UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the matter of CONSOLIDATED EDISON COMPANY OF NEW YORK, INC. (Indian Point, Unit No. 2) POWER AUTHORITY OF THE STATE OF NEW YORK (Indian Point, Unit No. 3)	Docket Nos. 50-247 SP 50-286 SP 2 December 1982

UCS/NYPIRG RESPONSE TO LICENSEES'
INTERROGATORIES AND DOCUMENT REQUESTS UNDER
COMMISSION QUESTIONS TWO AND FIVE TO INTERVENORS

Introduction

Pursuant to Board Order dated , UCS/NYPIRG hereby files the following responses to Licensees' interrogatories under Commission questions two and five, dated 18 July 1982.

Response to Interrogatories 1-7

In its Memorandum and Order dated 15 November 1982, the Board eliminated UCS/NYPIRG Contention III(A)(d), which the Board had renumbered as Contention 2.1(b), from the proceeding [see Memorandum and Order (Formulating Final Contentions and Setting Schedule), dated 15 November 1982, pages 9-10]. Thus, a response by UCS/NYPIRG to Licensees' interrogatories 1-7 is no longer required.

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Response to Interrogatories 8-23

In its Memcrandum and Order dated 15 November 1982, the Board eliminated Contention III(A)(g), which the Board had renumbered as Contention 2.1(c), from the proceeding. Thus, a response by UCS/NYPIRG with respect to core catchers in responding to Interrogatory Nos. 8-23 is no longer required. Responses to Interrogatories 8-23 with respect to UCS/NYPIRG Contentions III(A)(f) and III(A)(h), which the Board had renumbered as Contention 2.1(a) and Contention 2.1(b), are provided below.

Response to Interrogatory 8

Licensee's interrogatory 8 states as follows:

> "Describe in detail the types of each of the following devices which should be installed at Indian Point, state the ground for the contention that each such device should be installed, quantify the risk to the public health and safety which exists in the absence of installation of each such device, and quantify the reduction in risk which each would achieve:
>
> a. filtered, vented containment system;
>
> b. "core-catcher"; and
>
> c. separate containment structure."

The Nuclear Regulatory Commission sponsored an evaluation of alternative containment concepts in 1978 [NUREG/CR-0165, SAND77-1344, "A Value-Impact Assessment of Alternate Containment Concepts", David D. Carlson and Jack W. Hickman, Sandia Laboratories, June 1978, available from NRC Public Document Room, 1717 H Street, N.W., Washington, D.C., 20555]. The study evaluated the following concepts:

> 1. Increase containment design pressure through structural strengthening of traditional surface containments;

2. Increase containment design pressure by constructing containments underground by either shallow or deep burial;

3. Increase free containment volume;

4. Vent containment gases through a filtered venting system;

5. Compartment venting (vent containment gases to a separate, stand-by containment structure);

6. Decrease thickness of basement to assure early meltthrough failure as source of containment pressure relief;

7. Condensation of steam by use of an ice condenser;

8. Condensation of steam by use of a pressure-suppression pool;

9. Evacuated containment (inhibits hydrogen combustion by maintenance of a low oxygen inventory in containment); and

10. Double containment.

Of these concepts, UCS/NYPIRG finds 1, 2, 3, 6, 7, 8, 9, and 10 to be either impractical because they could not be backfit to an existing facility, because they would be prohibitively expensive to backfit to an existing facility, or because they would not substantially reduce risk. Thus, UCS/NYPIRG focused on options 4 and 5 which are represented as Contentions 2.1(a) and 2.1(d), respectively. Sandia concluded that the filtered venting system could be constructed for "a few million dollars" (NUREG/CR-0165, page 42). This is in line with other estimates; Gossett, et. al., estimated the cost for a PWR at $1.05 million in 1977 dollars (UCLA-ENG-7775, page 6-1). Sandia estimated the cost of a compartment venting system to be "on the order of $20 - $40 million" (NUREG/CR-0165, page 43).

Sandia evaluated the effect of these options on five containment failure modes: (a) vessel steam explosion; (b) containment leakage; (c) hydrogen burning; (d) overpressure; and (e) meltthrough of the basemat. For the filtered venting system option, Sandia concluded as follows:

a. Vessel steam explosion is unaffected by filtered venting;

b. Containment leakage is unaffected by filtered venting;

c. Hydrogen burning is eliminated unless active components fail;

d. Overpressure is eliminated unless active components fail; and

e. Meltthrough of the basemat is increased in likelihood by filtered venting.

For the compartment venting, Sandia concluded as follows:

a. Vessel steam explosion is unaffected by compartment venting;

b. Containment leakage is unaffected by compartment venting;

c. Hydrogen burning is eliminated unless active components fail;

d. Overpressure is eliminated unless active components fail; and

e. Meltthrough of the basemat is increased in likelihood by compartment venting.

Thus, Sandia concluded that filtered venting and compartment venting would have the same impacts. UCS/NYPIRG disagrees with the Sandia assessment, however, in the following respects. We disagree that containment leakage is "unaffected" by filtered venting. If a leak develops which is causing the release of iodines, particulates, and aerosols to the environment, it would appear to be quite feasible for operators to manually initiate filtered venting. This would result in a noble gas release which might be substantially larger than if the leakage is allowed to persist, but the release of iodines, pa-ticulates, and aerosols would be reduced because substantial quantities of these materials would be diverted to the filters in the filtered venting system. Although this does not affect the probability of containment leakage, filtered venting appears to have the capability to reduce the quantity of iodines, particulates, and aerosols released to the environment, thus affecting the consequences of such an event.

We also disagree that vessel steam explosion is "unaffected" by filtered venting. Prior to vessel steam explosion a portion of the source term will have been released into containment because of core damage. This portion of the source term will be available for release to the environment if a vessel steam explosion fails the containment. Operator action to manually initiate filtered venting could reduce this portion of the source term by eliminating most of the iodines, particulates, and aerosols. Thus, although filtered venting does not affect the probability of a vessel steam explosion, it would appear to have the capability to reduce the quantity of materials released to the environment, thus reducing the consequences of a vessel steam explosion accident.

If a vessel steam explosion does not fail the containment immediately, filtered venting could be utilized to further reduce the source term from this accident. Thus, UCS/NYPIRG believes filtered venting may be useful for vessel steam explosion accidents.

Similarly, UCS/NYPIRG believes compartment venting may also be useful for vessel steam explosion and containment leakage containment failure modes. Pressure relief into the stand-by containment structure could be terminated when pressure is equalized between the main containment and the stand-by containment, thus trapping a portion of the source term in the stand-by containment. This would not affect the probability of these failure modes, but would appear to have the capability of reducing the consequences from such events.

UCS/NYPIRG notes further that if the stand-by containment is equipped with a spray system or ice-condenser system, further pressure reduction and further source term reductions may be achieved. Indeed, this is envisioned by Sandia in NURE/CR-0165; this would permit the construction of a much smaller stand-by containment than if extra volume alone is relied upon. In addition, a dedicated diesel generator power source and redundancy in the spray system would increase likelihood of success in this regard. This is discussed briefly in NUREG/CR-0165 at pages 28-29.

UCS/NYPIRG notes that while the likelihood of basemat meltthrough is increased by the use of filtered venting and compartment venting, the consequences of basemat meltthrough could be reduced because a portion of the source term that might otherwise be available for release to the liquid pathway could be diverted to the stand-by containment or the filtered vent. This may increase the atmospheric release of noble gases, but appears to have the capability to reduce the liquid pathway source term. It should be noted that basemat meltthrough is predicted to result in a PWR-6 release category, contrasted with the PWR-2 or PWR-3 release category associated with above-ground containment failure resulting from overpressure or hydrogen burning (NUREG/CR-0165, page 32).

Although the uncertainties are large, the following analysis carried out by some of the authors of WASH-1400 indicates the relative risk of a PWR-2 or PWR-3 release category versus a PWR-6 release category at a probability of one in a billion per reactor year (NUREG-0340, I.B. Wall, et. al., "Overview of the Reactor Safety Study Consequence Model", October 1977, available in NRC's Public Document Room):

RELEASE CATEGORY	EARLY FATALITIES	TOTAL LATENT FATALITIES	DAMAGE ($\$10^9$)
PWR-2	1,000	18,750	10
PWR-3	300	18,750	10
PWR-6	0	360	0.1

Sandia attempted to quantify the risk reduction associated with filtered venting and compartment venting. UCS/NYPIRG notes that the Sandia analysis is based on the results of the Reactor Safety Study (WASH-1400); UCS/NYPIRG has already stated in some detail is concern about the accuracy of these results, particularly with respect to their dependence upon accurate determinations of probability (see "UCS/NYPIRG Response to Licensees' First Set of Interrogatories Under Commission Question One", July 23, 1982, pages 1-5). Licensees may refer to NUREG/CR-0165, pages 32-33 and 39-41 for Sandia's analysis. UCS/NYPIRG draws Licensees' attention to Sandia's conclusion that allowing a failure rate of 1:100 for the filtered venting and compartment venting systems did not noticeably affect their risk results.

In summary, Sandia concluded that both filtered venting and compartment venting result in "significant potential risk reduction" for both early fatalities and latent cancer fatalities. If the "expected value" (mean) and the "maximum calculated value" of early fatalities and latent cancer fatalities are normalized to a value of 1 for "current surface plants", filtered venting and compartment venting were predicted by Sandia to result in the following relative values (NUREG/CR-0165, page 40):

	EARLY FATALTIES MEAN	EARLY FATALTIES MAXIMUM	LATENT EFFECTS MEAN	LATENT EFFECTS MAXIMUM
Current Plants	1.00	1.00	1.00	1.00
Filtered Venting	0.08	0.29	0.11	0.43
Compartment Venting	0.08	0.29	0.11	0.43

The risk which exists in the absence of the filtered venting system and the compartment venting system is well-known to the Licensees. In addition to the Licensees' own IPPSS study, the Licensees have been provided with the CRAC calculations performed by the NRC staff (from which can be extracted CCDF curves from which comparisons can be made using the above reduction factors). UCS/NYPIRG has not yet done this comparison although we expect to do so in preparation for the hearings. In addition, the NRC has made available the conditional consequence output from the CRAC2 code used in the Sandia siting study (NUREG/CR-2239, SAND81-1549, "Technical Guidance for Siting Criteria Development", D.C. Aldrich, et. al., Sandia National Laboratories, November 1982, available in the NRC's Public Document Room, as is the computer printout; you may contact Lynn Calvin at the PDR to request this material).

Finally, UCS/NYPIRG notes that a filtered venting system is planned for the Clinch River Breeder Reactor Plant in Oak Ridge, Tennessee. In addition, the Swedish government has mandated the installation of a filtered venting system at the Barseback reactor station in Sweden. Some discussion of the Clinch River system is available in NUREG-0139, Supplement No. 1, "Supplement to Final Environmental Statement Related to Construction and Operation of Clinch River Breeder Reactor Plant", U.S. Nuclear Regulatory Commission, October 1982. The system is briefly discussed in Appendix J of this report. UCS/NYPIRG is aware of no documents which discuss the Clinch River system in detail; we are attempting to secure such documents and will notify Licensees of any reports obtained in this regard. A report which describes the Barseback system is listed as reference 17 in response to interrogatory 9, below.

Response to Interrogatory 9

Licensee interrogatory 9 states as follows:

> "Provide all documents which contain and/or pertain to analyses regarding reduction in risk resulting from installation of the devices described in Interrogatory No. 8, and state whether and to what extent the installation of such devices could increase risk under any circumstances."

UCS/NYPIRG has identified the following documents as being responsive to Licensees' interrogatory 9:

1. UCLA-ENG-7775, B. Gossett, et. al., "Post-Accident Filtration as a Means of Improving Containment Effectiveness", UCLA School of Engineering and Applied Science, December 1977, available from UCS.

2. NUREG/CR-2228, BNL-NUREG-51415, W.T. Pratt and R.A. Bari, "Containment Response During Degraded Core Accidents Initiated by Transients and Small Break LOCA in the Zion/Indian Point Reactor Plants", Brookhaven National Laboratory, July 1981, a copy of which has either been served upon the licensees or is available from NRC's Public Document Room.

3. NUREG/CR-2549, SAND82-0324, Thomas E. Blejwas, et. al., "Background Study and Preliminary Plans for a Program on the Safety Margins of Containments", Sandia National Laboratories, May 1982, available from the NRC's Public Document Room.

4. NUREG/CR-2155, SAND81-0416, John L. Darby, "A Review of the Applicability of Core Retention Concepts to Light Water Reactor Containments", Sandia National Laboratories, September 1981, available from the NRC's Public Document Room.

5. NUREG/CR-2569, LA-9301-MS, T.A. Butler and L.E. Fugelso, "Response of the Zion and Indian Point Containment Buildings to Severe Accident Pressures", Los Alamos National Laboratory, May 1982, a copy of which has either been served upon the licensees or is available in the NRC's Public Document Room.

6. NUREG-0850, Vol. 1, Office of Nuclear Reactor Regulation, U.S. NRC, "Preliminary Assessment of Core Melt Accidents at the Zion and Indian Point Nuclear Power Plants and Strategies for Mitigating Their Effects: Analysis of Containment Building Failure Modes", November 1981, a copy of which has either been served upon the Licensees or is available in the NRC's Public Document Room.

7. NUREG/CR-1409, SAND80-0617, Walter B. Murfin, "Summary of the Zion/Indian Point Study", Sandia National Laboratories, April 1980, available in the NRC's Public Document Room.

8. NUREG/CR-1410, SAND80-06176/1, W.B. Murfin, "Report of the Zion/Indian Point Study, Volume 1", Sandia National Laboratories, August 1980, available in the NRC's Public Document Room.

9. NUREG/CR-1411, LA-8306-MS, M/G. Stevenson, compiler, "Report of the Zion/Indian Point Study, Volume II', Los Alamos Scientific Laboratory, April 1980, available in the NRC's Public Documennt Room.

10. PU/CEES Report #94, Jan Beyea and Frank von Hippel, "Nuclear Reactor Accidents: The Value of Improved Containment", Center for Energy and Environmental Studies, Princeton University, January 20, 1980, available from UCS.

11. Jan Beyea and Frank von Hippel, "Containment of a Reactor Meltdown", Bulletin of the Atomic Scientists, August/September 1982, pages 52-59, available in many public libraries and technical libraries.

12. NUREG/CR-0165, SAND77-1344, David D. Carlson and Jack W. Hickman, "A Value-Impact Assessment of Alternate Containment Concepts", Sandia Laboratories, June 1978, available in the NRC's Public Document Room.

13. NUREG/CR-1029, SAND79-1088, Allan S. Benjamin, "Program Plan for the Investigation of Vent-Filtered Containment Conceptual Designs for Light Water Reactors", Sandia Laboratories, October 1979, available in the NRC's Public Document Room.

14. Michael B. Weinstein, "Primary Containment Leakage Integrity: Availability and Review of Failure Experience", Nuclear Safety, Vol. 21, No. 5, September-October 1980, pages 618-632, available in most technical libraries or from UCS.

15. R.S. Dennning and P. Cybulskis, "Reduction in Reactor Risk by the Mitigation of Accident Consequences', Nuclear Safety, Vol. 22, No. 2, March-April 1981, pages 165-172, available in most technical libraries or from UCS.

16. SAND80-0887, A.S. Benjamin and H.C. Walling, "Development and Analysis of Vent-Filtered Containment Conceptual Designs", Sandia National Laboratories, undated, available in NRC's Public Document Room.

17. K. Johansson, et. al., "Design Considerations for Implementing a Vent-Filter System at the Barseback Nuclear Power Plant", FILTRA LOG NO. 255, paper intended for presentation at the International Meeting on Thermal Nuclear Reactor Safety, August 29-September 2, 1982, Chicago, Illinois, available from UCS. The authors are affiliated with Studsvik Energiteknik, ASEA-ATOM, and Sydkraft in Sweden.

Regarding a possible increase in risk due to operation of filtered venting or compartment venting systems, this issue was discussed by Beyea and von Hippel (reference 11 above) with respect to filtered venting, and they stated the following:

> "The possibility of early venting is two-edged, however, because it requires a judgment that nothing else can be done to prevent a major release of radioactivity. That judgment might be wrong or the filtered venting system might even operate accidently. The resulting releases would be dominated by the non-filterable radioactive noble gases which would contribute about one-thousandth of the cumulative radiation dose from an uncontained meltdown accident. The Commission's safety concern about filtered venting, therefore, focuses on the fact

> that a filtered venting system, while offering some protection against large releases of radioactivity to the atmosphere would also increase by an uncertain amount the frequency of public exposure to very much smaller releases."
>
> "This concern is akin to the one about automobile seat belts -- that by slowing a passenger's escape from a vehicle in some accident situations, a seat belt could contribute to rather than prevent a death. But seat belts, as we know from statistics, save vastly more lives than they endanger. In the case of reactor core meltdown accients we (fortunately) have no statistics yet. The Commission will, therefore, have to make a careful judgment. It seems likely that the final conclusion will be that, for a well-designed system, the reduction in the risks of large releases will greatly exceed the increased risk of small releases."

UCS/NYPIRG notes further that compartment venting involves a much smaller risk of "small releases" than does the filtered venting system since the excess pressure is entirely contained within the stand-by containment structure (assuming that containment failure is averted). In addition, filtered venting and compartment venting will reduce societal risks even under the most optimistic assumptions of emergency response, since while in theory it may be possible to move all persons who would otherwise be exposed to radioactivity from the areas affected by the plume (given enough time and resources), it is not possible to avoid land contamination. Release of noble gases results in no land contamination, nor does holdup of fission products in a stand-by containment structure. Thus, considerable societal costs associated with decontamination, crop and water interdiction, and loss of land and resources associated with contamination as a result of a large release of radioactivity can be largely averted. The economic impacts of reactor accidents are discussed in two reports:

1. NUREG/CR-2591, J.V. Cartwright, et. al., "Estimating the Potential Impacts of a Nuclear Reactor Accident: Methodology and Case Studies", U.S. Department of

Commerce, April 1982, available in the NRC's Public Document Room.

2. J.M. Griesmeyer, et. al., "Management of Potential Resource Losses Due to Nuclear Power Plant Accidents", August 1982. Authors T.E. McKone and W.L. Baldwicz are ACRS Fellows; author J.M. Griesmeyer was formerly with ACRS Staff, and is presently with Sandia National Laboratories. UCS/NYPIRG understands from discussions with Dr. McKone that this paper was submitted to the ACRS and to the NRC Commissioners, and has been submitted for review and publication to the American Journal of Public Health. The paper is available from UCS.

UCS/NYPIRG has discussed the Department of Commerce report with author J.V. Cartwright (202-523-0594) and with Mr. Brian Richter of NRC who oversees the contract under which the work is being done (301-492-4877). We understand that evaluations, based on the occurrence of an SST1 type of accident (the nature of an SST1 release is discussed in NUREG/CR-2239 and NUREG-0771), have been carried out for the St. Lucie, Perry, Fermi, Catawba, and Skagit/Hanford facilities, and that additional analyses for Limerick, Shearon Harris, and Bellefonte are planned or will soon be published.

In the event of an active component failure in either the filtered venting or compartment venting systems, of course, the accident will proceed as before installation of such systems. The exception might be that for filtered venting systems installed underground that the release may occur at ground level as opposed to an elevate release. UCS/NYPIRG notes, however, that an NRC-sponsored evaluation of the failure modes of the Zion and Indian Point plants indicates that a likely location for containment failure at Indian Point is at the "cylindrical sidewall" (the point at which the containment cylinder joins the basemat (NUREG/CR-2569, pages 24-30).

Response to Interrogatory 10

Licensees' interrogatory 10 states as follows:

> "Specify all accident scenarios considered, and the probability of the occurrence of each, in the analyses described in Interrogatory No. 9, and provide all documents which pertain to such considerations and/or probabilities."

UCS/NYPIRG has not independently calculated the probabilities of accident scenarios and does not endorse any such calculations done by others. The scenarios considered and probabilities assessed for these scenarios are set forth in some of the source documents listed above. Some of the documents reference WASH-1400 which is available in the NRC's Public Document Room.

Response to Interrogatory 11

Licensees' interrogatory 11 states as follows:

> "Regarding the accident scenarios described in Interrogatory No. 10:
>
> a. state separately for each scenario the calculated temperature and pressure inside the Indian Point containment(s) at each stage of such scenario;
>
> b. state the calculated accident pressure inside the Indian Point containment(s), specify the phenomenological investigation which supports the calculation(s), and provide all documents which contain and/or pertain to such calculation(s);
>
> c. state the assumed failure pressure and mode of failure for the Indian Point containment(s);
>
> d. state the conservative and non-conservative assumptions made in the calculations described in Interrogatory Nos. 11a-11c, and specify the effects of each upon the conditional probability of radioactive releases;
>
> e. define "conditional probability" as UCS/NYPIRG understands the term;

f. describe in detail the phenomena which are anticipated in the primary system and in the containment, state the basis for such anticipated phenomena, and provide all documents which pertain to such phenomena;

g. state the conditional probability assigned to each postulated containment failure mode; and

h. state the containment leakage rate postulated for containment failure."

See response to Interrogatory 10. UCS/NYPIRG has made no such calculations. Conditional probability is a probability of occurrence which is conditioned on a preexisting condition or conditions, and may be contrasted with absolute probability which has no conditions and which is the end product of calculations involving all factors relevant to the occurrence of a specific event or consequence. An example of a conditional probability is found in NUREG/CR-2239, SAND81-1549, in Appendix C which contains conditional consequence CCDF curves for early fatalities, early injuries, and latent cancer fatalities based upon the occurrence of an SST1 release for an 1120-megawatt thermal reactor for 91 reactor sites in the U.S. In this instance, the curves are conditioned on the occurrence of an SST1 release; the effect of this assumption is to set the probability of the release equal to one for the CCDF curves presented.

The curves could be translated to absolute results if the probability of an SST1 release could be accurately determined by setting the probability of an SST1 release equal to the calculated value and multiplying each of the points used to construct the CCDF by this probability and replotting the CCDF curve using these data. UCS/NYPIRG is aware of no reliable means for determining release category probabilities.

Response to Interrogatory 12

Licensees' interrogatory 12 states as follows:

> "Regarding the analyses described in Interrogatory No. 9, state whether UCS/NYPIRG considered any addition to risk to the workers installing the devices described in Interrogatory No. 8."

UCS/NYPIRG considered this factor in evaluating the necessity for the filtered venting and compartment venting systems. Risk to workers would arise almost entirely from risks associated with construction of the necessary facilities, and UCS/NYPIRG has no reason to believe that these risks would be any different from any other construction work which occurs at nuclear power plant sites throughout the country. Workers could be exposed to radioactivity in the event of a release during construction, but workers would be exposed in such an eventuality regardless of whether the system was being constructed or not. This risk could be avoided by performing the installation during shutdown for refueling, maintenance, or other cause which results in a shutdown sufficiently long to permit work to progress on the systems.

The principal radiological risk to workers installing the systems might arise from work around the containment penetration selected for use with the system. For the filtered venting system, UCS/NYPIRG understands that it may be possible to use the vent/purge system valves. For the compartment venting system, it may be necessary to create a new penetration if existing penetrations prove to be unsatisfactory. This radiological risk should not be different from that involved in other construction work in containment or near containment penetrations.

UCS/NYPIRG has not carried out any detailed dose calculations regarding this matter.

Response to Interrogatory 13

Licensees' interrogatory 13 states as follows:

> "If the answer to Interrogatory No. 12 is yes, state to what extent the installation of such devices could increase risk, and provide all documents which contain and/or pertain to such consideration."

See response to Interrogatory 12, above. NUREG/CR-0165 discusses this matter in brief on pages 42-43.

Response to Interrogatory 14

Licensees' interrogatory 14 states as follows:

> "State what UCS/NYPIRG believes to be the acceptable level of risk(s) addressed by the installation of the devices described in Interrogatory No. 8."

UCS/NYPIRG interprets the phrase "acceptable level of risk(s) addressed by the installation of the devices" to mean what degree of risk reduction would justify implementation of a mitigative system. With this understanding, UCS/NYPIRG finds a risk reduction of a factor of 2 to be sufficient justification. This does not imply, however, that once implemented such a system would make the risk acceptable, only that the risk would be reduced.

Response to Interrogatory 15

Licensees' interrogatory 15 states as follows:

> "Provide all documents which contain and/or pertain to cost estimates or cost-benefit analyses performed for the devices described in Interrogatory No. 8."

The documents are cited in response to interrogatory 8, above; the particular reports addressing cost estimates or cost-benefit analyses are numbers 1, 12, and 13. In addition, analyses could be conducted of the cost-benefit of installation of filtered venting or compartment venting systems by utilizing the correction factors presented in response to interrogatory 8 and CCDF curves for property damage with and without decontamination. These data points with which to construct the CCDF curves are available from the NRC staff which has carried out independent calculations using the CRAC code, and from the NRC's Public Document Room (i.e., the Sandia siting study CRAC2 calculations for Indian Point, appropriately corrected to reflect actual reactor size by using sensitivity data prepared for the study, and placing an appropriate probability on the occurrence of an SST1 release). The NRC staff calculations have been provided to UCS/NYPIRG and, we understand, to PASNY; they are available for inspection by contacting Mr. Jerry Hulman of the NRC staff and are also available in the NRC's Public Document Room (contact Lynn Calvin).

Response to Interrogatory 16

Licensees' interrogatory 16 states as follows:

> "State whether the costs, in terms of reduction in population dose (man rem), were considered in the analyses described in Interrogatory No. 9 or separately, and if so, provide all documents which pertain to such costs."

UCS/NYPIRG has carried out no such calculations as noted above. However, such calculations could be performed based on risk calculations performed by the NRC staff and Sandia National Laboratories using the reduction factors for filtered venting and compartment venting systems described above in response to interrogatory 8. The sources for these calculations are given above in response to interrogatory 15.

Response to Interrogatory 17

Licensees' interrogatory 17 states as follows:

> "Provide all design specifications, and performance characteristics and parameters for each of the devices described in Interrogatory No. 8."

UCS/NYPIRG has made no such specifications, performance characteristics or parameters for the systems discussed in response to interrogatory 8. Such matters are discussed in certain of the source documents listed in response to interrogatory 8. UCS/NYPIRG does not specifically endorse these values.

Response to Interrogatory 18

Licensees' interrogatory 18 states as follows:

> "Specify the quantitative risk for each Indian Point unit with and without each device described in Interrogatory No. 8, state the grounds for such quantifications, and provide all documents which pertain to the effectiveness of the devices."

As noted above, these calculations have not been performed. The means by which to perform the calculations have been discussed above.

Response to Interrogatory 19

Licensees' interrogatory 19 states as follows:

> "State what UCS/NYPIRG believes to be the risk to the public health and safety of malfunction of a filtered vented containment and separate containment structure, and provide all documents which pertain to the calculation of such risk."

As noted above in response to interrogatory 9, UCS/NYPIRG does not believe the risk of a malfunction of filtered vented containment systems and compartment venting systems are markedly different than exist for the Indian Point reactors without the systems. UCS/NYPIRG is unaware of any means by which these systems might increase risk with the exception mentioned above cf such a malfunction resulting in a ground-level release as opposed to an elevated release. It should be noted that ground-level releases are possible even without the installation of filtered venting systems.

Moreover, should either of these systems experience a structural failure, the valves leading to the systems could be closed, thus limiting any release which could occur. This may, however, result in the eventual failure of the main containment structure depending upon how much pressure relief is accomplished prior to the time isolation of the filtered venting system or the compartment venting system is necessary.

Response to Interrogatory 20

Licensees' interrogatory 20 states as follows:

> "State what UCS/NYPIRG believes to be the probability of the inadvertent or planned venting into the atmosphere of radiation released through a filtered, vented containment during the course of a nuclear accident, absent the occurrence of overpressurization of the containment, and provide all documents which pertain to the calculation of such probability."

UCS/NYPIRG has not independently calculated such probabilities. We note, however, that inadvertent actuation of the filtered venting system will at most release a large quantity of noble gases and minor amounts of other radionuclides (and this only in the event of core melt or severe core damage;

for other accidents of less severity, the release will be less, perhaps approximating a gap release less the quantity removed by the filtered venting system). A more severe risk would be posed by failure to actuate the system when it is actually needed. In this case, the risk would be equivalent to that posed by whatever containment failure mode develops without the filtered venting system. As noted above, however, even if the containment fails prior to initiation of filtered venting, the system can still reduce consequences by filtering some portion of the containment atmosphere prior to release, particularly for basemat meltthrough and containment leakage failure modes.

Response to Interrogatory 21

Licensees' interrogatory 21 states as follows:

> "State the additional protective action time which will be gained in the event of a serious accident by installation of a filtered, vented containment, a core-catcher, and both such devices, state the basis for such claims, and provide all documents which contain and/or pertain to the calculation of such time."

As noted above, since the Board has eliminated Contention 2.1(c) from the proceeding, no response is required regarding core-catchers. In addition, no contention covers installation of these devices together, although Licensees have already been alerted to a report which discusses this matter (reference number 4 given in response to interrogatory 9).

Installation of a filtered venting system could provide additional protective action time by virtue of its ability to delay or prevent containment failure for certain containment failure modes. See response to interrogatory 8.

In addition, to the extent that the system will reduce releases for other containment failure modes (thus offsite doses would be projected to be lower at a given distance) this may also provide additional time for implementation of protective actions, although this margin of difference would not intuitively appear to be significant.

It should be noted that from the standpoint of societal risk, filtered venting systems can be useful even when protective actions are completed by averting a late overpressure failure and thus averting a substantial release of radioactivity which would subsequently contaminate offsite areas. The reduction in risk here is in the form of reduced financial losses and reduced chronic exposures to the general population if and when return to contaminated areas is permitted.

Response to Interrogatory 22

Licensees' interrogatory 22 states as follows:

> "State to what degree the risk of containment failure by overpressurization will be reduced by installation of a separate containment structure, state the basis for such claim, and provide all documents which contain and/or pertain to the calculation of such reduction in risk."

As noted in response to interrogatory 8, Sandia concluded (NUREG/CR-0165) that overpressurization as a containment failure mode is eliminated by a separate containment structure (i.e., compartment venting) unless active components fail. It was also noted that the reduction in risk from installation of a compartment venting system was not significantly affected by assumed failure rates of up to 1 in 100 for such a system. UCS/NYPIRG has carried out no such calculations independently.

Response to Interrogatory 23

Licensees' interrogatory 23 states as follows:

"State the probabilities of the occurrence at Indian Point of the events described in Interrogatory Nos. 21 and 22, and provide all documents which contain and/or pertain to the calculation thereof."

UCS/NYPIRG has carried out no calculations of such probability and endorses no others.

Response to Interrogatory 52

Licensees' interrogatory 52 states as follows:

"With respect to each person whom the intervenors intend to call as a witness regarding Commission Questions 2 and 5 in this proceeding:

a. identify by name, address and affiliation each such person;

b. state the educational and professional background of each such person, including occupation and institutional affiliations, publications and papers;

c. identify the contentions as to which each such person will testify;

d. describe the nature of the testimony which will be presented by each such person, including an identification of all documents which the person will rely upon in the testimony; and

e. identify by court, agency or other body, and by proceeding, date and subject matter all prior testimony by each such person."

UCS/NYPIRG has not yet secured witnesses on Commission Questions two and five. Licensees will be notified within 48 hours of the time that any witness has been secured.

Response to Interrogatory 53

Licensees' interrogatory 53 states as follows:

> "Identify all other persons not included in Interrogatory No. 52 who have assisted in the preparation of any analyses or testimony regarding Commission Questions 2 and 5 for this proceeding."

Mr. Steven C. Sholly, Technical Research Assistant for UCS, has performed analysis pertaining to Commission Questions 2 and 5 for UCS/NYPIRG. Mr. Sholly's business address is Union of Concerned Scientists, 1346 Connecticut Avenue, N.W., Suite 1101, Washington, D.C. 20036. He has been employed in his present position since February 1, 1981.

Response to Interrogatory 54

Licensees' interrogatory 54 states as follows:

> "State whether the intervenors believe that the risk of a core melt at Indian Point to populations located within 10 miles, within 30 miles, and within 50 miles of the site are greater than at the Zion, Millstone, Duane Arnold, Three Mile Island, Trojan, Beaver Valley, Limerick, Bailly, Fermi, Waterford, Dresden, Salem, and Shoreham nuclear power plants for similarly located populations."

Licensees have not defined "risk of a core melt". UCS/NYPIRG understands that the "risk of a core melt" is distinguishable from the "risk of core melt with containment failure". The former is unrelated to the population surrounding the plant, whereas the latter is closely related to the population surrounding the plant. UCS/NYPIRG is in the process of compiling from the Sandia siting study conditional CCDF curves for a variety of sites.

With respect to Shoreham and Limerick, obviously since these reactors are not yet in operation, Indian Point poses a much greater risk. Regarding the Bailly site, the UCS/NYPIRG understands that the reactor planned for this site has been cancelled.

Comparisons of risk between reactors and reactor sites involves evaluation of many consequences, including early fatalities, early injuries, latent cancer fatalities, property damage, thyroid cancer fatalities and thyroid nodules, genetic effects, and loss of societal resources (as discussed in the Griesmeyer, et. al., paper, for example). Thus no simple answer is possible. In general, however, to the extent that consequences are affected by population density and sector population densities, UCS/NYPIRG believes that Indian Point can be shown to pose a greater overall risk to the surrounding population than for reactors at any of the named sites. It may be that for specific consequences one or more of the named sites may pose a greater risk, but on balance UCS/NYPIRG believes that Indian Point poses a greater societal risk than each of the named reactors.

Response to Interrogatory 55

Licensees' interrogatory 55 states as follows:

> "If the response to Interrogatory No. 54 is yes, state the ground for such response and quantify the difference in risks.

See response to interrogatory 54. UCS/NYPIRG is aware of the existence of a variety of so-called "probabilistic risk assessment" studies which purport, to varying degrees, to quantify the probability of core melt and of the occurrence of various release categories. In addition to the Surry and Peach Bottom reactors which were studied in WASH-1400, the following reports have been published by the NRC in the IREP (Interim Reliability Evaluation Program) and RSSMAP (Reactor Safety Study Methodology Applications Program) series:

a. NUREG/CR-1659, Vols. 1-4, RSSMAP reports on Calvert Cliffs Unit 2 (850-MWe Combustion Engineering PWR with large dry containment), Sequoyah Unit 1 (1148-MWe Westinghouse PWR with ice condenser containment), Oconee Unit 3 (886-MWe Babcock and Wilcox PWR with large dry containment), and Grand Gulf Unit 1 (1250-MWe General Electric BWR/6 with Mark III containment).

b. NUREG/CR-2515, IREP report on Crystal River Unit 3 (885-MWe Babcock and Wilcox PWR with large dry containment).

c. NUREG/CR-2802, IREP report on Browns Ferry Unit 1 (1065-MWe General Electric BWR with Mark I containment).

d. NUREG/CR-2787, IREP report on Arkansas Nuclear One Unit 1 (850-MWe Babcock and Wilcox PWR with large dry containment).

It should be noted, however, that it is UCS/NYPIRG's understanding that none of these seven studies account for external events as accident initiators, nor do they account for sabotage as an accident initiator. Further, none of these studies evaluated accident consequences.

UCS/NYPIRG understands that these factors, as well as many others related to plant design as well as to management, operations, operator training, control room design, maintenance, and others can affect the probability of core melt. Given these considerations as well as UCS/NYPIRG's views on probabilistic risk assessment (see, "UCS/NYPIRG Response to Licensees' First Set of Interrogatories Under Commission Question One", July 23, 1982, pages 1-5), we perceive no basis upon which to attempt a absolute quantitative comparison of risk between reactors. A conditional comparison, quantitatively expressed with uncertainty bounding, represents an appropriate comparitive basis.

Response to Interrogatory 56

Licensees' interrogatory 56 states as follows:

"Provide all documents which pertain to the comparison of risks between Indian Point and the facilities described in Interrogatory No. 54, including but not limited to calculations of such risks."

Other than documents already identified, UCS/NYPIRG believes that the following documents are covered by Licensees' request:

a. SAND78-0556, Jeremy L. Sprung, "An Investigation of the Adequacy of the Composite Population Distributions Used in the Reactor Safety Study", Sandia Laboratories, October 1978, available in the NRC's Public Document Room.

b. Subcommittee on Oversight and Investigations, "Calculation of Reactor Accident Consequences (CRAC2) for U.S. Nuclear Power Plants (Health Effects and Costs) Conditional on an 'SST1' Release", November 1, 1982, and "List of Sites with the Highest Scaled Consequences Based on NRC CRAC2 Accident Consequence Analysis", November 1, 1982, both available from the Subcommittee or UCS.

c. NUREG-0715, R.M. Bernero, et. al., "Report of the Task Force on Interim Operation of Indian Point", U.S. Nuclear Regulatory Commission, June 1980, also published as SECY-80-283, June 12, 1980, memorandum from Edward J. Hanrahan and Leonard Bickwit to the Commissioners, both available in the NRC's Public Document Room.

Response to Interrogatory 57

Licensees' interrogatory 57 states as follows:

"Specify whether the risks posed by Indian Point fall within the range of risks posed by other licensed nuclear power plants, and if not, state the basis for such answer."

This interrogatory is quite broad and contains no limitations whatsoever. UCS/NYPIRG interprets the interrogatory to be limited to nuclear reactors in the United States which have a full-power operating license from the U.S. Nuclear Regulatory Commission.

See response to interrogatories 54-56. For example, on a conditional basis with the Sandia results appropriately scaled for actual reactor size, Indian Point was placed as follows by the staff of the Subcommittee on Oversight and Investigation of maximum calculated accident consequences: (a) fourth in early fatalities; (b) second in early injuries; and (c) first in property damage. Indian Point may thus be seen to be at the extreme upper limit in two important categories, and as the most risky in one important category. It is UCS/NYPIRG's position that such comparisons can only accurately be made for conditional consequences since there are no probabilistic risk studies for many of these reactors, and further the results of such studies are not sufficiently reliable for such uses.

Response to Interrogatory 58

Licensees' interrogatory 58 states as follows:

> "Specify the impact(s) at Indian Point of both normal operation and accidents beyond the design basis upon the safety of persons, wildlife, domestic animals, and aquatic life forms, and upon agricultural and recreational areas, located:
>
> a. within 10 miles of the site;
>
> b. within 30 miles of the site; and
>
> c. within 50 miles of the site."

UCS/NYPIRG has not carried out specific analyses of this type. Such analyses may be found in documents listed above in response to several interrogatories, although not necessarily within the distance ranges specified by the Licensees. UCS/NYPIRG notes that a recent Battelle Pacific Northwest Laboratory evaluation of the Licensees' liquid pathways analysis was found to be "totally inadequate and absolutely unconvincing" (letter dated July 29, 1982, from C.T. Kincaid to Richard D. Codell, served on all parties by the NRC staff on October 26, 1982); thus, there is no reliable liquid pathways analysis for Indian Point of which UCS/NYPIRG is aware to even attempt a portion of the evaluation sought by the Licensees.

Response to Interrogatory 59

Licensees' interrogatory 59 states as follows:

> "Provide all documents which pertain to the impact(s) described in Interrogatory No. 59."

See response to interrogatory 58.

Respectfully submitted,

DATED: 2 Decemeber 1982

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VERIFICATION

DISTRICT OF COLUMBIA) : SS.:

I, STEVEN C. SHOLLY, being duly sworn, depose and say:

That I am Technical Research Assistant for the Union of Concerned Scientists, a joint intervenor with the New York Public Interest Research Group, Inc., in the Indian Point Special Investigation being conducted for the U.S. Nuclear Regulatory Commission by the Atomic Safety and Licensing Board; that I am authorized to make this verification on behalf of UCS/NYPIRG; and that the foregoing answers to interrogatories were prepared under my direction and supervision and are true and correct to the best of my knowledge, information, and belief.

Steven C. Sholly

STEVEN C. SHOLLY

Sworn to before me this

2nd day of December, 1982

Kimberly H. Smith

Notary Public.

My Commission expires
October 31, 1986