:2	33:12,15 171:8
<b>maximum</b> 14:17	116:16 117:4,10	<b>microns</b> 101:10,21	<b>mobilize</b> 192:15	195:7,18
36:7	118:4 119:3 120:2	<b>microphone</b> 195:15	<b>mobilized</b> 11:17	<b>national</b> 13:4 17:11
<b>ma'am</b> 56:11 66:11	120:11,18 122:2,4	<b>middle</b> 123:19	<b>model</b> 37:10 97:5	18:5 23:8 24:11
<b>McMurray</b> 122:15	125:11,15,21	124:1,4,12	114:21 125:5	28:1 29:2,13 31:4
<b>mean</b> 47:11 61:17	126:3 127:1,4	<b>mid-1950s</b> 12:2	<b>models</b> 156:11	31:17 32:6,12
68:1,1,2 79:9 80:2	128:16 130:18	<b>mid-1990s</b> 12:12	<b>modes</b> 64:11	97:4 196:13
86:7,7 108:4	133:8,20 134:5,10	<b>Mile</b> 171:7,12	<b>modification</b> 82:1	<b>National's</b> 30:2
110:21 114:16	134:20 135:4	<b>millirem</b> 44:21	158:2,8,21	<b>natural</b> 71:7
118:15 124:18	136:4 137:9 139:3	<b>mind</b> 70:20 81:19	<b>modifications</b> 8:8	162:20 163:4
133:21 134:15	145:3,7 146:6,11	122:9 135:11	126:20 157:13,21	<b>naturally</b> 65:1
135:18 139:8	146:19 147:12,19	139:2 164:21	158:3	<b>nature</b> 52:16 72:17
140:7,9 141:8	149:16 150:18	<b>minimize</b> 38:6	<b>modified</b> 19:20	181:9 196:6
154:13 155:16	151:7,8,14 152:5	49:22 155:1	55:12 74:3 78:2	<b>near</b> 15:22 36:5
159:9,22 161:21	153:14 155:20	<b>mining</b> 122:21,22	<b>modify</b> 55:19 123:9	<b>nearing</b> 144:19

156:21	<b>nice</b> 119:9	<b>O</b>	114:1 125:14	<b>operated</b> 37:3
<b>nearly</b> 119:6	<b>night</b> 194:19	<b>obligated</b> 161:8	134:5 139:20	70:14,15
<b>necessarily</b> 15:22	<b>night's</b> 114:19	163:16 164:18	140:9,15,21	<b>operating</b> 9:22
165:21 175:20	<b>nitric</b> 113:1 158:1	<b>obtaining</b> 13:2	141:14,22 143:19	16:22 37:5 39:10
<b>necessary</b> 8:9,18	<b>non</b> 50:6 189:17	<b>obvious</b> 82:15	146:19 154:1,3,8	64:19 65:4 74:4
16:20 23:15 33:3	<b>non-MAR</b> 42:2	164:2	154:12 161:6	91:5 95:6 96:19
121:22	<b>non-mechanistic</b>	<b>obviously</b> 72:12	162:3 164:11,20	96:21 100:14
<b>necessitate</b> 143:15	189:14	124:17 126:13	164:22 165:1	130:15 159:2
<b>necessity</b> 118:6	<b>non-safety</b> 188:5	128:22 187:19	168:1 180:19	197:15 201:13
<b>need</b> 12:4 17:5	<b>normal</b> 21:9 59:9	196:18	181:17 183:7,21	<b>operation</b> 3:16
21:16 40:13 45:1	63:20 128:12	<b>occur</b> 16:7 30:9	184:1,20 185:12	9:19 10:7 11:13
56:14 57:13 58:11	164:8	31:11 68:19 101:7	185:21 186:10	13:5 16:12 20:5
60:14,22 64:18	<b>normally</b> 38:13	<b>occurred</b> 70:1	188:8,17 189:8	23:14 32:17 34:5
70:12,13 77:8	<b>Northwest</b> 97:4	<b>occurs</b> 69:2	195:18 199:13	34:14 36:3 65:11
82:14 83:18 84:10	<b>note</b> 13:8 150:8,16	<b>OCTOBER</b> 1:8	<b>old</b> 10:13,14 66:22	67:10 72:3 81:4
84:19 106:14	<b>noted</b> 16:4 41:14	<b>offer</b> 83:11 139:15	68:16 70:18 72:21	89:12,12,13 90:4
114:2 121:18	178:12,17	139:18	<b>Olinger</b> 18:22	91:8 107:5 108:1
125:20 129:2	<b>notice</b> 5:21	<b>offered</b> 33:10	23:20 33:8 61:13	108:2,3 119:8
130:13 131:12	<b>noticed</b> 4:22	<b>offers</b> 33:11	82:7 87:19 89:4	124:9 128:18
136:19 140:14	<b>November</b> 7:9	<b>office</b> 18:13 19:1	174:21	129:18 130:11
143:14 144:5,18	29:18 91:22 106:3	24:3,7,15 29:1,14	<b>once</b> 14:12 26:20	169:20
144:19,21 150:9	106:4	31:20 53:15 61:9	31:7 32:15 84:7	<b>operational</b> 12:20
155:3,13 156:21	<b>nuclear</b> 1:3 4:5,19	69:3,4,6,14 74:11	109:17 169:16	13:7 14:13 25:19
168:5,9 170:21	8:5 22:7,10,15	74:13 75:13,15	<b>ones</b> 57:9	26:21 28:4 33:2
173:19 191:22	24:6 29:11 33:18	87:11,13 89:3	<b>one-forth</b> 38:20	35:5 39:20 63:16
<b>needed</b> 26:16 73:14	54:2 59:18 63:13	143:2 167:3 169:7	<b>one-of-a-kind</b>	68:9 73:10 75:5
115:21 121:1	63:17 84:9 91:5	171:3 180:22	35:12 126:16	76:7 93:14,22
123:17 165:9	96:6 144:20 146:3	181:5	<b>one-tenth</b> 201:8	94:3
177:13	167:13 169:3,6	<b>offset</b> 43:21	<b>ongoing</b> 167:12	<b>operationally</b>
<b>needs</b> 71:4 95:22	170:17 175:19	<b>offsite</b> 109:11	<b>online</b> 169:19	66:16
102:6 171:22	176:5,10 177:12	110:5,15 112:2	<b>onus</b> 140:10	<b>operations</b> 11:4
<b>neither</b> 27:15	178:10,14 179:4,8	115:20 118:7	<b>open</b> 5:3 7:9	19:11 20:15 26:15
<b>net</b> 31:9	179:18 180:7	<b>off-normal</b> 132:16	<b>opening</b> 3:2,4 18:7	47:3 54:1 63:21
<b>never</b> 64:3 111:3	181:15 189:12,21	<b>Oh</b> 172:17 184:22	18:9 63:2 82:6	70:11,13,20 71:1
119:11 127:7	195:9,20,21 196:9	<b>oil</b> 127:15 196:7,9	100:10,11 147:20	72:14 73:15,16
185:6	196:12	196:10	152:3	83:4 90:15 93:6
<b>new</b> 8:4 19:22 23:4	<b>number</b> 20:6 25:10	<b>okay</b> 55:22 56:12	<b>operability</b> 39:3	96:9 100:11,21,21
32:8,13,20 41:7	27:16 28:5 74:20	56:12 58:5 61:7	89:5	115:6 142:5 147:6
48:9 51:20 69:3	78:6 81:21 92:11	62:20 63:6,10	<b>operable</b> 149:4	165:18 166:22
88:7,10,11 100:15	93:7 117:8 119:18	64:21 65:7,13	<b>operate</b> 10:20	169:3
120:13 121:4,15	119:20 120:3,3,10	67:8 78:14 81:1	16:13 34:21 38:17	<b>operator</b> 76:14
128:9 137:17	140:6 148:14	81:14 85:6 87:3	39:17 86:6 87:15	96:4 121:11
138:5,6,8 144:20	191:19,20 193:8	90:5 97:9 99:8,20	89:19 90:1,22	154:22 188:3
156:18 162:21	193:15 198:2	99:21 100:7 103:6	94:5,14,18 95:1	<b>operators</b> 94:21
177:13,15 178:1	<b>numerous</b> 22:11	103:12,17 104:20	95:14 105:7	95:14,18
<b>news</b> 104:14	198:6	106:5 107:4,8,11	119:11 147:10	<b>opinion</b> 75:12
<b>Newtonian</b> 50:7		108:20 109:10,15	160:10,19 166:9	91:10 92:19

176:14 180:16 198:22 <b>opportunities</b> 129:19 <b>opportunity</b> 6:15 6:20 18:17 24:1 83:13 84:1 107:22 <b>opposed</b> 123:12 <b>ops</b> 68:6 <b>optimize</b> 36:7 69:18 <b>options</b> 14:14 136:19 159:3 <b>oral</b> 9:9 <b>order</b> 6:7,9,18,19 47:16 138:4 175:22 <b>orders</b> 177:1 <b>ordinary</b> 106:15 <b>organic</b> 99:11 <b>organization</b> 56:4,8 56:10 57:12 60:4 <b>organizations</b> 53:11 <b>original</b> 6:21 129:7 <b>originally</b> 27:7 126:7 <b>ORP</b> 61:8 90:13 147:5 <b>ought</b> 138:19 <b>outcome</b> 124:7 161:21 <b>output</b> 161:22 <b>outside</b> 26:17 87:22 117:20 <b>outstanding</b> 14:8 <b>overall</b> 24:21 32:22 58:21 59:4 81:22 142:4 <b>overconservative</b> 78:22 <b>overcrowding</b> 26:18 <b>overly</b> 89:7 <b>oversight</b> 4:18 9:17 12:14 74:12 75:13 87:13 124:5	166:22 169:5 176:3,10 <b>overtly</b> 130:14 <b>over-conservative</b> 92:18 <b>owner</b> 24:6 <b>owners</b> 61:10 90:7 105:13,14 <b>ownership</b> 122:20 <b>owning</b> 122:22 123:1 <b>owns</b> 123:19 <hr/> <b>P</b> <hr/> <b>Pacific</b> 97:4 <b>package</b> 29:5,14 <b>pages</b> 15:10 <b>panel</b> 1:21 2:10 3:7 18:6 53:9 54:4,17 <b>panelist</b> 54:11 <b>panelists</b> 54:7,8 <b>paper</b> 129:12 138:2 180:9 <b>paragraph</b> 8:21 <b>parameter</b> 42:19 74:22 128:14 178:15 <b>parameters</b> 44:18 45:6 64:9 65:9 73:22 76:8 89:7 103:22 104:10 <b>paramount</b> 142:18 <b>part</b> 9:4 15:13 16:1 30:14 47:3 49:7 71:3,18 80:17 105:17,19 117:8 117:22 122:22 123:1 131:4 132:18 148:9 151:21 156:4,6 158:3 162:20 167:14 170:7 175:2 181:2 188:14 190:1 <b>participate</b> 18:5 176:5 <b>particle</b> 36:12	72:15 <b>particles</b> 101:9,20 191:15 <b>particular</b> 87:11 136:5,16 162:19 169:2 174:18 177:21 181:12 <b>particularly</b> 36:14 50:6,22 52:15 72:21 127:16 132:6 157:12,15 <b>parts</b> 88:7 144:17 <b>passive</b> 26:19 32:18 148:12 <b>path</b> 14:6 22:22 108:5 161:11 <b>paths</b> 151:17 152:9 <b>Patrick</b> 3:20 195:6 195:7,19 <b>Paul</b> 2:16 104:17 <b>pause</b> 60:4 <b>PDSA</b> 50:15,20 51:8,22 52:22 55:7,8,13,17 57:7 57:7 59:1,1 85:14 105:18 139:5,5,9 140:19 141:20 142:11,21 143:14 143:15 145:12 146:4,8 149:21 162:12,17 163:7 182:15 <b>pedigree</b> 154:16 183:12 <b>peer</b> 180:11 <b>people</b> 6:6 95:4 136:12 139:19 <b>perceived</b> 40:13 <b>percent</b> 13:11,13 13:14 19:14,15,16 20:10 25:13 52:11 78:2,11,12,13 126:11 159:17 200:14,15 <b>perform</b> 47:8 58:15 73:17 <b>performance</b> 13:6	17:1 54:1 58:8 186:1 <b>performed</b> 49:9 175:5 178:21 <b>period</b> 24:10 28:21 165:11 <b>periodically</b> 8:13 <b>permanent</b> 49:19 <b>permeate</b> 200:10 <b>permit</b> 7:2 <b>permits</b> 195:3 <b>permitting</b> 32:2 <b>person</b> 69:5,5 93:5 94:11 <b>personally</b> 94:3 <b>perspective</b> 19:8 24:5 25:19 56:2 56:15 57:15 61:10 61:18 71:17 82:12 90:7 105:15 108:17,17 121:8 167:8 172:11 176:4 177:5 182:8 <b>Peter</b> 1:12,14 4:4 <b>PEURRUNG</b> 2:13 <b>phase</b> 74:11 143:13 <b>phenomenology</b> 22:20 <b>philosophy</b> 14:19 <b>phrase</b> 185:22 <b>physical</b> 73:22 124:7 <b>physically</b> 124:3 <b>pick</b> 154:10 155:13 156:21 157:1 190:22 <b>picked</b> 165:13 189:9 <b>piece</b> 173:2 <b>pieces</b> 144:17 148:15 <b>pilot</b> 177:10,14,21 181:6,13 <b>Pinto</b> 3:20 195:6,7 195:8,16,18,19 199:9,13 200:17 200:19 201:1,16	<b>pipe</b> 31:10 32:13 49:20 55:20 111:13,15 150:3 155:15,15 163:10 170:9 183:18,18 185:1,1 191:5 <b>pipeline</b> 122:15 <b>pipes</b> 30:20 35:7 136:13 153:18 154:8,16 162:5,22 165:11 171:22 182:15 197:1 <b>pipng</b> 17:18 20:1,2 20:9 21:5 25:5 26:9,13 27:18 28:18 30:9 31:14 31:18 32:10 43:2 43:6 44:11 46:4,6 46:8,11,13,20 47:12 48:11,15,19 49:2,5,10,15,17 50:1 51:10,19 109:19 145:14 149:20 150:15 152:1,6,9 155:8 181:22 182:2,9 185:5,14 186:3 187:3,8,9 189:16 190:1,6,8,13 <b>pitching</b> 122:12 <b>pivot</b> 14:5 <b>pivoting</b> 13:22 14:22 <b>PJMs</b> 131:7,10 197:10,10 <b>place</b> 85:10 101:12 102:10 123:22 <b>places</b> 37:22 38:10 119:10 182:20 <b>plan</b> 9:7 19:10 30:2 31:4,6 68:6 144:3 144:12,12 156:4 192:14 <b>planned</b> 88:13 191:20 <b>planning</b> 14:2 57:3 57:11 60:20
---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

144:13 153:2 199:5 <b>plans</b> 173:11 <b>plant</b> 9:7 10:5,7,18 12:11,11 13:6,11 13:12,18 14:11 16:10,12,14,16 18:1 19:3,5,12 20:13,16,19,22 22:1,5 23:2,4,6,15 24:13 28:2,11 31:5,14 33:21,22 37:7 38:16 39:17 40:2 53:18,19,21 54:3 69:10 71:1,8 75:11 76:3,7 78:4 78:9 87:16 88:18 89:5 90:9,22 92:19 94:20 95:1 95:10 100:14 101:11 105:6,16 116:5 119:1 120:21 124:8 126:1 128:19 134:1,13 155:22 159:11 166:9 173:8 175:8 176:16 177:9,20 178:16,18,22 179:15,19,21 180:4,6,11 196:17 197:15 <b>plant's</b> 14:4 16:22 17:1 <b>plan's</b> 31:2 <b>play</b> 130:15 140:1 <b>plays</b> 23:2 <b>please</b> 78:16 97:16 105:2 145:6 174:15 186:14 195:17 200:22 201:20 <b>plug</b> 115:14 157:16 158:11 <b>plugging</b> 111:14,16 111:22 115:8,9,12 131:21 132:6,7,9	132:13,17,18,22 <b>plugging/bursting</b> 35:6 <b>plugs</b> 133:2 <b>plutonium</b> 36:15 36:16 101:9,20 197:2 <b>PNL</b> 132:20 <b>PNNL</b> 2:13 97:3 <b>pockets</b> 117:1 <b>point</b> 16:6 26:12 59:14,19 65:9 76:21 79:12 81:18 83:19 88:1 91:2 97:1,21 107:1 117:7,8,13,16 120:14 124:17 126:10 128:20 130:2,5 133:13 140:15 141:11 142:16 146:5 156:20 181:6 <b>polices</b> 167:10 <b>policies</b> 25:1 167:19 <b>policy</b> 23:7 33:2 46:22 166:17 168:4,5 <b>polishing</b> 200:3 <b>poor</b> 11:13 <b>portion</b> 59:5,6 202:4 <b>position</b> 18:18,22 33:12 39:7 100:1 100:4,16 125:1 169:13 179:9 <b>positive</b> 135:11 <b>possibilities</b> 151:18 <b>possibility</b> 73:1 88:15 <b>possible</b> 5:11 6:8 14:17 21:6 36:7 48:20 52:3 106:13 121:3 182:1 <b>post</b> 131:18 149:2 <b>posted</b> 6:5 <b>postpone</b> 7:12	<b>postulate</b> 182:20 183:10 <b>postulated</b> 140:21 <b>postulating</b> 183:12 <b>posture</b> 73:11 <b>post-DBE</b> 187:17 188:2 <b>post-seismic</b> 187:17 <b>potential</b> 12:20 17:9 30:4 32:4 37:18 39:3 45:18 48:12,14 49:11,22 62:5 63:15 70:3 83:14 111:15 132:9,13,16 144:9 148:18 155:1 183:3 189:4 <b>potentially</b> 41:4 48:15 72:14 140:4 <b>power</b> 109:11,13 109:21 110:1,6,11 110:15,15 111:7 112:3 113:9,15,15 113:17 114:9,12 114:16 115:11,20 115:22 118:8 131:20 188:5 <b>PRA</b> 136:17 166:14 171:14 <b>practical</b> 25:20 28:8 <b>practice</b> 5:20 176:1 177:12 <b>practices</b> 167:5 175:19 <b>precedent</b> 194:6 <b>precipitation</b> 108:8 157:13 <b>preclude</b> 156:17 157:13 158:10 <b>predecessor</b> 18:21 <b>predicated</b> 123:11 <b>predicted</b> 45:11 171:11 <b>Predicting</b> 157:4 <b>preliminary</b> 19:19	32:11 50:14,15,18 55:2 60:22 144:13 <b>premise</b> 73:20 158:16 199:15 <b>preparation</b> 39:15 <b>prepare</b> 29:3 <b>prepared</b> 31:4 53:3 <b>prequalification</b> 160:9 <b>prequalified</b> 37:4 <b>present</b> 1:13,18,21 2:10 4:20 28:18 108:3 199:7 <b>presentation</b> 6:11 6:15 29:9 <b>presentations</b> 7:2,6 <b>presenters</b> 6:21 <b>presents</b> 108:2 166:15 <b>preside</b> 4:6 <b>President</b> 53:22 <b>presiding</b> 1:12 <b>press</b> 175:22 176:12 <b>pressure</b> 38:10 152:17,19 <b>pressurized</b> 115:4 131:14 <b>pretreat</b> 59:19 111:4,4 145:10 158:4 159:1 <b>pretreatment</b> 3:9 3:16 17:10,13,16 18:20 19:8,13 20:5,13 22:21,22 24:4,9,22 25:11 26:8 28:18 32:22 34:4,12 38:18 41:13 43:4 50:18 52:8,10,18 53:1 56:19 90:9 105:17 106:11 155:22 160:5 172:6 201:11 <b>pretty</b> 57:9 120:22 123:11 124:13 151:3	<b>prevent</b> 8:22 47:19 48:22 75:21 155:10,14,17 157:16 182:11 183:18 <b>preventative</b> 25:7 27:17 <b>prevented</b> 48:10 49:5 <b>preventive</b> 183:15 <b>previous</b> 6:16 16:2 85:13 87:11 118:1 <b>previously</b> 37:9 78:11 148:10,16 152:22 <b>price</b> 127:17 196:10 <b>primarily</b> 84:22 189:2 <b>primary</b> 17:20 34:17 43:4 46:2 47:12,19 49:7,10 100:5 153:17 170:8 180:22 182:22 185:11 190:6,8,12,22 191:5 <b>principally</b> 25:6 <b>principle</b> 25:18 <b>prior</b> 20:17 24:2 26:2 38:13 125:17 <b>priority</b> 47:21 <b>private</b> 196:19 <b>privatization</b> 12:15 <b>Probabilistic</b> 136:17 <b>probability</b> 31:10 136:17 <b>probably</b> 62:22 81:12 84:2 108:11 148:5 150:16 155:6 173:18 186:8 <b>probe</b> 118:13 <b>problem</b> 10:9 11:15 116:19 135:8 136:11,14
--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

137:5 166:14,15 171:1 172:20 173:6,7 195:13 200:6,16 <b>problematic</b> 11:22 73:1 <b>problems</b> 35:5 38:2 135:6,10 166:13 198:19 <b>procedures</b> 39:10 167:10 <b>proceed</b> 7:16 <b>proceeding</b> 7:8 <b>proceedings</b> 15:8,9 15:14 <b>process</b> 13:3 18:2 21:21 42:16 44:11 46:4 47:18 48:22 49:1,2,5 52:15 59:17 63:6 65:15 71:22 76:12 80:11 80:20 84:8 96:22 97:13 122:6 124:1 125:9 126:10 127:9,12 128:5 131:16 136:2 139:6,19 141:9 148:1,8,9 156:7 156:19 158:2,6,12 160:11,19 161:14 161:18 164:8,16 165:3,4,20 167:15 169:14 175:16 176:6,9 178:7 186:11 193:7 196:3 197:5 198:3 198:3 201:8 <b>processed</b> 26:4 35:18 100:13 <b>processes</b> 24:18 38:6 56:22 <b>processing</b> 17:5 27:11,12 35:22 122:13 123:1 134:17 142:8 <b>Process/Cesium</b> 158:1	<b>procuring/instru...</b> 23:10 <b>produce</b> 56:15 <b>product</b> 127:16,17 173:20 <b>professional</b> 198:22 <b>profile</b> 78:8 <b>program</b> 28:21 70:16 103:2 121:7 122:1 164:9 167:8 167:17 169:1 175:17 196:4 <b>programs</b> 94:16 <b>progression</b> 20:18 21:9 71:7 <b>project</b> 9:11 11:6 11:20 12:13,14,21 12:22 13:2,18,19 14:21 19:5,14 21:10 22:2 23:9 27:21 29:12 32:16 38:3 39:9,12,22 44:2 52:16 53:2 53:17,18 56:18 58:20 59:10 60:19 69:3,15 84:13 92:14 93:4 97:3 122:20,20 123:13 123:15 124:20 127:7 144:7 156:11 159:3 196:14 198:7 201:18 <b>projected</b> 10:14 13:6 <b>projects</b> 186:13 <b>project's</b> 21:5 22:14 28:20 38:9 182:13 <b>promulgation</b> 177:22 <b>proper</b> 10:6 192:5 <b>properly</b> 124:2 132:11 <b>properties</b> 11:16 192:2	<b>proposal</b> 50:10 <b>propose</b> 197:6 <b>proposed</b> 29:10 48:12,13 52:20 <b>protect</b> 63:10 65:10 154:19 155:3 164:5 190:21 <b>protected</b> 26:16 85:5 163:20 171:22 <b>protecting</b> 46:2 131:19 <b>protection</b> 8:10,19 10:1 18:13 19:1 24:3,7,15 27:3 29:2,15 31:21 45:21 53:16 61:9 64:18 69:7 74:11 75:14,16 87:12,14 89:3 143:3 <b>prototypically</b> 131:9 <b>proven</b> 12:3 <b>proves</b> 50:4 <b>provide</b> 11:5 14:5 17:5 18:13,19 22:8 24:2,5 40:19 47:18 115:3 124:5 155:3 156:22 171:21 <b>provided</b> 15:10 50:3 117:5 <b>provides</b> 125:2 154:12 157:2 <b>providing</b> 113:9 114:15 198:14 <b>provision</b> 109:4,6 <b>provisions</b> 5:4 <b>provocative</b> 66:15 <b>prudent</b> 14:19 62:14 179:20 180:2 <b>public</b> 1:5 3:19 4:6 5:3,16,22 6:2,14 7:19 8:10,19 10:2 10:19 15:6,7 16:8 23:22 41:15 42:21	43:13 44:20 45:3 45:11,17,18,19,21 46:2 49:12 194:22 202:1,3 <b>publicly</b> 4:22 <b>public's</b> 201:3 <b>pulled</b> 102:16 <b>pulse</b> 35:16 131:7 <b>pump</b> 25:13 106:18 110:8 111:12 114:15 <b>pumping</b> 188:6,6 200:7 <b>pumps</b> 110:16,19 110:20 111:1,6,8 114:7,9 115:22 136:12 150:19 188:5 <b>purge</b> 148:12 <b>purges</b> 116:22 <b>purpose</b> 51:12 66:7 102:19 <b>purposely</b> 74:21 <b>purposes</b> 117:12 <b>pursued</b> 13:1 <b>pushing</b> 168:3 <b>put</b> 41:4 57:13 98:13 101:3,17 105:13,14 124:14 128:13 145:18,20 <b>puts</b> 101:18 <b>putting</b> 130:1 179:12 <b>P&amp;ID</b> 145:13 <b>P&amp;IDs</b> 156:11 <b>P-R-O-C-E-E-D-...</b> 4:1 <b>p.m</b> 4:2 202:12	165:3,5 166:5,15 167:5,9,18 168:7 168:9 169:2,13,18 171:14,19 173:10 174:3,19,22 175:9 176:2,12,14,21 177:4,14 181:6,13 <b>QRAs</b> 52:2 <b>qualification</b> 121:12 151:22 153:6,7,10 <b>qualified</b> 151:17 152:15,18 153:8 186:5 187:13 <b>qualify</b> 187:7,10 <b>quality</b> 47:6,14 154:16 <b>quantification</b> 137:3 <b>quantitative</b> 30:2,5 30:6 51:9 107:13 <b>quarterly</b> 41:21 <b>question</b> 7:5 42:1 54:12,13,17 55:1 61:19 64:22 66:14 68:10,21 70:1 76:16 83:5 85:20 87:10 96:13 100:17 106:20 119:14 124:10 126:20 133:12 137:11 140:2 144:8,9 145:2 147:8,22 149:18 151:6,15 152:7 156:14 165:20 169:16 170:12 171:17 173:7,22 174:10,14 178:3,5 181:18 185:20 <b>questioning</b> 100:4 116:18 130:8 <b>questions</b> 15:11,12 15:16 16:5,6 39:14 53:5,7 54:9 59:3 71:15,18 81:7 105:2 106:8
------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

107:16 119:2,9 128:9,10 141:18 169:12 193:20 194:10 <b>quick</b> 167:22 <b>quote</b> 8:3 90:10	118:13,22 123:9 123:17 128:12,17 130:2,13 131:7 136:2 141:17 150:13 158:15 160:22 166:2 172:9,10 197:20 198:12,13	<b>recommended</b> 28:9 28:15 <b>reconfigure</b> 95:22 <b>reconvene</b> 7:12 202:10 <b>record</b> 7:8 9:8 15:14 33:13 54:12 54:13 71:4,20 92:5 96:16 105:14 124:19 147:12 163:2,3 174:16 199:12 201:21 202:13	<b>refining</b> 123:7 <b>reflect</b> 21:3 24:16 55:12 74:16 141:2 142:2 <b>reflecting</b> 55:5 <b>reflects</b> 141:21 <b>refreshing</b> 142:10 <b>refuge</b> 196:11 <b>regard</b> 36:14 <b>regarding</b> 38:2 39:6 44:8 <b>regardless</b> 75:3,4 77:9 135:19 189:16,20 <b>Register</b> 4:22 5:21 <b>registered</b> 6:17 <b>regulate</b> 7:11 <b>Regulations</b> 30:15 <b>regulator</b> 24:7 <b>reinforce</b> 151:15 <b>relate</b> 35:3 <b>related</b> 12:18 37:17 42:3 52:2,2 173:10 <b>relating</b> 8:16 <b>relation</b> 73:2 <b>relative</b> 132:21 186:22 <b>release</b> 42:22 46:3 48:14 49:11 154:5 162:2 <b>released</b> 84:7 <b>releases</b> 47:20 48:10 <b>reliability</b> 33:3 47:9 62:1 76:8 90:14 147:5 <b>reliable</b> 24:18 32:17 89:11 90:4 95:11,13 129:12 <b>reliably</b> 86:6 89:20 91:1 <b>relied</b> 28:13 89:13 <b>relies</b> 47:6 <b>relook</b> 149:11 <b>rely</b> 49:21 <b>relying</b> 48:2 75:17	80:18 153:16,18 <b>rem</b> 44:21,22 45:4 45:12,19 <b>remain</b> 5:12 7:9 36:2 42:11,14,17 156:1 <b>remains</b> 11:22 15:3 39:21 <b>remarks</b> 3:2,4 18:7 18:9,14,19 24:2,5 195:2 200:21 <b>remediate</b> 10:21 <b>remediation</b> 34:15 <b>remedy</b> 66:3 <b>remember</b> 79:17 81:7 92:4 95:20 <b>remote</b> 27:1 <b>removal</b> 149:6 <b>remove</b> 64:22 65:2 68:13 76:15 87:21 87:22 88:1,2 103:20,22 104:10 113:5 133:2 158:12 200:10 <b>removed</b> 40:15 101:15 117:12 <b>removing</b> 12:8 40:18 41:2 140:14 <b>renoticed</b> 5:1 <b>replace</b> 158:13 <b>report</b> 41:21 61:8 93:1,16 95:3,4 105:20,22 119:22 132:14 143:11 171:8,8 <b>reports</b> 29:22 161:16 167:13 198:8,22 <b>represent</b> 20:10 <b>represented</b> 10:22 73:18 <b>reprocessing</b> 195:9 195:21 <b>request</b> 18:11 27:8 89:2 150:12 <b>requested</b> 18:4 25:2
<b>R</b>	<b>reanalyzing</b> 40:5 <b>reason</b> 104:16 119:4 188:15 199:16 <b>reasonable</b> 8:8,15 45:6 93:3 94:19 128:10 <b>reasonably</b> 43:10 44:3 79:1 93:10 93:18,21 96:7 125:16,22 <b>reasons</b> 113:18 <b>rebooting</b> 93:17 <b>recall</b> 148:6 171:6 <b>receipt</b> 78:4 <b>receive</b> 159:16 <b>received</b> 41:6 78:3 <b>receives</b> 74:12 <b>receiving</b> 11:8 <b>recess</b> 7:12 <b>recessing</b> 202:10 <b>recipe</b> 97:6 <b>recipes</b> 138:5 <b>recirculate</b> 160:15 <b>reclassification</b> 148:18 <b>reclassify</b> 42:10 <b>recognize</b> 27:20 <b>recognizes</b> 34:14 34:21 <b>recognizing</b> 30:7 145:9 <b>recommend</b> 8:7 <b>recommendation</b> 9:13 28:19 92:22 168:3 174:4 <b>recommendations</b> 8:16 9:10,12 29:1 29:6	<b>recording</b> 5:9 <b>Recovery</b> 158:1 <b>recycled</b> 98:8,9 <b>redesign</b> 13:9,12 <b>redlined</b> 145:17 <b>reduce</b> 12:9 17:16 21:12 40:3,13 62:5 75:10 79:12 93:21 94:2 130:17 140:4,5,6 <b>reduced</b> 20:19 21:3 37:13 42:5 71:9 150:2 <b>reduces</b> 71:22 <b>reducing</b> 32:4 34:18 40:6 42:1 79:2 <b>reduction</b> 17:14 19:21 20:12,16 40:12 41:16 61:11 72:12 74:18 82:8 82:21 118:16,22 158:8,9 <b>redundancy</b> 83:3 <b>reevaluating</b> 40:8 <b>refer</b> 157:9 <b>reference</b> 130:22 <b>referred</b> 13:21 26:6 149:9 <b>referring</b> 77:7 152:3 <b>refine</b> 84:7 <b>refined</b> 21:11 57:3 184:11		

<b>requests</b> 54:8	38:13 42:8 104:18	<b>review</b> 8:2,4,14	27:4 28:3 30:3,5,6	<b>rocket</b> 189:1
<b>require</b> 45:20	121:18 143:3	28:2 30:19,22	34:7,18 36:20,21	<b>role</b> 8:2 23:2 75:13
137:17 191:11,13	166:8 178:8,8	31:1,8,12 32:7	37:8,16 38:3 51:9	100:2,6,16,22
191:13,15 192:1,7	<b>resolving</b> 10:8 32:6	40:17 42:1 56:8	52:22 59:13 62:6	102:7 121:21
192:8,9 193:1	139:21	56:11 59:18 92:1	70:3,6,15 71:6,11	<b>room</b> 5:16 6:13
<b>required</b> 27:16	<b>respect</b> 9:5 24:8	92:3,11 173:16	72:2,19 73:10,11	70:22
29:3 37:16 46:15	144:9 165:19	175:15 176:16,20	73:18 74:17 75:8	<b>route</b> 165:13
47:8 85:17,18	169:12 175:16	180:9	75:10 76:3,9 77:3	<b>routes</b> 32:13
96:6 113:17 117:1	179:3 186:5	<b>reviewed</b> 180:12	77:4,5,12 78:8	106:13
133:2 135:21	201:14	<b>reviewing</b> 28:22	79:2,4 88:8,9 89:6	<b>route-specific</b> 30:3
163:8 164:3 190:2	<b>respectfully</b> 180:14	34:12 44:6 92:8	107:13 123:6,7	<b>routine</b> 57:2
192:3	<b>respond</b> 77:21	<b>reviews</b> 13:2 33:20	136:17 137:6,13	106:14 166:11
<b>requirement</b> 78:5	78:15 96:16	56:4 105:8	137:17 138:7	<b>routinely</b> 36:20
78:10,12 80:3	<b>response</b> 15:16	<b>revised</b> 39:19 40:19	142:12 166:1	107:4
85:5 98:19 101:8	21:5 22:13 39:14	41:10 44:7 51:1	168:4 176:14	<b>Roy</b> 33:16
149:12,13 152:16	53:8 69:1,2 81:6,8	82:13,20 138:9	<b>risks</b> 37:1 38:13	<b>Roy's</b> 152:3
153:3 192:22	102:4 131:13	<b>revision</b> 85:9 150:5	108:1 191:17	<b>rule</b> 164:17 166:1
<b>requirements</b>	178:13 194:13	157:10	<b>River</b> 11:19 18:13	<b>rules</b> 183:16
12:19 22:8 23:12	198:20 202:2	<b>revisions</b> 157:20	19:1 24:3,7,15	<b>run</b> 117:16,20
26:10 28:11 29:8	<b>responses</b> 71:15	<b>rheology</b> 72:16	27:13 29:1,14	131:8 200:6
39:11 41:4 43:5	88:14	108:13,19 192:17	31:20 53:15 61:9	201:11
46:17 49:14,18	<b>responsibilities</b>	<b>Richard</b> 1:19 4:15	69:7 74:11 75:14	<b>running</b> 83:21
50:21 51:22 52:4	9:18 121:15	202:8	75:15 87:11,13	94:13
52:5 55:4,18,19	<b>responsibility</b> 19:4	<b>rid</b> 197:20 199:1,6	89:3 98:3,10	<b>Russo</b> 2:14 53:18
63:19 65:17 76:13	<b>responsible</b> 33:19	<b>rig</b> 114:13 115:20	143:3	122:2,3,7 125:13
77:17,22 78:1	<b>restored</b> 112:5	118:6	<b>Rivers</b> 1:10	125:19 126:1,6
80:21 84:18 88:12	<b>restrict</b> 101:12	<b>right</b> 4:11,12,17	<b>Roberson</b> 1:15	127:3,11 128:21
90:11 103:7	<b>restriction</b> 81:9	7:10 55:6 56:6	4:10 54:18,19	145:5,8 158:20
134:16 138:7,8	<b>restrictions</b> 101:18	61:4 62:6 64:14	55:22 56:3,12	<b>Rutland</b> 2:16
141:4 143:18	<b>restrictive</b> 17:4	65:17 66:1,4,7	57:20 58:17 59:11	101:14 102:18
144:21 147:2	72:11	73:17 80:9 84:10	61:2,7,22 62:4,8	103:8,11 104:15
152:16 162:7,9	<b>result</b> 17:2 30:10	86:20 87:5 93:14	62:20 64:5,13,16	160:1
165:6,7 166:1	31:9 35:4 42:9	94:15,15 97:7	64:21 65:4,7,13	
174:2 175:10	43:12 44:15 73:8	104:3 114:10,17	65:20 66:1,6,9,12	<b>S</b>
192:16 193:13,18	80:21 81:22 82:7	115:5 116:6	66:20 67:4,8,11	<b>S</b> 1:12,14 2:12
<b>requires</b> 192:14	86:11 120:13	118:21 126:2,12	67:12,19 69:20	<b>safe</b> 13:5 32:16
<b>requiring</b> 163:19	138:9 179:17	136:21 144:2	71:13 72:4,7	70:22 164:17
<b>reserved</b> 109:12	<b>resulted</b> 73:13	151:13 153:12	73:14 76:10 77:13	198:9
<b>reserves</b> 7:10	<b>resulting</b> 16:22	163:3 168:20	77:20 78:14 79:5	<b>safely</b> 10:20 18:1
<b>resin</b> 199:7	25:16 32:17 34:7	173:19 180:1	79:8 80:7,10,19	34:22 38:17 69:19
<b>resolution</b> 31:3	34:18 39:1 50:17	185:2 191:19	81:1 96:11,12	70:12,21
57:4,8 58:6	51:22	<b>rigor</b> 169:8	97:9 99:8,13,21	<b>safer</b> 89:13 171:19
111:20 173:15	<b>results</b> 28:20 32:12	<b>rigorous</b> 46:15	123:5 129:10	172:4,12
<b>resolve</b> 14:8 21:17	43:12 59:2 120:20	167:11	137:4,14 141:19	<b>safety</b> 1:3 3:9 4:5,8
30:17 40:1 57:10	156:8 175:15	<b>rise</b> 45:19 58:1	180:18,19	8:11,19 10:2,2,8
57:18 58:2 116:20	<b>retaining</b> 49:1	<b>risk</b> 11:3 17:15	<b>robust</b> 46:8,21	10:21 12:10,19,20
<b>resolved</b> 14:12 37:1	<b>retrieved</b> 37:4	19:21,22 26:7	49:19	15:7 16:11,19

17:12,17 18:20 19:3,9,18,19 20:4 20:13,14 21:18 22:2,7,15 23:7,13 24:4,6,8,14,17,21 25:1,7,10,14,15 25:22 27:18 28:12 29:4,8,11,22 30:8 30:19 32:22 33:1 34:8,13 35:3,4,11 39:10,11,20 40:14 40:19 42:10,12,13 43:3 45:1,20,22 46:17 47:2,14,16 47:17,22 49:1,9 50:13,14,16,18,21 51:2,3,7,10,17 52:1,5,9,20 54:2 55:2,3,5,17,18 56:5,7,14,15 58:4 58:14,16 59:4,17 59:18 60:1 61:3,8 61:18 62:6 63:7,9 63:13,17,19 64:19 65:10,16,17 75:10 82:12,16 83:8,8 83:19 84:10,16,17 85:5 86:9 90:14 93:7,19 95:19,21 96:6 105:20,21 110:7 113:17 114:18 116:4 118:20 119:8,21 119:21 121:2,17 121:20 129:5 136:11 140:6,11 140:22 141:3,10 141:14 143:11,18 144:20 146:3 147:6 148:11,17 149:13 150:1,2,7 150:17,21,22 151:22 152:1,15 154:12 155:8 156:1,22 157:2 161:1 162:6,9 164:9 165:6,19	166:21 167:13 169:6 170:6,16,17 170:21 171:4 173:3,6,6,7 175:1 176:5,10 178:10 178:14,18 179:2,5 179:8,18 180:7 181:15 185:6,14 186:2,9,15,21 187:4,6 189:21 190:2 194:2 196:15 197:22 198:14 <b>safety-related</b> 3:12 22:5 23:10 34:3 38:8 39:2 40:21 162:4 163:12 <b>Sain</b> 2:17 53:22 66:9,11,19,21 67:6,14 78:15,16 79:7,11 80:9,13 89:1,14 91:16,18 91:19 94:8,11 95:13 97:7,8,19 99:10,20 104:13 106:10 133:12,17 134:2,6,19,22 135:5 138:11 171:6 192:19 <b>salt</b> 27:12 <b>sampling</b> 191:13 <b>Saskatchewan</b> 122:14 <b>satisfaction</b> 16:1 <b>satisfy</b> 169:12 192:3 <b>Savannah</b> 11:19 27:12 98:2,10 <b>save</b> 159:1,7 <b>saved</b> 115:18 <b>savings</b> 199:4 <b>saw</b> 155:15 174:20 <b>saying</b> 88:20 96:15 97:10,14 99:14,15 109:21 116:3,4 176:14 177:3 181:20 190:5	198:8 <b>says</b> 60:5 90:6 147:1,7 <b>scale</b> 119:16 120:4 131:1,8 <b>scenarios</b> 40:20 51:3 155:16 <b>schedule</b> 7:10 38:10 69:19 <b>science</b> 189:1 <b>scope</b> 121:14 144:1 <b>scoping</b> 184:15 <b>scrub</b> 166:5 <b>scrubber</b> 148:15 149:4 <b>seated</b> 4:15,17 <b>seats</b> 53:12 <b>second</b> 17:7,15 35:19 43:18 44:4 44:5 153:22 <b>Secretary</b> 8:7,15,22 9:10,13 53:13 166:21 168:6 179:8 <b>section</b> 7:22 8:1 77:14 <b>Security</b> 171:4 <b>see</b> 71:13 73:2 77:11 79:15 93:2 103:21 118:10,13 125:13 128:5 156:15 169:18 170:15 173:15,19 174:9 176:21 199:16 <b>seek</b> 196:11 <b>seen</b> 59:20 85:13 183:7 <b>segments</b> 120:7 <b>seismic</b> 40:10 46:15 153:6 185:7,9 186:16,21 187:4,5 187:6,7,14 188:9 188:10,12,13 <b>select</b> 20:7 183:17 <b>selected</b> 30:10 40:9 42:18 44:19 45:10	45:22 159:6 161:11 170:7 <b>selecting</b> 74:21 77:3 <b>selection</b> 22:3 71:9 74:20 154:6 170:6 <b>self-interest</b> 123:12 <b>send</b> 98:18 99:6 101:9,20 124:2 129:19 133:22 134:12 143:9 <b>senior</b> 100:15 121:5 <b>sensitivity</b> 178:21 <b>sent</b> 99:2 <b>separate</b> 88:6 201:6 <b>separation</b> 201:4 <b>September</b> 5:2 143:8 <b>sequence</b> 128:13 <b>sequencing</b> 95:8 <b>SER</b> 61:8 121:4 <b>series</b> 106:8 <b>serve</b> 177:14,21 181:7 <b>service</b> 100:16 121:5 <b>SES</b> 121:5 125:1 <b>session</b> 17:7,8,21 33:9 51:6 54:17 77:15,19 107:19 162:20 202:4,5 <b>sessions</b> 6:2 144:13 <b>set</b> 22:7 26:2 60:3 63:18 64:2 194:6 <b>sets</b> 114:12 <b>settle</b> 197:7 199:16 199:18 <b>settling</b> 201:6 <b>seven</b> 11:12 <b>severely</b> 39:2 <b>severity</b> 41:11 42:3 44:6,7 184:10 <b>shared</b> 156:5 <b>shear</b> 192:5 <b>sheer</b> 93:12	<b>sheet</b> 6:13 52:12,18 123:19 124:16 125:4 127:9 155:21 156:2 157:6,9,10,18,19 158:16 159:12,18 159:19,20 160:4 160:10,18,22 <b>sheets</b> 156:10 160:2 <b>Shell</b> 122:13,22 123:14 <b>shipped</b> 37:6 <b>Shirley</b> 18:22 23:19 <b>shocks</b> 151:19 <b>Short</b> 194:4 <b>shortening</b> 32:2 <b>showing</b> 75:22 <b>shown</b> 32:13 <b>showstoppers</b> 156:15 <b>shut</b> 106:17 <b>side</b> 123:21 139:17 141:7 188:11 <b>sides</b> 123:16 125:2 <b>sign</b> 6:16 <b>signed</b> 6:18 106:3 194:22 <b>significance</b> 60:1 <b>significant</b> 13:9 25:10 32:5 35:4 48:8 83:8 92:20 150:2,7,17,21,22 152:1 155:8 185:6 185:14 186:2,9,15 186:21 187:4,6,20 <b>significantly</b> 74:7 <b>sign-up</b> 6:13 <b>similar</b> 27:16 122:11 123:4 189:12 <b>simple</b> 25:19 96:9 106:9 140:3 164:20 199:1 <b>simpler/safer</b> 97:12 <b>simplest</b> 134:21 <b>simplicity</b> 61:20 <b>simplified</b> 32:11
-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

91:9	201:4,7	<b>spending</b> 70:18	92:7 95:4 141:19	55:6 58:21 59:4
<b>simplifies</b> 32:1	<b>solution</b> 12:8	<b>spent</b> 64:8	196:1	60:11 63:17 71:10
<b>simplify</b> 165:5	116:22 117:3	<b>spoke</b> 146:2 192:13	<b>starting</b> 13:10 16:6	82:14,18 84:19
<b>simplifying</b> 29:6	136:6 166:15	<b>sponsored</b> 171:5	57:16 94:12	85:9,17 99:15
<b>simplistic</b> 96:8	<b>solutions</b> 14:17	<b>spray</b> 22:19 43:2,3	<b>startling</b> 139:2	118:1 131:4,10
<b>simply</b> 62:11 71:6	123:14	44:10,14,17 45:5	<b>startup</b> 23:14	182:13,14 183:14
<b>simulation</b> 121:13	<b>somebody</b> 81:12	48:5 58:7 59:1	<b>state</b> 6:10 163:22	183:15 190:2,20
<b>simultaneously</b>	147:21 191:14	151:11 183:7	174:15	191:2
96:2	<b>soon</b> 5:10 52:3	189:13 190:1	<b>stated</b> 5:20 39:15	<b>stream</b> 75:3,6,11
<b>single</b> 48:3	121:3 143:9	<b>sprayed</b> 151:11	153:3 176:17	77:2 137:19 138:1
<b>single-shell</b> 11:9	146:16	<b>sprays</b> 149:3,17	<b>statement</b> 19:7	193:2 200:15
12:1,2 78:18	<b>sorry</b> 86:17 121:5	<b>SS</b> 187:6	61:14 63:2 72:2	<b>streaming</b> 5:7
<b>sir</b> 122:3 127:3	153:13 184:3	<b>SSCs</b> 82:22	73:20 82:6 105:6	<b>streams</b> 200:3
151:7 195:12,17	<b>sort</b> 109:6 136:20	<b>stabilization</b> 23:17	105:10 119:10	<b>strength</b> 192:6
<b>site</b> 11:19 34:16	<b>sound</b> 114:17	33:5	127:12 146:13,14	<b>stressful</b> 73:16
43:11	<b>sounds</b> 159:8	<b>stabilizing</b> 12:8	147:1,21 186:12	<b>strongly</b> 144:4
<b>sites</b> 11:18 135:6	<b>source</b> 20:15 142:6	<b>stable</b> 12:5	198:11	<b>structure</b> 46:1 58:4
<b>situation</b> 180:1	190:21	<b>Stacy</b> 1:23 124:21	<b>statements</b> 3:19	60:15 190:11
<b>situations</b> 14:16	<b>space</b> 82:16 83:19	<b>staff</b> 1:18 4:18	6:21 39:5 147:20	<b>structures</b> 3:12
114:21 176:22	100:7,8 141:1	22:15 23:22 33:11	152:4	14:4 22:6 23:11
<b>six</b> 37:5 92:6	170:21 197:8,19	33:17,20 34:5,12	<b>states</b> 1:1 47:2	29:17 47:7 82:22
<b>size</b> 36:12 72:15	<b>speak</b> 6:8,20	34:14,20 39:4,8	<b>stating</b> 33:12 41:22	<b>studied</b> 111:17
93:13	178:11 194:22	41:1,3,13,17 42:7	179:14	<b>studies</b> 21:12,15
<b>sleep</b> 114:19	196:18 202:1	43:22 44:8 46:10	<b>statute</b> 7:20	132:18
<b>slowing</b> 161:1	<b>speaker</b> 195:1,5	46:19 48:18 49:8	<b>statutory</b> 7:17 9:5	<b>stuff</b> 68:18 98:12
<b>sludge</b> 97:22 98:2,4	<b>speakers</b> 6:4,9,10	49:14 50:2,7	9:21 10:5 15:5	105:8 135:15
98:14 191:12	<b>speaking</b> 65:14	51:18 132:15	<b>stayed</b> 77:10 79:22	138:21
192:7 196:3,4	196:19	133:4 153:1	98:16,22	<b>subject</b> 7:18 18:19
<b>sludges</b> 192:16	<b>specific</b> 20:20	194:16	<b>staying</b> 129:5	24:4 31:2 51:11
<b>sluiced</b> 196:5	56:17 65:11 71:10	<b>staff's</b> 35:2,11	<b>steel</b> 31:14,20	170:19
<b>sluicing</b> 196:4	104:8,10 109:15	<b>stage</b> 27:21 92:20	<b>Steve</b> 166:22	<b>subjects</b> 7:4
<b>slurry</b> 115:13	110:6,6,19,20	127:8 162:17	<b>Steven</b> 33:16	<b>submit</b> 8:15 54:5
122:16	111:7,8 121:17	189:2,7	<b>stock</b> 128:11	198:21 199:11
<b>small</b> 81:21 193:8	152:14 153:9	<b>stages</b> 122:19	<b>Stokes</b> 33:16	201:20 202:6
197:16 200:3	160:13,20 162:9	<b>stagnant</b> 109:19	105:19 106:2	<b>submittals</b> 29:4
<b>smartest</b> 84:2	182:16,17 193:17	110:13	<b>stop</b> 158:11 188:5,6	<b>submitted</b> 29:13
<b>sodium</b> 112:22	<b>specifically</b> 89:4	<b>stainless</b> 31:13,20	<b>storage</b> 34:18	56:6
158:8	157:22 182:9	<b>standard</b> 47:1	193:7	<b>Subpart</b> 162:11
<b>solely</b> 10:16	183:14	<b>standards</b> 23:12	<b>stored</b> 10:10	<b>subsequently</b> 44:12
<b>solid</b> 116:15 150:10	<b>specification</b> 28:10	167:20 174:2	<b>storing</b> 36:1	101:6
<b>solids</b> 36:6,13,15	<b>specified</b> 43:16	177:2,13,16 178:1	<b>strategies</b> 21:21	<b>substantial</b> 57:9
36:16 78:3 131:18	49:15	189:15,17 190:14	52:21 118:20	113:13 115:7
157:14,15,16	<b>specifies</b> 47:21	<b>standpoint</b> 185:5	<b>strategy</b> 16:17,21	<b>substantially</b> 74:6
159:17 193:5	<b>specify</b> 37:10 47:17	188:19	17:18 19:9 24:9	78:8
196:6 197:7,8,18	49:4	<b>start</b> 54:20,22	28:16 30:19 32:9	<b>substantiate</b> 39:7
199:16,18,20	<b>speculate</b> 156:4	130:13 195:17	37:13 39:20 43:3	<b>successful</b> 11:3
200:4,5,9,13,14	<b>speech</b> 201:17	<b>started</b> 60:21 86:1	50:19 51:2,16	<b>successfully</b> 51:17

52:21	132:14 133:3	179:2 182:9	77:12 78:6,19	201:4
<b>suction</b> 106:22	135:4 139:13		79:3,3,10,13,14	<b>tell</b> 66:20 73:4
<b>suffer</b> 10:18	145:7 151:22	<b>T</b>	79:18,22 80:17,21	80:20 81:2 94:1
<b>sufficient</b> 43:19	154:17 161:8	<b>table</b> 6:12 151:4	81:4,10 88:8,10	101:19 139:7
176:11	174:18 185:2	<b>take</b> 9:12 15:14	88:19,20 96:21	147:11 149:18
<b>suggest</b> 197:3	<b>surprised</b> 68:2	53:11 54:11 95:14	97:3,17 98:16	<b>telling</b> 128:17
<b>suggested</b> 40:14	180:14	108:7,10,18	99:2,17 100:2,7	159:12
<b>suggests</b> 39:20	<b>surprises</b> 120:13	111:11 134:22	100:21 101:10,13	<b>tenet</b> 154:10
<b>suitable</b> 12:6 50:9	<b>surrounding</b> 39:19	138:19 180:5,12	101:18 106:13,13	<b>tenets</b> 170:2
<b>suite</b> 153:22 158:3	<b>suspect</b> 143:7	180:15 197:16	120:21 124:2,22	<b>term</b> 41:12
172:5 184:13	<b>suspected</b> 12:1	<b>taken</b> 27:21 51:21	133:13 136:9	<b>terminates</b> 188:4
<b>suits</b> 129:20	<b>suspended</b> 197:4,9	99:1 100:20	137:22,22 138:6,9	<b>terminology</b> 60:12
<b>summarize</b> 199:10	197:18	135:17	138:15 183:6	186:16
<b>summary</b> 25:2	<b>sweet</b> 97:17	<b>takes</b> 102:10	193:4,10 196:2	<b>terms</b> 84:11 119:15
161:16	<b>switch</b> 188:2,4	123:22 170:12	197:7,19,20 200:7	123:6,18 124:19
<b>summer</b> 29:11	<b>system</b> 42:15 43:3	197:9	200:9,11	124:22 126:11,15
<b>sump</b> 135:16	46:1 47:12 48:4	<b>talk</b> 82:2 107:15	<b>tanks</b> 10:11,12 11:7	131:6 132:5 140:3
<b>Sunshine</b> 5:5	48:15,19 49:10,16	111:3 149:2,17	11:9 12:2,5 34:20	142:7 149:6
<b>super</b> 77:10 79:22	49:18 58:4,15	152:14 157:21	36:10 67:1,16,18	152:13 169:17
98:16 138:15	69:8 109:1 113:20	160:6	69:9 72:20 75:4	181:8 192:16
<b>superior</b> 23:5	114:15 115:21	<b>talked</b> 101:4,8	78:18 115:3	193:5,13
24:21 32:21 76:6	126:4,7,18,19	104:17 121:18	134:13 135:5,7,7	<b>test</b> 83:21 131:2
82:9,15 83:10	131:2,10,14	132:7 148:18	135:16,17 196:5	153:1,2,9 166:11
87:20	141:10 148:1,8,12	155:21 158:5	<b>tasked</b> 40:7	<b>tested</b> 103:5 153:5
<b>supernate</b> 98:8	148:12,13,14,19	160:1 173:13	<b>team</b> 28:22 30:22	<b>testified</b> 87:19
192:11	149:13 153:19	187:15 193:4	31:1,8,12 32:7	<b>testimony</b> 6:1
<b>supertank</b> 20:17	157:12,20 159:15	<b>talking</b> 64:8 78:17	68:2 89:2 92:12	18:10 33:10,11
37:10,12,15 75:1	184:21 192:14	81:21 112:6 123:5	123:15 173:16	54:5 187:16
75:6 77:1 78:21	193:7 195:15	150:14 153:15,15	176:17	194:15 202:6
79:9 92:12,17	199:1,5,7,8,14,17	155:12 158:21	<b>teams</b> 28:1,6,9,15	<b>testing</b> 9:19 28:20
99:1,15 118:15	199:21,22	162:4 181:21	<b>technical</b> 1:19 4:16	62:16 119:16,19
136:5 137:20	<b>systematic</b> 60:18	185:15 189:20	7:3 9:15 14:9,12	120:4,8,16 121:7
141:22	144:15	197:14	29:4 30:17 39:10	122:1 124:15
<b>supplied</b> 113:16	<b>systematically</b>	<b>talks</b> 124:16	44:1 50:21 52:5	125:16,18,19
<b>supplier</b> 149:2	57:14 156:13	<b>tank</b> 10:22 11:13	56:20 57:10 58:1	132:21
<b>supply</b> 115:22	<b>systems</b> 3:12 14:4,7	12:1 16:15 17:3	58:10 63:18 84:17	<b>tests</b> 120:3
<b>support</b> 23:14	17:2 22:6 23:10	18:2 20:15,21	85:5 92:1,8	<b>thank</b> 15:15 18:15
39:11 84:15	25:13 26:9,13	27:14 28:12,14,14	139:22 140:16	33:6,7 54:15 82:4
<b>supportable</b> 74:20	27:17,19 28:19	36:2,10 37:4,18	141:3 143:18,21	133:6,8 139:3
<b>supporting</b> 162:18	29:18 30:12 31:15	37:19 41:5 61:4	150:10 167:1,6	145:8 146:6,19
<b>supportive</b> 75:14	39:2 42:11,16	65:16 66:3,16	169:4 171:21	147:18 149:16
<b>supports</b> 175:9	43:7 47:7 48:11	67:9,22 70:2,4,7	174:1 175:5,14,18	155:20 160:21
<b>suppose</b> 59:16	49:2 51:11,20	70:11,17 71:6,12	176:6,8,20 177:6	162:3 170:11,12
<b>sure</b> 62:14 63:4	69:11 83:1 113:2	72:3,13,19,22	177:18 181:14	173:21 180:17
67:6 76:20 79:7	113:12,13,16,22	73:8 74:2,4,5 75:3	<b>technically</b> 43:18	194:14,17 201:15
86:8 87:6 100:1	115:14 116:15	75:5,6,11 76:4,13	<b>technologies</b> 35:15	201:19 202:9
107:15 116:9	140:6 158:19	76:14 77:2,6,8,10	<b>technology</b> 200:2	<b>Thanks</b> 191:3

<b>thick</b> 50:6 122:16	184:2,3	155:7 202:11	<b>transmittal</b> 16:4	90:18 94:19 95:12
<b>thing</b> 77:14 79:15	<b>thoughts</b> 137:8	<b>tomorrow's</b> 107:19	<b>transmitted</b> 9:14	96:5 97:21 118:11
101:16 102:1	<b>thousand</b> 75:17	<b>tonight</b> 195:6	<b>transparent</b> 69:22	118:13 200:8
114:12 119:4	<b>threats</b> 12:9	<b>tool</b> 30:7 51:10	<b>transuranic</b> 129:21	<b>TSR</b> 163:20 164:6
131:11 135:12,14	<b>three</b> 1:10 6:1	84:5,22 85:12	<b>treat</b> 67:18 69:7,17	172:2
138:12,14 142:4	120:15 125:17	163:12,14 165:12	69:19 160:4	<b>TSRs</b> 84:17 85:16
146:21 164:4	130:11 171:7,12	165:17 168:10	<b>treated</b> 189:14	130:12 139:6
172:20	<b>threshold</b> 45:20	170:6,20 173:17	<b>treatment</b> 9:6,7	<b>turn</b> 23:18 73:13
<b>things</b> 62:19 72:16	<b>THURSDAY</b> 1:8	174:19 175:1	10:4,14,18 12:10	86:2 114:14 139:4
81:2 82:5 85:14	<b>tighter</b> 41:8	181:3,8	12:11 13:14,18	143:1
90:20 94:22 95:16	<b>time</b> 4:7 6:16 7:2	<b>tools</b> 32:8,9	16:10 19:3,5,12	<b>turnover</b> 105:4,5
107:12 113:7	8:8,16 11:4,22	<b>tornado</b> 197:19	20:13,16,18,22	<b>two</b> 68:4 73:3 74:14
119:20 121:1	15:1 21:11 24:10	<b>total</b> 92:6 109:11	22:1,5 23:2,3,6,15	92:13 119:6
136:11 138:17	28:21 33:6 38:17	<b>totality</b> 97:13 137:5	24:13 28:2,11	130:11 159:3
163:21 164:1	39:12 42:7 50:2	<b>totally</b> 92:17	31:5,14 33:21	168:2 185:13
166:8 171:11	54:14 64:8 66:22	127:13,14 199:4,6	35:21 37:7 53:17	196:22
<b>think</b> 55:13 58:19	67:17 86:14 92:8	<b>touch</b> 145:13,15	53:19,21 54:3	<b>two-thirds</b> 38:19
59:1,8,22 60:3	94:4 96:14 97:15	<b>toxic</b> 10:9	69:10,15 71:1,8	<b>type</b> 101:16 177:11
62:2,15,21 65:8	127:6,20 130:14	<b>traditional</b> 171:16	76:3,7 87:15	185:1 189:13
66:19 72:9 81:18	133:7 136:11	<b>train</b> 139:8	88:18 89:5 90:8	<b>types</b> 35:17
85:7 86:3 91:21	140:15 145:15,16	<b>training</b> 121:11	101:11 105:16	<b>typically</b> 47:4 48:9
94:4,8,17,18 95:3	145:22 163:8	<b>transactions</b> 68:16	120:21 133:22	59:9 128:5 182:22
95:7 96:8,15	171:10 173:14	70:2	134:13 173:8	186:11
100:3 104:13	195:2,3 201:9	<b>transcript</b> 5:13	175:7 176:15	
108:11 118:12	202:1,7	<b>transfer</b> 79:21 80:4	177:9,20 178:16	<b>U</b>
120:5 126:7	<b>timeframe</b> 15:4	103:17 106:13,17	178:18,22 179:15	<b>UFP</b> 131:13,15
129:10,22 130:9	105:22	108:17 109:11,13	179:19,21 180:4,6	160:16
130:21 131:3	<b>timeline</b> 139:12	109:22 110:2,8	180:11 192:22	<b>ultimate</b> 16:12
135:14 136:22	<b>timely</b> 15:16 50:5	134:9 151:17	196:17	178:14
139:16 140:16	<b>timers</b> 25:13	199:2	<b>Triay</b> 2:18 53:12	<b>ultimately</b> 45:17
141:16,18 142:12	<b>times</b> 81:7 147:13	<b>transferred</b> 16:15	74:9 76:20 80:18	104:11 165:10
143:7 144:3 145:3	160:15 201:12	120:20	81:14 87:3,6,9	<b>ultrafilters</b> 201:7
149:22 150:15	<b>time-consuming</b>	<b>transferring</b> 98:18	89:21 91:2,14	<b>ultrafiltration</b> 32:3
152:2,3 155:6	36:11	<b>transfers</b> 72:21	137:10 166:20	157:14 198:2
157:3 159:22	<b>Timothy</b> 1:19 4:16	73:14 88:12 97:20	168:16,17,20	199:14,17,20,22
162:11,19 165:4,8	<b>tired</b> 196:8	107:5 109:14	173:22 174:9,17	200:1,5
170:18 171:2,18	<b>title</b> 6:10 7:22	198:6,7	177:3 178:9	<b>unable</b> 39:7
172:11,14 174:13	<b>TMI</b> 95:15,17	<b>transient</b> 154:19	179:14 180:3	<b>unacceptable</b> 70:15
177:17 181:11,18	<b>today</b> 64:9 85:17	<b>transients</b> 189:3	181:4 192:13	<b>unachievable</b>
186:5 191:21	98:3,20 139:1	<b>transition</b> 13:21	<b>tripping</b> 92:12	92:17
198:11	149:20 157:18	71:6 141:2 142:21	<b>true</b> 198:12	<b>unanswered</b> 156:1
<b>third</b> 17:17 36:9	164:13	161:12	<b>truly</b> 76:1	<b>uncertain</b> 36:14
<b>thorough</b> 138:13	<b>today's</b> 4:21 51:6	<b>transitioning</b> 13:17	<b>try</b> 53:4 63:4 96:13	38:3
<b>thought</b> 65:15	<b>told</b> 101:6 130:9	19:10	137:4 163:5	<b>uncertainties</b> 20:19
77:18 117:10	<b>tolerance</b> 47:10	<b>translate</b> 72:2	183:22	21:13 45:9
133:11 165:16	<b>tomorrow</b> 51:5	<b>translated</b> 71:12	<b>trying</b> 17:22 63:10	<b>uncertainty</b> 21:3
166:3 172:10,12	107:17 108:12	<b>translates</b> 72:18	75:20 76:15 90:16	22:17 26:3 36:20

37:8,17 171:5 179:15 <b>uncomfortable</b> 151:2 <b>uncomfortableness</b> 60:9 <b>undergo</b> 157:10,19 158:5,17 <b>underground</b> 10:10 <b>underlie</b> 35:11 <b>underlying</b> 10:8 <b>underpredicting</b> 43:12 <b>Undersecretary</b> 167:14 169:7 <b>undersized</b> 148:1,7 <b>understand</b> 17:22 39:5 43:22 61:17 63:5 69:21 73:20 77:14 80:8 97:2 100:6 118:14 128:15,17 130:6 144:8,20 152:11 161:17 170:19,22 176:19 183:16 185:20 <b>understandable</b> 118:17 <b>understanding</b> 11:16 15:19 56:2 62:17 74:8 86:1 100:3 128:1 143:17 147:15 163:10 171:21 180:22 181:8 <b>understands</b> 138:4 <b>understood</b> 25:21 62:15 77:19 <b>undertook</b> 13:9 <b>undue</b> 78:7 <b>unduly</b> 53:1 <b>unfair</b> 127:14,14 <b>unflushed</b> 108:5 <b>unforeseen</b> 90:12 147:4 <b>unfortunately</b>	183:6 <b>unique</b> 35:8 186:22 <b>unit</b> 127:17 145:21 <b>UNITED</b> 1:1 <b>unmitigated</b> 40:6 41:12,14 43:13 44:10,19 45:2 140:20 150:6 184:9,14 188:22 189:7 <b>unnecessary</b> 40:4,8 40:18 <b>unprecedented</b> 51:13 <b>unproven</b> 35:15,16 <b>unreasonable</b> 66:17 <b>unrelated</b> 144:10 <b>unresolved</b> 42:18 <b>unreviewed</b> 165:19 <b>unsafe</b> 172:12 <b>upcoming</b> 180:9 <b>update</b> 57:2 143:10 156:10,11 161:4 161:22 <b>updated</b> 141:1 142:2 156:8 159:19 184:12 <b>updating</b> 103:2,4 <b>upgraded</b> 149:12 <b>Upgrades</b> 78:18 <b>upset</b> 63:15 158:10 <b>URS</b> 1:23 2:17 53:22 54:2 121:20 <b>use</b> 30:2 35:14 37:9 44:3 45:16 51:8 51:12,19 52:2 112:22,22 135:2 136:1 165:5,22 167:4 168:12 169:4 171:18 173:10 178:16,20 179:17,17 180:2 180:10 186:17 189:14,17 192:10 197:10 199:5 200:2,4 201:5	<b>uses</b> 198:4 <b>USQ</b> 169:22 <b>usual</b> 47:17 <b>utilization</b> 176:2 <b>utilize</b> 169:10 179:19 <b>utilized</b> 76:9 181:9 <hr/> <b>V</b> <hr/> <b>validated</b> 99:5 171:12 <b>Valley</b> 198:18,19 <b>valuable</b> 70:8 <b>value</b> 43:9 44:3 45:14 93:3,8,10 93:19 178:20 179:10,13,19 180:1,2 194:3 <b>values</b> 42:18 180:10 <b>valve</b> 137:2 151:10 187:13 188:9 198:4,19,21 <b>valveless</b> 199:2 <b>valves</b> 109:5 110:18 114:7 115:22 136:13 150:19 151:9 187:11,12,16 188:2,4 198:5,15 198:16 199:2 <b>valving</b> 151:16 <b>vapor</b> 197:18 <b>vapors</b> 27:5 <b>variable</b> 35:21 <b>variety</b> 35:17 <b>various</b> 30:8 56:22 63:22 136:19 <b>velocities</b> 132:21 133:1 <b>velocity</b> 22:19 42:19 43:9,17 44:5 45:15 103:14 103:16 178:6,13 179:10 194:1 <b>vent</b> 25:12 141:11 148:8,11,14,19	149:8 <b>ventilate</b> 197:7,18 <b>ventilation</b> 21:20 30:12 42:14,15 46:1 48:4 49:2 58:15 113:20 148:1,8 153:19 154:7 <b>Venting</b> 116:22 <b>vents</b> 26:12 88:1 117:5,7,8,14,16 132:2 <b>verbal</b> 16:2 <b>verbatim</b> 5:13 <b>verification</b> 143:5 <b>verified</b> 103:5 <b>verify</b> 161:3 <b>vernacular</b> 64:4 <b>versions</b> 85:13 <b>versus</b> 123:6 176:18 183:15 <b>vessel</b> 20:8 21:16 78:4 148:8,11,12 148:19 149:8 161:16 189:22 <b>vessels</b> 17:18 20:1,3 25:6 35:6 42:16 46:14 48:11,16 49:1,15 103:6 114:5 162:22 187:10,21,21 189:16 <b>Vice</b> 1:15 4:9 53:22 54:19 55:22 56:3 56:12 57:20 58:17 59:11 61:2,7,22 62:4,8,20 64:5,13 64:16,21 65:4,7 65:13,20 66:1,6,9 66:12,20 67:4,8 67:12,19 69:20 71:13 72:4,7 76:10 77:13 78:14 79:5,8 80:7,10 81:1 96:12 97:9 99:8,13,21 180:19 <b>video</b> 5:7,8	<b>view</b> 19:10 21:8 78:21 79:2 124:18 133:14 146:5 <b>viewed</b> 16:1,6 174:22 <b>viewing</b> 5:15 <b>views</b> 180:17 <b>virtual</b> 197:19 <b>vision</b> 143:17 <b>vital</b> 34:15 <b>vitrified</b> 18:3 <b>volume</b> 10:9 15:20 193:2 <hr/> <b>W</b> <hr/> <b>W</b> 1:11,16 <b>WAC</b> 72:10 123:21 133:14 134:3,3,6 134:14,15 <b>wait</b> 114:11,12 125:12 <b>waiting</b> 143:4 173:15 <b>walls</b> 26:18 <b>want</b> 15:14 18:11 59:15 68:17 78:15 81:11 96:18 99:22 116:2,6 118:17 126:11 130:18 131:11 135:1 138:3,11 142:22 145:15 155:17 157:16 171:9 178:11 180:20 <b>wanted</b> 81:16,17 82:5 85:22 91:15 104:9 116:8 139:15 145:13 146:12,20 167:4 <b>wants</b> 167:22 180:10 <b>warranted</b> 28:7 61:12 <b>wash</b> 157:14 160:15 <b>Washington</b> 1:12 5:17
----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

<b>WASH-1400</b> 171:7	178:18,22 179:15	<b>Winokur</b> 1:12,14	129:13	138:16 139:1
<b>wasn't</b> 86:14,20	179:19,20 180:4,6	3:3 4:3,4 23:21	<b>workers</b> 10:3,19	147:6 158:10
90:20 99:5 123:9	180:10 191:9	33:7 53:6 67:2,9	14:16 129:19	160:9 162:6
141:17 150:3	192:7 193:2,6	72:6,8 73:12	<b>working</b> 27:22 29:2	171:19 173:10
182:1 184:18	195:10,21 196:17	81:15 82:4 83:16	121:22 141:9	174:3 186:20
185:3 189:7	197:3 200:3	84:14 85:7,21	183:5 196:1,3,17	187:1,5 192:10
191:21	<b>wastes</b> 35:17 36:4	86:15,17,19 87:7	<b>works</b> 136:7	193:13,18
<b>waste</b> 9:6,7 10:4,10	112:21 160:3	89:15 90:5 91:12	<b>world</b> 142:17	<b>WTP's</b> 36:17 37:11
10:17,22 11:7,8	<b>wasting</b> 201:2	91:17 94:7,9 95:7	183:13 186:15	44:6 46:20
11:14,17,21 12:4	<b>water</b> 98:8,9	96:11 104:20,22	<b>worried</b> 152:7	<b>WTP-specific</b>
12:8,10,11 13:18	114:14	105:12,21 106:4	<b>worry</b> 198:10	44:16
14:13 16:10,15,19	<b>way</b> 74:3 77:5 84:2	118:12 130:20	<b>worst</b> 184:15	
17:3,4,19 18:2	88:20 99:19	133:6 147:11	189:10	<b>Y</b>
19:3,5,12 20:13	103:12 104:4	151:5 153:12	<b>wouldn't</b> 59:7	<b>year</b> 22:11 68:1
20:16,16,18,22	127:5,20 129:8	170:10 174:13	116:18 150:7	158:18
21:1 22:1,5 23:1,3	130:3 151:17	179:7,22 180:13	184:21 188:20	<b>years</b> 7:21 10:13,13
23:6,14,16 24:12	155:2,15 169:6	181:17 191:7	194:9	26:2 34:11 68:1
26:4,5,9,13,15	186:1 187:10	193:21 194:12	<b>wow</b> 119:13	72:21 93:7 119:6
27:11,12,14 28:2	192:1	195:12 199:9	<b>wrap</b> 14:2 99:13	120:15 122:9
28:11,14,17 31:5	<b>ways</b> 120:7 122:11	200:17,20 201:15	<b>wrapping</b> 14:22	125:17 126:15
31:14 33:4,21	183:19	201:19	<b>wrap-up</b> 133:9	130:11 135:12
34:19,20 35:20,22	<b>website</b> 5:8,10	<b>wish</b> 6:8,14 54:4	<b>wreck</b> 116:4	147:14 167:3
36:1,8,10,10,13	15:13	201:17 202:1	<b>write</b> 58:13 83:4,6	183:6 195:11
37:3,6,7,11,18,19	<b>week</b> 68:2 112:10	<b>wishes</b> 120:13	172:2	196:1
41:6,8 43:11 50:7	<b>weeks</b> 68:4	202:6	<b>writing</b> 142:8	<b>Yep</b> 164:4
53:17,19,21 54:3	<b>weight</b> 78:2,11,12	<b>wishing</b> 6:19	<b>written</b> 5:13 9:9	<b>yield</b> 23:5 24:20
67:18 69:8,10,15	78:13 159:17	<b>withstand</b> 48:11,19	15:10 16:2 54:5	32:21 199:21
69:18,19 71:1,8	<b>welcome</b> 5:21	<b>witnesses</b> 53:10,12	85:15 198:8 202:6	
72:10 73:22 75:2	18:16 24:1	<b>wondered</b> 147:21	<b>wrong</b> 64:1,7 95:8	<b>\$</b>
75:6,11 76:3,6	<b>welded</b> 46:14	<b>words</b> 104:6 174:21	120:19 150:17	<b>\$6</b> 122:12
77:2,8 78:4 79:19	<b>went</b> 61:13 103:1	<b>work</b> 50:9 60:22	194:3 201:3	
79:20 80:5 81:9	138:15 145:17	80:16 97:17,19	<b>WRPS</b> 2:16	<b>0</b>
82:1 87:15 88:15	196:9,12 202:13	119:20 141:8	<b>WTP</b> 22:4 33:17	<b>0.1</b> 44:4 179:11
88:18 89:5 90:8	<b>West</b> 198:18,19	145:21,21 156:12	34:9,12,15,17,21	<b>0.3</b> 44:4 179:11
97:16 98:6 99:2	<b>we'll</b> 106:5 107:15	162:14,16 164:10	35:9,12,18 36:3,4	<b>08</b> 91:22
101:10 105:16	188:6,6	165:11 176:8	37:2,19,21 38:7	
106:22 107:2	<b>we're</b> 67:15 83:14	177:17 180:8	38:22 39:3 40:11	<b>1</b>
108:16 109:19	86:8 91:17 105:12	181:16 191:14	41:7 43:11,18	<b>1</b> 3:9 178:20,20
110:9 111:11	105:13 160:18,19	196:7,9,12	44:11,15,21 45:5	179:17,17 187:4,6
112:7 114:3	178:4 179:22	<b>worked</b> 57:12 60:4	45:12,16,19 51:17	187:7,14 188:9,10
120:21 129:21	183:11 195:12	103:9 123:15	52:16 61:4 65:17	<b>10</b> 30:14 78:13
133:22 134:7,9,13	<b>we've</b> 79:11 135:22	127:7 181:5	66:2 69:15 70:6	101:10,21 144:14
136:3 137:18,18	139:9 144:17	193:10 195:9,20	72:1 74:2 76:15	162:7 174:19
138:1 151:11	172:8	196:13	90:15 92:20 93:13	175:3 177:5
153:17 173:7	<b>whatsoever</b> 122:18	<b>worker</b> 27:3,4 48:6	96:20 97:16 99:3	200:14 201:12
175:7 176:15	<b>whiz</b> 119:13	49:13 62:6 68:15	99:7,10,16 100:2	<b>100</b> 10:13
177:8,19 178:16	<b>wide</b> 181:10	70:3,6 75:21	100:8,21 104:17	<b>11</b> 200:14
				<b>1189</b> 186:17

<b>12</b> 144:14	<b>336</b> 106:12			
<b>15</b> 5:2 29:20 200:14	<b>35</b> 195:10,22			
<b>16</b> 78:12				
<b>17</b> 144:1	<hr/> <b>4</b> <hr/>			
<b>18</b> 3:4	<b>4</b> 3:2 58:13			
<b>19</b> 73:7	<b>40-year</b> 13:7			
<b>1940s</b> 11:8	<b>42</b> 7:22			
<b>195</b> 3:20	<b>420.1</b> 47:16			
<b>1954</b> 7:15				
<b>1973</b> 196:2	<hr/> <b>5</b> <hr/>			
<b>1980</b> 196:7	<b>5</b> 151:4			
<b>1985</b> 196:10	<b>5:00</b> 4:2			
	<b>50</b> 19:16			
<hr/> <b>2</b> <hr/>	<b>500-mile</b> 122:15			
<b>2</b> 3:16 29:18	<b>53</b> 3:7			
<b>20</b> 7:21				
<b>20-year</b> 11:11	<hr/> <b>6</b> <hr/>			
<b>200</b> 15:10	<b>60</b> 5:12 10:13 72:20			
<b>2001</b> 196:16	<b>65</b> 106:14			
<b>2002</b> 12:16				
<b>2003</b> 28:12	<hr/> <b>7</b> <hr/>			
<b>2006</b> 25:4 28:21	<b>7</b> 1:8 7:9			
<b>2008</b> 25:1 38:15	<b>7th</b> 5:16			
89:18 90:21	<b>70</b> 10:13 13:11			
<b>2008/2009</b> 86:4	25:13 72:21			
<b>2009</b> 13:10 24:10	<b>70-year</b> 68:16			
28:21 29:12,15,18	<b>7016</b> 1:11			
38:21 40:16 41:10				
41:21 42:9 106:3	<hr/> <b>8</b> <hr/>			
106:4	<b>8:00</b> 202:11			
<b>2009-1</b> 168:3	<b>8:25</b> 202:12			
<b>2010</b> 1:8 5:1,2 7:9	<b>80</b> 13:13 19:14,15			
16:5 24:10 29:20	44:21 52:10			
<b>202</b> 3:22	126:11			
<b>2286</b> 7:22	<b>830</b> 30:15 162:7			
<b>24</b> 108:22	165:7 174:19			
<b>26</b> 5:1	175:3 177:5 181:1			
<hr/> <b>3</b> <hr/>				
<b>3</b> 57:6 140:12 141:1				
143:16 186:16,21				
188:12,13				
<b>30</b> 13:14				
<b>300</b> 191:20				
<b>3009</b> 85:3 162:7				
163:14,15 165:7				
168:11 175:10				
181:1				