UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In The Matter of	)	
	)	
	)	
COMMONWEALTH EDISON COMPANY	)	Docket Nos. 50-454 0L
	)	50-455 0L
	)	
(Byron Nuclear Power Station, Units 1 & 2)	)	

AFFIDAVIT OF JOHN C. GOLDEN

The attached questions and answers constitute my testimony in the above-captioned proceeding. The testimony is true and accurate to the best of my knowledge, information and belief.

John C. Golden

Subscribed and sworn to before me this 4th day of June, 1982.

Notary Public

TESTIMONY OF JOHN C. GOLDEN

ON DAARE/SAFE CONTENTION 3

Q. Please state your name, present occupation, and present position.

A. My name is John C. Golden. I am employed by the Commonwealth Edison Company ("Commonwealth Edison") as Supervisor of Health Physics and Emergency Planning. I am also Commonwealth Edison's Radiation Protection Officer. I have been employed by Commonwealth Edison since January 11, 1971.

Q. Briefly state your educational and professional qualifications.

A. I have a Bachelor of Science in Physics (1962) from the University of Massachusetts, and a Master of Public Health (1964) and Doctor of Public Health (1970) from the University of Michigan. At Michigan I majored in radiological and environmental health. Prior to working for Commonwealth Edison, I worked as a health physicist for the Florida State Board of Health (1964-1966) and Sandia Corporation, Albuquerque, New Mexico (1966-1968).

Q. Describe your duties and responsibilities as Supervisor of Health Physics and Emergency Planning.

A. As Supervisor of Health Physics and Emergency Planning, I am responsible for (a) the functional control of

Commonwealth Edison's nuclear station radiation protection programs, (b) development, review, coordination and approval of nuclear station environmental radiological monitoring programs and emergency planning, and (c) providing radiation protection services to Commonwealth Edison's licensed non-nuclear generating stations.

Q. To which contention is this testimony addressed?

A. Contention 3. The contention asserts that Edison's emergency plan for Byron improperly fails to take into account five enumerated factors, each of which DAARE/SAFE assert must be considered in an emergency plan for it to be meaningful and adequate. The five factors are as follows: (a) the need for evacuation planning for more than 20,000 students attending Northern Illinois University in DeKalb or those students at other colleges in "affected areas"; (b) the need for contingency plans for an acute gasoline shortage coinciding with the need for evacuation; (c) the need for local, state and national emergency plans for coping with an emergency at Byron; (d) the need for plans to take emergency measures other than evacuation when evacuation is impracticable; and (e) the need for plans to deal with weather dependent worst case analysis and involving core melt with breach of containment events.

Q. Have you been provided with any additional information bearing upon Contention 3?

A. Yes, in response to interrogatories directed at DAARE and SAFE by Edison and the NRC Staff, DAARE/SAFE reiterated its position that the five factors identified above must be considered in Edison's emergency plan for the Byron Station.

Q. Could you briefly describe emergency planning requirements relating to the Byron Station?

A. The Illinois Plan for Radiological Accidents (IPRA) is based upon the Illinois Emergency Services and Disaster Agency's Comprehensive Disaster Response Plan (The Illinois Disaster Plan). The Illinois Disaster Plan outlines state, local, and over-all responses to every conceivable emergency or disaster (for example, tornadoes, floods, hazardous materials, blizzards). The Illinois Disaster Plan is a generalized blueprint for emergency response; it details the ways in which the state interacts with government and private emergency workers.

The IPRA is the Illinois Disaster Plan applied to the specific case of nuclear emergency. I worked closely with the Illinois Emergency Service and Disaster Agency in applying IPRA to a potential nuclear emergency. IPRA was developed following extensive discussions conducted with potential participants in a nuclear incident response: federal and state agencies, local governments, law enforcement and social service groups,

the Salvation Army and the American Red Cross, etc. Besides various reports concerning Three Mile Island, the following documents relating to nuclear preparedness were consulted: NUREG 0396, NUREG 0610, and NUREG 0654/FEMA-REP-1.

The Illinois Disaster Plan requires planning for all local governments, while the IPRA deals specifically with the local governments within the Plume Exposure Emergency Planning Zone (EPZ), a circular zone within a ten-mile radius of Byron Station within which detailed protective actions will be carried out.

The emergency preparedness plan for Byron Station is composed of five parts: (1) the generic Commonwealth Edison Generating Stations Emergency Plan (GSEP); (2) the site specific Byron annex of GSEP; (3) the generic Illinois Plan for Radiological Accidents (IPRA); (4) the site specific Byron local plan; and (5) the various plans of the Federal agencies (such as NRC, FEMA). GSEP and the site specific GSEP annex are written; IPRA is written; development of the local plan will commence in 1982 and be completed in 1983 before the Byron exercise; and the generic Federal plans are written. The local plan will describe the various measures or options available for protecting the public - one of these options being evacuation.

Q. Have you considered the five factors listed in Contention 3 to determine whether Edison's emergency plan for the Byron Station takes these factors into account?

A. Yes, some of these factors are specifically dealt with in the Byron Station Emergency Plan. Others are not addressed and, in my opinion, need not be addressed either to comply with applicable regulatory requirements or guidance or to provide reasonable assurance that the public health and safety will be adequately protected.

Q. With respect to factor (a), does Edison's emergency plan address the need to evacuate students attending Northern Illinois University in DeKalb or other students attending other colleges in the Byron vicinity?

A. The Byron emergency plan does not specifically address the need to evacuate students attending Northern. DeKalb is approximately 28 miles from Byron Station, some 18 miles beyond the distance required for evacuation planning by NUREG-0654 (the NRC/FEMA criteria). However, if evacuation or any other protective measure were required beyond 10 miles, it would be implemented as an extension of the protective measure being taken in the ten-mile area. Schools and colleges in the 10 mile planning zone will be addressed in the plan.

Emergency planning criteria require that "Emergency Planning Zones" (EPZs) around each nuclear facility be defined both for the short term "plume exposure pathway"

and for the longer term "ingestion exposure pathways." EPZs are defined as the areas for which planning is needed to assure that prompt and effective actions can be taken to protect the public in the event of an accident.

The choice of the size of the Emergency Planning Zones represents a judgment on the extent of detailed planning which must be performed to assure an adequate response base. In a particular emergency, protective actions might well be restricted to a small part of the planning zones. On the other hand, for the worst possible accidents, protective actions may need to be taken outside the planning zones.

The State of Illinois has selected a radius of about 10 miles for the plume exposure pathway and a radius of about 50 miles for the ingestion exposure pathway. Although the radius for the EPZ implies a circular area, the actual shape would depend upon the characteristics of a particular site.

The size (about 10 miles radius) of the plume exposure EPZ was based primarily on the following considerations: (a) projected doses from the traditional design basis accidents would not exceed Protective Action Guide levels outside the zone; (b) projected doses from most core melt sequences would not exceed

Protective Action Guide levels outside the zone; (c) for the worst core melt sequences, immediate life threatening doses would generally not occur outside the zone; and (d) detailed planning within 10 miles would provide a substantial base for expansion of response efforts in the event that this proved necessary.

I believe that it would be unlikely that any protective actions for the plume exposure pathway would be required beyond the plume exposure EPZ. Also, the plume exposure EPZ is of sufficient size for actions within this zone to provide for substantial reduction in radiation dose in the event of a worst case core melt accident. Therefore, I do not believe that specific plans to evacuate Northern Illinois University students located outside the 10 mile plume exposure EPZ are warranted.

Q. With respect to factor (b), does the Byron emergency plan address the possibility of acute gasoline shortages coinciding with the need for evacuation?

A. To the best of my knowledge the Byron emergency plan does not address the specific issue of an acute gasoline shortage coinciding with the need for evacuation. The likelihood of such a gasoline shortage which could possibly effect evacuation efforts is simply too remote a contingency to warrant development of specific plans. In addition, there would obviously be significant advance

warning of a gasoline shortage of this magnitude such that if it appeared that planning for this contingency was necessary they could be developed as needed.

Q. With respect to factor (c), does the emergency plan address the interface of local, state and national emergency planning authorities and the specific plans which these authorities have developed in the event of an emergency at the Byron Station?

A. Yes. The IPRA site specific annex for Byron will be written to assure it interfaces with IPRA, and as such, all related plans, because the annex will be written under the direction of the same State agency that wrote the State plan, i.e. the Illinois Emergency Services and Disaster Agency. The various Federal agencies have generic plans which are not site specific. However, all plans are developed in accordance to established emergency planning criteria which requires adequate interface between the various authorities responsible for responding to emergency conditions.

The IPRA site specific annex will be written by a team of emergency planning professionals drawn from state, and possibly local, agencies, the Commonwealth Edison Company, and a consultant organization paid by Edison. This team goes to the station, establishes a headquarters in its vicinity, and then, working with local officials, gathers the data necessary to prepare the site specific annex. This report, after review

and approval by appropriate local officials, then serves as the principal training document for local governmental and other personnel who are involved with the Byron emergency planning effort.

Since mid-1980, the State of Illinois and Commonwealth Edison have tested the nuclear station emergency plans six times at other nuclear power plants operated by Edison: twice in 1980 at Dresden and LaSalle; three times in 1981 at Quad Cities, Zion and Dresden; and once to date (6/2/82) in 1982 at LaSalle. By the date of the Byron exercise, now scheduled for May 1983, an additional three tests will have been performed. The six tests (or exercises, as they are called) have been successful and there is every reason to believe that the next three exercises, the 1983 Byron exercise, and all subsequent exercises will likewise be successful. All of these exercises involved or will involve participation by state, local, and Edison emergency personnel. In addition, Wisconsin and Iowa agencies participate in the Zion and Quad Cities exercises, respectively. The Zion exercise of July 1981 included a test of the interface with Federal agencies. This aspect of the exercise was also successful.

Q. With respect to factor (d), does the Byron emergency plan consider alternatives to evacuation where evacuation is impracticable?

A. Yes. Specific actions taken by Federal, State, and local authorities to minimize radiation exposure to the local population during a nuclear incident are called protective actions. Protective actions include: evacuation; instructions that individuals take shelter; access control into potentially contaminated areas; food, water, and milk control; and protective actions for emergency workers and confined persons. The protective actions involve the following:

Evacuation: The notification of the public living within a potentially affected area, via mobile public address systems and commercial radio, to leave their homes and go to a predesignated registration/evacuation center. Evacuees will remain in these centers until it is safe to return to their homes.

Shelter: The notification of the public, via mobile public address systems and commercial radio, to take shelter in their homes, stores, or places of business, and to remain there until it is safe to go outside. Relocation may be recommended for special cases within the affected area (e.g., people at parks or golf courses).

Access Control: The closing of transportation facilities and the establishment of barriers by means of roadblocks, etc. to prevent people and vehicles from entering evacuation/take shelter areas.

Food, Water, and Milk Control: The sampling, testing for radioactivity, and, if necessary, restriction of public consumption of food, water, and milk until the concentrations of radioactivity have decreased to allowable levels.

Protective Actions for Emergency Workers: The provision of respiratory protection in the form of supplied breathing air or appropriate filtration devices, the oral administration of non-radioactive iodine in the form of potassium iodide, and the provision of protective clothing.

Protective Actions for Confined Persons: The provision for oral administration of non-radioactive iodine in the form of potassium iodide to persons whose mobility is restricted, such as persons in hospitals or nursing homes.

The decision as to which protective action or actions to take is made by the Governor of Illinois, based on recommendations made by the Illinois Emergency Services and Disaster Agency and Department of Nuclear Safety. In Wisconsin, Iowa and Indiana, similar decision-making processes exist. These recommendations are formulated after considering information provided by Edison relating to the size of the accident, its potential for worsening, the potential radioactivity release, the weather conditions, road conditions, wind direction, etc. Prior to operating the facility Edison

will have installed monitor systems and will have trained personnel capable of providing information pertaining to matters such as the condition of the reactor and likelihood of release of radioactivity, wind speed, wind direction, atmospheric stability conditions, and projected offsite doses should the radioactivity be released.

Q. With respect to factor (e), does the emergency plan for Byron address actions to be taken in various weather conditions?

A. Yes. In the Commonwealth Edison emergency plan and various station and corporate emergency procedures derived therefrom, weather conditions are noted as a factor to be considered in any recommendation of protective action. It is, however, a judgment decision by personnel responsible for making the recommendation as to whether or not it is safe to move people without undue risk from adverse weather conditions. As noted previously, the state of the weather is an important factor considered by governmental officials in deciding the appropriate response to a given emergency situation.

Q. Also with respect to factor (e), does the Byron emergency plan consider emergency response to events involving core melt with breach of containment?

A. Yes. Such events would fall within the emergency class called "General Emergency." A General Emergency involves events which involve actual or imminent substantial core degradation or melting with the likelihood of a related release of appreciable quantities of fission products (i.e. radioactivity) to the environment. This class is characterized by offsite consequences requiring protective measures as a matter of prudence or necessity.

Q. Could you please summarize your conclusions with respect to the adequacy of the emergency planning measures which will be in effect at the time the Byron facility begins operation?

A. In my opinion the Byron emergency plan will provide reasonable assurance that prompt and effective actions will be taken to protect the public health and safety in the unlikely event such actions are necessary.

DAARE/SAFE CONTENTION 4

THE CONTENTION

Intervenors contend that the Applicant's Final Safety Analysis Report (FSAR) does not comply with 10 CFR Part 50.34(b)(4) in that the FSAR and Applicant fail to take into account all "pertinent information developed since the submittal of the preliminary safety analysis report" as required by 10 CFR Part 50.34(b)(4). Specifically, Intervenors contend that the FSAR does not analyze the risks to the public health and safety from the potential of accidents resulting from multiple, mutually independent failures as opposed to a "single failure," as defined in 10 CFR Part 50, Appendix A. Applicant's Chapter 15 FSAR examines a set of single failure scenarios. The potential of multiple failure accidents has become more apparent since March and April of 1979 at which time the nuclear generating plant at Three Mile Island near Harrisburg, Pennsylvania, experienced an accident resulting from multiple, mutually independent failures, that is, failures which occurred in proximate time to one another without actually being caused by one another. In 10 CFR Part 50, Appendix A, Introduction, it is noted that even though no specific design criteria for a problem has been defined, Applicant is not relieved from the obligation to consider new important safety matters, in this case, in its analysis of accident risk and prevention under the requirements of 10 CFR 50.34(a)(4)(i) and (ii), and 10 CFR 50.34(b)(4).

Examples of multiple failure accidents can be found in a report written by Dr. Richard E. Webb entitled "An Analysis of Three Mile Island Accident," 1979. Quoting from Chapter 12 of that report:

(1) Rupture of a defective control rod drive mechanism (CRDM) housing which causes adjacent, similarly defective CRDM housings to rupture in a cascade manner. Such ruptures could cause the affected control rods to be ejected from the core by the reactor pressure, thereby causing a potentially catastrophic power excursion.

(2) Failure of the main feedwater system followed by a scram system failure, which results in a high level of heat generation in the core of the reactor but low heat removal from the reactor system.

(3) Seizure of a main coolant pump followed by a scram failure.

(4) Continuous withdrawal of control rods with a scram failure.

(5) Loss of electric power to the coolant pump followed by a scram failure.

(6) Loss of turbine steam condenser vacuum with scram failure.

(7) Small coolant pipe rupture with a scram failure.

(8) Large coolant pipe rupture followed by failure of the emergency coolant system to function.

(9) Spontaneous reactor vessel explosion due to failure of defective closure bolts.

(10) Errors in regulating the boron chemical concentration in the reactor coolant causing excessive over-power transients or power excursions.

(11) A large pipe rupture followed by failures of additional pipes and components due to the reaction forces that occur as a result of the pipe rupture.

(12) Coolant pipe rupture due to a strong pressure surge caused by a core power or under-cooling incident; or a simultaneous rupture of a set of defective control rod drive mechanism housings due to a strong coolant pressure surge, water hammer, or a coolant explosion caused by a molten fuel-water interaction in an accident in which the fuel melts.

(13) Steam generator vessel rupture.

(14) Improper operator actions in response to a particular accident situation which tends to worsen the accident.

(15) Accidents caused by faulty gauges and instruments.

MATERIAL FACTS AS TO WHICH THERE IS NO GENUINE ISSUE TO BE HEARD

1. There are no unique or special design or site characteristics associated with the Byron Station which would contribute to higher risk. (Affidavit of George Klopp, p. 8; Final Environmental Statement Related to Operation of Byron Station, Units 1 and 2, p. 5-67).
2. The accidents which DAARE/SAFE assert should be analyzed are with two exceptions accidents which fall beyond the design basis accidents analyzed in the FSAR. (Affidavit of George Klopp, p. 6.)
3. Edison has analyzed accidents related to boron dilution and loss of main feedwater events in the FSAR in accordance with NRC requirements. (Affidavit of George Klopp, pp. 18 and 21.)
4. The risk to the public health and safety associated with the accidents identified by DAARE/SAFE is insignificant because of the low probability of occurrence and relativly insignificant consequences associated with these events. (Affidavit of George Klopp, p. 23.)

DISCUSSION

During the course of discovery, DAARE/SAFE identified Dr. Michio Kaku as its expert witness on Contention 4. On March 12, 1982 Dr. Kaku was deposed by counsel for Edison and the NRC Staff. The deposition clarified a number of matters relative to DAARE/SAFE's position of Contention 4. First, it became clear that the contention does not actually challenge the fact that the accident analysis performed by

Edison and documented in the Byron FSAR conforms with NRC regulatory requirements. Instead, it is based on DAARE/SAFE's disagreement with the requirements imposed by the regulations applicable to nuclear power plant accident analyses. (Transcript of Deposition of Dr. Kaku, at p. 48.*/) It was also made clear that the scenarios which are identified in the contention, and the additional scenarios which Dr. Kaku identified during the course of his deposition, are scenarios which, according to Dr. Kaku, are accidents which are beyond the design basis accident, (Transcript of Deposition of Dr. Kaku, pp. 148-149), and that Dr. Kaku could not identify any special or unique siting or design considerations related to the Byron facility. Dr. Kaku admitted that he had not considered the probability of occurrence of any of the accidents which DAARE/SAFE asserts should be analyzed, (Transcript of Deposition of Dr. Kaku, p. 65), though he did not believe that Edison should be required to analyze accidents such as those identified in the Reactor Safety Study, WASH-1400, which are postulated to lead to a release of radioactivity of the most severe kind, i.e. a PWR-1 release. Finally, Dr. Kaku stated that if the scenarios identified were analyzed, DAARE/SAFE's concerns with respect to Contention 4 would have been satisfied. (Transcript of Deposition of Dr. Kaku, p. 126.)

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*/ The cited pages of the deposition transcript are attached. Shortly after having received the original transcript of the deposition, counsel for Edison forwarded the transcript to Dr. Kaku requesting that he review the transcript, note changes thereto on an errata sheet, sign and return it. As of this date Dr. Kaku has had the transcript for more than two months, but has not returned the signed copy for filing.

In view of what has developed as a result of discovery conducted in this proceeding, it has become apparent that DAARE/SAFE is not alleging that Edison's accident analysis for the Byron Station does not conform to applicable regulatory requirements; rather DAARE/SAFE is questioning the basic policy underlying these requirements. For the most part, DAARE/SAFE has chosen accidents which have been analyzed in the FSAR and request that Edison postulate one or more additional failures to the specific accident sequence analyzed. As George Klopp, General Design Engineer for Commonwealth Edison explains, NRC regulatory requirements prescribe the consideration of certain selected accident sequences which are analyzed pursuant to conservative acceptance criteria. These analyses must demonstrate that the equipment and systems included as part of the design of the facility are capable of effectively withstanding and mitigating the results of the accidents. (Klopp Affidavit, p. 7.) The accident scenarios selected are deemed to envelop other credible accident sequences not specifically analyzed, i.e. the accident sequences not analyzed are deemed not to result in conditions which are more severe than those resulting from the accidents analyzed and designed for. (Klopp Affidavit, p. 7.)

It is well established NRC practice that where an intervenor asserts that an applicant should be required to postulate and analyze accident sequences more severe than

those against which the General Design Criteria set forth in 10 CFR Part 50, Appendix A require a reactor be designed, there must be a showing of "special circumstances" involving the facility at issue. See Consolidated Edison Company of New York, (Indiana Point No. 2) (LI-72-29, 5 AEC 20, 21 at fn. 5 (1972). In this case, it is clear that DAARE/SAFE knows of no such special circumstances. Indeed, DAARE/SAFE's witness disclaims knowledge of any special circumstances related to Byron. (Transcript of Deposition of Dr. Kaku, at p. 152.) Mr. Klopp's affidavit and the NRC Staff's Final Environmental Statement regarding Byron fully support this conclusion. (Klopp Affidavit, p. 8; Byron FES p. 5-67.) Thus, DAARE/SAFE's contention amounts to nothing more than a generalized attack on the policies and standards underlying the Commission's regulations. Quite obviously, a forum other than a trial type licensing adjudication should be chosen to resolve such policy questions. See Philadelphia Electric Co., (Peach Bottom Atlantic Power Station, Units 2 and 3), ALAB-216, 8 AEC 13.20 (1974).

Moreover, even if it were appropriate to consider the ability of the Byron Station to prevent and mitigate consequences of accidents which fall beyond the design basis accident, Mr. Klopp's affidavit shows that under Dr. Kaku's intuitive criteria by which he would exclude certain accident sequences from consideration in individual licensing proceedings, the accidents postulated by DAARE/SAFE should

not be analyzed. Although Dr. Kaku stated that he did not perform any probabilistic evaluation of the accidents postulated by DAARE/SAFE, he agreed that there should and must be a limit on the accident sequences which Edison should be required to investigate. Thus, Dr. Kaku would not require an analysis of accidents resulting in a PWR-1 release as described in WASH-1400 on the grounds that such accidents are incredible. (Transcript of Deposition of Dr. Kaku, at p. 54). Based upon this statement, Mr. Klopp has performed an initial probabilistic evaluation of the accidents identified by Dr. Kaku which demonstrates that the risk to the public health and safety associated with these accidents is lower than the risk associated with an accident leading to a PWR-1 release. (Klopp Affidavit, pp. 8-26).

In sum, by the admissions of the expert witness DAARE/SAFE has offered to sponsor Contention 4, DAARE/SAFE does not have any evidence which would warrant requiring Edison to analyze accidents more severe than those required to be analyzed pursuant to the Commission's regulations. Moreover, Mr. Klopp's affidavit demonstrates that the accidents identified by DAARE/SAFE represent an insignificant risk to the public health and safety both in terms of Dr. Kaku's criteria and in terms of these criteria commonly used by Edison and the NRC Staff in evaluating the risk of events more severe than postulated "design-basis" accidents. Accordingly, Edison is entitled to a favorable decision on Contention 4 as a matter of law.

UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the matter of:	:	
COMMONWEALTH EDISON COMPANY	:	Docket Nos. 50-454 50-455 (OL
(Byron Nuclear Power Station, Units 1 and 2)	:	

Conference Room
Isham, Lincoln & Beale
4200 One First National Plaza
Chicago, Illinois

Friday, March 12, 1982

Deposition of DR. MICHIO KAKU, beginning at 10:45 a.m., pursuant to notice, was taken in the above-entitled matter, before Ann Riley, a Notary Public in and for the State of Maryland.

Q You used the word "self-serving" in the previous response to my question. Can you define that term for me, please?

A Self-serving is when you do things to serve yourself, rather than the interest of taxpayers, ratepayers, the general public, general interest.

Q I meant in the context of your response. Who was serving themselves?

A I think the NRC has been negligent in terms of requiring utilities to look into the possibility of multiple failures in terms of its licensing of nuclear power stations.

Q So do you disagree with the requirements imposed by the NRC's regulations for designing against accidents at nuclear power plants?

A That is correct.

Q Is it your opinion, Dr. Kaku, that the Applicant has not considered all credible accidents in designing the Byron nuclear power plant?

A That's correct. And Contention 4 tries to elaborate in a little bit of detail some of these accident scenarios which should be looked into, given the fact that Three Mile Island was a multiple failure.

which was given a probability of one to 10 billion years of reactor operation.

Q Why are you excluding those accidents?

A Because I think it is unfair to Commonwealth Edison to postulate accident scenarios which are "incredible" according to the NRC on the scale of PWR-1. A PWR-1, just for the record, is when -- a PWR-1 accident is when you shoot the core of a nuclear reactor through the internals package, through the roof of the reactor, and you shoot about 100 percent of core inventory several hundred feet into the air. That is a PWR-1 accident.

Q And you believe that to be an incredible accident?

A That to me is an accident I would not want to put on my list of top 15 or top 20 accidents that Commonwealth Edison should look into.

Q Do you believe that to be a credible accident?

A I believe it's an accident that has to be looked into. I believe it's an accident that Dr. Simon of the NRC studied at length in Appendix XIII of WASH 1400.

Q So you believe it's a credible accident?

A I don't know what you mean by credible accident. I know what I mean by it.

A I think that it is a reasonable request that Commonwealth Edison perform a calculation with a modified TWINKLE, LOFTRAN, SATAN-6 and REFLOOD, such that we postulate a failure of the main feedwater, followed by a failure to scram.

Now, to be specific, the initiation of scram can be kept in an arbitrary parameter, so we would have scram not taking place within a few seconds, like what is postulated in Appendix 15. But I would find it very acceptable if we had the initiation of scram kept an arbitrary parameter, scram within one minute, scram within five minutes, scram within 10 minutes, scram within one hour, just to see whether or not we can keep within Appendix K and keep within the reg guides also mentioned within 10 CFR 50, okay?

I think it is a reasonable request; with a minor modification of TWINKLE, LOFTRAN, SATAN-6 and REFLOOD, I think this calculation can be done.

Q Again, sticking to our questions, have you done any calculations regarding the probability?

A The answer is no to the entire set.

Q So you have not looked into the probability of any of the accidents identified in Contention 4?

don't kick on properly. What happens.

Q Are we talking about the units simultaneously?

A One unit.

Q One unit?

A Yes. And that would be it.

Q When you say that would be it--

A That's 18 altogether.

Q You have 18 examples of what you characterize as multiple, mutually independent accident scenarios.

A Multiple failures.

Q Multiple failures.

A Of which mutually independent failures are a subset. In other words, common mode failures, common event failures.

Q So if we addressed each of the 18 scenarios which are identified both in the Contention itself, and will be identified in the transcript of your deposition today, would that satisfy your concerns raised in Contention 4?

A That's right. I have tried to be reasonable in trying to model these calculations as carefully as I can to what is in existence. If these calculations require a lot more work, well, I'll be glad to consult with the engineers

to get into the specifics of which ones are common mode, common event, mutual independent.

Q How much time do you think it would require, Doctor, for you to look at No. 1, for example, and tell me whether that is a multiple mutually independent failure?

Can you tell me first how much time it might take?

A Well, if you give me five minutes, I can probably give you --

Q Why don't we hold off on that and see how our time goes.

A Okay. Can you give me five or 10 minutes?

Q No, let's hold off on that question and see if we have time for it later.

A Okay. I'd be happy to answer it.

Q I understand, but it's a question of priorities. We don't have a terrible amount of time.

A It's easy to answer.

Q Am I also correct that it would take you time to analyze which of these are or would result in Class 9 accidents?

A All could conceivably result in Class 9 accidents. The reason I say so is that most of these result in Class 8,

taken singly. So, together it's not a stretch of the imagination to imagine pushing an 8 into a 9.

Q So it is your testimony that all of these could result in Class 9 accidents?

A Or 8. I would be happy if someone could prove to me that each of these leads to a Class 8.

Q Dr. Kaku, are you familiar with the Standard Review Plan which is used by the NRC Staff, NUREG 0800?

A No, I have not seen NUREG 0800.

Q You do consider yourself an expert on multiple failures, though; is that correct?

A Well, my definition of expert is a Ph.D. I have a Ph.D. in physics. To the degree that physics embraces multiple failures -- I do not have a Ph.D. in multiple failures because no such Ph.D. is given. I have a Ph.D. in physics.

Q Doctor, if I give you credit for life's experience, would you then consider yourself an expert on multiple failures?

A Yes. There are gaps in my understanding, but I have tried to model several multiple failures.

Q What are the gaps in your understanding, Doctor?

Appendix D. Does that refresh your recollection?

A Annex to --

Q Dr. Kaku, are you aware of anything novel or unique about the Byron reactor design?

A Not that I know of. I have been given Chapter 6 and Chapter 15 of the FSAR. I did not find anything novel or unique in Chapter 6 or Chapter 15.

Q Is there anything unique about the siting mode for the Byron facility?

A Not that I know.

Q Is the Byron facility, to the best of your knowledge, in proximity to any manmade hazards or natural hazards?

A It could be. I do not have the Draft Environmental Report. I was never given it by anyone.

Q But you are not aware of any industrial, transportation or military facilities which would create a special hazard for this plant; is that correct?

A There could be, but I'm not aware of any.

Q Are you aware of whether the population density in the area of the Byron plant exceeds the trip points provided in the Standard Review Plan in Reg Guide 4.7?

A I'm not aware because I haven't seen the Draft