November 3, 1978

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In the Matter of
LONG ISLAND LIGHTING COMPANY
(Shoreham Nuclear Power Station,
Unit 1)
Docket No. 50-322

Gentlemen:

Enclosed for your information are copies of the Commission and Appeal Board decisions In the Matter of Pacific Gas and Electric Company (Diablo Canyon Nuclear Power Plant Unit, Nos. 1 and 2).*/ These decisions deal with the treatment of issues relevant to the issuance of a 10 CFR Part 70 license to store unirradiated nuclear fuel assemblies at a facility currently under construction prior to the issuance of an operating license. The Long Island Lighting Company has applied for a Part 70 license for its Shoreham facility.

If you have any questions, please do not hesitate to contact me.

Sincerely,

Richard K. Hoefling

Richard K. Hoefling
Counsel for NRC Staff

*/ CLI-76-1, 3 NRC 73 (1976); ALAB-344, 3 NRC 809 (1976).

Enclosures as Stated

cc (w/encls.):

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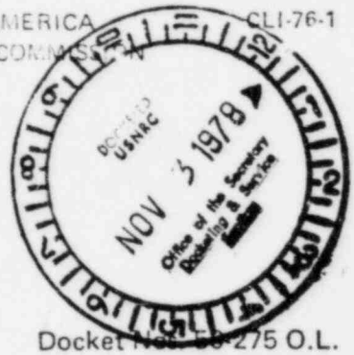
Atomic Safety & Licensing Board
Atomic Safety & Licensing Appeal Board
Docketing and Service Section

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

CLI-76-1



Commissioners:
William A. Anders, Chairman
Edward A. Mason
Victor Gilinsky
Richard T. Kennedy

In the Matter of

PACIFIC GAS AND ELECTRIC COMPANY

(Diablo Canyon Nuclear Power Plant, Units Nos. 1 and 2)

Docket Nos. 50-275 O.L.
50-323 O.L.

February 5, 1976

Upon petition by intervenors for the designation of an appropriate board or panel to hear their appeal from the Licensing Board's order granting a materials license under 10 C.F.R. Part 70, the Commission (1) rules that the Licensing Board order is final for review purposes (and hence ripe for review) since it authorizes the issuance of a materials license; and (2) pursuant to 10 C.F.R. §2.785, delegates to the Appeal Board authority to assume jurisdiction over the appeal.

RULES OF PRACTICE: APPELLATE REVIEW

A licensing board order which is interlocutory in the formalistic sense that it was rendered in the context of an ongoing operating license proceeding may nonetheless be final for purposes of review if it authorizes the grant to the applicant of a license to perform activities that later will be included in its operating license.

MEMORANDUM AND ORDER

The San Luis Obispo Mothers for Peace (MFP), intervenors in this operating licensing proceeding, have petitioned us to designate "an appropriate board or panel" to hear their appeal from the Licensing Board's order of December 23, 1975. The utility had applied for a materials license under 10 CFR Part 70 under which it could deliver and store fuel assemblies at the Diablo Canyon site prior

to issuance of the requested operating licenses. The Licensing Board held an evidentiary hearing on the Part 70 license and denied MFP's motion to prevent delivery and storage of the fuel in its December 23 order.[1]

The regulatory staff takes the position that the Licensing Board's order is interlocutory because the MFP motion was heard as a part of the operating licensing proceeding in which hearings are not yet complete. See 10 CFR 2.714a, 730(f); *Louisiana Power and Light Co.* (Waterford Steam Electric Station, Unit 3), RAI-73-12-1155. The staff suggests, however, that in the circumstances of this case an exception to the usual rule should be made, and that an appeal should be allowed.

We do not think that the Board's order is interlocutory except in the formalistic sense that it was heard in the context of the operating license proceeding. The issue presented by the MFP motion was whether the utility should be issued an NRC license that would authorize, it, among other things, to transport and store fuel assemblies at the Diablo Canyon site until operating licenses are issued in this proceeding.[2] That issue has now been heard and decided and a Part 70 license has been duly issued. As things now stand, the utility is free to ship and store fuel at its convenience, consistent with the license conditions. Accordingly, the matter is ripe for review.

There is, however, an obstacle to review of the Licensing Board's order by an Atomic Safety and Licensing Appeal Board which, under our present rules of practice, can only be removed by Commission action. Under 10 CFR 2.785, the Appeal Board does not have jurisdiction over proceedings for the issuance of a license under Part 70, such as the license involved here, without a specific delegation from us.

We think it would be appropriate, in the circumstances of this case, that the Licensing Board's decision be reviewed by an Atomic Safety and Licensing Appeal Board. The initial decision on the operating license applications may not be rendered for some months. Without, of course, intimating any view on the merits of MFP's contentions, it is true that their contentions may be rendered moot if an appeal on the Part 70 license must await the initial decision on the

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[1] The Atomic Safety and Licensing Boards may be given jurisdiction over proceedings for the issuance of Part 70 materials licenses. 10 CFR 2.721. Normally, the notice of hearing constituting a particular board confers jurisdiction in a particular case by referencing the specific license application or applications to be considered. Although the notice of hearing establishing the present board did not explicitly reference the materials license in question here, that license is integral to the Diablo Canyon project, and it does not appear that any interested person was actually prejudiced by the lack of such a reference. Given that Board's familiarity with the Diablo Canyon project, it made good practical sense for it to hear and decide the related issues raised by the Part 70 materials license application. Accordingly, we hereby confirm the Licensing Board's assertion of jurisdiction in this instance.

[2] If and when such licenses are issued, they would include authority to transport and store fuel and the separate Part 70 license would no longer be needed.

operating licenses. Appeal Board, as compared with Commission, review is more appropriate for the essentially factual contentions involved here.

An Appeal Board for this operating license proceeding has already been constituted. Accordingly, we direct that Board to assume jurisdiction over MFP's appeal.

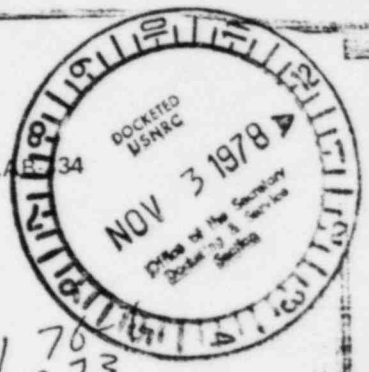
MFP has requested that its "time to file a formal appeal be extended to two weeks after receipt of the Commission's response to this appeal." We leave to the Appeal Board the establishment of appropriate filing deadlines for the parties.

It is so ORDERED.

By the Commission

SAMUEL J. CHILK
Secretary of the Commission

Dated at Washington, D. C.
this 5th day of February 1976.



UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

ALAB-434

ATOMIC SAFETY AND LICENSING APPEAL BOARD

Richard S. Salzman, Chairman
Dr. Lawrence R. Quarles
Dr. W. Reed Johnson

CLI 76
p 73

In the Matter of

Docket Nos. 50-275 O.L.
50-323 O.L.

PACIFIC GAS AND ELECTRIC COMPANY

(Diablo Canyon Nuclear Power Plant
Units Nos. 1 and 2)

On the ground that it would involve no unreasonable risk of harm to the public, the Licensing Board authorized the applicant to be licensed under Part 70 of the Commission's regulations to store unused nuclear fuel assemblies at its Diablo Canyon facility before the facility itself was licensed for operation. Intervenors excepted and the Appeal Board affirmed, holding that the Licensing Board had (1) applied the correct standard (2) rendered a decision in accordance with and supported by the evidence and (3) not committed prejudicial procedural error.

RULES OF PRACTICE: TELEPHONE CONFERENCE CALLS

Promptly after any prehearing conference carried on via telephone during which rulings governing the conduct of the proceedings have been made, licensing boards must draft and enter written orders confirming those rulings. 10 C.F.R. §2.752 (c).

RULES OF PRACTICE: TELEPHONE CONFERENCE CALLS

When a prehearing conference is conducted via telephone, the licensing board must insure that representatives of all parties concerned are on the line unless that representation has been waived.

RULES OF PRACTICE: HARMLESS ERROR

It is error for a licensing board to make a ruling at a prehearing conference via telephone where one party is unrepresented without conveying that ruling to the absent party; the error is harmless, however, where the ruling in question operates in favor of the absent party.

standards which should govern its exercise generally and in this case in particular?

FOR THE ATOMIC SAFETY
AND LICENSING APPEAL BOARD

Margaret E. Du Flo
Secretary to the Appeal Board

Supplemental concurring opinion of Mr. Salzman:

In *Jamesport*, the NRC staff had urged upon us the theory that parties who lacked "judicial" standing could nonetheless be admitted to Commission proceedings "in the sound exercise of administrative discretion". See NRCI-75/10 at 658. I supported that position, expressing my view that the Commission was not bound to apply—and indeed should not apply—in its own proceedings rules of standing developed in the federal courts for reasons largely extraneous to the admininstrative process. *Id.* at 654-59. That position, however, was rejected by the majority of the board hearing the *Jamesport* appeal. Under our practice subsequent appeal boards (as well as the licensing boards) are bound by the *Jamesport* ruling that judicial standing tests govern entry to the Commission's licensing proceedings. Hence, though my personal views differ, I feel constrained to go along with my colleagues in holding that "rate payers" as such lack standing and may not intervene in this case.[1]

The Commission has in the past allowed us to apply the judicial standing tests with some liberality. Those tests cannot be stretched indefinitely, however. And it is by no means true that every party deserving of the Commission's ear would have standing under those precepts.[2] I therefore concur in my colleagues' treatment of this intervention appeal and join them in urging a Commission decision now on the certified questions.

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[1] There may well be, as my colleagues say, a suggestion in the recent *Edlow International* decision that discretion exists (at least in domestic cases) to allow deserving parties who do not meet the tests for judicial standing to intervene in Commission proceedings. If that be true, no clue is there provided about who possesses that discretion or about the standards for its exercise. To raise such a "hint" to the status of a holding (or even a *dictum* for that matter) would require us to engage in levitation, not adjudication.

[2] See, *e.g.*, *Jamesport*, *supra*, NRCI-75/10 at 658-59.

RULES OF PRACTICE: DISCOVERY

It is not error to deny discovery into matters irrelevant and immaterial to the proceeding to be heard.

RULES OF PRACTICE: CROSS-EXAMINATION

The licensing boards are vested with discretion to limit cross-examination to exclude irrelevant testimony and to cut off such examination entirely when it ventures into matters too far removed from the issue being heard. 10 C.F.R. §2.757.

MATERIALS LICENSE UNDER PART 70: STANDARDS

Part 70 of the Commission's regulations precludes authorization of a license to store unused nuclear fuel assemblies without a finding, *inter alia*, that issuance of the license would not constitute an unreasonable risk to the public health and safety. 10 C.F.R. §70.31 (d).

RULES OF PRACTICE: CROSS-EXAMINATION (HYPOTHETICAL QUESTIONS)

While the appropriateness of any given hypothetical question is a matter largely for the trial board's discretion, as a general rule such questions are impermissible unless based on facts supported by evidence in the record or which that evidence tends to prove.

TECHNICAL ISSUE DISCUSSED: Unspent reactor fuel storage risks.

Mr. Philip A. Crane, Jr., San Francisco, California (**Messrs. John C. Morrissey, Dennis C. Sullivan** and **Bruce R. Worthington**, San Francisco, California, with him on the brief) for the applicant Pacific Gas and Electric Company, *appellee*.

Mrs. Sandra A. Silver and **Mr. Gordon Silver**, North Hollywood, California, for Joint Intervenors San Luis Obispo Mothers for Peace and John J. Forster, *appellants*.

Mr. James R. Tourtellotte (**Mr. L. Dow Davis** with him on the brief) for the Nuclear Regulatory Commission Staff.

DECISION
June 22, 1976

The Licensing Board now has before it Pacific Gas and Electric Company's application for a license to operate its nearly completed Diablo Canyon Nuclear Power Plant. In the course of this proceeding, the applicant sought a "materials license" under Part 70 of the Commission's regulations (10 C.F.R. Part 70) to receive and store at the Diablo Canyon site nuclear fuel assemblies for future use at that facility. The San Luis Obispo Mothers for Peace and John J. Forster are intervenors in the operating license proceeding. They objected to granting applicant that interim license before the plant itself was licensed,[1] contending that the storage of nuclear fuel at the facility would constitute an unreasonable risk to the public health and safety. The Commission's regulations prohibit the issuance of a license under Part 70 where such risk exists. 10 C.F.R. §70.31 (d).[2]

The Licensing Board held a three-day hearing on intervenors' objections, taking testimony from seven witnesses proffered by the applicant and the staff. The intervenors presented no witnesses of their own but their representatives, who are not attorneys, did cross-examine those of the other parties. On the basis of the record developed at the hearing, the Board concluded that the applicant could receive and store nuclear fuel assemblies at its Diablo Canyon facility without creating any unreasonable risk of public harm. Accordingly, on December 23, 1975 the Board authorized the applicant to be licensed to undertake such storage.[3]

The intervenors have jointly appealed from the Licensing Board's December 23rd order.[4] They argue that it must be set aside because of procedural errors and because it lacks support in the record.[5] We do not agree.

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[1] For obvious reasons, authority to receive and store nuclear fuel is granted to applicants awarded an operating license.

[2] The Commission's regulations provide in pertinent part that "[n]o license [under Part 70] will be issued * * * if the Commission finds that the issuance of such license * * * would constitute an unreasonable risk to the health and safety of the public." 10 C.F.R. §70.31 (d).

[3] The Licensing Board's December 23rd order is unpublished.

[4] Our jurisdiction is normally limited to appeals arising in proceedings under Part 50 of the Commission's regulations. 10 C.F.R. §2.785 (a). We entertain this Part 70 appeal by virtue of a specific delegation of authority from the Commission. CLI-76-1, NRCI-76/2, 73 (February 5, 1976).

[5] On March 18, 1976 we denied Joint Intervenors' motion to stay shipments of nuclear fuel to the plant site pending our disposition of this appeal. ALAB-320, NRCI-76/3, 196.

I

oint Intervenors direct our attention to three procedural rulings by the Licensing Board which they assert are grounds for overturning the decision below. The claims are made that the Board (1) changed the issues in controversy without notice to the representative of the Mothers for Peace, to that intervenor's serious disadvantage; (2) denied improperly intervenors' attempt to discover details of the security plan for the Diablo Canyon facility and (3) limited unfairly intervenors' right to cross-examine witnesses for the purpose of eliciting testimony about the value of the nuclear fuel assemblies and the number of saboteurs who might be able to break into the plant. We discuss those assertions in that order.

1. The modification of the issues in controversy. The hearing below was precipitated by a motion made on April 10, 1975 at a prehearing conference. Mrs. Sandra Silver, representing intervenor Mothers for Peace, there moved to preclude the applicant from receiving and storing nuclear fuel assemblies at the Diablo Canyon site before the facility was licensed for operation (Tr. 444). On June 3rd, Mr. Gordon Silver, husband of Mrs. Silver and representative in this proceeding of intervenor John J. Forster, moved on Forster's behalf "to allow him to associate with and support [that] MFP motion at all proceedings connected with it." On June 24th the Licensing Board acted on both motions. It ruled that the MFP motion raised factual issues which would require a hearing for resolution and stated those issues to be:

(1) The forces to which the fuel storage building could be subjected to as the result of the occurrence of a hypothetical earthquake appropriate for this site;

(2) The probability and significance of the formation of a critical mass as a result of the application of this force (including the presence of water due to possible pipe breakage);

(3) The probability and significance of a critical mass being formed by an act of sabotage; and

(4) Alternatives to the storage of the fuel at the site.[6]

There were no objections to the Board's formulation of the issues. The Board also granted Mr. Silver's request on behalf of intervenor Forster "to associate with and support" the MFP motion.

At Mr. Silver's instigation, in October the Board held a telephone conference call to discuss matters relevant to the conduct of the fuel storage license hearing which had been calendared to get underway the following December. (Tr. 650-52). For reasons not entirely clear to us, Mrs. Silver was apparently not

[6] Order of June 24, 1975, p. 4 (unpublished).

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[7] Licensing Board Orde
[8] *Ibid.*
[9] *Ibid.*
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asked to and did not participate in the call. *(Ibid.)* Mr. Silver was aware of that fact at the time, but made no mention of it. The record is ambiguous about whether the Board failed to appreciate Mrs. Silver's absence from among the parties on the line or assumed that Mr. Silver was speaking for her as well as for himself.

During the course of the conference call the Board made several rulings. Pertinent here are its instructions to the parties to assume for purposes of the forthcoming hearing, first, that the Diablo Canyon fuel storage building had collapsed in an earthquake and damaged the racks in which the nuclear fuel was stored and, second, that the plant's security arrangements had been breached and saboteurs had gained entry.[7] The Board then indicated that, in light of those assumptions, only two issues remained for trial: (1) "the effect of an earthquake" and (2) "the effect of entry of saboteurs."[8] The Board dropped the fourth issue (alternative fuel storage sites) althogether, observing that it involved only economics and was not relevant to the issue of the public health and safety, the subject of the materials license hearing.[9]

The Licensing Board did not memorialize its actions in a formal order. Although Mr. Silver admitted discussing other matters raised at the conference call with Mrs. Silver, he stated that he did not draw her attention to the Board's simplification of the hearing issues. (App. Tr. 13-14, 77-78). Mrs. Silver represents to us that she did not become aware of the modifications virtually until the opening of the hearing itself.[10] The Mothers for Peace now advance the claim that the failure to give Mrs. Silver timely notice of the change in issues placed them at an "unconscionable disadvantage" in the hearing. For this reason, they say, the Board's order must be reversed.

We begin our analysis by observing that the Board below expressly found intervenors not to have been prejudiced by being required to go ahead with their case in the circumstances described. (Order of Dec. 23, 1975, p. 3; Tr. 658.) Nor do intervenors themselves particularize any disadvantage under which they were compelled to labor by the Licensing Board's rulings. On the basis of our review of the record we perceive none.

We reached our conclusion by the following route. First, the Board below did not use the conference call to inject new issues into the case. It merely eliminated certain existing matters in controversy by requiring the parties to assume (for purposes of the part 70 license hearing) that intervenors would prevail on those issues. Thus, as a consequence of the Board's conference call rulings, the intervenors no longer needed to show that the facility could not withstand an earthquake (this was issue (1)). Instead, they had only to demon-

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[7] Licensing Board Order of December 23, 1975, p. 5.

[8] *Ibid.*

[9] *Ibid.*

[10] Joint Intervenors' brief, p. 7, and Tr. 650-51.

strate how, in the event of such a seismic occurrence, the stored nuclear fuel might be formed into a "critical mass"[11] and, should that transpire, how the public might be harmed as a result (issue(2)).

Similarly, the Licensing Board did not burden intervenors by ruling that the parties need only consider the consequences of "the entry of saboteurs" into the Diablo Canyon facility and not concern themselves about how that entry was achieved. To the contrary, as the Board below noted,[12] this ruling relieved intervenors of a burden they would otherwise have had to shoulder, *i.e.*, of demonstrating how intruders could evade or overpower the facility's guard force. In other words, for purposes of the hearing the Board accepted intervenors' argument that applicant's security arrangements would be inadequate (issue (3), part 1). This allowed intervenors to make out a case against issuance of the materials license on sabotage grounds simply by showing–if they could–how saboteurs might use the stored nuclear fuel to endanger public health and safety (issue (3), part 2). And the dropping of point (4) by the Board meant that if intervenors could prevail on either of the two issues remaining *(i.e.*, the effects of sabotage or earthquake), the Part 70 license would have to be denied even if the applicant lacked an economically reasonable alternative to storing the fuel at the Diablo Canyon site.

In short, the Board's actions in the conference call did no more than eliminate intervenors' obligation to establish (or to discredit their opponents' showing on) a number of key points. Whether the Board below should have reformulated the issues as it did may be debatable. But the reformation accrued to intervenors' benefit, not detriment. Thus, even accepting as true Mrs. Silver's lack of awareness of the Licensing Board's simplification of the trial issues, the only consequence was her appearance at the hearing primed to litigate four issues when only two remained to be heard.[13] Be that as it may, it is fruitless for a party to complain on appeal about trial rulings which operated *in its favor.*[14]

We do agree with the intervenors that the Licensing Board should have reduced its prehearing conference call rulings to writing. Had this been done, the confusion about the number and nature of the issues to be tried probably would have been avoided. Indeed, the Commission's Rules of Practice contemplate that a licensing board will "enter an order which recites the action taken at the

[11] "Critical Mass" and "criticality" are discussed in part II, *infra*, pp. 818-819.

[12] Licensing Board Order of December 23, 1975, p. 3.

[13] Lack of notice of those changes might have inconvenienced any witnesses brought by intervenors to testify about issues no longer in the case. As we noted, however, intervenors had no witnesses of their own.

[14] *Ford Motor Company* v. *Mathis*, 322 F. 2d 267, 274 (5th Cir. 1963); *Highway Const. Co.* v. *City of Miami*, 126 F. 2d 777, 780-81 (5th Cir.), *certiorari denied*, 317 U.S. 643 (1942); *Langroise* v. *Cummings*, 123F.2d 969, 974 (9th Cir. 1941), *certiorari denied*, 316 U.S. 664 (1942); *Montgomery Ward & Co.* v. *Medline*, 104 F.2d 485 (4th Cir. 1939).

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conference * * * which limits the issues or defines the matters in controversy to be determined at the proceeding." 10 C.F.R. §2.752 (c). The Board's failure to have written and entered such an order following its rulings at the conference call was error. For the reasons just described, however, in this instance the error was harmless.

Manifestly, that result was fortuitous. But we can envision other situations where a failure to enter written procedural orders may not be so harmless. We recognize that instances arise when licensing boards feel they must hold prehearing conferences by telephone. For the reasons this case illustrates, however, on those occasions the board must insure that orders rendered over the telephone are followed up promptly with written confirmation to all parties. Honoring this practice—required by the rules—not only should avoid repetition of what happened here, but also would enable the parties to bring to the boards' attention before memory fades any discrepancies between the oral and written orders.

Our disposition of this point renders it unnecessary to decide whether the staff is correct in its suggestion that, on the facts of this case, Mr. Silver's participation in the conference call was adequate notice to Mrs. Silver of any action taken there. (See Tr. 655-66). We take this opportunity, however, to reiterate what we said in *North Coast*: "As a general matter, conference calls which include some parties and exclude others are to be avoided except in the case of the most dire necessity."[15] That case, unlike this one, involved the possibility of a violation of the Commission's rules against *ex-parte* communications. The circumstances here exemplify another good reason why conference calls among fewer than all the parties are unwise.

In sum, we believe that considerations of simple fairness make it the duty of any party who becomes aware that another is not represented at a conference call to bring that fact to the presiding officer's attention. And it is the obligation of the board and the staff (as a representative of the public interest) to make appropriate inquiry at such a call to ascertain that all the parties are in fact on the line or have waived representation. By taking that precaution, problems of the type encountered here and in *North Coast* should be eliminated.[16]

2. Denial of discovery. For reasons which need not be rehearsed here, the Licensing Board reserved consideration of the adequacy of applicant's security plan to the operating license hearing. Completion of discovery in this area has

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[15] *Puerto Rico Water Resources Authority* (North Coast Nuclear Plant, Unit 1), ALAB-313, NRCI-76/2, 94, 96 (1976).

[16] We appreciate that *North Coast* was handed down after the conference call at issue in this proceeding. Nevertheless, what we said in that decision should have been obvious to the Board below and to the staff. Particularly where parties are proceeding *pro se* and are not fully aware of procedural niceties, the boards must act scrupulously to protect their interests in order to insure that justice is not only done, but seen to be done.

been delayed pending the adoption of final arrangements for keeping information about the plan confidential.[17] This was one of the reasons which underlay the Board's decision to instruct the parties to assume for purposes of the materials license hearing that the security plan was inadequate,[18] thus making it necessary in this case to delve directly into questions of the risk of harm to the public health and safety from successful acts of sabotage involving the stored nuclear fuel assemblies.[19]

Intervenors nevertheless contend that their lack of discovery of the security plan handicapped the presentation of their case. We think intervenors' position not well taken. A purpose of the security plan is, of course, to exclude unauthorized individuals—including saboteurs—from the facility. The Board, however, required the parties to assume that security was breached. Consequently, the staff is correct in pointing out that this left intervenors free to assume that security would be breached by as many individuals as were necessary for as long as needed to establish "criticality." Knowledge of applicant's security plan was thus irrelevant for purposes of the Part 70 hearing as structured by the Board, consequently it was not error to hold the hearing before discovery was completed in this area.

3. Limitation on cross-examination. Intervenors' final assertion of procedural error involves two occasions on which the Licensing Board cut short their cross-examination. The first instance involved Mr. Lindblad, one of applicant's witnesses. Intervenors contend that the Board would not let them explore through Mr. Lindblad the situation which would be created in the event more than four saboteurs broke into the plant. It was intervenors' position before the Licensing Board that "the consequences of an act of sabotage is a function of the number of saboteurs". They argue to us that their "position was compromised by the Board's limitation" of their cross-examination.[20]

The short answer to this charge is that intervenors simply have misconceived the witness' testimony and the Board's rulings. Mr. Lindblad merely testified that, in his judgment, the plant's internal security forces could handle any threat up to four intruders, but for greater numbers the applicant would rely on "outside public agencies for reinforcement." (Tr. 1027-28, 1033). The Board did not use this testimony as a basis for ruling out consideration of acts of sabotage achievable only by more than four individuals. Neither did it limit the number of intruders intervenors might hypothesize. What the Board did do at that point was to remind the intervenors that they were to proceed from the assumption that "criticality" would be achieved by whatever number of saboteurs entered

[17] See Joint Intervenors' brief, p. 10.

[18] Licensing Board Order of December 23, 1975, p. 5.

[19] See part II, *infra*, pp 817-828.

[20] Joint Intervenors' brief, p. 10.

facility and, therefore, to move along and address themselves to "the significance of criticality" (Tr. 1029). The Board carefully explained to intervenors that "if you are able to establish that there would be a significant result flowing from criticality", it would allow them to take up the likelihood of its occurrence. (Tr. 1034). Given the posture of the case and the Board's assumptions regarding the saboteurs' effectiveness, we think the ruling complained of was within the Board's discretion to make. Under the Commission's rules, it was fully entitled to limit the cross-examination of witnesses to exclude irrelevant testimony. 10 C.F.R. §2.757 (c).[21]

Intervenors also complain that the Board sustained objections to their questions about the value of nuclear fuel assemblies. (Tr. 1205-06). Intervenors' theory was that these are costly items which might be stolen for blackmail purposes. We think the Board did not err in cutting short this line of inquiry as "too far removed from our immediate concerns" in the hearing. (Tr. 1206). As we noted, the parties were instructed to accept as fact that unauthorized persons had already gained possession of the nuclear fuel. The point of the hearing was to explore the possible risk of harm or injury to the public through their use of that fuel. Intervenors' questions were clearly tangential to that basic inquiry and the Board did not abuse its discretion in declining to allow them. 10 C.F.R. §2.757.

II

In the first portion of this opinion we explained why intervenors were without cause to complain of the Licensing Board's procedural rulings. We turn here to a consideration of their substantive dissatisfaction with the decision below. In order to place their objections in perspective, as well as to indicate the context in which the Board's rulings were made, we preface our discussion with a brief and perhaps somewhat elementary description of nuclear fuel, how it is used and the way it is stored.

A. Background. The Diablo Canyon nuclear power plants will be fueled with uranium dioxide (uranium-238 enriched with uranium-235 to a maximum of 3.1%). The fuel is in the form of "sintered" pellets; that is to say pellets which

[21] The applicant also suggests (br. p. 11) that the intervenors' cross-examination was properly cut off because "license applicants need not consider actions by an 'armed band of trained saboteurs' ", citing *Consolidated Edison Company* (Indian Point Station, Unit 2), ALAB-197R, 7 AEC 825, 830 (1974). The applicant misreads our decision, for it also holds that it must demonstrate that it has a security plan adequate to *detect* encroaching saboteurs and to *alert* law enforcement authorities to their presence quickly and effectively. *Ibid.* See 10 C.F.R. §§50.34 (c), 73.1, 73.2(p), and 73.40; Regulatory Guide 1.17. The limitation of the intervenors' cross-examination was permissible for the reasons discussed above, not because all aspects of protection against saboteurs are beyond the Board's ken.

have been sufficiently heated to cause them to assume the form of a dense ceramic material. (Tr. fol. p. 1130, p. 7). New fuel pellets are not dangerously radioactive and may safely be held in the hand.[22] For use in the reactor, the pellets are stacked in tubes made of a corrosion-resistant alloy of zirconium known as "zircaloy". *[Ibid.]* Each tube measures about twelve feet long, but has an outside diameter of only 0.374 inches (Tr. fol. p. 1130, App. A). (Their slender shape suggests why they are commonly called "fuel pins".) After being loaded with pellets, the tubes are pressurized with helium and sealed.[23] Unused fuel pins, like new fuel pellets, may be handled without danger. (Tr. 1160). The fuel pins in turn are permanently assembled in a 17 x 17 square array, are fixed in place by top and bottom nozzle assemblies and laterally supported by grids at 6 positions along their length. Each array of fuel pins is known as a "fuel assembly" or "fuel element," is approximately 13-1/2 feet long and 8 1/2 inches square, and weighs approximately 3/4 of a ton (1500 lbs.) (Tr. fol. p. 1130, App. A). It is in this form that the uranium fuel is placed in reactors.

In about one third of the Diablo Canyon fuel assemblies, certain of the fuel pin spaces hold movable "control rod cluster assemblies" containing neutron-absorbing material, which can travel in and out of the array. And in lieu of certain other pins, steel rods with "burnable poisons" have been inserted for purposes related to the efficiency of reactor operation. (Tr. 1050-51).

The assemblies are made at a fabrication plant (in this case by Westinghouse in South Carolina) and trucked in reusable sealed casks to the reactor. Each cask is steel, holds two fuel assemblies, and weighs 7,400 pounds (3.7 tons) loaded. (Tr. 1163). It is permission to receive and store these fuel assemblies at the Diablo Canyon facility which the applicant sought and the Licensing Board granted in this proceeding.

The chain reaction principle on which nuclear reactors operate has often been described. For purposes of this case it is sufficient to observe that, under appropriate conditions, a uranium atom which absorbs a neutron may undergo "fission," that is split into two or more lighter elements ("fission products"), release energy in the form of heat, and free additional neutrons in the process. Should these neutrons strike other uranium atoms and one cause fission, the process will be repeated with the same consequences of heat generation and neutron release. In an operating nuclear power reactor, conditions are maintained that assure the occurrence of this stable "chain reaction" in which each fission triggers another. This balanced condition of continuous neutron production and loss is known as "criticality"; a physical system in which such a process

[22] Tr. fol. 1130 at p. 8, 1157, 1163.

[23] Because it is in hard pellet form, the nuclear fuel is not in uniform contact with the fuel rod itself. The main purpose of the helium is to use its superior heat conducting properties to facilitate the transfer of heat from the fuel to the rod when the reactor is in operation.

reacting place is said to have "gone critical."[24] If the system is a power reactor, the heat energy released by the fission process is removed from the fuel by cooling water which ultimately produces steam to drive a turbine and generate electric power.

The stable chain reaction process just described can be sustained only where a series of essential conditions are first satisfied. To start with, there must be a sufficient supply of uranium fuel. No chain reaction can be sustained without the presence of a "critical mass." Second, the fuel must be placed in a "moderator" (usually water) to reduce the speed of neutrons. (Tr. 893, 1139). For reasons we need not go into here, this increases the likelihood that the neutrons will remain in the system, strike the uranium atoms and cause fission. Third, the fuel elements, and the rods within those elements, must be arrayed in a proper geometric pattern, with the fuel/moderator ratio within certain limits. Finally, the heat produced by the fission process must be carefully controlled. If the moderator is allowed to overheat, rather than slowing the neutrons it will let them escape ("moderator voiding," Tr. 1087). And heating the fuel itself increases the likelihood that the uranium will simply absorb neutrons rather than undergo fission ("doppler coefficient"). (Tr. 1141). In either event, these feedback mechanisms act to terminate the state of criticality. In the limiting case of an uncontrolled power excursion or "supercriticality event" (see footnote 24, *supra*), the sudden generation of great amounts of heat causes the water moderator to flash into steam. Unless the excursion is otherwise controlled, the forces created by enormous steam pressure, which occurs almost instantaneously, will thrust the fuel elements apart or distort the slender fuel pins. Either case immediately disrupts the geometrical configuration of the fuel, thereby destroying a condition necessary for criticality and terminating the chain reaction.

At the Diablo Canyon facility, 270 fuel elements can be stored vertically in specially constructed steel racks. The racks retain the fuel elements in a "subcritical array", *i.e.*, sufficiently separated to prevent the formation of a critical mass. The racks themselves are permanently affixed to the bottom of a pool constructed of reinforced concrete and lined with steel. This fuel storage pool is

[24] In more technical terms, a state of criticality exists in a neutron multiplying system when the number of neutrons in one generation equals the number in the preceding generation. In this condition the neutron production rate (due to neutron absorption and fission in ^{235}U) is exactly equal to the neutron loss rate. Neutrons may be lost by absorption in ^{235}U (leading to more neutrons), by non-productive absorption in ^{238}U and other materials in the system, or by leakage from the system. The ratio of the number of neutrons in one generation to the number in the preceding generation is commonly called the multiplication factor and is often referred to as "K-effective" (K_{eff}). Thus for exact balance (criticality) the multiplication is unity and $K_{eff}=1$. An unbalanced condition in which the multiplication is greater than unity (a condition known as supercriticality) causes the neutron population to increase continuously until some change acts to restore the balance so that K_{eff} again equals unity. In a normal reactor the restoring action may be taken by the operator or it may be the action of an automatic control or safety device.

40 feet deep and filled with cold borated water to a point 23 feet above the top of the fuel. The water protects persons in the fuel building from exposure to radiation when "spent" (*i.e.*, used and therefore highly radioactive) fuel elements are stored in the pool. As an additional safety measure, neutron-absorbing boron is maintained at a concentration in the water high enough to prevent the establishment of a critical state under any geometrical configuration of the fuel elements. (Tr. fol. 850, pp. 5-9).

Because of their weight, individual fuel elements can be inserted in or removed from the fuel racks in the pool only with a powered crane. (Tr. fol. 1039, 1041). Even were some of those elements removed from the rack and assembled in the pool in the appropriate geometrical array, criticality could not be achieved unless the borated pool water was replaced or substantially diluted with the fresh water. It was testified that the dilution would require more than four and one half hours to accomplish under the most favorable conditions; total replacement would take longer. (Tr. fol. 850, pp. 6-9).

The foregoing recital is well documented in the record and is not disputed. At issue before the Board below was whether, given these conditions, there exists an unreasonable risk to public health and safety if a critical mass were to be formed as the result of an earthquake or an act of sabotage. We turn now to these questions.

B. Consequences of an earthquake. The Licensing Board held that the Diablo Canyon fuel storage facilities were so designed and located that the consequences of an earthquake "cannot lead to the formation of a critical mass." (December 23rd order, p. 8.). On appeal, Joint Intervenors neither challenge nor discuss that conclusion in their brief, much less attack the evidence introduced before the Board below upon which it rests. In the circumstances we need not consider the issue[25] and content ourselves with noting that, in our judgment, the Licensing Board's conclusion on this question stands on a firm evidentiary footing.[26]

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[25] "Appellate tribunals may generally disregard issues not briefed and we follow that practice." *Northern Indiana Public Service Company* (Bailly Generating Station, Nuclear-1), ALAB-207, 7 AEC 957 (1974) (citations of authority omitted).

[26] Both the pool and storage racks are designed to withstand without damage earthquakes whose effects are twice as severe as those anticipatible in the Diablo Canyon area. As long as the fuel elements are in the racks no critical mass can be formed. Should the storage racks collapse or the fuel elements be dislodged and fall into precisely that geometrical arrangement necessary to criticality, the borated pool water would preclude its occurrence. The pool is designed so that neither rainwater nor water from the plant's piping systems can dilute the pool water sufficiently to allow criticality; it has no bottom drain and the borated water can be removed only by pumping. Moreover, all the facility's fresh water storage tanks are situated below the level of the fuel storage pool. The only fresh water piping systems above pool level are closed off by valves located below the pool elevation. Should the pool water all leak out, criticality would then be impossible because of the absence of the necessary moderator. See Tr. fol. 850 (Lindblad); fol. 1130 (Staff Safety Evaluation).

C. Risk to the public

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C. Risk to the public from incidents of sabotag . For reasons explained earlier, the Board instructed the parties to try the cas on the assumption that saboteurs would be able to enter the Diablo Canyon f cility and gain access to the stored nuclear fuel elements. (See pp. 815-816, *sup r*). In essence, this meant the parties were required to address two principal is ues: first, the likelihood that saboteurs could use that fuel to start a chain reac on ("achieve criticality") and second, if they did so, what harm to the public mig it ensue.

To this end the applicant proffered several expe t witnesses, including its engineering project manager (Mr. Lindblad) and an e pert on radiation effects (Dr. Brunot). The staff tendered four additional witn ses, all with considerable experience in nuclear power engineering. Of the seven witnesses in all, two held earned doctorates in nuclear engineering; none was challenged as to his technical qualifications. The essence of their testimony was that it was virtually impossible for intruders to be able to establish criticality using the new fuel assemblies stored at Diablo Canyon but, even could they do so, that criticality would be of but momentary duration without significant consequence for public safety. The intervenors offered no witnesses of their own, expert or otherwise. Their participation was limited solely to cross-examination of the other parties' experts in an effort to weaken their testimony.

On the basis of the evidence adduced before it, the Licensing Board found that formation of a critical mass out of the stored fuel elements "would be extremely difficult," and that the likelihood of saboteurs being able to do so, though theoretically possible, was "remote." The Board did not elect to rest its decision authorizing the fuel storage license on this ground, however. Rather it relied on its further finding that, even were saboteurs successful in forming a critical mass from the nuclear fuel, the public would not be subjected to any unreasonable risk of harm.

1. Likelihood of saboteurs forming a critical mass. On appeal, the intervenors do not question the Licensing Board's assessment of the likelihood of saboteurs being able to form a critical mass, apparently being of the view that even a "remote" possibility is sufficient cause for concern. On this point, therefore, we simply note that our independent review of the record confirms that the Board below did not underestimate the possibility of a successful effort by saboteurs.[27]

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[27] The expert witnesses testified that several difficult steps would first have to be accomplished to achieve criticality. First, the boron content of the water in the fuel pool would have to be diluted from its present concentration of 4550 parts per million to a maximum of 2125 ppm, a process which would take at least four and one half hours with the fresh water sources available at the site (the pool volume is almost 54,000 cubic feet.) (Tr. fol. 850, pp. 6-9.). Then at least three fuel elements, the minimum needed to form a critical mass, would have to be removed from the racks. (Tr. 1038). These weigh about 3/4

(Footnote continued on next page)

2. Consequences of a criticality incident. The intervenors start from the unexceptionable premise that an applicant for a materials license under Part 70 must prove that no unreasonable risk of public harm is involved in granting it. 10 C.F.R. §§2.731 and 70.31 (d). The heart of intervenors' case is that this applicant did not carry that burden. In intervenors' view, the witnesses inadequately analyzed the consequences of a criticality incident. Therefore, intervenors say, they well may have underestimated the potential danger should such an event occur, through sabotage or otherwise.

(a) To comprehend the testimony directed to this question—and intervenors' criticism—it must first be understood that a state of criticality, or for that matter a supercritical power excursion, does not in and of itself represent a serious risk to the public at large.[28] Research reactors, for example (Tr. 1200), for years have operated continuously at power levels up to five megawatts in open pools (about 20 feet beneath the surface) and some of them have been deliberately put into supercritical excursions (pulses) for experimental purposes. Operators and visitors may look down upon these critical nuclear reactors at essentially no risk to themselves. We do not understand intervenors to suggest otherwise. Rather, their brief focuses on the radioactive fission products which would be formed as a result of a criticality incident and on whether those products are the source of a potential safety hazard.[29]

(Footnote continued from previous page)

of a ton apiece (Tr. 10-1). Consequently the removal would have to be accomplished with a crane dependent on offsite electric power that would be available only on the assumption that the saboteurs remained entirely undetected. (Tr. fol. 850 at p. 12). Because the nuclear fuel is only slightly enriched with 3.1% U-235, it will become critical only if the close geometrical array of the fuel rods is carefully maintained by keeping a horizontal distance between the fuel elements of .3 inches (Tr. 861 and fol. 1130 at p. 13). This is why the assemblies must be removed from the racks, which maintain greater separation. *(Ibid.)*. Finally, even were the requisite number of fuel elements placed in the proper geometrical array for criticality initially, steam pressure generated by that occurrence would disperse them instantly, automatically ending the critical state (Tr. 1049, 1064). The witnesses testified that no bindings placed around the fuel elements would be sufficiently strong to overcome the forces of dispersion (Tr. 1059). Even if the elements could be kept together, the slender fuel pins themselves would be twisted out of shape sufficiently to destroy the geometry absolutely necessary to maintain the critical state (Tr. 1064). As we noted, the intervenors neither offered contrary evidence of their own nor challenged the qualifications of the witnesses who so testified. In the circumstances, the Board's characterization of the likelihood of saboteurs establishing criticality with the stored fuel as "remote" was compelled by the record.

[28] To be sure, the neutron and gamma radiation produced by a critical or super-critical assembly if not shielded will present a hazard to individuals in the immediate vicinity. For the various scenarios considered at these hearings, water shielding was normally assumed to be present at least to some degree and the only persons in the vicinity of any of the criticality situations examined would be the saboteurs.

[29] Joint Intervenors' brief, pp. 2-6.

The answer to that question requires a basic understanding of the release mechanism for fission products. When nuclear fuel elements "go critical," the radioactive products created by the fission process do not precipitate out to the bottom of the fuel pins in the manner of many familiar chemical reactions. Rather, the new lighter elements are created, atom by atom, throughout the oxide fuel pellets (UO_2). (It is to be remembered that although fuel elements can be "burned" in a reactor for extended periods, the actual quantity of uranium transformed by the fission is relatively small.) To be released to the atmosphere, these fission products must first diffuse out of the solid UO_2. This process is extremely slow and takes place to any appreciable extent only when the fuel is held at high temperature (greater than 1000°F) for an extended period of time.[30] Those fission products which diffuse out of the pellets are contained by the zirconium cladding of the fuel pins; only upon failure of the cladding will they be released into the water moderator, which itself tends to absorb them. (As discussed earlier, water must be present as a moderator or there will be no criticality at all.) In sum, only that fraction of the fission products produced which diffuses from the fuel pellets, gets by the cladding and escapes from the water into the atmosphere can pose a threat to the public at large.

(b) Applicant's radiological expert, Dr. Brunot, addressed himself to the likely results of a criticality incident with the new fuel stored at Diablo Canyon. (Tr. fol. 912). He elected to respond to the hypothetical situation suggested by intervenors by comparing it to the consequences envisioned in the "Fuel Handling Accident" analysed in the Final Safety Analysis Report ("FSAR") for the Diablo Canyon facility. Like the hypothetical scenarios postulated by intervenors, that accident assumes an incident in the fuel storage pool which releases radioactive fission products–albeit from spent rather than new fuel. The potential consequences of such an accident are explored in some detail in the FSAR, including whether such an event might expose the public to radiation in excess of guidelines accepted by the Commission in the interests of safety. See FSAR §15.4.6.

Dr. Brunot's approach was to ascertain what he deemed the key factors in both situations and then to adjust those factors as he thought appropriate to reflect differences between the spent fuel accident and the postulated new fuel incident. Utilizing those figures, he then estimated the potential public exposure to fission products from what, in applicant's judgment, was the most serious incident involving criticality which saboteurs might be able to create with the stored unused nuclear fuel, assuming *arguendo* (as the Licensing Board had directed) that they could establish criticality.

Dr. Brunot explained that the quantity of fission products produced by an

[30] See Final Safety Analysis Report (FSAR), Chapter 11.1, and Tr. 1205.

incident of criticality was dependent upon the number of fissions which occurred during the event. For purposes of his analysis, he reviewed existing data and deliberately chose the largest number of fissions which had ever been reported as occurring in a criticality accident (some 6×10^{19}) on which to base his calculations. He then estimated a dose from criticality accidents based on comparison of the types of radioactive isotopes which would be present in an incident involving new fuel as distinct from a spent fuel accident. The proportion of isotopes with long half-lives would be larger in the latter situation because a considerable part of those with short half-lives would already have decayed. He then determined the portion of the isotopes which would diffuse (escape) from the fuel and the cladding, and adjusted that figure to account for the effect of isotope absorption by the water moderator and the filtration system of the fuel assembly building to find that fraction of the fission products which would actually reach the atmosphere. Finally, to arrive at the dose to which a member of the public might be exposed, he reduced that fraction to take account of atmospheric dilution (*i.e.*, reduction of isotopic concentration as a result of dispersion by air currents) and radioactive decay which could be expected to take place between the release point of the isotopes and their travel through the atmosphere to the site boundary. Based on these considerations, Dr. Brunot testified that the result of a deliberately set criticality incident with new fuel "would be expected to cause potential radiological exposures approximately 600 times less than those following a spent fuel handling accident,"[31] and be "well below the guide line levels established [by the Commission] for design basis accidents" and, therefore, "would not consitute an undue risk to the health and safety of the public." (Tr. fol. 912 at p. 10, 949-53).

Dr. Hirons and Mr. Marotta testified for the staff that, although they did not perform the calculations independently, they did review Dr. Brunot's procedures and computations. In their judgment, Dr. Brunot's methodology was acceptable and his results "conservative." In other words, the staff's expert witnesses expressed the view that if there were any error in Dr. Brunot's conclusions, it was that he had overestimated rather than underestimated the seriousness of a criticality incident with new fuel. (Tr. 1146-1151).

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[31] The Fuel Handling Accident consequences were reported for spent fuel in the FSAR at Table 15.4-41, summarized as follows:

	Site Bound.	Low Pop. Zone	NRC Guidelines (10 CFR Part 100)
Whole Body Dose (REM)	2.5	0.10	25
Thyroid Dose (REM)	11.1	0.46	300

The Board below found that "the radiological consequences of the formation of a critical mass in the fuel storage pool would be no greater than those resulting from a spent fuel handling accident and are therefore acceptable", and concluded that storage of unused nuclear fuel at the Diablo Canyon facility in the manner described would pose no unreasonable risk to the health and safety of the public. Those findings and conclusions rest on the foregoing evidence.[32]

(c) Although intervenors proffered no evidence contrary to that relied upon by the Licensing Board, they nevertheless argue on appeal that Board should have denied the application for the materials license. Their thesis is that the testimony adduced by the applicant and supported by the staff rests on faulty premises and should have been rejected. Their first point challenges Dr. Brunot's calculation of the total quantity of radioactive fission products which might be produced in a saboteur-induced criticality. They do not dispute that the total is proportional to the number of fissions which take place and that this in turn is related to the duration of the critical state. What they do contend is that Dr. Brunot's testimony that the maximum number of fissions would be 6×10^{19} is arbitrary because it rests on his assumption that any critical state established by saboteurs would necessarily be transitory. (Tr. 934-35, 1064). The intervenors assert that if the saboteurs strapped the fuel elements together with bonds of sufficient strength to prevent their disruption, the critical state could be extended to allow a far greater number of fissions than Dr. Brunot predicted.

This claim is refuted by the uncontradicted expert evidence. Witnesses with unchallenged qualifications in the field of nuclear engineering testified that the forces which would develop immediately upon the occurrence of a "criticality incident" *(i.e.*, a nuclear excursion) would be of such magnitude that no form of "strapping" the assemblies together could prevent their immediate disassembly (in "milliseconds") or preclude extreme distortion of the fuel pins. (Tr. 1060-65, 1074-75, 1097). Either consequence would promptly terminate criticality by removal of the critical mass or destruction the necessary spacing of the pins. (see p. 819, *supra.*) Intervenors' assertion that criticality could be maintained by binding the assemblies was no more than an unsupported hypothetical which they posed to expert witnesses and which those witnesses flatly rejected. As the courts have ruled, "[i]t is axiomatic that a hypothetical question is not evidence. It should be an accurate summation of the evidence already presented in the record and can neither add to nor detract from that evidence." *Myers* v. *Weinberger*, 514 F.2d 293, 294 (6th Cir. 1975) (overturning an administrative decision which relied on hypotheses unsupported by evidence in the record.). Consequently, the Board below may not be faulted for crediting expert testi-

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[32] Licensing Board Order of December 23, 1975, pp. 10-11.

mony or the number of fissions over a mere hypothesis devoid of evidentiary support.[33]

(d) Intervenors also criticize the testimony, credited by the Board below, respecting the rate at which radioactive fission products would be released from the new fuel and cladding in the event of an excursion incident. For reasons we need not rehearse in detail here, Dr. Brunot testified that, given the new fuel and brevity of the criticality excursion, a release of about 1/100th of the amount of radioactive isotopes would occur in the postuled incident as compared with release of such products in an accident with spent fuel. This, combined with other factors (dispersion and decay), would in his judgment result in an individual dose at the site boundary of 1/600th that which would occur from the "Fuel Handling Accident" analysed in the FSAR, which itself is within permissible Commission guidelines.[34] He attributed the overall difference in

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[33] Our own review of the record convinces us that Dr. Brunot's figure (6×10^{19} fissions) is not too low but too high. Even were it possible to bind several Diablo Canyon fuel assemblies together and operate them as a natural convection-cooled pool-type reactor, at a steady power of 1 megawatt the assembly would need 30 minutes to produce 6×10^{19} fissions. But our own experience is that steady-state reactor operation requires extensive instrumentation and elaborate controls. These simply could not be set up in a few hours. We agree, therefore, that assuming *arguendo* that saboteurs could achieve criticality by binding nuclear fuel assemblies together and putting them back in the fuel storage pool (or the ocean), what would follow (if anything) would be a sudden excursion, of which mere bonds could not prevent almost instantaneous disassembly and immediate cessation of criticality. Dr. Brunot's use of 6×10^{19} fissions is the result of its being the largest value listed in a table of reactor criticality accidents. See, Thompson and Beckerly, *Reactor Safety Technology*, Vol. 1, Ch. 11, pp. 616-17, Table 3.1. But the accident from which this result was derived was not of the sudden excursion type. Rather, it involved a relatively lone (70-second) power operation in a cooled reactor. In our judgment, the results of certain "SPERT" excursion tests (also reported in Thompson and Beckerly, *op. cit. supra*, pp. 684-85) are closer to the situation intervenors postulate. In these tests, control rods were forcibly ejected from the reactor system, providing a step increase in the multiplication constant (k_{eff}) beyond unity and a rapid, transient super-criticality which resulted in a total number of fissions of about 5.5×10^{18}. (See Tr. fol. 912 at p. 6-8). We consider this figure a more reasonable upper bound on the number of fissions to be anticipated from an excursion with a slightly enriched UO_2 fuel system such as the one at Diablo Canyon.

Intervenors complain that differences between the tested system and the Diablo fuel make it inappropriate to use SPERT data. According to staff witness, however, these tests provide the best experimental or analytical information available and, in fact, are as close to a representation of the poorly specified "sabotage criticality" as one might hope to achieve. (Tr. 1149-50). The key determining parameters in the SPERT tests are similar to those present at the Diablo Canyon facility, *i.e.*, low enriched UO_2 fuel and a water moderator. Differences between the test fuel and the Diablo fuel such as fuel pin size, spacing, and type of cladding material, would have little effect on the total fission yield. We therefore agree with the staff that, on this issue, Dr. Brunot's figures are conservative.

[34] See fn. 31, *supra*.

...charges essentially to the greater amount of undecayed fission products which would have accumulated in and would be released from the spent fuel because of its extended use, while the new fuel would have experienced but a brief state of criticality and accumulated correspondingly fewer such fission products. Dr. Brunot supported his testimony with references to experimental data, *inter alia*, the "SPERT" analysis. (Tr. fol. 912 at 6-8, 950-51).

As before, intervenors' objections are not based on any contrary evidence of their own. They simply disagree with Dr. Brunot's conclusions. Much of their argument on this point is directed at disputing that the experimental results of the SPERT tests are appropriate for Diablo fuel, a contention which we rejected earlier. See fn. 33, *supra*. Intervenors again complain that Dr. Brunot limited his testimony to evaluating a criticality of a transient nature and made "no effort * * * to ascertain or even suggest the consequences of a criticality occurring in a bound and restrained fuel assembly bundle." (Br. p. 4.) The short answer to this complaint was given earlier; such restraints could not effectively prolong any critical event. See fn. 27, *supra*.

What intervenors apparently have not appreciated is that the most effective retardant of fission products is the UO_2 fuel itself. Even when a reactor is operated at its rated power--and the high temperatures there developed enhance the diffusion of the individual atoms of the various fission products from the ceramic fuel pellets--only a small fraction of the radioisotopes created by the fission process ever diffuses out of the fuel. (Tr. fol. 912 at 8, Tr. 1205, FSAR 11.1-2 and 3). *A fortiori*, under conditions of "excursive criticality" such as those likely to be associated with the hypothetical acts of sabotage postulated by intervenors (assuming any criticality at all), or for that matter under the extended period of criticality at a steady state, lower power, low temperature operation of intervenors' alternate hypothesis, an even smaller fraction of those fission products would escape. (Tr. 1204-05). We therefore accept as reasonable Dr. Brunot's values regarding the rate of isotopic release in the event of an excursion incident with new fuel.

(e) Lastly, intervenors challenge Dr. Brunot's computation of that fraction of the fission products which, though released from the nuclear fuel, necessarily could not affect the public because absorbed by the water moderator, trapped in the fuel building and its filter system or diluted by atmospheric dispersion. Intervenors do not deny that some portion of those fission products will be thus neutralized. Rather, they claim that Dr. Brunot's computation of that fraction rests on faulty premises. In particular, intervenors contend that he unjustifiably assumed that the saboteurs would necessarily create any criticality incident in the fuel pool under 23 feet of water and would not be able to shut down the filter system. They also claim there to be no foundation for Dr. Brunot's use of a reduction factor for atmospheric dilution and downwind decay six times greater than that applicable to the spent fuel accident analyzed in the FSAR.

Those criticisms are not well founded. First, for reasons previously explained, the presence of water is indisputably necessary to achieve criticality.[35] But water also absorbs fission products. The Board below found that the only possibility (and this more theoretical than practical) remotely "credible" of saboteurs forming a critical mass with the stored fuel required them to make use of the 40 foot deep fuel storage pool.[36] Even assuming that saboteurs were able to establish criticality by reassembling fuel elements atop the pool storage racks, the rack tops are 23 feet under water (Tr. 1060), the figure used by Dr. Brunot in his calculations.

Second, it is simply incorrect that Dr. Brunot assumed that the fuel building filter system would be operating; the record reflects that he also made allowance for the possibility that it might fail. (See. Tr. fol. 912 at p. 9). Finally, the reason the reduction factor for atmospheric dilution and downward decay is greater in the case of an incident with new (unused) fuel than with spent (used) fuel lies in the nature of the fission products coupled with each. As explained earlier, a much larger proportion of fission products having short half-lives are associated with the former than with the latter. A portion of those short-lived products naturally decays during the time required for them to travel downwind from their point of release into the atmosphere to the site boundary. (See p. 824, *supra*, and Tr. 1149).

Moreover, even were this reduction factor assumed to be identical in the case of both new and spent fuel, it would hold no significance for this case. The potential public exposure to radiation at the site boundary as a result of a criticality incident with new fuel would still be less by a factor of 100 than that calculated in the FSAR for the [Spent] Fuel Handling Accident. Such exposures fall well within the Commission's safety guidelines.[37]

III

We cannot close this opinion without at least a brief comment on the Licensing Board's handling of hypothetical questions. The Board permitted the intervenors, over timely objections, to pose hypothetical questions to applicant and staff witnesses which assumed facts unsupported by evidence, if not contrary to it.[38] We agree that the appropriateness of a hypothetical question is

[35] See p. 819, *supra*, and Tr. 857. 857.

[36] Order of December 23, 1975, p. 9. The expert witnesses considered all the other hypotheses suggested by intervenors including the one that saboteurs might transport the fuel elements to the ocean) as "incredible." (See *e.g.*, Tr. 904). No contrary evidence was offered by intervenors. Given the great weight of the individual fuel assemblies and the consequent need to maneuver them by crane, we can not fault the Board's finding in this respect. See fn. 27, *supra*.

[37] See p. 824, *supra*.

[38] See, *e.g.*, Tr. 916-17A, 1018-2., 1070-74.

a matter largely for the trial board's discretion. But, even recognizing that intervenors were proceeding without counsel, we think the Board below departed too far from the "general rule * * * that a hypothetical should remain within the evidence and include only such facts as are supported by the evidence or which the evidence tends to prove." *Grand Island Grain Co.* v. *Roush Mobile Home Sales, Inc.*, 391 F. 2d 35, 41 (8th Cir. 1968) (Blackmun, J.). Such departures are at best unfair and at worst lead to a misleading and unsatisfactory record. Accordingly, they should be avoided. Assuming that the Board erred in this respect, the errors were in intervenors' favor and, given our disposition of the case, were harmless.

For the reasons developed in the foregoing opinion, the decision of the Licensing Board is *affirmed*.

It is so ORDERED.

FOR THE ATOMIC SAFETY AND
LICENSING APPEAL BOARD

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