UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

AUG 11 1986

NOTE TO: Tom Novak

FROM: Inemis Speis

SUBJECT: REVIEW OF THE SEABROOK EPZ SUBMITTAL

I have reviewed your proposed memo to H. Denton on the Seabrook review and provided comments in the form of markups to V. Noonan on August 8. It is important to decide what direction NRC is going to take on this issue before a detailed technical review can start. A decision chart set up in the form of three questions is attached for your consideration. I would recommend that you assemble a small group to assess the potential approaches to the review. Four individuals, one from each, PWRL, USRO, IE and OGC, could do the job in about two weeks. Our representative is Len Soffer, please feel free to contact him directly.

Inemis Speis

cc: H. Denton

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Potential Approaches to the Review of the Seabrook EPZ Submittal

1. Assuming that all technical information received from Seabrook is correct, can NRC reduce the Seabrook EPZ or evacuation zone below the 10 mile limit under current regulations and established regulatory practice?

   If answer is No, go to Q-2.

   If answer is Yes:

   What information is important for the decision?
   What additional information is needed from PSNH?

2. Can NRC use a risk based criteria to justify a reduction in EPZ or evacuation zone for Seabrook without "rulemaking" or granting an exemption?

   If answer is No - Seabrook should either join the ongoing rulemaking or go to Q-3.

   If answer is Yes:

   What information is important for the decision?
   What additional information is needed for PSNH?

3. What basis could NRC have for granting an exemption from existing emergency planning requirements for Seabrook?

   a.) Is the Seabrook plant significantly different from other PWRs with large dry containments with respect to Emergency Planning requirements?

   If answer is No, go to Q-3b.

   If answer is Yes:

   What information is important for the decision?
   What additional information is needed from PSNH?

   b.) Is there an "immediate need" for Seabrook, that would justify exempting it from current EPZ requirements while the rule change is underway?

   If answer is No - give up!

   If answer is Yes:

   What information is important for the decision?
   What additional information is needed from PSNH?

ENCLOSURE 3

References:

1. George S. Thomas to Vincent S. Noonan letter dated July 29, 1986, Seabrook Station Probabilistic Safety Study Update.

2. John DeVincentis to Vincent S. Noonan letter dated July 21, 1986, Seabrook Station Probabilistic Safety Assessment Update.

3. Seismic Fragilities of Structures and Components of the Seabrook Generating Station, Units 1 & 2, prepared by NTS Engineering, Long Beach, CA for Pickard, Lowe and Garrick, Inc. and New Hampshire Yankee Division, Public Service Company of New Hampshire, Seabrook, New Hampshire, June 1986. Technical Report No. 1589.01.

4. Seabrook Station Emergency Planning Sensitivity Study, prepared by Pickard, Lowe and Garrick, Inc., Newport Beach, CA for New Hampshire Yankee Division, Public Service Company of New Hampshire, Seabrook, New Hampshire, April 1986. PLG - 0465.

5. John DeVincentis to George W. Knighton letter dated January 30, 1984, Seabrook Station Probabilistic Safety Assessment Main Report and Summary Report.

6. Seabrook Station Risk Management and Emergency Planning Study, prepared by Pickard, Lowe and Garrick, Inc., Newport Beach, CA for New Hampshire Yankee Division, Public Service Company of New Hampshire, Seabrook, New Hampshire, December 1985. PLG - 0432.

7. Seabrook Station Probabilistic Safety Assessment (Summary Report and 6 volumes), prepared by Pickard, Lowe and Garrick, Inc., Newport Beach, CA for Public Service Company of New Hampshire, Manchester, New Hampshire and Yankee Atomic Electric Company, Framingham, MA, December 1983. PLG - 3000.

8. Seabrook Station Probabilistic Safety Assessment Technical Summary Report, prepared by Pickard, Lowe and Garrick, Newport Beach, CA for Public Service Company of New Hampshire, Manchester, New Hampshire and Yankee Atomic Electric Company, Framingham, MA, June 1984. PLG - 0365.

David Tirrell - Wysocki - AP

· Request for PSNH to

NRC will give them top priority -

Top. prelim review in 3 mo
normally take - out of ordinary

Sense of urgency - no discussion of [illegible]
holding up licensing

What kind of things

Then utility will determine if they want
to go further

Go over - changes in EP

What other kind of things may be involved
graded response - change current graded response
size of EPZ

There are so many options - get rid of Mass
so they don't have to submit

Rick made public - November 3 call status

Lillian [illegible] Givenchy - Spray   Tabu [illegible] Spray - [illegible]

Globe

*John Quinn - VP - NH Yankee.

initial report - lots of work for us to do
possible outcome
not a simple thing to do

* Jody Averill / Gazette
Seabrook indicated - would be the basis

[illegible]

still in the works - discussed at staff meeting - Tech Basis

Cy Weiss

Region I. K. Abraham

. Letter that NHY sent to NRC requesting EPZ to be reduced

Only request for reduced EPZ for Current Cliffs

State use police powers to frustrate Federal
2 things - 1) enforce
2) challenge → court → decide

Mass. legislature - created 40 mi EPZ .

① Xerox report pages + letter to Abraham + John Lopach
② Travel
③ Meeting minutes
④ Buy ticket

Ron Hernan: 29519

interim - for purpose of telling them where we're at

September 25th afternoon downtown joint on Seabrook

Subcommittee
Full
Visit . they'll do what

occupational + prot EP2
→ Kerr ←
Moeller –
Seabrook visit + Z
Joint Seabrook/
Occupational + Env
Prot Systems Sub's
[Seiss] [Olive-Ella]
Only Seiss / Kerr / Moeller
Tally wide Specific Seabrook mtg

Subs gather + exchange staff PSNH status report

worked off

* • Rich Major

wrapup
{Kerr, Lewis, Moeller
Michelson

[Michele
10:00]

{Mr. Sittenger
Voss}

Millstone 3
projects ... for Oct. Full Mtg
> Savio / Okrent <

—

*Bill Derrickson —

*technical basis * reporters

Union Leader
Portsmouth Herald

Ch. 9.11

* Does this mean reducing the EPZ
is an option but not requesting this end
may be other options.
60 more days

Technically correct
But intervenors - plants not safe
* Brad Pokorney
remarks

8/19/86

Noonan - intro

communicate info need over next 3 mo. for review
do review in short period of time to get positive
response or questions needed to get there

C. Higginbotham

learn as much as we can about cont. strength
calc. + confirm analyses of key parts of exam
know everything there is to know; then focus on key things
* (see agenda)

Design, construction + key elements
then failure modes + specific details
(weak elements)

Site visit for BNL - schedule this today
also tell us what's important - any recommendations

① Design of Containment

Vince - unique features of Seabrook containment?
let's try to make it more unique - show it's
better than average

Rich Tolland/Calvati

Non prototype - (Indian Point 2-3 / WNP 1-4)
generic design

For East Coast Cont. - 52 psi - Design Accident Load
+ .25 peak ground acc seismic
not design for aircraft impact but shown to withstand
shield building helps distribute the load - FSAR vol. 5

unique for east coast

General description: liner, T anchors, reinforced concrete, rebar
Behavior as a shell
ASME Code Desig - 62 ksi yield, 72 ksi yield
.9/54 ksi
Addition of seismic rebar - enhances strength under pressure.
Custom - considered load of 1.5P? Yes - have to by code
Quality - design + constructed to code - yes (1975)
Liner as barrier but not strengthened from code point of view

C.H - Base Shear Design?
no welded rebar splices in containment except rod welds
How does this differ from In. Pt.?
design acc. ?
Seismic peak ground acc.
Comparable material + rebar, equipment + pipe similar
Dome plate @ apex different
Seabrook bigger diam.
UNP-1 is larger than Seabrook
Jon Wesley: looked @ IP - design philosophy seismic rebar vs pressure rebar
seismic gives strength capacity - once you add these 2 - higher probably a higher % of diag. slab in Seabrook

added or not?

- inclined bars are outermost layer
- foundation - 9000 velocity rock
  bottom of mat = -26
  cavity = -82

Cont. is free standing embedded in rock
Encl. + cont. do not share ——

Wesley - lack of interaction → sq. factor is basemat uplift

Garcem - shear stress in mat can be limiting
lead us - changes in reinforcing pattern

Karrel - with liner capacity goes up - no displacement between
liner + wall - is connection between the 2 designed?
- welded T anchors

Garcem - analyses done for severe accident condition
Wesley compatability of liner + rebar which fails first (liner vs. rebar)
ultimate capacity - seven dynamics - liner follows concrete

Ult. Cap in PRA ans. vs design

liner base - there is strength here
how hi a T considered - design - 271°
300 - 350°F considered by Tolland

C. Hofmayer - need to know any key features about design and implementation - otherwise we can look at drawings

- main rebar is continuous / goes around openings rather than terminating / all the bars are taken around

- dome rebar - continued on same single plain / 4 quadrant

what about anchorages, penetration into concrete
e.g. equip hatch - shear loads on it?
continuous heavy lane welded on top with additional lug weld to containment line from thickness
double lugs weld all around with stiffeners in between

C.H. how carefully was this looked at.
Wesley - not controlling - large margin over failure controlling modes

C.H. would like to look at what you looked at and how you did it

Wesley. publications - looked at vendor design calc.
hatches themselves shown to be very over designed
∴ large margins in the hatches
P capacity were all designed - equip. hatch big

Gordon - go back to purchase spec. to show any difference?
post tensioned vs reinforced concrete
barrel has to be able to withstand imposed displacements from shell.

Top dome rebar from hanger shear bars

No crane on the shell Rem - smooth transition to dome

Gatum - local loads.

Staggered cadweld pattern

Relationship to adjacent structures

Penetration assembly details

Refueling bld + fuel transfer canal

Circul + bldr Rus flexible isolation joint

Due accident pressure 4% strain

Adjacent Building: Equip Hatch, Fuel Storag Bldg, Elec. Penetr. Area, Main Steam + Feed piping

Hot + Cold Penetrations, any guard pipe? No

all major penetrations below grade

elec penetration - welded parts

main steam + feed lines are fixed heads

Vince: feed circ. water system taking water from 1 mi offsite to bypass cont. to relieve pres into containment + get it offshore ✓

use this for cold venting system 1 mi offshore - consider this

would cont pres. be enough to drive it out or would

you need another sept - then add this to emerg. op. proc.

Gatum - most possible would be something thru fuel pool

John D. looking at this

Seabrook EPZ:

Conf Call - with BNL (Art Tingle - Woodard, etc)

Mtg next week plant model V-sequence

Site Visit

ACRS mtg

PLG c California - Jim Moody
Cora Flemming
c D.C. Keith Woodard
D.C Sweeny
Framingham Shengdar Li
BNL Art Tingle

Purpose of phone call to get emergency activity going

Art - CRAC IT CALCS done by Woodard with PLG
202-296-8633

Q raised c mtg relocation comm calc.
Take some time - do such calcs with
CRAC or MACCS

· Diff between CRAC II + CRAC IT -
MACCS - dosimetry difference

Once case was a single puff - easy comp. curve
Late overpressure type calc - easier to verify CRAC IT with
single release vs multipuff
Doesn't make diff. after the puff on the grid of wind changes direction.
∴ MACCS Calc - roughly

②

(Check this)

* NRC preps MACCS code - but its not available

clustering to get the source terms (random sampling)

Can control running the uncertainty process —

They have run CRAC 2 + are familiar with the format

Sherrgian do they have CRAC II compatible input tape

1 hr. Met data for 1 year.

Call Fleming - testing + auditing CRAC II model

what's been done? tel

1) benchmark study

2) report out where they are the same pt (CRAC 2 - no MACCS)

Roger Blond - "Int Comp Study on Rx Acc Conseq Models"

EPRI 2 is PLE - Guni MEA

OECD published it

Org. for Economic Coop + Development

germane to verification of CRAC II model

show differences in different codes

Population Table → NO, Dose vs Distance worksheet (0390)

who? Call Sherrgian to send a copy of tape - send him a listing

1 yr data - Keith - confirm with listing that Sherrgian ...

Mtg may be needed - Moody

Ask to run tape first - then run audit calc

against this

[Sherrgian to send CRAC 2 tape which utilizes 1 yr. met data
to BNL. Then BNL to do audit of ... using CRAC 2.

Keep in mind - ocean site - so if no people, there cant
be a dose. Ask to discuss of any differences after running.

J. Moody -
474-9521, no Xtension
2401 (O. Vincento)
> Art reviewing inputs <
Schedule - slip.

V-sequence @ m. Carl / give him some guidance

all interesting release categories are multi puffs

Flemming in the 2nd study, they did V-sequence (S-7W)
with a single puff source term - another option

1 S-7W - submerged release (V-sequence)
in PLG-0465, p. 4-8 source Term Table
Another alternative is single puff source term

Study supports [illegible] source term [illegible]
make sure they putting in [illegible]
• They may want [illegible] source term [illegible]
sensitive parameters [illegible] the input

Sheryl [illegible] → 617-874-5100 - X2630
- Tape specs?
- CRAC - [illegible] 1 - 0030, [illegible] 4/1 - 5/30 ?
Time [illegible] doesn't make any difference
Name: Arthur Tingle
[illegible] 130
BNL
Upton N.Y. 11973 [illegible] 516-282-7155
[illegible] of it only [illegible] a454
> 1 week - to read tape + run a dummy calc - the acu or source Terms

[illegible]

27th mtg - Trevor Pratt + Ris mtg
what does he need to see -
capture his background, then entertain QS
Commercial PRA aspects vs. Plant models (vacations)
Put together an agenda

As PRA results unfolded
what
external events - he should be there
Bring memo to Novak/Lyon
Direct mtg at Cont.
Sept. 8 + 9 (Mon - Tues)
Tom + Wesley can't make it - what does Browns Ferry
available for following week -
[illegible] + Systems type person [illegible]
+ Operator (Mike David)

2.W Conf Call

Flumagan - ... conf mtd ...

Wash

California

1:30 Site

NRC

BNL

Offsite Conf No.

* Gartum X 27070   What is the magus no?

- Tingle

Art Tingle 8-666   666-

Art Tingle V 7755   516-282-7755

Mihsen Kuttro R

8-666 - 2626

666-2630

C Homagan -

August no visit

Sept. maybe OK

How many different types of penetration details do we have
- bellows?

< penetrations + how it's closed - how sleeve tied in
- get these drawings → FSAR
we want to be sure there's nothing unique

Wesley - what were the limiting cases
1) ~~outliers~~
2) most likely to fail
3) piping isos - to identify closest support to a penetration

③ Construction of the Cont.
Anything unusual occur? about liner, reinforcing steel
What about NCRs - listed in construction reports

- Cadweld lineup at certain locations } monitoring during
- Potential void behind the liner } Cont. SIT
- + other minor NCRs - damage to rebar (not = lot)

% total hoop reinforce - how much damaged?
could be done but not in shell but mat

. Wesley - cadweld scatter ∴ did not take any reduction
majority of failures took place in bars not cadwelds
82% bar failure occurred in rebar

2c) Material Certification Reports
data to confirm strength
? Documented report of review by Tollerd. what is this
he doesn't recall
Vince - can he defend the work in a hearing

C.H. where is the official synopsis of construction of containment

Can't identify anything in nonconformance reports that would
have any effect - Woley won't effect overall P capacity
(Seabrook to look at allegation files to see if anyone
John D.? disagrees about containment
Wesley did the same. UE.C. Yankee had none
about structural capacity.
Gautam - our best approach would be to look at allegation files
Seabrook to do this - we may look too.

---

3) Integrated leak rate test - leakage was ½ allowable - they have report
any correction which had to be done?

rate of increase in pressure too low; one valve was open
once closed everything went perfectly.
ILRT was 24 hrs @ 52

leak chases behind the liner - what did they do with them
they are basically inside cont. not outside
Gautam - are there double barriers?
every area has a specific boundary for leak check.

what pressure were these tested to?

---

4. Ultimate Strength Evaluation - UE&C
Tolland: when responded to NRC request for info
UE&C did the same as for IP
describe behavior of thing to limit state (shell undergoes large deformations) - essential linear behavior of shell
then postulate structural - mechanical interaction failure mode.
with local phenomena precipitate failures
→ any failure of cont. would be considered leakage mode.
looking at details moving away from bursting mode

∴ lets see if we can get cont. to a certain level
then failure occurs at some pt beyond → limit state approach
not PRA approach

① took shell, then looked at liner, rebar yield strengths,
when ultimate cap. was calculated data (margins ok),
scrutinized shell to find what P produces deformation of shell
P (depending on T) ≈ 145 psig (They only took it to 350°)

There is a mode to go thru. Hierarchy of postulated failure modes
In terms of shell structure interactive behavior / all
mod to upligt - but restrained the way it would uplift
Interacting Modes:
① displacements in shell

Mechanical Review -

no failure mode ≤ 150 psig - they wanted to be able to say it's at least as good as this

1) looked at piping penetrations (T was important) 150 psig . 350°F - no problems

2) electrical ....

stayed within context of design basis for structural
Equip hatch, airlock, basemat - forces, moments, shears in these locations

Question - for IP shear strength would be the same
IP a little different
We have report

CH basemat has more hoop strength ∴ shear capacity would dominate

Question - did they still run into interference from structures
no - 3" gap

Ultimate Strength Evaluation - SMA
TO Develop Seismic Frag. + Cont. depressurization
Total Variability around central influence broken into randomness + uncertainty
Uncertainty - material properties, uncertainty from analytical assumption
identify failure modes assoc with overpress. - ones not looked at in design - then identify median internal Pres Capacity

Breach of cont. liner = failure (SNA)

Base case = design basis accident T°

no basis to know what max. Temp might be
∴ P capacity based on design basis pressure distribution
then capacities could be reduced by ——

2 types of failure modes
① Direct/actual P failure of the structure
② Indirect / interaction basis failure pipe penetration

Eval based on median material properties
4000 psi 28 day strength
Typical aging properties - 6500 psi = median
rebar strength - limited data on liner strength
Elongation properties - based on assumed crack propagation
4.7% failure - assumed linear stress between cracks

First looked at structure:
membrane failure
shell failure modes
discontinuity stresses
failure modes of penetrations
looked at general state of yield - 15%
Task checked for strength of the liner
Compatability between liner strains + rebar strains
what is an average crack spacing
anchors Ts or localized

These make a difference in failure mode
Resulted in average elongation capacity of 4.7%
Can't just take elongation properties of the liner itself
when it is biaxial state of stress
how much total elongation do you get —

% evaluate what total % of elongation in liner
comes from reeling
Effect of reeling is something we don't have good data for.

Bottom line of compatability:
Highly likely that elong capability of liner
would exceed the liner → rupture of rebar first

What if the liner does fracture first - average hoop strain < 3%
Ultimate P capacity = 216 psig using design basis T
Very unlikely the liner will fail - Controlling failure mode
in hoop direction in cylinder wall

Refer to calcs given Wesley on problem failure mode of
10 degree crack going from 15" to 25'
We need to convince ourselves it's O.K.

Interaction - both radial and potential vertical
Structure to structure - vertical growth doesn't
Effect it but radially leads to punching
Shear thru conc (after 6')
other place to worry about is in the piping
structure to pipe problem of punching action of
pipe into penetration

Concentrate on interference from radial growth not vertical
- Can you get these kinds of failures
What kind of penetrations
It's worse for shortness of pipe (you can develop _ loads)
They looked to see where are the pipes with the shortest support open

> Failure to isolate purg. one of most dominant in PRA

Question - what happens to air operated valves at hi P.
air op. valves fail safe?
Vince 1037 Study - when do these valves open to - which ones

Wesley - they did look at fluid head condition
One thing concerned about: Breach of liner / are you going to fail the pipe,

they looked at screening of these pipes .. situation is complicated .. They have not looked at every piping system but looked at worse cases (bounding conditions)
Computer input for BNL for Fires from UE&C

Question what about Sandia Test Results - not available before

CH - thermal load. have they come up with higher loads in accident sequences

People from T. Audit Division to talk about PRA aspects
Consequence analysis - get in touch with Fred if any more info needed

Containment has not changed from original PRA

? 2 models are CRAC 2 or MACCS
Chap 2 - 32 radial sectors vs 16 radial sectors
? compatability of data base - how can they get weather + population in compatible format?

> Fred - Source Terms important from multiple release
A. Can't make any runs w/o weather
source term reduction responsible dominant effect
Fred 2 sets of conseq parameters → need 2 separate runs
Keith Woodard: should be able to get input tapes (in Wash)
202-296-8633
5 or 6 other parameters

Noonan (John D- Lillyfield should be involved in conversation w Keith
ECO to be coordinator of exchange of info
Chap 2 population in FSAR

Garden - consideration of sheltering within 1 mi - sheltering parameters look o.k.

Fred CRAC doesn't calculate dose w/o person - BNL can do this

NRC must determine whether they want to use MACCS or CRAC.
Will have to get both. CRAC would make more sense if were comparing to CDF's
Maybe both should put decks on Tape then have a mtg

In WASH 1400 - method 1 & method 2
risk, acute fatality and latent fatality
median curves changed to mean in 2 cases

Effects of External Events & Seismic Fragility Report
Equipment Updated but not structural
Fragilities for Seabrook keyed to effective PGA

Question - have they looked at protective ways to see if they control fragility? - Relay Chatter
EDG protective relays
Effects of relay chatter not looked at in much detail
PGA - 1.7g

What are critical elements of PRA driving the results
- reduction with allowing valves to go closed with loss of air
-

Identify what fragilities are risk significant

After updating report (fragilities) results of original PRA have not changed. But will probably have an effect on latent effects
Nothing has changed - but relay chatter was identified

Look at effects of relay chatter then get back

Quantum - what are they going to do with fragility report
- will use it to update PRA next year
  L's talk this till Seabrook has made up their mind

↔

Any other significant external events?

Brookhaven to go to site - 1st week in Sept. Pow about 9/4
- will have to talk to T. Pratt - we R may have to have another meeting with him - won't involve as much exchange of ~~[illegible]~~ data.

ACRS Subcommittee to have mtg on 9/25.
also want to go to local community - end of August

V Sequence, Cont. 200, Cont bypass to be looked at by T. Pratt

Will we do any much calculations.

C. Hofmeyer:
Laundry list

- design draw struct + pen
- " specs
- " report
- UE+C ult. capacity analysis
- SMA reports " and fragility
- Capacity Report (Appendix H)
- Piping penetration analysis
- Construction Report
- Drawings showing interfaces between adj. structures → get this
- Model at the site
- SIT Test
- Material Test Reports
- Structural Analysis Model – UE+C has the best one → detail
- What is released in FSAR? - 3.8.6