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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

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Before the Atomic Safety and Licensing Board

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| In the Matter of |) | Docket Nos. 50-352-OL-2 |
| |) | 50-353-OL-2 |
| Philadelphia Electric Company |) | |
| |) | (Severe Accident |
| (Limerick Generating Station, |) | Mitigation Design |
| Units 1 and 2) |) | Alternatives) |

LICENSEE'S MEMORANDUM RELATED TO PROPOSED
DESIGN MITIGATION ALTERNATIVES FOR WHICH
AGREEMENT AMONG THE PARTIES COULD NOT BE REACHED

Introduction

In its June 9, 1989 Prehearing Conference Order, the Atomic Safety and Licensing Board (Licensing Board or Board) directed the parties to confer and determine which severe accident mitigation design alternatives (SAMDA's) they agree upon for litigation. The Board requested a stipulation as to those alternatives which the parties agreed should be litigated. As to those on which they differed, each party was directed to prepare a memorandum supporting its position, with the stipulation and memoranda to be filed by July 3, 1989.

After a number of discussions among the parties, a document entitled "Report of the Parties," was executed by the Licensee Philadelphia Electric Company (Licensee), Limerick Ecology Action (LEA) and the Nuclear Regulatory Commission (NRC or Commission) Staff, the three parties to

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the proceeding, and served upon the Licensing Board on June 30, 1989. That document contained a statement of the areas of agreement among the parties. This pleading presents Licensee's position regarding those alternatives proposed for consideration by LEA for which no agreement has been reached.

Background

By Order dated May 5, 1989, the Commission directed the Chairman of the Atomic Safety and Licensing Board Panel to convene a licensing board to conduct additional proceedings related to LEA's contention regarding SAMDA's. This action was the result of a February 28, 1989 decision by the United States Court of Appeals for the Third Circuit in Limerick Ecology Action, Inc. v. NRC, 869 F.2d 719 (3d Cir. 1989), which remanded to the NRC, inter alia, the issue of whether SAMDA's should be considered for Limerick pursuant to the National Environmental Policy Act (NEPA), 42 U.S.C. §4321 et seq.

In its May 5, 1989 Order, the Commission specifically directed this Board to limit its consideration of SAMDA's to those identified by the Appeal Board in Philadelphia Electric Company (Limerick Generating Station, Units 1 and 2), ALAB-819, 22 NRC 681, 693-94 (1985). The Commission observed that those pages contained references to NRC-sponsored studies on severe accident mitigation identified by LEA or submitted to the Licensing Board which provided basis and specificity for the contention. The

Commission limited the litigation on LEA's previously rejected contention "to those mitigation alternatives identified by the Appeal Board as being supported with the required basis and specificity" in its decision of October 22, 1985.^{1/} Thus, only those mitigation alternatives specifically discussed in the Appeal Board decision in the two pages referenced by the Commission and found by it to be described with basis and specificity are candidates for further consideration.

In discussing the basis and specificity of the contention, the Appeal Board noted LEA's reliance on the Staff's own studies, done under contract, to identify severe accident mitigation design alternatives specifically for the Limerick facility. In particular, the Appeal Board pointed to Chapter 7 of NUREG/CR-2666 "PWR Severe Accident Delineation and Assessment" (January 1983) as discussing a filtered vented containment system and containment spray system which could lower the risk from a severe accident.^{2/}

The Appeal Board also examined an NRC contract with R&D Associates (RDA) (Contract No. NRC-03-83-092) which analyzes

1/ Commission "Order" at 2 (May 5, 1989).

2/ The Appeal Board notes, however, that the authors of NUREG/CR-2666 did not include consideration of the containment spray system currently installed at Limerick. ALAB-819 at 694 n.5. The Appeal Board also pointed out that the discussion in Chapter 7 was largely qualitative rather than quantitative and no cost benefit for any design feature was performed.

the cost-effectiveness of a number of specific design features. In examining the RDA study, the Appeal Board pointed to the September 15, 1983 status report on the project as containing information on SAMDA's relating to containert heat removal, core residue capture and retention without concrete attack, and (if anticipated transient without scram events are to be mitigated) a venting system.

The Appeal Board noted that candidate components to fulfill these requirements had been selected by RDA for preliminary conceptual design and cost estimation. The Appeal Board then traced the development of the RDA project and stated that by March 15, 1984, RDA had completed the preliminary design and cost analysis for several particular mitigation systems and formulated the methodology for a quantitative value/impact analysis. The Appeal Board found that the interim material which was available to the Licensing Board at the time of its ruling on the contention in question appears to have satisfied the threshold basis and specificity requirements because "particular design changes that might be cost effective were at least identified."^{3/}

^{3/} Limerick, ALAB-819, 22 NRC at 694 (emphasis supplied). The Appeal Board noted, however, that whether such specific alternatives would ultimately prove to be cost effective was another matter which was not an appropriate inquiry at the contention-admission stage.

Thus, in accordance with the Commission's May 5, 1989 Order, only those design alternatives which were specifically mentioned by the Appeal Board in ALAB-819 would be subject to further consideration as SAMDA's. Moreover, at least a preliminary but specific description of the proposed alternative and an assertion that the benefits would exceed the associated costs would have to be provided to fulfill the requirements of basis and specificity, as stated by the Appeal Board in ALAB-819.

Explicit in the Third Circuit's remand to the Commission^{4/} was that the scope of the renewed proceeding be limited to consideration of design alternatives, i.e., physical changes to the facility to reduce the consequences of a severe accident. There is no indication that the Third Circuit or Commission meant to include consideration of broad programmatic or procedural changes or generalized training programs within the ambit of design mitigation devices. Moreover, to be considered a mitigation device, a candidate must be intended to reduce, ameliorate or remove the consequences to the public of a severe accident wherein the core is degraded or melted.^{5/} This is in contrast to

^{4/} 869 F.2d at 741.

^{5/} For example, one of the references cited by LEA in its list of references, R&D Associates, Mitigation Systems for Mark II Reactors - Preliminary Report, May 1984 (RDA-TR-127303-001) at 1-44 states that:

(Footnote Continued)

prophylactic action designed for controlling the condition of the reactor and fuel before the core is damaged or melted. The limited scope of the remand as described by the Commission should not be permitted to expand into an overall review or second-guessing of Commission safety programs. Thus, considering the criteria which a proposed SAMDA must meet to qualify for consideration herein, we now turn to the particular matters raised by LEA.^{6/}

Clearly, in accordance with the Commission's May 5, 1989 Order, LEA had the obligation to identify to the Board the proposed alternatives with specificity.^{7/} The Licensing

(Footnote Continued)

For the purposes of this study, the NRC has defined severe accident mitigation as those actions, devices or systems intended to reduce, ameliorate, or remove the consequences to the public of a severe accident wherein the core is degraded or melted.

6/ Licensee fulfilled the Commission's Order to identify SAMDA candidates by listing them in Paragraph 2 of the Report of the Parties and fleshing them out in its June 23, 1989 response to the May 23, 1989 letter of the Staff transmitting three questions related to SAMDA's. Subsequent references to Paragraph 2 and its various subsections should be understood to incorporate the specific descriptions contained in Licensee's June 23, 1989 letter.

7/ "[T]he filing of a vague, unparticularized contention, followed by an endeavor to flesh it out through discovery against the applicant or staff" is strictly impermissible. Duke Power Company (Catawba Nuclear Station, Units 1 and 2), ALAB-687, 16 NRC 460, 468 (1982), aff'd in relevant part, CLI-83-19, 17 NRC 1041 (1983).

Board need not and should not have to sift through LEA's voluminous filings and other references relating to SAMDA's to determine for itself potential SAMDA candidates. As is readily apparent, many LEA references are to entire documents, none of which LEA provided to this Board. As the Commission recently stated:

Commission practice is clear that a petitioner may not simply incorporate massive documents by reference in the basis for or a statement of his contentions. Tennessee Valley Authority (Browns Ferry Nuclear Plant, Units 1 and 2), LBP-76-10, 3 NRC 209, 216 (1976). Such a wholesale incorporation by reference does not serve the purposes of a pleading. See Commonwealth Edison Company, rev'd and remanded on other grounds, CLI-86-8, 23 NRC 241 (1986). The Commission expects parties to bear their burden and to clearly identify the matters on which they intend to rely with reference to a specific point. The Commission cannot be faulted for not having searched for a needle that may be in a haystack.^{8/}

To allow LEA to argue, as in effect it does here, that its candidate SAMDA's lie somewhere within the tomes of materials it has previously submitted or referred to, would be to create an open-ended issue bounded only by counsel's imagination.

LEA has submitted two documents containing its proposed design alternatives. The first entitled "Limerick Ecology

^{8/} Public Service Company of New Hampshire (Seabrook Station, Units 1 and 2), CLI-89-3, 29 NRC 234, 240-41 (1989).

Action, Inc. List of Primary Candidates for Severe Accident Mitigation," (List) Attachment 2 to the Report of the Parties, consists of nine subheadings. While there is considerable general discussion in each subsection, only a limited number of candidate alternatives are noted. To the extent Licensee has been able to identify them, they are reviewed herein against the criteria established by the Commission for candidate SAMDA's.

Extremely late in the period allotted by the Licensing Board, LEA sent to the Licensee and NRC Staff a list of approximately 85 items which were unfocused and repetitious and, in Licensee's view, completely contrary to the directive of the Licensing Board to narrow the issues. This was entitled "Supplemental List of Litigable Severe Accident Mitigation Alternatives for Litigation of Limerick Ecology Action, Inc. Contention on Severe Accident Mitigation Alternatives for the Limerick Nuclear Generating Station" (Supplemental List). The Licensee and Staff had, in good faith, expended considerable time and effort in responding to LEA's original list with the expectation that such efforts also involved the good faith of LEA.

Each of the matters raised in Attachments 2 and 4 to the Report of the Parties is addressed below.

Licensee's Position on the
Alternatives Raised by LEA in its "List"

Venting Filter Devices

While it is sometimes difficult to decide which specific alternatives LEA seeks to raise, LEA's discussion in this subsection alludes to an add-on filtered vented containment system and a hard pipe vent from the containment to the plant stack. Inasmuch as Licensee agrees that this alternative is within the ambit of the remand and therefore has already considered such subsystems (see Paragraphs 2d and 2e of the Report of the Parties), Licensee does not object to consideration of such alternatives to the extent they were defined with basis and specificity and considered by Licensee.

Containment Spray Flooding Modifications

The general statements in this section are impermissibly vague to provide basis and specificity for litigation of a design alternative. Moreover, the only alternatives to which LEA alludes relate to capping certain drywell spray locations and modifying the drywell spray rings so as to spray in the vicinity of openings in the reactor pedestal. LEA has not shown how this "alternative" specifically derives from any of the alternatives discussed by the Appeal Board in ALAB-819. Nor has LEA demonstrated that this "alternative" was specifically referred to in material available to the Licensing Board. For these reasons, this subsection contains no litigable alternatives.

Containment Heat Removal
Augmentation Modifications

The only potential alternative for Limerick noted in this section is an augmented suppression pool cooling function. Inasmuch as this item falls within the category of alternatives contained in Paragraph 2a of the Report of the Parties, Licensee does not object to this alternative to the extent it has been defined with basis and specificity and considered by Licensee.

Spent Fuel Pool Accident
Risk Modifications

While this subsection refers to recent studies of spent fuel risks at a BWR and a PWR, the Commission's consideration of this matter predates even the filing of an operating license for Limerick. The Commission considered the question of zircaloy fire at least as early as the Salem fuel pool proceeding.^{9/} This matter could clearly have been raised previously in support of LEA's contention, but it was not. The record is completely devoid of any request to consider spent fuel pool accidents in the context of SAMDA's (or any other context) in the Limerick docket. Certainly, it was not noted by the Appeal Board in ALAB-819.

Furthermore, LEA has further failed to show any nexus between a postulated accident in the reactor and the

^{9/} Public Service Electric and Gas Company (Salem Nuclear Generating Station, Unit 1), LBP-80-27, 12 NRC 435 (1980), aff'd, ALAB-650, 14 NRC 43 (1981).

hypothesized zircaloy fire, nor has it provided any specificity as to any accident sequence leading to such a fire. This issue is entirely without specificity and basis and cannot properly be an issue for litigation before the Licensing Board within the scope of the Commission's May 5, 1989 Order.

Human Factors Modifications
Including Procedures

This entire section does not relate to design alternatives but to human factors and procedure changes. These were not discussed in ALAB-819 and were not before the original Licensing or Appeal Boards when they considered this contention. Hence, these proposals are entirely outside the scope of the remand and should not be considered by the Board as mitigation candidates. Furthermore, no specificity is given as to how implementation of a revision to emergency operating procedures would reduce the risk nor is any attempt made to quantify the benefit or risk.

Similarly, LEA offers a general allegation that there should be plant specific procedural guidance for operators in responding to seismic events. Certainly, the Commission did not contemplate that the Licensing Board would re-examine plant procedures to respond to the Third Circuit's decision. Whether lists of relays and breakers should or should not be included in plant procedures is clearly beyond the requirements of the Commission's Order.

One human factors consideration proposed by LEA is whether control room design review and fixes for any human engineering deficiencies should be expedited. There is no showing that "human factors" had been previously raised or considered by the Appeal Board in ALAB-819. Also, this portion of the alternative is completely speculative and provides no specific basis for consideration. Like the other matters proposed in this section, no "design alternative" has been suggested. No litigable SAMDA has been raised by this section.

Seismic Modifications

This section similarly raises matters not previously brought to the attention of the Licensing or Appeal Board. There is no reason given why it could not have been raised earlier. Certainly, the Appeal Board did not discuss this matter in ALAB-819. Aside from an assertion that a particular wall should be examined for its ability to withstand a 0.9g force, there is no description of the issue.^{10/} LEA states that recent, but unnamed, studies have identified the potential for chatter of relays and states that there needs to be a plant-specific assessment to evaluate this risk. There is no specificity as to whether and how this problem affects Limerick such as to require a mitigation alternative

^{10/} This value is six times the acceleration of the safe shutdown earthquake required by the Commission's regulation as the design basis for Limerick.

to be installed. In any event, any change to the seismic design of the facility would be preventative rather than mitigative. For these reasons, this section presents no litigable mitigation candidate.

Reduction of Transient Initiator Frequency

The only matter this section seeks to raise is the proposed adoption of three new programs related to scram reduction, reliability centered maintenance and relaxation of technical specifications. None of these three programs is a design alternative, nor would any of them mitigate a core melt accident. Hence, they are not design mitigation alternatives. There is no basis for stating that any quantifiable risk would be averted should programs like this be adopted nor any specificity as to the content of the programs to be adopted. No discussion is given as to how these matters derive from alternatives discussed by the Appeal Board in ALAB-819. There is no litigable alternative within this subheading.

Reactor Vessel Depressurization
System Modifications

This section suggests the modification of the Automatic Depressurization System (ADS) at Limerick as recommended by NUREG/CR-4920, Vol. 2. Initially, LEA has failed to demonstrate how this matter derived from any of the material before the Appeal Board when it decided ALAB-819. In any event, all three of the suggested hardware changes (the modification of the ADS, the use of bottled nitrogen gas and

modification of the ADS design to permit actuation while the containment pressure is high) have been made.^{11/} Therefore, there is no issue which to litigate raised in this subsection.

Current "Best Estimate" Risk
Reduction Package for Limerick

This subsection largely repeats and summarizes the previous section of LEA's list. However, Item h appears to be a catchall which would require the Board to consider the potential need for "other fixes" presumably to be developed or given specificity and basis later by LEA. Such attempted reservation is contrary to the requirements of the Commission's May 5, 1989 Order as well as this Board's June 9, 1989 Prehearing Conference Order. There are general examples given, but no detailed description of them, no assertion that they are cost beneficial nor any showing that they are derived from material available to the Appeal Board or discussed in ALAB-819. For these reasons, no new permissible alternatives are contained within this matter.

Licensee's Position on the Alternatives
Raised by LEA in its Supplemental List

Inasmuch as this list contains merely general references and, to a large extent, duplicative citations, Licensee will respond by listing the LEA items in the left column

^{11/} This has been documented in the FSAR. See §§5.2.2.4.1, 7.3.1.1.1.2 and 9.3.1.3.

and presenting the Licensee's position in the right column for the corresponding group of suggested "alternatives." Licensee submits that, except as they coincide with the alternatives suggested by Licensee and accepted by the NRC Staff, these 85 supplemental "alternatives" do not present a single, new litigable matter before this Licensing Board.

Mode of Operation

Procedures

Neither of these alternatives involves a design alternative, nor is it clear they involve mitigation of a postulated core melt accident. The references given are merely to LEA pleadings and provide no specificity as to the modes of operation or procedures being advocated as mitigation alternatives. There is no statement as to cost beneficiality of these items or their specific application to Limerick. These items were not discussed in ALAB-819.

Alternatives described in Beyea, Jan and Von Hippel, "Nuclear Reactor Accidents: The Value of Improved Containment," Center for Energy and Environmental Studies,

The improvements in the containment that LEA wishes considered are not specified in the list provided by LEA. There has been no allegation of any applicability of any alternatives which might be contained in this document to

Princeton University
(PU/CEES Report #94),
Jan. 1980

the design of Limerick or any
assertion that they are cost
beneficial. This reference was
not noted by the Appeal Board
in ALAB-819.

Alternatives described
in NUREG/CR-0850 Nov.
1981, "Preliminary
Assessment of Core
Melt Accidents at the
Zion and Indian Point
Nuclear Power Plants
and Strategies for
Mitigating their
Effects"

The specific alternatives LEA
wishes to have considered are
completely absent from its
list. There has been no
showing that any alternative
within the cited reference
would apply to the design of
Limerick, nor any assertion
that they are cost beneficial.
This reference is not one noted
by the Appeal Board in
ALAB-819. The document
refers to Zion and Indian Point
Nuclear Power Plants, which are
pressurized water reactors
(PWR) and not to Limerick, a
boiling water reactor (BWR).
Thus, the requisite specificity
and basis does not exist to

permit consideration of this item.

Filter venting of
containment

More reliable
containment heat
removal subsystems

These items are merely general references to filtered vented containment and allegedly more reliable heat removal subsystems, with a citation to a pleading by LEA, which in turn cites a general reference to a then proposed policy statement. They completely lack specificity and any demonstrated relationship to Limerick. However, to the extent that these two items are identical to the alternatives being considered by the Licensee as described in Paragraphs 2a and 2e of the Report of the Parties, Licensee does not object to their consideration.

Alternatives under
examination in
Commission severe
accident research
program

This item represents merely
another general reference to
alternatives which may be
considered under the
Commission's accident research
program. No specific,
cost-beneficial application to
Limerick has been alleged. It
is not a reference utilized by
the Appeal Board in ALAB-819.
No litigable alternative has
been presented.

Filter vented
containments

Filter venting of the
containment - Inside
NRC vol. 5, no. 18
(Sept. 5, 1983)

Alternatives
identified in
NUREG/CR-1029,

These three items merely
provide general references
regarding filtered vented
containments. The specific
reference is to actions which
were asserted to be taken for
reactors in France and at the
Indian Point facility (PWR's)
and to a program plan to
investigate conceptual designs
for filtered vented

"Program Plan for the
Investigation of
Vent-Filtered
Containment Conceptual
Designs for Light
Water Reactors"
(Sandia, Oct. 1979)

containment. Inasmuch as the
Indian Point facility and
French reactors are of designs
different than Limerick, there
is no assertion, with
specificity, of cost-beneficial
applicability to Limerick. As
such, these items lack
specific applicability to
Limerick. Also, the given
references were not cited by
the Appeal Board in ALAB-819.
Nonetheless, to the extent that
these three items are identical
to the alternatives being
considered by Licensee as
described in Paragraph 2e of
the Report of the Parties,
Licensee does not object to
their consideration.

Various options for
core retention
identified in
NUREG/CR-2155 "A

The documents cited in these
items provide only general
references to core retention
concepts and alternatives which

Review of the
Applicability of Core
Retention Concepts to
Light Water Reactor
Containments" (Sandia,
Sept. 1981)

Variations of
filtered-vented
containment systems
(Proposed Policy
Statement on Severe
Accidents and Related
Views on Nuclear
Reactor Regulation, 48
Fed. Reg. at 16019
(April 13, 1983)

may be considered under the
Commission's accident research
program. There is no
specificity as to their
applicability to Limerick.
These references are not
mentioned in ALAB-819. LEA
provides no specificity as to
the alternatives it wishes
considered based upon the
NUREG document or Policy
Statement. These items lack
specific applicability to
Limerick and there is no
assertion that they are cost
beneficial. However, to the
extent that these two items are
identical to the alternatives
being considered by Licensee as
described in the Report of the
Parties in Paragraphs 2c and
2e, Licensee does not object to
their consideration.

Alternatives

In ALAB-819, the Appeal Board

identified in
NUREG/CR-2666, Chapter
7 "Further
Considerations of
Mitigative Features
for Specific Plants:
Limerick" in PWR
Severe Accident
Delineation and
Assessment

identified two specific
mitigation alternatives: a
filtered-vented containment
system and a containment spray
system. As the Appeal Board
noted, this NUREG reference
lacks any cost-benefit analysis
for any design feature and,
thus, Licensee submits could
not support consideration of an
alternative. In any event, as
discussed in Paragraphs 2b and
2e of the Report of the
Parties, the Licensee has
examined alternatives relating
to drywell spray and filtered
vent. To the extent that the
alternatives identified in this
NUREG contract were examined by
Licensee in detail as stated in
Paragraph 2 of the Report of
the Parties, Licensee does not
object to their consideration.

Alternatives

This is merely a general

identified in R&D
Associates reports for
Contract NRC-03-83-092

reference to alternatives
contained in the RDA contract
reports noted by the Appeal
Board in ALAB-819. It provides
no specificity and presents no
specific mitigation
alternatives or cost benefit
discussion for consideration.

Strategy to address
failure mode of
overpressure failure
with either wetwell or
drywell break
(NUREG/CR-2666, p.
7-6)

This item, "strategy to address
failure mode of overpressure
failure . . ." does not present
any design alternative for
consideration, let alone an
alternative with sufficient
basis and specificity for
litigation. The cited page in
NUREG/CR-2666 merely discusses
different possible release
categories and a statement that
any alternative to be
considered must address these
particular failure modes. This
item lacks specificity and any
supporting cost-benefit

analysis. No litigable alternative is stated.

Filtered vented
containment system
(NUREG/CR-2666, p.
7-9)

Licensee does not object to consideration of this alternative to the extent that it is already being considered by Licensee, as specified in Item 2c of the Report of the Parties.

Upgrading performance
of containment sprays
to cope with severe
environmental
conditions in accident

Licensee does not object to consideration of this alternative to the extent that it is already being considered by Licensee, as specified in Item 2b of the Report of the Parties.

Filter venting
strategies suggested

This item specifically
references NUREG/CR-2666.

by work of A.S.
Benjamin and F.T.
Harper in "Risk
Assessment of Filtered
Vented Containment
Options for a BWR Mark
I Containment"
Proceedings of the
International ANS/ENS
Topical Meeting on
Probabilistic Risk
Assessment, Sept. 1981

At pp. 7-9, that document
states that the discussion is
based upon work done for Mark I
and Mark III containments. The
additional reference given on
pp. 7-14 is to a topical
meeting whose subject was BWR
Mark I containments. Inasmuch
as Limerick is a BWR Mark II
containment, there is no
alternative stated with
specific applicability for
Limerick. To the extent,
however, that this matter is
specifically addressed by
Licensee as described in Item
2e of the Report of the
Parties, Licensee does not
object to its consideration.

Protection of
diaphragm for
sequences that lead to
containment failure
caused by diaphragm

The referenced discussion
relating to diaphragm failure
provides no specificity for a
mitigation alternative for
Limerick. Its applicability to

failure by modifying
the region under the
reactor vessel
(NUREG/CR-2666, p.
7-12)

any plant is speculative in
that the modification should be
considered only "if existing
drains do not supply a
sufficient path." LEA has
failed to provide sufficient
specificity describing
any cost-beneficial
"alternative" to be considered
or its nexus to the Limerick
design.

Heat removal from
containment by low
volume flow
vent-filtered system,
heat pipe or
containment spray
system (NUREG/CR-2666,
p. 7-13)

Licensee has no objection to
this item to the extent it
addresses consideration of a
vented filtered system or a
containment spray system,
as specifically described in
Report of the Parties at
Paragraph 2b and 2e and has
already been considered by
Licensee. To the extent it
addresses a "heat pipe,"
this "alternative" is not
supported with specificity by

the reference and has not been asserted to be cost-beneficial. Nor is it one of the items noted by the Appeal Board in ALAB-819 as having a basis in NUREG/CR-2666.

Increased reliability of suppression pool cooling with system that could be driven from outside containment, and closed loop heat exchange process

While Licensee does not believe that this alternative is described in sufficient detail or supported with specificity in the referenced NUREG, it does not object to its consideration to the extent it coincides with the separate, independent dedicated system for transferring heat from the suppression pool used in conjunction with the drywell spray alternative being considered by Licensee. See Report of the Parties at Paragraph 2a.

High-volume
vent-filter or high
capacity sprays "if
operated in a timely
manner," thus
requiring procedural
alternatives to assure
timely spray operation

Measures to assure
core debris bed
coolability within
pedestal, including
e.g., rubble bed,
suitable flow passages
in pedestal wall, and
measures identified by
Swanson in "Core Melt
Materials Interaction
Evaluation" Annual
Progress Report April
1980 to March 1981,
ASAI Report No. 81-001

While the alternatives which
LEA wishes to have considered
are not described with any
detail, to the extent they are
already being considered by
Licensee, it does not object.
See Report of the Parties at
Paragraphs 2b and 2e.

Licensee objects to
consideration of this item as a
SAMDA. The only reference
given, NUREG/CR-2666, provides
no specific design. Nor is
there even an assertion that
these items are
cost-beneficial. To the extent
this alternative coincides with
those being considered by the
Licensee as described in
Paragraph 2c of the Report of
the Parties dealing with core
debris control, Licensee does
not object to such

consideration.

Alternatives
identified in
NUREG/CR-3028 "A
Review of the Limerick
Generating Station
Probabilistic Risk
Assessment"

Alternatives
identified in
NUREG/CR-3299, "Core
Melt Materials
Interactions
Evaluation"

Alternatives
identified in
NUREG/CR-2182 "Station
Blackout at Browns
Ferry Unit 1 - Iodine
and Noble Gas

No specificity is given in its listing as to the alternatives LEA seeks to litigate before the Licensing Board. There has been no showing that any alternatives which may be identified have specific applicability to Limerick. Nor is there any assertion that any of them are cost-beneficial for Limerick. These items do not raise any specific alternative applicable to Limerick and thus are not suitable for litigation. The citations are not to any utilized by the Appeal Board in ALAB-819.

Distribution and
Release" (Sept. 1982)

Alternatives
identified in
NUREG/CR-2672 "SBLOCA
Outside Containment at
Browns Ferry Unit 1 -
Accident Sequence
Analysis" (November
1982)

Alternatives
identified in
NUREG/CR-2973 "Loss of
DHR Sequences at
Browns Ferry-Unit 1
Accident Sequence
Analysis" (May 1983)

Alternatives
identified in R&D
Monthly Project Status

LEA has not herein specified
the specific alternatives it
wishes considered, but merely

Reports Contract

NRC-03-83-092

references 18 pages from various progress reports relating to this particular NRC contract. This is a catchall item as evidenced by the fact that the next several dozen proposed alternatives derive from the same source. However, to the extent these alternatives were specifically considered and examined in the final RDA report with specificity both as to cost and as to the benefits to be derived (Mitigation Systems for Mark II Reactors RDA-TR-127303-001), Licensee does not object to their consideration. In fact, the alternatives being examined by Licensee contained in Paragraph 2 of the Report of the Parties were based upon such material.

Water cooled crucible
core retention device

Flooded thoria rubble
bed core retention
device

Water cooled
refractory tiles core
retention device

Pebble-bed covering
cooling coils core
retention device

High-alumina cement
covering cooling coils
core retention device

Magnesium dioxide
covering cooling coils
core retention device

Zirconium dioxide
covering cooling coils
core retention device

These items are based upon a list of alternatives which RDA prepared as to types of proposed mitigation systems. But according to RDA, "[n]o classification was made as to feasibility, effectiveness or cost of the proposed systems." Inasmuch as there is no stated basis for asserting that these devices may be feasible, effective or cost-effective for Limerick, they cannot form the basis of a contention related to SAMDA's. To the extent these alternatives were later examined by RDA and included in its final report with costs and benefits related to Limerick discussed with reasonable specificity, Licensee does not object to the consideration of those alternatives. As discussed in the preceding item, some of these alternatives as refined

Graphite covering
cooling coils core
retention device

Borax bath (thick
layer of borax bricks
sealed in stainless
steel, covering the
bottom of the reactor
cavity) core retention
device

Heavy metal bath
(lead, uranium, or
copper)

Iron oxide (layer of
iron oxide over
cooling coils)

Basalt concrete and
basalt rubble bed core
retention drive

Sand core retention
system

by RDA and discussed in its
report on its activities
related to Limerick form the
basis

for Licensee's review of
alternatives as contained in
Paragraph 2 of the Report of
the Parties. Certain of the
suggested alternatives are
clearly not applicable to
Limerick, such as the suggested
alternative of underground
siting of the containment
vessel. See JA at 170.
Furthermore, one of the
alternatives suggested,
increased volume of containment
building, is specifically
stated as applicable only
to new designs and thus not
Limerick. See JA at 170.

Iron core retention
system

Flooded cavity (water
added to flood entire
cavity to vessel for
core material to be
kept dispersed enough
to remain quenched)

Other active cooling
systems (special
jackets and piping
system in and around
the reactor vessel
with intention of
retaining the molten
core within the
reactor vessel)

Alternatives for
overpressure control
from hydrogen or
hydrogen burning,
including oxygen
exclusion, oxygen

removal, oxygen
dilution, igniters,
fans

Overpressure control
from attack on
concrete including
special concrete
composition of reactor
cavity and basemat to
limit release of
noncondensable gases
on core-concrete
attack, and thin
basemat composition

Overpressure control
by venting the
containment building
with vent to tall
stack, vent to
receiver (another
large, closed building
to provide larger
total expansion volume
and greater cooling)
and vent to

condenser-filter such
as sand beds, gravel
beds, scrubbers,
gravel/sand, water
pools, sand filters,
charcoal filters,
chemical scrubbers,
all in various
combinations

Overpressure control
by containment heat
removal with heat
pipes, modified heat
pipes, heat
exchangers, spray
coolers, fan coolers,
secondary suppression
pool, and more
reliable residual heat
removal system by
increasing redundancy
and ruggedness of RHR
system

Containment protection
against missiles -

various structures
designed to protect
the containment
penetrations or walls
against flying debris
or thrashing piping
inside containment

Special containment
structures such as
underground siting of
containment vessel,
berm shield, double
containment,
containment strength
improvements of
pressure ratings,
increased volume of
containment building,
and strengthen safety
systems by means of
armor, bunkers, and
heavier construction

Fission product
removal systems such
as enhanced

containment spray
systems, and gas
treatment system
(special recirculating
treatment system to
remove fission
products from the
containment gas
volume)

Alternatives
identified in
documents identified
in Appendix A to NRC
Response to FOIA
83-432, documents 1-38

This item is another catchall.
It attempts to raise
alternatives purportedly
identified in some 38 documents
provided in response to a
Freedom of Information Act
request in 1983. To Licensee's
knowledge, the 38 referenced
documents were not transmitted
to either the Licensing or
Appeal Boards. They certainly
were not discussed in ALAB-819.
LEA has failed to identify any
specific alternatives within
these references applicable to

Limerick. There is no assertion that these alternatives have been analyzed in detail and found to be cost-beneficial for Limerick.

Alternatives
identified in LEA
Contentions on the
Environmental
Assessment of Severe
Accidents as Discussed
in the NRC Staff DES,
Supp. 1

This is a general reference to two LEA pleadings. Licensee has been unable to determine a single mitigation alternative stated therein let alone any with the requisite basis and specificity or supporting cost-benefit analysis. These matters were not referenced in the Appeal Board's discussion in ALAB-819. No litigable alternative is presented.

Alternatives
identified in R&D
Associates Monthly
Project Status Reports

This is a blanket reference to a number of monthly reports related to the RDA contracts. These matters have already been

NRC Contract NRC
03-83-092 and other
documents attached to
EA Statement of
Significance of NRC
Severe Accident
Mitigation Systems
Contract Documents to
LEA Contention DES-5

discussed. No specific,
cost-beneficial alternatives
are identified. This item
therefore provides no basis for
consideration of any specific
alternative.

Alternatives
identified in "State
of the Art of Reactor
Containment Systems,
Dominant Failure
Modes, and Mitigation
Opportunities," Jan.
1984

These alternatives relate to a
specific reference, "State of
the Art of Reactor Containment
Systems, Dominant Failure Modes
and Mitigation Opportunities."
The first item is merely a
general reference and presents
no specific, cost-beneficial
alternatives for consideration
by the Licensing Board. The
next two items relate to
operator action, which as
previously discussed, is not a
design alternative. In any
event, the descriptions are too

"Operator action" as
part of a "containment
mitigation system,"
defined as a
cooperative
combination of

devices, subsystems,
and components:

"operator action can
be a part of such a
system" and "operator
action or modification
of existing equipment
can possibly perform
as well as dedicated
hardware in some cases
and at lower cost."

"State of the Art of
Reactor Containment
Systems, Dominant
Failure Modes, and
Mitigation
Opportunities," Jan.
1984 Final Report, p.
1-5

"Operator action can
play an important role
in accident mitigation
providing there is
enough time. Such a
strategy could
potentially be much

general to qualify for
consideration as a specific
cost-beneficial design
alternative. Neither were
these references discussed in
ALAB-819. No specific SAMDA is
raised by any of these items.

more cost effective
than dedicated
automatic systems with
fail-safe initiating
methods [I]t
is obvious that
changes in current
operating procedures
both inside the
plant . . . and
outside . . . may
offer cost-effective
reductions in risk."

Alternatives Identified in Documents
Identified to ASLB/ALAB

| | |
|---|---|
| Containment heat removal (energy removal through containment heat removal - active or passive) | As admitted in LEA's heading for this section, these alternatives were discussed in documents identified to the Licensing Board and the Appeal Board, but not provided to them. Certainly, the Appeal Board did not refer to or rely on these references in |
| Containment-atmosphere removal (energy | |

removal through
containment -
atmosphere removal -
filtered vented
containment systems)

Increased containment
volume (energy
dilution through
increased containment
volume)

Suppression of the
burning of hydrogen
and other combustible
gases-energy-release
control through
suppression of burning
(e.g., adding inert
gases, Halon, water
mists)

Controlled burning of
hydrogen and other
combustible gases
(energy release
management through

ALAB-819. Most assuredly, the Commission's adjudicatory boards are not required to search out references to support an intervenor's contention. See p. 7, supra. For this reason, these items need not be considered by the Licensing Board. These items present only a very sketchy outline of suggested alternatives with no specificity as to design features or discussion of their cost-beneficial nature. The reference given, NUREG-0850, discusses hypothetical core melt accidents at Zion and Indian Point nuclear power plants. No nexus between those plants (their potential accident scenarios or potential SAMDA's) and Limerick is demonstrated. For these reasons, no viable alternative for consideration is given. To the extent that these general

controlled burning of hydrogen and other combustible gases, e.g., ignition systems)

Core retention devices- energy release control and core mass management through core retention devices (core catchers, core ladle, cavity flooding, and active and passive cooling)

Missile shields - kinetic energy dissipation of missiles

Strengthening of containment structures- energy absorption enhancement

statements of alternatives have been specified by the Licensee and considered in its evaluation as described in Paragraph 2 of the Report of the Parties and as specified in its June 23, 1989 reply to the Staff's three questions, Licensee does not object to their consideration.

For example, containment heat removal is specified in Paragraph 2a of the Report of the Parties.

Containment atmosphere removal is a general statement of a filtered vented device considered by Licensee. See Paragraph 2e of the Report of the Parties. The item related to increased containment volume appears not to be viable for a facility already constructed such as Limerick. The item related to suppression of the burning of hydrogen and other

through strengthening
of containment
structures

combustible gases, while it may be applicable to a PWR, is not applicable to a Mark II BWR containment which is inerted during operation. Core retention devices have been considered by the Licensee and, to the extent discussed in Paragraph 2c of the Stipulation, Licensee does not object to consideration of that alternative. Except as specifically stated to the contrary, these items do not present viable alternatives for consideration by the Licensing Board.

Containment heat
removal alternatives
such as heat pipes
with input surface in
the drywell region and
discharge surface to
the atmosphere

These items represent another generalized listing of alternatives examined by RDA under one of its contracts. LEA goes as far as to utilize references out of the cited RDA report and assert they present

outside, cold water spray condensers in the drywell, or surface-type heat exchangers to cool suppression pool water

Containment venting of clean steam and nitrogen directly to surroundings and venting smaller quantities of contaminated steam and gas through condensers and filter beds.

Options also include those examined by Murfin, NUREG/CR-1410, "Report of the Zion/Indian Point Study: Vol. I, 1989, Levy, "Review of Proposed Improvements, Including Filter/Vent of BWR Pressure - Suppression . . ."

additional sources that the Licensing Board should examine in an attempt to ferret out litigable alternatives. In addressing these candidate mitigation devices, the authors of the RDA report state that not all of the categories noted by LEA are "necessarily justified in view of their cost v. risk averted. Before specific systems can be selected, each component must be assessed for practicality, reliability, availability and risk reduction effectiveness at a specific site." (R&D Associates, State of the Art of Reactor Containment Systems, Dominant Failure Mode and Mitigation Opportunities Final Report (January 1984) at 3-42). Thus, there is no specificity and basis given for these alternatives nor any basis for assuming that these generalized alternatives would have any

EPRI NP-1747, Ahmad, et al., NUREG/CR-2666, "PWR Severe Accident Delineation and Assessment," and Reilly, "Conceptual Design of Alternative Core Melt Mitigation Systems for a PWR with an Ice-Condenser Containment"

NUREG/CR-3068 (1982) [note that the Reilly study described as including designs suitable for the Mark II]

Core retention or debris control

Combustible gas control - while H2 control is provided in Mark II by deinerting containment with nitrogen, additional

specific applicability to Limerick or that they would be cost-beneficial. Again, to the extent these items have been considered by Licensee as described in Paragraph 2 of the Report of the Parties, Licensee has no objection to their consideration.

measures for hydrogen control may be needed (Papazoglou, NUREG/CR-3028 cited) to reduce the danger of flammability during service deinerting

Increased containment mass holding capability with increased volume, increased pressure capability, improved pressure suppression capability

Protection for containment penetrations

Vent-filtered containment options described throughout the document

This item is a general reference to vent filtered containment conceptual designs within a program plan developed

under contract with the NRC and would require the Licensing Board to examine the reference, NUREG/CR-1029, to divine whether there are any specific, cost-beneficial alternatives applicable to Limerick. Clearly, this item does not state a SAMDA suitable for litigation in this proceeding.

Alternatives Identified in or Suggested by Documents Published After the Denial of the LEA Contention

| | |
|---|---|
| Modifications to reduce seismic risk | This category as defined by LEA runs contrary to the specific requirements of the Commission that the alternatives be specified by the Appeal Board in ALAB-819. For this reason, all of these alternatives are defective and should be excluded from further consideration. Even more importantly, each of the items merely refers to alternatives discussed generally within referenced documentation |
| Safety assurance program | |
| Alternatives identified in NUREG/CR-3908, "Survey of the State of the Art in Mitigation Systems," July 1984 | |
| Alternatives | |

identified in
NUREG/CR-4920,
"Assessment of Severe
Accident Prevention
and Mitigation
Features: BWR Mark II
Containment Design
NOTE: These include
plant features and
operator
action/procedures

Alternatives
identified in
NUREG/CR-4244,
"Strategies for
Implementing a
Mitigation for Light
Water Reactors,"
January 1988

Alternatives
identified in Boston
Edison Co., "Report
Pilgrim Station Safety
Enhancements" as
revised NOTE: these

without specificity, without a
description of the
applicability of these items to
Limerick and without any basis
for finding that any
alternative would be
cost-beneficial for Limerick.
The reference to the safety
assurance program clearly goes
beyond examinations of design
alternatives. One of the
alternatives suggested herein
refers to BWR 6 "Advance
Reactor Design." There is no
showing that any such
alternative would be
cost-beneficial or even
applicable to Limerick.
Moreover, the final item in
this category talks about
operational alternatives and
not design alternatives.
Accordingly, these suggested
alternatives should not be
considered by the Licensing
Board.

alternatives include
both physical and
operational plant
changes

Supplemental
containment system and
other modifications as
proposed and installed
for the Shoreham
Nuclear Power Station

Alternatives suggested
by the GESSAR II/BWR 6
"advanced reactor
design"

Alternatives
identified in
NUREG/CR-4243,
"Value/Impact Analysis
for Evaluating

Alternative Mitigation
Systems," January 1988

Alternatives

identified in
NUREG-1150, "Reactor
Risk Reference
Document," 1987

Operational
alternatives
identified or
suggested by
NUREG/CR-4177,
"Management of Severe
Accidents," May 1985

Alternatives
identified in
NUREG/CR-4025, "Design
and Feasibility of
Accident Mitigation
Systems for Light
Water Reactors,"
August 1985, see esp.,
pp. 3-24 to 3-77

Conclusion

For the foregoing reasons, only the specific SAMDA's which are being considered by Licensee as described in Paragraph 2 of the Report of the Parties and as further specified in its June 23, 1989 answer to the NRC's questions of May 23, 1989 need and should be given further consideration by the Licensing Board.

Respectfully submitted,

CONNER & WETTERHAHN, P.C.

A handwritten signature in cursive script, appearing to read "Mark J. Wetterhahn".

Troy B. Conner, Jr.
Mark J. Wetterhahn
Counsel for Licensee

July 3, 1989

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

In the Matter of)
)
Philadelphia Electric Company) Docket Nos. 50-352
) 50-353
(Limerick Generating Station,)
Units 1 and 2))

CERTIFICATE OF SERVICE

I hereby certify that copies of "Licensee's Memorandum Related To Proposed Design Mitigation Alternatives For Which Agreement Among The Parties Could Not Be Reached," dated July 3, 1989 in the captioned matter have been served upon the following by deposit in the United States mail this 3rd day of July, 1989:

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