



**UNITED STATES
NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
WASHINGTON, DC 20555 - 0001**

November 20, 2018

MEMORANDUM TO: ACRS Members

FROM: Quynh Nguyen, Senior Staff Engineer */RA/*
Technical Support Branch, ACRS

SUBJECT: CERTIFIED MINUTES OF THE ACRS REGULATORY POLICIES AND
PRACTICES SUBCOMMITTEE MEETING ON AUGUST 22, 2018

The minutes of the subject meeting were certified on November 15, 2018, as the official record of the proceedings of that meeting. Copies of the certification letter and minutes are attached.

Attachments: As stated

cc w/ att. A. Veil
M. Banks



**UNITED STATES
NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
WASHINGTON, DC 20555 - 0001**

MEMORANDUM TO: Quynh Nguyen, Senior Staff Engineer
Technical Support Branch, ACRS

FROM: Walter Kirchner, Chairman
Regulatory Policies and Practices Subcommittee

SUBJECT: CERTIFICATION OF THE MINUTES OF THE REGULATORY
POLICIES AND PRACTICES SUBCOMMITTEE MEETING ON
August 22, 2018

I hereby certify, to the best of my knowledge and belief, that the minutes of the subject meeting are an accurate record of the proceedings for that meeting.

/RA/

November 15, 2018

Walter Kirchner, Chairman
Regulatory Policies and
Practices Subcommittee

Dated

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
MINUTES OF THE REGULATORY POLICIES & PRACTICES SUBCOMMITTEE MEETING
August 22, 2018

The ACRS Regulatory Policies & Practices Subcommittee held a meeting on August 22, 2018 in T2-B1, 11545 Rockville Pike, Rockville, Maryland. The meeting convened at 1:00 PM and adjourned at 3:42 PM.

The entire meeting was open to the public.

No written comments or requests for time to make oral statements were received from members of the public related to this meeting.

ATTENDEES

ACRS Members/Consultants/Staff

WALTER L. KIRCHNER, Chairman
DENNIS C. BLEY, Member
RONALD G. BALLINGER, Member
MICHAEL L. CORRADINI, Member
JOSE A. MARCH-LEUBA, Member
JOY L. REMPE, Member
MATTHEW W. SUNSERI, Member
QUYNH NGUYEN, Designated Federal Official

Other Participants:

ANNA BRADFORD, NRO
MICHELLE HART, NRO
ARCHIE MANOHARAN, TVA
BRUCE MUSICO, NSIR
RAYMOND SCHIELE, TVA
DANIEL STOUT, TVA
MALLECIA SUTTON, NRO
KENNETH THOMAS, NSIR
SCOTT WEBBER, NuScale
ALEX YOUNG, TVA

SUMMARY

The purpose of this meeting is the review of section 13.3, "Emergency Planning," of Tennessee Valley Authority's (TVA) Clinch River Early Site Permit (ESP) application. The meeting transcripts are attached and contain an accurate description of each matter discussed during

the meeting. The presentation slides and handouts used during the meeting are attached to these transcripts.

SIGNIFICANT ISSUES	
Issue	Reference Pages in Transcript
Ms. Bradford stated that the staff was directed by SECY-15-0077 to use existing exemption processes with changes to emergency planning zone (EPZ) sizes, where requested by an applicant prior to a rule being completed. The TVA ESP application includes a proposed methodology that, if approved, could be used by a future combined license applicant to establish a plume exposure pathway EPZ at the site boundary or a plume exposure pathway EPZ with a two-mile radius, if certain conditions are met.	7-9
Mr. Stout stated that the contested hearing has been terminated by the Atomic Licensing Safety Board (ALSB) though there will be a mandatory hearing after the final NRC safety evaluation (SE). Two miles is a surrogate for scalable (used the four candidates in the Plant Parameter Envelope (PPE)).	10, 14
Ms. Manoharan described the emergency preparedness plans for 1) a site boundary EPZ and 2) a 2-mile EPZ. NUREG-0396 introduced the concept of a generic EPZ as the basis for planning of response saving in areas surrounding a nuclear plant in case of a serious reactor accident. The NUREG concluded that the objective of an emergency plan should be to provide dose savings for a spectrum of accidents that could produce offsite doses in excess of the protective action guides. (21).	16
Dose-based methodology takes into consideration the unique SMR design features which vary significantly from large light water reactors.	22
The technical criteria for determining a plume exposure path for the EPZ has three criteria (A, B, and C). The methodology for A and B are discussed. The methodology for C is discussed (29).	23
Mr. Young discussed an example applying the methodology. His conclusion was that the criterion A and B were satisfied and there were no accidents for consideration for criterion C and that a site boundary EPZ is possible at the Clinch River Site (44). Multiple module events would be considered at the COLA stage if appropriate.	30
Member Corradini asked about the source term but that discussion was not possible because of NuScale proprietary information. Miss Bradford reminded the Committee that this was not a NuScale Review (43).	37

Member Rempe began a discussion regarding the four days after a release and Mr. Young offered clarification. During the COLA stage, the source term will be compared to the criterion A and B source terms for the accident selected to the four-day atmospheric release source term for the EPZ exemption request applicability.	51
Ms. Manoharan discussed the interactions with other entities in the area as well as the size of the anticipated sizes of the planning zone.	54-62
Ms. Sutton provided a review of the PPE approach and how a reactor technology is not selected until the COLA stage.	67
Mr. Musico and Ms. Hart (80) discussed how two emergency plans (site boundary, 2-mile) are being approved during the ESP but will be revisited at the COLA stage. At the ESP stage, the applicant must have major features and limitations of their emergency plans (107). If the site boundary plan is approved, there would be no need for FEMA approval of off-site radiological plans (115). The methodology is the dose at whatever distance it turns out to be (118).	73

Documents provided to the Committee:

REFERENCES:

1. Safety Evaluation: Clinch River, "Conduct of Operations" (**ML17291A052**)

Official Transcript of Proceedings
NUCLEAR REGULATORY COMMISSION

Title: ACRS Regulatory Policies and Practices
Subcommittee

Docket Number: N/A

Location: Rockville, Maryland

Date: August 22, 2018

Work Order No.: NRC-3860

Pages 1-184

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UNITED STATES NUCLEAR REGULATORY COMMISSION'S
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

The contents of this transcript of the proceeding of the United States Nuclear Regulatory Commission Advisory Committee on Reactor Safeguards, as reported herein, is a record of the discussions recorded at the meeting.

This transcript has not been reviewed, corrected, and edited, and it may contain inaccuracies.

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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

(ACRS)

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REGULATORY POLICIES AND PRACTICES SUBCOMMITTEE

+ + + + +

WEDNESDAY

AUGUST 22, 2018

+ + + + +

ROCKVILLE, MARYLAND

+ + + + +

The Subcommittee met at the Nuclear Regulatory Commission, Two White Flint North, Room T2B1, 11545 Rockville Pike, at 1:00 p.m., Walter L. Kirchner, Chairman, presiding.

COMMITTEE MEMBERS:

WALTER L. KIRCHNER, Chairman

RONALD G. BALLINGER, Member

DENNIS C. BLEY, Member

MICHAEL L. CORRADINI, Member

JOSE A. MARCH-LEUBA, Member

JOY L. REMPE, Member

MATTHEW W. SUNSERI, Member

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DESIGNATED FEDERAL OFFICIAL:

QUYNH NGUYEN

ALSO PRESENT:

ANNA BRADFORD, NRO

MICHELLE HART, NRO

ARCHIE MANOHARAN, TVA

BRUCE MUSICO, NSIR

RAYMOND SCHIELE, TVA

DANIEL STOUT, TVA

MALLECIA SUTTON, NRO

KENNETH THOMAS, NSIR

SCOTT WEBBER, NuScale

ALEX YOUNG, TVA

*Present via telephone

TABLE OF CONTENTS

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25

Page

Opening Remarks

Walter Kirchner 4

Introductions and Overview

Anna Bradford 7

Chapter 13, Section 13.3:

Emergency Planning

Daniel Stout, Raymond Schiele,
Archie Manoharan, and Alex Young 9

Safety Evaluation Chapter 13,

Section 13.3: Emergency Planning

Mallecia Sutton, Bruce Musico,
and Michelle Hart 67

Public Comment

Walter Kirchner 124

Committee Discussion

Walter Kirchner 124

Adjourn

Walter Kirchner 125

P R O C E E D I N G S

(12:59 p.m.)

CHAIRMAN KIRCHNER: The meeting will now come to order.

This is a meeting of the Regulatory Policies and Practices Subcommittee of the Advisory Committee on Reactor Safeguards.

I am Walt Kirchner, the Chairman of this subcommittee meeting. ACRS members in the room are Ron Ballinger, Dennis Bley, Matt Sunseri, Joy Rempe, and Jose March-Leuba. Quynh Nguyen, who is of the ACRS staff, is the designated federal official for this hearing.

The subcommittee will hear from representatives of TVA and the staff regarding a Section 13.3, Emergency Planning, of TVA's Clinch River early site permit application and the corresponding safety evaluation.

The subcommittee will gather information, analyze relevant issues and facts, and formulate proposed positions and actions, as appropriate for full deliberation by the full committee.

The ACRS was established by statute and is governed by the Federal Advisory Committee Act. This means that the committee can only speak through its

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1 published letter reports. We hold meetings to gather
2 information to support our deliberations.

3 Interested parties who wish to provide
4 comments can contact our offices requesting time after
5 the meeting announcement is published in the Federal
6 Register. That said, we also set aside some time for
7 spur of the moment comments from members of the public
8 attending or listening to our meetings. Written
9 comments are also welcome.

10 In regard to early site permits, 10 CFR
11 52.23 provides that the Commission shall refer a copy
12 of the application to the ACRS and the committee shall
13 report on those portions which concern safety.

14 The ACRS section of the U.S. NRC public
15 website provides our charter, bylaws, letter reports,
16 and full transcripts of all full and subcommittee
17 meetings, including slides presented at the meetings.

18 The rules for participation in today's
19 meeting were previously announced in the Federal
20 Register. We have received no written comments or
21 requests for time to make oral statements from members
22 of the public regarding today's meeting. Is that
23 still true? Yes, okay.

24 We have a bridge line established -- you
25 can hear the static -- for interested members of the

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1 public to listen in. To preclude interruption of the
2 meeting, the phone bridge will be placed in a listen-
3 in mode during the presentations and maybe
4 discussions. We will unmute the bridge line at a
5 designated time to afford the public an opportunity to
6 make a statement or provide comments.

7 At this time, I request that meeting
8 attendees and participants silence their cell phones
9 and any other electronic devices that are audible.

10 A transcript of the meeting is being kept
11 and will be made available as stated in the Federal
12 Register notice. Therefore, we request that
13 participants in this meeting use the microphones
14 located throughout the meeting room when addressing
15 the subcommittee. The participants should first
16 identify themselves and speak with sufficient clarity
17 and volume so that they may be readily heard. Make
18 sure the little green light of the microphone is on
19 before speaking and off when not in use.

20 Before we proceed with the meeting, we
21 have been joined by our chairman, Mike Corradini.

22 Do we have Pete on the line?

23 MEMBER CORRADINI: He was. I do not think
24 he is.

25 CHAIRMAN KIRCHNER: Okay. So at this

1 point, I think I can turn to Anna Bradford, who is the
2 Deputy Director over in NRO.

3 MS. BRADFORD: Thank you. Again, my name
4 is Anna Bradford. I am the Deputy Director of the
5 Division of Licensing, Siting, and Environmental
6 Analysis in the Office of New Reactors.

7 This morning, you heard from the staff on
8 a proposed rule for emergency planning for small
9 modular reactors and other new technologies. In the
10 SRM for SECY-15-0077, the Commission directed the
11 staff to use its existing exemption processes with
12 changes to emergency planning zone sizes, where
13 requested by an applicant prior to the rule being
14 completed.

15 This afternoon, we will discuss an
16 exemption request from the TVA Clinch River Nuclear
17 Site that was reviewed against the current regulations
18 and guidance.

19 The TVA early site permit application
20 includes a proposed methodology that, if approved,
21 could be used by a future combined license applicant
22 to establish a plume exposure pathway emergency
23 planning zone at the site boundary or a plume exposure
24 pathway emergency planning zone with a two-mile radius
25 if certain conditions are met. If these exemptions

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1 are approved as part of the ESP, they will be
2 accompanied by permit conditions specifying the
3 circumstances under which they can be used by the
4 combined license applicant.

5 As you will hear, the NRC staff evaluated
6 TVA's proposed methodology for determining a plume
7 exposure pathway emergency planning zone, the proposed
8 major feature's emergency plans, and the associated
9 exemption request to determine whether they would be
10 protective of public health and safety.

11 It is important to note that the plume
12 exposure pathway emergency planning zone size itself
13 for the site will not be finalized in the early site
14 permit, if approved. The appropriate plume exposure
15 pathway emergency planning zone size for the site will
16 not be determined until a combined license application
17 that references a specific small modular reactor
18 design is submitted and reviewed for the Clinch River
19 Nuclear Site.

20 Separately, other subcommittee meetings on
21 the other chapters of the safety evaluation report for
22 the early site permit application are currently
23 planned for October 2018 and our goal is to have the
24 ACRS full committee in November or December of 2018.

25 I will now turn the presentation over to

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1 TVA. Thank you.

2 MR. STOUT: Thank you, Anna.

3 So on behalf of TVA, I want to thank you
4 for the opportunity to come and present. I'm Dan
5 Stout, Senior Manager, Small Modular Reactors for TVA.
6 I've been working in the nuclear business for about 33
7 years at TVA, managing SMRs for about six years.

8 I also have Archie Manoharan and Alex
9 Young, who are going to cover part of the
10 presentation. Ray Schiele, to my left here, is our
11 Licensing Manager. And we have a number of TVA
12 employees and contractors able to support.

13 I do want to make the point that
14 protecting public health and safety is our highest
15 priority and we take our responsibility with respect
16 to emergency preparedness very seriously.

17 Here on slide 2 I want to acknowledge the
18 Department of Energy is a partner in the work that we
19 do. They not only support us in terms of programs and
20 resources, but they have been reimbursing roughly 50
21 percent of our costs in the work that we're doing.
22 Nevertheless, the views that are expressed are TVA's
23 alone.

24 Slide 3: The work that TVA is doing on
25 small modular reactors and on emergency preparedness

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1 is consistent with TVA's mission to make life better
2 for the people in the Tennessee Valley by providing
3 safe, clean, affordable, and reliable electricity.
4 Nuclear energy, in general, is important to our
5 environmental stewardship and economic development
6 missions.

7 TVA provides electricity to 154 local
8 power companies who serve the 900 -- I'm sorry -- nine
9 million customers of the Tennessee Valley throughout
10 about seven states. We also directly serve 54
11 industrial customers and that includes the Department
12 of Energy.

13 Slide 4: TVA's nuclear fleet generates
14 roughly 40 percent of our electricity. We have seven
15 nuclear units at three sites: Browns Ferry, a three-
16 unit plant in Alabama; Sequoyah and Watts Bar, both
17 two-unit plants in Tennessee.

18 The blue star in this figure is located on
19 the Watts Bar Reservoir and the nearest large city is
20 Knoxville. It is actually within the city limits of
21 Oak Ridge in Roan County, Tennessee.

22 On slide 5 I have a high-level overview of
23 the NRC review schedule. I wanted to provide this to
24 give you the frame of reference of where we are. We
25 submitted the application in May of 2016. It was

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1 accepted at the end of 2016 and in March 2017, the NRC
2 issued its review schedule. One of those milestones
3 is the ACRS review March 26, 2019.

4 We have completed one subcommittee
5 meeting. This is the second. We anticipate one or
6 two more and then hoping that the full committee
7 meeting is in advance of that milestone date.

8 The second line down shows environmental
9 review. The NRC's published schedule calls for the
10 final EIS in June of 2019. The NRC did issue the
11 draft environmental impact statement about five weeks
12 early. We're hoping that that trend continues there
13 as well.

14 Moving down to the last row is the
15 hearings. And a point of note on July 31st, the
16 Atomic Safety and Licensing Board dismissed the last
17 contention, denied two others that were proposed, and
18 terminated the contested hearing.

19 Slide 6.

20 MEMBER CORRADINI: So the hearings are
21 concluded?

22 MR. STOUT: The ASLB has terminated the
23 contested hearing. There will be a mandatory hearing
24 after the NRC concludes the final safety evaluation
25 report.

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1 MEMBER CORRADINI: Okay, thank you.

2 MR. STOUT: So now I turn to the
3 development of the early sit permit application and
4 emergency preparedness content, in particular.

5 TVA used a plant parameter envelope in
6 formulating the early site permit application,
7 consistent with 10 CFR Part 52 and it's based on the
8 design information that was supplied to us from the
9 four light water small modular reactor designs under
10 development at that time. Those include NuScale,
11 Holtec, mPower, and Westinghouse.

12 Now TVA has not selected a design for the
13 Clinch River Site yet. That is something that is
14 necessary for future licensing action in the COLA.
15 These new designs do include significant advances in
16 safety, such as smaller source terms from postulated
17 accidents, slower accident progression, and more
18 reliance on passive safety features. With this in
19 mind, TVA developed a dose-based consequence-oriented
20 approach to determine the EPZ size, which considers
21 the unique design and safety features of the SMRs.

22 NUREG-0396, which introduced the concept
23 of emergency planning zones is about 40 years old.
24 TVA's approach to determining the EPZ size uses the
25 same dose criteria as the NUREG. The approach that we

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1 have proposed does not ask for a change or an
2 exemption from this dose criteria. The dose criteria
3 is based on the EPA protective action guidelines: one
4 rem.

5 TVA's approach is also consistent with
6 SECY-15-0077, where the staff proposed a consequence-
7 based approach. TVA analyzes a spectrum of accidents,
8 both design basis and beyond design basis, and
9 considers defense-in-depth to ensure public health and
10 safety protection at the EPZ boundary.

11 We're applying more precise analysis to
12 ensure that public dose is below the dose limits at
13 the EPZ boundary. The establishment of a site
14 boundary or two-mile zone remains the same basis for
15 level of protection as an existing ten-mile zone
16 provides for operating plants.

17 So as TVA evaluated the design information
18 from the four SMR designs, we concluded that it was
19 likely that all four would be able to meet the dose
20 criteria at a two-mile radius and at least one would
21 be able to meet site boundary, which is roughly 1,100
22 feet.

23 So TVA developed two distinct major
24 features emergency plans and included them in the
25 early site permit application and sought NRC's review

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1 and approval of both. There remains this additional
2 licensing step at COLA phase, where a specific design
3 must be selected and analyzed. In that potential
4 future licensing step, TVA could include one of these
5 two major features emergency plans if the detailed
6 analysis confirms their applicability that the public
7 dose is below the dose limits.

8 MEMBER CORRADINI: So if I might just
9 clarify, you used information from the four candidates
10 to help define the two miles, or you had defined the
11 two miles and you did some sample calculations, or are
12 we going to get into that?

13 MR. STOUT: It's more the former. We
14 looked at the information that we got, made a
15 determination that two miles ought to be sufficient.

16 MEMBER CORRADINI: Okay.

17 MR. STOUT: Two miles is essentially a
18 surrogate for scalable. That's kind of how we viewed
19 it. We think that so by having approval of it, let's
20 suppose in the COLA phase we end up determining,
21 through analysis, that we reach the PAG at one mile.
22 Well, we can't use site boundary. We have to use two-
23 mile. So that's how it would work.

24 Last --

25 MEMBER BLEY: And that's all based on a

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1 single module.

2 MR. STOUT: No, we considered both design
3 basis and beyond design basis. Multi-module would be
4 in the design basis phase.

5 MEMBER BLEY: Okay and you still come up
6 -- okay.

7 MEMBER CORRADINI: Well I guess that leads
8 me to the non-bulleted sub thing, which is combined
9 nuclear generating capacity for Clinch River Site is
10 not to exceed 800 megawatts or 24 --

11 So you took combinations that would look
12 as large of a thermal output and an associated source
13 term as that limit? That's I think where --

14 MR. STOUT: So we have a number of
15 detailed slides and we're going to walk through the
16 methodology --

17 MEMBER CORRADINI: Okay.

18 MR. STOUT: -- and we'll provide an
19 example calculation for information.

20 MEMBER CORRADINI: Okay, thank you.

21 MR. STOUT: All right. So with that,
22 consider this as all background. Now, let's jump into
23 the details of TVA's emergency preparedness content in
24 the ESPA. And I'm going to turn it over to Archie.

25 MS. MANOHARAN: Thank you, Dan.

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1 Good afternoon. My name is Archie
2 Manoharan. I have been part of the licensing team at
3 TVA's Clinch River as the mod project for over a year.
4 Prior to that, I've been in licensing for over ten
5 years. And thank you for having us and giving us this
6 opportunity to present today.

7 As Dan said, we would like to present
8 details of the emergency preparedness information in
9 the application -- in the early sit permit
10 application. I would first like to begin with an
11 outline of the presentation we have for you today.

12 To fully understand the emergency
13 preparedness approach for a small modular reactor at
14 the Clinch River Site, information in three parts of
15 the application needs to be considered. Today we are
16 going to discuss and present information from Part 2,
17 the Site Safety Analysis Report, and Part 5, Emergency
18 Plan, Part 6, Exemptions and Departures.

19 Specifically in Part 2, in Section 13.3,
20 Emergency Preparedness Information and Section 13.3.3,
21 which discusses the dose-based consequence of
22 methodology that Dan had alluded to in the slide
23 before.

24 This methodology and the small modular
25 reactor design features are the basis for the

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1 emergency preparedness approach that we are proposing
2 in the application. Based on this methodology, two
3 distinct emergency plans have been put together in
4 Part 5. In Part 5A, major features of an emergency
5 plan that would support a site boundary EPZ are
6 discussed. In Part 5B, major features of an emergency
7 plan for a two-mile EPZ are discussed.

8 As Dan already mentioned, an SMR design
9 for the Clinch River Site has not been selected yet.
10 So in Part 2, we are seeking review and approval of
11 the methodology and in Part 5, we are seeking review
12 and approval by the staff of the major features of
13 these emergency plans.

14 In a future COLA, once the reactor design
15 -- once a small modular reactor design has been
16 selected, the dose-based methodology will be
17 implemented to show that the dose criteria is either
18 met at site boundary or two-mile. If it's met at site
19 boundary, then the Part 5A emergency plan, major
20 features emergency plan, will be utilized to create a
21 complete and integrated emergency plan and COLA. If
22 the dose criteria is met at two-mile EPZ, then the
23 Part 5B major features emergency plan will be utilized
24 to create a complete and integrated emergency plan in
25 COLA.

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1 To support the information in Part 5, a
2 set of exemption requests have been described and
3 submitted in Part 6 of the ESPA. We will go over
4 these in detail in the next slides. But just to avoid
5 any potential confusion, unless stated otherwise, the
6 terms emergency planning zone, EPZ, refers to plume
7 exposure pathway emergency planning zone. We will try
8 our best to use the entire term but when we say EPZ,
9 we are referring to plume exposure pathway.

10 Next slide, please.

11 MEMBER SUNSERI: Archie, could I ask you
12 to move your microphone a little closer?

13 MEMBER CORRADINI: Yes, can you repeat
14 what you just said at the end? I didn't catch it.

15 MS. MANOHARAN: Oh.

16 MEMBER CORRADINI: And closer still for
17 your mike.

18 CHAIRMAN KIRCHNER: Thank you.

19 MS. MANOHARAN: To avoid any potential
20 confusion, we are going to -- the terms emergency
21 planning zone or EPZ, when we use those terms, we are
22 referring to plume exposure pathway emergency planning
23 zone.

24 MEMBER BLEY: Not ingestion.

25 MS. MANOHARAN: Not ingestion and my next

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1 slide explains why.

2 MEMBER BLEY: Okay.

3 MS. MANOHARAN: So in the course of the
4 staff's review of the emergency preparedness
5 information in our application, several requests for
6 additional information were issued. You see a few
7 listed here. In addition to the two that are listed,
8 RAI-9227 was also issued earlier this year, which is
9 not listed on this slide. But as a response to that
10 additional RAI, we withdrew our request for ingestion
11 exposure pathway exemption requests. And, therefore,
12 EPZ refers to plume exposure pathway.

13 Two audits were held to review the dose-
14 based methodology described in Section 13.3 and also
15 focused on reviewing the example analysis that was
16 conducted by TVA to show that the dose criteria can be
17 met at Clinch River Site boundary. Alex Young is
18 going to walk through the example analysis in a few
19 slides.

20 Starting with our information in Part 2,
21 Section 13.3.1, Physical Characteristics, this section
22 describes information concerning site description and
23 area population. As the figure here illustrates the
24 site vicinity, you can see the Clinch River Site in
25 the central of the figure there north of Interstate I-

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1 40. The Interstate I-40 is located about a mile away
2 from the site. The gray shaded area to the northeast
3 of the site is the DOE Oakridge Reservation. And two
4 towns are visible in this figure, Kingston to the west
5 about 6.8 miles away, and Lenoir City to the southeast
6 about 8.8. miles away.

7 Next slide.

8 MEMBER CORRADINI: So is there where
9 Clinch River Breeder Reactor, is that the same site
10 we're talking about?

11 MS. MANOHARAN: That's it.

12 MEMBER CORRADINI: Okay. So this is
13 irrelevant but curiosity. So when CRBR was being
14 considered, what was their emergency planning zone?
15 It was only 40 years ago. I don't see what's the
16 problem.

17 MR. STOUT: I don't know.

18 MEMBER CORRADINI: Yes? Oh, they
19 submitted to the NRC. Okay.

20 And then the second part of it is, if
21 you're within the EPZ -- if your EPZ is within -- I
22 can't remember the distance -- 1200 feet, it's all
23 within the red.

24 MR. STOUT: Yes, sir.

25 MS. MANOHARAN: That's correct.

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1 MEMBER CORRADINI: And just for the sake
2 of thinking it through, what is two miles from the red
3 dot -- the red star?

4 MS. MANOHARAN: I have a slide that is
5 coming up that actually shows the exact size.

6 MEMBER CORRADINI: Okay, fine. All right,
7 sorry.

8 MS. MANOHARAN: So that will answer that
9 question.

10 MEMBER CORRADINI: Okay, thank you.

11 MS. MANOHARAN: Okay. Section 13.3.3 in
12 Part 2 describes a dose-based consequence or entered
13 methodology for determining an appropriate EPZ size
14 for a small modular reactor at the Clinch River Site.
15 This approach, this methodology uses the same approach
16 and is consistent with the NUREG-0396 approach.

17 NUREG-0396 provided a basis for federal,
18 state, and local government agencies preparedness
19 organizations to determine the appropriate degree of
20 emergency response planning efforts in the area
21 surrounding a nuclear power plant. The report
22 introduced the concept of a generic EPZ as the basis
23 for planning of response actions which would result in
24 a dose savings in areas surrounding a nuclear plant in
25 case of a serious reactor accident.

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1 The NUREG concluded that the objective of
2 an emergency plan -- emergency response plan should be
3 to provide dose savings for a spectrum of accidents
4 that could produce offsite doses in excess of
5 protective action guides, PAGs.

6 Consistent with this recommendation, the
7 dose-based methodology that is described in the ESPA
8 analyzes a spectrum of accidents and uses the same
9 dose criteria that is used in NUREG-0396, which is the
10 one rem total effective dose equivalent limit
11 established in the EPA PAGs.

12 What the dose-based methodology does is
13 take into consideration the unique SMR design features
14 which vary significantly from large light water
15 reactors. For example, SMRs have smaller cores.
16 Their source terms are expected to be several
17 magnitudes lower than large light water reactors,
18 which results in reduced accident consequences, as
19 demonstrated in the example analysis that we'll go
20 over in a minute, and also are expected to have
21 reduced likelihood of accidents. Their core damage
22 frequency is expected to be several magnitudes
23 reduced, compared to large light water reactors and
24 also are expected to have slower accident progression,
25 which allows for more time to take mitigative actions.

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1 Next slide.

2 CHAIRMAN KIRCHNER: This may be, on my
3 part, maybe just quibbling with the words in the
4 previous field graph that rigorously, it doesn't
5 ensure protection for doses above one rem. The one
6 rem is the trigger point to start your emergency
7 planning. And that's no guarantee that it's less than
8 one rem exposure. That's the intent.

9 So it's more trigger than it is -- and
10 it's a measure to protect the public against dose
11 aversion but it's not a guarantee that a member of the
12 public wouldn't get 1.5 rem or whatever total dose,
13 right?

14 MS. MANOHARAN: Yes.

15 CHAIRMAN KIRCHNER: Okay.

16 MS. MANOHARAN: The intent of that
17 supplement was to show that we are using one rem TEDE.
18 But I do -- your point is noted. Thank you.

19 Next slide, please.

20 The technical criteria for determining a
21 plume exposure path for the EPZ has three criteria, A,
22 B, and C.

23 Criterion A encompasses those areas in
24 which projected dose from design basis accidents could
25 exceed EPA PAGs. Criterion B encompasses those areas

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1 in consequences -- for which consequences of less
2 severe core melt accidents with intact containment
3 could exceed the EPA PAGs. For C, it ensures that
4 this EPZ is of sufficient size to provide substantial
5 reduction in early severe health effects in the event
6 of severe core melt -- in more severe core melt
7 accidents with containment by this failure.

8 Next slide, please.

9 MEMBER MARCH-LEUBA: Tell me what a less
10 severe core melt is. I mean on B, you said the
11 consequences of a less severe core melt accident.

12 MS. MANOHARAN: Yes.

13 MEMBER MARCH-LEUBA: What is that?

14 MS. MANOHARAN: So the less severe core --
15 just one second here. Yes, so the accident scenarios
16 would include core melt accidents with intact
17 containment beyond design basis scenarios and accident
18 scenarios with core damage frequencies greater than 10
19 to the negative six, which I will explain in the next
20 --

21 MEMBER MARCH-LEUBA: You'll explain later?

22 MS. MANOHARAN: Yes.

23 MEMBER MARCH-LEUBA: I'll wait.

24 MS. MANOHARAN: And there is a distinction
25 between each of them, which we will go over.

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1 MEMBER BLEY: So there is both a frequency
2 component to this and it is a contained melt.

3 MS. MANOHARAN: That is correct.

4 MEMBER CORRADINI: Did you really want to
5 say yes to that? In other words, you're assuming at
6 all times the containment is intact? Because I got
7 the impression you're looking for the collection, I
8 thought the collection of sequences that are both for
9 intact containments, which might have an unphysically
10 -- I'll use the word unphysical -- a prescribed source
11 term with an intact containment as well as PRA
12 sequences that would have a variety of source terms
13 but the containment could be bypassed.

14 MEMBER BLEY: It has the frequency element
15 on it, right?

16 MR. YOUNG: So I'd just like to clarify.
17 The criterion B portion, the less severe core melt
18 accidents is only looking at the intact containment.

19 MEMBER CORRADINI: Okay.

20 MR. YOUNG: The containment failure bypass
21 is handled in criterion C, which is the early severe
22 -- or the more severe core melt accident.

23 MEMBER CORRADINI: Okay, that's fine. And
24 then I thought you had said, I want to make sure, that
25 you have a frequency cut-off.

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1 MS. MANOHARAN: Yes, which is coming up in
2 the next slides.

3 MEMBER CORRADINI: Okay, fine. Thank you.

4 Okay, so we are at the frequency cutoff
5 slide, so the criterion A and B methodology
6 implementation. To verify that the dose consequences
7 beyond the EPZ do not exceed the EPA early phase PAGs,
8 the methodology starts with selecting appropriate
9 accident scenarios. The accident scenarios would mean
10 core damage frequency of 1E to the negative 6 per
11 reactor year is being selected.

12 Based on the accident scenarios that I've
13 selected, the source terms I calculated and the dose
14 consequence for the selected accident scenarios are
15 evaluated.

16 MEMBER BLEY: Now you're in category C,
17 right?

18 MS. MANOHARAN: This is still 1E to the
19 negative 6 per reactor year and then intact
20 containment. So we are in --

21 MEMBER BLEY: Oh, so you're still in B.

22 MR. YOUNG: Yes, so the blue box is
23 important.

24 MS. MANOHARAN: Yes, so we group A and B
25 together and this slide discusses how criterion A and

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1 B are evaluated. The next slide talks about how
2 criteria C is evaluated.

3 MEMBER CORRADINI: And then -- okay. I'm
4 not sure how to ask the question so let me ask it this
5 way.

6 So you're assuming that the containment is
7 intact during these -- in criterion A and B,
8 regardless of the accident sequence or is it
9 interwoven with the sequence itself tells you whether
10 the containment is in or out?

11 MR. YOUNG: The latter.

12 MEMBER CORRADINI: The latter.

13 MR. YOUNG: So if it meets the cutoff
14 frequency we've established here, we're only looking
15 at those accidents that are intact containment that
16 meet this cutoff frequency.

17 MEMBER CORRADINI: Okay. So my second
18 part of the question is where did you get 10 to the
19 minus 6 mean? Because as you get to these -- I'm
20 waiting for Dr. Kirchner to say this but I'll steal
21 his thunder. The uncertainty is such that is mean the
22 right value? Is 10 to the minus 6 with the mean the
23 right? Why? Why 10 to the minus six? Why mean?

24 MR. YOUNG: Sure. So the main core damage
25 frequency cutoff criteria we've established for

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1 criterion B and C is established by a significant
2 amount of industry documentation. A lot of that
3 industry documentation identifies E to the minus 6 as
4 a point that most accidents are encompassed by that.
5 An example of that would include the SOARCA analysis.

6 MEMBER CORRADINI: Yes, well, don't point
7 to them. I'm looking at our resident PRA expert
8 because that surprised me.

9 MEMBER BLEY: I don't quite get this. If
10 you've done a PRA, if you had a plant, there are a
11 great many accidents at lower frequency and,
12 depending, some or a lot above this. I don't quite
13 understand it.

14 MEMBER CORRADINI: But you put everything
15 -- I guess what I'm trying to understand is you put
16 everything into two baskets. First, regardless of the
17 basket, you're only looking at things that pop at 10
18 to the minus 6 or larger. And then, depending upon
19 the sequence, if the containment fails or not fails,
20 you have it in two bins.

21 MR. YOUNG: And so if the containment
22 fails, it would not be considered in the criterion B
23 greater than $1E-6$. We have a cutoff frequency that is
24 further down line for criterion C. So if you did have
25 a cutoff frequency, you would have to evaluate that in

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1 criterion C.

2 MEMBER CORRADINI: Okay, I think I got it.

3 MS. MANOHARAN: So the very last step in
4 the methodology, implementation for criteria A and B
5 is to take the dose consequences calculated and
6 compare them to the EPA early phase PAG to ensure that
7 they are not exceeding.

8 So next slide, Criterion C. So EPZ should
9 be of sufficient size to provide substantial reduction
10 in early severe health effects in the event of a more
11 severe more melt accidents with intact containment.

12 So the first three steps are similar to
13 criteria A and B in that appropriate accident
14 scenarios, as selected, the cutoff here is mean core
15 damage frequency greater than $1E-7$ per
16 reactor year. And source terms are calculated for the
17 selected accident scenarios and dose consequences from
18 those were evaluated.

19 There are two additional steps in
20 criterion C, which is to calculate the distance at
21 which the conditional probability to exceed 200 rem
22 whole body exceeds $1E-3$ per reactor
23 year, consistent with the basis provided in NUREG-0396
24 and, finally, to compare the distance to the EPZ to
25 ensure that it is of sufficient size.

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1 Next slide, please. I would like to turn
2 it over to Alex Young, who is going to walk through
3 the example analysis that was conducted as a result of
4 an RAI request.

5 MR. YOUNG: Thanks, Archie. My name is
6 Alex Young. I'm part of the engineering team working
7 design engineering for the Clinch River project for
8 TVA. I've been working on this project for about four
9 years now.

10 Over the course of the review, one of the
11 things that was requested of TVA was for us to provide
12 some additional information that demonstrates that the
13 methodology we've just described can be implemented
14 and that the criteria for both the EPA early phase PAG
15 limits and the substantial reduction early health
16 effects can be met by an SMR design considered in an
17 OSI permit application.

18 To demonstrate this methodology, Clinch
19 River Site-specific example calculation was performed.
20 At the COLA, the applicant will still need to perform
21 an evaluation of whichever design is chosen for COLA.
22 This is just an example to demonstrate the
23 methodology.

24 This example calculation utilizes a
25 NuScale design that is assumed to be sited at the

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1 Clinch River Site. So we used NuScale-specific design
2 information like PRA and source terms and applied it
3 to Clinch River Site's specific information like
4 meteorological data and conservative assumptions like
5 the 1,100 foot distance from release boundary to site
6 boundary.

7 To summarize the evaluation, we start with
8 criterion A, looking at design basis accidents. We
9 utilized the design basis source term determined in
10 NuScale's Chapter 15 of their design cert to calculate
11 a dose of 0.104 rem and that leaves a significant
12 amount of margin compared to the one rem limit that
13 was established.

14 And we after we evaluated the design basis
15 accidents, we considered the less severe core melt
16 accidents, which are those of the criterion B
17 evaluation. For this criterion, we look at accident
18 scenarios with the main core damage frequency greater
19 than the 1E minus 6 and they have intact containments.
20 But for the NuScale design, there are no accident
21 scenarios that meet this cutoff frequency.

22 However, there is a note in our
23 methodology that if no accidents meet that cutoff
24 frequency, we will develop a surrogate source term and
25 analyze that source term to the limits.

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1 MEMBER BLEY: What kind of -- sorry, go
2 ahead.

3 What kind of guidance have you given
4 yourself on how you define a scenario? A clever
5 analyst can break up the scenario into many sub-
6 scenarios, each one of which has a lower frequency.
7 So what kind of rules do you have to make sure these
8 10 to the minus 6 and 10 to the minus 7s are
9 meaningful?

10 MR. YOUNG: Sure so I'll start by making
11 a statement and then I'll hand it over to help from
12 Scott Webber, who can give some more detail about how
13 we did that in our example analysis.

14 But we look at various timing aspects and
15 equipment availability aspects.

16 MEMBER BLEY: So you may be grouping
17 things from a PRA --

18 MR. YOUNG: Yes.

19 MEMBER BLEY: -- or from higher level set
20 that have to meet these criteria?

21 MR. YOUNG: Yes. And it would be design-
22 specific. Scott can speak to how we handled this in
23 the example.

24 MEMBER BLEY: Okay.

25 MR. WEBBER: I'm Scott Webber, PRA Group

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1 at NuScale responsible for severe accidents and
2 emergency planning zone.

3 So towards what Alex was saying, in the
4 example work that was done here, there was no need to
5 distinguish between accident scenarios and accident
6 sequences because the as-submitted NuScale PRA has a
7 total CDF that is below the screening limits. And so
8 the question of --

9 MEMBER BLEY: Does that include external
10 events --

11 MR. WEBBER: That's correct.

12 MEMBER BLEY: -- and fires?

13 MR. WEBBER: All PRA that was part of
14 NuScale's design certification is included and that's
15 everything -- external events, internal, except for
16 seismic, which was not required at that time.

17 So the total core damage frequency is
18 greater -- sorry -- less than the screening limits
19 and, therefore, the grouping of accidents is
20 redundant.

21 MEMBER REMPE: Okay, I got confused in
22 your response. You said you did include external
23 events but then you said excluding seismic. Is that
24 what you said? So how could you do that?

25 MR. WEBBER: Right so the seismic PRA is

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1 not required for design certification PRA.

2 MEMBER REMPE: Okay.

3 MR. WEBBER: And so there is no seismic
4 here available at this time.

5 MEMBER REMPE: Okay.

6 MEMBER CORRADINI: So I'm waiting for
7 other people to ask the question but I'm the least
8 competent.

9 So what did you pick to get 0.158?

10 MR. YOUNG: Sure so as we will continue on
11 in the slides, we will get to that point.

12 MEMBER CORRADINI: Okay. And then let me
13 make sure I understand. So bin A is design basis
14 accidents that are Chapter 15 related and with
15 containment intact. And based on that collection, you
16 got a number. And then B, there was an empty set. So
17 you assumed something and got a number.

18 And C was an empty set?

19 MR. YOUNG: Sure, so --

20 MEMBER CORRADINI: They never broke
21 containment?

22 MR. YOUNG: So there are -- well, we'll
23 cover C here in just a second about how we exclude
24 that one. I would first like to cover the what
25 accident was selected for B.

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1 MEMBER CORRADINI: Okay.

2 MR. YOUNG: So as we mentioned for
3 criterion B, there were no accidents that SCRAMed in,
4 based on the cutoff frequency we said but we are going
5 to evaluate a surrogate source term. The source term
6 we evaluated is the most frequent accident that is
7 used to develop the Chapter 15 design basis source
8 term for the NuScale design.

9 Utilizing that source term from that
10 accident, that event, we determined the 0.158 rem.

11 MEMBER CORRADINI: What was that sequence?
12 What was the event?

13 MR. YOUNG: Sure. So the sequence is a
14 loss of DC power with an ECCS failure. To give you --
15 it is several orders of magnitude below what the
16 cutoff frequency is.

17 MEMBER MARCH-LEUBA: And it results in
18 core melt?

19 MR. YOUNG: I'm sorry?

20 MEMBER MARCH-LEUBA: You end up having a
21 core melt?

22 MR. YOUNG: It does result in core damage.

23 MEMBER MARCH-LEUBA: Core damage? How
24 severe?

25 MR. YOUNG: Scott, can you speak to how

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1 severe the core damage is on that accident?

2 MR. WEBBER: The severity of the accident
3 is somewhat of a vague definition. There is a core
4 damage threshold that the PRA Group uses, which is a
5 peak cladding temperature of 2200 Fahrenheit that is
6 reached in all portions of the core.

7 MEMBER MARCH-LEUBA: A hundred percent of
8 the core --

9 MR. WEBBER: Exceeds --

10 MEMBER MARCH-LEUBA: -- exceeds the 2200
11 --

12 MR. WEBBER: -- the peak cladding
13 temperature.

14 MEMBER MARCH-LEUBA: So this is a complete
15 meltdown.

16 MR. WEBBER: Well based on the NuScale
17 design, it is not -- it does not necessarily melt.

18 MEMBER MARCH-LEUBA: But your initial do
19 cladding.

20 MR. WEBBER: There is definitely fuel
21 failure and relocation of fuel. Melting is a sort of
22 variable, depending on the amount of cooling in the
23 scenario.

24 MEMBER MARCH-LEUBA: So the oxide doesn't
25 melt but all of the cladding disappears.

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1 MR. WEBBER: There is significant
2 oxidation in the fuel relocation, yes.

3 MEMBER CORRADINI: So now let me ask the
4 question that I've been waiting for.

5 If I put the alternative source term up
6 with categories in terms of the seven radiological
7 groups and then I have the timing, there is a conical
8 graph of that, and I put your source term up and
9 mapped it into that, what would it look like? Because
10 I assume this is much smaller than the alternative
11 source term on the percentage basis of the core.

12 MR. YOUNG: Which -- what are you asking
13 is smaller?

14 MEMBER CORRADINI: If I take NUREG-1465,
15 which is the alternative source term, it has
16 categories in terms of halogens, alkaline metals,
17 blah, blah, blah, and then it has timing -- when to
18 release gap release in-vessel, ex-vessel, et cetera.

19 I'm kind of curious if you've mapped in
20 the source term you used based on the discussion we
21 just heard, that comparison.

22 MR. YOUNG: I'll point to Scott to talk
23 about the specific source term and how that compares.

24 MEMBER CORRADINI: Do you have a slide
25 somewhere that we could look at or something we can

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1 read later?

2 MR. YOUNG: We don't provide -- in this
3 presentation, we don't provide the specific source
4 term for this. That would be NuScale proprietary.

5 MEMBER CORRADINI: Ah.

6 MEMBER BLEY: We might see it in our
7 review.

8 MEMBER CORRADINI: Okay. Okay, that's
9 fine. That's good enough for the moment.

10 MS. MANOHARAN: I wouldn't say that there
11 is an RAI response that has the source term
12 information. It is NuScale proprietary, so it was
13 treated appropriately.

14 MEMBER CORRADINI: Okay so then we'll turn
15 to the staff and ask them. Thank you.

16 CHAIRMAN KIRCHNER: Now just to clarify
17 for the record, A on this slide and B both assume that
18 the containment leaks at the design leakage rate. Is
19 that correct?

20 MR. YOUNG: Yes, so the leakage rate for
21 A would be based on the assumptions in the NuScale
22 Chapter 15 analysis.

23 CHAIRMAN KIRCHNER: Sure. Right. Right.

24 MR. YOUNG: And the way NuScale has
25 specifically analyzed those accidents, those will be

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1 reviewed in more detail at the COLA stage or during
2 the design certification.

3 CHAIRMAN KIRCHNER: Sure. An B, the same
4 assumption for containment performance?

5 MR. YOUNG: Scott, can you speak to
6 containment performance for criterion B in the leakage
7 rate?

8 MR. WEBBER: You were right, Alex, the
9 tech spec leakage is assumed for both.

10 CHAIRMAN KIRCHNER: For both. That's what
11 I assumed.

12 Then -- well, this is not a review of
13 NuScale. So perhaps going into it in detail is not
14 appropriate. But I'm just looking at the ratio of the
15 numbers from A to B.

16 A suggests and I'll just guess it's some
17 kind of LOCA kind of event or equivalent. I wouldn't
18 expect complete core failure. And that number is 50
19 percent higher for B. So it doesn't suggest that
20 you've lost the entire core. I just was a little
21 concerned, for the record, and I don't have enough
22 information to back up my intuition.

23 MR. YOUNG: So I'd like to clarify that
24 the criterion A design basis accidents is based on
25 NuScale's Chapter 15 --

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1 CHAIRMAN KIRCHNER: Right.

2 MR. YOUNG: -- which is based on a
3 spectrum of accidents and not just a single LOCA
4 event.

5 CHAIRMAN KIRCHNER: Okay.

6 MEMBER MARCH-LEUBA: Now is the related
7 Chapter 15 accident analyzed in the results in core
8 failure?

9 MR. YOUNG: I'm sorry.

10 MEMBER MARCH-LEUBA: In any Chapter 15
11 event results in cladding damage?

12 MR. YOUNG: Not for NuScale.

13 MEMBER MARCH-LEUBA: Then why is it not
14 zero?

15 MR. YOUNG: I'll let Scott answer the
16 question on NuScale's Chapter 15 analysis.

17 CHAIRMAN KIRCHNER: Okay, sure.

18 MR. WEBBER: Yes, so as has been stated,
19 the NuScale analysis is an example based on best
20 available. But as of the design that has been
21 submitted, there is no fuel failure in any design
22 basis events for the NuScale design. So, therefore,
23 for the purposes of design basis source term to be
24 used for siting and other purposes, it was necessary
25 to already go beyond the design basis. So NuScale has

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1 come up with what is called a design basis source
2 term, which is based on a set of five beyond design
3 basis accidents that include both LOCAs and losses of
4 power.

5 And so the design basis source term, which
6 is used for criterion A as a surrogate of all those
7 sequences that incorporates worst timing and new
8 releases.

9 MEMBER MARCH-LEUBA: I understand what it
10 is. I don't know why you did it. I mean it should be
11 sealed.

12 CHAIRMAN KIRCHNER: Okay, you may proceed.

13 MR. YOUNG: Okay, moving on to the
14 criterion C portion --

15 MEMBER MARCH-LEUBA: Sorry. Is this for
16 one NuScale module or 800 megawatts electric worth of
17 emollients, which of the two?

18 MR. YOUNG: This is for a single NuScale
19 module.

20 MEMBER MARCH-LEUBA: So no need to put
21 failures.

22 MR. YOUNG: No, not for this analysis.

23 MEMBER MARCH-LEUBA: But see if you have
24 a full plant, you will have two of those and then you
25 will be over one.

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1 MR. YOUNG: Well the multi-module question
2 will be addressed in the specific PRA results of the
3 design that is chosen at COLA.

4 For this analysis, using the NuScale plant
5 at this time, multi-module events were not -- were
6 below the threshold for consideration in the analysis.

7 MEMBER MARCH-LEUBA: So was this one.

8 MR. YOUNG: But criterion A is based on a
9 Chapter 15 analysis. So and NuScale considered the
10 design basis source term in their Chapter 15 analysis.
11 We used that for the example calculation.

12 MS. MANOHARAN: Maybe I didn't provide a
13 little bit of context. We did the example analysis as
14 the result of an RAI that asked us to demonstrate that
15 the methodology can be implemented and dose criteria
16 can be met. NuScale being the only SMR design
17 available to us with the design certification
18 application that is in review with the staff and the
19 design maturity enough for us to go and use them for
20 this example. That was the intent of this example
21 analysis, to show that those criteria can be met.

22 MEMBER MARCH-LEUBA: Okay, so we assume
23 that there was 100 percent fuel failure of all the
24 cladding in which 2200 Fahrenheit. And it is robbing
25 oxidation of everything and the whole things goes to

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1 the bottom of the core.

2 The containment remains closed. How did
3 you get any releases?

4 CHAIRMAN KIRCHNER: In design basis leak
5 rate -- tech spec leak rate of containment would give
6 you --

7 MEMBER MARCH-LEUBA: For NuScale?

8 CHAIRMAN KIRCHNER: Sure.

9 MEMBER MARCH-LEUBA: Well the first thing
10 to do is depressurize. There is no leakage. I guess
11 this is another possibility approximation.

12 MR. YOUNG: So moving on to criterion C,
13 this is the evaluation of the substantial reduction in
14 early health effects. When we performed the accident
15 screening, there were no accident scenarios for the
16 NuScale design with the main core damage frequency
17 greater than 1E minus 7.

18 MEMBER BALLINGER: Let me pull the string
19 a little bit more from Jose's. If you have 100
20 percent of the fuel -- of the cladding oxidized, what
21 is the pressure inside that vessel?

22 MS. BRADFORD: Can I -- this is Anna
23 Bradford from NRO. We're in a little bit of a gray
24 area here because we are not talking about the NuScale
25 design today. We will be coming to you with the

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1 NuScale design certification SE in the future, where
2 we can get into these details. But TVA is not the
3 designer of NuScale. They used some of NuScale's
4 design information because we asked for details to
5 show that this was even possible, given possible
6 designs. You know show us that such a thing could
7 even occur.

8 So I just don't want TVA or maybe even
9 NuScale, who is I guess accommodating here today, to
10 have to get into the details of what was assumed in
11 the design by the designer because they are not the
12 designer.

13 You will be seeing that in the future when
14 we come to ACRS with those details and with our
15 analysis of those details.

16 MR. YOUNG: So criterion C, no accident
17 scenario screened in based on the cored damage
18 frequency of $1E$ minus 7 and, therefore, there is no
19 dose evaluation for criterion C.

20 All this is to say that we met the
21 criterion A and B EPA early phase PAG dose limits and
22 did not screen any accidents for consideration in
23 criterion C. All this evaluation concludes that a
24 site boundary EPZ is possible at the Clinch River
25 Site.

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1 Next slide.

2 CHAIRMAN KIRCHNER: Okay, mindful of Anna
3 Bradford's comments that this is not a NuScale review,
4 but let me just -- so let's neutralize that.

5 Say you put the source of this number
6 aside. Multiply this number by the number of modules
7 that you might have and then, as was pointed out by
8 one of my colleagues, then you're above the one rem
9 trigger point.

10 So how do you plan going forward to deal
11 with the multi-module issue or you believe that you
12 can convince the staff that in PRA space, common mode,
13 common cause failure wouldn't require you to take all
14 X modules into consideration?

15 MR. YOUNG: So I'll say that our
16 methodology would consider multi-module events. The
17 inclusion of multi-module events is a design-specific
18 consideration that at COLA will be evaluated for the
19 particular design chosen.

20 So if we choose a particular design where
21 multi-module events need to be considered, those will
22 be considered in the methodology.

23 MEMBER REMPE: That's your hope is that it
24 will fall below the frequency is what I would guess.

25 MS. MANOHARAN: Yes, if the dose -- if I

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1 could just add to that point, if the dose criteria is
2 not met at site boundary, then we would not be able to
3 use site boundary. That's why there is a two-mile
4 emergency path. We definitely wanted to move that
5 boundary and have some confidence that at least one
6 reactor design would meet it.

7 MEMBER REMPE: And again, I am kind of
8 coming to this without the background because I'm not
9 inside the subcommittee but this A and B is a little
10 misleading because the staff asked you to do it. But
11 I'm guessing that if you really had picked the NuScale
12 design, you'd say hey, no, I'm not going to do this
13 because it all falls below, right?

14 MR. YOUNG: Well, just to clarify that
15 point, criterion B, whether anything screens in or
16 not, requires us to evaluate a surrogate source term
17 and come up with a perspective dose.

18 For criterion A, that would be very
19 technology-specific because our methodology requires
20 us to consider the same evaluation that the design
21 would consider in their Chapter 15 of their design
22 cert or equivalent.

23 MEMBER REMPE: If they can't get a dose in
24 any other design basis accidents, then you'll put a
25 big zero there.

1 MR. YOUNG: Yes. If the --

2 MEMBER REMPE: Which means no circulating
3 release or whatever but, yes.

4 MR. YOUNG: If the design could prove that
5 the accident did not have to consider those design
6 basis accidents and the equivalent, those would be
7 zero and we would put a zero there.

8 Moving on to the next slide, so we just
9 discussed the example analysis that we performed. In
10 addition to this, we established an EPZ plant
11 parameter. This is separate from the plant parameter
12 envelope described in Chapter 2 of the site safety
13 analysis report. It is specific to the EPZ exemption
14 request. It does not apply to the rest of the site
15 safety analysis.

16 This is used to demonstrate or to ensure
17 that the exemption request would be applied
18 appropriately in the future at COLA. Even though this
19 is not an EPZ plant parameter envelope, as in Chapter
20 2, it would be applied very similarly in that at COLA
21 we will have to evaluate to ensure that the selected
22 design is bounded by the source terms established in
23 this plant parameter.

24 MEMBER REMPE: Well I have questions about
25 this, too. First of all, from this morning I asked a

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1 lot of questions about this four-day thing. And I was
2 told after the meeting this morning it's a rolling
3 four-days. It shouldn't be at t equals zero, which
4 wasn't conveyed this morning.

5 Is your thing going to be a rolling four-
6 day, as long as there is a release?

7 MR. YOUNG: So the way we look at the 96-
8 hour period is we look at from the start of release,
9 not the start of accident. So different accidents may
10 have different release timings.

11 So we start at the release time, not at
12 the accident start time. So we consider the initial
13 part of the release.

14 MEMBER REMPE: If I had a plant that had
15 a circulating release and they vented, and then they
16 managed to keep the core damage going for another 95
17 or 97 hours, and then they had core damage and,
18 kaboom, a lot of stuff came out, that's you know,
19 again, at the worst four hours would be start after
20 the event and do it later. So that's something.

21 And I would think, Ken Thomas, if he's
22 still here, can elaborate on this because if it is the
23 worst four days, then that won't work if you do it at
24 t equals zero. You should pick the most severe four
25 days is what you said is in the regulation and it was

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1 just what was in the draft rule was incorrect.

2 MR. THOMAS: So this is Kenny Thomas from
3 NSIR DPR, technical aid for this morning's discussion.
4 It's not in the current rule. That is part of the
5 confusion that we had this morning is what is the
6 necessary intent of the 96 hours.

7 So the 96 hours is an homage to the four-
8 day integrated dose and that's ongoing from the point
9 of when you start doing your dose projections you
10 start looking at what is the consequence impact to the
11 public and do you exceed one rem forecast over the
12 next 96 hours for the release and so forth.

13 So that is not in the current rule. It is
14 not in the guidance and it's one of the points of
15 confusion that we had this morning.

16 MEMBER REMPE: What is the legal
17 requirement for what they are doing? Do they have to
18 pick the most severe four days of a release so that
19 you can let the circulating release go on and then
20 start timing when you have the most severe? What is
21 the current requirement?

22 MR. THOMAS: Well, with respect to my
23 rule, it is not in it.

24 MEMBER REMPE: Not in your rule. That's
25 the current --

1 MR. THOMAS: Not yet.

2 MEMBER REMPE: I thought at the end of
3 this morning's -- or this afternoon when you got me
4 before this meeting and said this, I thought you said
5 the intent was to have the most severe and that's what
6 in the regulation. What's in the regulation?

7 MR. THOMAS: It's not in the regulation.

8 MEMBER REMPE: Oh, the guidance.

9 MR. THOMAS: Right or it's not even in the
10 guidance yet.

11 We don't have the proper people. I don't
12 see the research individuals who do -- or Michelle
13 Hart -- who do the consequence analysis.

14 So I would have to approach the
15 consequence analysis folks for that.

16 MS. BRADFORD: This is Anna Bradford, NRO.
17 We can go over this during the staff part of this
18 presentation, if that would be helpful.

19 MEMBER REMPE: Yes, again, because I don't
20 know about your four plans you've picked but to me it
21 seems like you might be able to have something more
22 severe if you --

23 CHAIRMAN KIRCHNER: Well, for the record,
24 they are not considering that technology.

25 MEMBER REMPE: Well I don't know the four

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1 that they've picked if they've picked the most severe
2 for all four days.

3 CHAIRMAN KIRCHNER: But let's ask them how
4 they define your four days.

5 MEMBER REMPE: They've already told me
6 they start --

7 CHAIRMAN KIRCHNER: From the start of
8 release.

9 MEMBER REMPE: Yes, that's what they've
10 said. So did you look beyond?

11 MR. YOUNG: I'll make a quick
12 clarification of that. This is for a plan parameter
13 that we've established based on certain accidents. We
14 considered that we did use the first four days from
15 the start of release. For established -- for
16 implementation of the methodology, we will evaluate
17 the most appropriate source term based on the accident
18 scenario that needs to be considered.

19 So the way our methodology worked, it does
20 not preclude us from having to consider the worst four
21 days or the early four days. That will revolve around
22 the accident selection and source term selection for
23 implementation of methodology but this is separate
24 from the example and separate from actual
25 implementation of the methodology.

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1 MEMBER REMPE: Okay, that helps, as long
2 as I know somebody is going to think about the most
3 severe four days. Thank you.

4 MR. YOUNG: Continuing on with this slide,
5 this is the plant parameter. We'll have to evaluate
6 it at COLA to ensure that the selected design meets
7 the source term we've developed.

8 To establish this EPZ plant parameter, we
9 developed the four-day atmospheric release source
10 term. This allowed us to account for various SMR
11 designs, and accident types, and the total four-day
12 release that was required for the EPA early phase PAG
13 dose limits.

14 The four-day atmospheric release source
15 term is a composite of three different source terms,
16 which includes the ESPA PPE Chapter 15 source terms
17 and the two source terms evaluated in the example
18 calculation. This accounts for various SMR designs
19 and various accident types to be considered.

20 The worst activity from each isotope
21 considered for each major time period, which we
22 considered to be the zero to 8, 8 to 24, and 24 to 96-
23 hour time period is then accumulated into a composite.
24 We summed those up over four days and come up with a
25 total four-day atmospheric release source term.

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1 We then applied 25 percent of
2 discretionary margin to that total. From the four-day
3 total composite source term with the 25 percent
4 discretionary margin, we evaluate the dose
5 consequences. We determined that with this source
6 term, the four-day total composite plus 25 percent we
7 would be in compliance with the EPA PAG dose limit of
8 one rem.

9 At COLA, we will compare this source term
10 to the criterion A and B source terms for the accident
11 selected to this four-day atmospheric release source
12 term for EPZ exemption request applicability.

13 MEMBER REMPE: So you only considered the
14 species or the isotope. Did you consider like the
15 form, whether it is a particulate, whether it's a --
16 I mean what did you do with respect to the form of the
17 isotopic release?

18 MR. YOUNG: So we utilized the atmospheric
19 -- the gaseous release source terms that were
20 determined from the two example analyses source terms
21 and the PPE source term. Specific percentages or
22 breakdown of particulate versus aerosol, et cetera, is
23 specific to those source terms for the reactor
24 designs.

25 And where we're at, we don't have all that

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1 information but the vendors consider that proprietary.
2 So we're just evaluating a known isotope with a known
3 activity.

4 MEMBER REMPE: Thank you.

5 MR. YOUNG: For the rest of the
6 presentation, I'll turn that back over to Archie.

7 MS. MANOHARAN: Thank you, Alex.

8 The last topic we have for Section 13.3 in
9 Part 2, we are on slide number 17, is information
10 concerning contacts and agreements.

11 In support of the ESPA, letters of support
12 from State of Tennessee, Anderson County, Roane
13 County, and City of Oak Ridge were submitted to the
14 staff. If a future combined license application is
15 pursued, TVA will pursue the appropriate certification
16 letters and letters of agreement with the local
17 emergency medical and law enforcement agencies to
18 ensure that there is enough emergency response
19 organization support available.

20 Most important before we leave Part 2
21 information is TVA would continue to work with state
22 and local support organizations to establish an
23 emergency preparedness at Clinch River that is
24 commensurate to the reactor design but selected at
25 COLA and the potential consequences resulting from

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1 that reactor design to the public health and safety.

2 Next slide. Moving on to information in
3 Part 5 Emergency Plans, as I had mentioned at the
4 beginning of this presentation, in Part 5 the ESP
5 contains two major features -- two emergency plans
6 major features for a site boundary EPZ and major
7 features of an emergency plan for two-mile EPZ.

8 Both of these plans consider and address
9 the 16 planning standards of NUREG-0654. They contain
10 the amount of information available to us during the
11 ESP development. So design-specific information such
12 as that would be required to develop accident
13 analyses, or staffing levels, or EALs are not
14 addressed in Part 5.

15 You also need to consider the information
16 in Part 5 with the exemptions request in Part 6, which
17 I will summarize later in the presentation. Next
18 slide.

19 There was a question earlier about what
20 does the site boundary EPZ look like. This figure
21 here in red shows the EPZ site boundary for Clinch
22 River. The layout of the information in Part 5A for
23 site boundary EPZ has two parts. One is the main
24 plan, which builds on the generic emergency plan used
25 by TVA for the current nuclear operating plants

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1 already approved by the staff and an appendix that has
2 site-specific information concerning the site location
3 and other site-specific features.

4 In addition to providing information
5 concerning the necessary actions to safeguard on-site
6 personnel and minimize damage, it proposes how the
7 emergency plan is compatible with the site.

8 Next slide. Another question was what
9 does the two-mile EPZ look like. The figure here, the
10 blue circle is the two-mile radius from approximately
11 the center of the site. The red is the exact size and
12 configuration of the two-mile EPZ. As you can see, in
13 most areas, it is actually larger than two-mile EPZ
14 and never less than two.

15 The exact size and configuration of the
16 two-mile EPZ was developed in relation to local
17 emergency response needs and capabilities, as they are
18 affected by conditions such as demography, topography,
19 land characteristics, and access routes.

20 MEMBER MARCH-LEUBA: In that, what is the
21 funny red line?

22 MS. MANOHARAN: The red line is the actual
23 two-mile EPZ. So --

24 MEMBER MARCH-LEUBA: No, the two-mile is
25 the circle.

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1 MS. MANOHARAN: The blue line, which is a
2 circle, is to show you the circle with the two-mile
3 radius from the center of the site. But when you
4 actually create your exact EPZ size, you take into
5 account population, land characteristics, ease of
6 access --

7 MEMBER MARCH-LEUBA: This is your
8 imaginary line to two-miles, which is not two miles?
9 This is something larger.

10 MEMBER BLEY: The actual EPZ is a little
11 bigger. So it is probably roads and things it looks
12 like.

13 MS. MANOHARAN: Yes, some rivers and
14 roads.

15 MEMBER MARCH-LEUBA: You were following
16 some existing roads and things like that?

17 MS. MANOHARAN: Yes, that's correct. Yes.

18 MEMBER MARCH-LEUBA: So basically, ORNL is
19 outside the line, the extant plant?

20 MR. YOUNG: Yes.

21 MS. MANOHARAN: A site evacuation --
22 evacuation time estimate analysis was conducted to
23 show -- to support information, in part, which I will
24 go over in the next slide. Next slide, please.

25 So as I said, an evacuation time estimate

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1 analysis was conducted to show that there are no
2 physical characteristics unique to the Clinch River
3 Site that would pose a significant impediment to
4 development of emergency planning -- emergency plans
5 at the site.

6 In addition to providing -- acting as a
7 tool to TVA and state and local governments for
8 specific -- site-specific information needed for
9 protective action decisions, it also serves as a tool
10 to show that there are no physical characteristics
11 that would hinder emergency plans.

12 It was conducted in accordance with
13 NUREG/CR-7002 and just to provide a clarification,
14 there is no site evacuation time estimate for Part 5A
15 because it is in the site boundary EPZ.

16 Next slide. That concludes our
17 information that we had for Part 5.

18 Moving on to Part 6 of the presentation,
19 to support the information in Part 5 of which has a
20 two-mile EPZ and a site boundary EPZ emergency plans,
21 a set of exemption requests were developed after
22 reviewing the current emergency preparedness
23 requirements and each set supports either Part 5A or
24 Part 5B. I will go over the exemption requests in a
25 summary in the next couple of slides. Next slide,

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1 please.

2 In Table 1-1 of Part 6, exemption requests
3 are described that support site boundary EPZ emergency
4 plan. In addition to deviating from the current ten-
5 mile plume exposure pathway EPZ size, certain elements
6 of a formal offsite emergency plan are being asked to
7 be exempt from, the logic being, at a COLA, after
8 reactor design has been selected, the dose-based
9 methodology that was described in 13.3 is implemented
10 to show that the dose criteria is adequately met at
11 site boundary. If that is the case, then these
12 exemptions would be warranted.

13 But it is also important to note that
14 TVA's emergency plans will describe the capabilities
15 to determine if a radiological release is occurring,
16 promptly communicate it to offsite organizations for
17 their consideration.

18 Next slide. Table 1-2 of Part 6 describes
19 certain exemption requests that support, again, site
20 boundary EPZ emergency plan, specifically from
21 evacuation time estimates, certain elements of offsite
22 notification, and offsite exercises.

23 Following the same logic, the SMR design
24 would have to show that it meets the dose criteria at
25 COLA, it goes with the dose-based methodology review

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1 and then these exemptions will be granted.

2 It is also important to note before we
3 move on from here is that TVA is not seeking an
4 exemption from the requirements to notify responsible
5 state and local government agencies and, also, will
6 continue to invite state and local support
7 organizations to participate in periodic drills and
8 exercises.

9 Next slide. The last table, Table 1-3 in
10 Part 6, describes the exemption request that we put
11 forth for the two-mile EPZ emergency plan. The only
12 request or the only exemption request in place for a
13 two-mile EPZ is to deviate from the current ten-mile
14 EPZ size, which goes back to Dan's point at the
15 beginning of the presentation that it is the surrogate
16 to a ten-mile.

17 Next slide. Just to summarize the
18 technical basis in TVA's opinion for the exemptions is
19 the dose-based methodology consequence oriented
20 methodology that is described in Section 13.3, which
21 as we elaborated earlier, has the consistent approach
22 to NUREG-0396, evaluates a spectrum of accidents, has
23 the same dose criteria as EPA PAG and also ensures
24 that the EPZ is of sufficient size to provide
25 significant reduction in the case of severe health

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1 effects.

2 Combined with this technical criteria and
3 the dose-based methodology, and the SMR design
4 features, we believe that there are special
5 circumstances that exist that warrant granting the
6 exemption and that if a selected SMR design at COLA is
7 able to show that the dose criterias are met at either
8 site boundary or two-mile, exempting from these
9 requirements would still allow us to meet the
10 underlying purpose of the regulations.

11 Next slide, please. In summary, I think
12 it would be beneficial to go over what TVA is asking
13 for review in the ESPA and how that might be used in
14 a future combined license application.

15 So in Part 2 of the ESPA, we are seeking
16 approval of the dose-based consequence oriented
17 methodology for determining the plume exposure pathway
18 EPZ size. In a COLA, that methodology will be
19 implemented to develop a design-specific
20 implementation of the methodology, if approved in
21 ESPA.

22 In the ESPA in Part 6, we are asking to
23 deviate from the current ten-mile EPZ requirements
24 based on the dose-based methodology described in
25 Section 13.3. In COLA, design-specific EPZ size will

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1 be determined, based on the dose-based methodology.

2 In Part 5 of the ESPA, major features of
3 two emergency plans are described and approval for
4 these is being sought for site boundary and two-mile.
5 In COLA, once the SMR reactor design has been
6 selected, dose-based methodology implemented, and the
7 design-specific EPZ sizes established, it could be
8 site boundary, in which case Part 5A emergency plan --
9 major features of the Part 5 emergency plan will be
10 used to create a complete and integrated plan. The
11 same if the dose criteria is met at two-mile.

12 If the selected SMR design does not meet
13 the dose criteria, a new EPZ size will be developed
14 and a supporting emergency plan.

15 Okay, that concludes our presentation.
16 Thank you for your time. If there are any questions,
17 we will be happy to answer them.

18 CHAIRMAN KIRCHNER: Thank you.

19 Members, are there other questions?

20 Well, I should remind you that when you
21 have questions or comments from us individually that
22 doesn't necessarily represent the full committee.

23 And so with that, I will make a personal
24 observation. It seems to me that your plan B, if you
25 will, of the two-mile radius is prudent and a logical

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1 backup to not being able to fit into your exclusion
2 area boundary -- or your site boundary. Sorry, I
3 misspoke.

4 How, given some of the examples that you
5 have worked, how confident are you on your local
6 weather patterns and other things such that you can,
7 with some margin, and this would be an interesting
8 thing to also ask the staff, to squeeze in your site
9 boundary these up to your multi-unit -- what's your
10 limit, 2,400 megawatts thermal?

11 MR. YOUNG: 2,420.

12 CHAIRMAN KIRCHNER: Yes. Do you have any
13 feeling for that or is that the purpose for the two-
14 mile backup?

15 MR. YOUNG: So I believe the question --

16 CHAIRMAN KIRCHNER: Because it begs some
17 really detailed analysis over time of weather patterns
18 and such.

19 MR. YOUNG: Sure, the question revolves
20 around meteorology. We used Clinch River-specific
21 meteorological data that we collected in accordance
22 with the guidance, such as we did for the remainder of
23 the application, the end-dose analysis.

24 We have a lot of confidence in that data
25 because of some of the conservatisms we embedded into

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1 our analysis, such as the 1,100 foot distance from
2 release boundary to site boundary that's been
3 mentioned and some of our other conservatisms in that
4 analysis.

5 CHAIRMAN KIRCHNER: So the weather is
6 going to accommodate your rather irregular shape, by
7 and large?

8 MR. YOUNG: Right. We --

9 CHAIRMAN KIRCHNER: Do you see where -- I
10 mean given, say it were one-mile instead of 1,100 feet
11 and it was a circle, not your boundary, then
12 variations in weather patterns and such are not as
13 crucial as trying to make sure it shoehorns into that
14 irregular shape of your actual site.

15 MR. STOUT: So we're pretty confident in
16 1,100 feet. The site is big enough that you have a
17 lot of flexibility on exactly where you put the
18 footprint within that, so that you have more than
19 1,100 feet.

20 And then we have the meteorology data in
21 all directions, and all conditions, all seasons. So
22 you know our analysis was built in the conservatisms
23 to give us confidence that 1,100 feet is adequate.

24 CHAIRMAN KIRCHNER: Okay. All right,
25 thank you.

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1 MEMBER REMPE: I'm sure I didn't -- if I
2 had done all my homework, I would know but did you do
3 like 30 years of site data or how many years of site
4 data did you consider?

5 MR. YOUNG: So we collected I believe
6 three years of on-site data that was utilized and we
7 did have data from the Clinch River Breeder Project
8 that we did use.

9 Scott, can you tell us how much data we
10 actually considered in the example analysis?

11 MR. WEBBER: Yes, so in the example
12 analysis, we used about representative years' worth of
13 data. It was I believe 2012 and '13, which was
14 considered to be well-representative of the
15 information that TVA had available for a larger
16 spread.

17 And the analysis also did dose assessment
18 for essentially every hour of that year so that there
19 was a release going in every direction and every
20 weather condition.

21 So what TVA was saying we have high
22 confidence that the analysis captured the most severe
23 meteorological conditions.

24 MEMBER MARCH-LEUBA: And the MA report is
25 the evidence for that year or is it 95 percent? Which

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1 is it?

2 MR. WEBBER: The numbers that were in the
3 slide are 50th percentile.

4 MEMBER MARCH-LEUBA: You said 80th
5 percentile?

6 MR. WEBBER: 50th percentile.

7 MEMBER MARCH-LEUBA: 50th.

8 MR. WEBBER: Yes. Mean and 95th were also
9 provided but he 50th percentile was shown.

10 MEMBER MARCH-LEUBA: For future already in
11 Knoxville you only get east wind when there is a
12 hurricane. And I'm sure you have even considered it
13 but there are hurricanes, I can assure you. So I
14 don't see how -- I mean for a real analysis, you need
15 to consider a hurricane. And you only get east wind
16 with a hurricane, which didn't happen in your three
17 years' of data.

18 MR. YOUNG: Sure. So we're many, many
19 miles inland, compared from where we see the really
20 high winds of met data. So from the averages of the
21 met data we collect, you know there are significant
22 meteorological events that get embedded into that.

23 MEMBER MARCH-LEUBA: But once every three,
24 four, or five years, you get 50 mile an hour coming
25 from the east. I know. I live there. And I know you

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1 didn't consider that.

2 MR. YOUNG: Well you know --

3 MR. WEBBER: I'd just like to make a point
4 that for perspectives of dose to site boundary, faster
5 winds are not necessarily more conservative. The wind
6 speed is too high. You can push the plume out so fast
7 that you have almost no exposure.

8 So I think in this instance, actually, a
9 hurricane would not be limiting.

10 CHAIRMAN KIRCHNER: Yes, it may be that an
11 inversion is more limiting for them.

12 MEMBER MARCH-LEUBA: I just wanted to
13 analyze. I think the worst and they entirely say I
14 don't want to do it.

15 CHAIRMAN KIRCHNER: Okay. At this point,
16 if there are no further questions of the applicant,
17 let us take a quick break and we can reset and start
18 at 2:30 on this clock. We are recessed.

19 (Whereupon, the above-entitled matter went
20 off the record at 2:19 p.m. and resumed at 2:31 p.m.)

21 MS. SUTTON: Good afternoon. My name is
22 Mallecia Sutton. I am one of the safety project
23 managers for the Clinch River Nuclear Site early site
24 permit application. With me today is Mr. Allen
25 Fetter, the other safety project manager. Also with

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1 me are the technical reviewers who will be presenting
2 the topic area, Bruce Musico, from the Division of
3 Preparedness and Response for Nuclear Security and
4 Incident Response, also known as NSIR, and Michelle
5 Hart from the Division of Licensing Site and
6 Environmental Analysis in the Office of New Reactors,
7 also known as NRO.

8 In the audience and on the conference
9 bridge are representatives from the Federal Emergency
10 Management Agency, FEMA, Technological Hazardous
11 Division. Also, representatives from Tennessee
12 Emergency Management Agency, TEMA, are on the
13 conference bridge, including TEMA Director Patrick
14 Sheehan.

15 TVA is asking approval for an early site
16 permit for the Clinch River Nuclear Site. As part of
17 the application, TVA described emergency planning
18 topics for approval. You have heard from TVA what
19 they submitted. The staff will be describing the
20 review of the emergency planning information.
21 Although the staff will be presenting its findings,
22 the licensing action will not be complete until the
23 Commission makes the decision whether to grant the
24 early site permit and the exemptions.

25 The appropriate plume exposure pathway

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1 emergency planning zone size for this site will not be
2 determined until a combined license application that
3 references a specific small modular reactor design is
4 submitted for the Clinch River Nuclear Site. The
5 staff will be using several acronyms and abbreviations
6 in this presentation today. The presentation has a
7 list of definitions on the last two slides for your
8 reference.

9 Earlier today you heard the staff give a
10 detailed presentation of the rulemaking for emergency
11 planning for small modular reactors and other new
12 technologies currently in process. The ACRS should
13 recognize that TVA's Clinch River early site permit
14 application was submitted in May 2016. This was
15 before the staff started work on the small modular
16 reactor and other technologies rulemaking.
17 Accordingly, the application and review of the
18 application by the staff is based on current
19 regulations and guidance. The staff cannot review to
20 regulations or guidance that is not yet approved.

21 I will now briefly describe the early site
22 permit and the plan parameter envelope. An early site
23 permit is an approval of safety and environmental
24 suitability of a proposed site to support future
25 construction operation of the nuclear plant. In an

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1 early site permit application, the applicant doesn't
2 have to commit to building the reactor or specify
3 reactor design that would be built there. The early
4 site permit reserves both site safety and
5 environmental issues that are independent of the type
6 of reactor design. An early site permit does not
7 allow for construction and operation of a nuclear
8 plant.

9 Before a nuclear plant can be constructed
10 and operated at a site with an early site permit under
11 Part 52, a combined licensed application referencing
12 a specific reactor technology for this site must be
13 reviewed and approved by NRC. It is possible to
14 approve an early site permit site without a selected
15 reactor technology.

16 An early site permit plant parameter
17 envelope or PPE values are intended to bound a variety
18 of reactor technologies, rather than one specific
19 technology. The PPE values represent a surrogate
20 nuclear plant for the purpose of siting determination.
21 The PPE values are bound in criteria used by the staff
22 to determine the suitability of an early site permit
23 site for construction and operation of a nuclear
24 plant. The safety evaluation report evaluates the
25 site characteristics to include design basics,

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1 tornado, flood, and groundwater moisture, just to give
2 a few examples.

3 In the combined license application, when
4 a specific technology is identified, the PPE values
5 are compared to those of the selected technology. If
6 design parameters of the selected technology exceed
7 bounding early site permit PPE values, additional
8 reviews are conducted to ensure that the site remains
9 suitable from a safety and environmental standpoint
10 for construction and operation of its selected nuclear
11 plant technology. In addition, the site parameters
12 for the referenced certified design must be bounded by
13 the site characteristics in the early site permit.

14 In the development of a plant parameter
15 envelope, an applicant typically draws data from a
16 number of plant technologies under consideration to
17 construct a bounding envelope. It is important to
18 note that when issuing a permit, the NRC approves the
19 PPE rather than the specific technologies that a PPE
20 was drawn from. As such, any plant technology that
21 can demonstrate to be bounded by the plant parameter
22 envelope is suitable for use in a combined license
23 application.

24 The safety evaluation report for Chapter
25 13, Section 13.3 for the TVA Clinch River Nuclear Site

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1 application addresses the plant's design features,
2 facilities, functions, and equipment necessary to a
3 logical emergency planning that must be considered in
4 an early site permit application that includes
5 proposed major features of the emergency plans.

6 TVA early site permit application includes
7 a methodology that, if approved in an early site
8 permit, could be used in future combined license
9 application referencing a specific small modular
10 reactor design and early site permit to determine the
11 appropriate site-specific plume exposure pathway
12 emergency planning zone size for the TVA Clinch River
13 Nuclear Site.

14 The submitted early site permit
15 application requests two sets of exemptions from the
16 current ten-mile plume exposure pathway emergency
17 planning zone requirements if certain conditions are
18 met: one set of 25 exemptions to support major
19 features emergency planning based on the plume
20 exposure pathway emergency planning zone at site
21 boundary and one set of two exemptions plume exposure
22 pathway emergency planning zone with a two-mile
23 radius.

24 If these sets of exemptions are approved
25 as part of the early site permit, it will be

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1 accompanied by permit conditions specifying the
2 circumstances under which these plans can be used in
3 the combined license application. The combined
4 licensed applicant would apply the methodology
5 approved in the early site permit to the design
6 selected for the combined license application in order
7 to determine whether the conditions for either of the
8 two sets of exemptions have been met.

9 Now, I turn the presentation over to Bruce
10 and Michelle to discuss the technical review.

11 Bruce.

12 MR. MUSICO: Thank you. Good afternoon.
13 My name is Bruce Musico. I am a Senior Emergency
14 Preparedness Specialist. I and Michelle Hart reviewed
15 the emergency planning information that TVA provide
16 in its ESP application. Slide 2, please.

17 You're going to see somewhat of an overlap
18 from our slides with TVAs because we cover common
19 areas.

20 The ESP application requested a review of
21 three key areas. First of all, the plume exposure
22 pathway emergency planning zone, or EPZ, sizing
23 methodology. And Michelle is going to address that
24 shortly.

25 Secondly, TVA requested approval of two

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1 major features on-site emergency plans. The first
2 emergency plan assumed a site boundary plume exposure
3 pathway EPZ. The second emergency plan reflected an
4 approximately two-mile plume exposure pathway EPZ and
5 this particular major feature of emergency plan
6 included an evacuation time estimate.

7 And third, TVA requested approval of 25
8 exemption requests. And these are broken down into
9 two sets. One set was associated with the site
10 boundary emergency plan, major features emergency plan
11 and the second set was associated with the two-mile
12 plume exposure pathway EPZ.

13 The ESP proposes an exemption from the
14 current ten-mile plume exposure pathway EPZ, which is
15 currently in our regulations. The exemptions address
16 portions of our regulations, including 10 CFR 50.33,
17 .47, and Appendix E to 10 CFR Part 50. This is for
18 both on-site and off-site emergency planning. Next
19 slide, please.

20 This slide addresses the 10 CFR Part 52
21 licensing process in general. Upon issuance of an
22 early site permit, the applicant acquires approval
23 with conditions on: the plume exposure pathway EPZ
24 sizing methodology, the 25 requested exemptions, and
25 the two major features emergency plans, site boundary

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1 and two-mile EPZs.

2 In the future, a combined license
3 application that incorporates by reference the early
4 site permit will identify a chosen small modular
5 reactor or SMR technology for the Clinch River Nuclear
6 Site. At that time, the applicant must demonstrate
7 that the EPZ sizing methodology supports either the
8 site boundary or two-miles plume exposure pathway
9 emergency planning zone.

10 At that time, the COL applicant must also
11 provide a complete and integrated emergency plan. For
12 the two-mile plume exposure pathway EPZ, the COLA
13 applicant must provide an on-site emergency plan --
14 I'm sorry -- provide an on-site and off-site emergency
15 plan. For the site boundary plume exposure pathway
16 EPZ, the applicant must provide an on-site emergency
17 plan, which assumes that the site boundary, as defined
18 for EP purposes in the COLA, will be within the
19 applicant's owner-controlled area.

20 And in addition, the COL applicant must
21 address the identified COL action items, of which we
22 have identified 16, and the four permit conditions
23 that we've identified in the application.

24 MEMBER MARCH-LEUBA: So Bruce, could I
25 talk for a minute?

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1 MR. MUSICO: Yes.

2 MEMBER MARCH-LEUBA: The ESP -- you will
3 issue an SER or sign an ESP for them which has two
4 options, the two-mile or the site boundary.

5 MR. MUSICO: Site boundary, yes, that's
6 correct.

7 MEMBER MARCH-LEUBA: Is that correct? I
8 mean you approved both of them?

9 MR. MUSICO: We are approving both major
10 features emergency plan.

11 MEMBER CORRADINI: And they have to come
12 back with a chosen technology and show that they fit
13 into one of them.

14 MR. MUSICO: According to the methodology
15 that what we've also reviewed we'll have approved.
16 That's correct.

17 MEMBER CORRADINI: Okay.

18 MR. MUSICO: That's correct. This was a
19 first of a kind application in which we received two
20 emergency plans, rather than one with the application.
21 So it is kind of interesting in that respect.

22 MEMBER MARCH-LEUBA: And on that ESP, will
23 you have limitations about the methodology? Because
24 on their methodology, on their example, they have this
25 criteria for the frequency of 10 to the minus 6 and 10

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1 to the minus 7, which are proposed. Will those become
2 part of the approval?

3 MR. MUSICO: The short answer is yes and
4 Michelle Hart is going to address that later.

5 The specific methodology is, however,
6 defined in Section 13.3 of the site safety analysis
7 report, which is Part 2 of the application, the ESP
8 application. So they have identified specifically
9 what the methodology is.

10 Next slide, please.

11 MEMBER BLEY: Quick question. They have
12 given you two on-site emergency plans. Are they
13 essentially identical?

14 MR. MUSICO: No.

15 MEMBER BLEY: Okay.

16 MR. MUSICO: They are very close. They
17 are very close.

18 MEMBER BLEY: Some will have connections
19 to off-site, I assume.

20 MR. MUSICO: Well, they're limited. First
21 of all, since they are major features emergency plan,
22 they are limited with respect to the extent that they
23 address our current emergency planning regulations and
24 guidance and they are permitted to do that. They can
25 pick and choose the limited aspects that they want to

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1 address at the ESP stage.

2 And they've provided us with two separate
3 plans. We've reviewed them separately but we also
4 compared them and, to a great extent, both plans are
5 virtually identical, except to the extent that one
6 plan reflects the site boundary of EPZ that they're
7 proposing. The other one reflects the approximate
8 two-mile EPZ that they're proposing and they also
9 reflect the exemptions that are specifically requested
10 for them.

11 For example, the site boundary major
12 features emergency plan reflects the 25 exemption
13 requests for that particular plant. For the two-mile
14 major features emergency plan, there's not that much
15 different than a ten-mile as far as the off-site
16 requirements. So they only have two exemption
17 requests that they are requesting for the two-mile
18 major features emergency plant.

19 So the fact that they were, to a great
20 extent, identical, made our job a little easier with
21 respect to approving them or reviewing them and
22 approving them, even though they are limited because
23 they are major features, but we also distinguished the
24 two plans, and you'll see that in the safety
25 evaluation, between language in one versus the other

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1 in that one would address various aspects of say the
2 site boundary EPZ, where the other one would reflect
3 and describe various aspects of the two-mile plume
4 exposure pathway EPZ.

5 So there were differences and we called
6 those out specifically in the safety evaluation.

7 MEMBER BLEY: Thank you.

8 MR. MUSICO: All right, slide 4, please.
9 This slide reviews the staff's review of the specific
10 exemptions. The NRC reviewed the requested exemptions
11 pursuant to 10 CFR 50.12, which is entitled Specific
12 Exemptions.

13 Specifically, 50.12(a)(2) states that the
14 Commission will not consider granting an exemption
15 unless special circumstances are present. And then in
16 (ii), it states that special circumstances are present
17 whenever application of the regulation in the
18 particular circumstances would not serve the
19 underlying purpose of the rule or is not necessary to
20 achieve the underlying purpose of the rule.

21 Now for exemption requests there are a
22 number of special circumstances that are available to
23 them. This was one that they identified as applicable
24 to the application and the staff agree with that.
25 This is appropriate.

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1 Next slide, please. The underlying
2 purpose of 10 CFR 50.33, 50.47, and Appendix E to Part
3 50 is to, first of all, ensure that licensee maintain
4 effective on-site and off-site radiological emergency
5 response plans; secondly, to ensure that there is
6 reasonable assurance that adequate protective measures
7 can and will be taken in the event of a radiological
8 emergency; and third, establish a plume exposure and
9 ingestion pathway EPZ as appropriate.

10 And then the second bullet is the ESP
11 application serves to provide a basis for the
12 establishment in the COL application of either a site
13 boundary or two-mile plume exposure EPZ, and they can
14 pick which one, which maintains the same level of
15 protection, that is dose savings in the event of a
16 radiological emergency, in the environs of the Clinch
17 River Nuclear Site as that which exists in the basis
18 for the ten-mile plume exposure pathway EPZ.

19 So the safety level is maintained. It's
20 the same.

21 Next slide, please. Now, I'll turn it
22 over to Michelle.

23 MS. HART: Hi. I'm Michelle Hart. I'm in
24 the Office of New Reactors and I do look at siting
25 analysis as well as I looked at the analysis that they

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1 provided for the EPZ sizing methodology and criteria.

2 So TVA had stated that their plume
3 exposure pathway EPZ size methodology is based on
4 these following technical criteria. And I think they
5 described them before but, to remind you, they are the
6 plume exposure pathway EPZ should encompass those
7 areas in which project dose from design-basis
8 accidents could the EPA early phase protective action
9 guides; that the plume exposure pathway EPZ should
10 encompass those areas in which consequences of less
11 severe core melt accidents could exceed the EPA early
12 phase protective action guides; and plume exposure
13 pathway EPZ should be of sufficient size to provide
14 for substantial reduction in early health effects in
15 the event of more severe core melt accidents.

16 Next slide, please. This is slide 7. So
17 the features or the outline of the methodology that
18 they provided in their site safety analysis report,
19 the first step that you go through is the accident
20 scenario selection. So you would use the bounding
21 design-basis accident from the combined operating
22 license final safety analysis report Chapter 15. And
23 that is the analyses that you would use to look at the
24 safety of the plant and also to look at siting. And
25 so in addition to those accidents which do not have

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1 core failure, you would have an accident used to
2 assess your siting in the regulation and that,
3 generally in the past, for the large light water
4 reactors has been the LOCA with an intact containment
5 and using the tech spec release rate from the
6 containment. So you would use that same accident
7 that's used for the siting analysis.

8 And then you would go to use the combined
9 operating license application site- and design-
10 specific probabilistic risk assessment to categorize
11 the severe accident scenarios.

12 So this PRA and the assessment of severe
13 accident scenarios should be all modes, include
14 internal and external events, would also include
15 applicable fuel handling and spent fuel pool
16 accidents, and would have multi-module considerations,
17 if those are applicable to the specific SMR design
18 that they choose.

19 You would start with all sequences with a
20 mean core damage frequency about 10 to the minus 8 per
21 reactor year and then you would further categorize
22 those scenarios, once you look at those, and determine
23 the scenarios from that.

24 So the first category, which when TVA was
25 talking that was the criterion B that they were

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1 talking about, would be the more probable, less severe
2 core melt scenarios. And those are with a mean CDF
3 greater than 10 to the minus 6 per reactor year and
4 include intact containment.

5 And the third category, or what they would
6 call criterion C, is the less probable, more severe
7 core melt scenarios. And those are with a mean CDF
8 greater than 10 to the minus 7 per reactor year with
9 containment bypass or failure.

10 CHAIRMAN KIRCHNER: Michelle, now let me
11 ask a question. You specify a mean CDF. How much
12 uncertainty do you consider beyond just a mean CDF?

13 I mean where I'm going with this, I've
14 raised this point before, is that for the less mature
15 concepts, let me say it that way, more still on paper,
16 not any real operating experience, how do you assess
17 the PRA and the uncertainties with that? Because I
18 suspect that most design teams will come in with very
19 low mean CDF numbers and then say well, I meet your
20 criteria on this slide and we don't have to consider
21 severe accidents.

22 MS. HART: Right.

23 CHAIRMAN KIRCHNER: How prudent is that
24 and how are you going to interject some, how should I
25 say it, regulatory certainty? Because that's one of

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1 the things you're trying to do in all of your
2 processes.

3 How do you see the staff approaching this?

4 MS. HART: Well how -- I mean certainly,
5 it remains to be seen what will actually go through
6 when we do the implementation, when the applicant goes
7 through the implementation and when we review the
8 implementation of it.

9 And so it does, as you are rightly saying,
10 it does depend on the maturity of the specific design
11 that they've chosen and the quality of their PRA, the
12 acceptability of their PRA for this purpose. And we
13 would review that in conjunction with the PRA
14 reviewers in the Office of New Reactors to determine
15 the usability of the information that they gave us.

16 So there's no specific -- I don't think --
17 I think there is room for us to make that
18 determination at the time of implementation. We're
19 trying to cut off, trying to make the appropriate
20 decisions at that time.

21 Right now, we're saying that this looks
22 reasonable to categorize your events using your PRA
23 and mean seems to be a reasonable bound to use for
24 that purpose, for the emergency planning purposes.

25 MEMBER BLEY: Well there are some things

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1 you might want to consider and that is, at the time of
2 COLA, at least from what we've seen on other designs
3 that have come through, they typically have no
4 operating experience. They might not -- they don't
5 have to have all their emergency procedures in place.
6 Those have to be in place before startup. They don't
7 have real operators yet and they haven't had operators
8 through training. So there is a lot of things not
9 there.

10 On the site-specific side of it, by COLA,
11 you should have a specific site but they typically
12 don't upgrade their PRA to account for that, except
13 with some purely loose bounding calculations that say
14 yes, we meet the envelope of what was assumed in the
15 design cert PRA. So those kind of things you need to
16 give some kind of weight to along the lines of Walt
17 talking, account for them as possibly giving you
18 higher results than the existing work.

19 MS. HART: Right. I think it's we do
20 recognize that the PRA for the design and the PRA use
21 for the combined operating license, in general, may
22 not include all the information or may not be the
23 exact same quality that you would need to do this
24 assessment. And so there may be some portions of it
25 that they have to describe to us why that's

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1 appropriate. And I think that that's -- it's a
2 discussion that we've been having with the licensing
3 modernization project also about the applicability of
4 the PRA and how you show that that's appropriate to
5 use for the purposes --

6 MEMBER BLEY: Well, I'm glad they're
7 talking to you.

8 MS. HART: Yes. So there is some
9 discussion along those lines that what you -- what we
10 have said in some of our guidance about what is
11 required for a PRA, for the design certification
12 especially, is that it's appropriate so that we don't
13 have to do a detailed analysis of -- or a detailed
14 review of their PRA. And so there may be some further
15 step that has to come here, depending on the design
16 and what they say in the PRA.

17 So a lot of this, unfortunately at this
18 stage, we have to kind of rely on how we would
19 implement it later. And I know it may not seem like
20 it gives enough information or enough detailed
21 information but I think you know this is a first of a
22 kind thing and if TVA does choose to go forward, if
23 they get their early site permit and then just decide
24 to go forward with the COL, we've been discussing this
25 with them -- not maybe necessarily this specific topic

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1 but the idea of this analysis. And they helped
2 develop this analysis. They based it off of the
3 information in NUREG-0396. And so, generally, they're
4 trying to recreate what was done in NUREG-0396 for
5 their specific site at some future point, when they
6 specific design.

7 MEMBER BLEY: Yes, I don't have any real
8 qualms with the general approach but you will be the
9 first specific one looking at this, it appears to me.
10 So some kind of compensation for the things that
11 aren't there and can't be there yet ought to be on the
12 table.

13 MS. HART: Right and I think uncertainty
14 analysis is very important and it's something that we
15 will review carefully, the uncertainty, when we get to
16 the implementation stage.

17 MEMBER BLEY: Yes, it's not just
18 parametric uncertainty here. It's uncertainty in
19 things that aren't there that you can actually see
20 that aren't there yet.

21 MS. HART: That's correct.

22 Okay. So then of course, after you
23 categorize your events and select your scenarios, you
24 may group them, as you sometimes do in PRA but you
25 would determine source releases to the atmosphere for

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1 each of the categories, the design-basis accident,
2 more severe, less severe, you know if there are more
3 severe accidents. You would calculate the dose
4 consequences at distance from the plant and then you
5 would determine the plume exposure pathway, EPZ size
6 that would meet the dose-based criteria to be used in
7 further determination of the actual emergency planning
8 zone.

9 Next slide, please. So slide 8, so the
10 dose-based EPZ size criteria is a dose to an
11 individual from exposure to the airborne plume during
12 its passage and also to groundshine, using average
13 atmospheric dispersion characteristics for the site.
14 This is very similar to the way that it was done in
15 NUREG-0396 using average atmospheric dispersion
16 characteristics was one of the features that they
17 used.

18 And for the design-basis accident and for
19 the more severe less -- more probable, less severe
20 accidents, the dose criterion is one rem total
21 effective dose equivalent from a 96-hour exposure.
22 And that one rem over 96 hours is at the lower end of
23 the dose range for the EPA PAG for early phase
24 protective actions, for example, evacuation and
25 sheltering. And this is to verify that dose

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1 consequences do not exceed the EPA PAG beyond the site
2 boundary, which is within the owner-controlled area,
3 for the two-mile plume exposure pathway EPZ.

4 For that last category, the less probable,
5 more severe accidents, you would calculate the
6 distance at which the conditional probability to
7 exceed 200 rem whole body from a 24-hour exposure
8 would exceed 10 to the minus 3 per reactor year. And
9 the 200 rem whole body is an acute dose at which
10 radiation-induced early health effects may begin to be
11 noted. For example, one of those effects is nausea.
12 And this is to verify that the plume exposure pathway
13 EPZ supports substantial reduction in early health
14 effects.

15 Next slide, please. So for the staff to
16 review the plume exposure pathway EPZ size methodology
17 that TVA provided, we did compare TVA's methodology
18 and the dose criteria to the study used as the
19 technical basis for the current 10-mile plume exposure
20 pathway EPZ requirement. And that study was NUREG-
21 0396.

22 And the features of TVA's methodology are
23 consistent with NUREG-0396, in that it considered a
24 range of accidents. It performed accident consequence
25 analyses, and it determined an area outside of which

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1 early protective actions are not likely to be
2 necessary to protect the public from radiological
3 releases.

4 And, therefore, the staff concludes that
5 the applicant's proposed methodology is reasonable and
6 consistent with the analyses that form the technical
7 basis for the current regulatory requirement of a
8 plume exposure pathway EPZ of about ten miles in
9 radius.

10 MEMBER BLEY: If these are based on PRA,
11 do you have a sense for what not likely means,
12 quantitatively?

13 MS. HART: Quantitatively, there is
14 nothing in NUREG-0396 that would give you a clue to
15 that. I mean it did use NUREG -- I mean it used WASH-
16 1400 as its basis.

17 MEMBER BLEY: WASH-1400, which you could
18 look at.

19 MS. HART: Yes. Yes, and so in general,
20 I think in general we talk a lot about the cutoff. I
21 know that that was a discussion this morning, the
22 cutoff for what the frequency of the events or the
23 sequences should be that you should evaluate. And 10
24 to the minus 8, 10 to the minus 7, 10 to the minus 6,
25 those all have been numbers that have been floating

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1 around. And as TVA had stated, the specifics for like
2 the 10 to the minus 6 per reactor year for the more
3 probable accidents in that category has been discussed
4 in several different areas. In industry, they have
5 used that number a lot.

6 Ten to the minus seven, maybe not quite as
7 often, has been discussed but it seems reasonable, at
8 this point. I think it's when we get to the
9 implementation phase, if there is some special case or
10 there is something like we were talking about
11 NuScale's PRA, their design PRA doesn't have anything
12 in that category of 10 to the minus 6 or higher but do
13 they have a backstop that they would provide some
14 other analysis to bound any potential severe
15 accidents.

16 So I think it's a reasonable good bounding
17 assessment.

18 MEMBER MARCH-LEUBA: When in slide 7 when
19 you say 10 to the minus 7 per reactor year, you mean
20 module or multi-module year?

21 MS. HART: Well that is actually the quote
22 from TVA's methodology. It does depend on the design
23 that is used. And so I think we will definitely look
24 at that. I think in general, though, we would say it
25 is equivalent to a module year, unless there is

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1 something in the design that would show that there
2 would be multi-module events that would occur.

3 MEMBER REMPE: So when you reviewed their
4 analyses, what made you decide it was acceptable to
5 use one year of site-specific meteorological data from
6 TVA and use a 50 percent value?

7 MS. HART: I will be discussing the
8 example calculation and it's just an example to
9 evaluate the usability of the methodology. I did not
10 use their analysis to approve anything, per se. You
11 know I am not approving an EPZ size at this time.

12 MEMBER REMPE: Okay.

13 MS. HART: So it's just to say you know
14 how they used the methodology.

15 But the methodology does include the
16 feature that they would use average meteorological
17 conditions for the site and that was something that
18 was also done in NUREG-0396. So I think when you're
19 looking -- when you're doing projected analyses for
20 licensing purposes, in general, you want to use -- for
21 these purposes you want it to be a little bit more
22 representative than bounding in this case.

23 MEMBER REMPE: And is one year enough to
24 decide that something is representative?

25 MS. HART: That I can't say for sure.

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1 We'll look at the implementation. I think we will
2 look at multiple years of data because they are
3 required to provide multiple years of data. And so
4 we'll determine if the information they are using in
5 their analyses is representative of the site, whether
6 it is that specific year or not.

7 MEMBER REMPE: Okay, thank you.

8 MS. HART: Okay, next slide, please, so
9 slide 10. In their request for the exemptions -- so
10 now we've moved on from the methodology to the
11 exemption requests -- they did describe that there are
12 features of small modular reactors that support the
13 exemption requests. And TVA stated that special
14 circumstances exist at the Clinch River Nuclear Site,
15 due to the anticipated enhanced safety features of the
16 SMR designs under consideration. And those things are
17 such as: smaller radionuclide inventories and source
18 terms; projected accident progression rates are
19 anticipated to be slower; that various design features
20 are expected to eliminate several historically-
21 considered design-basis events, for example, you
22 wouldn't have a lock rotor accident if you don't have
23 reactor coolant pumps; and advanced design features
24 would minimize accident consequences.

25 MEMBER BLEY: Are you saying this has to

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1 be confirmed when they come in for a specific design
2 or just the results of the calculation?

3 MS. HART: Well that is -- I think the
4 results of the calculation are what tell you the
5 emergency planning zone size. That would be the
6 actual proof of that.

7 I think for the purposes of requesting the
8 exemptions, they had to make general statements about
9 SMR designs and why they thought they were special.

10 MEMBER MARCH-LEUBA: For the record, I
11 don't agree with the point number one, a smaller
12 inventory. Per megawatt, because their refueling is
13 longer, it is not accumulating only two years of
14 inventory. It will accumulate ten years of inventory.
15 So the inventory is larger per megawatt.

16 MS. HART: Yes, some designs, that's true.

17 MEMBER MARCH-LEUBA: But it has to be
18 plant-specific.

19 MS. HART: I think in general that idea is
20 just that they are at smaller power in the first
21 place.

22 MEMBER MARCH-LEUBA: Right.

23 MS. HART: So the stuff in the core is
24 less --

25 MEMBER MARCH-LEUBA: If you want to do it

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1 my module, then you take advantage of the lower power.

2 MS. HART: Yes.

3 MEMBER MARCH-LEUBA: But specifically
4 NuScale, if you are going to have an accident that
5 melts the core, it is going to be an external event
6 with a high probability of killing all 12 of them.

7 So the multi-module thing has to be
8 addressed properly.

9 MS. HART: Multi-module accidents do need
10 to be considered and that would be in your source
11 terms, if that is something that is appropriate to the
12 design that's been chosen.

13 MEMBER MARCH-LEUBA: If you look at those
14 sequences, to damage the core, it has to be an
15 external event and it will hit all of it.

16 MS. HART: I don't know if that is true.
17 That is something to discuss with NuScale.

18 MEMBER BLEY: And we don't know what they
19 are going to plan.

20 MS. HART: For the TVA Site, we do not
21 know which design they are going to choose. It may
22 not be NuScale. You never know.

23 Next slide, please. So, as you expressed
24 some concern about the statements that were made, I
25 also had some questions about them. So I asked them

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1 to provide some information about what they mean by
2 these things.

3 And so in my request for additional
4 information, I did ask for specific technical support
5 related to those statements and a comparison to large
6 light water reactors. And in their response, TVA did
7 provide tables with several parameters, comparing the
8 smallest and largest SMRs, by that I mean based on
9 unit-rated thermal power, in the Clinch River Nuclear
10 early site permit application plant parameter envelope
11 to the large and medium currently operating
12 pressurized water reactors, one example of each one of
13 those, and the AP1000, as well.

14 And some examples of the parameters that
15 they had comparisons was the internal events CDF and
16 large release frequency for the designs or for the
17 operating plants; the source term total activity -- so
18 that was just a total curie amount within the core of
19 each of those designs; the primary coolant liquid mass
20 to power ratio; and some severe accident progression
21 information, you know the length of the releases, the
22 timing of the releases, things like that. And there
23 were some additional parameters and I didn't describe
24 them all here but they are in the response to the
25 first RAI.

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1 And in general, they showed that the SMRs
2 do have better characteristics, if you look at these
3 specific parameters.

4 Next slide, please. So I also asked them
5 to give -- them being TVA -- to give me a
6 demonstration that the proposed plume exposure pathway
7 size criteria could be met at a given EPZ boundary
8 distance for potential reactor facilities that would
9 be represented by the surrogate design in the plant
10 parameter envelope.

11 And as you know, the plant parameter
12 envelope had several different designs that were used
13 to develop this envelope for the plant, surrogate
14 plant.

15 So in response to this request for
16 additional information, TVA provided an example
17 analysis using design information for a specific SMR
18 design -- as they described earlier, it was NuScale --
19 as input to their plume exposure pathway EPZ size
20 methodology.

21 And the example analysis did show that the
22 design could support a site boundary plume exposure
23 pathway EPZ, however, it was not intended, either by
24 TVA nor interpreted that way by the staff, to prove
25 the case for the early site permit application to

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1 justify a specific plume exposure pathway EPZ size.
2 And that is because it was based on preliminary design
3 information for an SMR at the lower end of the rate of
4 power that is part of the basis for the Clinch River
5 Nuclear Site ESP plant parameter envelope.

6 It used internal events design PRA only.
7 It did not include external events. And it did not do
8 a detailed uncertainly analysis. And the most
9 important reason, which of course I didn't put on the
10 slide, is that they are not asking for a specific EPZ
11 size at this time.

12 Next slide, please. So as TVA had
13 described, for use of the exemptions themselves in the
14 combined operating license, they did develop a non-
15 design-specific accident release source term that
16 would meet the plume exposure pathway EPZ size
17 criteria to be used as plant parameters. And those
18 are listed in our safety evaluation report Table 13.3-
19 1. It's the same idea as a plant parameter envelope
20 design-basis accident source term and it's used to
21 envelope an unknown design.

22 And this non-design-specific accident
23 release source term is reference in Permit Condition
24 1 for adoption of the EP exemptions by a COL that
25 references the ESP.

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1 This non-design-specific accident release
2 source term is an isotopic total release activity over
3 96 hours, which results in a total effective dose
4 equivalent of around 0.9 rem at the site boundary.
5 And as TVA had described earlier, it was based on
6 three core melt intact containment accidents, two were
7 design-basis accidents and one was a severe accidents,
8 from two different SMRs from the NuScale design and
9 also from the design that they used as the basis for
10 their early site permit siting analysis.

11 And they used the maximum activity release
12 for a specific nuclide from any of the three accidents
13 over a specific dose averaging period. They assumed
14 that would be the maximum release activity. And they
15 lined up the start of the release. Each time equals
16 zero at the same time of the release. So there was no
17 -- like if one started releasing at five hours and the
18 other one started releasing at ten hours, they moved
19 those both to the same starting period. And by dose
20 averaging period I mean those dose averaging periods
21 that we used in meteorological analysis, the zero to
22 8 hours, 8 to 24 hours, and 24 to 96 hours.

23 Once they determined the maximum release
24 for each radionuclide -- and the different
25 radionuclides may have a release from a different

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1 plant or a different accident; they were all a
2 composite together -- they added a 25 percent margin.
3 And then they did a back calculation to ensure that
4 they fit within the dose criteria at the site
5 boundary. And there was an additional adjustment to
6 some of those values. So there was at least a 25
7 percent margin over top of the maximum release for any
8 of those three accidents that was included in this
9 non-design-specific accident release source term.

10 Next slide, please. So as I said, this
11 was referenced in Permit Condition 1. And in Permit
12 Condition 1, COL applicant referencing the ESP, if
13 approved, would perform an analysis using the plume
14 exposure pathway EPZ size methodology with site- and
15 design-specific input to justify the plume exposure
16 EPZ size for the combined operating license
17 application.

18 In addition to the output of the EPZ size
19 basis, it would also include the source term releases
20 to the atmosphere. So an outcome of that analysis
21 would give you what was released to the atmosphere,
22 isotopic activity over time.

23 You would compare that release
24 characteristics to the environment to the SER Table
25 13.3-1 non-design-specific plant parameter source

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1 term. And then you fit within -- if all of their
2 releases were less than what's in that table that was
3 developed in the ESP, then the COL applicant can adopt
4 the emergency planning exemptions.

5 And so that table, if you've looked at it
6 is a four-day total activity release to the atmosphere
7 for 71 separate isotopes.

8 So do you have any questions about that?

9 CHAIRMAN KIRCHNER: Yes, please. I was
10 just going back to the inventory is based on the
11 largest thermal unit that they were --

12 MS. HART: It included the largest thermal
13 unit as one of the accidents.

14 CHAIRMAN KIRCHNER: One of the accidents.

15 MS. HART: Yes, and the other one was the
16 NuScale examples that they provided in the RAI
17 response.

18 MEMBER REMPE: So just to make sure about
19 this four-day question that I keep harping about, if
20 they finally come in, you will be -- there is some
21 clue to tell people hey, I'm not just going to look at
22 from the first of the release, I'm going to look at
23 the most severe time.

24 MS. HART: We'll look at the
25 characteristics of the entire scenario to determine if

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1 they've evaluated the appropriate release
2 characteristics.

3 MEMBER REMPE: Thank you.

4 MS. HART: Okay, next slide, please.

5 So as a reminder, we've been talking about
6 the plant parameter envelope. It does include the
7 four different SMR designs, preliminary designs, the
8 mPower and NuScale, Holtec SMR, and Westinghouse SMR.
9 And the plant parameter envelope, itself, you could
10 include a different reactor design in the COLA that
11 falls within the following PPE information range and
12 that's two or more SMRs with a maximum 800 megawatts
13 thermal for a single unit and a combined site capacity
14 not to exceed 2,420 megawatts thermal or 800 megawatts
15 electric.

16 So next slide, please and I will turn it
17 back over to Bruce.

18 CHAIRMAN KIRCHNER: Michelle?

19 MS. HART: Oh, I'm sorry.

20 CHAIRMAN KIRCHNER: I was just thinking
21 about Table 13.3-1 and the condition, permit
22 condition. Different reactor vendors might have
23 different accident sequences and might get their
24 release from different isotopes. Do you see where I'm
25 going?

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1 MS. HART: Yes.

2 CHAIRMAN KIRCHNER: So how does this fit
3 back to making that a condition that they live within
4 all of these four-day activity curie limits? Does
5 that always equate to still being below one rem at the
6 --

7 MS. HART: Right. So --

8 CHAIRMAN KIRCHNER: Do you see what I'm
9 going with?

10 MS. HART: Right, I see what you're
11 saying. So one of the reasons that this is a four-day
12 total integrated dose, so if there were different
13 characteristics to the rate of release, that's not
14 going to be a problem for them. But if there are
15 different isotopes that are included in this envelope
16 or if there is one isotope that is just really
17 different for a new design, it may not fit within this
18 table.

19 So, therefore, they don't automatically
20 get to use the exemptions but that doesn't mean that
21 they can't have a site boundary, a plume exposure
22 pathway EPZ because their analysis would prove that.

23 CHAIRMAN KIRCHNER: Okay.

24 MS. HART: This table is really only to
25 tell you that this is the information that we had in-

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1 house at the time that we evaluated their exemption
2 requests. And so these are the conditions on the
3 exemption, as we understand it now. So we're not
4 trying to bound everything.

5 CHAIRMAN KIRCHNER: But when it really
6 came to an actual COLA with an actual plant, and if
7 something --

8 MS. HART: They could take a variance.

9 CHAIRMAN KIRCHNER: -- say that -- I'll
10 pick something like xenon-133, which is a biggie here.

11 MS. HART: Right.

12 CHAIRMAN KIRCHNER: We're a little higher,
13 a little lower. Lower is okay but I mean say it were
14 higher, you would just analyze that as a variance.

15 I'm assuming it's not off the charts
16 different but it would be --

17 MS. HART: Right. Right and I think the
18 implementation is still to be seen as well. I mean a
19 permit condition should be, as the lawyers have told
20 us, it should be ministerial. So you don't assess the
21 information. You just verify that the information has
22 been met --

23 CHAIRMAN KIRCHNER: Okay, all right.

24 MS. HART: -- if that makes sense. But
25 they still may be able to justify a site boundary EPZ.

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1 It's just they may have to take a variance or --

2 CHAIRMAN KIRCHNER: Yes, they may, for
3 whatever reason, fuel choices or something, have a
4 different mix come out of their accident scenarios.

5 MS. HART: Right.

6 CHAIRMAN KIRCHNER: Okay.

7 MS. HART: Right.

8 Any additional questions on that?

9 Okay, so I will turn the presentation back
10 over to Bruce.

11 MR. MUSICO: Thank you. Slide 16, please.

12 This slide merely identifies some of the
13 key standards and guidance that the staff used to
14 perform its evaluation. There are additional
15 requirements and guidance documents that the staff
16 also used and those are identified within the safety
17 evaluation but these are the key ones.

18 Next slide, please. This slide deals with
19 the Federal Emergency Management Agency, FEMA, and our
20 consultation with them.

21 The NRC performed its review in
22 consultation with FEMA, pursuant to the FEMA-NRC
23 Memorandum of Understanding. FEMA's review was
24 limited in this case because, first of all, the ESP
25 application did not include any off-site emergency

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1 plans and, in addition, the major features plans only
2 addressed a limited aspect of the on-site emergency
3 planning features.

4 In FEMA's January 24, 2018 letter, FEMA
5 stated that, working with TEMA, and that's the
6 Tennessee Emergency Management Agency, FEMA did not
7 identify physical characteristics of the proposed site
8 that could pose a significant impediment to the
9 development of emergency plans, including evacuation
10 from the two-mile emergency planning zone.

11 In addition, the boundary established for
12 the proposed two-mile plume exposure pathway EPZ was
13 established relative to local emergency response needs
14 and capabilities, as they are affected by conditions
15 as demography, topography, land characteristics,
16 access routes, and jurisdictional boundaries.

17 And at this time, FEMA's finding does not
18 endorse or determine the adequacy of a proposed two-
19 mile plume exposure pathway EPZ for the site if
20 proposed during the licensing process. And these are
21 statements directly out of their letter.

22 In FEMA's June 12, 2017 letter, FEMA
23 further stated that it did not review or analyze the
24 feasibility and assumptions for the site boundary
25 emergency planning zone but, if requested in the

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1 future, would provide comments and recommendations to
2 the NRC.

3 CHAIRMAN KIRCHNER: May I make an
4 observation here, Bruce?

5 If I remember correctly the rules under
6 Part 50 and Part 52, the applicant is not required to
7 have this at this ESP juncture. Is that correct?

8 MR. MUSICO: Not required to have what?

9 CHAIRMAN KIRCHNER: The way -- the fully-
10 developed emergency plans.

11 MR. MUSICO: No. No, they are permitted
12 to come in with a major features emergency plan with
13 limitations.

14 CHAIRMAN KIRCHNER: Right.

15 MR. MUSICO: However, they are required to
16 come in and show that there are no physical
17 characteristics that could pose a significant
18 impediment to development of an emergency plan.

19 CHAIRMAN KIRCHNER: Yes.

20 MR. MUSICO: And also with respect to --
21 let me see -- the boundary established for the
22 proposed two-mile plume exposure pathway EPZ, they
23 looked at that as well. And that was defined in the
24 evacuation time estimate.

25 CHAIRMAN KIRCHNER: Right.

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1 MR. MUSICO: Now, if the applicant chose
2 not to submit an evacuation time estimate at this
3 time, it would be very limited with respect to what we
4 could evaluate and what finality they would get at
5 this time. So again, that is one of the advantages of
6 the major features emergency plan that they could come
7 in with and that they could pick and choose what
8 aspects of emergency planning they choose to address.
9 And it was limited, in this case, but it included
10 various aspects that they reflected and we reviewed.

11 CHAIRMAN KIRCHNER: The reason I brought
12 it up is I'm not an expert from alpha to omega on all
13 the details. But the implication from the slide, it
14 just it's like negative you know but actually I think
15 the applicant has met all of your requirements --

16 MR. MUSICO: Well I -- I'm sorry.

17 CHAIRMAN KIRCHNER: -- or in Part 52 for
18 the ESP.

19 MR. MUSICO: I would characterize the
20 slide as positive in that --

21 CHAIRMAN KIRCHNER: Okay. All right.

22 MR. MUSICO: It doesn't say no.

23 CHAIRMAN KIRCHNER: It only addressed
24 limited features and so on but --

25 MR. MUSICO: An unbiased opinion here but

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1 what the slide represents is that there were two key
2 aspects that we are required to consult with FEMA. If
3 you look at the regulations from 10 CFR Part 52, there
4 are two areas where it specifically directs the staff
5 to make determinations in consultation with FEMA.

6 CHAIRMAN KIRCHNER: Right.

7 MR. MUSICO: And that's reflected in their
8 letter.

9 CHAIRMAN KIRCHNER: Yes.

10 MR. MUSICO: What the letter does reflect,
11 also, is that there are limitations that FEMA has
12 identified that they would still look at in a further
13 licensing process and they are not approving an
14 emergency planning zone at this time.

15 So I think it's an appropriate balance in
16 the response, where they did respond to the two in
17 consultation with requirements that are required for
18 us to work with them on in an early site permit but,
19 also, in addition, reflected an area of concern that
20 they had going forward in the licensing process.

21 CHAIRMAN KIRCHNER: Yes, that's fine.
22 It's just that when you went through the list, as you
23 did -- I'm sure this is quite accurate -- I just come
24 away with a feeling like they maybe they didn't do
25 something correctly. But as far as I can tell, the

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1 read from this slide is that they've done everything
2 that's needed at this point.

3 MR. MUSICO: That's correct. That's
4 correct, they did.

5 CHAIRMAN KIRCHNER: Okay, thank you.

6 MR. MUSICO: So we satisfied the two in
7 consultation with requirements in the regulations --

8 CHAIRMAN KIRCHNER: Right, that's what I
9 thought. Okay, thank you.

10 MR. MUSICO: -- as well as identifying the
11 path going forward and their concerns going forward.

12 MEMBER BLEY: So you weren't approving an
13 EPZ at this time. You're approving an approach to
14 define.

15 MR. MUSICO: We are not approving an EPZ
16 at this time, a plume exposure pathway EPZ at this
17 time. We are approving a methodology for determining
18 dose that would be used to determine which of the two
19 major features emergency plans they can utilize in the
20 COLA application.

21 We are approving the two major features
22 emergency plans, which are reflected by the site
23 boundary EPZ and the two-mile EPZ.

24 MEMBER BLEY: Right.

25 MR. MUSICO: But in approving those, as

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1 they relate and are reflected in the respective major
2 features emergency plan, does not approve those for
3 the site because that choice will be made at the COL
4 application stage.

5 MEMBER BLEY: Right.

6 MR. MUSICO: And at that stage, let's say
7 they picked the two-mile plume exposure pathway EPZ in
8 the COLA, while they get the benefit of finality and
9 the approval of the two-mile major features plan that
10 we approved, it is a major feature plan. It is
11 limited aspects of emergency planning. At that time,
12 they do have to come in with a complete and integrated
13 emergency plan.

14 So there is a delta between the limited
15 aspect of EP that we approved now, versus what the
16 final, all the EP requirements that they have to show
17 in the COLA.

18 CHAIRMAN KIRCHNER: Right.

19 MEMBER BLEY: When we get to the COLA
20 stage, before you approve the COLA, does FEMA have to
21 agree? Do they have to approve it or do they just
22 have to not -- you just have to consult with them and
23 they shouldn't have any major objections.

24 MR. MUSICO: Well, it depends. It depends
25 on which -- naturally, we would consult with them on

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1 the application, whatever came in. But as far as the
2 requirement for any approval from them, it depends on
3 which major features emergency plan is chosen by TVA.
4 And I'll discuss that in the upcoming slide.

5 MEMBER BLEY: Okay.

6 MR. MUSICO: Next slide, please, it would
7 be slide 18.

8 In the safety evaluation, the staff
9 identified 16 COL action items and we identified four
10 permit conditions. This merely distinguishes between
11 what a COL action item is and what a permit condition
12 is.

13 For the COL action items, what they do is
14 they track information that is needed before granting
15 a COL but is not required in the early site permit
16 application. They reflect the SMR design that may be
17 identified in the COLA and they require NRC
18 evaluation, further analysis, as part of the COL
19 application review.

20 What these primarily come from is the fact
21 -- this is similar to the PSEG site application that
22 we reviewed, which came in with a plant parameter
23 envelope, where they didn't identify specific reactor
24 technology. So there are certain areas that deal with
25 emergency planning that are reactor-specific. And so

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1 for those particular areas, that information just
2 isn't available yet because they haven't identified
3 the reactor.

4 So the TVA identified a number of areas
5 where this information is not available now. It will
6 be identified and addressed at the COL application
7 and, at that stage, we will review it in detail. And
8 we captured that as COL action items.

9 In short, COL action items request
10 information that they choose not to provide or is not
11 available at this time but will require a subsequent
12 analysis in the COL application. So we will be doing
13 a detailed analysis on that information at that time.

14 In contrast, we identified four permit
15 conditions and Michelle mentioned for Permit Condition
16 1 ministerial aspect of confirmation of whether they
17 met the permit conditions. We identified four, one of
18 which was Permit Condition 1 that Michelle addressed,
19 and these all have that characteristic.

20 An ESP is granted subject to permit
21 conditions, which address required detailed
22 information that is not yet known but will be
23 available in the COLA and subject to NRC confirmation.

24 Next slide, please. The next two slides,
25 19 and 20, merely list the 16 COL action items. And

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1 I won't read through those. You can read through them
2 yourself. But the details associated with why these
3 were identified and how the staff recommended that
4 there be COL action items, this is detailed within the
5 safety evaluation. You can look for detail in the SE.

6 Slide 21. Slide 21 lists the four permit
7 conditions that the staff identified and also we
8 identified one confirmatory item, which reflected
9 TVA's withdrawal of one of their exemption requests.
10 And this will be closed out when we receive the ESP
11 Application Revision 2. So this is just a minor
12 issue, as far as a confirmation in Rev. 2 that they
13 actually withdrew it in Rev. 2.

14 Next slide, please. This deals with the
15 COL application, the combined license application. In
16 the COL application, the COL applicant will identify
17 an SMR technology which must meet the plume exposure
18 pathway EPZ sizing methodology approved in the early
19 site permit for either the site boundary or two-mile
20 plume exposure pathway EPZ, or if they choose, they
21 may proposed a new emergency plan.

22 In other words, if they come in and they
23 show that one of the technologies they've chosen does
24 not -- using the methodology that we've approved in
25 the ESP does not meet either the site boundary or two-

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1 mile plume exposure pathway EPZ, then they would lose
2 the benefit of the finality associated with the
3 approved two major features emergency plan. And they
4 would have to come in at the COL time with a complete
5 and integrated emergency plan, a completely new
6 complete and integrated emergency plan with no benefit
7 from the preapproval and finality for the site
8 boundary or two-mile plan that we've reviewed.

9 If the two-mile plume exposure pathway EPZ
10 is selected and justified, the NRC will request that
11 FEMA review the off-site emergency plans -- and I
12 think that addresses your earlier question -- because
13 at that time, there would be a requirement for a
14 complete and integrated emergency plan to have to
15 submit off-site emergency plans. And that's where
16 FEMA would come in, where they would review and
17 approve, as part of our consultation, the off-site
18 emergency plans.

19 If, however, the site boundary plume
20 exposure pathway EPZ is selected and justified using
21 the methodology, no formal FEMA approval of the off-
22 site radiological plans are required because there
23 would not be any off-site radiological emergency plans
24 submitted in the COLA.

25 The COL applicant will still need,

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1 however, to address requirements to communicate and
2 coordinate with off-site support organizations and
3 agencies.

4 Yes?

5 CHAIRMAN KIRCHNER: Let me throw a
6 hypothetical case out there. So invariably, we've
7 seen this with the existing fleet. They always want
8 to uprate the power, get more out of their investment.

9 So what happens now if TVA -- you grant
10 these exemptions, et cetera, and with these
11 limitations, permit conditions, et cetera -- but they
12 think this over for a bit and they say well, you know,
13 we really ought to get a few more hundred megawatts
14 electric out of this and they'll push up the thermal
15 rating? Are you still then in a position,
16 notwithstanding what we heard this morning -- I don't
17 know if you were there on the rulemaking --

18 MR. MUSICO: I was there.

19 CHAIRMAN KIRCHNER: -- and the future of
20 that rulemaking, if they came in and said well, gee,
21 I think we can't quite shoehorn it into our current
22 site boundary and maybe we need a little cushion, so
23 we want to do it at three miles, what would happen
24 then? Would you -- notwithstanding the rulemaking
25 that should allow that flexibility, would you then

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1 just reopen the case for that contingency?

2 MR. MUSICO: Well, yes. Yes, we would.

3 CHAIRMAN KIRCHNER: And I guess exemption
4 would be the means to handle it.

5 MR. MUSICO: They would -- pardon?

6 CHAIRMAN KIRCHNER: An exemption, then,
7 would be the means to handle it.

8 MR. MUSICO: No, not necessarily. If they
9 came in and they determined, through whatever means --
10 the power itself, the power levels are really not
11 particularly relevant to the analysis that we did,
12 except to the extent that using the methodology,
13 subsequently they can meet the dose -- using the
14 methodology they've defined and we've approved, they
15 can meet the site boundary of two miles.

16 If they decide to come in with the reactor
17 technology that has a higher power level than that
18 could not meet either the site boundary or two-mile
19 plume exposure pathway EPZ, they would lose the
20 finality, the benefit associated with the two major
21 features emergency plan that we approved. They would
22 be required to come in with a totally new complete and
23 integrated emergency plan which reflected that.

24 With respect to the methodology, they have
25 the benefit of the methodology and if they could show

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1 that, using that methodology, they don't meet the two-
2 mile or the site boundary but they meet three miles,
3 conceivably, they could come in and use the
4 methodology with a new complete and integrated
5 emergency plan --

6 CHAIRMAN KIRCHNER: That's what I was
7 testing.

8 MR. MUSICO: -- and we would review that.

9 CHAIRMAN KIRCHNER: And you would review
10 that.

11 MR. MUSICO: Well, we wouldn't be
12 reviewing the methodology again.

13 CHAIRMAN KIRCHNER: Right, no.

14 MR. MUSICO: We would be reviewing the
15 complete and integrated emergency plan.

16 CHAIRMAN KIRCHNER: Right but you wouldn't
17 throw them out and say no, that's ten miles, folks.

18 MR. MUSICO: No. No --

19 CHAIRMAN KIRCHNER: Okay. That's what I'm
20 testing.

21 MR. MUSICO: -- because the methodology --

22 CHAIRMAN KIRCHNER: I'm testing how
23 flexible your approach is.

24 MR. MUSICO: -- is not site boundary, two
25 miles, or ten miles. The methodology is the dose at

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1 whatever distance it turns out to be.

2 CHAIRMAN KIRCHNER: Exactly.

3 MR. MUSICO: So we did think about that.

4 CHAIRMAN KIRCHNER: Okay, good.

5 MR. MUSICO: So yes, that's an interesting
6 approach that they could possibly take.

7 MS. BRADFORD: This is Anna Bradford from
8 NRO. Just one nuance is we wouldn't necessarily have
9 to -- I mean the methodology would be approved. So
10 someone said we wouldn't review the methodology. We
11 would review the application of that methodology --

12 CHAIRMAN KIRCHNER: Of course. Yes, of
13 course.

14 MS. BRADFORD: -- to make sure we agree
15 with where they came out.

16 CHAIRMAN KIRCHNER: Yes, all right.

17 MEMBER MARCH-LEUBA: Yes, but make sure
18 when you write the SP that you box yourself with the
19 two-mile because you call it two-mile everywhere. I'm
20 looking at a map and I would love to have a one and a
21 half mile.

22 MR. MUSICO: Well, I wouldn't say they
23 boxed themselves. I would say they provide themselves
24 with a high amount of flexibility.

25 CHAIRMAN KIRCHNER: Yes.

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1 MEMBER MARCH-LEUBA: Well tell me again,
2 if it was only one and a half mile, you could make the
3 lower, the south boundary I-40 and don't have to have
4 any migration plans.

5 MR. MUSICO: They would have to choose the
6 two-mile emergency planning zone if they wanted to use
7 that major feature as a risk plan.

8 MEMBER MARCH-LEUBA: They cannot take one
9 and a half?

10 MR. MUSICO: They can take one and a half
11 but they still have to use the two-mile emergency
12 planning major features plan.

13 MEMBER MARCH-LEUBA: Why?

14 MR. MUSICO: If the methodology determined
15 that the desired dose was at one and a half miles,
16 they couldn't have the benefit of the site boundary
17 major features emergency plan. They would have to
18 utilize the two-mile major features emergency plan.

19 Now, if they didn't want to utilize that
20 and let's say they wanted to have a new one and a half
21 mile emergency planning zone, they would also lose the
22 benefit of the evacuation time estimate and they would
23 still have to off-site emergency plans. So, it would
24 be -- it wouldn't be advantageous to them to do that
25 because they've already gotten a lot of finality for

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1 that two-mile emergency planning zone. They've got
2 the finality associated with the evacuation time
3 estimate, as far as our review of the major features
4 emergency plan. And they just have to supplement
5 that, provide the delta for the complete and
6 integrated emergency at the COL application --

7 MEMBER MARCH-LEUBA: Most of the plan is
8 on I-40 and the Oak Ridge Turnpike because everything
9 else is a desert. There is nothing there.

10 MR. MUSICO: Well you know they could move
11 the road. Who knows.

12 MEMBER MARCH-LEUBA: Okay.

13 MR. MUSICO: All right, slide 23. Thank
14 you.

15 All right, slide 23 -- let's see -- this
16 summarizes the five key findings that the staff made
17 in the safety evaluation report and these reflect the
18 findings that are required by our regulation.

19 First of all, the staff found that there
20 are no significant impediments to the development of
21 emergency plans. Secondly, there was an adequate --
22 TVA provided an adequate description of contacts and
23 arrangements with federal, state, and local support
24 agencies. The staff found that the proposed
25 exemptions are acceptable. The staff found that the

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1 proposed major features emergency plans are
2 acceptable. And finally, that the proposed dose-based
3 consequence-oriented EPZ sizing methodology is
4 reasonable.

5 Next slide, please, and I'll turn it back
6 over to Michelle or to Mallecia. Sorry.

7 MS. SUTTON: The staff's conclusion. The
8 staff presented its review and findings on emergency
9 planning for the TVA Clinch River early site permit
10 application. The staff concludes that the plume
11 exposure pathway emergency planning zone size and
12 methodology is acceptable for determining the
13 appropriate size of the plume exposure pathway
14 emergency planning zone for the Clinch River Nuclear
15 Site because it is consistent with the analyses that
16 form the technical basis for the current ten-mile
17 plume exposure pathway emergency planning zone.

18 The two major features emergency plans are
19 acceptable because they meet the applicable standards
20 of 10 CFR 50.47 and requirements of Appendix E to 10
21 CFR Part 50.

22 The exemption requests are acceptable
23 because they are authorized by law, will not present
24 an undue risk to the public health and safety, are
25 consistent with the common defense and security, and

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1 special circumstances are present.

2 Therefore, the staff finds the TVA early
3 site permit application acceptable with respect to
4 emergency planning and related exemption requests.

5 Because we are discussing an early site
6 permit, the staff wanted to clarify the relationship
7 of the early site permit exemptions to a future
8 combined license application that references the
9 permit. The staff's presentation provided details on
10 the evaluation of TVA's methodology, exemption
11 requests, and emergency plans. This table provides
12 the breakdown of TVA's request for approval in these
13 three topic areas in their early site permit
14 application and the final products of the staff's
15 evaluation.

16 In addition, it provides how the early
17 site permit and exemptions can be implemented in a
18 combined license application if the early site permit
19 conditions are met.

20 The last is an action that will not be
21 completed until the Commission makes a decision
22 whether to grant an early site permit and the
23 exemptions. The appropriate plume exposure pathway
24 emergency planning zone size for this site will not be
25 determined until a combined license application that

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1 references a specific small modular reactor design is
2 submitted for the Clinch River Nuclear Site.

3 If there are no additional questions on
4 this table or for the staff, this will conclude the
5 staff's presentation.

6 Any questions?

7 CHAIRMAN KIRCHNER: Thank you. Let me go
8 around first -- or take public comments first. Excuse
9 me.

10 So let me look around and see if anyone is
11 in the room. Is there anyone in the room from the
12 public who wishes to make a comment?

13 Seeing no one stepping forward, can we
14 open -- it is open.

15 To those on our bridge line, is there
16 anyone from the public who would wish to make a
17 comment?

18 Hearing none, we can close the bridge line
19 -- or mute the bridge line. Thank you.

20 And I will go around the table, starting
21 with Ron.

22 MEMBER BALLINGER: No comments.

23 CHAIRMAN KIRCHNER: Dennis.

24 MEMBER BLEY: No comments.

25 CHAIRMAN KIRCHNER: Matt.

1 MEMBER SUNSERI: I appreciate the
2 presentations. I have no comments.

3 CHAIRMAN KIRCHNER: Joy.

4 MEMBER REMPE: I also appreciate the
5 presentations but have no comment.

6 CHAIRMAN KIRCHNER: Jose.

7 MEMBER MARCH-LEUBA: Why break a perfect
8 record? No comment.

9 CHAIRMAN KIRCHNER: Well, again, with the
10 caveat that this is just one member's opinion and not
11 that speaking for the ACRS, I think what we've heard
12 from the applicant and what the staff has presented --
13 thank you for your presentations -- sounds reasonable
14 and prudent. And I expect that the devil will be in
15 the details when we actually see an actual technology
16 selection and the COLA.

17 So if there are no further comments, thank
18 you again, and we are adjourned.

19 (Whereupon, the above-entitled matter went
20 off the record at 3:42 p.m.)

21

22

23

24

25



Clinch River
Early Site Permit
Part 2, SSAR Section 13.3, Part 5, & Part 6

Advisory Committee on Reactor Safeguards

Committee Meeting

Presented by

Archie Manoharan, Licensing

Alex Young, Engineering

August 22, 2018

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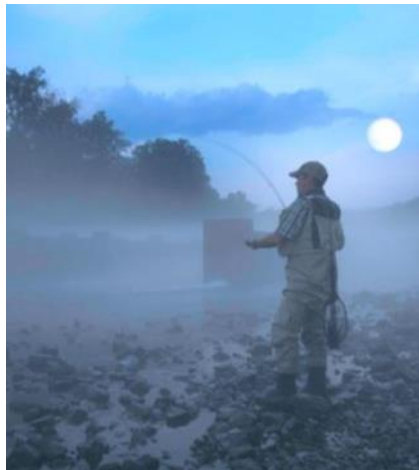
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Energy



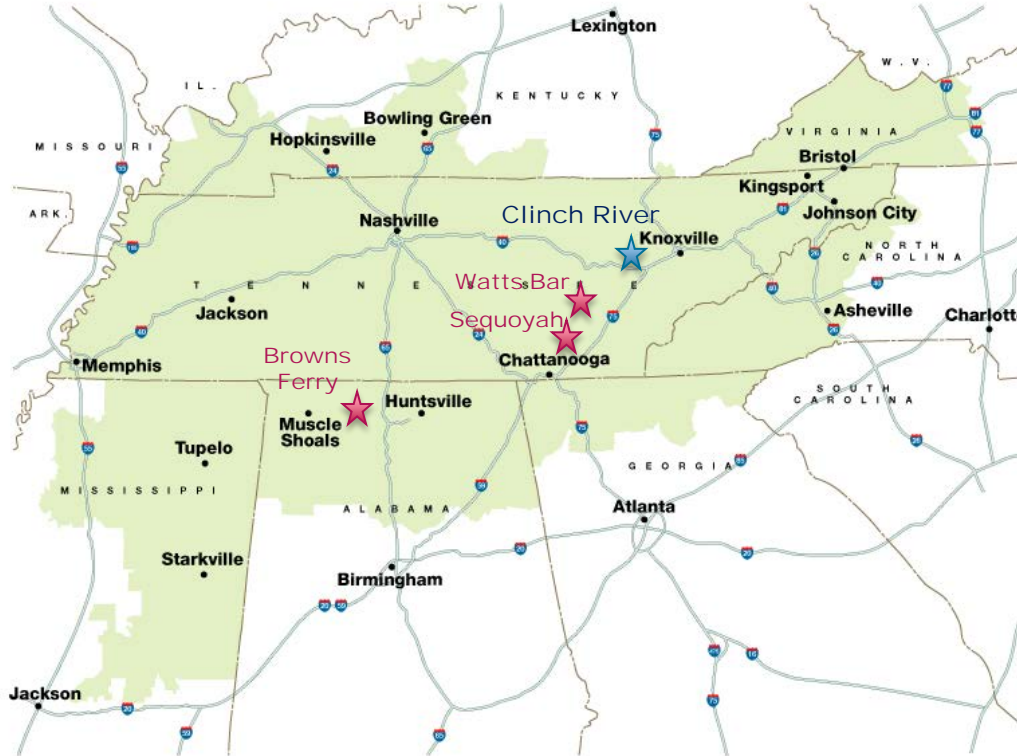
Environment



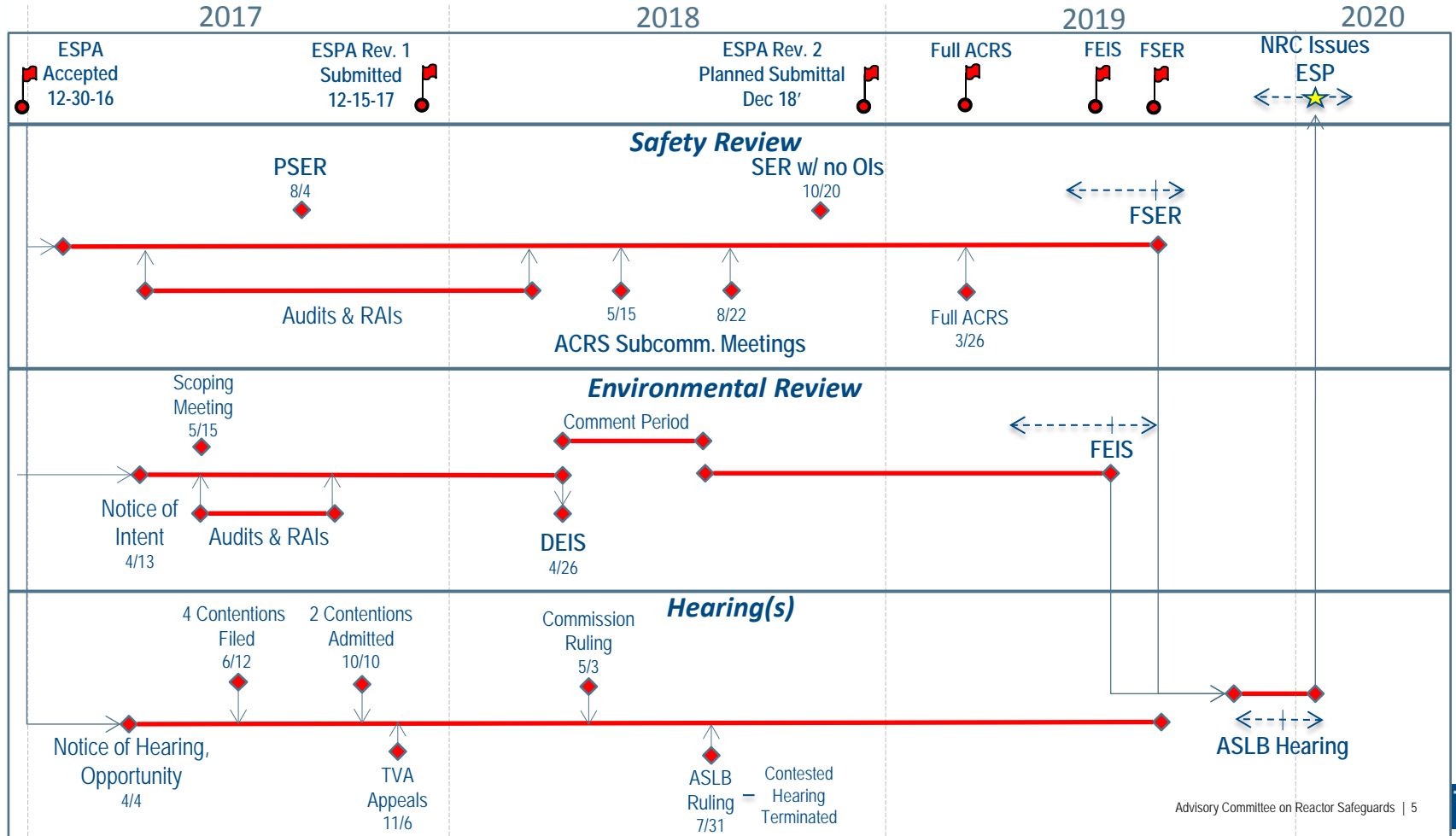
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TVA's Nuclear Fleet



NRC Review of ESPA



ESPA – Emergency Preparedness Development

The ESPA considered information from four light water small modular reactor (SMR) designs:

- NuScale (160 megawatts thermal (MWt), 50 megawatts electrical (MWe))
- SMR-160 Holtec (525 MWt, 160 MWe)
- mPower (530 MWt, 180 MWe)
- Westinghouse (800 MWt, 225 MWe)

Combined nuclear generating capacity for the Clinch River Site not to exceed 2420 MWt (800 MWe)

Need for Scalable Emergency Planning Zone (EPZ):

- NUREG-0396 introduced the concept of a 10-mile EPZ 40 years ago
- NUREG-0396 considered large light water reactors (LWRs)

Based on SMR design information:

- TVA developed a dose-based, consequence-oriented approach to determine an appropriate EPZ size for a SMR
 - approach has the same dose criteria as NUREG-0396
 - takes into consideration SMR design and safety advancements
- Two emergency plans were proposed and developed
 - all four designs are expected to be able to meet the dose criteria for 2-mile EPZ
 - at least one design is expected to be able to meet the dose criteria for Site Boundary EPZ
- Exemption requests that allow for review of major features of emergency plans other than 10-mile EPZ

Presentation Outline

Part 2, Site Safety Analysis Report (SSAR), Section 13.3, Emergency Preparedness:

- 13.3.1 Physical Characteristics
- 13.3.2 Emergency Plan (Refers to Part 5 of the ESPA)
- 13.3.3 Emergency Planning Zones
- 13.3.4 Evacuation Time Estimates (Supports Part 5B)
- 13.3.5 Contacts and Agreements

Part 5, Emergency Plan:

- Part 5A Emergency Plan Site Boundary EPZ
- Part 5B Emergency Plan 2-Mile EPZ

Part 6, Exemptions and Departures

- Exemption Requests for a Plume Exposure Pathway (PEP) EPZ at Site Boundary
- Exemption Requests for an approximate 2-mile PEP EPZ

Key NRC Interactions Related to Emergency Preparedness

Two audits were conducted to review the emergency preparedness information in the ESPA

- First audit – November 2017 through February 2018
 - Example analysis completed by TVA to demonstrate feasibility that dose criteria can be met at Clinch River Site Boundary (RAI-8885)
- Second audit – April 2018
 - EPZ Plant Parameter Approach (RAI-9206)

Requests for Additional Information (RAIs)

- RAI-8885 – demonstrate that dose criteria can be met at Site Boundary EPZ
- RAI-9206 – discuss how EPZ methodology was implemented in the example analysis and the EPZ plant parameter approach developed

Part 2, SSAR,
Chapter 13 – Section 13.3
Emergency Preparedness

Section 13.3.1 – Physical Characteristics

Site Description

DOE Oak Ridge Reservation borders the North-East sides

6.8 miles East of Kingston, TN

8.8 miles Northwest of Lenoir City, TN

9.2 miles East-Southeast of Harriman, TN (not shown)

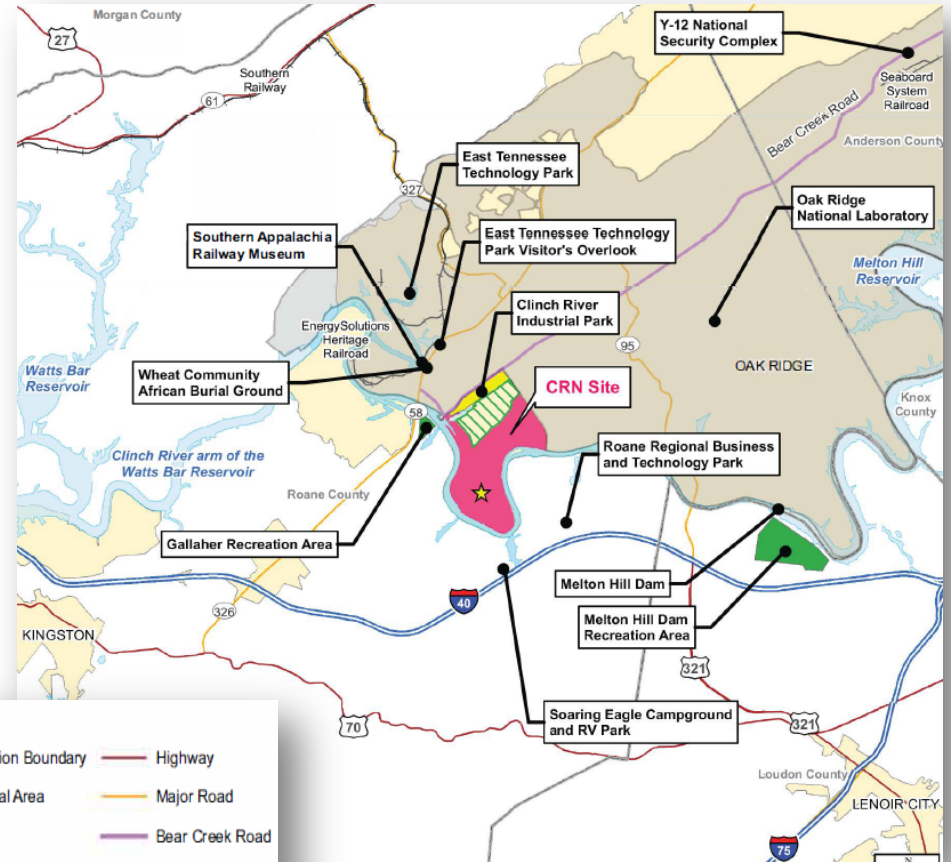
25.6 miles West-Southwest of Knoxville, TN (not shown)

Area Population

U.S. Census 2010 data projected to 2015

856 permanent residents within 2-mile PEP EPZ

186,500 permanent residents within 15 miles



Legend

CRN Site Center Point	Counties	Oak Ridge Reservation Boundary	Highway
CRN Site	Rivers and Lakes	Clinch River Industrial Area	Major Road
Town/City Boundaries	Grassy Creek Habitat Protection Area	Railroad	Bear Creek Road
Recreation Areas	Interstate		

Section 13.3.3 – Emergency Planning Zones

The methodology uses a dose-based, consequence-oriented approach for determining the appropriate size of the PEP EPZ consistent with the NUREG-0396 approach with a dose criteria of the Environmental Protection Agency (EPA) early phase Protective Action Guides (PAGs).

The methodology is consistent with the NUREG-0396 approach:

- a spectrum of accidents are addressed
- Dose criteria is the same
- PEP EPZ boundary ensures protection from dose levels above 1 rem total effective dose equivalent (TEDE) limit established in the EPA PAG

Four light water SMR designs were considered which significantly differ from the large LWRs:

- smaller cores
- lower source terms
- reduced accident consequences
- reduced likelihood of accidents
- slower accident progression allows more time for mitigating actions

Section 13.3.3 – Emergency Planning Zones

Technical criteria for determining the PEP EPZ size uses the existing emergency preparedness regulatory framework and dose saving criteria established in NUREG-0396

- Consistent with the NUREG-0396 sizing rationale, the technical criteria for determining the PEP EPZ size:
 - A. Encompass those areas in which projected dose from design basis accidents (DBAs) could exceed the EPA early phase PAGs.
 - B. Encompass those areas in which consequences of less severe core melt accidents could exceed the EPA early phase PAGs.
 - C. Be of sufficient size to provide for substantial reduction in early severe health effects in the event of more severe core melt accidents.

Section 13.3.3 – Emergency Planning Zones

Criteria A and B: PEP EPZ encompasses those areas in which the plume exposure doses from DBAs and less severe core melt accidents could exceed the EPA early phase PAG

- Areas outside the PEP EPZ would meet the EPA early phase PAG dose limit of less than 1 rem TEDE.
- The methodology for verifying dose consequences beyond the PEP EPZ do not exceed the EPA early phase PAG levels includes:
 - Step 1 - Selecting appropriate accident scenarios (*accident scenarios with mean core damage frequency (CDF) greater than $1E-6$ per reactor-year (rx-yr)*)
 - Step 2 - Determining source terms for selected accident scenarios
 - Step 3 - Calculating the dose consequences for selected accident scenarios
 - Step 4 - Comparing the dose consequences for selected accident scenarios with the EPA early phase PAG

Section 13.3.3 – Emergency Planning Zones

Criteria C: PEP EPZ be of sufficient size to provide for substantial reduction in early severe health effects in the event of more severe core melt accidents

Methodology for verifying that areas outside the PEP EPZ meet the limits for substantial reduction in early health effects:

- Step 1 - Selecting appropriate accident scenarios (*accident scenarios with mean CDF greater than $1E-7$ per rx-yr*)
- Step 2 - Determine source terms for selected accident scenarios
- Step 3 - Calculate the dose consequences for selected accident scenarios at the PEP EPZ boundary
- Step 4 - Calculate the distance at which the conditional probability to exceed 200 rem (whole body) exceeds $1E-3$ per rx-yr
- Step 5 - Compare that distance with the PEP EPZ

Design Specific Example Analysis – Site Boundary PEP EPZ

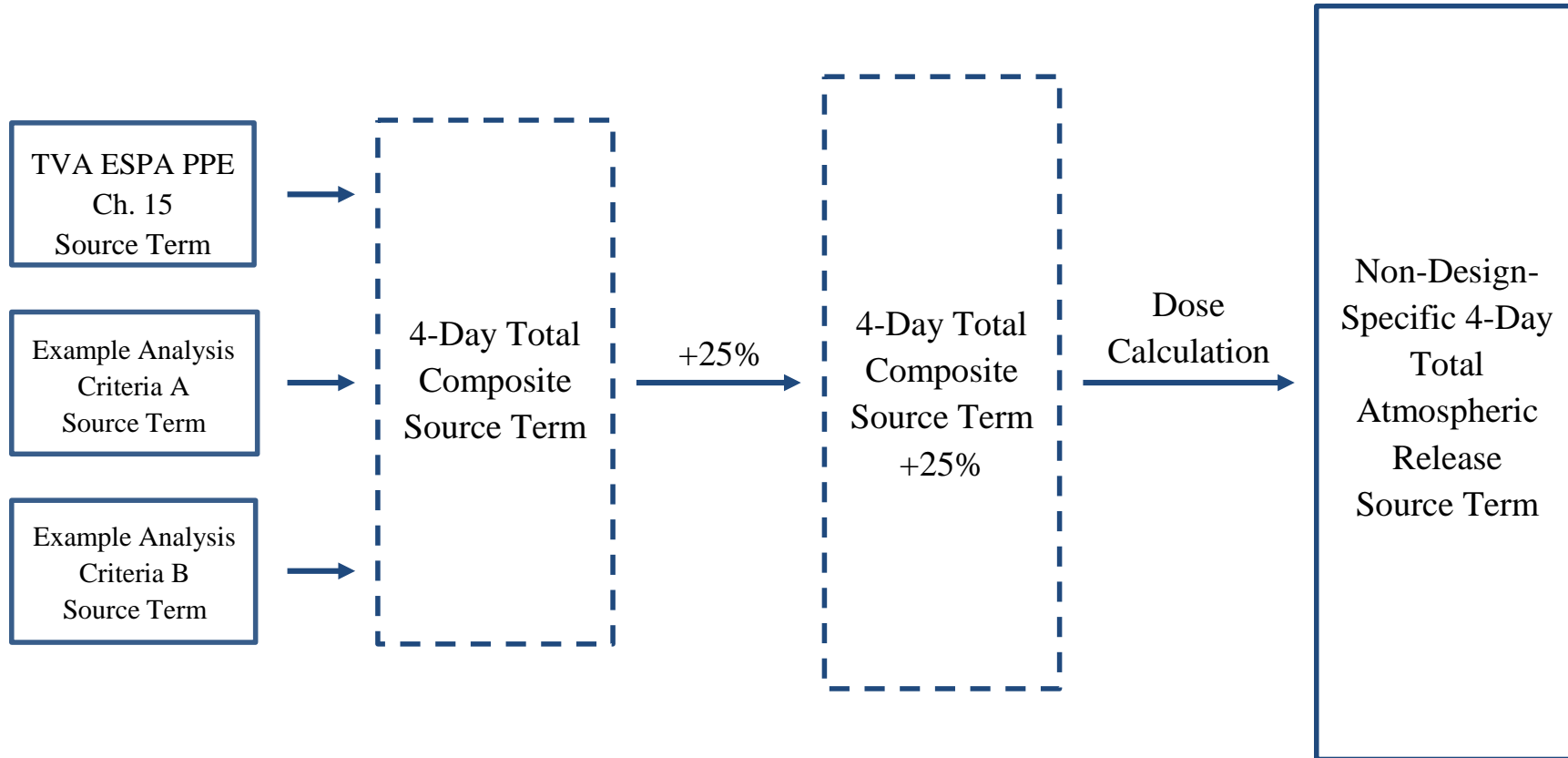
- Evaluates NuScale Power Plant at the Clinch River Site
- Implements the dose-based methodology described in SSAR Section 13.3
- Demonstrates that Site Boundary EPZ is possible
- Doses at Site Boundary are much less than the EPA early phase PAG

Criteria	Site Boundary Dose TEDE (rem)	EPA Early Phase PAG Limit TEDE (rem)
A: Design Basis Accidents	0.104	1
B: Less Severe Core Melt Accidents	0.158	1

C: Reduction in Early Severe Health Effects

No accident scenarios with mean CDF greater than $1E-7$ per rx-yr.

EPZ Plant Parameter Approach



Section 13.3.5 – Contacts and Agreements

Letters of Support

- Letters of support from the State of Tennessee, Anderson County, Roane County, and the City of Oak Ridge were submitted in support of the ESPA.
- 10 CFR 52.17(b)(4) requires that the applicant make good-faith efforts to obtain certifications from local, State, and Federal governmental agencies with EP responsibilities.

Letters of Agreements and Certification Letters

- Certification letters and letters of agreements will be pursued during the combined license application (COLA) process.
- TVA will maintain agreements with surrounding emergency response organizations.
- **TVA would continue to work with State and local support organizations to establish an emergency preparedness at Clinch River commensurate with the potential consequences to public health and safety**

Part 5 – Emergency Plan

Part 5 – Emergency Plan

Part 5 of the ESPA contains the major features of two distinct Emergency Plans for Clinch River Site in accordance with 10 CFR 52.17(b)(2)(i).

Part 5A

- Describes major features of an Emergency Plan for a PEP EPZ consisting of the area encompassed by the Site Boundary.

Part 5B

- Describes major features of an Emergency Plan for a PEP EPZ consisting of an area approximately two miles in radius surrounding the Clinch River Site.

Both plans address the 16 planning standards in NUREG–0654, Section II, which reflects the requirements in 10 CFR 50.47(b)(1) through 10 CFR 50.47(b)(16) and Appendix E to 10 CFR Part 50 considering the requested exemptions described in Part 6 of the ESPA

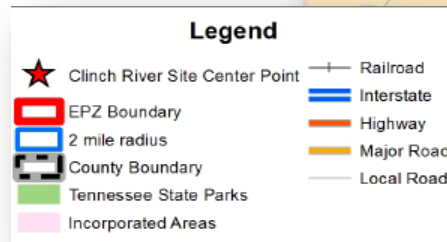
Part 5A – Emergency Plan (Site Boundary EPZ)

- TVA Generic Emergency Plan as modified for Clinch River Site and an appendix with Site-Specific information
- Actions necessary to safeguard onsite personnel (within the site boundary) and minimize damage to property
- Information to ensure the compatibility of the proposed emergency plans (for onsite areas) with facility design features, site layout, and site location



Part 5B – Emergency Plan (2-Mile EPZ)

- TVA Generic Emergency Plan as modified for Clinch River Site and a Site-specific appendix
- Information to ensure the compatibility of the proposed emergency plans (for both onsite areas and the PEP EPZ) with facility design features, site layout, and site location.
- Site Evacuation Time Estimate Report



Part 5B – Evacuation Time Estimate

- Analysis of evacuation times is one method to identify any significant impediments to the development of emergency plans at the Site
- Provides TVA, State and local governments with site-specific information needed for protective action decision making
- Evacuation Time Estimates (ETE) analyses for Clinch River Site were completed in accordance with the guidance provided in NUREG/CR-7002, Criteria for Development of Evacuation Time Estimate Studies
- These analyses did not identify any physical characteristics unique to the Clinch River Site that could pose a significant impediment to the development of emergency plans

Part 6 – Exemptions and Departures

Part 6 – Exemptions and Departures

Pursuant to 10 CFR 52.7, Specific Exemptions, which is governed by 10 CFR 50.12, Specific Exemptions, TVA requested exemptions from the following emergency preparedness requirements for the Clinch River Site:

- Certain standards in 10 CFR 50.47(b) regarding onsite and offsite emergency response plans for nuclear power reactors
- Certain requirements of 10 CFR 50.33(g) and 10 CFR 50.47(c)(2) to establish PEP EPZ for nuclear power plants
- Certain requirements of 10 CFR Part 50, Appendix E, which establish the elements that make up the content of emergency plans

Two Sets of Exemptions

Based on the dose-based EPZ methodology described in Section 13.3 and taking light water SMR designs into consideration, two sets of exemptions were developed:

- Exemptions for a PEP EPZ established at the Site Boundary (Part 5A)
- Exemptions for an approximate 2-mile PEP EPZ (Part 5B)

Part 6 – Exemptions and Departures

Requested exemptions – Table 1-1 Exemptions Requested from 10 CFR 50.33(g), 50.47(b), and 50.47 (c)(2) for the **Site Boundary PEP EPZ Emergency Plan**

Regulation	Requirement	Exemption Request
10 CFR 50.33(g) 10 CFR 50.47(c)(2)	10 mile PEP EPZ distance	Deviate from 10 mile PEP EPZ
10 CFR 50.47(b), b(4), b(5), b(6), b(9), b(10)	Various elements of a formal offsite emergency plan	Deviate from formal offsite radiological emergency plan requirements on the basis that there are no offsite radiological consequences from any credible event in excess of the criteria described in Section 13.3. Note: TVA's emergency plan will describe the capabilities to determine if a radiological release is occurring and promptly communicate that information to the offsite response organizations for their consideration.

Part 6 – Exemptions and Departures

Requested Exemptions – Table 1-2 Exemptions Requested from 10 CFR 50, Appendix E for the Site Boundary PEP EPZ Emergency Plan

Regulation	Requirement	Exemption Request
10 CFR 50, Appendix E, Section IV.2 – IV.7	Evacuation time estimates (ETEs)	Deviate from ETE requirements as no offsite consequences from any credible event in excess of the criteria provided in Section 13.3, formal offsite radiological emergency response plans with preplanned evacuation details are not necessary. Therefore, there is no need for ETEs.
10 CFR 50, Appendix E, Section IV.D.1, D.3, D. 4	Certain elements of offsite notifications	Deviate from certain offsite notification requirements as members of public would not be within the Site Boundary PEP EPZ. (Note: TVA is not seeking an exemption from the requirement to notify responsible State and local government agencies within 15 minutes after declaring an emergency.)
10 CFR 50, Appendix E, Section IV.F.2, F.2.a, F. 2.a.(i) – 2.a.(iii), F.2.b, F.2.c, F.2.d	Certain elements of offsite exercises	Deviate from certain offsite exercise requirements as no formal offsite radiological emergency response plans would be needed as no offsite consequences from any credible event in excess of the criteria provided in Section 13.3. (Note: TVA would continue to invite State and local support organizations to participate in the periodic drills and exercises conducted.)

Part 6 – Exemptions and Departures

Requested Exemptions – Table 1-3 Exemptions Requested from 10 CFR 50.33(g) and 50.47(c)(2) for the 2-Mile PEP EPZ Emergency Plan

Regulation	Requirement	Exemption Request
10 CFR 50.33(g) 10 CFR 50.47(c)(2)	10 mile PEP EPZ distance	Deviate from 10 mile PEP EPZ

Part 6 – Exemptions and Departures

Technical Justification

- The criteria established in the methodology described in Section 13.3, provides for adequate protection of public health and safety by providing a EPZ that encompasses the areas in which the plume exposure doses could exceed the EPA early phase PAG, and for where there is a substantial reduction in risk of significant early health effects.

Special Circumstances Exist – Underlying Purpose of the Regulations Being Met

- Exemptions are Authorized by Law
- Exemptions Will not Present Undue Risk to Public Health And Safety
- Exemptions Are Consistent with the Common Defense and Security

Summary

	ESPA	COLA
PEP EPZ Methodology (Part 2, SSAR, Section 13.3)	Approval of the <u>dose-based, consequence oriented methodology</u> for determining the PEP EPZ size	Approval of <u>design specific implementation</u> of the methodology approved in the ESPA
EPZ Size (Part 6)	Approval to <u>deviate from the current 10-mile PEP EPZ requirements</u> based on the methodology to determine PEP EPZ size	Approval of <u>design specific PEP EPZ size</u> based on design specific implementation of the methodology
Emergency Plan (Part 5)	Approval of the <u>major features</u> of the Site Boundary and 2-mile emergency plans presented in Part 5	Approval of the <u>remaining elements</u> of either the Site Boundary or 2-mile emergency plans OR a new plan based on design specific PEP EPZ size using methodology





ACRS Subcommittee

August 22, 2018

Tennessee Valley Authority (TVA)

Early Site Permit Application (ESPA)

ESPA Site Safety Analysis Report (SSAR) Section 13.3

Emergency Planning

Advanced Safety Evaluation Report (SER) with no Open Items

Project Managers

Mallecia Sutton (NRO)

Allen Fetter (NRO)

Technical Reviewers

Bruce Musico (NSIR)

Michelle Hart (NRO)

13.3 Emergency Planning – TVA Early Site Permit Application

The ESPA requested review of 3 key areas, which consist of:

- Plume exposure pathway (PEP) emergency planning zone (EPZ) sizing methodology (ESPA SSAR, Sec. 13.3)
- 2 Major Features (onsite) Emergency Plans (ESPA Part 5)
 - ESPA Part 5A reflects a Site Boundary PEP EPZ
 - ESPA Part 5B reflects a 2-Mile PEP EPZ (includes an evacuation time estimate)
- 25 Exemption Requests (ESPA Part 6)
 - ESPA proposes 2 sets of exemptions (for the site boundary/2-mile PEP EPZs)
 - ESPA proposes an exemption from the current 10-mile PEP EPZ
 - Exemptions address portions of 10 CFR 50.33(g), 50.47(b) & (c)(2), and Appendix E to 10 CFR Part 50, for onsite and offsite emergency planning (EP)

Part 52 Licensing Process

- Upon issuance of the early site permit (ESP), the applicant acquires approval, with conditions, on:
 - The PEP EPZ sizing methodology
 - The 25 requested exemptions
 - The 2 major features E-plans (site boundary & 2-mi PEP EPZ)
- In the future, a combined license application (COLA) that incorporates by reference the ESP will:
 - Identify a chosen small modular reactor (SMR) technology for the Clinch River Nuclear Site
 - The applicant must demonstrate that the EPZ sizing methodology supports either the site boundary or 2-mile PEP EPZ
 - Provide a complete & integrated emergency plan
 - For the 2-mile PEP EPZ, must provide onsite & offsite emergency plans
 - For the site boundary PEP EPZ, must provide onsite emergency plan (assumes that site boundary, as defined for EP purposes in the COLA, will be within the applicant's owner controlled area)
 - Address identified COL action items and permit conditions

Review of Exemptions (Special Circumstances)

- The NRC reviewed the requested exemptions pursuant to 10 CFR 50.12 (Specific Exemptions)
 - 50.12(a)(2) – The Commission will not consider granting an exemption unless special circumstances are present.
 - Special circumstances are present whenever –
 - (ii) – Application of the regulation in the particular circumstances would not serve the underlying purpose of the rule, or is not necessary to achieve the underlying purpose of the rule.

Special Circumstances (Underlying Purpose of Rule)

- The underlying purpose of 10 CFR 50.33, 50.47, and Appendix E to 10 CFR Part 50, is to:
 - Ensure that licensees maintain effective onsite and offsite radiological emergency response plans,
 - Ensure that there is reasonable assurance that adequate protective measures can and will be taken in the event of a radiological emergency, and
 - Establish plume exposure and ingestion pathway EPZs.
- The ESPA serves to provide a basis for the establishment (in the COLA) of either a Site Boundary or 2-mi PEP EPZ, which maintains the same level of protection (i.e., dose savings in the event of a radiological emergency) in the environs of the Clinch River Nuclear Site, as that which exists in the basis for a 10-mi PEP EPZ.

TVA PEP EPZ Size Methodology

Technical Criteria

- PEP EPZ should encompass those areas in which projected dose from design basis accidents (DBAs) could exceed the U.S. Environmental Protection Agency (EPA) early phase protective action guide (PAG)
- PEP EPZ should encompass those areas in which consequences of less severe core melt accidents could exceed the EPA early phase PAG
- PEP EPZ should be of sufficient size to provide for substantial reduction in early health effects in the event of more severe core melt accidents

TVA PEP EPZ Size Methodology

SSAR Section 13.3.3.1

- Accident scenario selection
 - Use bounding DBA from COLA Final Safety Analysis Report Chapter 15
 - Use COLA site- and design-specific probabilistic risk assessment (PRA) to categorize severe accident scenarios
 - All modes, internal and external events, applicable fuel handling and spent fuel pool accidents, multi-module considerations
 - Assess all sequences with mean core damage frequency (CDF) $> 10^{-8}$ per rx-yr
 - More probable, less severe core melt scenarios
 - Mean CDF $> 10^{-6}$ per rx-yr, intact containment
 - Less probable, more severe core melt scenarios
 - Mean CDF $> 10^{-7}$ per rx-yr, containment bypass or failure
- Determine source term releases to atmosphere
- Calculate dose consequences at distance from plant
- Determine PEP EPZ size that meets the dose-based criteria

TVA Dose-Based PEP EPZ Size Criteria

- Dose to individual from exposure to the airborne plume during its passage and to groundshine, using average atmospheric dispersion characteristics for site
- DBA and more probable, less severe accidents
 - 1 rem total effective dose equivalent (TEDE) from 96-hr exposure
 - Lower end of dose range EPA PAG for early phase protective actions (e.g., evacuation and sheltering)
 - Verify that dose consequences do not exceed the EPA PAG beyond the site boundary (within owner controlled area) and 2-mile PEP EPZs
- Less probable, more severe accidents
 - Calculate the distance at which the conditional probability to exceed 200 rem whole body from 24-hr exposure exceeds 10^{-3} per rx-yr
 - Acute dose at which radiation-induced early health effects may begin to be noted (e.g., nausea)
 - Verify that the PEP EPZ supports substantial reduction in early health effects

Review of PEP EPZ Size Methodology

- Staff compared TVA's methodology and dose criteria to the study used as technical basis for current 10-mile PEP EPZ requirement (NUREG-0396)
 - The features of TVA's methodology are consistent with NUREG-0396
 - Considered a range of accidents
 - Performed accident consequence analyses
 - Determined an area outside of which early protective actions are not likely to be necessary to protect the public from radiological releases
- The staff concludes that the applicant's proposed methodology is reasonable, and consistent with the analyses that form the technical basis for the current regulatory requirement of a PEP EPZ of about 10 miles in radius.

SMR Features that Support the Exemption Requests

- TVA stated that special circumstances exist at the Clinch River Nuclear Site due to the anticipated enhanced safety features of the SMR designs under consideration
 - Smaller radionuclide inventory and source terms
 - Projected accident progression rate is anticipated to be slower
 - Various design features are expected to eliminate several historically considered design basis events
 - Severe accidents are projected to be less likely to occur
 - Advanced design features that would minimize accident consequences

Request for Additional Information

Question 1

- Specific technical support related to the statements on SMR features and comparison to large light water reactors (LLWRs)
- TVA provided tables with several parameters comparing the smallest and largest SMRs (based on unit rated thermal power) in the Clinch River Nuclear ESPA plant parameter envelope (PPE) to large and medium currently operating pressurized water reactors and the AP1000

For example:

- Internal events CDF and large release frequency
- Source term total activity
- Primary coolant liquid mass to power ratio
- Severe accident progression information

Request for Additional Information

Question 2

- Demonstration that the proposed PEP EPZ size criteria could be met at a given EPZ boundary distance for potential reactor facilities that would be represented by the surrogate design in the PPE
- TVA provided an example analysis using design information for a specific SMR design as input to the SSAR 13.3 PEP EPZ size methodology
 - Example analysis showed that design could support a site boundary PEP EPZ
 - Not intended to prove case for ESPA to justify a specific PEP EPZ size
 - Based on preliminary design information for an SMR at the lower end of the rated power (160 MWt) that is part of the basis for the Clinch River Nuclear ESPA PPE
 - Used internal events design PRA only
 - Did not do detailed uncertainty analysis

EP Exemption Plant Parameters

- TVA developed a non-design-specific accident release source term that would meet the PEP EPZ size criteria to be used as plant parameters (SER Table 13.3-1)
 - Same idea as PPE DBA source term to envelope an unknown design
 - Referenced in Permit Condition 1 for adoption of EP exemptions
- Isotopic total release activity over 96 hrs results in TEDE of about 0.9 rem at site boundary
 - 3 core melt, intact containment accidents (2 DBAs and 1 severe accident)
 - From 2 SMRs (160 MWt and 800 MWt)
 - Maximum activity release for a specific radionuclide from any of the 3 accidents over a specific dose averaging period was assumed to be the release activity of that radionuclide for that period
 - 0-8 hrs, 8-24 hrs, 24-96 hrs
 - Added 25% margin
 - Additional adjustment to values for backcalculation

Permit Condition 1

- COL applicant referencing the ESP (if approved) would perform an analysis using the SSAR 13.3 PEP EPZ size methodology, with site- and design-specific input, to justify the PEP EPZ size for the COLA
- The COLA PEP EPZ size analysis output includes the source term releases to the atmosphere
 - Isotopic activity release over time
- If the COLA PEP EPZ size analysis source term releases to the atmosphere are bounded by the non-design-specific plant parameter source term information in SER Table 13.3-1, then the COL applicant can adopt the EP exemptions
 - 4-day total activity release to the atmosphere for 71 isotopes
 - COLA values should be shown to be less than ESP (Table 13.3-1) values to adopt the EP exemptions

Plant Parameter Envelope

- TVA identified 4 SMR designs to develop the PPE
 - BWXT mPower (Generation mPower)
 - NuScale (NuScale Power)
 - SMR-160 (Holtec SMR)
 - Westinghouse SMR (Westinghouse Electric Co.)
- A different reactor design that falls within the following PPE information range may be selected in the COLA
 - 2 or more SMRs with a maximum 800 MWt for a single unit
 - Combined site capacity not to exceed 2420 MWt (800 MWe)



Review Standards/Guidance

- 10 CFR Part 52, Subpart A, Early Site Permits
- 10 CFR 50.47 & Appendix E to Part 50
- 10 CFR 50.12 & 52.7, Specific Exemptions
- NUREG-0800, Standard Review Plan, Sec. 13.3, Emergency Planning
- NUREG-0654/FEMA-REP-1 (Rev. 1), Suppl. 2, NSIR/DPR-ISG-01
- NUREG-0696, Functional Criteria for Emergency Response Facilities
- NUREG/CR-7002, Criteria for Development of ETE Studies
- NUREG-0396, Planning Basis for the Development of State and Local Government Radiological Emergency Response Plans in Support of Light Water Nuclear Power Plants
- EPA PAG Manual: Protective Action Guides and Planning Guidance for Radiological Incidents



Federal Emergency Management Agency (FEMA) Consultation

- NRC performed its review in consultation with FEMA, pursuant to the FEMA-NRC Memorandum of Understanding (MOU) (12/7/15, ML15344A371)
- FEMA review was limited because:
 - The ESPA did not include offsite emergency plans, and
 - The major features plans only addressed limited onsite EP features.
- FEMA's January 24, 2018, letter (ML18031B055) stated that:
 - Working with TEMA, FEMA did not identify physical characteristic of the proposed site that could pose a significant impediment to the development of emergency plans, including evacuation from the 2-mi EPZ.
 - The boundary established for the proposed 2-mi PEP EPZ was established relative to local emergency response needs and capabilities, as they are affected by such conditions as demography, topography, land characteristics, access routes, and jurisdictional boundaries.
 - At this time, FEMA's finding does not endorse or determine the adequacy of a proposed 2-mi PEP EPZ for the site if proposed during the licensing process.
- In its June 12, 2017, letter (ML17164A206) FEMA further stated that it did not review or analyze the feasibility and assumptions for the site boundary EPZ, but if requested in the future, would provide comments and recommendations.

COL Action Items vs. Permit Conditions

- The 16 COL Action Items:
 - Track information that is needed before granting a COL, but is not required in the ESPA
 - Reflect the SMR design that may be identified in the COLA
 - Require NRC evaluation as part of the COLA review
- The 4 Permit Conditions:
 - An ESP is granted subject to permit conditions, which address required detailed information that is not yet known, but will be available in the COLA and subject to NRC confirmation

16 COL Action Items

- 13.3-1, Select SMR (EPA PAGs)/PEP EPZ/E-plan
- 13.3-2, Update Letters of Agreement/MOUs
- 13.3-3, SMR facilities & staffing
- 13.3-4, Emergency action level scheme
- 13.3-5, Alert and notification system
- 13.3-6, SMR communications/data links
- 13.3-7, Joint Information Center location/capabilities
- 13.3-8, Onsite monitoring systems/equipment

COL Action Items (cont.)

- 13.3-9, Technical Support Center
- 13.3-10, Operations Support Center
- 13.3-11, Local Recovery Center
- 13.3-12, Central Emergency Control Center
- 13.3-13, Radiation monitoring systems
- 13.3-14, Meteorological tower & monitoring program
- 13.3-15, On-site personnel decontamination facility
- 13.3-16, Communications testing & hostile action exercises

4 Permit Conditions, 1 Confirmatory Item

- Permit Conditions (PC)
 - SMR PPE Accident Consequence Analyses
 - PC 1, Calculation of EPZ Size
 - Fukushima Dai-ichi (near term task force 9.3, Tier 1)
 - PC 2, Multi-Unit Staffing Assessment
 - PC 3, Communications Assessment
 - 2011 Emergency Preparedness Rulemaking
 - PC 4, On-Shift Staffing Analysis
- Confirmatory Item 13.3-1
 - Withdrawal of exemption request Item No. 19 (re: the requirement for remedial exercises)
 - Section IV.F.2.f of App. E to 10 CFR Part 50
 - Can be closed out when ESPA Rev. 2 is submitted



Combined License Application (COLA)

- In the COL Application:
 - The COL applicant will identify an SMR technology, which must meet the PEP EPZ sizing methodology approved in the ESP for either the site boundary or 2-mile PEP EPZ, or may propose a new emergency plan.
 - If the 2-mile PEP EPZ is selected and justified, the NRC will request that FEMA review the offsite emergency plans.
 - If the site boundary PEP EPZ is selected and justified, no formal FEMA-approved offsite radiological plans are required.
 - The COL applicant will still need to address requirements to communicate and coordinate with offsite support organizations and agencies

Staff Review Findings

- No significant impediments to the development of emergency plans (10 CFR 52.17(b)(1))
- Adequate description of contacts and arrangements with Federal/State/local support agencies (10 CFR 52.17(b)(4))
- Proposed exemptions are acceptable (10 CFR 50.12, 52.7)
- Proposed major features emergency plans are acceptable (10 CFR 52.17(b)(2)(i))
- Proposed dose-based, consequence-oriented EPZ sizing methodology is reasonable

Conclusions

- The staff concludes that:
 - The PEP EPZ sizing methodology is acceptable for determining the appropriate size of the PEP EPZ for the Clinch River Nuclear Site because it is consistent with the analyses that form the technical basis for the current 10-mile PEP EPZ.
 - The 2 major features emergency plans are acceptable because they meet the applicable standards of 10 CFR 50.47 and requirements of Appendix E to 10 CFR Part 50.
 - The exemption requests are acceptable because they are authorized by law, will not present an undue risk to the public health and safety, are consistent with the common defense and security, and special circumstances are present.
- Therefore, the staff finds the TVA ESPA acceptable with respect to emergency planning and related exemption requests.

TVA's Request in ESP Application and Method of Implementation (if ESP Application Approved) in COLA			Final Products and Approval Mechanism	
	ESP	COLA	ESP	COLA
Methodology (SSAR 13.3)	Approval of a dose-based methodology for determining the EPZ size, as described in SSAR Section 13.3.	Approval of site-specific implementation of the previously approved methodology in ESP SSAR Section 13.3 to justify EPZ size. EPZ size calculation provided using site- and design-specific information. Approval of final EPZ size.	Final Product: SER and permit Staff relies on NUREG-0396 and EPA PAG Manual. SECY-15-0077: Staff initiated rulemaking for SMRs and ONTs. Prior to establishment of rule, staff should be prepared to adapt approach to EPZs for SMRs under existing exemption processes, in parallel with its rulemaking efforts (case-by-case).	Final Product: SER, license with EPZ size Using the methodology in ESP SSAR Section 13.3, the COL applicant must demonstrate that the selected SMR design meets EPA PAGs for the selected EPZ size.
Exemption Request (Part 6)	Approval for exemptions from the current 10-mile EPZ requirement if certain conditions are met. Approval to use the methodology in ESP SSAR Section 13.3 to determine EPZ size in the COLA. The ESPA requests 2 sets of exemptions, one for a site boundary EPZ and one for a 2 mile EPZ, and proposed major features of emergency plans for each.	The COLA can rely on EP exemptions granted in the ESP, provided site- and design-specific information justify use of one of the sets of exemptions evaluated in the ESPA.	Final Product: SER and permit with exemptions (if approved) and related conditions Staff relies on exemption guidance, NUREG-0396 and EPA PAG Manual	Final Product: SER, license to reflect EPZ size supported in the COLA.
Emergency Plans (Part 5A and Part 5B)	Approval of the major features of the site boundary and 2-mile emergency plans in Part 5.	Approval of complete and integrated emergency plans, including offsite emergency plans if a PEP EPZ other than site boundary is selected. Includes the remaining features of the emergency plan (either site boundary or 2-mile) from the ESP or new emergency plan based on the final dose-based EPZ size.	Final Product: SER and permit Staff relies on existing rules and guidance, except to the extent that they are not applicable because of the requested exemptions.	Final Product: SER, license to reflect EPZ size supported in the COLA.

Abbreviations

- CDF – core damage frequency
- CFR – Code of Federal Regulations
- COL – combined license
- COLA – combined license application
- DBA – design basis accident
- EP – emergency planning
- EPA – U.S. Environmental Protection Agency
- EPZ – emergency planning zone
- ESP – early site permit
- ESPA – early site permit application
- ETE – evacuation time estimate
- FEMA – Federal Emergency Management Agency
- FSAR – Final Safety Analysis Report
- LLWR – large light water reactor
- MOU – memorandum of understanding
- MWe – megawatts electric
- MWt – megawatts thermal
- NTTF – Near-Term Task Force

Abbreviations (cont.)

- PAG – (EPA) protective action guide
- PC – permit condition
- PEP – plume exposure pathway
- PPE – plant parameter envelope
- PRA – probabilistic risk assessment
- RG – Regulatory Guide
- rem – roentgen equivalent man (1 rem = 0.01 Sv)
- rx-yr – reactor-year
- SER – safety evaluation report
- SMR – small modular reactor
- SSAR – site safety analysis report
- TEDE – total effective dose equivalent
- TEMA – Tennessee Emergency Management Agency
- TVA – Tennessee Valley Authority



Clinch River
Early Site Permit
Part 2, SSAR Section 13.3, Part 5, & Part 6

Advisory Committee on Reactor Safeguards

Committee Meeting

Presented by

Archie Manoharan, Licensing

Alex Young, Engineering

August 22, 2018

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TVA's Mission

Serving the people of the Tennessee Valley to make life better.



Energy



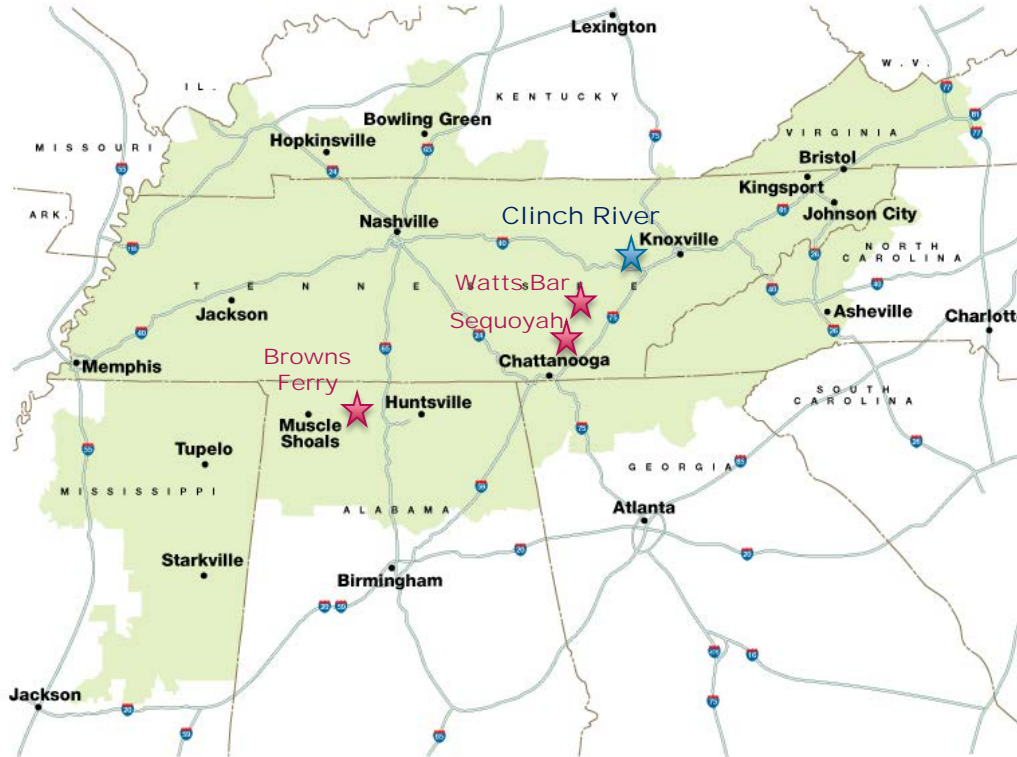
Environment



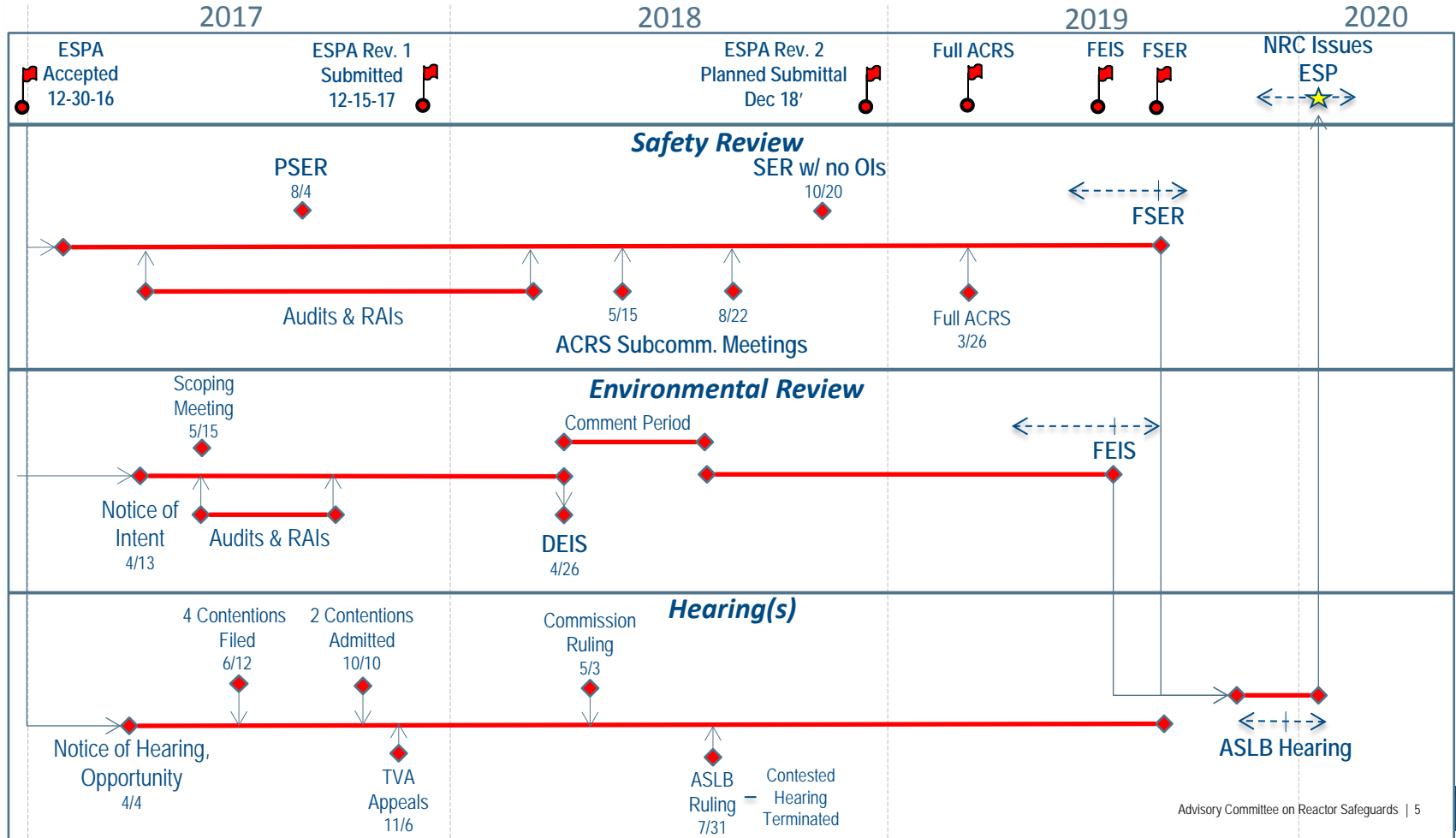
Economic Development

Partner with **154** local power companies, to serve more than **9 million** customers in parts of **seven states**. Directly serve **54** large industries and federal installations.

TVA's Nuclear Fleet



NRC Review of ESPA



ESPA – Emergency Preparedness Development

The ESPA considered information from four light water small modular reactor (SMR) designs:

- NuScale (160 megawatts thermal (MWt), 50 megawatts electrical (MWe))
- SMR-160 Holtec (525 MWt, 160 MWe)
- mPower (530 MWt, 180 MWe)
- Westinghouse (800 MWt, 225 MWe)

Combined nuclear generating capacity for the Clinch River Site not to exceed 2420 MWt (800 MWe)

Need for Scalable Emergency Planning Zone (EPZ):

- NUREG-0396 introduced the concept of a 10-mile EPZ 40 years ago
- NUREG-0396 considered large light water reactors (LWRs)

Based on SMR design information:

- TVA developed a dose-based, consequence-oriented approach to determine an appropriate EPZ size for a SMR
 - approach has the same dose criteria as NUREG-0396
 - takes into consideration SMR design and safety advancements
- Two emergency plans were proposed and developed
 - all four designs are expected to be able to meet the dose criteria for 2-mile EPZ
 - at least one design is expected to be able to meet the dose criteria for Site Boundary EPZ
- Exemption requests that allow for review of major features of emergency plans other than 10-mile EPZ

Presentation Outline

Part 2, Site Safety Analysis Report (SSAR), Section 13.3, Emergency Preparedness:

- 13.3.1 Physical Characteristics
- 13.3.2 Emergency Plan (Refers to Part 5 of the ESPA)
- 13.3.3 Emergency Planning Zones
- 13.3.4 Evacuation Time Estimates (Supports Part 5B)
- 13.3.5 Contacts and Agreements

Part 5, Emergency Plan:

- Part 5A Emergency Plan Site Boundary EPZ
- Part 5B Emergency Plan 2-Mile EPZ

Part 6, Exemptions and Departures

- Exemption Requests for a Plume Exposure Pathway (PEP) EPZ at Site Boundary
- Exemption Requests for an approximate 2-mile PEP EPZ

Key NRC Interactions Related to Emergency Preparedness

Two audits were conducted to review the emergency preparedness information in the ESPA

- First audit – November 2017 through February 2018
 - Example analysis completed by TVA to demonstrate feasibility that dose criteria can be met at Clinch River Site Boundary (RAI-8885)
- Second audit – April 2018
 - EPZ Plant Parameter Approach (RAI-9206)

Requests for Additional Information (RAIs)

- RAI-8885 – demonstrate that dose criteria can be met at Site Boundary EPZ
- RAI-9206 – discuss how EPZ methodology was implemented in the example analysis and the EPZ plant parameter approach developed

Part 2, SSAR,
Chapter 13 – Section 13.3
Emergency Preparedness

Section 13.3.1 – Physical Characteristics

Site Description

DOE Oak Ridge Reservation borders the North-East sides

6.8 miles East of Kingston, TN

8.8 miles Northwest of Lenoir City, TN

9.2 miles East-Southeast of Harriman, TN (not shown)

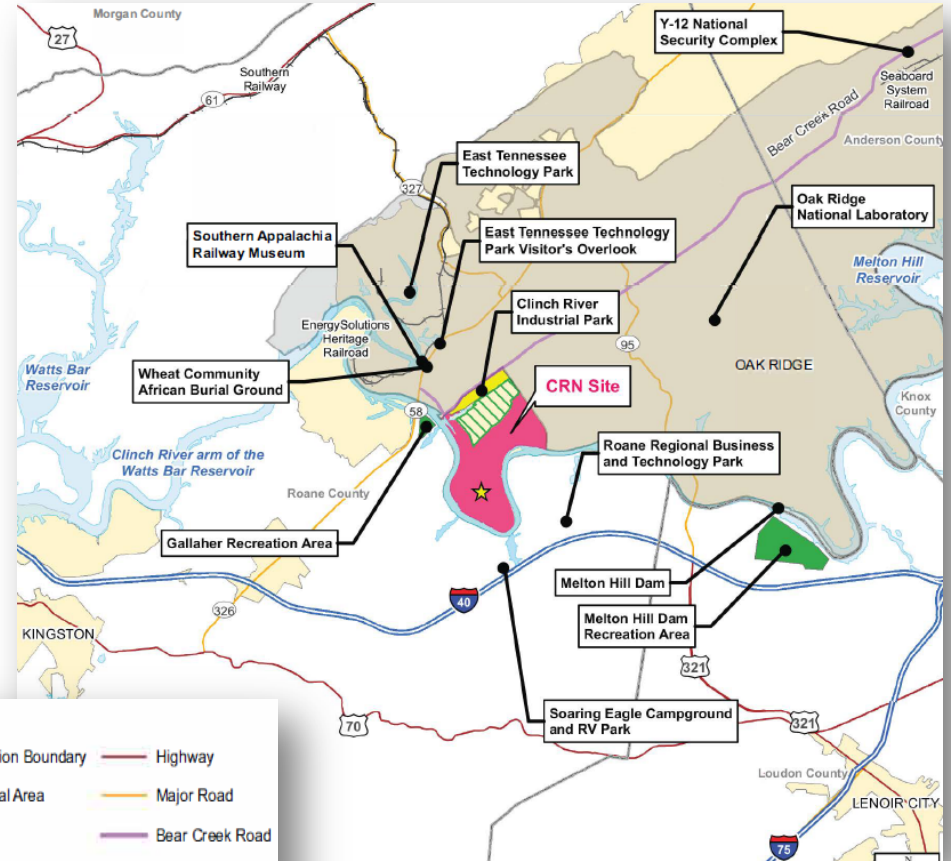
25.6 miles West-Southwest of Knoxville, TN (not shown)

Area Population

U.S. Census 2010 data projected to 2015

856 permanent residents within 2-mile PEP EPZ

186,500 permanent residents within 15 miles



Legend

CRN Site Center Point	Counties	Oak Ridge Reservation Boundary	Highway
CRN Site	Rivers and Lakes	Clinch River Industrial Area	Major Road
Town/City Boundaries	Grassy Creek Habitat Protection Area	Railroad	Bear Creek Road
Recreation Areas	Interstate		

Section 13.3.3 – Emergency Planning Zones

The methodology uses a dose-based, consequence-oriented approach for determining the appropriate size of the PEP EPZ consistent with the NUREG-0396 approach with a dose criteria of the Environmental Protection Agency (EPA) early phase Protective Action Guides (PAGs).

The methodology is consistent with the NUREG-0396 approach:

- a spectrum of accidents are addressed
- Dose criteria is the same
- PEP EPZ boundary ensures protection from dose levels above 1 rem total effective dose equivalent (TEDE) limit established in the EPA PAG

Four light water SMR designs were considered which significantly differ from the large LWRs:

- smaller cores
- lower source terms
- reduced accident consequences
- reduced likelihood of accidents
- slower accident progression allows more time for mitigating actions

Section 13.3.3 – Emergency Planning Zones

Technical criteria for determining the PEP EPZ size uses the existing emergency preparedness regulatory framework and dose saving criteria established in NUREG-0396

- Consistent with the NUREG-0396 sizing rationale, the technical criteria for determining the PEP EPZ size:
 - A. Encompass those areas in which projected dose from design basis accidents (DBAs) could exceed the EPA early phase PAGs.
 - B. Encompass those areas in which consequences of less severe core melt accidents could exceed the EPA early phase PAGs.
 - C. Be of sufficient size to provide for substantial reduction in early severe health effects in the event of more severe core melt accidents.

Section 13.3.3 – Emergency Planning Zones

Criteria A and B: PEP EPZ encompasses those areas in which the plume exposure doses from DBAs and less severe core melt accidents could exceed the EPA early phase PAG

- Areas outside the PEP EPZ would meet the EPA early phase PAG dose limit of less than 1 rem TEDE.
- The methodology for verifying dose consequences beyond the PEP EPZ do not exceed the EPA early phase PAG levels includes:
 - Step 1 - Selecting appropriate accident scenarios (*accident scenarios with mean core damage frequency (CDF) greater than $1E-6$ per reactor-year (rx-yr)*)
 - Step 2 - Determining source terms for selected accident scenarios
 - Step 3 - Calculating the dose consequences for selected accident scenarios
 - Step 4 - Comparing the dose consequences for selected accident scenarios with the EPA early phase PAG

Section 13.3.3 – Emergency Planning Zones

Criteria C: PEP EPZ be of sufficient size to provide for substantial reduction in early severe health effects in the event of more severe core melt accidents

Methodology for verifying that areas outside the PEP EPZ meet the limits for substantial reduction in early health effects:

- Step 1 - Selecting appropriate accident scenarios (*accident scenarios with mean CDF greater than $1E-7$ per rx-yr*)
- Step 2 - Determine source terms for selected accident scenarios
- Step 3 - Calculate the dose consequences for selected accident scenarios at the PEP EPZ boundary
- Step 4 - Calculate the distance at which the conditional probability to exceed 200 rem (whole body) exceeds $1E-3$ per rx-yr
- Step 5 - Compare that distance with the PEP EPZ

Design Specific Example Analysis – Site Boundary PEP EPZ

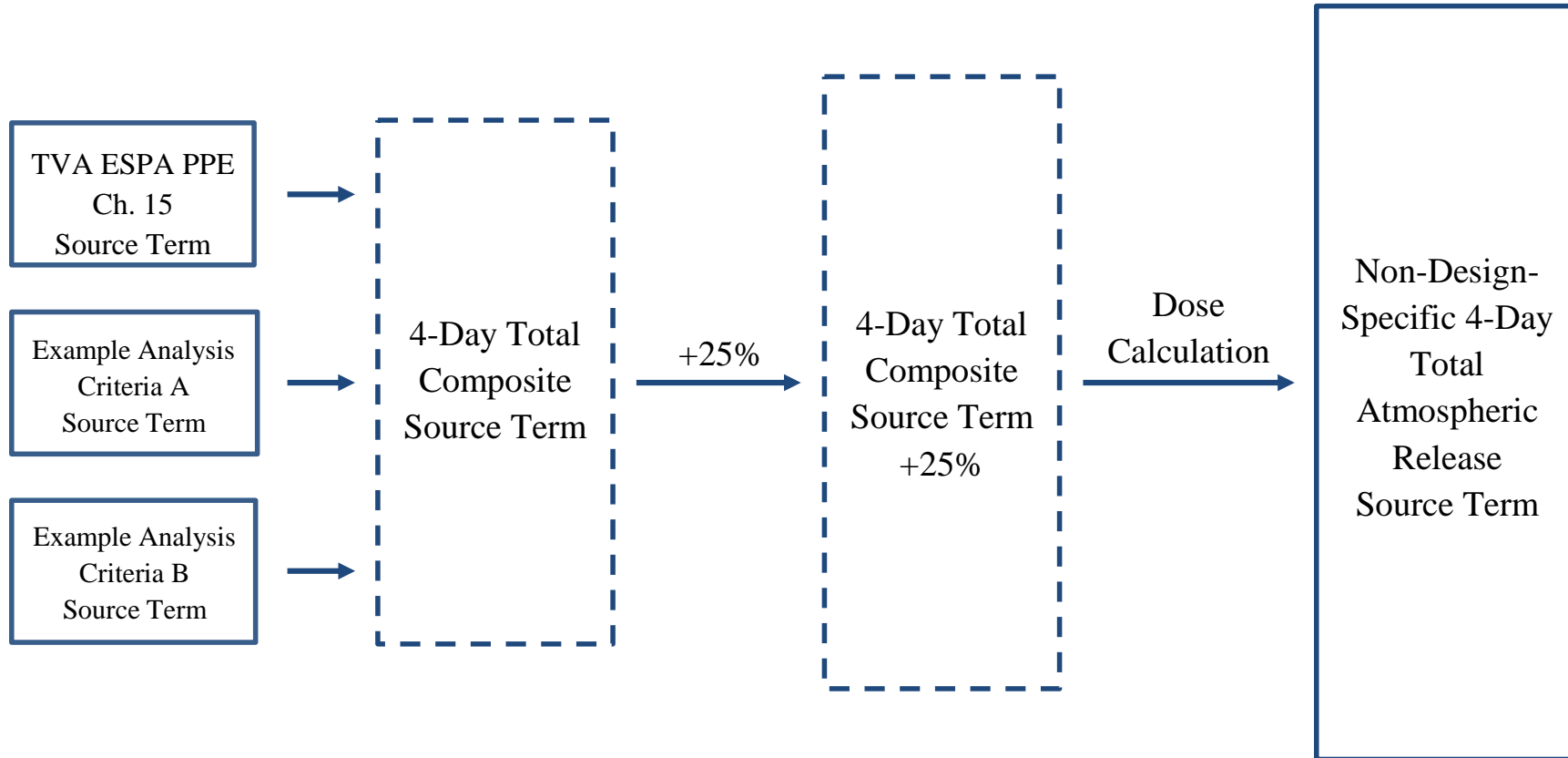
- Evaluates NuScale Power Plant at the Clinch River Site
- Implements the dose-based methodology described in SSAR Section 13.3
- Demonstrates that Site Boundary EPZ is possible
- Doses at Site Boundary are much less than the EPA early phase PAG

Criteria	Site Boundary Dose TEDE (rem)	EPA Early Phase PAG Limit TEDE (rem)
A: Design Basis Accidents	0.104	1
B: Less Severe Core Melt Accidents	0.158	1

C: Reduction in Early Severe Health Effects

No accident scenarios with mean CDF greater than $1E-7$ per rx-yr.

EPZ Plant Parameter Approach



Section 13.3.5 – Contacts and Agreements

Letters of Support

- Letters of support from the State of Tennessee, Anderson County, Roane County, and the City of Oak Ridge were submitted in support of the ESPA.
- 10 CFR 52.17(b)(4) requires that the applicant make good-faith efforts to obtain certifications from local, State, and Federal governmental agencies with EP responsibilities.

Letters of Agreements and Certification Letters

- Certification letters and letters of agreements will be pursued during the combined license application (COLA) process.
- TVA will maintain agreements with surrounding emergency response organizations.
- **TVA would continue to work with State and local support organizations to establish an emergency preparedness at Clinch River commensurate with the potential consequences to public health and safety**

Part 5 – Emergency Plan

Part 5 – Emergency Plan

Part 5 of the ESPA contains the major features of two distinct Emergency Plans for Clinch River Site in accordance with 10 CFR 52.17(b)(2)(i).

Part 5A

- Describes major features of an Emergency Plan for a PEP EPZ consisting of the area encompassed by the Site Boundary.

Part 5B

- Describes major features of an Emergency Plan for a PEP EPZ consisting of an area approximately two miles in radius surrounding the Clinch River Site.

Both plans address the 16 planning standards in NUREG–0654, Section II, which reflects the requirements in 10 CFR 50.47(b)(1) through 10 CFR 50.47(b)(16) and Appendix E to 10 CFR Part 50 considering the requested exemptions described in Part 6 of the ESPA

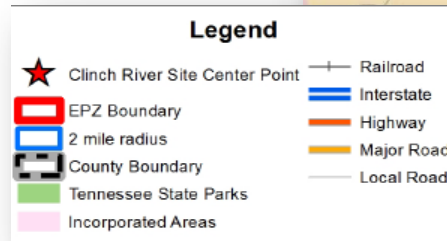
Part 5A – Emergency Plan (Site Boundary EPZ)

- TVA Generic Emergency Plan as modified for Clinch River Site and an appendix with Site-Specific information
- Actions necessary to safeguard onsite personnel (within the site boundary) and minimize damage to property
- Information to ensure the compatibility of the proposed emergency plans (for onsite areas) with facility design features, site layout, and site location



Part 5B – Emergency Plan (2-Mile EPZ)

- TVA Generic Emergency Plan as modified for Clinch River Site and a Site-specific appendix
- Information to ensure the compatibility of the proposed emergency plans (for both onsite areas and the PEP EPZ) with facility design features, site layout, and site location.
- Site Evacuation Time Estimate Report



Part 5B – Evacuation Time Estimate

- Analysis of evacuation times is one method to identify any significant impediments to the development of emergency plans at the Site
- Provides TVA, State and local governments with site-specific information needed for protective action decision making
- Evacuation Time Estimates (ETE) analyses for Clinch River Site were completed in accordance with the guidance provided in NUREG/CR-7002, Criteria for Development of Evacuation Time Estimate Studies
- These analyses did not identify any physical characteristics unique to the Clinch River Site that could pose a significant impediment to the development of emergency plans

Part 6 – Exemptions and Departures

Part 6 – Exemptions and Departures

Pursuant to 10 CFR 52.7, Specific Exemptions, which is governed by 10 CFR 50.12, Specific Exemptions, TVA requested exemptions from the following emergency preparedness requirements for the Clinch River Site:

- Certain standards in 10 CFR 50.47(b) regarding onsite and offsite emergency response plans for nuclear power reactors
- Certain requirements of 10 CFR 50.33(g) and 10 CFR 50.47(c)(2) to establish PEP EPZ for nuclear power plants
- Certain requirements of 10 CFR Part 50, Appendix E, which establish the elements that make up the content of emergency plans

Two Sets of Exemptions

Based on the dose-based EPZ methodology described in Section 13.3 and taking light water SMR designs into consideration, two sets of exemptions were developed:

- Exemptions for a PEP EPZ established at the Site Boundary (Part 5A)
- Exemptions for an approximate 2-mile PEP EPZ (Part 5B)

Part 6 – Exemptions and Departures

Requested exemptions – Table 1-1 Exemptions Requested from 10 CFR 50.33(g), 50.47(b), and 50.47 (c)(2) for the **Site Boundary PEP EPZ Emergency Plan**

Regulation	Requirement	Exemption Request
10 CFR 50.33(g) 10 CFR 50.47(c)(2)	10 mile PEP EPZ distance	Deviate from 10 mile PEP EPZ
10 CFR 50.47(b), b(4), b(5), b(6), b(9), b(10)	Various elements of a formal offsite emergency plan	Deviate from formal offsite radiological emergency plan requirements on the basis that there are no offsite radiological consequences from any credible event in excess of the criteria described in Section 13.3. Note: TVA's emergency plan will describe the capabilities to determine if a radiological release is occurring and promptly communicate that information to the offsite response organizations for their consideration.

Part 6 – Exemptions and Departures

Requested Exemptions – Table 1-2 Exemptions Requested from 10 CFR 50, Appendix E for the Site Boundary PEP EPZ Emergency Plan

Regulation	Requirement	Exemption Request
10 CFR 50, Appendix E, Section IV.2 – IV.7	Evacuation time estimates (ETEs)	Deviate from ETE requirements as no offsite consequences from any credible event in excess of the criteria provided in Section 13.3, formal offsite radiological emergency response plans with preplanned evacuation details are not necessary. Therefore, there is no need for ETEs.
10 CFR 50, Appendix E, Section IV.D.1, D.3, D. 4	Certain elements of offsite notifications	Deviate from certain offsite notification requirements as members of public would not be within the Site Boundary PEP EPZ. (Note: TVA is not seeking an exemption from the requirement to notify responsible State and local government agencies within 15 minutes after declaring an emergency.)
10 CFR 50, Appendix E, Section IV.F.2, F.2.a, F. 2.a.(i) – 2.a.(iii), F.2.b, F.2.c, F.2.d	Certain elements of offsite exercises	Deviate from certain offsite exercise requirements as no formal offsite radiological emergency response plans would be needed as no offsite consequences from any credible event in excess of the criteria provided in Section 13.3. (Note: TVA would continue to invite State and local support organizations to participate in the periodic drills and exercises conducted.)

Part 6 – Exemptions and Departures

Requested Exemptions – Table 1-3 Exemptions Requested from 10 CFR 50.33(g) and 50.47(c)(2) for the 2-Mile PEP EPZ Emergency Plan

Regulation	Requirement	Exemption Request
10 CFR 50.33(g) 10 CFR 50.47(c)(2)	10 mile PEP EPZ distance	Deviate from 10 mile PEP EPZ

Part 6 – Exemptions and Departures

Technical Justification

- The criteria established in the methodology described in Section 13.3, provides for adequate protection of public health and safety by providing a EPZ that encompasses the areas in which the plume exposure doses could exceed the EPA early phase PAG, and for where there is a substantial reduction in risk of significant early health effects.

Special Circumstances Exist – Underlying Purpose of the Regulations Being Met

- Exemptions are Authorized by Law
- Exemptions Will not Present Undue Risk to Public Health And Safety
- Exemptions Are Consistent with the Common Defense and Security

Summary

	ESPA	COLA
PEP EPZ Methodology (Part 2, SSAR, Section 13.3)	Approval of the <u>dose-based, consequence oriented methodology</u> for determining the PEP EPZ size	Approval of <u>design specific implementation</u> of the methodology approved in the ESPA
EPZ Size (Part 6)	Approval to <u>deviate from the current 10-mile PEP EPZ requirements</u> based on the methodology to determine PEP EPZ size	Approval of <u>design specific PEP EPZ size</u> based on design specific implementation of the methodology
Emergency Plan (Part 5)	Approval of the <u>major features</u> of the Site Boundary and 2-mile emergency plans presented in Part 5	Approval of the <u>remaining elements</u> of either the Site Boundary or 2-mile emergency plans OR a new plan based on design specific PEP EPZ size using methodology





ACRS Subcommittee

August 22, 2018

Tennessee Valley Authority (TVA)

Early Site Permit Application (ESPA)

ESPA Site Safety Analysis Report (SSAR) Section 13.3

Emergency Planning

Advanced Safety Evaluation Report (SER) with no Open Items

Project Managers

Mallecia Sutton (NRO)

Allen Fetter (NRO)

Technical Reviewers

Bruce Musico (NSIR)

Michelle Hart (NRO)

13.3 Emergency Planning – TVA Early Site Permit Application

The ESPA requested review of 3 key areas, which consist of:

- Plume exposure pathway (PEP) emergency planning zone (EPZ) sizing methodology (ESPA SSAR, Sec. 13.3)
- 2 Major Features (onsite) Emergency Plans (ESPA Part 5)
 - ESPA Part 5A reflects a Site Boundary PEP EPZ
 - ESPA Part 5B reflects a 2-Mile PEP EPZ (includes an evacuation time estimate)
- 25 Exemption Requests (ESPA Part 6)
 - ESPA proposes 2 sets of exemptions (for the site boundary/2-mile PEP EPZs)
 - ESPA proposes an exemption from the current 10-mile PEP EPZ
 - Exemptions address portions of 10 CFR 50.33(g), 50.47(b) & (c)(2), and Appendix E to 10 CFR Part 50, for onsite and offsite emergency planning (EP)

Part 52 Licensing Process

- Upon issuance of the early site permit (ESP), the applicant acquires approval, with conditions, on:
 - The PEP EPZ sizing methodology
 - The 25 requested exemptions
 - The 2 major features E-plans (site boundary & 2-mi PEP EPZ)
- In the future, a combined license application (COLA) that incorporates by reference the ESP will:
 - Identify a chosen small modular reactor (SMR) technology for the Clinch River Nuclear Site
 - The applicant must demonstrate that the EPZ sizing methodology supports either the site boundary or 2-mile PEP EPZ
 - Provide a complete & integrated emergency plan
 - For the 2-mile PEP EPZ, must provide onsite & offsite emergency plans
 - For the site boundary PEP EPZ, must provide onsite emergency plan (assumes that site boundary, as defined for EP purposes in the COLA, will be within the applicant's owner controlled area)
 - Address identified COL action items and permit conditions

Review of Exemptions (Special Circumstances)

- The NRC reviewed the requested exemptions pursuant to 10 CFR 50.12 (Specific Exemptions)
 - 50.12(a)(2) – The Commission will not consider granting an exemption unless special circumstances are present.
 - Special circumstances are present whenever –
 - (ii) – Application of the regulation in the particular circumstances would not serve the underlying purpose of the rule, or is not necessary to achieve the underlying purpose of the rule.

Special Circumstances (Underlying Purpose of Rule)

- The underlying purpose of 10 CFR 50.33, 50.47, and Appendix E to 10 CFR Part 50, is to:
 - Ensure that licensees maintain effective onsite and offsite radiological emergency response plans,
 - Ensure that there is reasonable assurance that adequate protective measures can and will be taken in the event of a radiological emergency, and
 - Establish plume exposure and ingestion pathway EPZs.
- The ESPA serves to provide a basis for the establishment (in the COLA) of either a Site Boundary or 2-mi PEP EPZ, which maintains the same level of protection (i.e., dose savings in the event of a radiological emergency) in the environs of the Clinch River Nuclear Site, as that which exists in the basis for a 10-mi PEP EPZ.

TVA PEP EPZ Size Methodology

Technical Criteria

- PEP EPZ should encompass those areas in which projected dose from design basis accidents (DBAs) could exceed the U.S. Environmental Protection Agency (EPA) early phase protective action guide (PAG)
- PEP EPZ should encompass those areas in which consequences of less severe core melt accidents could exceed the EPA early phase PAG
- PEP EPZ should be of sufficient size to provide for substantial reduction in early health effects in the event of more severe core melt accidents

TVA PEP EPZ Size Methodology

SSAR Section 13.3.3.1

- Accident scenario selection
 - Use bounding DBA from COLA Final Safety Analysis Report Chapter 15
 - Use COLA site- and design-specific probabilistic risk assessment (PRA) to categorize severe accident scenarios
 - All modes, internal and external events, applicable fuel handling and spent fuel pool accidents, multi-module considerations
 - Assess all sequences with mean core damage frequency (CDF) $> 10^{-8}$ per rx-yr
 - More probable, less severe core melt scenarios
 - Mean CDF $> 10^{-6}$ per rx-yr, intact containment
 - Less probable, more severe core melt scenarios
 - Mean CDF $> 10^{-7}$ per rx-yr, containment bypass or failure
- Determine source term releases to atmosphere
- Calculate dose consequences at distance from plant
- Determine PEP EPZ size that meets the dose-based criteria

TVA Dose-Based PEP EPZ Size Criteria

- Dose to individual from exposure to the airborne plume during its passage and to groundshine, using average atmospheric dispersion characteristics for site
- DBA and more probable, less severe accidents
 - 1 rem total effective dose equivalent (TEDE) from 96-hr exposure
 - Lower end of dose range EPA PAG for early phase protective actions (e.g., evacuation and sheltering)
 - Verify that dose consequences do not exceed the EPA PAG beyond the site boundary (within owner controlled area) and 2-mile PEP EPZs
- Less probable, more severe accidents
 - Calculate the distance at which the conditional probability to exceed 200 rem whole body from 24-hr exposure exceeds 10^{-3} per rx-yr
 - Acute dose at which radiation-induced early health effects may begin to be noted (e.g., nausea)
 - Verify that the PEP EPZ supports substantial reduction in early health effects

Review of PEP EPZ Size Methodology

- Staff compared TVA's methodology and dose criteria to the study used as technical basis for current 10-mile PEP EPZ requirement (NUREG-0396)
 - The features of TVA's methodology are consistent with NUREG-0396
 - Considered a range of accidents
 - Performed accident consequence analyses
 - Determined an area outside of which early protective actions are not likely to be necessary to protect the public from radiological releases
- The staff concludes that the applicant's proposed methodology is reasonable, and consistent with the analyses that form the technical basis for the current regulatory requirement of a PEP EPZ of about 10 miles in radius.

SMR Features that Support the Exemption Requests

- TVA stated that special circumstances exist at the Clinch River Nuclear Site due to the anticipated enhanced safety features of the SMR designs under consideration
 - Smaller radionuclide inventory and source terms
 - Projected accident progression rate is anticipated to be slower
 - Various design features are expected to eliminate several historically considered design basis events
 - Severe accidents are projected to be less likely to occur
 - Advanced design features that would minimize accident consequences

Request for Additional Information

Question 1

- Specific technical support related to the statements on SMR features and comparison to large light water reactors (LLWRs)
- TVA provided tables with several parameters comparing the smallest and largest SMRs (based on unit rated thermal power) in the Clinch River Nuclear ESPA plant parameter envelope (PPE) to large and medium currently operating pressurized water reactors and the AP1000

For example:

- Internal events CDF and large release frequency
- Source term total activity
- Primary coolant liquid mass to power ratio
- Severe accident progression information

Request for Additional Information

Question 2

- Demonstration that the proposed PEP EPZ size criteria could be met at a given EPZ boundary distance for potential reactor facilities that would be represented by the surrogate design in the PPE
- TVA provided an example analysis using design information for a specific SMR design as input to the SSAR 13.3 PEP EPZ size methodology
 - Example analysis showed that design could support a site boundary PEP EPZ
 - Not intended to prove case for ESPA to justify a specific PEP EPZ size
 - Based on preliminary design information for an SMR at the lower end of the rated power (160 MWt) that is part of the basis for the Clinch River Nuclear ESPA PPE
 - Used internal events design PRA only
 - Did not do detailed uncertainty analysis

EP Exemption Plant Parameters

- TVA developed a non-design-specific accident release source term that would meet the PEP EPZ size criteria to be used as plant parameters (SER Table 13.3-1)
 - Same idea as PPE DBA source term to envelope an unknown design
 - Referenced in Permit Condition 1 for adoption of EP exemptions
- Isotopic total release activity over 96 hrs results in TEDE of about 0.9 rem at site boundary
 - 3 core melt, intact containment accidents (2 DBAs and 1 severe accident)
 - From 2 SMRs (160 MWt and 800 MWt)
 - Maximum activity release for a specific radionuclide from any of the 3 accidents over a specific dose averaging period was assumed to be the release activity of that radionuclide for that period
 - 0-8 hrs, 8-24 hrs, 24-96 hrs
 - Added 25% margin
 - Additional adjustment to values for backcalculation

Permit Condition 1

- COL applicant referencing the ESP (if approved) would perform an analysis using the SSAR 13.3 PEP EPZ size methodology, with site- and design-specific input, to justify the PEP EPZ size for the COLA
- The COLA PEP EPZ size analysis output includes the source term releases to the atmosphere
 - Isotopic activity release over time
- If the COLA PEP EPZ size analysis source term releases to the atmosphere are bounded by the non-design-specific plant parameter source term information in SER Table 13.3-1, then the COL applicant can adopt the EP exemptions
 - 4-day total activity release to the atmosphere for 71 isotopes
 - COLA values should be shown to be less than ESP (Table 13.3-1) values to adopt the EP exemptions

Plant Parameter Envelope

- TVA identified 4 SMR designs to develop the PPE
 - BWXT mPower (Generation mPower)
 - NuScale (NuScale Power)
 - SMR-160 (Holtec SMR)
 - Westinghouse SMR (Westinghouse Electric Co.)
- A different reactor design that falls within the following PPE information range may be selected in the COLA
 - 2 or more SMRs with a maximum 800 MWt for a single unit
 - Combined site capacity not to exceed 2420 MWt (800 MWe)



Review Standards/Guidance

- 10 CFR Part 52, Subpart A, Early Site Permits
- 10 CFR 50.47 & Appendix E to Part 50
- 10 CFR 50.12 & 52.7, Specific Exemptions
- NUREG-0800, Standard Review Plan, Sec. 13.3, Emergency Planning
- NUREG-0654/FEMA-REP-1 (Rev. 1), Suppl. 2, NSIR/DPR-ISG-01
- NUREG-0696, Functional Criteria for Emergency Response Facilities
- NUREG/CR-7002, Criteria for Development of ETE Studies
- NUREG-0396, Planning Basis for the Development of State and Local Government Radiological Emergency Response Plans in Support of Light Water Nuclear Power Plants
- EPA PAG Manual: Protective Action Guides and Planning Guidance for Radiological Incidents



Federal Emergency Management Agency (FEMA) Consultation

- NRC performed its review in consultation with FEMA, pursuant to the FEMA-NRC Memorandum of Understanding (MOU) (12/7/15, ML15344A371)
- FEMA review was limited because:
 - The ESPA did not include offsite emergency plans, and
 - The major features plans only addressed limited onsite EP features.
- FEMA's January 24, 2018, letter (ML18031B055) stated that:
 - Working with TEMA, FEMA did not identify physical characteristic of the proposed site that could pose a significant impediment to the development of emergency plans, including evacuation from the 2-mi EPZ.
 - The boundary established for the proposed 2-mi PEP EPZ was established relative to local emergency response needs and capabilities, as they are affected by such conditions as demography, topography, land characteristics, access routes, and jurisdictional boundaries.
 - At this time, FEMA's finding does not endorse or determine the adequacy of a proposed 2-mi PEP EPZ for the site if proposed during the licensing process.
- In its June 12, 2017, letter (ML17164A206) FEMA further stated that it did not review or analyze the feasibility and assumptions for the site boundary EPZ, but if requested in the future, would provide comments and recommendations.

COL Action Items vs. Permit Conditions

- The 16 COL Action Items:
 - Track information that is needed before granting a COL, but is not required in the ESPA
 - Reflect the SMR design that may be identified in the COLA
 - Require NRC evaluation as part of the COLA review
- The 4 Permit Conditions:
 - An ESP is granted subject to permit conditions, which address required detailed information that is not yet known, but will be available in the COLA and subject to NRC confirmation

16 COL Action Items

- 13.3-1, Select SMR (EPA PAGs)/PEP EPZ/E-plan
- 13.3-2, Update Letters of Agreement/MOUs
- 13.3-3, SMR facilities & staffing
- 13.3-4, Emergency action level scheme
- 13.3-5, Alert and notification system
- 13.3-6, SMR communications/data links
- 13.3-7, Joint Information Center location/capabilities
- 13.3-8, Onsite monitoring systems/equipment

COL Action Items (cont.)

- 13.3-9, Technical Support Center
- 13.3-10, Operations Support Center
- 13.3-11, Local Recovery Center
- 13.3-12, Central Emergency Control Center
- 13.3-13, Radiation monitoring systems
- 13.3-14, Meteorological tower & monitoring program
- 13.3-15, On-site personnel decontamination facility
- 13.3-16, Communications testing & hostile action exercises

4 Permit Conditions, 1 Confirmatory Item

- Permit Conditions (PC)
 - SMR PPE Accident Consequence Analyses
 - PC 1, Calculation of EPZ Size
 - Fukushima Dai-ichi (near term task force 9.3, Tier 1)
 - PC 2, Multi-Unit Staffing Assessment
 - PC 3, Communications Assessment
 - 2011 Emergency Preparedness Rulemaking
 - PC 4, On-Shift Staffing Analysis
- Confirmatory Item 13.3-1
 - Withdrawal of exemption request Item No. 19 (re: the requirement for remedial exercises)
 - Section IV.F.2.f of App. E to 10 CFR Part 50
 - Can be closed out when ESPA Rev. 2 is submitted



Combined License Application (COLA)

- In the COL Application:
 - The COL applicant will identify an SMR technology, which must meet the PEP EPZ sizing methodology approved in the ESP for either the site boundary or 2-mile PEP EPZ, or may propose a new emergency plan.
 - If the 2-mile PEP EPZ is selected and justified, the NRC will request that FEMA review the offsite emergency plans.
 - If the site boundary PEP EPZ is selected and justified, no formal FEMA-approved offsite radiological plans are required.
 - The COL applicant will still need to address requirements to communicate and coordinate with offsite support organizations and agencies

Staff Review Findings

- No significant impediments to the development of emergency plans (10 CFR 52.17(b)(1))
- Adequate description of contacts and arrangements with Federal/State/local support agencies (10 CFR 52.17(b)(4))
- Proposed exemptions are acceptable (10 CFR 50.12, 52.7)
- Proposed major features emergency plans are acceptable (10 CFR 52.17(b)(2)(i))
- Proposed dose-based, consequence-oriented EPZ sizing methodology is reasonable

Conclusions

- The staff concludes that:
 - The PEP EPZ sizing methodology is acceptable for determining the appropriate size of the PEP EPZ for the Clinch River Nuclear Site because it is consistent with the analyses that form the technical basis for the current 10-mile PEP EPZ.
 - The 2 major features emergency plans are acceptable because they meet the applicable standards of 10 CFR 50.47 and requirements of Appendix E to 10 CFR Part 50.
 - The exemption requests are acceptable because they are authorized by law, will not present an undue risk to the public health and safety, are consistent with the common defense and security, and special circumstances are present.
- Therefore, the staff finds the TVA ESPA acceptable with respect to emergency planning and related exemption requests.

TVA's Request in ESP Application and Method of Implementation (if ESP Application Approved) in COLA			Final Products and Approval Mechanism	
	ESP	COLA	ESP	COLA
Methodology (SSAR 13.3)	Approval of a dose-based methodology for determining the EPZ size, as described in SSAR Section 13.3.	Approval of site-specific implementation of the previously approved methodology in ESP SSAR Section 13.3 to justify EPZ size. EPZ size calculation provided using site- and design-specific information. Approval of final EPZ size.	Final Product: SER and permit Staff relies on NUREG-0396 and EPA PAG Manual. SECY-15-0077: Staff initiated rulemaking for SMRs and ONTs. Prior to establishment of rule, staff should be prepared to adapt approach to EPZs for SMRs under existing exemption processes, in parallel with its rulemaking efforts (case-by-case).	Final Product: SER, license with EPZ size Using the methodology in ESP SSAR Section 13.3, the COL applicant must demonstrate that the selected SMR design meets EPA PAGs for the selected EPZ size.
Exemption Request (Part 6)	Approval for exemptions from the current 10-mile EPZ requirement if certain conditions are met. Approval to use the methodology in ESP SSAR Section 13.3 to determine EPZ size in the COLA. The ESPA requests 2 sets of exemptions, one for a site boundary EPZ and one for a 2 mile EPZ, and proposed major features of emergency plans for each.	The COLA can rely on EP exemptions granted in the ESP, provided site- and design-specific information justify use of one of the sets of exemptions evaluated in the ESPA.	Final Product: SER and permit with exemptions (if approved) and related conditions Staff relies on exemption guidance, NUREG-0396 and EPA PAG Manual	Final Product: SER, license to reflect EPZ size supported in the COLA.
Emergency Plans (Part 5A and Part 5B)	Approval of the major features of the site boundary and 2-mile emergency plans in Part 5.	Approval of complete and integrated emergency plans, including offsite emergency plans if a PEP EPZ other than site boundary is selected. Includes the remaining features of the emergency plan (either site boundary or 2-mile) from the ESP or new emergency plan based on the final dose-based EPZ size.	Final Product: SER and permit Staff relies on existing rules and guidance, except to the extent that they are not applicable because of the requested exemptions.	Final Product: SER, license to reflect EPZ size supported in the COLA.

Abbreviations

- CDF – core damage frequency
- CFR – Code of Federal Regulations
- COL – combined license
- COLA – combined license application
- DBA – design basis accident
- EP – emergency planning
- EPA – U.S. Environmental Protection Agency
- EPZ – emergency planning zone
- ESP – early site permit
- ESPA – early site permit application
- ETE – evacuation time estimate
- FEMA – Federal Emergency Management Agency
- FSAR – Final Safety Analysis Report
- LLWR – large light water reactor
- MOU – memorandum of understanding
- MWe – megawatts electric
- MWt – megawatts thermal
- NTTF – Near-Term Task Force

Abbreviations (cont.)

- PAG – (EPA) protective action guide
- PC – permit condition
- PEP – plume exposure pathway
- PPE – plant parameter envelope
- PRA – probabilistic risk assessment
- RG – Regulatory Guide
- rem – roentgen equivalent man (1 rem = 0.01 Sv)
- rx-yr – reactor-year
- SER – safety evaluation report
- SMR – small modular reactor
- SSAR – site safety analysis report
- TEDE – total effective dose equivalent
- TEMA – Tennessee Emergency Management Agency
- TVA – Tennessee Valley Authority