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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

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635TH MEETING

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

(ACRS)

+ + + + +

WEDNESDAY

JULY 6, 2016

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ROCKVILLE, MARYLAND

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The Advisory Committee met at the Nuclear Regulatory Commission, Two White Flint North, Room T2B1, 11545 Rockville Pike, at 1:04 p.m., Dennis C. Bley, Chairman, presiding.

COMMITTEE MEMBERS:

DENNIS C. BLEY, Chairman

MICHAEL L. CORRADINI, Vice Chairman

PETER RICCARDELLA, Member-at-Large

RONALD G. BALLINGER, Member

CHARLES H. BROWN, JR. Member

MARGARET CHU, Member

WALTER L. KIRCHNER, Member

JOSE A. MARCH-LEUBA, Member

DANA A. POWERS, Member

HAROLD B. RAY , Member

JOY REMPE, Member

GORDON R. SKILLMAN, Member

JOHN W. STETKAR, Member

MATTHEW W. SUNSERI, Member

DESIGNATED FEDERAL OFFICIAL:

KENT L. HOWARD, SR.

ALSO PRESENT:

BEN BEASLEY, NRR

YOIRA DIAZ-SANABRIA, NRR

MIKE GALLAGHER, Exelon

ALLEN HISER, DLR

JOHN HUFNAGEL, Exelon

LOIS JAMES, NRR

JOHN KOWALSKI, Exelon

JANE MARSHALL, NRR

JEFFERY MITCHELL, NRR

ANDY SCHIERER, Exelon

DON WARFEL, Exelon

PAUL WEYHMULLER, Exelon

*Present via telephone

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

2 1:04 p.m.

3 MEMBER BLEY: The meeting will now come

4 to order.

5 This is the first day of the 635th

6 meeting of the Advisory Committee on Reactor

7 Safeguards.

8 During today's meeting, the Committee

9 will consider the following, the LaSalle license

10 renewal, preparation for the October meeting with

11 the Commission and preparation of ACRS reports.

12 This meeting is being conducted in

13 accordance with the provisions of the Federal

14 Advisory Committee Act. Mr. Kent Howard is the

15 Designated Federal Official for the initial portion

16 of this meeting.

17 We have received no written comments or

18 requests to make oral statements from members of the

19 public regarding today's sessions.

20 There will be a phone bridge line. To

21 preclude interruption of the meeting, the phone will

22 be placed in a listen in mode during the

23 presentations and Committee discussion.

24 A transcript of portions of the meeting

25 is being kept and it is requested that the speakers

1 use one of the microphones, identify themselves and
2 speak with sufficient clarity and volume so that
3 they can be readily heard.
4 And, for the speakers up here, there's a
5 little push button on your mics nearest you can push
6 to turn them on. Turn them off when you're not
7 talking so we can keep the sound better on the phone
8 line.
9 A -- oh, I just did that.
10 I also want to make folks aware that
11 this meeting is being webcast with the ability to
12 view our presentation slides on the web.
13 Any of you out there on the bridge line
14 might want to do that because the sound is actually
15 better through the web link than it is on the bridge
16 line connection.
17 If you have any problems with it, please
18 call our office.
19 As items of interest, I want to welcome
20 four new members to the Committee, Dr. Margaret Chu
21 is a consultant to international and domestic
22 clients on nuclear waste management, nuclear fuel
23 cycle analysis and nonproliferation technologies,
24 nuclear material management and nuclear smuggling
25 detection.

Dr. Walt Kirchner is the technical expert in nuclear reactor design, thermal hydraulics and nuclear reactor safety.

Dr. Jose March-Leuba is an expert in reactor thermal hydraulics and dynamics, reactor instrumentation and control and protection systems, software development and testing and instrumentation and development for international safeguards.

Mr. Matt Sunseri has a wide range of experience in the operation maintenance, engineering, oversight and security of the nation's commercial and nuclear power fleet.

We'd also like to announce that our Executive Director, Andrea Valentin, will receive a career achievement government award at the 21st Women of Color STEM Conference on October 15th in our hometown of Detroit.

Again, please join me in welcoming our new members and congratulating Andrea.

(APPLAUSE)

MEMBER BLEY: At this point, I will turn the meeting over to Member Skillman to lead us through the discussion of those license renewals.

MEMBER SKILLMAN: Mr. Chairman --

MEMBER BLEY: Go ahead, Dick.

1 MEMBER SKILLMAN: Thank you.

2 I'm Dick Skillman, I'm the Subcommittee
3 Chairman for this license renewal activity for the
4 LaSalle Country Station's Unit 1 and 2 owned and
5 operated by Exelon.

6 With that, I'm going to call upon Jane
7 Marshall to begin the presentation, please.

8 MS. MARSHALL: Thank you, Mr. Skillman,
9 thank you, Chairman Bley and Members of the ACRS.

10 As stated, I'm Jane Marshall and I'm the
11 Acting Director for the Division of License Renewal.

12 With me here today at the table is Yoira
13 Diaz-Sanabria, she is Branch Chief of Project Branch
14 I for Safety.

15 And, in the audience today are Ben
16 Beasley, Acting Deputy Director for the Division of
17 License Renewal and Technical Review Branch Chiefs
18 for DLR, Dennis Morey and Brian Wittick.

19 Presenting for the NRC today will be
20 Jeffery Mitchell, the License Renewal Safety Project
21 Manager.

22 We also have members from the DLR
23 Technical Review team here in the audience today and
24 on the phone.

25 We look forward to a productive

1 discussion today when we present the safety
2 evaluation report for LaSalle County Station Units 1
3 and 2.
4 During the Subcommittee meeting, we
5 discussed two open items in the SER with open items.
6 These have since been closed and the staff will be
7 discussing their resolution during our presentation.
8 At this time, I'd like to turn the
9 presentation over to Exelon Generating Company and
10 the Vice President for License Renewal Projects,
11 Mike Gallagher, to introduce his team and commence
12 their presentation.
13 MR. GALLAGHER: Okay, thanks, Jane.
14 Thank you, Jane.
15 Good afternoon, my name is Mike
16 Gallagher and I am the Vice President of License
17 Renewal Projects for Exelon. I have 35 years of
18 nuclear power plant experience and I've been working
19 on our license renewal projects since the year 2006.
20 Slide one, please?
21 MEMBER POWERS: Yes, I think we're going
22 to have to give Mike a special chair here if he
23 shows up enough.
24 (LAUGHTER)
25 MR. GALLAGHER: Thank you, Dr. Powers.

(LAUGHTER)

MR. GALLAGHER: As long as it's comfortable.

MEMBER POWERS: I didn't promise that.

(LAUGHTER)

MEMBER POWERS: In fact, I can guarantee it won't be.

(LAUGHTER)

MEMBER POWERS: Long to seeing you, Mike.

MR. GALLAGHER: All right, thank you.

Well so, before we get in today's presentation, you've probably heard this, too, Dr. Powers, but I'd like to introduce the presenters.

To my right is John Kowalski and John is the LaSalle Engineering Director and John had 24 years of nuclear power plant experience, including the last 18 at LaSalle.

To John's right is Paul Weyhmuller and Paul is our License Renewal Technical Manager for the LaSalle Project and Paul has 33 years of nuclear power plant experience, including working on Exelon's license renewal projects since 2011.

And, to Paul's right is Andy Schierer. And, Andy is our LaSalle Engineering Program Manager

1 and Andy has nine years of nuclear power plant
2 experience, all at LaSalle.
3 To my left is John Hufnagel and John is
4 our Project Licensing Lead and John has 36 years of
5 nuclear power plant experience including working on
6 Exelon's license renewal projects since 2005.
7 In addition to our technical support, we
8 have back here and over here, we have Bill Trafton
9 and Bill is our Site Vice President of the LaSalle
10 Station.
11 Slide 2, please?
12 This slide shows our agenda for today.
13 We will present to you some highlights, background
14 information about the station and then some
15 highlights of our license renewal application.
16 Then, we will discuss how we addressed
17 the SER open items and I'm going to answer any
18 questions you may have.
19 We believe we've developed a robust,
20 high-quality license renewal application. We've
21 also developed effective aging management programs
22 to ensure the continued safe operation of LaSalle.
23 And, we appreciate this opportunity to
24 make this presentation and look forward to answering
25 any questions you may have.

1 So, with that, I'll turn the
2 presentation over to John Kowalski. John?
3 MR. KOWALSKI: Thanks, Mike.
4 Slide 3, please?
5 Good afternoon, my name is John
6 Kowalski. I am the Engineering Director at LaSalle
7 County Station.
8 LaSalle Country Station Unit 1 and 2 are
9 GE boiling water reactors with Mark II containments
10 that are owned and operated by Exelon.
11 LaSalle County Station is located in the
12 State of Illinois about 55 miles southwest of
13 Chicago.
14 Slide 4, please?
15 This slide shows an aerial view of
16 LaSalle County Station. On the slide, you can see
17 the reactor building, the auxiliary building and the
18 turbine building which are located in the center of
19 the picture.
20 The intake flume from the cooling lake
21 to the lake screen house, the discharge flume which
22 goes back to the cooling lake.
23 There is a submerged pond under a
24 portion of the cooling lake that extends under the
25 intake flume which is the LaSalle safety related

ultimate heat sink. This is shown by the dotted line in the photo.

The independent spent fuel storage installation and the 345 kilovolt switch yard.

Slide 5, please?

This slide provides an overview of LaSalle's history and some major station improvements.

LaSalle was initially licensed in 1982 for Unit 1 and 1983 for Unit 2. Each unit was initially licensed for a rated thermal power of 3323 megawatts thermal.

A five percent increase in rated power on both units was performed in the year 2000.

In 2010, for Unit 1 and 2011 for Unit 2, a 1.65 percent measurement uncertainty recapture was implemented which increased the thermal rating on each unit to their current rating of 3546 megawatts thermal.

Exelon has also continued to make substantial improvements to LaSalle for long-term operation such as noble metal chemical addition, hydrogen water chemistry, independent spent fuel storage installation and main power transformer replacements.

1 LaSalle has operated on 24-month fuel
2 cycles. The station capacity factor was 91.9
3 percent in 2015.
4 The license renewal application was
5 submitted on December 9th, 2014. Our current
6 licenses expire on LaSalle on April 17th, 2022 for
7 Unit 1 and December 16th, 2023 for Unit 2.
8 I will now turn it over to Paul
9 Weyhmuller who will present to you the highlights of
10 the license renewal application.
11 MR. WEYHMULLER: Thank you, John.
12 Slide 6, please?
13 Good afternoon, my name is Paul
14 Weyhmuller. I am the LaSalle License Renewal
15 Technical Manager.
16 I will discuss the highlights of our
17 license renewal application, focusing on aging
18 management programs, specifically, GALL consistency,
19 our commitments and the exceptions we have taken to
20 the GALL.
21 Slide 7, please?
22 In preparing the application, Exelon
23 used industry and NRC guidance to make our
24 application as consistent with GALL as possible.
25 Our submittal was based on guidance

1 provided in both NUREG-1800 and 1801, Revision 2 as
2 amended by Interim Staff Guidance as described in
3 the LRA located in Section 2.1.4.
4 The aging management programs were
5 developed, incorporating lessons learned from
6 previous Exelon projects as well as from
7 benchmarking industry LRAs.
8 The aging management programs were also
9 developed using insight from industry RAIs.
10 There are 48 commitments for the
11 implementation of license renewal at LaSalle.
12 Forty-six commitments are for the implementation of
13 individual aging management programs.
14 One additional commitment assures the
15 continuance of the operating experience program
16 improvements related to aging management that were
17 implemented prior to the LRA submittal in accordance
18 with ISG 2011, Tech 05, Ongoing Review of Operating
19 Experience.
20 The final commitment is for specific
21 aging management activities for installed subjoint
22 clamps on Unit 1 jet pumps. This commitment
23 requires analysis for higher acceptable fluence
24 value or taking other corrective action such as
25 repair or replacement of the clamps prior to

1 exceeding the limiting fluence values currently
2 projected to occur near the end of PEO.
3 These commitments will be captured in
4 the license renewal UFSAR Supplement and the station
5 commitment tracking database and managed according
6 with 10 CFR 50.59 and the commitment management
7 program, which is based on NRC endorsed NEI 99 Tech
8 04 process.
9 The table shown on the slide provides a
10 breakdown of aging management programs in regards to
11 consistency with the GALL.
12 The summary table also provides a
13 numerical breakdown for existing and new AMPs.
14 There are only six programs with
15 exceptions and an overall total of nine exceptions.
16 The following slide summarizes these exceptions.
17 Slide 8, please?
18 This table shows a summary of the
19 exceptions taken as part of the LaSalle LRA
20 identifying the program, the exception taken and the
21 justification for the difference.
22 Each exception we have provided an
23 alternative to the recommendation in GALL,
24 supporting technical justification has been provided
25 and has been found acceptable as identified in the

1 final SER.

2 Each of these exceptions were discussed

3 with the ACRS Subcommittee on April 19th, 2016.

4 And, I can provide additional detail on any specific

5 exception, as requested by ACRS Members.

6 With that, I'll now turn the

7 presentation over the Andy Schierer who will discuss

8 LaSalle's open items.

9 MR. SCHIERER: Thank you, Paul.

10 Slide 9, please?

11 Good afternoon. My name is Andy

12 Schierer and I am the Engineering Program Manager at

13 LaSalle County Station.

14 The NRC staff had identified two open

15 items which have been addressed.

16 Slide 10, please?

17 These open items involved examination

18 coverage and two aging management programs, BWR

19 vessel ID attachment welds aging management program

20 and BWR stress corrosion cracking aging management

21 program.

22 Slide 11, please?

23 The first open item was related to

24 questions that the NRC staff had associated with

25 limitations and exam coverage for BWR vessel ID

1 attachment welds using the enhanced visual
2 examination technique commonly referred to as EVT-1.
3 As discussed in the SER with open items,
4 the NRC staff expressed concern that a LaSalle
5 procedure could allow as low as zero percent EVT-1
6 exam coverage for reactor internal components
7 including the vessel ID attachment welds.
8 Exelon provided the following
9 information to the staff. We clarified that BWRVIP
10 reports do not establish minimum quantitative
11 requirements for EVT-1 exam coverage.
12 However, for EVT-1 examinations, the
13 expectation of both Exelon and the BWRVIP is to
14 perform a visual inspection of the entire accessible
15 weld surface by a qualified and certified NDE
16 examiner and to maximize EVT-1 exam coverage within
17 the requirement of the EVT-1 technique.
18 This is consistent with BWRVIP Tech 03
19 which provides examination requirements for
20 inspections of reactor vessel internal components.
21 LaSalle procedures for inspection of
22 vessel ID attachment welds implement BWRVIP
23 expectations relative to exam coverage.
24 The procedure of concern has been
25 revised to eliminate the possibility that EVT-1

1 examination coverage of zero percent would be
2 considered acceptable.
3 Current EVT-1 requirements were put in
4 place in 2009. A review of examination results
5 since this time has found that, on average,
6 approximately 68 percent of the entire weld surface
7 was inspected with the EVT-1 examination technique.
8 The remaining accessible weld surface
9 was visually examined by a qualified and certified
10 NDE examiner.
11 It is expected that EVT-1 examinations
12 of vessel ID attachment welds during the period of
13 extended operation will result in examination
14 coverage -- in similar examination coverage as
15 recently performed examinations.
16 Therefore, the visual examination
17 methods used at LaSalle for EVT-1 examination of
18 vessel internals provide for a robust aging
19 management program.
20 It should be noted that neither LaSalle
21 nor the domestic BWR fleet has identified any IGSEC
22 cracking of vessel ID attachment welds.
23 This information has been found
24 acceptable to the NRC staff as documented in the
25 final SER.

1 Slide 12, please?

2 The second open item was related to
3 volumetric exam coverage of less than 90 percent
4 within the BWR stress corrosion cracking aging
5 management program.

6 As discussed in the SER with open items,
7 the NRC staff expressed concern that volumetric
8 exams with less than 90 percent coverage that are
9 performed within the BWR stress corrosion and
10 cracking program that are not credited for As-Meet
11 Code Section 11 may not be properly evaluated to
12 consider those exams as acceptable.

13 All volumetric examinations under the
14 BWR stress corrosion and cracking program are
15 performed using current performance demonstration
16 initiative, or PDI, equipment and procedures.

17 For certain weld configurations, due to
18 the specific contour of the weld or other
19 interferences to the equipment, examination method
20 can only provide qualified results for a limited
21 examination volume of the weld that may be less than
22 90 percent.

23 Exelon provided the information to the
24 staff that clarifies that 90 percent coverage will
25 be considered the minimum acceptable examination

1 coverage during the period of extended operation
2 unless the basis for accepting limited coverage is
3 evaluated and documented.
4 If the examination coverage is less than
5 90 percent, LaSalle will continue to implement
6 actions to maximize the extent of examination
7 coverage, generate a corrective action issue report
8 to document and disposition weld examinations
9 achieving less than 90 percent coverage and initiate
10 a relief request to justify the adequacy of limited
11 examination coverage if the exam is also being
12 credited to meet As-Meet Code Section 11
13 requirements.
14 Additionally, if the exam is only
15 credited for the BWR stress corrosion and cracking
16 program, LaSalle will justify the adequacy of the
17 limited examination coverage and an engineering
18 technical evaluation that is consistent with the
19 content found in the relief request.
20 These evaluations will be independently
21 reviewed and retained as permanent plant records.
22 This information has been found
23 acceptable to the NRC staff as documented in the
24 final SER.
25 I'll now turn the presentation over to

1 Mike Gallagher for closing remarks.

2 MR. GALLAGHER: Okay, thanks, Andy.

3 So, again, we believe we've developed a

4 comprehensive, high-quality license renewal

5 application and robust aging management programs

6 that will ensure the continued safe operation of

7 LaSalle.

8 Pending any questions you may have, this

9 concludes our formal presentation.

10 MEMBER SKILLMAN: Colleagues, any

11 questions for our Exelon team, please?

12 Hearing none, Mike, thank you to your

13 and your team and I would like to ask the entire

14 congregation to take about a 300 second break, five

15 minutes, so we can swap technology.

16 With that, Mike, your team is relieved.

17 Stand by in case there are questions.

18 MR. GALLAGHER: We'll be here. Thank

19 you.

20 MEMBER SKILLMAN: Thank you.

21 (Whereupon, the above-entitled matter

22 went off the record at 1:24 p.m. and resumed at 1:28

23 p.m.)

24 MEMBER SKILLMAN: Okay, Jane, let's

25 resume and back to you, please?

1 MS. MARSHALL: Okay, thank you.

2 At this time, I'd like to turn it over

3 to Jeff Mitchell, Project Manager for LaSalle.

4 MR. MITCHELL: Thank you, Jane.

5 Are we on? Are we on? Okay.

6 Thank you.

7 Good afternoon, Chairman Bley, Mr.

8 Skillman and Members of the ACRS. My name is

9 Jeffery Mitchell and I am the License Renewal

10 Project Manager for the LaSalle County Station Units

11 1 and 2, or LaSalle License Renewal Safety Review.

12 We are here today to discuss the review

13 of the LaSalle license renewal application as

14 documented in the Safety Evaluation Report which was

15 issued on June 2nd, 2016.

16 Joining me here at the table today are

17 Dr. Allen Hiser, Division of License Renewal Senior

18 Technical Advisor and Ms. Lois James, DLR Senior

19 Project Manager running the slides.

20 Seated in the audience and joining by

21 phone are members of the technical staff who

22 participated in the review of the license renewal

23 application and conducted the onsite audits.

24 Next slide, please?

25 I will begin the presentation with a

1 general overview of the staff's review. I will then
2 discuss the closure of the open items related to BWR
3 Vessel Inside Diameter Attachment Welds and BWR
4 Stress Corrosion Cracking Programs and, finally, the
5 staff's conclusions.
6 Next slide?
7 Exelon Generation Company submitted a
8 license renewal application, or LRA, for LaSalle
9 County Station in December of 2014.
10 The staff issued the Safety Evaluation
11 Report, or SER, with open items in February 2016 and
12 presented to the ACRS Subcommittee on License
13 Renewal in April of 2016.
14 The staff closed the two open items and
15 issued the final SER on June 2nd.
16 Next slide?
17 The applicant identified 45 aging
18 management programs in the original LRA. This slide
19 identifies the applicant's original disposition of
20 these AMPs in the left column and the final
21 disposition in the SER as a result of the staff's
22 review in the right column.
23 All were evaluated by the staff for
24 consistency with the GALL Report.
25 During the staff's review, the staff

1 issued Requests for Additional Information regarding
2 the differences in the Unit 1 and Unit 2 small bore
3 piping programs and the operating experience which
4 resulted in the applicant crediting the GALL Report
5 AMP for Unit 1 only and a new plant-specific AMP for
6 Unit 2.
7 This Unit 2 inspection of As-Meet Code
8 Class 1 Small Bore Piping Program is included in the
9 final count of 46 total aging management programs on
10 the right hand side of the slide.
11 The two programs which had related open
12 items, BWR Vessel Inside Diameter Attachment Welds
13 and BWR Stress Corrosion Cracking were submitted as
14 consistent with the GALL Report.
15 Upon closure of the open items, the
16 staff concludes that these two programs are
17 consistent with the GALL Report.
18 Section 3.0.3.1.2 describes the BWR
19 Vessel Inside Diameter Attachment Welds Program.
20 During the AMP audit, the staff reviewed documents
21 relevant to the program and concluded that program
22 elements 1 through 6 were consistent with the
23 corresponding program elements of GALL Report AMP
24 11.M4.
25 However, as a result of the subsequent

1 inspection in accordance with NRC Inspection
2 Procedure IP-71002, License Renewal Inspection, the
3 staff had an opportunity to review the applicant's
4 implementing procedures again.
5 The staff noted that, as a result of
6 recent revisions to the inspection requirements for
7 EVT-1, Visual Examinations and Boiling Water Reactor
8 Vessel and Internals Project of BWRVIP 03, reactor
9 pressure vessel and internals examination
10 requirements, the effective examination coverage may
11 have been reduced to zero percent for some
12 locations.
13 Because the relevant BWRVIP guidelines
14 for this aging management program do no provide a
15 minimum required effective examination coverage for
16 these EVT-1 examinations, inspections which may
17 yield an effective examination coverage of zero
18 percent could be interpreted as meeting BWRVIP
19 guidelines and, therefore, would not require a
20 deviation report, engineering evaluation or
21 mitigating actions.
22 On February 16th, 2016, the staff issued
23 a Request for Additional Information requesting that
24 the applicant provide clarification for the extent
25 of examination coverage of past EVT-1 inspections

1 performed at LaSalle and the technical bases for
2 limited inspection coverage.
3 On February 25th, 2016, the applicant
4 responded to the RAI. The applicant stated that,
5 (1) the revised EVT-1 viewing angle requirements
6 resulted in average coverage reductions from 91 and
7 97 percent to 72 and 66 percent for Units 1 and 2
8 respectively, roughly 20 percent.
9 However, the accessible portions of the
10 attachment weld that cannot be examined -- excuse me
11 -- to the revised EVT-1 requirements are visually
12 inspected by a qualified nondestructive examination
13 specialist.
14 And, based on historical data, zero
15 percent EVT-1 examination coverage is not expected.
16 And, the program procedure discussing the
17 possibility of zero percent coverage was revised
18 with a requirement to enter such a condition into
19 the corrective action program for evaluation for a
20 BWRVIP deviation report.
21 The staff finds the applicant's response
22 acceptable because the past EVT-1 examinations
23 provide a level of examination equivalent to or
24 superior to the examinations had they been performed
25 to As-Meet requirements for vessel inside diameter

1 attachment welds.

2 And, the revised program procedures will

3 require a corrective action program evaluation of

4 any condition with zero percent EVT-1 coverage.

5 The staff's concerns related to open

6 item 3.0.3.1.2-1 are resolved and this open item is

7 closed as documented in the final SER.

8 Yes, sir?

9 MEMBER RICCARDELLA: Summarize just

10 briefly the difference between the EVT-1 exam and

11 the exam done by a qualified technician that is for

12 some reason not EVT-1?

13 MR. MITCHELL: Sure. My statement

14 regarding that was essentially all of the accessible

15 locations are inspected and evaluated by a qualified

16 NDE including those portions that are not able to be

17 qualified to EVT-1 standards.

18 So, the point is just that even those

19 portions outside that are not qualified to EVT-1s

20 are also qualified.

21 MEMBER RICCARDELLA: I'm trying to

22 understand the difference.

23 MR. HISER: The difference is -- this

24 Allen Hiser of the staff.

25 The difference is just the angle that

1 you view the surface at. It had the BWRVIP
2 decreased the angular scope that would be counted as
3 a what a qualified or completed exam within the
4 BWRVIP document.
5 So, the inspection methodology technique
6 personnel are all the same. It's just that the
7 BWRVIP said only this, you know, specific, what was
8 it, plus or minus 15 or plus or minus 30 degrees.
9 MEMBER RICCARDELLA: Thirty degrees?
10 MR. HISER: Yes, so about a 60 degree
11 angle would be considered to be an acceptable
12 examination.
13 MEMBER RICCARDELLA: Thank you.
14 MR. MITCHELL: Okay. Section 3.0.3.1.5
15 describes the BWR Stress Corrosion Cracking Program.
16 During the AMP audit, the staff reviewed
17 recent LaSalle post-outage 90-day in-service
18 inspection summary reports and noted that the
19 examination coverage for some welds in the program
20 was as low as 50 percent.
21 Because these examinations are
22 classified as augmented in-service inspections that
23 are outside the As-Meet Code requirements, the
24 applicant is not required to submit relief requests
25 for the limited examination coverage as would be

1 required if they were inspections to meet As-Meet
2 Code Section 11 requirements.
3 The applicant provided sufficient
4 technical justification for the adequacy of the
5 examination coverage.
6 However, the program did not require a
7 formal disposition of weld inspections with limited
8 examination coverage.
9 On February 16, 2016, the staff issued a
10 Request for Additional Information asking the
11 applicant to confirm the percentage of examination
12 coverage that Exelon considers as meeting the
13 program requirements as well as to provide how the
14 program will disposition instances when the coverage
15 obtained is less than the As-Meet Code requirement
16 of 90 percent.
17 The applicant responded to the RAI on
18 February 25th, 2016. The applicant stated that the
19 minimum percent of weld volume examination coverage
20 to be considered inspected is greater than 90
21 percent unless the bases for accepting a limited
22 coverage is evaluated and documented.
23 Implementing procedures currently
24 require generation of a corrective action issue
25 report if minimum coverage is not achieved.

1 Implementing procedures will be revised
2 to clarify the extent of evaluation required in the
3 corrective action report and will require
4 performance of an engineering technical evaluation
5 that includes content comparable with that which
6 would be included in a relief request had the
7 inspection been an As-Meet Code inspection or
8 examination.
9 The staff finds the applicant's response
10 acceptable because the program specifies the
11 coverage required to be considered inspected and the
12 program will ensure that there will be a documented
13 technical basis for all weld examination with
14 limited coverage.
15 The staff's concerns related to the open
16 item 3.0.3.1.5-1 are resolved and this open item is
17 closed as documented in the final SER.
18 In conclusion, the staff has determined
19 that the requirements of 10 CFR 54.29(a) have been
20 met for the license renewal of LaSalle County
21 Station Units 1 and 2.
22 This concludes our staff presentation.
23 We are available for any further questions from the
24 Committee.
25 MEMBER MARCH-LEUBA: I have one short

1 question. This is just a restated question.
2 This procedure is not an internal
3 procedure?
4 MR. MITCHELL: Which procedure, sir?
5 MEMBER MARCH-LEUBA: The one you were
6 talking on the previous slide?
7 MR. MITCHELL: Regarding the BWR --
8 MEMBER MARCH-LEUBA: That's correct,
9 yes.
10 MR. MITCHELL: -- SEC?
11 MEMBER MARCH-LEUBA: Yes.
12 MR. MITCHELL: Correct, that's a plant-
13 specific procedure.
14 MEMBER MARCH-LEUBA: So, you just looked
15 at the procedure and, I mean, if -- are we all to
16 change it? Probably wouldn't, right?
17 MR. MITCHELL: The procedures, correct.
18 There are procedures where they can change it and,
19 in fact, there are -- and within 10 CFR Part 50,
20 there are guidelines for what changes can be made.
21 MEMBER MARCH-LEUBA: But, you are
22 confident that this is a sufficiently implementation
23 of the situation, right?
24 MR. MITCHELL: Yes.
25 MR. HISER: Yes, I think one of the

1 things to remember within the process is that there
2 is an inspection, 71-003 inspection prior to a plant
3 going into the PEO and that inspection would
4 consider changes to procedures and things like that.
5 MEMBER MARCH-LEUBA: Okay, it was just
6 on the specific question.
7 MEMBER SKILLMAN: So, colleagues, any
8 questions for the NRC staff relative to LaSalle
9 license renewal?
10 Hearing none, Jeffery, Dr. Hiser, Lois,
11 thank you. Jane, thank you.
12 And, Dennis, I turn it back to you.
13 MEMBER BLEY: We need to ask for public
14 comments.
15 MEMBER SKILLMAN: Oh, I'm sorry.
16 Is there anybody in the room that would
17 like to make a comment, put a comment on record?
18 Seeing none, the line is open.
19 Ladies and gentlemen on the phone line,
20 is there any individual that would like to make a
21 comment? If so, would you please simply state your
22 name?
23 Hearing none, we will close the phone
24 line.
25 Kent, thank you.

1 And, Dennis, back to you.

2 MEMBER BLEY: Thank you.

3 The next thing on our schedule for today

4 is a 4:00 p.m. meeting to discuss our meeting with

5 the Commission in October and we have to hold that

6 until 4:00 I guess, that's the rule.

7 What we're going to do in the interim is

8 work on the LaSalle letter and it's ready to be read

9 now. And, since we haven't been at this long, we'll

10 go ahead and get as far along with that as we can.

11 MEMBER SKILLMAN: I think we should let

12 Jeffery and his team exit.

13 Thank you, Jane, thank you.

14 MS. MARSHALL: Thank you.

15 MEMBER BLEY: At this point, we're going

16 to go off the record until 4:00 and then we'll be

17 back on the record.

18 We need to be on the record for that?

19 You don't think so?

20 (Whereupon, the above-entitled matter

21 went off the record at 1:42 p.m.)

United States Nuclear Regulatory Commission

Protecting People and the Environment

Advisory Committee on Reactor Safeguards Full Committee Meeting

July 6, 2016

LaSalle County Station, Units 1 and 2 Safety Evaluation Report (SER)

Jeffrey Mitchell, Project Manager
Office of Nuclear Reactor Regulation

Presentation Outline

- **Overview of LaSalle license renewal review**
- **Closure of Open Items**
  - OI 3.0.3.1.2-1 BWR Vessel ID Attachment Welds
  - OI 3.0.3.1.5-1 BWR Stress Corrosion Cracking
- **Conclusion**

Review Milestones

- License Renewal Application Received December 9, 2014
- Safety Evaluation Report (SER) with Open Items issued February 29, 2016
- ACRS License Renewal Subcommittee meeting held April 19, 2016
- Final SER issued June 2, 2016

SER Section 3

3.0.3 - Aging Management Programs

Applicant's Original Disposition of AMPs	Final Disposition of AMPs in Final SER
• 10 new programs – 9 consistent – 1 plant specific • 35 existing programs - 12 consistent - 19 consistent with enhancements - 2 consistent with exceptions - 2 consistent with enhancements and exceptions	• 11 new programs – 9 consistent – 2 plant specific* • 35 existing programs - 10 consistent - 19 consistent with enhancements - 3 consistent with exceptions - 3 consistent with enhancements and exceptions * 1 new plant specific AMP added during review

Open Item 3.0.3.1.2-1

3.0.3.1.2 – BWR Vessel ID Attachment Welds

- **Issue**:
  - BWRVIP-03 Rev 10 guidance changes for EVT-1 viewing angle limitation reduced effective examination coverage.
  - Coverage requirements not specified.
  - Program's ability to credit EVT-1s with zero percent coverage questioned program adequacy.
- **Applicant's Response**:
  - Revised EVT-1 requirements reduced coverage by 20 percentage points, but qualified NDE specialist visually examines portions not meeting EVT-1.
  - Revised procedures that discussed possibility of zero percent coverage and requires corrective action evaluation if no EVT-1 coverage achieved.
- **Conclusion**: Program with revised procedures is acceptable.

Open Item 3.0.3.1.5-1

3.0.3.1.5 – BWR Stress Corrosion Cracking

- **Issue**:
  - Formal disposition of limited examination coverage for augmented weld inspections was not included
  - Program effectiveness was not assured without documented bases for crediting limited weld inspections
- **Applicant Response**:
  - Current implementing procedure requires corrective action issue report for examinations with limited coverage results (less than 90-percent coverage)
  - Procedure revised to require "Engineering Technical Evaluation" with content comparable to that required for a ASME relief request
- **Conclusion**: Program with revised procedures is acceptable.

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Conclusion

On the basis of its review, the staff determines that the requirements of 10 CFR 54.29(a) have been met for the license renewal of LaSalle County Station, Units 1 and 2.

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NRC Vision and Strategy: Safely Achieving Effective and Efficient Non-Light Water Reactor Mission Readiness

Mike Jones
Project Manager, NRO/ARPB

July 6, 2016

Background

- Previously Licensed Commercial Non-LWRs
  - Fermi 1 (sodium-cooled reactor) licensed by AEC
    - OL in 1963, shutdown in 1972
  - Peach Bottom 1 (HTGR) licensed by AEC
    - OL in 1966, shutdown in 1974
  - Fort St. Vrain (HTGR) licensed by AEC
    - OL in 1973, shutdown in 1989
- The NRC recently issued a CP for "SHINE" facility
  - Moly-99 medical isotope production facility
- The NRC could review and license a non-LWR today, if needed
- The NRC needs to be efficient and effective as it conducts its safety, security, and environmental protection mission

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Non-LWR Vision & Strategy

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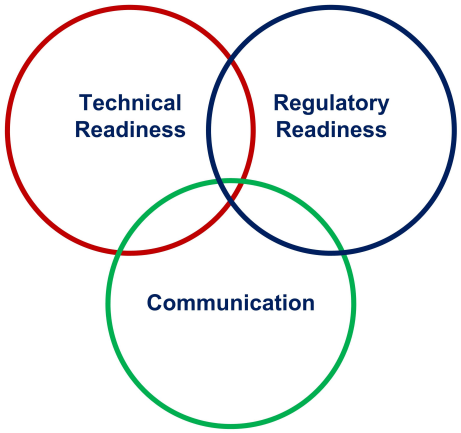
ML16139A812

NRC Vision and Strategy:
Safely Achieving Effective and Efficient
Non-Light Water Reactor
Mission Readiness



DRAFT

- Draft NRC Vision & Strategy made public at DOE-NRC Workshop on June 7-8, 2016 (ML16139A812)
- Phase 1 (Draft) Complete – Identification of Mission, Vision, Strategic Goal for Non-LWRs, Strategic Objectives and Contributing Activities
- Currently being processed for 60-day public comment period
- Phase 2 (Creation of Near-Term Implementation Action Plans) began in June 2016 with a target of September 2016 for draft completion

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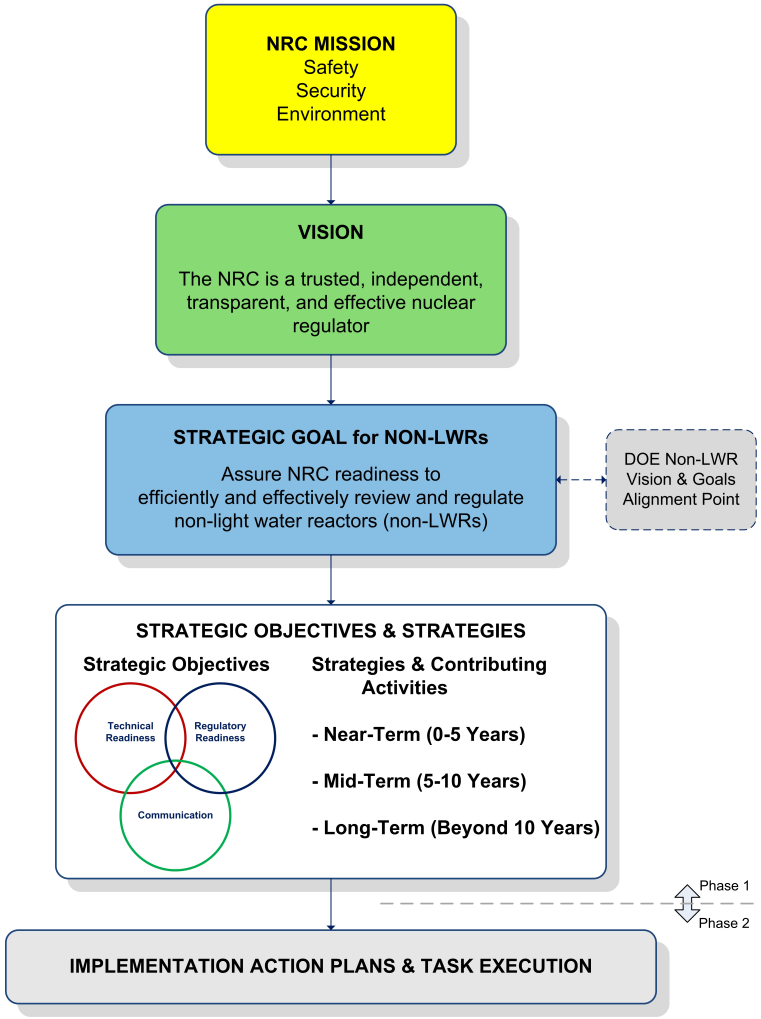
NRC Non-LWR
Mission Readiness Roadmap



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Strategic Goal for Non-LWRs

Assure NRC readiness to efficiently and effectively review and regulate non-light water reactors

- Strategic objectives and contributing activities support this goal

- Aligns with DOE's vision and strategy
  - Goal: By the early 2030s, at least two non-light water advanced reactor concepts have reached technical maturity, demonstrated safety and economic benefits, and completed licensing reviews by the NRC sufficient to allow construction to go forward.

Near-Term Strategies (0-5 years)

- Acquire/develop sufficient knowledge, technical skills, and capacity
- Acquire/develop sufficient computer codes and tools
- Establish more flexible, risk-informed and performance-based review process
- Facilitate industry codes and standards needed to support the non-LWR life cycle
- Identify and resolve technology-neutral policy issues
- Develop and implement a structured, integrated communication strategy

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Mid-Term Strategies (5-10 years)

- Identify and resolve technology-specific policy issues that impact regulatory reviews
- Acquire/develop sufficient technical skills and capacity to perform regulatory reviews/oversight
- Initiate and develop new non-LWR regulatory framework (if needed)

Long-Term Strategies (10+ years)

- Finalize a new non-LWR regulatory framework (if needed) that is risk-informed, performance-based, and that features staff review efforts commensurate with the demonstrated safety performance of the non-LWR NPP design being considered
  - A new regulatory framework could be helpful
  - The current framework was developed to support licensing LWRs
  - Non-LWR designs use different fuel types, coolants, passive safety features, and other design features
  - Non-LWRS exhibit different behavior during plant transients or accidents
  - It would better integrate risk-insights, address technological differences, and align with various industry and international standards

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Implementation Action Plans

- Development of IAPs will include:
  - Identification of detailed tasks to be performed
  - Preparation of cost estimates (jobhours, FTE)
  - Estimated work durations
  - Expected participants by organization
- Execution of IAPs depends on:
  - Resource availability
  - Maturity/readiness of non-LWR technologies/vendors
  - Specific non-LWR stakeholder needs

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Conclusions

- The NRC could review and license a non-LWR today
- The NRC has a vision and strategy for non-LWR mission readiness
- Our strategic goal to assure NRC readiness to efficiently and effectively review and regulate non-light water reactors aligns with DOE's vision and strategy
- We have a number of near, mid, and long term strategies and associated contributing activities to support our goals and are currently developing implementation action plans

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Regulatory Readiness: Review Process Options for Non-LWR Designs

Anna Bradford, Acting Deputy Director
Division of Site Safety and Environmental Analysis

July 6, 2016

Introduction

Why we are developing options for regulatory review processes:

- To respond to non-LWR industry needs
- To provide flexibility for stakeholders
- To become familiar with new designs and technologies
- To gain information on industry plans early

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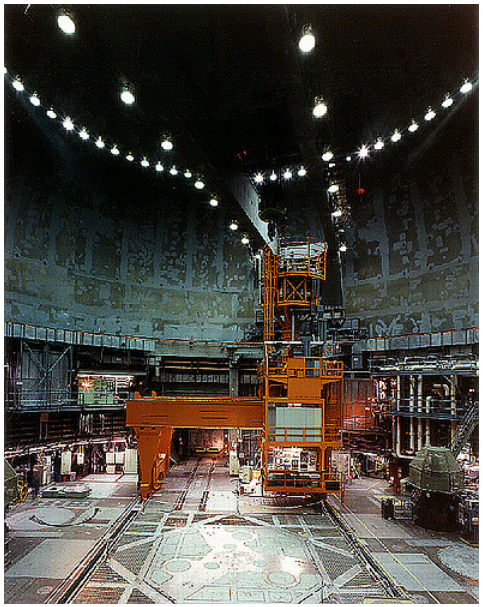
Non-LWRs Have Been and Can Be Licensed in the U.S. under the Current Regulatory Framework

- Examples include HTGRs and SFRs

Fort St. Vrain in Colorado 1974 - 1989

EBR- 1 at Argonne National Lab 1951 - 1964



Fast Flux Facility at Hanford 1980 - 1993

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Review Processes

Our current work on review process options utilize the NRC's existing regulatory framework:

- Design Review Processes
- Licensing Review Processes

In the future, we may develop a new regulatory framework.

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NRC Design Review Processes Being Considered

DR Process 1 – Letters/ White Papers / Technical Reports / Topical Reports – Provide varying degrees of feedback on regulatory or technical topics

DR Process 2 – Pre-app Readiness Reviews, Pre-app Audits – Provide feedback prior to submitting an application

DR Process 3 – Conceptual Design Assessment – Provides early design phase regulatory feedback on potential technical risks and regulatory challenges

DR Process 4 – Staged Design Review - Utilizes elements of the Standard Design Approval to package discrete sections of the application for review by NRC

DR Process 5 – Preliminary Design Review – Pre-application SER similar to PRISM, SAFR, HTGR, etc.

DR Process 6 – Standard Design Approval – 10 CFR Part 52 Subpart E

DR Process 7 – Standard Design Certification – 10 CFR Part 52 Subpart B

Key: Green: New Process | Yellow: Existing Process

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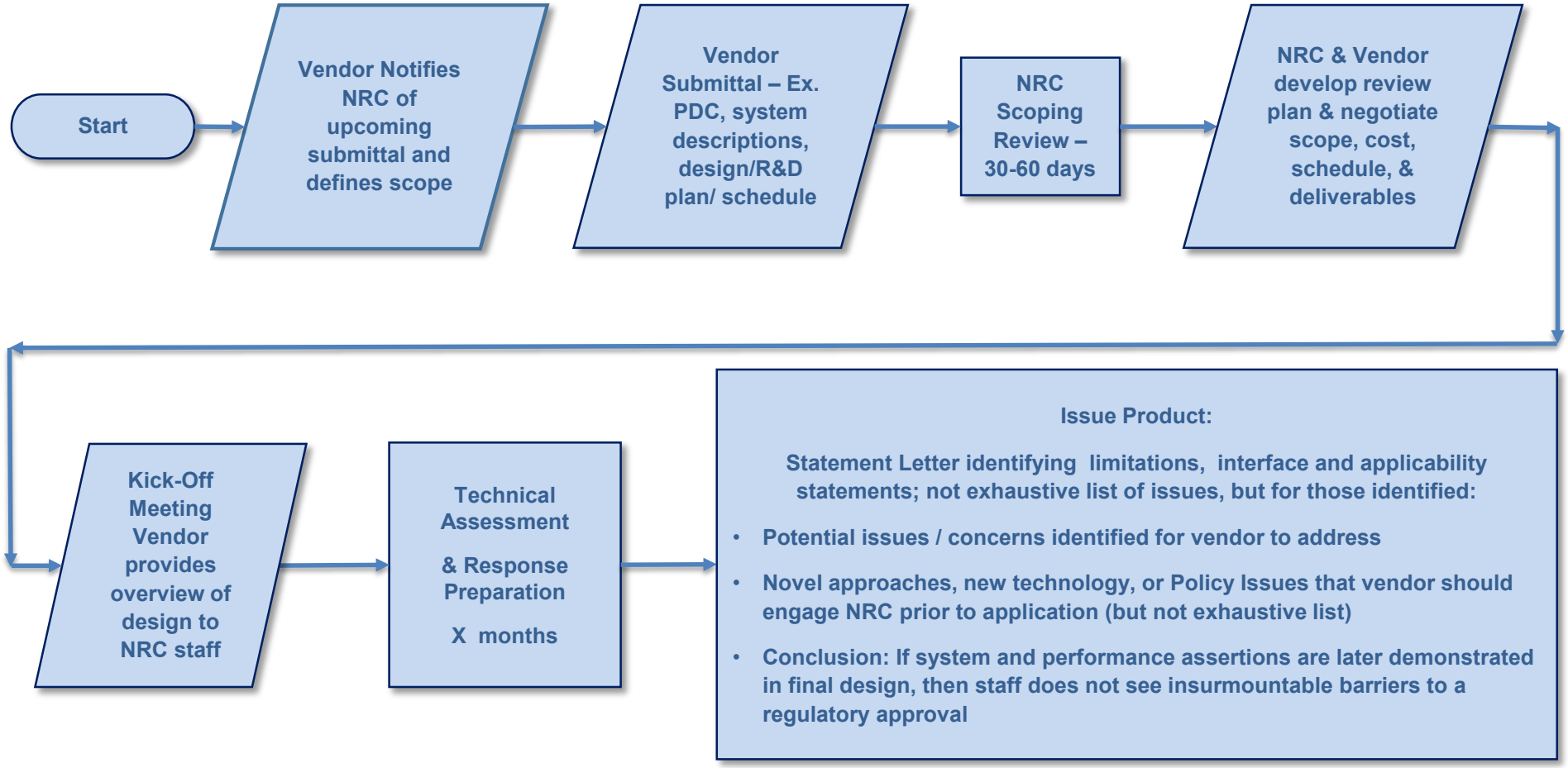
DR Process 3 – Conceptual Design Assessment Approach Under Consideration



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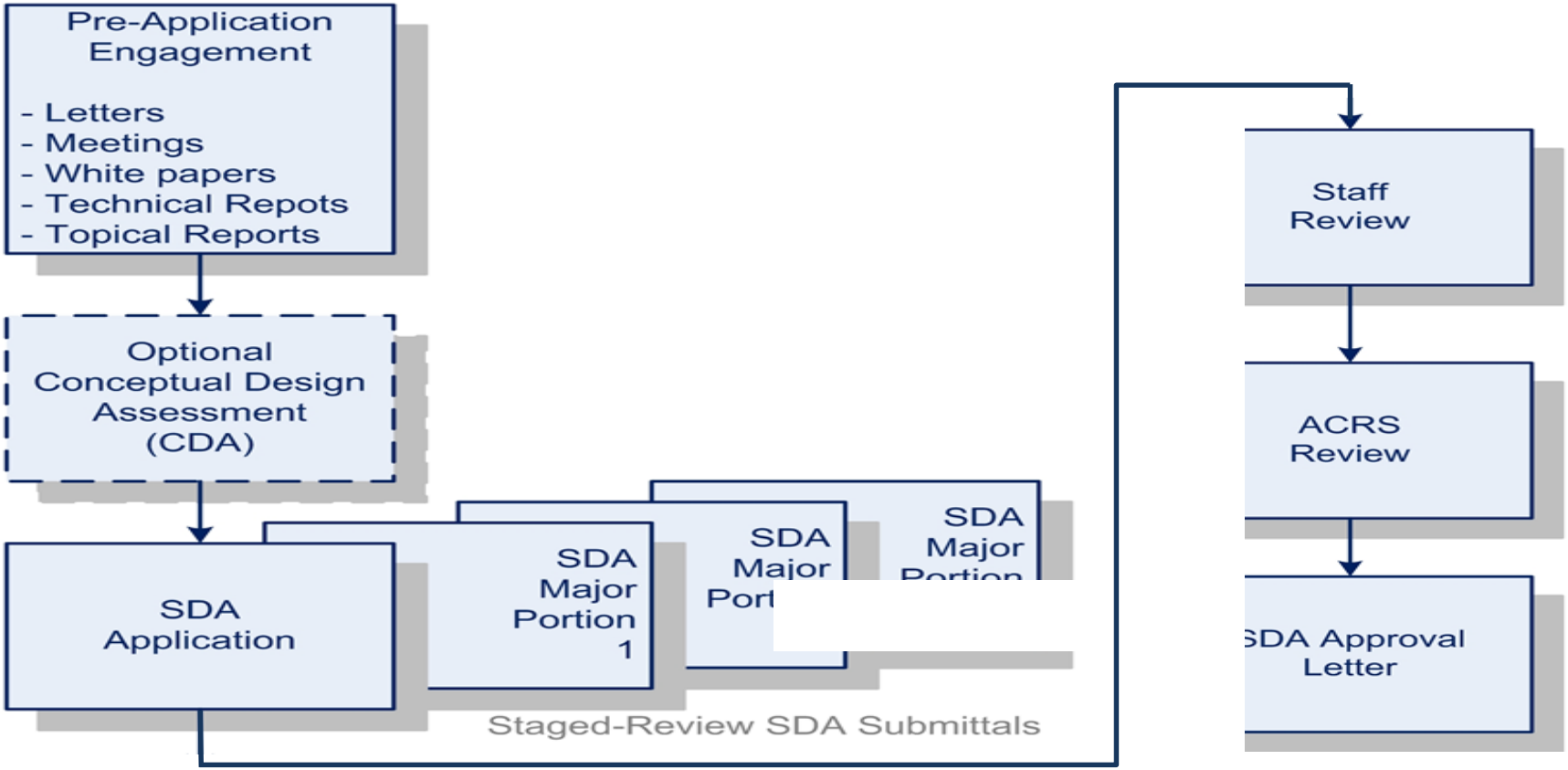
DR Process 4 –Staged Design Review Using Standard Design Approval (SDA) Under Consideration



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NRC Licensing Review Process Options Under Consideration

LIC Option 1a – Part 50 (CP and OL, LWA) Application

LIC Option 1b – Part 50 (CP and OL, LWA) Application for a Prototype Reactor

LIC Option 2a – Part 52 (COL, DC, ESP, LWA) Application

LIC Option 2b – Part 52 (COL, DC, ESP, LWA) Application for a Prototype Reactor

Future New Risk Informed Performance Based (RI/BP) Technology Neutral Framework (if/when available):

LIC Option 3a – New "Part XX" RI/ PB - Application
LIC Option 3b – New "Part XX" RI/ PB – for a Prototype Reactor

Key: Green: New Process | Yellow: Existing Process

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Licensing Options Under New RI/PB Framework

- NEW FUTURE process codified by NEW regulation
- Fully risk-informed/performance based
- Technology neutral for both LWR and Non-LWR technologies

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Resolution of Key Policy Issues Proceeding

Issue	No Further Action	Path Forward
Prototype Reactors	✓	
Licensing of Multi-Module Facilities	✓	
Manufacturing License	✓	
Defense-In-Depth	✓	
Key Design Issues	✓	
Control Room Staffing	✓	
Operational Programs	✓	
Installation During Construction	✓	
Facilities Using Process Heat	✓	

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Resolution of Key Policy Issues Proceeding (Cont.)

Issue	No Further Action	Path Forward
Security and Safeguards	✓	
Aircraft Impact	✓	
Decommissioning Funding	✓	
SMR Variable Annual Fees	✓	
Multi-Module Risk	✓	
Mechanistic Source Term		Obtaining public input
Emergency Preparedness		Proceeding with rulemaking
Insurance and Liability		Assessing the need for action

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Conclusion

- NRC is developing new processes to respond to the needs of stakeholders
- Near term processes utilize the existing regulatory framework to respond to near term needs
- Future long term risk-informed performance-based technology neutral process is envisioned

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Advanced Non-Light Water Reactor Design Criteria

Jan Mazza, Project Manager
Advanced Reactor and Policy Branch

July 6, 2016

Overview

- Background of the initiative to develop non-Light Water Reactor (LWR) design criteria
- Current Status of the non-LWR design criteria initiative
- Future Activities for non-LWR design criteria

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Background

- DOE and NRC agreed in June 2013 to pursue a joint initiative to formulate guidance for developing principal design criteria (PDC) for non-light water reactor designers
  - NRC Regulations 10 CFR Part 50 Appendix A establish General Design Criteria (GDC) specific to LWRs and "generally applicable" to non-LWRs
  - Applicants must establish PDC based on the GDC (10 CFR Part 50.34(a)(3),10 CFR Part 52.47(a)(3), etc.)

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Background cont.

Purpose

- Establish clear guidance for the development of the PDC for advanced non-LWR developers
- Guidance will provide the following key benefits:
  - Reduced regulatory uncertainty for advanced non-light water reactor developers
  - Improved guidance for NRC staff reviewing future advanced reactor license applications
  - Improved timeliness and efficiency of licensing activities for both applicants and NRC staff

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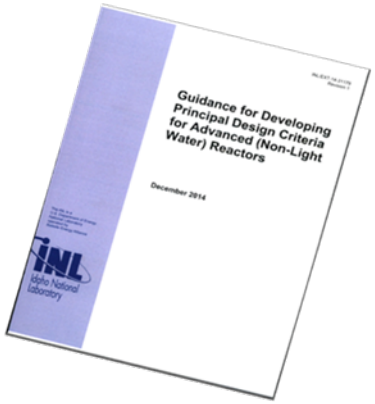
Background cont.

- Phased Approach
  - "Phase 1" – DOE and DOE lab expertise was utilized for research, review, evaluation, and documentation.
    - DOE sought and received stakeholder input:

      American Nuclear Society, AREVA, Argonne National Laboratory, Flibe Energy, CBI Federal Services, General Atomics, General Electric, Gen4 Energy, Inc., Hybrid Power Technologies LLC, Japan Atomic Energy Agency, Korea Atomic Energy Research Institute, TerraPower, Toshiba, X-Energy
    - DOE report, "Guidance for Developing Principal Design Criteria for Advanced (Non-Light Water) Reactors issued December 2014



Background cont.

DOE report included:

- A proposed set of Advanced Reactor Design Criteria, generally applicable to:
  - Sodium-cooled Fast Reactors (SFRs)
  - Lead Fast Reactors (LFRs)
  - Gas-cooled Fast Reactors (GFRs)
  - Modular High Temperature Gas-cooled Reactors (mHTGRs)
  - Fluoride High Temperature Reactors (FHRs)
  - Molten Salt Reactors (MSRs)
- A proposed set of Sodium-cooled Fast Reactor Design Criteria.
- A proposed set of modular High Temperature Gas-cooled Reactor Design Criteria.
- DOEs technical justification for adaptations of the original GDC

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Background cont.

- DOE also developed technology-specific design criteria for SFRs and mHTGRs to address design features not encompassed by the LWR-focused GDC:
  - Expands existing design criteria to address new structures, systems, and components important to safety.
  - Expands existing design criteria to address technology specific hazards.

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Background cont.

- "Phase 2" – NRC considers the DOE report and develops regulatory guidance
- "Phase 2" activities include:
  - Form a team from across the agency to review and consider DOE report and references
  - Develop a proposed NRC version of ARDC, SFR-DC and mHTGR-DC
  - Develop a draft and final Regulatory Guide commensurate with an official NRC staff position

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Current Status

NRC staff reviewed the DOE report, "Guidance for Developing Principal Design Criteria for Advanced (Non-Light Water) Reactors" and developed the NRC versions of:

- Advanced Reactor Design Criteria
- Sodium-cooled Fast Reactor Design Criteria
- modular High Temperature Gas-cooled Reactor Design Criteria

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Current Status cont.

- The NRC version of the Design Criteria sent out for 60 day informal comment on April 7, 2016
- Public Meeting held May 17, 2016
- Informal public comments received June 8, 2016
  - Over 350 comments received from over 20 stakeholder organizations

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Security Design Considerations

- Security Design Considerations (SDCs) were developed in addition to the non-LWR design criteria
- SDCs help designers identify opportunities for resolving security issues through:
  - the facility design
  - engineered security features
  - formulation of mitigation measures
  - reduced reliance on human actions
- NRC is working to issue these for informal public comment
- Security Design Considerations will be included as part of the non-LWR design criteria regulatory guide

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Further Engagement

- The NRC expects further engagement on key issues in design criteria for non-LWRs
  - mHTGR-DC 16 Functional Containment
  - mHTGR-DC 10 Reactor Design
  - ARDC 17 Electric Power Systems
  - ARDC 34, SFR-DC 34, mHTGR-DC 34 and ARDC 35 Residual Heat Removal and Emergency Core Cooling
  - Security Design Considerations

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Future Activities

- Review and consider informal comments non-LWR Design Criteria
- Public meeting(s) during the summer / fall 2016
- Issue Security Design Considerations for an informal 45-day comment period
- Issue draft regulatory guide (RG) for 60-day public comment period early 2017
- ACRS review/interaction on draft RG
- Final regulatory guide issuance planned for 2017

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Summary

- The initiative to develop a regulatory guide for non-LWR design criteria continues to progress
- Security design considerations were developed to help designers resolve security issues through the facility design
- Further engagement is expected on key issues in design criteria for non-LWRs
- Future activities include developing draft Reg. Guide, ACRS interaction, public meetings/comment period, and developing final Reg. Guide

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Future Plant Designs

Michael Mayfield, Director
Division of Engineering, Infrastructure, and Advanced Reactors
Office of New Reactors

June 7, 2016

Agenda

- Nuclear Energy Institute
- United States Nuclear Infrastructure Council
- Department of Energy
- NRC Activities
  - NRC Vision and Strategy: Safely Achieving Effective and Efficient Non-Light Water Reactor Mission Readiness
  - Regulatory Readiness: Review Process Options for Non-LWR Designs
  - Advanced Non-LWR Design Criteria

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U.S. DEPARTMENT OF ENERGY | Nuclear Energy

DOE Initiatives on Non-Light Water Reactors (Vision and Strategy)

Craig Welling
Deputy Director, Advanced Reactor Technologies
U.S. Department of Energy

Advisory Committee on Reactor Safeguards
Future Reactor Designs Subcommittee
July 6, 2016

U.S. DEPARTMENT OF ENERGY

Nuclear Energy

Advanced Non-Light Water Reactors Overview

There has been increasing interest in advanced Non-light water reactors and benefits they can provide toward clean energy and energy security needs.

- **DOE initiatives have included:**
  - Development of a vision and strategy for advanced reactors
  - Establishment of the Gateway for Accelerated Innovation in Nuclear (GAIN)
  - Conduct of a Test/Demonstration Advanced Reactor Planning Study
  - Providing cost shared support for reactor concepts.
- **These initiatives support the need for new nuclear capacity that will be needed in the 2030 to 2050 time frame.**

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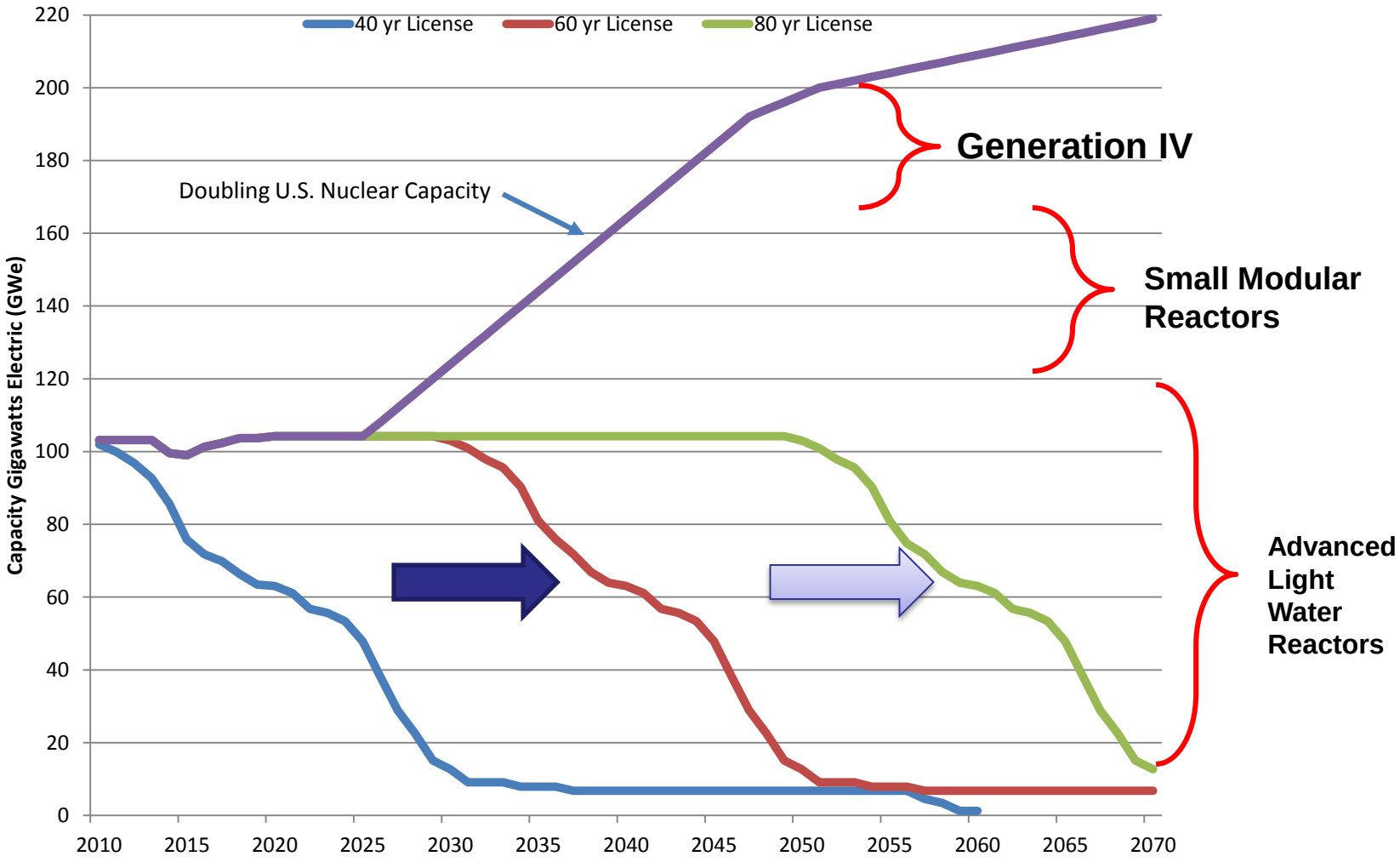
Nuclear Energy

Nuclear Power Capacity needed to meet Clean Power Goals



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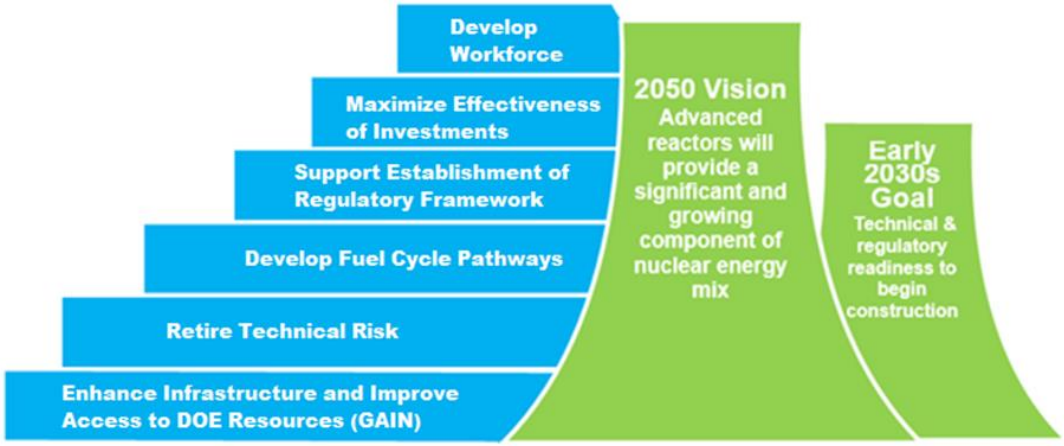
Nuclear Energy

Vision and Strategy for Advanced Reactors

- **To meet the challenge, DOE has developed the *Vision and Strategy for Development and Deployment of Advanced Reactors***
  - Final draft publically available at http://energy.gov/ne/downloads/draft-vision-and-strategy-development-and-deployment-advanced-reactors
- **The Vision and Strategy will complement DOE efforts to:**
  - Support the current Light Water Reactor fleet
  - Pursue the construction/operation of Generation III+ reactors
  - Support the development/licensing/deployment of Small Modular Reactors



Vision and Strategy for Advanced Reactors

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Nuclear Energy

Vision and Goal

VISION

By 2050, advanced reactors will provide a significant and growing component of the nuclear energy mix both domestically and globally, due to their advantages in terms of improved safety, cost, performance, sustainability, and reduced proliferation risks.

GOAL

By the early 2030s, at least two non-light water advanced reactor concepts have reached technical maturity, demonstrated safety and economic benefits, and completed licensing reviews by the U.S. Nuclear Regulatory Commission (NRC) sufficient to allow construction to go forward.

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Nuclear Energy

Strategic Objectives

1. Enhance the innovation infrastructure for nuclear technologies and vastly improve access to DOE expertise and capabilities through the Gateway for Accelerated Innovation in Nuclear (GAIN) initiative
2. Demonstrate performance and retire technical risks for advanced reactors
3. Support the development of fuel cycle pathways for advanced reactors
4. Support the establishment of an efficient and reliable regulatory framework for advanced reactors
5. Effectively leverage public/private sector resources and policy incentives to aid the private sector in accelerating advanced reactor deployment
6. Address human capital and workforce development needs

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Nuclear Energy

Enhanced Nuclear Innovation Infrastructure and Improved Access

- **Continue to enhance experimental, testing, and simulation capabilities while vastly improving access to DOE expertise and facilities. Key activities include:**
  - Implement the Gateway for Accelerated Innovation in Nuclear (GAIN)
    - Provides greater access to experimental, testing, and modeling and simulation capabilities
    - Facilitates use of the DOE nuclear technology database
    - Promotes broader engagement with industry to understand technical needs.
  - Restart the Transient Reactor Test Facility (TREAT)
  - Use the results of the advanced test/demonstration reactor planning study
  - Explore options for adding international collaboration elements to GAIN and the Nuclear Science User Facilities (NSUF) program

TREAT Facility

GAIN Gateway for Accelerated Innovation in Nuclear

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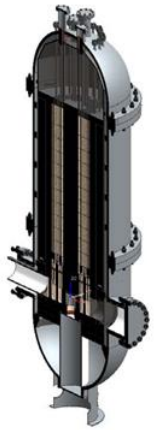
Retiring Advanced Reactor Technical Risk

- **DOE will pursue a multifaceted set of efforts to retire technical risks associated with advanced reactors including:**
  - Soliciting industry input on R&D needs
  - Supporting cost-shared, industry-led R&D for concept-level development and conduct research on advanced reactor technologies to reduce risk, enhance safety and security and improve economic competitiveness.
  - Activities to support advanced reactor development
    - Laboratory directed R&D and relevant research projects selected through the DOE's Nuclear Energy University Program
    - Potential consideration to develop a test/demonstration reactor(s) to further enhance testing capabilities and support the timely deployment of advanced reactors
    - Pursuing technical solutions to support the changing role of nuclear energy as part of a diverse electricity generation mix and for non-electric uses

Mechanisms Engineering (Sodium) Test Loop at ANL



High Temperature Test Facility at Oregon State University

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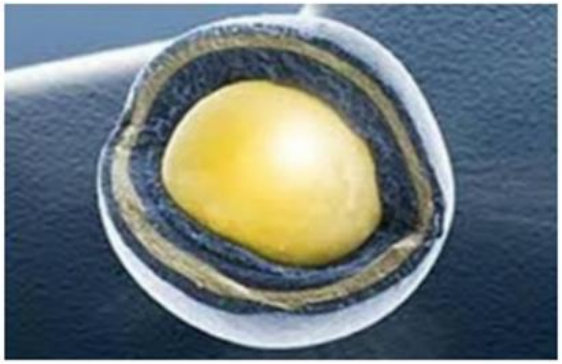
Nuclear Energy

Fuel Cycle Pathways for Advanced Reactors

- **DOE will pursue R&D to develop improved fuels for existing reactor technologies and suitable fuels for advanced reactors. Working with industry, these efforts will likely focus on:**
  - TRISO-coated particle fuel for high temperature reactors, metallic fuel for fast reactors, and transmutation fuels for longer-term applications
  - Identifying and characterizing fuels and separations/enrichment technologies.
    - DOE would assess the need for and/or provide for the deployment of fuel cycle facilities.
  - Addressing the back end of the nuclear fuel cycle
    - DOE is pursuing R&D to develop the technologies and capabilities needed to enable the safe storage, transportation, and disposal of used nuclear fuel and wastes generated by existing and future nuclear fuel cycles



TRISO coated particle fuel

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Supporting Regulatory Framework Development for Advanced Reactors

- **DOE and its stakeholders will collaborate with the NRC as the NRC develops a regulatory framework for advanced reactors. Potential efforts include:**
  - Providing assistance to the NRC as it develops
    - design criteria for advanced reactors
    - potential staged licensing and preliminary licensability review processes
  - Assisting the NRC in resolving key policy issues by
    - co-hosting joint workshops
    - exploring options for new fuel and fuel fabrication facilities
    - modifying existing guidance (such as the Standard Review Plan) to accommodate advanced non-light water reactor designs

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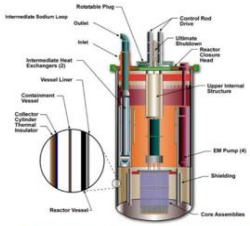
Maximizing the Effectiveness of Public and Private-Sector Investments to Accelerate Advanced Reactor Deployment

- **DOE will explore new ways to work with the private sector to accelerate advanced reactor deployment and support further development of advanced reactor concepts.**
  - DOE would use public-private partnerships and technology-specific working groups to identify opportunities for government investment that could help advance multiple reactor concepts
  - DOE and the Administration will explore the use of other appropriate policy or financial incentives to support advanced reactor deployment

- PWR
- BWR

- AP1000
- ESBWR

- NuScale
- B&W mPower
- Holtec SMR-160
- Westinghouse SMR



- Sodium Fast Reactor
- High Temperature Gas Reactor
- Lead Fast Reactor
- Gas Fast Reactor
- Molten Salt Reactor

GEN II	GEN III +	SMR	GEN IV Advanced Reactors
Leveraged Support	NP 2010	SMR Licensing Technical Support	Cost Shared and Potential Future Support for Advanced Reactors

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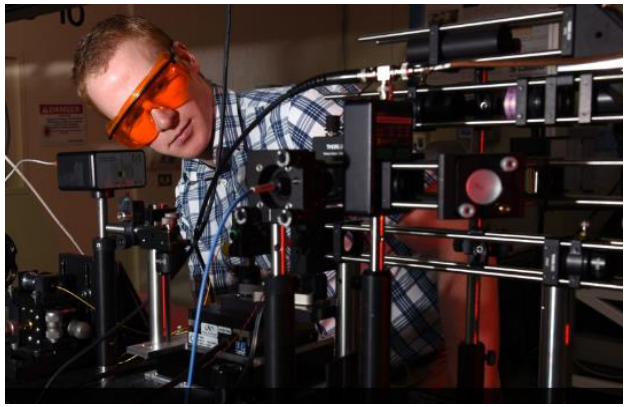
Developing the Nuclear Energy Workforce of the Future

- **Continue funding nuclear-related research projects and scholarships and fellowships through its Nuclear Energy University Program (NEUP) and Integrated University Program (IUP)**
- **Promote advanced reactor technology training opportunities through workshops, curriculum development, and joint laboratory, university, and industry projects**
- **Seek opportunities to engage academic institutions in enhancing research efforts relevant to the development of advanced reactor technologies**

NEUP Nuclear Energy University Program

U.S. Department of Energy



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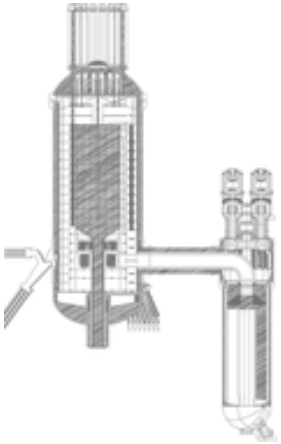
Industry Collaboration – Cost Shared support for reactor concepts

- **DOE made multiple awards totaling $16.5M in FY 2013 and FY 2014 for cost shared industry-led R&D to address specific technical R&D needs of advanced reactors.**

- **With FY15 funding DOE is providing $12.5M for cost-shared further development of two performance based advanced reactor concepts. Awardees are:**
  - X-Energy (Pebble Bed High Temperature Gas Reactor)
  - Southern Company Services (Molten Chloride Fast Reactor).

- **These awards reflect DOE's interest in collaborating with industry and Congressional support for advanced reactor development.**



X-Energy Xe-100

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Advanced Test/Demo Planning Study

- **FY15 Omnibus Spending Bill**
  "$7,000,000 is for an advanced test/demonstration reactor planning study by the national laboratories, industry, and other relevant stakeholders of such a reactor in the U.S. The study will evaluate advanced reactor technology options, capabilities, and requirements within the context of national needs and public policy to support innovation in nuclear energy."
- **The objective of the study is to provide options for a test and or demonstration reactor(s) to be built to support innovation and long term commercialization**
- **Draft report has been provided to the Nuclear Energy Advisory Committee.**

Summary

- **Achieving our vision of a substantial role for nuclear power for a clean energy future and in support of national security requires:**
  - The continued long-term operation of the existing fleet of nuclear power plants
  - The deployment of new nuclear plants, including a mixture of
    - Large LWRs
    - SMRs
    - Advanced Reactors
- **Through the Vision and Strategy for Development and Deployment of Advanced Reactors, GAIN and other initiatives DOE will work with key stakeholders, the NRC, and the private sector to lay the foundation for advanced reactor deployment.**