UNITED STATES OF AMERICA

ATOMIC ENERGY COMMISSION

IN THE MATTER OF	)	
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CONSOLIDATED EDISON COMPANY OF NEW YORK, INC.	)	DOCKET NO. 50-286
(Indian Point Nuclear Generating Unit 3)	)	

Appearances

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Lex K. Larson, Esq.
on behalf of Applicant
Consolidated Edison Company of New York, Inc.

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on behalf of the
Regulatory Staff of the
Atomic Energy Commission

Harold P. Green, Esq.
Richard G. Berryman, Esq.
at Prehearing Conference and
First Evidentiary Hearing Session
on behalf of
Citizens' Committee for the Protection of the Environment

Larry Bogart
on behalf of
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INITIAL DECISION

Consolidated Edison Company of New York, Inc. (Con Ed or Applicant) filed an application on April 25, 1967, pursuant to the provisions of Section 104b [1] of the Atomic Energy Act, as amended, and later submitted twelve amendments, for authority to construct and operate a nuclear power pressurized water reactor facility. Con Ed described the facility as Indian Point No. 3 reactor since two other nuclear power facilities have been authorized for the same Indian Point location on the Hudson River, approximately 25 miles from New York City. Con Ed proposes an initial power level for the No. 3 facility of 3,025 megawatts thermal; [2] the other two facilities have authorized thermal power levels of 615 megawatts and 2,758 megawatts. The Indian Point location of the three nuclear reactors is in the Town of Buchanan, Westchester County, New York.

After a review of the application with amendments, including conferences with Con Ed by the Division of Reactor Licensing of the Commission, and after a similar consideration by the statutory

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1/ Section 104b of the Atomic Energy Act, as amended, authorizes the Commission "... to issue licenses to persons applying therefor for utilization and production facilities involved in the conduct of research and development activities leading to the demonstration of the practical value of such facilities for industrial or commercial purposes...."

2/ The application refers to an intended thermal power level of 3,025 MW(t). The construction permit proposed to be issued by the Director of Regulation as shown in 34 Federal Register, page 1742 states that the proposed facility "... is designed to operate at 3,025 megawatts (thermal)... ." The Staff, by a communication dated June 13, 1969, stated that the ultimate power level is 3,217 MW(t). The Board has not been able to locate the Applicant's request for this level of power. The Staff's Safety Evaluation does not indicate an analysis at this higher power. Applicant's proposed findings state that the authority sought is for an initial operation of 3,025 MW(t).

consultant group known as the Advisory Committee on Reactor Safeguards,[3/] the Commission in accordance with the requirements of the Atomic Energy Act, as amended, issued a Notice of Hearing which provided for a public hearing and participation in further consideration of the Con Ed application. In accordance with the Notice, a prehearing conference was held in Washington, D. C., and three sessions of evidentiary hearings were convened near the location of the proposed construction and operation. One session was held in the Hendrik Hudson High School at Montrose, New York, and two sessions were held at the Springvale Inn at Crugers, New York. Three intervenors participated: Mary Hays Weik, as an individual, the Atomic Energy Council of New York State, and the

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3/ The Advisory Committee on Reactor Safeguards, in its letter expression of belief that the proposed facility can be constructed with reasonable assurance that it can be operated without undue risk to the health and safety of the public, enumerated five items which were suggested for further design or mechanical improvements in the facility. The Staff in its Safety Evaluation indicated its intended review of the foregoing and other items and concluded that it believed all matters could be satisfactorily resolved and thus the facility could be constructed and operated without undue risk to the health and safety of the public.

Citizens Committee for the Protection of the Environment (Committee).[4] Also in accordance with the Rules of Practice of the Commission, thirty-one persons[5] participated in the evidentiary hearings by making unsworn statements[6] to express concerns respecting or approvals of the Con Ed proposal.

4/ Citizens Committee was represented by counsel at the prehearing conference and the first session of the evidentiary hearings. An extended recess, for the time requested, was granted to the Committee after that first session to permit adequate preparation; however, a week before the second session was due to reconvene, Committee counsel withdrew from the proceedings "... because of lack of funds to finance an effective and fully responsible intervention effort. ... and cannot obtain, the financial resources to support its further participation in the proceeding...." Committee counsel stated that the Commission procedures "... discourage and prohibit meaningful and responsible participation of those members of the public who are affected...." Thereafter, the Board permitted the principal officer of the Committee, a layman, to represent the group and to present two witnesses.

5/ One limited participant questioned whether the licensing action to issue a construction permit as proposed by the Director of Regulation would conflict with the Hudson River Basin Compact Act, especially in relation to esthetic and non-radiological items. The Commission in a report to the Bureau of the Budget stated that the Atomic Energy Act did not permit the Commission to include conditions respecting esthetic and non-radiological items. This Board concludes that no conflict exists between the two statutes.

6/ As stated on the record, the unsworn statements do not constitute evidence for the decision in this proceeding. The Commission's Rules of Practice in permitting unsworn statements to be presented are intended to provide for general public participation and to permit expressions of concern or approval that the parties to the proceeding may desire to consider in reference to their presentation of evidence. Although unsworn statements were also made by one of the intervenor parties appearing pro se, such statements, likewise, do not constitute evidence as defined by the Administrative Procedure Act which, except as modified by the Atomic Energy Act, as amended, governs the proceeding. The modification relates to the provision for an Atomic Safety and Licensing Board to conduct hearings on applications such as this one. The Atomic Energy Act, as amended, further provides that public hearings are mandatory in reference to the initial consideration of applications, that is related to construction permits, whereas, hearings are discretionary with the Commission in reference to operating licenses which are considered after the design and construction are completed.

Two intervenors opposed the granting of the construction permit. By that opposition, this proceeding became a "contested" proceeding, as instituted and defined by the Commission's Rules of Practice, as distinguished from an uncontested case, in which all parties, including the Regulatory Staff, favor the issuance of a construction permit. Section 2.104b of the Commission's Rules of Practice specifies the issues to be resolved[7/] in a contested case; these issues are set forth in the Notice of Hearing.

7/ Recommended procedures and guides issued by the Commission relative to the decisional process in a contested case are set forth in the Statement of Policy appended to the Rules of Practice. The findings herein made by this Atomic Safety and Licensing Board are consistent with those procedures and thus not all matters previously evaluated by the Staff are reviewed or evaluated by the Board. A portion of the Commission's Statement is as follows:

> "(d) Participation by board members:
> "In contested proceedings, the board will determine controverted matters as well as decide whether the findings required by the Act and the Commission's regulations should be made. Thus, in such proceedings, the board will determine the matters in controversy and may be called upon to make technical judgments of its own on those matters. As to matters which are not in controversy, boards are neither required nor expected to duplicate the review already performed by the regulatory staff and the ACRS and they are authorized to rely upon the testimony of the regulatory staff and the applicant, and the conclusions of the ACRS, which are not controverted by any party. Thus, the board need not evaluate those matters already evaluated by the staff which are not in controversy."

In addition to those contentions of the intervenors which are reflected in the findings hereinafter made, two of their basic assertions are: first, urging the Commission to control thermal liquid releases from reactors, which are alleged to cause pollution, and second, the contention that there is an inadequacy in the Commission's regulations, particularly 10 CFR Part 20 relating to amounts of radioactive effluents, liquid and gaseous which may be released to the unrestricted area, i.e., beyond the control of the Applicant. At the hearing the Committee urged the Board to disregard the Commission's decisions that it does not have jurisdiction to regulate thermal releases,[8/] if there is no relationship to radioactive effects.[9/] The Board rejected that contention. The evidence in

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8/ The Commission does not have jurisdiction to control thermal effluents from reactor operations if radiological components or effects are not involved. See: State of New Hampshire v. Atomic Energy Commission, 406 Fed (2nd) 170, Petition for Certiorari denied, U. S. Supreme Court, June 16, 1969. Respecting the adequacy of the regulations regarding releases of liquid and gaseous effluents, in the absence of evidence attacking the regulations, the Board ruled that it was bound by the regulations and decisions of the Commission.

9/ The intervenor Committee introduced evidence that increases in river temperatures could increase the effect of the radioactivity on certain living organisms in the water. Applicant's evidence showed contrary effects. The Staff presented a witness from the U. S. Fish and Wildlife Service who stated that depending upon the circumstances and the type of organism involved either of the above effects could be found. This witness also stated: "In this abstract the comment is made that the upper end of their temperature range -- this 27 degrees -- the first tolerated more radiation and lower salinity but at the lower end of the temperature range the tolerance was reversed." The consensus of the evidence is that research should be undertaken to determine reconcentration aspects of radioactivity in the human food chain.

regard to the adequacy[10/] of the Commission regulations for the protection of safety is considered herein.

The proposed Indian Point nuclear reactor facility Unit No. 3 will utilize a pressurized water reactor with an initial rating of 3,025 megawatts thermal and 965 megawatts electric. The reactor will operate at a pressure of 2,250 psia and an average temperature of 579° F. The reactor core will be approximately eleven feet in diameter and twelve feet long. It will be made up of 193 fuel assemblies, each containing a square array of 204 fuel rods. These fuel rods will be fabricated from Zircaloy tubes filled with fuel pellets of slightly enriched uranium dioxide. Four cooling loops will be used to carry the heat from the reactor. Although the power level of Unit No. 3 is somewhat higher than reactors currently operating, it is lower than other reactors which are already the subjects of construction permits issued by the Commission. Information from the operation of these facilities will be available and will be utilized in the startup and operation of Unit No. 3.

Unit No. 3 will employ a steel-lined reinforced concrete containment similar to that used in Unit No. 2 and other facilities approved for construction. This containment will be tested for both structural integrity and leak-tightness prior to operation of the facility and will be capable of periodic testing over the life

10/ As to the adequacy of the Commission's 10 CFR 20 regulations in reference to releases of concentrations of radioactivity in liquids or gases, an ecologist from Cornell University who was a witness for the intervenor Committee, in response to an inquiry whether he did not agree with the values in Part 20, answered:

> "I don't say that I can do any better. It is a terribly difficult problem. I say that they are arbitrary in the sense that they have to represent somebody's judgment of what is tolerable and I am sure they have done the best job they know how to do and with all honesty and sincerity I hope they are right. I hope these are reasonable values. I don't know."

of the facility. Associated with the containment are a weld channel pressurization system and an isolation valve seal water system, which are intended to provide an essentially leak-tight containment system. Not all of the design arrangements for the Indian Point No. 3 facility were completed as of the date of the hearings. While there are some similarities of Unit No. 3 with Unit No. 2, and other reactor facilities constructed for others, both Con Ed and its nuclear facility contractor stated that the developing technology applicable to Unit No. 3 will require that certain aspects will await further research and development. That position is consistent with the Commission's Rule which provides in part as follows:

> "Section 50.35 Issuance of provisional construction permits.
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> "(a) When an applicant has not supplied initially all of the technical information required to complete the application and support the issuance of a construction permit which approves all proposed design features, the Commission may issue a provisional construction permit if the Commission finds that (1) the applicant has described the proposed design of the facility, including, but not limited to, the principal architectural and engineering criteria for the design, and has identified the major features or components incorporated therein for the protection of the health and safety of the public; (2) such further technical or design information as may be required to complete the safety analysis, and which can reasonably be left for later consideration, will be supplied in the final safety analysis report; (3) safety features or components, if any, which require research and development have been described by the applicant and the applicant has identified, and there will be conducted, a research and development program reasonably designed to resolve any safety questions associated with such features or components;

> and that (4) on the basis of the foregoing, there is reasonable assurance that ... the proposed facility can be constructed and operated at the proposed location without undue risk to the health and safety of the public."

Con Ed has identified the items yet to be developed for the reactor, and which will be considered later in the decision, as well as the items presently designed for the reactor. Certain engineered safeguards utilized in Unit No. 3 include an emergency core cooling system which in the event of a loss of coolant accident provides borated cooling water to the core, a containment spray system designed for post-accident heat removal and elemental iodine removal capability, a containment air recirculation cooling and filtration system which also is designed to provide containment atmosphere cooling and organic iodide removal capability, and hydrogen flame recombiners for the purpose of removing hydrogen from the post-accident containment atmosphere. These hydrogen combiners are intended to limit hydrogen concentration in the containment atmosphere below flamability limits, using the containment atmosphere as a primary oxidant and supplemental hydrogen as fuel. Two hydrogen combiners, also known as flame combustors, will be located inside the containment, one serving as a spare. The operation of the units are proposed to be initiated prior to such time as hydrogen concentration reaches the flamability limit. The potential for hydrogen accumulation in the post-loss-of-coolant accident environment as a result of radiolytic decomposition and other hydrogen sources, is subject to further

research and development. In order to meet the Commission's reactor site criteria (10 CFR 100) under the conditions of the design basis accident and the worst hypothesized meteorological conditions, the operation of some combination of these engineered safeguards systems is essential.

The operation of a nuclear reactor facility such as Indian Point No. 3 has potential environmental consequences from the release of both liquid and gaseous effluents. These releases can occur either in normal operating conditions or in any possible accidental occurrence.

In normal operations, the gaseous and liquid effluents are generally released under controlled conditions; that is, storage containers retain volumes of the effluents until calculations are made which indicate that releases can be made at levels below those limits permitted by the regulations of the Commission. In addition to calculations, certain monitoring devices are made functional to measure the radioactivity in the releases. The liquid monitoring devices measure the gamma activity, and the air monitoring devices which measure the gamma and beta activity, both of which measurements can be related to other isotopes, which may be of concern, on the basis that the quantities of the measured isotopes bear to other radioactivity. For these considerations, it is important to determine the amounts of the released and measured isotopes, the time and

meteorology present at the time of the release and to know who are the persons likely to be affected and in what manner and extent.

As indicated, Indian Point No. 3 is located on the east bank of the Hudson River, in the Town of Buchanan, approximately 25 miles north of New York City and near the sizeable population center of Peekskill on the north, and the city of Haverstraw across the river. The area is largely residential although some small industries are nearby. Also at Chelsea north of Indian Point No. 3 is an emergency water intake facility for the New York City water supply, and easterly from Unit No. 3 is the Croton reservoir, another source for New York City water. In addition, from 3 to 5 miles from the site are other reservoir sources of water for local communities.

The Chelsea Pumping Station, located on the Hudson River about 22 miles north of the site, has been used as an emergency source of drinking water by the City of New York. The station is not currently in use and is not likely to be used except during a drought similar to that which occurred in the mid-1960's. Applicant has analyzed the results of normal operational releases of radioactivity to the river from Unit No. 3 and of releases from the site at the maximum concentrations permitted by 10 CFR 20 and has shown that the effect on concentrations of radioactivity at the Chelsea Pumping Station is expected to be insignificant. Applicant has also hypothesized an accident in which all the primary coolant from the facility

(assuming 1% fuel failure) is somehow discharged into the river and has demonstrated that the concentrations of radioactivity at the Chelsea Pumping Station would not be expected to exceed the concentration limits specified in 10 CFR 20, which are applicable to normal operational releases. Applicant's calculations were stated to have assumed conservative river conditions which yielded the highest concentrations of radioactivity at Chelsea.

Applicant conducted a two-year detailed study of the meteorological conditions at the Indian Point site in connection with the application for licenses for Unit No. 1. The program was begun in 1955 and was completed in 1957. The data developed from this study were used as a basis for determining the atmospheric dispersion conditions which should be applied to Unit No. 3 with respect to normal operational releases and with respect to hypothetical accident conditions. While the basic data derived from the 1955-57 program was not available for review in this proceeding, Con Ed stated that data from a further study now under way would be utilized in connection with the proposed operations for Unit No. 3. It is the Board's opinion that all parties would be greatly assisted if definitive criteria were developed for judging the adequacy of the meteorological program presented by the Applicant. The problem of adequate data and its proper use appears to be particularly difficult in locations such as Indian Point No. 3 because of the effect of

topography on the local meteorological conditions. For this reason the Board urges that the Applicant make its present continuing study as comprehensive as possible.

In determining the maximum permissible amount of gaseous radioactivity which may be released from the facility in compliance with 10 CFR 20, the Applicant assumes that releases are always made in the direction of that sector which would produce the highest calculated dose at the site boundary, using average yearly meteorological conditions. Applicant has also proposed to develop technical specifications which would provide that the controlled release of gaseous radioactive waste would not be made when actual measurements indicate that meteorological conditions are less favorable for dispersion than the average conditions described above.

Con Ed reported its experience in the releases of radioactive effluents from the Indian Point No. 1 facility and it appears that there has not been any correlation between the time of the releases and the more dispersive atmospheric conditions.[11/] While Con Ed also added that the Unit No. 1 facility releases had averaged only 28 curies a year, it must be emphasized that while Con Ed asserts that it will

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11/ Con Ed's witness testified that the company for Unit No. 1 operation does not wait for the more turbulent conditions to control the release of gas into the atmosphere.

do its best to keep radioactive effluents as low as possible, it is legally required only to stay within the limits of 10 CFR 20 which for Indian Point No. 1 is 16,000,000 curies per year,[12] when operating alone. The Staff has pointed out, however, that the 10 CFR 20 limits apply to the entire site no matter how many reactors are involved, and Con Ed agrees. Each reactor's effluent must therefore be limited such that the total effluent from the site does

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12/ The Commission's regulations provide basically for an averaging process, over a period of a year, for the amount of curies released. The Staff testified however that as a matter of practice releases of gaseous effluents are permitted in amounts which could result in offsite concentrations at levels up to ten times those permitted by 10 CFR 20, but such releases can occur for no longer than a 15 minute time period. Applicant however states that Indian Point 3 facilities have a cut off valve which will terminate the release when a high level of radioactivity is indicated on an alarm signal. Applicant agreed that instantaneous releases would be coordinated with local measurements of meteorology to assure that the ten times 10 CFR 100 limits are not exceeded in the 15 minute period. Further, the Applicant made a commitment that no gaseous releases would be made if local meteorological conditions are worse than the yearly average conditions used in the calculations of the annual allowable release.

not exceed 10 CFR 20. The presently calculated allowable[13/] gaseous effluent on an annual basis for each of the other reactors operating by itself on the site are 800,000 curies for Indian Point No. 2 and 570,000 curies for Indian Point No. 3.[14/]

The Board believes that it is essential for the safety of the people that both the expected and legal limit releases be considered in evaluating the possible offsite hazards. The information relevant

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13/ During the hearing, Staff counsel sought to allay concerns on the high level of release by his inquiry of intervenor witness on a premise that the Commission could, in accordance with 10 CFR 20.106(e), reduce the complete limits permitted under 10 CFR 20 to one-third if it found necessary. Later in the hearing Staff counsel explained that such a large reduction would only occur if the Commission were somehow apprised of a large increase of radioactivity from any one of many sources in a particular area, after which surveillance would be conducted to determine the level of activity and action then taken. Title 10 CFR 20.106(e) was adopted from the Federal Radiation Council recommendations, both of which state that the one-third limit would be imposed "... if it appears that the daily intake of radioactive material from air, water, or food by a suitable sample of an exposed population group, averaged over a period not exceeding one year, would otherwise exceed the daily intake resulting from continuous exposure to air or water containing one-third the concentration of radioactive materials specified...."

14/ Con Ed, despite the maximum level permitted for releases by the regulations, states that:

> "The design of Unit No. 3 and the other two facilities are such that they <u>can</u> be operated and <u>are expected</u> to operate with releases of radioactivity of only a small fraction of that permitted to be discharged in accordance with 10 CFR 20." (Emphasis added.)

to the latter was developed at the hearing and preliminary estimates were made of the nature of atmospheric dispersion of gaseous effluents under assumed operating conditions for all three facilities. Determining the expected atmospheric concentrations at the site boundary, and at various points beyond the boundary, is a complicated problem because of significant differences in release heights from the three facilities, and because of local terrain effects on meteorology. Evidence was introduced during the hearing which indicated the possibility that under certain conditions normal releases of gaseous effluent could result in ground level concentrations at positions beyond the site boundary which would exceed the ground-level concentration at the site boundary. Detailed consideration of these phenomena are to be made prior to the issuance of an operating license for Indian Point No. 3.

The present determination whether the gaseous effluents when released will exceed the regulation limits is made upon the basis of calculations of the amount and level of radioactivity of the effluent in the storage tanks and upon the basis of measurements made of the effluents released. For this latter procedure, Con Ed has an air monitoring device located in the effluent vent. This device measures total gamma and beta activity, and the amount of the various isotopes being emitted is calculated from the quantity of

these isotopes measured in the gas storage tank. The combination of these two devices, together with measurement of discharge rates and local meteorology, should enable Con Ed to properly adjust its rate of gaseous effluent discharge within the limits to be allotted to Indian Point No. 3 reactor. In addition, Con Ed has two air monitoring devices; one on-site about 400 feet from the 350 foot stack, and one near the boundary of the site. The evidence establishes that for the onsite monitor, the gaseous effluent plume in its major portion will pass over the onsite monitor, and the only way for that device to make a recording is for some deposition from the release to be caught in the instrument. During the course of the hearing, the Board inspected the onsite monitor and found it was located in a room that was filled with debris, broken boxes, old newspapers and covered with dust. In addition, the recorder for a temperature monitor was not operating correctly in that the paper on which the measurements were made was not being rolled up after recording, but rather was loose and spreading over the floor and debris. Although each of these conditions may not directly affect the radioactive monitoring, these general conditions raise serious questions concerning the care with which the air monitoring devices are used and maintained.

As for the air monitoring device located at the site boundary, its air intake came from top of a building which was located behind and at a lower altitude than other buildings nearby. The air intake travel to the air monitor was through a long tube with several turns, all of which may have lessened the level of radioactivity before it reached the air sampling and measuring device.

The onsite monitoring devices, as well as a mobile monitoring unit,[15/] are secondary measures to determine the permissible releases of radioactivity, but as presently used by Con Ed are in such a condition that the Board feels that they are completely inadequate for the operation of Indian Point No. 3. It is the Board's opinion that these secondary devices operated under the conditions that they are being operated at the present time are useless. Con Ed, however, has assured the Board that their present secondary

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15/ Con Ed has an additional sampling program for Unit No. 3 which includes a mobile air monitor located on a truck. The mobile unit will also be used for testing air, plant and soil samples in offsite areas close to the plant site. This unit is proposed to travel to different locations 3 to 5 miles distant to take measurements on a weekly basis. The ability of this mobile air monitor to catch an adequate sample of gaseous radioactivity from the air plume will depend upon the accuracy of the meteorological calculations of the atmospheric conditions. The truck has been used up to this time on a sporadic basis and its adequacy cannot be determined on this record.

monitoring equipment will be supplemented and maintained with the same care that its primary safety devices are maintained. It is the Board's opinion that the mobile unit must be maintained in a fully operable condition, at all times, with trained personnel available on call to use the equipment in the case of emergency. It is the Board's opinion also that a set of criteria for suitable environmental monitoring programs should be established by the Commission as soon as possible.

The vital importance of knowledge of the content and amount of radioactivity in gaseous and liquid effluents cannot be overemphasized. While many radioactive isotopes may be involved, tritium and iodine have been given the most attention. Much research and development has been undertaken in reference to iodine, but there appears to be a consensus that research and development on the mechanisms needed to sufficiently remove the iodine should be continued. Con Ed has stated that such research is continuing with specific results expected long before completion of Indian Point No. 3.

The major concern with iodines in gaseous effluents arises from the possibilities, remote but credible, that could occur in the event of a major accident. Several kinds of occurrences are considered and are classified in range of severity, including a design basis accident resulting from a postulated loss of coolant. The Board agrees that the design basis accident is an event of very low probability, and that it is also improbable that the failures

of various safety systems could be compounded to the situation which has been analyzed to lead to the accident doses quoted in Staff correspondence.[16/] However, the Board does not agree with the assertion by a Con Ed witness that the probability is so small as to be meaningless and unimportant, nor does it agree with the view that it is probability alone that determines risk, since the magnitude of the potential hazards of the improbable accident is also necessarily involved in such determination. Because of this, the design basis accident must have an exceedingly low probability of occurrence in order to result in a low risk of public exposure to radiation. The Board concludes that a suitably low risk can be attained only if the safety systems which are needed in the unlikely event of the accident of exceedingly low probability are given the same careful attention in relation to procedures for design, construction, and testing as those systems which are expected to function during the normal operation of the facility. One element of such procedures is careful identification of and adherence to performance objectives, with suitably conservative design margins for uncertainty. The Board concludes that the 300 rem limit of 10 CFR 100 is a vital element of the performance objectives of the safety systems and should be adhered to.

Any one of those kinds of accidents demands rigid and effective measures to control the releases of radioactivity which would originate in the event that the nuclear fuel located in a core should melt

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16/ Staff correspondence dated June 6, 1969 and June 20, 1969.

from excessive heat caused by some transient condition. Such a release would travel from the core to the pressure vessel surrounding the core and thence to the containment structure covering all the facility. This travel could occur in the event that certain safeguard devices did not operate, and such is indeed a premise for these accident considerations. The Commission in its 10 CFR 100 Site Criteria regulations has cited as a reference a calculational procedure set forth in a document numbered TID-14844 and entitled "Calculation of Distance Factors for Power and Test Reactor Sites". The reference by the Commission is that this document may be used as a guideline for site criteria. The document includes discussion that a hypothetical accident may entail consequences greater or less than calculated, but presents a compromise guideline. Part 100 of 10 CFR states that TID-14844 "... contains a procedural method and a sample calculation that result in distances roughly reflecting current siting practices of the Commission." The document also points out that certain protective safeguards, such as sprays or filters are not included in their considerations, but could provide additional iodine reduction factors of 10 to 1,000 over the considerations of the document. The procedural method and the calculational techniques presented in the document have been followed in most if not all of the nuclear reactor cases

and thus the components of the calculations are generally regarded as controlling.

Both Con Ed and the Regulatory Staff rely in part upon a calculational procedure outlined in TID-14844 in determining the amounts of possible radioactive releases from Indian Point No. 3. In addition, both rely upon the calculated efficiencies of certain mechanisms intended to remove principally the iodine isotopes from the radioactive effluents. These mechanisms include a containment spray system (which is also intended to be used to reduce the high temperature which is likely to occur in the containment structure) with a solution in the spray containing boron and sodium hydroxide, which latter is a caustic and a somewhat corrosive agent, and also the mechanism of impregnated charcoal filters. Con Ed has calculated certain levels of efficiency for these mechanisms. The Staff has calculated other levels of efficiency for which the Staff believes that it has included suitably conservative margins of safety.

The Board notes however that uncertainties exist in reference to the estimates of the iodine removal efficiencies of a full-scale spray system. These uncertainties are of the nature of simplifying assumptions which the Applicant has made in calculating spray performance, uncertainties in the simulation and interpretation of experimental data on spray absorption, uncertainties in the scale-up from laboratory and pilot plant tests, and certain unresolved anomalies in

the experimental data that have been obtained. Also, the performance of the spray system as installed will not be verified by functional testing of its iodine absorption capability. Con Ed has described a program of research and development on spray systems to be carried out during the course of construction, which is intended to resolve these uncertainties sufficiently for adequate proof of safety.

In reference to the Staff analysis of this filter and spray system for iodine removal, the Board notes that the 10 CFR 100 dose limits can only be achieved if a 50 percent plateout reduction in iodine content is assumed.[17/] This assumption is used in the sample calculation in TID-14844 for a reactor with no spray or filter system, and Con Ed does not rely upon this assumption because it considers such plateout to be a competing effect for iodine removal when sprays are operable.

17/ Without a plateout adsorption of the iodine content in the containment, the total doses would be 396 rem for the 2-hour dose at the site boundary and 348 rem for the 30-day dose at the low population boundary, based upon the Staff's suitably conservative estimates of iodine removal efficiency.

The Board is thus met with a difference in analyses by these parties[18] to the proceeding and for which no evidence has been presented to adequately resolve the matter at this time. Both Con Ed and the Staff believe that further research and development will provide the data necessary to make a suitable determination of the efficiency of the iodine removal system. The Staff, however, does not believe that the research and development program will provide information sufficient to resolve the present uncertainties (i.e., drop size spectrum, drop coalescence, and the possibility of liquid film mass transfer resistance), which led to its more conservative

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18/ The Staff in its analysis has proceeded on the assumption of iodine removal by plateout and thus without any sprays or filters operating, has stated that dose reduction factors of the 4.7 and 11.2 are needed to achieve the 10 CFR 100 limits for the 2-hour and 30-day periods respectively. Dose reduction during the 2-hour period must be achieved almost entirely by the spray system, since relatively little iodine removal can be achieved by the charcoal filters during this time period. Therefore, the overall dose reduction factor of 4.7 is identified by the Staff as a minimum performance requirement for the spray system. If plateout is not a realistic assumption, since it is used in the TID-14844 sample calculation in reference to a containment without flooding sprays and the like, the Board calculates that the necessary dose reduction factors would be 9.1 for the 2-hour dose and 21.2 for the 30-day period. This is the calculational technique used in Applicant's Exhibit 6 for estimating dose reduction factors when sprays are operating. The net effect of not relying upon a plateout in the Staff analysis is a substantial increase in the minimum required performance for the spray system. An overall dose reduction factor of 9.1 cannot be achieved by the spray system on the basis of the Staff's suitably conservative estimates of the spray removal efficiency.

estimate of the spray removal efficiency. Despite these uncertainties, the Staff concluded that it was not necessary to modify its analytical model because its calculations of the offsite doses, with plateout, will not exceed 10 CFR 100. It is further noted that the Applicant's calculations, utilizing its more optimistic assumptions, result in offsite doses within the limits of 10 CFR 100, even without plateout. The Board, however, does not find data 19/ in the record to provide reasonable assurance that the efficiency necessary to lessen the estimated accident doses can be achieved. In the opinion of the Board, this aspect of the case is so vital to safety and so important to all parties to the proceeding, that necessary data must be developed, or research and development programs be established to develop the data, in reference to the efficiencies of these mechanisms for iodine removal, including plateout removal in the presence of sprays if it is a mechanism which is to be relied upon. The Board's conclusion of adequate assurance of safety in this regard rests upon its belief that this issue can be and will be resolved by the Commission so that

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19/ The Staff states that the Applicant's more optimistic estimate of the spray efficiency results in removal of iodine by spray absorption at a rate comparable with "the plateout deposition velocity". For information appearing in the record of evidence in the proceeding to support these conclusions, the Staff refers to information concerning Applicant's Exhibit 6, Case P, for which the sprays and filters are assumed not to be operating. The Board does not find that this reference provides technical justification for the foregoing Staff conclusion regarding "plateout deposition velocity" as a dose-reduction mechanism when sprays are operating.

present uncertainties regarding necessary performance requirements and necessary removal efficiencies can be corrected and so that a necessary program to provide the necessary data to give adequate assurance of performance can be designed and carried out. The Board concludes that construction should be allowed to proceed but that this issue should be resolved in accordance with Section 50.35(b)[20/] of the Regulations (10 CFR 50.35(b)) so as to establish proper performance objectives for the construction and research and development program. Additional data of the kind described herein should be presented to the Commission so that they may determine the adequate margins of safety of the proposed filter-spray iodine removal system in advance of the consideration of an operating license for Indian Point No. 3. The Commission in accordance with its regular practice will make all these data available to the parties to the proceeding and to the public. The Board's finding of adequate assurance of safety rests upon the Board's belief that these data can be and will be developed adequately for the Commission's determination.

20/ The dissenting opinion refers to the Section 50.35(b) procedures for supplying additional data as a condition. The Board does not so characterize the process contemplated, nor does the Commission in its regulations, which, however, identifies the process as by a provision, which may have flexibility. The Board understands, in any event, that the Applicant in the course of its research and development program will develop and substantiate an adequate margin for uncertainty on the spray system, which will be reviewed by the regulatory bodies.

A further vital concern respecting the proposed Unit No. 3 reactor is the adequacy of the program for assuring that the specified or desired quality and capabilities of the components of and the entire facility will be achieved. The nuclear industry, as indicated in this record, has had a developing program for securing the designed and specified quality. Without a positive program in this regard, the early nuclear industry construction and operating experiences have been frought with delays and costly changes. In order to secure a safely operable nuclear facility, a carefully delineated outline and schedule for all phases of the nuclear plant must be established. In addition to the continuing and active efforts of an applicant in this regard, the Staff of the Commission must exercise a vigilant supervision, and as stated in a previous case "... it is imperative that the Staff pursue with rigor and determination an effective documented quality assurance surveillance." Initial Decision, Commonwealth Edison Company, Docket Nos. 50-295 and 50-304. The Commission review of that case did not result in any modification or change in the scope of such a surveillance.

Con Ed and its nuclear designer and constructor (Westinghouse) presented a detailed and extensive outline of procedures regarding the quality assurance program. Westinghouse has had considerable experience both with submarine and land based nuclear facilities. It is evident that that background experience has contributed to the pervasive

character of its program and the many specified procedures which are intended to assure itself of the quality sought and to check on the suppliers of various components needed for the facility. The Board believes that the program as outlined and presented in this proceeding will achieve satisfactory results if the program is actually executed as Westinghouse proposes to do.

The Board questioned the Staff concerning their documentation of their audits on the Applicant's quality assurance program and the Board inquired whether or not the Staff or the Compliance section used a check list method for assuring that their audits were complete. The Staff evidence is that there is not a specific check list for each surveillance but that general guidelines have been given to the Compliance inspectors who prepare written reports following an inspection. The Staff also stated that the inspectors are selected for a specific surveillance of a construction or operating activity based upon the expertness of the individual for the particular inspection which is to be undertaken. It is the view of the Staff that a written report based upon the general guideline instructions and the specific capabilities or competency of the inspector provides a comprehensive statement of the particular activities then under review. These reports, which are in range of length of from 25 to 40 pages, are submitted to both the Division of

Compliance and the Division of Reactor Licensing who can then determine what, if any, action shall be recommended to the Commission.

The Board concludes that these written reports can be helpful but as the Board indicated at the hearing, a specific check list would prevent the overlook of many important items that may become minimized if the particular expert is engaged in items more specific to his competency.

In addition, the Board firmly believes that a statistical sampling of the spray heads should be tested in a test chamber to prove that they are properly machined to give correct spray formation. Where the same spray header design has been used before, and where proper quality control checks are being made on the materials and machining of the heads, the Board recommends that at least one percent of these headers needs to be experimentally checked for proof of this operation. A somewhat similar problem occurs in testing the air blower and filter system.

The necessity for such testing of completed systems is not definitely established according to proposed criteria issued by the Commission. Initially in 1965, the Commission issued a proposal for design criteria for nuclear power plant construction permits which in part was as follows:

> "Criterion 22. Valves and their associated apparatus that are essential to the containment function must be redundant and so arranged that no credible combination of circumstances can interfere with their necessary functioning. .... Capability must be provided for testing functional operability of these valves and associated equipment to determine that no failure has occurred and that leakage is within acceptable limits."

A revision in the proposal for such design criteria was issued in 1967 and among other phases of plant design, made specific reference to containment spray systems, as follows:

> "Criterion No. 60. Testing of Containment Spray Systems. A capability shall be provided to test periodically the delivery capability of the containment spray system at a position as close to the spray nozzles as is practical."

Another pertinent criterion, which was considered at the hearing is proposed criterion 38, which is as follows:

> "Criterion No. 38. Reliability and Testability of Engineered Safety Features (Category A)
> All engineered safety features shall be designed to provide high functional reliability and ready testability. In determining the suitability of a facility for a proposed site, the degree of reliance upon and acceptance of the inherent and engineered safety afforded by the systems, including engineered safety features, will be influenced by the known and the demonstrated performance capability and reliability of the systems, and by the extent to which the operability of such systems can be tested and inspected where appropriate during the life of the plant."

Upon inquiry made, the evidence is that certain components are to be installed within the containment before the containment spray system could be tested. Con Ed stated that any spray solution would damage those installed components and that it would be difficult to plastic cocoon the entire innards of the containment in order to test the spray equipment.

The requirement or desirability of testing components and systems is a concern also in reference to the fans, motors and blowers needed for the air filter system. These filter systems would be located within the containment structure, where the design provides that the sprays will be operating in the vast atmosphere

within this dome like structure. In addition to overcoming excessive humidity, high pressure, and high temperature, there will be extremely high levels of radiation that can lead to disintegration of certain materials. Con Ed's constructor has presented evidence that the materials proposed to be used have been tested for all these conditions, but never tested for all occurring simultaneously. The concern expressed for the spray nozzles is equally applicable: will an assembled system of fans, motors and blowers operate, as they must to reduce levels of radioactivity, in the combined conditions of humidity, pressure, temperature and radiation? The revised design criteria provide in part as follows:

> "Criterion 63 -- Testing of Air Cleanup Systems Components (Category A)
>
> "Design provisions shall be made so that active components of the air cleanup systems, such as fans and dampers, can be tested periodically <u>for operability and required functional performance</u>." (Emphasis added.)
>
> "Criterion 64 -- Testing of Air Cleanup Systems (Category A)
>
> "A capability shall be provided for <u>in situ</u> periodic testing and surveillance of the air cleanup systems to ensure (a) filter bypass paths have not developed and (b) filter and trapping materials have not deteriorated beyond acceptable limits."

"Criterion 65 -- Testing of Operational Sequence of Air Cleanup Systems Category (a)

"A capability shall be provided to test under conditions as close to design as practical the full operational sequence that would bring the air cleanup systems into action, including the transfer to alternate power sources and the design air flow delivery capability." (Emphasis added.)

Category A has been defined for the proposed criteria as:

"Experience has shown that more definitive information is needed at the construction permit stage for the items listed in Category A than for those in Category B."

The testing capability of the air cleanup systems is measured, again like the spray systems, for conditions as close to design "as practical". Con Ed has stated that as with the spray system it is extremely difficult [21] to test this completed system and also relates the problem to engineering, schedule and economic considerations.

The research and development programs which are planned or are underway pertain to core stability and power distribution monitoring, burnable poison rods, rod burst program, organic iodine removal by charcoal filters, failed fuel monitor, hydrogen generation, and other identified matters. These research and development programs apply to the operation of all pressurized water reactors and have been underway for sometime, except in the case of the program for determining the

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21/ The Division of Reactor Licensing of the Commission in a recent public release (May 5, 1969) in reference to a failure of a safety system, unrelated to the instant matter, stated as follows:

"This occurrence demonstrates the need for a full and complete testing program through the total range for which a component is designed to operate."

efficiency of impregnated charcoal filters for removal of organic iodides under postulated post-accident conditions. After careful review, we conclude the programs for the items listed in this program, are reasonably designed to accomplish their objectives, will provide adequate information on which to base analysis of the design and performance and should lead to acceptable designs for the respective systems.

In the analysis of the thermal shock experienced by the vessel during safety injection following a loss-of-coolant accident, there are some uncertainties in the analytical method regarding properties of the steel after several years of neutron irradiation. These uncertainties are the subject of a research and development program. The results of the program will not be available until after Unit 3 begins operations. However, preliminary data indicate that the cumulative neutron irradiation of the vessel will not change its properties significantly prior to the time new information is available from the research and development program. Furthermore, provisions will be made in the design and layout of Unit No. 3 to enable installation of equipment to mitigate the consequences of a post-loss-of-coolant accident reactor vessel failure, if further analysis of the thermal shock experienced by the vessel during safety injection indicates that such protection should be required. We believe this research and development program provides reasonable assurance that the question will be satisfactorily resolved.

Con Ed has submitted a statement in its application that it is not owned, controlled or dominated by an alien, a foreign corporation, or a foreign government. In addition, Con Ed has submitted biographies of its principal officers and directors, all of whom are citizens of the United States. Section 104d of the Act prohibits the Commission from issuing a license to an applicant if it is owned, controlled or dominated by an alien, a foreign corporation or a foreign government, "... if the Commission knows or has reason to believe" that such is the case. The Commission, in the case of Commonwealth Edison Company (Zion Station, Units 1 and 2), Docket Nos. 50-295 and 50-304, stated that it considers

> "... it unnecessary, unreasonable and inconsistent with legislative intent to require an applicant to furnish conclusive proof of the negative where there is no record evidence, taking due account of the requirements of Section 50.33, which would provide a basis for a finding of alien ownership, domination or control."

The proof submitted by Con Ed is similar to the Zion presentation which has been approved by the Commission. That approval is considered to be a policy determination for guidance by a Board. Upon that basis, the finding is made that consistent with the requirements of Section 104d of the Act, Con Ed is not owned, controlled or dominated by an alien, a foreign corporation or a foreign government.

No question was raised in the proceeding concerning the technical and financial qualifications of Con Ed and its turnkey constructor for the project. The Board concludes from the evidence that adequate basis exists and thus finds that Con Ed is technically and financially qualified to construct and operate the proposed Indian Point Unit No. 3.

In addition to the findings of fact and conclusions of law reflected in the foregoing initial decision, which have accepted, modified and rejected proposed findings submitted by the parties to the extent therein shown, the following specific rulings are made in reference to the proposed findings of fact and conclusions of law submitted by the parties:

Applicant's findings of fact and conclusions of law accepted are: 1, 2 (accepted in part, but rejected in reference to the position of Atomic Energy Council), 3, 4, 5 (including the footnote with specific addition in part as follows: "... financial qualifications since they are covered by both private company insurance and by the Price Anderson Act..."), 6 (accepted in part, and rejected in part for the reason that Applicant has yet to complete the planned program to secure additional data), 7, 8, 9 (accepted in part and restated that the concentration of radioactivity at the Chelsea Pumping Station is expected to be 1.4% of

10 CFR 20 limits), 10 (accepted in part but restated that any pertinent atmospheric data should be applied to Unit No. 3), 11, 12 (accepted in part but restated that for the improbable event that Applicant considers that the differences in meteorological assumptions between Applicant and the Staff are not significant in regard to compliance with the Commission's site criteria, 10 CFR 100), 13 (accepted in part, but restated to add "present dispersion calculations" after "an adequate basis for the"), 14, 15 (accepted in part but restated by the addition of "principal means" after "will be" in second sentence), 16 (rejected in part, but accepted in reference to Applicant's showing that its proposed environmental monitoring program will be adequate), 17 (accepted in part but portion rejected is: "... to and adequate for discharges regardless of the temperature of the effluent or the environment..." since those statements do not appear in 10 CFR 20), 18, 19 (accepted in part, but restated to include: "are appropriate environmental measurements" in lieu of "are adequate" in first sentence, and add: "on basis of its proposed environmental program" at end of last sentence), 20 (accepted in part but rejected in reference to "orderly progression" shown in last sentence, rejected for lack of substantial evidence), 21, 22, 23, 24 and 25 and 26 (as a group are accepted to extent shown in this decision, and restated is number 25 that the doses predicted by Staff and Applicant are within 10 CFR 100

guidelines), 26 (accepted to extent shown by this decision), 27 (accepted but add at end of last sentence: "within the limits of practicality defined by Applicant), 28, 29 (accepted to extent shown by decision), 30, 31, 32 (accepted upon basis that this is a primary research and development program), 33, 34, 35 (accepted in part, but rejected is: "the conservatism of" in first sentence, rejected for lack of substantial evidence), 36, 37, 38 and 39.

Applicant's findings which are rejected are those portions shown in the foregoing paragraph.

The Regulatory Staff's proposed findings of fact and conclusions of law accepted are: 1, 2, 3, 4, 5, 6 (but rejected as irrelevant is statement of Board's authority), 7, 8, 9, 10, 11, 12 (but rejected is "adequately" in first line), 13 (but rejected is last sentence as contrary to the evidence), 14, 15, 16, 18 (but restated that discharges "can be" in lieu of "will be" in last sentence), 19, 20, 21 (accepted to extent shown in the decision), 22, 23, 24, and 25.

The Regulatory Staff's proposed findings of fact and conclusions of law rejected, and for the reasons shown, are: 17 (rejected as not supported by substantial evidence).

Intervenor Atomic Energy Council of the State of New York did not submit any proposals for findings of fact or conclusions of law, but it filed a statement that it had no objection to the proposed

findings and conclusions submitted by Applicant and the Regulatory Staff. The Council also requested that a closing statement of its position respecting several matters in the record be included. The request is granted.

Intervenor Citizens Committee for the Protection of the Environment filed a statement which did not comply with the Rules of Practice; nevertheless, the Board has considered the statement and concludes that the findings hereinbefore made in this Initial Decision consider and determine the said Citizens Committee's proposals. In addition, the following specific rulings are made in reference to Citizens Committee's proposals: Accepted are Citizens proposals 1, 6 (accepted upon basis that reasonable assurance exists that the necessary protection will be provided as a result of further reviews and analyses suggested by ACRS). Rejected, and for the reasons shown, are: 2 (rejected because some tests have been made and the principles have been tested), 3 (rejected for being contrary to the evidence), 4 (rejected for being contrary to law and that safety considerations are determined herein with respect to the specified aspects of the nuclear facility), 5 (accepted in part, but rejected in that part in relation to Con Ed's maintenance and operating procedures for the future), 7 (rejected since no evidence was presented respecting the recited subjects, in that an intervenor made unsubstantiated statements relative to causal relation to cancer deaths

and the Committee requested an investigation. The matter is submitted to the Commission without recommendation.), 8 (rejected first because data from other reactors will be considered in reference to Indian Point Unit No. 3, and second, because this Board has no jurisdiction in reference to providing a hearing on an operating license for Indian Point No. 2).

Intervenor Weik did not submit any proposed findings or conclusions.

Upon the basis of consideration of the entire record in this proceeding, and in the light of the foregoing which constitutes findings of fact and conclusions of law, the Atomic Safety and Licensing Board further finds and concludes as follows:

1. In accordance with the provisions of 10 CFR Section 50.35(a)
   (a) The Applicant has described the proposed design of the facility, including, but not limited to, the principal architectural and engineering criteria for the design, and has identified the major features or components incorporated therein for the protection of the health and safety of the public;
   (b) Such further technical or design information as may be required to complete the safety analysis and which

can reasonably be left for later consideration, will be supplied in the final safety analysis report;

(c) Safety features or components, if any, which require research and development have been described by the Applicant and the Applicant has identified, and there will be conducted, a research and development program reasonably designed to resolve any safety questions associated with such features or components; and

(d) On the basis of the foregoing, there is reasonable assurance that (i) such safety questions will be satisfactorily resolved at or before the latest date stated in the application for completion of construction of the proposed facility and (ii) taking into consideration the site criteria contained in 10 CFR Part 100, the proposed facility can be constructed and operated at the proposed location without undue risk to the health and safety of the public;

2. The Applicant is technically qualified to design and construct the proposed facility;

3. The Applicant is financially qualified to design and construct the proposed facility; and

4. The issuance of a permit for the construction of the facility will not be inimical to the common defense and security or to the health and safety of the public.

WHEREFORE, in accordance with Section 104b of the Atomic Energy Act, as amended, and the Rules and Regulations of the Commission, IT IS ORDERED that, subject to review by the Commission upon its own motion or upon the filing of exceptions in accordance with the Rules of Practice, 10 CFR Part 2, Consolidated Edison Company of New York, Inc. is authorized to construct the facility in accordance with the application and with the evidence and representations entered in the record at the hearing; and the Director of Regulation is directed to issue a provisional construction permit to Consolidated Edison Company of New York, Inc. as set forth in Appendix "A" to the Notice of Hearing in this proceeding, which was published in the Federal Register on February 5, 1969 (34 Fed. Reg. 1741).

IT IS FURTHER ORDERED, in accordance with Sections 2.760, 2.762 and 2.764, that this Initial Decision shall be come effective immediately and, in the absence of any further order from the Commission, shall constitute the final decision of the Commission forty-five days after the date of issuance, subject to the filing of exceptions and to any order by the Commission upon such petition or upon its own motion.

ATOMIC SAFETY AND LICENSING BOARD

Thomas H. Pigford

Thomas H. Pigford

Samuel W. Jensch

Samuel W. Jensch, Chairman

Issued:
August 13, 1969
Germantown, Maryland

Dr. John H. Buck, Board Member, concurring in part, and dissenting in part, as follows:

I agree in general with most of the Initial Decision but must dissent with the conclusion of my colleagues that a construction permit can be granted only under the condition that

both Applicant and Regulatory Staff present further evidence under 10 CFR Section 50.35 of the regulations concerning the design basis accident.

In my opinion, my colleagues reach this conclusion because they have not considered all of the factors involved in TID-14844 and the full relationship of these factors to the evidence submitted by the Applicant and the Staff during the course of this hearing.

In its calculation of the minimum requirements for certain engineered safeguards under design basis accident condition the Staff among other conditions uses the TID-14844 assumption that 50 percent of the inorganic iodine released from the core will be absorbed in the so-called plateout process. Staff's understanding of this process is explained on pages 1372 and 1373 of the transcript, particularly the section of page 1373 as follows:

> "The TID-14844 is not specific as to the mechanism of plateout. It does apply to the present generation of boiling water and pressurized water reactors, however. And the depletion of the airborne iodine is both a surface condensation plateout phenomenon and a depletion due to the steam flux which is present, initially carrying the iodine to the surfaces and the combination of these two mechanisms has been shown in many, many experiments to be much greater than -- shows a depletion factor much greater than this factor of two."

As a result of this assumption the Staff concludes that dosages at the boundary of the site can be held below 10 CFR requirements with no engineered safeguard except one-half of the spray system and

three-fifths of the filter systems operable. They calculate that with their assumptions the spray system need have an iodine removal rate of only 4.9/hr.

The Applicant on the other hand calculates that one-half of the spray removal system will have an iodine removal factor of at least 32/hr and this factor is confirmed by Battelle and Oak Ridge experiments. They find that this factor along with operation of three-fifths of the filter system is sufficient to reduce the iodine to the point where site edge dosages will be maintained below 10 CFR 100. They related that they did not use the plateout factor since with the more rapid spray removal factor the two might be competitive (see Tr. 1371). They do not disagree with Staff that plateout does occur.

It is my opinion based on Staff's testimony (particularly page 1375) that much of the plateout occurring on the condensing steam of the accident would occur before the elemental iodine has reached the containment structure where the spray is effective. The Staff furthermore made it clear (see Tr. 2152) that they recognized that their calculational model for spray included factors which they felt were over conservative. They pointed out also that they did not change their model because they felt it unnecessary in view of Applicant's model showing satisfactory results as far as

10 CFR 100 dosages are concerned. (See Staff's Answer to Board's Prehearing Conference Questions 4 and 5.) In addition to this, Applicant (Tr. 2197 through 2204) stated that the spray system design would be maintained to give a dose reduction factor of 64 unless present uncertainties are reduced by research and development data.

In summary, there is no disagreement between Applicant and Staff that the public will be protected from the improbable design basis accident even in the further improbable situation that of all the engineered safeguards only one-half of the spray system and two-thirds of the filter system work. In asking for more data to prove that there is sufficient safety factor involved, my colleagues are merely requesting a reaffirmation of an agreement.

It is my opinion that the time spent in preparing such a report can be better used by both Applicant and the Staff to ensure that basic design and construction quality are such that the design basis accident will not occur.

I agree with my colleagues in their statement of the Applicant's findings of fact and conclusions of law, except items 21, 22, 23, 24, 25, 26 and 27, accepted as a group. Item 29, accepted.

I also agree with my colleagues decision on the Regulatory Staff's proposed findings of fact and conclusions of law, except that I accept items 12 and 21 as written by the Staff. I accept in full the findings of my colleagues on the Intervenor, Atomic Energy Council of the State of New York; Intervenor, Citizens Committee for the Protection of the Environment; and Intervenor, Weik.

John H. Buck

John H. Buck

Dr. Pigford, Board Member, concurring specially;

A more detailed analysis supporting the conclusions of this decision is as follows:

The Commission in its 10 CFR 100 Site Criteria Regulations has cited as a reference a document numbered TID-14844, entitled "Calculation of Distance Factors for Power and Test Reactor Sites." 1/ This document contains a procedural method and sample calculation which may be used as a point of departure for consideration on particular site requirements which may result from evaluation of the characteristics of a particular reactor, its purpose and method of operation. For the purpose of safety analysis the document TID-14844 appears to serve two useful purposes. First, it describes a mathematical technique for predicting off-site doses from a hypothetical accident. Second, it presents a sample calculation of off-site doses from a hypothetical accident, illustrating the application of this mathematical technique and illustrating the site distances, i.e., exclusion radius and low population radius, which would be predicted on the basis of the various numerical assumptions used in this sample calculation. These assumptions include (1) a certainleakage rate from the containment structure, (2) use of a wind speed of one meter

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1/ dated March 23, 1962.

per second for the analysis of atmospheric dispersion, (3) the assumption that 50 percent of the fission product iodine inventory in the core is released into the reactor building, and (4) the assumption that 50 percent of the iodines released to the containment adsorb ("plateout") onto internal surfaces of the reactor building or adhere to internal components, the remaining 50 percent being available for release to the atmosphere by leakage from the containment. In this sample calculation no credit is taken for removal of radioactive iodine from protective safeguards such as cooling sprays and internal air recirculating systems.

It is understood that the main effect of the TID-14844 sample calculation is to present a reference case which serves as a point of departure for the subsequent calculation of off-site doses from a suitably conservative postulated accident for the actual reactor plant and plant site which the Applicant has proposed. In this latter instance, the Applicant is expected to examine all significant aspects of the hazards and safety problem which it believes to be appropriate to the particular situation, and the Applicant bears the responsibility for justifying all the assumptions and methods of calculation used in a hazards evaluation. The fact that certain aspects of the safety problem may not have been considered in the sample calculation set forth in TID-14844 does not relieve the Applicant of the responsibility of carefully examining, in his particular case, every significant facet of the hazards and

safety problem. Also, it is understood that an important function of the review by the Regulatory Staff is to insure that the information presented by the Applicant is that necessary to support findings in respect to safety. Another essential function of the Staff is to carry out an in-depth and in-breadth review of the information in the application and to arrive at its own judgment with respect to safety of the proposed plant.

The Applicant and the Regulatory Staff have generally approached their accident analyses in this way for the proposed Indian Point 3 facility. They use actual or expected performance parameters for the proposed plant and site when such information is available. When the necessary and suitably reliable performance parameters are not available, assumptions which are supposedly demonstrable as being suitably conservative are used in this calculation.[2/] For example, both the Applicant and the Regulatory Staff utilize modified versions of the TID-14844 sample calculation to estimate the off-site doses from fission-product iodines which would theoretically occur if the spray absorption system and the filter system for iodine removal, as well as other engineered safeguards, are not operating. Calculations of doses on this assumed basis are referred to herewith as Case P, adopting the nomenclature used in a table of dose calculations

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2/ Plans for programs of research, development, design, and analysis to obtain further information when necessary to validate essential assumptions, are described and evaluated at the Construction Permit stage.

presented by the Applicant. Case P iodine doses are then compared with the 300 rem thyroid value set forth in 10 CFR 100 to determine the minimum necessary dose reduction factors to be accomplished by the spray and filter systems.[3/] The accident postulated for these dose estimates involves the double-ended rupture of a main coolant pipe, with consequent expansion of the coolant as flashing steam, meltdown of the fuel [4/] and partial release of the fission product inventory to the atmosphere of the reactor building. This accident, referred to here as the "design basis accident", is considered to meet the criterion of exceedingly low probability of occurrence so that the doses calculated from this accident can be compared with the 10 CFR 100 values for the purposes of site evaluation.

In carrying out their Case P calculations, both Applicant and Staff rely only in part upon the numerical assumptions used in the sample calculation of TID-14844. For example, they both use somewhat different meteorological parameters in their estimates of atmospheric dispersion, including Applicant's use of a wind speed greater than one meter per second for time periods subsequent to the first two hours after the accident and Staff's use of a similarly greater wind speed after 8 hours. The Staff uses a

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3/ The mathematical technique of making this comparison differs between Applicant and Staff.

4/ Meltdown of the fuel implies the assumption, for the purpose of this accident analysis, that the emergency core cooling system (ECCS) does not function.

modified version of the mathematical technique described in TID-14844 for calculating atmospheric dispersion. The building leak rate used is that specified for Indian Point 3, which, for a portion of the accident period, happens to be numerically the same as that assumed in the TID-14844 sample calculation. Both Applicant and Staff assume that all organic iodine released to the containment remains available for release to the atmosphere by leakage from the containment and that there is no plateout of organic iodine on the containment surfaces. For the purpose of the Case P calculation, which assumes no spray absorption system or filter system for iodine removal, both Applicant and Staff assume that 50 percent of the inorganic iodine released to the containment plates out on the internal surfaces of the reactor building or adheres to internal components, as is assumed in the TID-14844 sample calculation with no sprays and filters operable. Applicant justified this plateout assumption for this Case P calculation on the grounds that, with no sprays and filters operable, no process which competes with plateout for iodine removal is present within the containment. Therefore, it appears that the technical justification for the plateout assumption used in the TID-14844 sample calculation, with no sprays or filters operable, is expected to be applicable to this Case P calculation. These are examples of modifications made by Applicant and Staff to the TID-14844 sample calculation so that the off-site doses

for the assumed Case P with no sprays or filters are more realistically estimated.

On the basis of its own estimates of the Case P doses, the Regulatory Staff concludes that the estimated two-hour iodine dose at the site boundary and the 30-day dose at the low-population boundary exceed the 300 rem value of 10 CFR 100 by factors of 4.7 and 11.2 respectively. The Regulatory Staff has therefore specified these dose reduction factors as the minimum performance requirements for the spray and filter systems, such that accident doses calculated with these iodine-removal systems operable would just meet the 300-rem guideline of 10 CFR 100. 5/

5/ This is a proper statement of the minimum performance requirement of the sprays and filters only if plateout of inorganic iodine can be expected to occur when sprays and filters are operable. If no plateout of inorganic iodine were assumed to occur with sprays and filters operating, the necessary minimum dose reduction requirements due to sprays and filters would be greater than those estimated by the Regulatory Staff because plateout is then lost as a dose reduction mechanism. On this basis, the 300-rem guideline of 10 CFR 100 should be compared with the Case P doses corrected by doubling the inorganic-iodine contribution to doses in the Case P calculation. This is the technique used by the Applicant in estimating off-site doses for specified dose reduction factors due to sprays and filters. Using the Staff's Case P dose estimates, the necessary dose reduction factors without iodine plateout would be 9.1 for the 2-hour dose and 21.2 for the 30-day dose. If filters and sprays are able to achieve dose reduction factors of this magnitude, and if plateout of inorganic iodine is not present as a dose reduction mechanism when sprays and filters are operable, the resulting off-site doses would just meet the 300-rem guideline of 10 CFR 100. In this sense the Staff's method of defining dose reduction factors is not the same as that used by the Applicant.

Dose reduction during the 2-hour period must be achieved almost entirely by the spray system, since relatively little iodine removal can be achieved by the charcoal filters during this time period. Therefore, the Staff's stated requirement of a minimum dose reduction factor of 4.7 during the 2-hour period is identified by the Staff as the minimum performance requirement for the spray system. The Staff expects that the minimum dose reduction factor of 11.2 for the 30-day period is to be accomplished principally by the sprays, with some augmentation by the charcoal filter system.

The containment spray system is intended to remove radioactive iodine in the inorganic form by physical absorption into the spray droplets and by chemical reaction with sodium hydroxide contained in those droplets. This spray system is also intended to reduce the high temperature and pressure which is likely to occur in the containment structure in the event of a design basis accident. The spray solution also contains a chemical compound of boron which serves a neutron-absorbing component in case the spray solution enters the reactor core after a design-basis accident. Concentration limits have been specified for the sodium hydroxide so that there will be an amount in excess of that theoretically required to react with the inorganic iodine which is released and so that the concentration will not exceed an upper limit set by considerations of compatibility with the structural materials to which the spary solution will be exposed. The charcoal filter system is intended

to reduce the concentration of radioactive iodine in the organic form by isotopic exchange with non-radioactive iodine which is maintained as an impregnant in the charcoal filters. Indian Point 3 is the first nuclear power plant for which a construction permit has been requested which depends upon this isotopic-exchange technique for removal of the radioactive iodine in organic forms. The Regulatory Staff has concluded that operation of both the spray absorption system and the charcoal filter system is necessary to insure adequate safety in the event of a design basis accident. Consistent with the requirements for redundancy in such vital systems for engineered safeguards, the spray system is to be designed so that the performance requirements can be met with one-half of the sprays operating, and the charcoal filters are to be designed so that the performance requirements can be met with sixty percent of the filters operating. It is important that, in the event of a design-basis accident, injection of spray solution into the containment space be initiated rapidly and the spray solution be capable of rapidly reducing the concentration of inorganic iodine within the containment.

In calculating the expected performance of the spray absorption system, both the Applicant and the Regulatory Staff rely upon theoretical estimates from an idealized absorption model generally known as the "single-drop model." The expected iodine-removal capability of the spray system is quoted in terms of the removal

rate constant, which is the fraction of the inorganic iodine within the entire containment system which is removed per unit time. On the basis of its simplified design model, the Applicant calculates a spray removal rate constant of 32 per hour, corresponding to a removal half life of 1.3 minutes. An apparent removal half life of this magnitude is supported by much of the test data on experimental spray systems on a much smaller scale than the spray system designed for the Indian Point 3 facility. A spray system with a removal rate constant this large would reduce the inorganic iodine sufficiently and rapidly enough to bring the 2-hour off-site doses well below the 10 CFR 100 guideline, and with adequate operation of the charcoal filters for organic iodine removal, would result in 30-day doses well below the 10 CFR 100 guidelines. However, although the removal rate constant itself is supported by a considerable portion of the experimental data on iodine absorption in sprays, it is recognized that there are uncertainties which remain when the Applicant's simplified version of the absorption model is used to predict the performance of the spray system which the Applicant proposes to install in the Indian Point 3 facility. These uncertainties are of the nature of simplifying assumptions which the Applicant has made in calculating spray performance with his simplified mathematical model, uncertainties in the simulation and interpretation of experimental data on spray absorption, uncertainties in scale-up from the pilot-plant tests, and certain unresolved anomalies in

some of the experimental data that have been obtained. The Applicant, the Regulatory Staff, and the Board agree that it would not be proper to use the Applicant's simplified design model to design a spray system with a predicted performance such that the iodine doses calculated by this model are just sufficient to meet the 300 rem limits of 10 CFR 100. There must be an adequate margin of uncertainty, referred to hereafter as a "design margin", which will provide reasonable assurance that the spray system will meet the necessary performance, when called upon to do so, in an emergency situation.

A further need for a design margin arises because the Applicant does not plan to carry out a functional test 6/ of the iodine absorption capability of the spray system which is to be installed in the proposed Indian Point 3 facility. The Board understands the Applicant's desire to follow his proposed construction sequence, which would evidently make such testing extremely difficult. Criterion 38, which has been proposed by the Commission as one of the design criteria for nuclear power plant construction permits, states

> "All engineered safety features shall be designed to provide high functional reliability and ready testa-

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6/ The Applicant has plans for several tests which are intended to demonstrate component reliability and flow reliability of the spray system. Tests of the performance capability of the installed spray system to absorb iodine, are, however, not planned.

A functional test of iodine absorption capability would not necessarily consist of a complete simulation of all conditions which would be expected within the containment in the event of a design-basis accident, such as the full inventory of radioactive iodine.

> bility. In determining the suitability of a facility for a proposed site, the degree of reliance upon and acceptance of the inherent and engineered safety afforded by the systems, including engineered safety features, will be influenced by the known and the demonstrated performance capability and reliability of the systems, and by the extent to which the operability of such systems can be tested and inspected where appropriate during the life of the plant."

There is no question here as to the degree to which the spray absorption system must be relied upon to reduce iodine content in the event of a design-basis accident. For the conditions stated for this accident, it is the only system provided to carry out this function for the 2-hour dose, and it must carry the largest burden of iodine removal to result in an acceptable value for the 30-day dose.[7/]

7/ It is to be recognized that the necessity for iodine absorption exists only if certain other safety systems do not function. The Emergency Core Cooling System (ECCS) is designed to prevent core melting in the event of a major pipe rupture. The Applicant expects that ECCS operation will reduce iodine release to 3 percent of the core inventory, as compared with 50 percent release expected if the ECCS does not function. Similarly, the Applicant has described an Isolation Valve Seal Water System (IVSWS), which is designed to operate within one minute after an accident and is designed to reduce the containment leakage rate to zero. This expected zero leakage will not be subject to proof testing or demonstration, however. According to the Applicant's calculations, operation of either the ECCS or the IVSWS would remove the need for iodine absorption. However, in calculating the off-site doses from the postulated major accident, and in comparing these doses with the 10 CFR 100 guidelines to assess plant safety, both the Applicant and the Regulatory Staff assume that operation of the iodine removal systems is required. It is understood that sufficiently rapid and extensive iodine removal under these design-basis accident conditions is a performance criterion for the spray and filter systems, and adequate performance according to this criterion is considered to be an essential element in assuring public safety.

Therefore, it is concluded that the absence of testing of the iodine absorption function of the spray system as installed argues for further conservatism in establishing a design margin for this system.

The Board has sought a determination of the margin of uncertainty which should be applied as a design margin to the spray absorption system in view of the present uncertainties and in view of the uncertainties which are likely to remain unresolved at the time the plant goes into operation.[8/] Since the actual iodine-absorption capability of the spray system will not be subject to verification by testing,[9/] and since the designed performance capability will rest upon the Applicant's simplified design approach as described above, establishment of a design margin of sufficient magnitude to provide reasonable assurance of safety is a necessary step in identifying the design criteria for this system. The Applicant's position with regard to the design objectives of the spray absorption system is stated as follows:

> ".... the commitment is to meet the guidelines of 10 CFR 100, with an adequate margin for uncertainty. If we can reduce the uncertainty in these figures, in the course of the detailed design of the plant, it is conceivable that a smaller dose reduction factor might be adequate. The judgment as to what is an adequate margin for uncertainty rests with the opinions of our experts and independent experts including those of the regulatory bodies in evaluating the final safety report on the facility."

8/ The Regulatory Staff has stated that uncertainties involved in the simplifying assumptions in the design model used by the Applicant will not be resolved by the spray R&D program.

9/ Infra, footnote 6

The Board agrees that the Applicant is committed to meet the guidelines of 10 CFR 100 as well as other applicable Commission regulations regarding safety. It is the question of reasonable assurance that these regulations can be and will be met in a way that provides adequate safety that is the issue before the Board. The identification and justification of a design margin which is adequate and suitable for assurance of safety, and justification that there is reasonable assurance that such performance can be and will be achieved, are subjects for this proceeding as well as for subsequent review at the time of a final safety report. 10/

10/ Clear and proper identification of performance requirements, as well as identification of means of assuring that these requirements will be met, are vital elements of a quality assurance program. In this sense quality assurance begins before an application for a construction permit is submitted and extends through the operating life of the plant. An independent review agency for quality assurance, including representatives from the AEC Division of Compliance, would find it difficult to determine whether or not the containment spray system is likely to meet the performance objectives as now formulated. This results in part because the Staff's stated minimum performance requirements of the spray system, in terms of a minimum requirement for the overall dose reduction factor for the spray system, are inconsistent with the overall dose reduction factors deduced by the Applicant. This inconsistency is noted in footnote 5/. Also, there should be developed a clear definition of the design margins that should be allowed for, and these margins should be subjected to continuous review as new information is developed.

Some help in resolution of the question of the necessary design margin for spray absorption is provided by the analyses carried out by the Regulatory Staff. The Staff has identified certain technical uncertainties in the Applicant's simplified design model [11/] and has made its own evaluation of the iodine removal rate for the spray system on the basis of its conservative assumptions regarding liquid film mass transfer resistance and drop size distribution and coalescence. Thus, the Staff has

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11/ These uncertainties are due, in part, to certain mechanisms which are neglected in the calculational model used by the Applicant. The mechanisms identified by the Staff are drop size distribution, drop coalescence, and liquid-film mass transfer resistance. Drop size distribution and drop coalescence affect the effective surface area for gas absorption. For a given spray nozzle and flow rate, the effective surface area may depend strongly upon the history of the spray drops as they travel through the containment atmosphere, and it may therefore depend upon the physical dimensions of the overall containment system. Liquid film resistance can arise here if there is not instantaneous chemical reaction, at the liquid surface of the drop, between sodium hydroxide and iodine to form non-volatile iodine compounds within the drop. The actual rate of depletion of volatile forms of dissolved iodine by chemical reaction depends both upon chemical reaction rates and the rate of diffusion of sodium hydroxide to the drop surface. Therefore, existence of reactive sodium hydroxide within the spray liquid does not necessarily preclude the existence of a liquid-film resistance. Such effects are difficult to deduce from experimental data and are difficult to predict accurately with theoretical techniques. Effective diffusion rates within spray drops depend strongly upon drop history and, therefore, upon the physical dimensions of the spray system.

Other uncertainties characteristic of spray absorption systems are the extent of mixing of the unabsorbed gas within the containment space and the possibility of non-gaseous forms of the absorbing component (iodine). These are not taken into account in the analyses by either the Applicant or by the Regulatory Staff.

incorporated into its own performance analysis quantitative factors to allow for some of the undertainties [12] mentioned earlier in this decision. Therefore, use of the Staff's removal rate constant for iodine absorption to assess the absorption capability of the sprays solves much of the problem of identifying the necessary margins for uncertainty.

Taking these additional factors into account, the Regulatory Staff calculates a spray removal rate constant of 4.9 per hour corresponding to a removal half life of 8.5 minutes.[13] The Staff then uses this value as a suitably conservative estimate of the iodine removal efficiency of the spray for the purpose of accident analysis. The Regulatory Staff concludes that sufficient conservatism has been incorporated into its estimate of the iodine removal efficiency so that doses estimated on the basis of this lower efficiency can be compared directly with the 10 CFR 100 guidelines without need for additional design margins. The Staff has stated

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12/ The Regulatory Staff states: "The R&D program relating to the drop size spectrum, drop coalescence, and to the possible effect of liquid phase mass transfer resistance is not in itself sufficient to resolve present uncertainties, insofar as it relies heavily on experimental data from other laboratories." The Staff also states "The R&D program as proposed here does not intend to produce any additional experimental data. It tends to rely on published data as it stands. We also have access to the same experimental data, and we have made our own interpretation of the meaning of that experimental data. That is really the significance of the R&D program here. As it stands, I think that there is little to be gained by its completion."

13/ This is to be compared with the Applicant's estimated removal half life of 1.3 minutes.

that it has reviewed all the design information and experimental data on spray absorption which were presented and discussed in this proceeding, and the Staff reaffirms,[14/] that upon review of this information it retains its more conservative estimate of the removal rate constant for the purpose of predicting the performance capability of the spray absorption system. Although it is possible that a research and development program could be carried out which would remove some of the uncertainties which have led to the Staff's more conservative estimate of the spray performance, the Staff concludes that the presently planned research and development program would not remove these uncertainties.[15/] It appears further that the Staff has concluded that these uncertainties do not need to be removed by the proposed research and development program, and indeed will not be removed, because even with the Staff's more conservative estimate of the spray removal efficiency the off-site doses as estimated by the Staff are sufficient to meet the guidelines of 10 CFR 100.[16/]

There are similar differences in the estimates by Applicant and the Regulatory Staff of the iodine removal efficiency of the charcoal bilters. The Applicant estimates a removal efficiency for organic

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14/ Post hearing correspondence from Regulatory Staff dated July 1, 1969.

15/ Infra, footnote 12.

16/ As will be explained subsequently, there remains significant uncertainty in the dose estimates by the Regulatory Staff, as relating to the Staff's use of a factor for iodine plateout in calculating these doses.

iodine of 50 percent per pass through the filters, and he also assumes that 90 percent of the inorganic iodine will be removed per pass. The Regulatory Staff uses a removal efficiency for organic iodine of 5 percent per pass[17/] in their analysis of off-site doses and has stated that it takes no credit for removal of inorganic iodine by the filters.

The uncertainty in the iodine removal efficiency for the filters is connected in part with the questionable performance of charcoal filters in a moving air stream which is near 100 percent relative humidity. The high humidity results in part from the large moisture content expected in the containment immediately following a design basis accident and in part from the operation of an air cooling unit which is ahead of the charcoal filters in the air recirculating system. Although the air leaving this cooling unit is likely to contain entrained moisture as droplets, the Applicant expects that a demister and HEPA filter between this cooler and the charcoal filters will reduce the moisture content to no more than 100 percent relative humidity. The Applicant expects that heating by the recirculating fans, through which the air passes prior to being bypassed to the charcoal filters, will reduce the relative humidity to somewhat below 100 percent. There remains the possibility that during the initial stages of operation of the charcoal filters in

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17/ The Staff has stated that a removal efficiency of 5 percent per pass is a minimum performance requirement of the filter system.

a design basis accident moisture may condense on the filters because the charcoal is initially at a temperature well below the temperature of the moving air stream. Such condensation as well as inefficient operation of the demister and upstream HEPA filter, could result in water flooding of the charcoal filters.

The Regulatory Staff has concluded that there is conflicting evidence regarding the capability of impregnated charcoals to effectively remove organic iodides from a moving air stream at a relative humidity near 100 percent. Data summarized by the Applicant indicate removal efficiencies varying from a few percent to as high as 90 percent per pass through filters of varying charcoal conditions. Because of this, the Applicant will conduct additional research and development on the removal or organic iodides by impregnated charcoal at high relative humidity. The Regulatory Staff has specified several alternatives in the design of the air handling and filtration unit, depending on the results of the R&D program. These are

(1) operation as now proposed, if it can be shown that the filter efficiency provides the required 5 percent per pass

(2) preheating the air entering the filter is necessary to achieve if the requirement of 5 percent per pass cannot otherwise be achieved

(3) isolation of the filter in a tight enclosure during the early portion of the post-accident period if the charcoal filter bed cannot recover from flooding but is otherwise acceptable in performance

(4) modification of the orientation of the filter bed if it is shown that the direction of air flow is a significant factor in improving either the removal efficiency or the ability to recover a flooded bed.

The Applicant has stated that sufficient space is allowed in the design to accommodate these modifications if needed. It is clear that the Staff's analyses of the iodine removal efficiency of the charcoal filters is based upon its conclusion that 5 percent per pass can be achieved, subject to possible modifications in the design as described above, and the Staff uses this value as a suitably conservative estimate of the filter efficiency for the purpose of analysis of offsite doses. It is concluded that the Staff estimate of the filter removal efficiency includes sufficient design margin for uncertainty so that doses estimated on the basis of this removal efficiency can be compared directly with the 300 rem guideline in 10 CFR 100 for the purpose of safety evaluation. It is further concluded that the R&D program for the charcoal filters is well formulated, has clearly defined objectives relative to the information needed, and provides suitable and well-defined alternatives which can be adopted in the event that the present expectations may not be fully achieved.

In addition to the proper functioning of the two iodine removal systems, the expected leakage rate of gaseous effluents from the containment structure must not be greater than designed. The containment is designed so that its capability to withstand excessive leakage

can be verified by preoperational and post-operational testing. The Applicant believes that the leakage rate will be less than the present design levels by the functioning of an additional safety mechanism described as a water seal injection system. Operation of the seal injection system is not assumed in the Staff's analysis of the off-site doses in a design basis accident.

The meteorological conditions used by the Staff in its analyses of off-site doses in a design basis accident are less conservative than those of the Applicant for the 2-hour dose at the site boundary and more conservative for the 30-day dose at the low population boundary.

The Staff estimates[18/] of the off-site doses for a design basis accident

Table I

DOSE ESTIMATES BY THE REGULATORY STAFF

		Thyroid Doses, REM		
		Inorganic	Organic	Total
Case-P	2-hr	1287	143	1430
	30-day	3010	335	3345
Design Basis Accident (sprays and filters operable)	2-hr	130	136	266
	30-day	48	252	300

18/ Post-hearing correspondence from Staff, dated June 20, 1969.

It is on the basis of the above estimates for the design basis accident doses, using its suitably conservative efficiencies for iodine removal, that the Staff concludes that the off-site doses from the design basis accident are within the 300-rem guideline of 10 CFR 100.

The information in the above table was requested from the Staff as a result of the Board's post-hearing attempt to resolve apparent discrepancies between statements made in the hearing by the Staff and data which appeared in a tabulation of dose estimates presented by the Applicant at the last session of the hearing. In calculating its off-site doses with spray and charcoal filter systems operable, the Applicant has taken no credit for any possible plateout of radioactive iodine released to the containment in a design basis accident.[19/]

In response to a post-hearing request by the Board, the Staff confirmed that it was relying upon the assumption that 50 percent plateout of the inorganic iodine released to the containment would plateout rapidly enough in the initial stages of a design basis accident so that the amount of iodine to be removed by the sprays would be reduced by a factor of two. The Staff position in this regard is less conservative than that of the Applicant, who takes no credit for iodine plateout in the containment or on the surfaces of internal components simultaneous with operations of the containment

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19/ The Applicant justifies the assumption of no plateout simultaneous with spray operation on the grounds that spray operation is a competing removal process. The Applicant uses a dose-reduction credit for plateout only in those accident calculations (Case P) in which sprays and filters are assumed inoperable.

spray system, because plateout is a competitive effect under these conditions.[20/]

To justify its assumption of plateout as a mechanism for removing iodine in the containment building when sprays and filters are operating, the Regulatory Staff refers[21/] to two portions of the transcript of the hearing. The first (Tr. 1696-7) deals with an explanation by the Applicant that plateout is not used in the Applicant's analyses of doses with sprays operating. This does not lend support to the Staff's plateout assumption. The second (Tr. 1372-3) deals with a statement by a Staff witness concerning the use of the plateout assumption in the TID-14844 sample calculation of doses. Again, this does not appear to answer the question of what technical information supports the assumption of plateout when sprays are operating. The Staff witness does assert that the plateout assumption is applicable to "the present generation of pressurized water reactors". This conclusion by the Staff is indeed consistent with the Staff's reliance on plateout as a necessary mechanism to achieve doses of 300 rem, or less, in their accident analysis with sprays operating. What has been sought,[22/] however, are technical data and other facts to support the Staff conclusion.

20/ Transcript page 1696.

21/ Post-hearing correspondence to Staff, dated June 20, 1969.

22/ Post-hearing correspondence to Staff, dated May 27, 1959 and June 12, 1969.

The Staff further argues[23] that the principal reason for the differences in approach by the Staff and the Applicant with regard to reliance upon plateout as a mechanism for iodine removal with sprays operable is connected with a comparison between spray removal rate and "plateout deposition velocity". References have not been given for data on "deposition velocity" to support this conclusion.[24]

For plateout to give a dose-reduction factor of the magnitude used by the Regulatory Staff in its dose calculations, either the inorganic iodine content must be reduced by a factor of two[25] instantaneously by plateout or it must be reduced by a greater factor if the plateout occurs at a finite rate. The rate at which iodine could plateout would depend strongly upon the processes by which the iodine released from the reactor core is transported to those surfaces which could give rise to plateout phenomena, and it seems likely that these transport processes would be significantly affected by the introduction of the heat-absorbing environment of the containment spray system.[26]

23/ Post-hearing correspondence from Staff, dated June 6, 1969.

24/ The meaning of comparing a removal rate with a "deposition velocity" should be clarified in future considerations of the plateout issue.

25/ The Staff states that such instantaneous reduction is the assumption used in the TID-14844 sample calculation.

26/ In further consideration of these phenomena, attention should be given to the effect of the temperatures of the material surfaces on which plateout is expected to occur. Applicant's Exhibit 7 provides information on material temperatures which might be expected during a design-basis accident.

The Staff has explained some of the plateout mechanisms relevant to the TID-14844 sample calculation, in which no sprays were assumed to be present. Evidently depletion of iodine by plateout is considered to be a surface condensation phenomenon and a depletion due to the "steam flux" which is present, initially carrying iodine to the surfaces. In the absence of sprays, the relatively cool containment walls would cause extensive condensation of steam at these surfaces and would stimulate a large steam flux to these surfaces, thereby enhancing transport of iodine to plateout surfaces. However, with sprays operating the extensive condensation of steam by the spray system, instead of by the containment walls, is likely to significantly alter the transport of steam-borne iodine to the plateout surfaces of the reactor building and internal components. This is one of the considerations which has led to the requests 27/ for technical references to support the Staff's assumption that the TID-14844 plateout factor can be relied upon when sprays are operable. The necessary references have not been supplied, and there remains reasonable doubt that the plateout mechanism which was assumed for the TID-14844 sample calculation, with no sprays operable, is equally applicable to the Indian Point No. 3 containment when sprays are operating.

Consideration has also been given to the possibility that iodine plateout might occur on the condensing steam of the accident and might occur before the iodine has reached the containment structure where

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27/ Post-hearing correspondence to Staff, dated May 27, 1969 and June 12, 1969.

the spray is effective. However, the steam issuing from the sudden double-ended rupture of a main coolant pipe in the design basis accident is not expected to condense appreciably before it reaches the containment structure or other portions of the containment system where the spray is expected to be present. Until some mechanism which could give rise to appreciable prior condensation of steam is identified and substantiated, it must be concluded that plateout is expected to occur primarily on the internal surface of the reactor building or internal components, and the extent of such plateout is probably significantly affected by the operation of the spray system.

The consequence of no plateout simultaneous with spray operation is to increase the estimates of off-site doses, using the Staff's suitably conservative estimates of spray and filter efficiencies, to levels in excess of the 10 CFR 100 guidelines. With no plateout the inorganic doses in the above table would be doubled, and the total doses would be 396 rem for the 2-hour dose at the site boundary and 348 rem for the 30-day dose at the low-population boundary.

Consideration has been given to the significance of dose estimates which exceed the 10 CFR 100 limits by this amount. There are many uncertainties in the calculation of off-site doses, and the magnitudes of these uncertainties have not yet been subjected to quantitative evaluation. However, some guidance can be obtained from positions taken by the Regulatory Staff with regard to the importance of meeting the 10 CFR 100 guidelines. Earlier in its review of this application, the

Staff had analyzed the off-site doses for the design basis accident on the basis of its conservative estimates of the iodine removal efficiency for the sprays but with no credit for organic iodine removal by the filters. The calculated results shown in Table I, as supplied by the Staff, show that on the basis of no removal of organic iodine the 30-day dose would exceed 300 rem by an amount comparable to the above estimates (396 rem and 348 rem) of the doses with spray and filter operation but with no plateout. This earlier Staff analysis then led to the proposal for redesign of the charcoal filters so that organic iodine could be removed sufficiently to bring the dose estimates, on the basis of the Staff's suitably conservative removal efficiencies, to levels within the 10 CFR 100 limits. Therefore, it is concluded that the Regulatory Staff does consider dose estimates which exceed the 10 CFR 100 limits by the amounts estimated above to be significant in the evaluation of safety issues, and the Board agrees that the 10 CFR 100 limit of 300 rem should be adhered to. Therefore, the present design cannot be considered acceptable from safety considerations until there is provided technical justification that sufficient plateout occurs simultaneous with spray and filter operation, until some other means are taken to reduce the uncertainties in the spray absorption capability, or until other steps are taken to provide reasonable assurance that these uncertainties can be and will be adequately resolved.

Although the evidence now presented is not in itself sufficient to support a finding that suitable assurance of safety to the public is provided in the case of a design basis accident, there are several alternative approaches which could be adopted to provide necessary information to support such a finding. It is conceivable that there may exist, outside the record of this hearing, suitable technical information which would provide necessary and adequate technical support for the proposed conclusion that the present design provides adequate safety when evaluated with the Staff's suitably conservative estimates of the iodine removal efficiencies of the spray system and charcoal filter system. Alternatively, the Applicant might undertake to identify a suitably conservative margin of uncertainty for the spray absorption performance and to justify its acceptance, and it is conceivable that information could be developed which could justify a margin less conservative than that now implied in the spray removal efficiency calculated by the Regulatory Staff. If it is impossible now to provide the technical information described above, plans could be presented for a research and development program designed to provide reasonable assurance that the necessary information can be and will be provided on a schedule consistent with that now proposed for the design and construction of

the Indian Point 3 facility. If this approach were followed, alternative steps should be described which could be implemented to provide adequate assurance of safety in the event that the proposed program does not confirm the present performance expectations. Alternatively, the power of the reactor could be limited so that the off-site doses calculated on the basis of suitably conservative performance estimates, and without the assumption of iodine plateout simultaneous with spray operation, would not exceed the 10 CFR 100 guidelines. The nature of the problem is such that one or more of the above alternatives, or some combination thereof, can be reasonably adopted and carried out.

In summary, there are not sufficient data provided here to establish reasonable assurance that the efficiencies of the iodine removal mechanisms, including iodine plateout, necessary to meet the 300 rem limit for the design basis accident doses can be achieved. The performance objectives of some of these mechanisms are not properly or clearly identified. In the absence of data to justify reliance upon plateout as an iodine removal mechanism, the objective of the spray research and development program must be modified and the research and development program must be altered to attain these objectives.

Since these problems affect design and construction, as well as research and development which is now underway, it is important that these issues be resolved by the Commission well before an application

for an operating license is considered. This is an unusual and exceptional case,[28/] and it is understood that procedures for such resolution are provided in the AEC Regulations, particularly Section 50.35(b). Findings of reasonable assurance of safety rest upon the belief that these issues can be and will be resolved.

This area of design basis accident doses and related engineered safeguards, dose-reduction factors, and performance objectives was identified by the Board at the prehearing conference as an area of concern to be explored during the hearing. The development of the evidentiary record of this proceeding, and the Board's review thereof, could have been considerably facilitated and expedited if the Applicant's Preliminary Safety Analysis Report (PSAR) had been suitably corrected, particularly with regard to dose-reduction factors and their bases,[29/] if the specific information in Applicant's Exhibit 6 had been

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28/ This proceeding involves a high power nuclear reactor within a complex of large total power, near large population, and in my opinion, there are unresolved safety issues which may require additional technical data or modification of the research and development program.

29/ There are many different bases for estimating dose-reduction factors as used in this application, including bases other than the two conflicting ones mentioned in footnote 5. Difficulties in comparing Applicant's estimates of expected performance, in terms of expected dose reduction factors, with Staff statements of minimum performance requirements, have already been noted. Also, some of the dose reduction factors in the application were based upon earlier expectations of organic iodine formation which had since been superseded, but not corrected. In future considerations, clarification should be made of the statements: "... the design of the Indian Point 3 facility will proceed on the basis of 5 percent of the maximum fission product iodine inventory of the core...." (PSAR, Suppl. 1) and "... the doses ... given in this hearing is assumed in accordance with the Staff model that two and a half percent of the core inventory was organic." (Tr. 1541).

Instances in which the Applicant had not been responsive to written requests for information by the Staff were also noted.

presented prior to the last session of the hearing, and if similar specific information had been presented by the Regulatory Staff in their Staff Safety Evaluation or earlier in the hearing. A clearer identification of the differences in approach between Applicant and Staff, and reasons and justification therefor, would have been of considerable aid to the Board.

Thomas H. Pigford

Thomas H. Pigford

UNITED STATES OF AMERICA
ATOMIC ENERGY COMMISSION

COMMISSIONERS:

James R. Schlesinger, Chairman
James T. Ramey
Wilfrid E. Johnson
Clarence E. Larson
William O. Doub

IN THE MATTER OF CONSOLIDATED EDISON COMPANY (Indian Point # 3)	DOCKET NO. 50-286

MEMORANDUM AND ORDER

On December 3, 1971, the Commission's Director of Regulation (Director) published in the Federal Register (36 F.R. 23082), his determination under 10 CFR Part 50, Appendix D, Section E, that construction activities at the Indian Point Nuclear Generating Unit No. 3 (authorized pursuant to Provisional Construction Permit No. CPPR-62) should not be suspended pending completion of the environmental review under the National Environmental Policy Act of 1969 (NEPA). The Federal Register notice also provided that persons whose interest may be affected could file a request for a hearing. In this regard the notice further provided that "such request should set forth the matters, with reference to the factors set out in section E.2 of Appendix D, alleged to warrant

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a determination other than that made by the Director of Regulation and shall set forth the factual basis for the request."[1/]

On December 16, 1971, the Commission's Office of the Secretary, received for filing a petition by Mary Hays Weik, as "a citizen of the area affected". The petition requested a hearing on the Director's determination, setting out the following contentions:

"I

"Many environmental effects of the renewed construction work which would follow the Commission's ruling are not fully treated in the summary given in the Determination. They require thoughtful public examination.

"II

"That resuming construction before NEPA review is completed would not preclude later and better alternatives, is not at all clear. The addition of a few new safety features, for example, would not cure fundamental errors in design.

1/ The criteria are:

"(a) Whether it is likely that limited operation during the prospective review period will give rise to a significant, adverse impact on the environment; the nature and extent of such impact, if any; and whether redress of any such adverse environmental impact can reasonably be effected should modification or termination of the limited license result from the ongoing NEPA environmental review.

"(b) Whether limited operation during the prospective review period would foreclose subsequent adoption of alternatives in facility design or operation of the type that could result from the ongoing NEPA environmental review.

"(c) The effect of delay in facility operation upon the public interest. Of primary importance under this criterion are the power needs to be served by the facility; the availability of alternative sources, if any, to meet those needs on a timely basis; and delay costs to the licensee and to consumers.

"III

"The actual 'costs of delay' cannot be figured only in dollar costs, as the Determination assumes. 'Fish protection' and 'Balanced accounting' are given far more weight in these documents than hazards to human beings - although our Government's first commitment is supposed to be the welfare of its citizens.

"The main concern of the Commission's ruling seems to be the prevention of added dollar outlays by Con-Ed's stockholders, due to construction delay. The fact is, the Company's undue haste to go ahead needs careful study. Indian Point's destructive fire on Nov. 4th at Reactor 2 - withheld for 10 days from New York papers and broadcasts - might never have occurred if a hasty agreement for a pre-license fuel loading had not slipped through the recent Indian Point hearings."

The request is opposed by the applicant and the regulatory staff on the ground that the petition fails to meet the requirements established by 10 CFR Part 50, Appendix D, Section E.4 and the notice, for such a request. It is their position that, as required, the request fails to set forth with reasonable specificity matters which warrant a determination other than that made by the Director of Regulation and the factual basis for the request.

We agree that the petition fails to meet our pleading requirements and that it should be denied. In addition to the extreme generality of its allegations, the petition is devoid of any factual basis for the request. The purpose of the pleading requirements is to provide the Commission with information on which to make an informed judgment as to whether a hearing is warranted. A hearing imposes serious economic and manpower burdens upon all concerned. It is essential, therefore, that a request for hearing be drawn with some particularity. In the

present circumstances, giving due recognition to the fact that petitioner appears without counsel, we conclude that the instant request does not warrant a hearing. In our view, a hearing request submitted by one in petitioner's circumstances[2/] should reflect at least some degree of compliance with applicable requirements. The present request falls far short of that standard, and it is denied.

It is so ORDERED.

By the Commission.

W. B. McCool
Secretary of the Commission

Dated: June 14, 1972

2/ Petitioner is no stranger to AEC proceedings, having participated extensively in the hearing on the issuance of the construction permit for this facility and in another licensing proceeding. See, In the Matter of Trustees of Columbia University in the City of New York, Docket No. 50-208. Moreover, she has several years' experience in journalism (Columbia Transcript, Mar. 18, 1969, p. 285).

UNITED STATES OF AMERICA
ATOMIC ENERGY COMMISSION

In the Matter of	)	
	)	
CONSOLIDATED EDISON COMPANY	)	Docket No. 50-286
(Indian Point No. 3)	)	
	)	
	)	

CERTIFICATE OF SERVICE

I hereby certify that copies of MEMORANDUM AND ORDER dated June 14, 1972, in the captioned matter have been served on the following by deposit in the United States mail, first class or air mail, this 14th day of June 1972:

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cc: Mr. Karman
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AS&LBP
Reg. Files

H. L. Smith

UNITED STATES OF AMERICA
ATOMIC ENERGY COMMISSION

In the Matter of

CONSOLIDATED EDISON COMPANY OF NEW YORK, INC.
(Indian Point Nuclear Generating Unit 3)

Docket No. 50-286

RECEIVED

CERTIFICATE OF SERVICE

I hereby certify that copies of the INITIAL DECISION dated August 13 1969 in the captioned matter have been served on the following by deposit in the United States mail, first class or air mail, this 13th day of August 1969:

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