UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of THE REGENTS OF THE UNIVERSITY OF CALIFORNIA (UCLA Research Reactor)	Docket No. 50-142 (Proposed Renewal of Facility License Number R-71)

ANSWERS OF THE COMMITTEE TO BRIDGE THE GAP
TO APPLICANT'S FOLLOW-UP SET OF INTERROGATORIES

Dated: November 9, 1981

COMMITTEE TO BRIDGE THE GAP
1637 Butler Avenue, Suite 203
Los Angeles, California 90025
(213) 478-0829

Intervenor

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INTRODUCTION

On September 22, 1981, Applicant, the REGENTS OF THE UNIVERSITY OF CALIFORNIA, submitted to Intervenor, THE COMMITTEE TO BRIDGE THE GAP, follow-up interrogatories as to matters in the above-captioned proceeding. Said interrogatories are answered in the responses that follow, subject to certain agreements between the parties made at a discovery conference on October 16, held pursuant to Board Order. Those agreements modified the language of Interrogatory 9 by removing the phrase "and such personnel had knowledge . . . operation?" Interrogatory 14 was modified by replacing the phrase "all calculations" with "principal calculations." Certain language in Applicant's introduction to the interrogatories regarding possible affiliations of individuals was also removed. By agreement between the parties, responses were to be filed November 9.

Discovery is proceeding on all the matters touched on in the Applicant's interrogatories. The following answers are provided without prejudice to Intervenor's ability to introduce subsequently discovered material ata later date at hearing or related proceeding. As Interrogatories 1-9 are requests for supplementation of previous answers, only supplementary material is provided; previously provided information is not repeated.

Intervenor objects to Interrogatory 26 and declines to attempt to answer it. The parties were unable to reach agreement about this particular Interrogatory despite several attempts during discovery conferences, although agreement may yet be reached. Intervenor objects to the interrogatory on the grounds that it is vastly overbroad & unduly burdensome. The question essentially asks Intervenor to identify every document, letter, note, or other written item in Intervenor's possession which is "in any manner whatsoever related to any of the issues in this

proceeding." The question is so broad that an answer is impossible, and Intervenor declines to attempt an answer to such a question. By agreement between the parties, a motion for protective order is not being filed at this time. Additional discovery conferences with Applicant are scheduled in an effort to avoid having to bring the matter to the Board for action.

Dated: November 9, 1981

Daniel O. Hirsch

Daniel O. Hirsch
President
COMMITTEE TO BRIDGE THE GAP
Intervenor

1. Yes.

(a) Since answering this question in the previous set of interrogatories, an NRC inspection has been conducted, based on revelations by UCLA in response to Intervenor's interrogatories to Applicant. Those responses indicated that Applicant had indeed permitted unlicensed operators to manipulate the NEL reactor's controls, a principal assertion made by Intervenor in support of its contention of inadequate managerial and administrative controls. On July 28, 1981, A.D. Johnson, Director of Enforcement and Investigations for NRC Region V, wrote to Walter Wegst at UCLA, stating: "We have evaluated the circumstances and management controls that existed in the past wherein high school and other students had been permitted to manipulate the switch controlling movement of a reactor control blade. We have concluded that your actions may not be in strict compliance with NRC rules and regulations." Since the time of that NRC inspection, Applicant has admitted in pleadings that there have been numerous times when unlicensed operators manipulated the reactor's controls. Intervenor has observed during document inspection at UCLA numerous such instances in the operating logs, including instances when junior high school children were permitted to operate the reactor controls and when young students were permitted to scram the reactor. All of this is additional support for Intervenor's contention that inadequate controls and supervision have existed at the facility.

In addition, the finding by the NRC that the practice has continued for more than a decade since the AEC on two previous occasions explicitly denied UCLA permission for operation by unlicensed operators provides additional support for Intervenor's concern about poor administrative procedures and controls. AEC directive was clear to the licensee in the past; yet despite clear direction against the practice existing in the docket for this reactor (direction that was appealed by UCLA and given again in very clear language by AEC), the practice continued for a decade. The ability of this facility to obey Commission regulations, and to use good internal controls to maintain proper procedures, is seriously called into question by NEL management's disregard for or ignorance of previous AEC explicit direction to this facility.

Other facts which support CBG's allegation of inadequate controls were found during document review at UCLA. In particular, there were numerous instances of documents which required signature by NEL administrative, managerial, or supervisorial entities which were not so signed and approved (particularly ECOs and ESAs). Intervenor only received copies of certain of these documents within the last few days, so tabulation of and itemization of each such poor practice has not begun. In addition, there were numerous indications of log-keeping errors and record-keeping deficiencies. The 1980 Audit Report--which Intervenor inspected and requested copied but which has not been provided--indicated numerous concerns about record-keeping. The recommendations therein for better compilation of procedures manual was contradicted in the RUC minutes which discussed those findings--indicating that in fact there was no procedures manual as such and one should be created. When we reviewed the procedures manual provided to us, an out-dated emergency procedure with incorrect identification of individuals and phone numbers to contact was included.

(b) The documents referred to above and identified below were reviewed by Daniel Hirsch, Steven Aftergood, Wendy Schnelker, Sheldon Plotkin, and David DuPont primarily, and it is from their personal knowledge of those documents that these facts have been detailed. No compilation of the material from those documents has yet been produced by Intervenor.

(c) The documents which support the allegation are the RUC and RSC minutes, the operating logs, the June 10, 1981 NRC inspection of UCLA, the ECO and ESA forms.

2. Yes

(a) The answer continues to be based on UCLA's own Hazards Analysis, which as indicated in previous sets of answers indicates melting could begin in the 2.3% range (and because of the error in use of incorrect void coefficient, actually 2.1%) with substantial uncertainties requiring a far lower excess reactivity level inorder to meet prudent safety standards. Nothing in the Battelle analysis changes that view of Intervenor's; in fact, the opposite, there is reinforcement of Intervenor's position that excess reactivity needs to be substantially lowered. See answers to questions 14-17.

Intervenor has made no firm conclusion as to the <u>most</u> credible accident scenario. Applicant's Hazards Analysis indicates it to be insertion of a large worth (negative) sample into the reactor and failure of operator to reinsert control blades prior to withdrawing sample. That scenario seems quite credible to intervenor, although the other scenarios identified in response to previous set #24 continue to appear quite credible.

(b) The information comes from documents, primarily Applicant's own Hazards Analysis. Dr. Michio Kaku has provided some useful additional information regarding power excursions at other research reactors, primarily SL-1.

(c) UCLA Hazards Analysis, the documents identified in questions 14-17, the GE report on the SL-1 accident, and Thompson and Beckerley.

3. Yes

Intervenor means by the phrase "inadequate monitoring" the same as it indicated in answering this question in the previous set.

(a) In addition to the information previously provided, Intervenor now believes the annual area surveys to be extremely poorly conducted. Very few areas are monitored (for example, right above the reactor the equipment room is monitored, which is supposed to be unoccupied, but the snack bar on the other side of the wall isn't monitored). No in-place long-term neutron measurements are made at key locations; the hand-held neutron readings are very high, and yet there is no evidence of follow-up to check them out. No signature of supervisorial staff reviewing the results of area surveys is in evidence, nor remedial action directed or outlined. The film badge threshholds are so elevated that they could read zero and people still be getting very significant doses. There seems to be continued disagreement over what those threshholds are, even after

policy has been set. A review of the specs on the hand-held GM counter and the hand-held neutron counter reveals that they simply aren't adequate for detecting the levels of radiation of concern. RUC minutes from late 1979 or early 1980 indicate that the secondary effluent monitor can't see several times MPC. Minutes also indicate an attempt to salvage monitors from an old reactor at Atomics International, devices which turned out to be even worse than the outmoded devices at NEL. The annual shield survey is with the neutron generator off and the ports closed and all the shielding in place--certainly not the way to determine conservatively doses in unrestricted areas. The weekly surveys are always with the reactor off--high exposures could continue for a year before detection, if then.

(b) The above facts are found in the documents identified below are were identified in the review of said documents by the individuals idnetified in 1(b) above.

(c) annual radiation area surveys; Hornor to Wegst memo regarding film badge minimums; weekly radiation surveys, specs for the NEL radiation monitors.

4. Yes

(a) - (c) The answers to 3 above are included herein by reference, because they do not refer to past monitoring procedures alone but current practice as well.

5. Yes.

(a) A review of the scram reports indicates constant or frequent malfunction of the following devices, indicating inadequate maintenance: log N input, North area monitor, RPPS, safety amplifier, period circuit input tubes, control and power wiring of sump pump, long N and period monitor, battery power supply, exhaust stack dampers, dump valve, CIC power supplies, reactor stack exhaust fan, control rod logic, Keithley 421 TT Amp, secondary water supply line. In addition, a review of NEL maintenance records indicates extremely little maintenance performed--entire maintenance log for 1974-1980 is only 70 pages.

(b) see 1(b)

(c) NEL scram reports and maintenance logs

6. Yes

REM-meter, Argon-41 monitor, GM hand-held counter, TLDs and film badges (in terms of proper controls).

7. Intervenor at this time has no information regarding Applicant's compliance or non-compliance during the past year with its technical specifications as to maintenance and calibration. No such contention at this time.

8. Yes

(a) secondary effluent monitor, secondary effluent recorder, control blade gear box and torsion rod, control blade motors, control blade logic, control blades themselves, startup counter and logic system, Heathkit Model 1B-1100 Frequency Counter, linear Preamp, Linear Amp, Proportional Amplifier, micro ammeter, AMF rod drive mechanism, flexo-rabbit pneumatic transfer system, ratemeter in effluent monitor, scintillation probes, linear recorder, log recorder, relay alarm unit, solu bridge controller, level switches, manometer, vibrating capacitor electrometer, safety amplifier, period and log N amplifier, exhaust stack damper and damper controls, Argon 41 recorder, hand and foot counters, activation analysis equipment, hot cell, temperature recorder, the fuel itself, rupture diaphragm, control room intercom, control room instrumentation indicating open doors in facility, warning lights, dump valve sensing switch, CIC's and UICs, low count rate meter inhibit and low count rate meter, Argon 41 monitor, thermocouples, conductivity meter, dump valve

The above list is preliminary, prior to actual inspection of the facility.

The hazards to the public from unreliability, difficulty to repair or replace, or inability to obtain spare parts are both individual and cumulative. Individually, failure of the secondary effluent monitor or recorder can lead to release of highly contaminated secondary effluent into the environment; failure of control blade components or use when not in perfect condition because of difficulty in replacing or repairing can lead to loss of a crucial safety device for regulating reactivity and could, for example by droppingout of core or being thrown out, lead to power excursion; the various ratemeters and flowmeters and safety amplifier and period meters all could, through unreliability, severely reduce the engineered safety features of the facility; pneumatic transfer system failure can lead to public radiation exposures because of the highly radioactive material which travels through it; inadequate hand and foot counters could permit individuals to become contaminated and not know it, thus contaminating others; failure of exhaust stack damper and controls could lead to public releases of radioactivity because of failure of reactor "confinement,"; Argon 41 recorder failure or monitor failure could lead to excessive emissions without control room being alerted and taking corrective action; inadequate hot cell could lead to significant radiation exposures; improper temperature recorder and thermocouples could give inaccurate temperature indications leading to overheating of fuel or insertion of excess reactivity through addition of very cold water; failure of warning lights, open door indicators, or control room intercom could mean failure to warn people so that corrective and protective measures could be taken in case of urgent situation (security vulnerability, radiation release, bomb threat); failure of dump valve and dump valve sensing switch could disable a key backup shutdown mechanism; Argon 41 monitor problems could lead to excessive emissions; thermocouple failure or inadequacy could lead to localized heating and bowing; inadequate conductivity meter could mean significant corrosion occur without detection and thus fission product release from corroded fuel or significant activation products created in effluent.

(b)-(d) the facts are identified in (a) above, they are known by the individuals who reviewed NEL's records identified in 1(b) above, and were revealed in NEL maintenance records, SCRAM reports, AMF maintenance manual, and instrument specification booklets.

9. Yes

(a) After reviewing the records referred to in 8(d) above, it is Intervenor's clear impression that the NEL staff has for many years continued to operate its reactor despite knowledge of the unreliability and aged condition of crucial equipment. The reactor would scram, the cause would be undetermined, and the reactor would be brought back on line nonetheless. The reactor would scram, the cause would be the long N and period meter, and yet the staff would wait years to replace it, despite failure after failure. The cause would be the safety amplifier, and it would never get replaced. Line transients would occur repeatedly; nothing would be done. Control blades would get stuck during long runs; the staff would try to avoid long runs, rather than resolve the problem. The Argon monitor was questionable and questioned since the early 1960s, yet still today there is question as to what is the precise concentration of Argon being emitted. The REM meter produces strange readings; yet it continues to be used and no one checks to see if those readings are accurate (at least, there is no record of a prompt check in the material provided Intervenor). The hand-and-foot counters are ancient; yet visitors and workers alike are checked out of radiation rooms with a cursory stop at the counter. The "hot cell" is referred to in NEL's own documents as the "poor man's hot cell."

(b) See 1(b) above.

(c) NEL maintenance records, SCRAM reports, ECCs, instrument specification booklets, operating logs.

10. The following portions of the Application are not original and should be: p. 5; all of Appendix I, Attachment B; p. II/3-1 to 7-1; III/1-1 to 5-16 (some phrases and sentences have been added and are original; 90% is not); Appendix III, Attachments A and B.

As Intervenor stated in response to the previous set Interrogatory 2, "An elementary requirement for an adequate application for facility license is that it be written about the facility for which the license is being applied." In order to meet the common standards for granting of the license requested (10 CFR 50.40) that adequate assurances exist in the application that grant of license will not endanger health and safety of the public, an application clearly must be about the facility for which the license is intended. 10 CFR 2.743(c) indicates that the Application cannot be admitted into evidence if it is not reliable, relevant and material. An application for a different facility than the one in question, written by unknown individuals not present for cross-examination, without independent review by Applicant of the relevance and reliability of the non-original material, cannot meet the 2.743(C) standard. 10 CFR 50.30 requires that applications be filed under oath or affirmation by those responsible for the application; non-original portions of applications cannot be sworn to or affirmed absent some clear effort to determine the accuracy and validity of those sections, effort not shown in the application currently before the ASLB.

11. "The core was observed for signs of structural damage or for potentially damaging displacements. None were observed. About 6 months after the vibration experiment routine tests indicated that one of the control blade insertion times had increased. A few months later safety blade No. 1 stuck in the 'out' position during a routine prestart checkout of the reactor control system.

"When the reactor was dismantled, we discovered that lead shielding bricks under the control blade drive shaft had been displaced upward, causing the shaft to bind."

One of the purposes of the vibration tests was to determine whether the UCLA reactor was vulnerable to structural damage or potentially damaging displacements. One of the results of the vibration tests was immobilization of a key safety device--a control blade--caused by core shifting leading to damage to the control blade drive shaft and the lead shielding. Since these tests were conducted at vibrations representing a small fraction of possible accelerations due to a real earthquake at this location, the reactor failed the test--it was demonstrated to be potentially vulnerable to structural damage or potentially damaging displacements in an actual major earthquake.

Note further that the Smith article also indicated that "core vibrations could cause transients in the reactor power" and suggests some extra safety mechanisms that could reduce the magnitude of the transients, mechanisms which Intervenor has not seen evidence of having been installed at the UCLA reactor.

12. Intervenor subscribes to the no-threshhold theory regarding radiation exposure, a premise assumed by virtually all experts in the field and indeed all regulatory and official advisory organizations. There is no "safe" level of radiation, increased dose produces increased biological insult. Thus all radiation doses produce some level of biological harm (i.e. increased risk of induction of cancer, leukemia, or genetic damage); the extent of harm being a function of the extent and type of radiation. See the NAS BEIR reports, the UNSCEAR report, the Tri-State Leukemia study, the Hanford radiation workers study, the S. Utah leukemia-in-chilren study. Thus, all radiation doses are clearly harmful. Harm is a function of dose; no threshhold can be assumed.

13. Yes. Violations 5,6,10,11,12,13 all contributed to long-term emissions of excessive radiation and radioactivity. The actual doses received are difficult to assess accurately because NEL has to date made no scientifically controlled, accurate measurements of those doses. What data do exist from university measurements indicate emissions at the stack while the reactor is running of about 250 times MPC; doses to members of the public in unrestricted areas in the range of 5-900 mr/yr. The date and time (if available) of the violations are included in the inspection reports identified in response to First Set Interrogatory 21; the resultant exposures have been long-term and are continuing. Please note that although Intervenor makes no assertion regarding radiation exposures due to violations 1-4,7-9, and 14-16, Intervenor believes those violations are evidence of extremely poor practices that make it impossible for a favorable determination to be made indicating that reasonable assurance exists Applicant will obey NRC regulations in the future and take the necessary safety precautions over the 20 years of the proposed license.

14. Intervenor's statement at this time of the primary calculations, computations, assumptions and conclusions of the Battelle study with which Intervenor is in disagreement must be prefaced with the following remarks: A significant part of the Battelle study is (1) conclusory, with no data presented to support the conclusion, (2) contradictory, with no explanation given to explain the apparent internal contradictions, (3) lacking in probative value, for example, assuming certain numerical values for key calculations without any evidence given of the validity or even of the number employed.

There may be explanations for these apparently crucial defects. What appears upon reading to be internal contradiction may be non-contradictory when additional information is presented. Sources of probative value may exist for apparently arbitrary assumptions. Conclusory statements may actually be based upon more than mere opinion of the authors.

Until the interrogatories submitted to NRC Staff and its consultants responsible for the Battelle study are answered, Intervenor can only give its disagreements based upon what appears to be the import of the Battelle study and what appears to be missing.

First of all, both the abstract and summary appear to be in direct contradiction with the text of the report. Intervenor can find nowhere in the body of the document support for the conclusion that "the only credible accident involving offsite doses was determined to be a fuel-handling accident." In fact, quite to the contrary; the report seems to Intervenor to describe numerous accident scenarios that are credible and would result in significantly greater effect.

The conclusion of 12 MWs energy release from an excess reactivity insertion seems unsupportable from the material presented in the report and from analysis of the SPERT, BORAX, and SL-1 original reports, and is in direct contradiction with the Hazards Analysis for the UCLA-type Argonaut reactor and, indeed, with the relicensing Application. No explanation of the contradictory values for power release is given; particularly there is no explanation of why the Battelle analysts took, in what was to be a conservative analysis, the least conservative of values for energy release from the values they themselves report from the literature (see p. 6-7). For example, the GNEC material concludes that 32 MWs is the resulting release from 2.4% delta k/k insertion; yet Battelle assumes--with virtually no basis given--that the energy release from a greater reactivity insertion (2.6%) would be less than ½ that which GNEC assumes for 2.4%. In a matter of such importance, such vast variation in assumption leads only to the conclusion of vast uncertainty and the need for vast margins of safety because of that uncertainty.

The report made clear that certain accident scenarios or initiating or contributing events were outside the scope of the report and not included. (p. 8, bottom paragraph details the additional research necessary for a probative conclusion to be reached.) Accidental or deliberate irradiation of explosives or common materials with explosive properties was inadequately addressed. The shock wave phenomenon was, by the author's admission, only touched upon and needs further research. "It is conceivable that substances could be deliberately added to cause rapid dissolution of the fuel plates," but then the authors stated that consideration of such an incident was "beyond the scope of this report." Thus the conclusions

identified in the summary and abstract have no weight, when the universe of possible initiating events and contribution events was so arbitrarily and restrictively drawn.

The disagreements Intervenor has with the Battelle section on reactivity insertions will be discussed in answer to Interrogatories 15 and 16 below. As to the section on Catastrophic Mechanical Rearrangement or Flooding, as we read the section, it outlines a massive amount of excess reactivity which can be inserted through rearrangements and/or flooding, and even if only a small portion of that potential reactivity were inserted, a major excursion could ensue. Note for example, that p. 27 indicates potential insertions of 5.6% from flooding, partial collapse producing 8.7%, and complete collapse of 18.5%. Those are immense values, considering the current debate over whether 2.3% could cause melting. If even a fraction of the available reactivity were inserted through rearrangement and/or flooding, a very serious incident would be possible, in Intervenor's view.

The discussion of a core-crushing accident is most confusing. It states very clearly that the consequences "from a core-crushing accident would be some multiple of the consequence of the fuel-handling accident", which is quite logical, and yet whoever wrote the abstract concludes that it is the fuel-handling accident which causes the maximum off-site doses. In addition, the analysis only seems to deal with dropping a shield block on the core, not the problem of earthquake and building collapse onto the core.

The explosive chemical reactions section is likewise inadequate. The explosive reactions possible in case of graphite fire (and the complications of fire fighting) are not considered carefully. SPERT and SL-1 both had explosive chemical reactions (see Thompson and Beckerley); the uncertainties of interaction with schock waves are, by admission, not dealt with. Metal-water reaction is not well understood (see appendix to WASH-1400 dealing with such reactions); the calculations made on page 29 cannot be made with any certainty and require huge error bars and safety margins, which have not been taken into consideration.

The graphite fire section appears to Intervenor to describe numerous credible scenarios for reactor fire which could lead to release of considerable fission products into the environment. Earthquake-induced fire plus core damage increasing airflow was not considered in detail. P. 32 statement "it would take an act of ignorance or willful disregard of proper procedure" appears to igrore the fact that these are research reactors operated by students and, in the case of UCLA, with a long history of disregard of proper procedures and NRC regulations.

Intervenor cannot find in Nightingale the energy accumulate rate cited by the Battelle study. The applicable figure appears much higher. In addition, the kWd figure given for UCLA is unreasonably low--both for current history and for the accumulated operating history by the end of the proposed license renewal period. The amount of absorbed energy thus is clearly not "trivial."

The various building fire and accidentally-induced reactor fire scenarios presented all support the conclusion on p. 43 "the aluminum fuel boxes and fuel could be at risk for melting." The entire section appears to contradict the abstract and summary's assertions about fuel handling being the only credible accident scenario.

The section of fuel-handling accident seems to raise serious questions as well. For example, the x/Q figure has no source or basis given in the study. In addition, it is most remarkable to Intervenor that Battelle assumed more curies of I-131 getting out of the reactor room than did UCLA's Hazards Analysis, and yet the dose to the nearest individual in an unrestricted area was determined by Battelle to be nearly 50 times lower than in UCLA's application. No attempt to resolve those discrepancies has been made; that range of uncertainty is such as to make even the fuel handling incident, which Intervenor believes to be a relatively minor accident considering the accident potential for this facility, an unacceptable possibility. Note also that direct exposure to radiation from an exposed, dropped fuel element is not considered.

15. Intervenor has at this time no figure for the level of excess reactivity that will produce melting in any fuel plate in Applicant's Argonaut reactor. We believe that there is an unacceptable likelihood that the current and proposed license limits can produce such melting, and therefore believe that the original hazards analysis for UCLA and the original license granted by the AEC were quite prudent in limiting the excess reactivity to less than that necessary for prompt criticality. Given the uncertainties in comparing 2 reactors of very different design, moderation, core configuration, cladding and meat and channel thicknesses, neutron lifetimes and flux ratios and figures of merit, each of which increases the necessary error bars, the prudent safe level is no higher than .6% delta k/k. The only way to know for sure what level of excess reactivity will cause fuel melting at the UCLA Argonaut is to conduct an extensive Borax or Spert type series of experiments on a reactor with precisely UCLA's characteristics, and under varying conditions (such as ambient temperature, graphite temperature and energy absorption history). In the absence of that necessary research, the error bars are too large to allow UCLA to operate at, beyond, or near the levels its own Hazards Analysis and current Application indicate could cause melting. For a description of how the Hazards Analysis shows melting could begin around 2.3%, see the Supplemental Contentions and the previous set of Interrogatory answers; in addition, because of use of an inaccurate void coefficient in the original calculations, simple correction of that single error brings the danger level down to 2.1%.

16. Yes. First of all it should be noted that the 2.6% Battelle calculation is based upon a 2.3% figure at normal temperature, which is the equivalent of 2.6% at very low temperatures. We have explained in 14 above our disagreement with the estimate of 12 MWs energy release. Note that on page 19 the study determines that such a reactivity insertion (with what we feel is a vastly unrealistically low estimate of energy release) nonetheless gets one to 74°C from the melting point of the fuel meat, according to the authors. However, note that p. 18 indicates melting occurs at 640°C, so there is a 20° error--Battelle is actually 54°C from melting, even with the unrealistic assumptions about small energy release. Note further that Battelle assumes a starting fuel temperature of 60°C whereas NRC Staff assumes a starting temperature of 75°C. If one takes the Staff figure, one is now 39°C from melting--with no error bars, no room for any other factor affecting the calculation.

Given the numerous factors that make such an extrapolation and interpolation of SPERT data to UCLA (and all Argonauts, no less!) difficult if not impossible, a 39°C margin of safety is no margin whatsoever. For example, if Applicant's analysis is correct rather than Battelle's as to the energy release, and one uses Battelle's energy release-to-temperature rise correlation, the temperature of the fuel would be many hundreds of degrees over melting.

In addition, note that whereas the original UCLA analysis converted from Borax data to UCLA by making corrections for different cladding, meat and coolant channel thickness, different figures of merit, different neutron flux ratios, and so on, Battelle makes none of these corrections. It makes only one modification, that of neutron lifetime. The Battelle analysis then is even more crude than the UCLA application's analysis, and even with all those non-conservancies, it still gets within 39° of melting.

Sources: "Experimental Study of Transient Behavior in a Subcooled, Water-Moderated Reactor" by F. Schroeder, et al, Nuclear Science and Engineering, 2, 96-115 (1957); Report on Spert I Destructive Test Results, Trans. ANS, 1963; IDO-16883 Miller, Sola and McCardell Spert report for Phillips; Experimental Determinations of the Self-Regulation and Safety of Operating Water-Moderated Reactors, W.R. Dietrich; UCLA Application

17. Intervenor has indeed begun analyses of these and other accident scenarios, although it continues to believe very strongly that it is Applicant that has the responsibility for thoroughly analyzing potential reactivity accidents, and other accidents. Intervenor needs additional information, both from Staff and Applicant, information which it has requested, to move further with these analyses. In particular, Intervenor still has not been provided enough data to estimate accurately maximum fission product inventory at time of accident; to estimate fission product release rate for UCLA's particular kind of fuel over a wide temperature range; and to make an independent, site-specific determination of x/Q at various locations in unrestricted areas near the reactor. Intervenor is actively pursuing its attempts to obtain that information.

For the reactivity accident scenarios referred to by Applicant in this interrogatory, Intervenor's preliminary analyses have focussed on insertions in the $3.00 to $4.00 range, although because of the uncertainties existing because of lack of reactivity research on Argonaut reactors, for the purpose of said analyses all that is required is the assumption of enough reactivity inserted to cause melting, and as stated in 15 and 16 above, not enough research has been done to determine conclusively what level of reactivity insertion will produce melting and/or steam explosion. The damage assumed to result was the same for each scenario--two levels of damage: fuel melting on one level of severity, fuel melting and steam explosion on the other. Substantial fission product inventory release occurs in either case, but Intervenor has not yet made a determination of specific fission product release fragment. The 10% volatile release assumed by Applicant in its Application appears at this stage of analysis by Intervenor to be reasonable for some accident cases but not sufficiently conservative for others, particularly the scenario in which the excursion is initiated by an earthquake that also produces core damage.

Sources: ORNL-2616 Experiments on theRelease of Fission Products from Molten Reactor Fuels" by Greek, Martin and Park, July 22, 1959; "Properties of Fission Product Aerosols Produced by Overheated Reactor Fuels"

by G.W. Parker et al, in ORNL-3547, March 1964; Thompson and Beckerley; District Surveys following the Windscale Incident, by H.J. Dunster, et al, from 2nd Peaceful Uses of Atomic Energy, Geneva, 1958, Vol. 18, p. 296; Airborne Radioactivity After a Reactor Accident, by Joh. Blok, also from Geneva Peaceful Uses Conference; IDO 16285 "Experimental Investigations of Reactor Transients"; Appendix VI to WASH-1400 "Calculation of Reactor Accident Consequences"

18. The organization referred to is the Intervenor organization, the Committee to Bridge the Gap. Intervenor does not know that it will reach a decision or judgment as to the most credible accident scenario, as it doesn't think that determination particularly relevant to the proceeding. The central issue is whether the maximum credible accident could produce unacceptable consequences. As we understand the position of Applicant, the consequences from any credible accident are minor and acceptable. Our position is quite the opposite. There are quite a number of credible accidents, in Intervenor's view, that could produce extremely serious and unacceptable consequences.

What Intervenor is in process of attempting to do--and it should be reiterated that it remains Intervenor's position that it is Applicant's burden to conduct such a thorough analysis, not Intervenor's--is to determine a number of credible serious accident scenarios for this facility, and attempt to determine the range of fission produce release possible, and from there consequential doses to the public in unrestricted areas.

Although Intervenor may reach a conclusion, when more information from Staff and Applicant becomes available, as to the maximum credible accident, it does not intend to focus on only one major accident, because its current analysis indicates roughly a dozen accident or hazard scenarios, each of which would produce unacceptable consequences and each of which is credible.

Preliminary opinion, however, is that a reactor fire (caused either within NEL or by a general building conflagration) is probably both the most likely and most serious of the accident scenarios currently under review by Intervenor. This is because such a fire could continue over an extended period of time, the flames could provide a significant driving force to spread both volatile and non-volatile fission products into the environment, and the emergency plans for fire-fighting (a particularly complicated response given the nature of graphite, uranium-metal, aluminum reactors) are so unclear. Intervenor notes that 20,000 Ci of I-131 were released from a graphite reactor fire at Winscale, through heavy filters in the stack (non-existent at UCLA).

The above represents a very preliminary view, as Intervenor's inspection of the facility has not been conducted yet, Staff answers to interrogatories on these matters have not yet been provided, a x/Q and fission product maximum inventory reasonable and conservative for this facility over the next 20 years still are not available.

19. The standards being violated are identified in Contention VI. The levels of radioactivity released are 1-2 x 10^{-5} μCi/ml of Argon-41; 100,000 cpm of Cobalt-60; 1 mr/hr neutrons. The source of the standards are also identified in Contention VI.

20. Dr. Lyon received his A.B. in 1942 in Zoology and his M.A. in 1949 in Physiology at UCLA, and his Ph.D. in Physiology at UC Berkeley in 1952. He has been a Rockefeller Foundation Fellow in the Medical Sciences at Harvard School of Public Health, held a dual appointment as Assistant Professor in the Dept. of Biological Chemistry at the University of Illinois College of Medicine and as a Research Associate in the Physiology and Biochemistry of Bone at Presbyterian-St. Luke's Hospital in Chicago, was an Associate Professor in the Dept of Biochemistry at the Chicago Medical School, Professor of Biology at Bennington College, a Senior Visitor at the Institute of Biological Chemistry at the University of Copenhagen, a Special Consultant to the California State Energy Commission, and has most recently taught at UCLA courses on radiation and human health focusing on exposures from the nuclear fuel cycle. He has more than 30 publications in biochemistry and biophysics in journals such as J. Biol. Chem., J. Amer. Pharm. Assn., Sci. Ed., J. Bone and Joint Surg., J. Bact., Mycopathol et Mycol. Appl., etc. and his written numerous reports for the State Energy Commission on Draft Environmental Impact Reports concerning nuclear power projects, EIR guidelines, reactor safety, etc. He was a researcher and author of the 400 page report for AMFP on radioactivity in California milk. Intervenor does not at this time intend to qualify Dr. Lyon as a witness in this proceeding.

Dr. Plotkin received his B.S. in Electrical Engineering in 1946 at University of Colorado; he has an additional B.S. in Aeronautical Engineering, also from University of Colorado, 1949; Ph. D. in Electrical Engineering from UC Berkeley, 1956. He is a registered Professional Engineer in safety engineering in the State of California; he is President of Plotkin and Associates, a consulting engineering firm specializing in accident analysis and consulting systems and safety engineering matters. He has worked at Los Alamos designing nuclear instrumentation; at US Air Missile Test Center at Pt. Mugu conducting missile flight test analysis and evaluation; in charge of instrumentation for Cosmic Ray Laboratory, UC Berkeley; designed and developed high power pulse modulators for Energy Systems; Assistant Professor of Electrical Engineering at USC; systems engineer for Hughes Aircraft; systems engineer for TRW, specialized in security system development for California Dept. of Corrections and TRW, among other projects; RAND Corp. as senior engineer. Among his publications are a book entitled Accident and Product Failure Analyses. Intervenor suspects it will call Dr. Plotkin as a witness in the UCLA proceeding, but has made no determination as to which contention(s) nor made a firm decision on the matter. For his part, Dr. Plotkin has indicated tentative agreement to testify, pending determination of date of hearing and certain other uncertainties not yet resolved. When a firm decision is made, this answer will be supplemented as per 10 CFR 2.740(e)(1).

21. The "twenty volunteer" researchers were not described as having helped write the report but as having helped make the report possible. The writing was done by a small sub-group. The other volunteers did the following kinds of research: searching NRC public documents regarding the reactor, submitting Freedom of Information requests for documents not otherwise available, doing computer searches through the medical library on research regarding the effects of Argon-41, searching for and pulling technical reports from the engineering library on NRC dispersion models and radiation limits, and researching NRC I & E policy and 2.206 and license intervention procedures. The Research Director for the project is no longer on the Bridge the Gap staff and she is the person with knowledge as to names and background of most of the volunteers. Michael Schwartz was a 3rd year law student at the time and well-schooled in legal research. Michael Rose, a UCLA graduate student with considerable background in news research, conducted much of the FOIA effort. A graduate student in nuclear engineering, a grad student in public health, and a grad student in statistics did preliminary research into and analysis of the Rubin thesis, the effluent records, and the properties of Argon generally. The background of Daniel Hirsch, Dr. Lyon and Dr. Plotkin have been provided Applicant previously. Three law students helped Michael Schwartz in his legal research; we remember them to be associated with the Environmental Law Society but have no record of their names. Andy Lieberman's contribution consisted of witnessing a radioactivity spill at the NEL reactor while being given a tour and providing details. We received valuable assistance regarding radiation effects and standards from Dr. Rosalie Bertell, formerly of the Tri-State Leukemia Study. The above represents the extent of records or memory as to names and backgrounds of the volunteers.

22. UCLA Response to Notice of Violation, sent by Thomas Hicks on March 13, 1975 at the bottom of the second-to-last page that certain conclusions as to dispersion factors can be drawn from the Applied Nucleonics study. Referring to that study, Dr. Hicks states that the study shows that the present stack would have a worst case dispersion factor of 1/120 whereas a modified stack would have a dispersion factor of 1/570, a more than four-fold change.

23. SF_6 has been used by NEL to simulate Argon-41 dispersion from the stack. See the Rubin thesis, "Atmospheric Disperion of Argon-41 from the UCLA Nuclear Reactor." As that thesis indicates, Mr. Rubin released a known concentration of SF_6 from the stack and attempted to measure its concentration at various locations away from the stack. NRC Staff and UCLA NEL Staff have relied heavily on those measurements in attempting to estimate Argon-41 concentration in unrestricted areas, dispersion factors, and consequential radiation exposure.

24. In addition to those abnormal occurrences reported by NEL as such, Intervenor includes in the term "non-standard incident" all the scrams identified in SCRAM reports, the summer 1979 pneumatic tube radioactivity spill incident, the January 1981 radioactivity spill incident, the spring 1981 flooding incident, the control panel shorting/flooding in fall 1979, the leaking start-up sources, the primary coolant leak, and the Cobalt-60 contamination incidents.

25. The code sections cited in Intervenor's previous answer are quite specific. The missing information includes: a description in sufficient detail to determine adequacy of the reactor shielding and the supplemental shielding on all sides and above the reactor (i.e. the reactor shielding and the shielding in the reactor room walls and roof), handling devices for radioactive substances and contaminated objects and individuals as well as spent fuel itself, detailed description of radwaste storage facilities, detailed description of working areas, detailed description of threshholds and history and accuracy of measuring and monitoring instruments; detailed description of reactor procedures, particularly those such as procedures to avoid accidental criticality, procedures for personnel monitoring and waste disposal, post-criticality emergency procedures, radwaste shipment procedures (high and low level), tour procedures for the public, procedures regarding operation of reactor controls by unlicensed operators, procedures for fighting reactor fires, procedures for controlling flammable loading in NEL, procedures for cleaning up contaminated liquid in case of significant flooding, procedures for freeing pinned control blades or dump valves; information detailing the nature, threshhold, reliability of criticality alarms, and the emergency procedures for each area in which SNM is handled, stored or used, to respond to criticality alarms, as well as placement of radiation survey instruments in accessible locations.

27. No arrangements for expert witnesses have yet been made, pending better idea of when hearing may possibly occur. Dr. Plotkin, as indicated in 20 above, has indicated a tentative willingness to serve in that capacity, contingent upon hearing dates and certain other factors, but that remains a very tentative expression. Likewise, Dr. Michio Kaku, a nuclear physicist from the City University of New York, has in recent days expressed a tentative willingness to testify, again contingent upon dates for hearing being set and certain other factors not yet resolved. Until Intervenor has a clearer idea of approximately when hearings might occur, it cannot make arrangements with expert witnesses, and has not. Information about Dr. Plotkin is supplied in 20 above; information Intervenor currently possesses about Dr. Kaku (not detailed, as discussions about serving as an expert remain quite preliminary) is that he received his Bachelor's degree from Harvard and his Ph.D. in physics from UC Berkeley; is a tenured professor of nuclear physics at CUNY; and has studied extensively research reactor accidents, in particular, reactivity accidents. No decision has been made as to which contentions he might address, should he testify, but V and X are likely candidates. Intervenor will supplement as per 10 CFR 2.740.

(a) - (c) see above.

28. No arrangements for other witnesses have been finalized, for the same reasons as given in 27 above. Intervenor is considering calling certain of its members who participated in document review at UCLA during which Applicant produced certain documents that may be introduced as evidence, in order to authenticate said documents. Daniel Hirsch and David DuPont would likely be the individuals so called; the documents involved would be taken from among those produced by Applicant, determination of which not having been made at this time. Until there is a better idea of when hearings may occur, no arrangements for witnesses are likely to be finalized. Intervenor will supplement as per 10 CFR 2.740.

(a) - (d) see above.

VERIFICATION

I, DANIEL O. HIRSCH, say:

1. I am the President of the COMMITTEE TO BRIDGE THE GAP, Intervenor in this action, and I have been authorized to sign this verification on its behalf.

2. All of the information provided in the attached ANSWERS OF THE COMMITTEE TO BRIDGE THE GAP TO APPLICANT'S FOLLOW-UP SET OF INTERROGATORIES represents the information currently possessed by the Intervenor relevant to those Interrogatories.

3. I have read all said ANSWERS and do believe them to be true and correct.

Signed on November 9, 1981, at Los Angeles, California.

I hereby affirm that the foregoing is true and correct.

Daniel O. Hirsch

Daniel O. Hirsch

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of THE REGENTS OF THE UNIVERSITY OF CALIFORNIA (UCLA Research Reactor)	)	Docket No. 50-142 (Proposed Renewal of Facility License)

DECLARATION OF SERVICE

I hereby declare that copies of "ANSWERS OF THE COMMITTEE TO BRIDG THE GAP TO APPLICANT'S FOLLOW-UP SET OF INTERROGATORIES" in the above-captioned proceeding have been served on the following by deposit in the United States mail, first class, this 9th day of November, 1981.

Elizabeth S. Bowers, Esq., Chairman
Administrative Judge
Atomic Safety and Licensing Board
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dr. Emmeth A. Luebke
Administrative Judge
Atomic Safety and Licensing Board
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dr. Oscar H. Paris
Administrative Judge
Atomic Safety and Licensing Board
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

William H. Cormier, Esq.
Office of Administrative Vice Chancellor
University of California
405 Hilgard Ave.
Los Angeles, CA 90024

Christine Helwick, Esq.
Glenn R. Woods, Esq.
Office of General Counsel
590 University Hall
2200 University Avenue
Berkeley, CA 94720

Counsel for NRC Staff
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Docketing and Service Section (3)
Office of the Secretary
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Wendy Schnelker

Wendy Schnelker