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UNIVERSITY OF CALIFORNIA, LOS ANGELES

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OFFICE OF ENVIRONMENTAL HEALTH AND SAFETY
THE CENTER FOR THE HEALTH SCIENCES
LOS ANGELES, CALIFORNIA 90024

May 13, 1980
ROS C1510

Robert W. Reid, Chief
Operating Reactors Branch #4
United States Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Reid:

RE: DOCKET NO. 50-142

Enclosed is the additional information you requested in your letter of April 17, 1980, regarding the application for the license renewal of the UCLA reactor. The information provided is clearly keyed to the fifteen (15) items posed in your lette-

The enclosed information has been reviewed by various members of UCLA's Radiation Use Committee and by myself. If you need further details concerning these, or other points, please let me know.

Very truly yours,

Walter F. Wegst

Walter F. Wegst
Director, Research
& Occupational Safety

WFW/lc
Enclosure

Question 1. 4-17-80

In order for us to prepare a rigorous analysis of student exposure, we request the receipt of a typical floor plan of the adjacent Math Building. This plan should show built up walls as well as more permanent fire walls.

The Math Sciences addition floor plans depend upon floor level and all the floor plans are enclosed. The following information will add clarification to the floor plans.

1) Outside walls.
   For the first two floors the outside walls are 15 inch-thick reinforced concrete. For the higher floor levels the thickness becomes 12 inches with parts of the north side of the building having a thickness of down to 8 inches. All outside walls are of reinforced concrete of the above thicknesses plus brick facing on all exposed outside walls.

2) Machine rooms and restrooms.
   All of 12 inch reinforced concrete.

3) Corridors, shafts (ducts), elevator and stairs.
   These walls incorporate metal studs with metal lath and plaster. The fire wall ratings are one hour and two hour depending on location.

4) Interior partitions separating offices.
   These walls incorporate 4 inch metal stud construction.

5) All interior walls shown on the drawings are full height to ceiling.

Enclosure: Nine drawings (floor plans), titled "Mathematical Sciences Addition, University of California - Los Angeles" numbered 186 through 194 at the lower right hand corner. Drawings are approximately 18" x 24" each and are individually identified by floor number and collectively identified as drawn by EES, date: 3-7-69.

Question 2. 4-17-80

Provide an analysis of the costs, benefits and problems associated with increasing the height of the discharge stack and other methods for reducing emissions concentrations onto the contiguous occupied buildings.

In 1975, UCLA proposed a stack extension and acceleration nozzle to increase the stack height by 18 feet. The proposal included increasing the exhaust fan drive to 15 horse power to compensate for the incremental acceleration requirement. The cost, estimated by the Campus Architects and Engineers, was $30,000. State funds in this amount were liened to effect the proposal.

The proposal, developed in response to a Notice of Violation, was abandoned when it was learned that no calculable benefit would derive from a stack unless it was at least twice the height of the surrounding buildings. On any basis of defining the height of the surrounding buildings, the stack would have been high, costly, and of dubious acceptability for aesthetic reasons.

In the course of filing the Amendment 10 Application, estimates were provided (Kastenberg to Goller, 5 November 1975) of population exposures in the Mathematical Sciences building. Under the proposed restriction to 438 operating hours per year at 100 kwt, the estimated population dosage was 2.4 man-rem per year.

In subsequent years, plume tracing studies and roof-top dosimeter (TLD) measurements have provided a clearer picture of the concentrations and radiation levels in regions of concerned interest. A summary report of these studies entitled "The UCLA Reactor Is Safe" has been transmitted to the Commission (Wegst to Ahearne, 3 January 1980). In the present context, these studies can be summarized by stating that the 1975 calculations (model) over-estimate the population exposure by an order of magnitude, and the true exposure is more nearly 0.2 man-rem per year if reactor operations are limited to 43,800 kwt per year.

From the foregoing, UCLA concludes that a modest increase in the stack height would yield little assured benefit, and the cost per man-rem per year reduction would greatly exceed the $1000 suggested by 10 CFR 50, Appendix I, Section II, D.

UCLA believes that for equal dollar expenditures, more certain benefits can be gained by compressed gas storage tanks than by a stack extension. The use of continuous flow, atmospheric pressure tanks was discussed in the letter of Kastenberg to Goller, 5 November 1975. The essential problem with such tanks is the large volume required to achieve a substantial effect.

The plan which will be proposed to the Commission will provide approximately 2000 SCF of hold-up volume at pressure ranging up to 150 psig. This volume could store 8 to 10 hours of core extract air that is rich in argon-41. Overnight holding (say 14 hours) would provide a decay of 7.65 half-lives for a reduction factor of approximately 200 in the annual argon-41 release.

Not all of the argon-41 will be captured in the core extract line, some will seep into the reactor room, and some losses will arise with operation of the pneumatic sample transport system. Thus a factor of 10 is a more realistic reduction expectation than the factor of 200 suggested by the decay time alone.

The plan is to provide three tanks, 24 inches in diameter by 20 feet long. These are to be horizontally disposed and stacked one above another along one wall of the reactor room. A concrete shield will be required. An equipment cost of about $5000 is anticipated, an overall cost of $10,000 will not be surprising. The tank volume was not optimized in a cost-benefit analysis, but was judged to be adequate and compatible with the available space.

UCLA is not currently requesting approval of the plan, but offers this description as a statement of intent. The plan will be submitted in connection with a proposal to relax the present operational limitation of 438 hours per year at 100 kwt. If the operating time is quadrupled and no other provision made, the population exposure in the Mathematical Sciences Building would be expected to rise from 0.2 to 0.8 man-rem per year. If a factor of 10 reduction in emissions can be realized with delay tanks, then that exposure should be reduced to approximately 0.08 man-rem per year.

Question 3. 4-17-80

Provide information on the various plugs used to seal the reactor. What is their condition? Do they have gaskets; what is their condition?

There are six horizontal beam ports into the reactor. These ports are stepped to prevent radiation streaming. Two plugs approximately three feet long secure each port. These plugs are concrete filled aluminum cylinders. The plugs have a nominal clearance of 1/8". At the present time, all horizontal plugs are sealed into the reactor with caulking compound and are given a cursory examination during each prestart check.

The thermal column consists of 15 rectangular ports. Like the horizontal beam ports, these ports are also stepped to prevent streaming. These plugs are fabricated from 1/4" steel, concrete filled, and have a nominal clearance of 1/8". All ports except the large (12" x 16") port are caulked in place. The large thermal column port has no seals but is given a cursory examination whenever the port is opened for sample loading.

The three vertical ports have a liner made of thin wall 2" diameter aluminum tubing and are capped on the bottom. These liners extend from the bottom of the core through the first 30" shield block and are flared at the top. This liner isolates the air flow in the core from the three vertical holes. A rabbit irradiation tube occupying the west vertical hole is shielded by an external shield to prevent streaming. This shield also covers the center and east vertical holes. Since the port liners extend through the first shield block, the inner plugs are no longer used. However, the outer plugs which are concrete filled aluminum cylinders 30" long, are used and mate to the flaired ends of the aluminum tube thereby greatly restricting any air flow in these tubes. The rolling external shield, 40" tall completes the shielding over the vertical ports.

Each liner contains a neoprene gasket at the flared end to seal the tube to the lower shield block and the rabbit tube itself contains a neoprene collar which seals it to the upper shield block. These gaskets are inspected only if there is need to remove the liners or the rabbit. The rabbit collar has been inspected in August of 1979 and found to be in excellent shape. The condition of the center vertical hole and the east vertical hole gaskets can be inferred by the resilience imparted to the outer shield plug when it is replaced following usage of that port for sample irradiation. By this measure, they appear to be in good condition.

Question 4. 4-17-80

Provide the justification for not using area monitors in the classrooms contiguous to the reactor room.

There is only one classroom contiguous to the reactor room (Room 2000). The room is within the radiation controlled area of the NEL and therefore requires that at least one radiation qualified individual be in the room simultaneously with classes, individual students or groups.

Located in this room, at the entrance to the reactor room, there is an alarming (audio and visual) hand and shoe monitor. This unit will alarm at between 2 and 3 times the background radiation. It is the equivalent to having 17 GM area monitors set to alarm at approximately 0.1 mR/hour. All qualified personnel know the meaning and the procedures to be followed when this alarm sounds.

There are also two area film badges in this classroom which have not detected any radiation above background since the room has been occupied, approximately 15 years. The badges are of 1 month and 3 month beta, gamma and x-ray film dosimeter type and have minimum detectable sensitivities of 10 mR and 3 mR respectively for x-rays.

In the reactor high bay, the north area monitor is directly in line with this classroom. This monitor is set to alarm in the reactor control room when the detector reaches a level of 5 mR/hour. Between this area radiation monitor and the classroom is a one foot thick solid, steel reinforced, load bearing concrete wall. If the area monitor should alarm, the reactor operator, who must be present when operations are underway, can either inform or evacuate the classroom from his position at the control console via the intercom or evacuation alarm systems.

Based on the operating history of the reactor, the type of area in which the classroom exists, the lack of radiation exposure on the area dosimeters, the requirement for qualified escorts and the alarming hand and shoe monitor, it was felt by the NEL staff and health physicist that the addition of an area monitor for this classroom would be both redundant and unnecessary.

Question 5. 4-17-80

Part 3.0 Page II/3-1 indicates that you had calculated doses to the environment for potential accident scenarios. Please provide us with those calculations.

UCLA suggests adding a second brief paragraph. That paragraph to read:

> Accidents and attendant releases are discussed in Appendix III (Safety Analysis Report), pg. III/8-1, and in the Attachments (calculations and other material) thereto.

Question 6. 4-17-80

Page III/8-1 refers to the "current restriction" on reactor operations 5% operating hours/year or 438 hours/year. Table III/1-5 indicates the reactor operated for 446 hours in 1979. Clarify this apparent violation. In addition, Technical Specification 3.8.2 on Page V/3-10 is ambiguous. It could be interpreted as limiting on a week-by-week basis (i.e., more restrictive). Clarify the Technical Specification to indicate exactly the restriction within which the reactor is to be operated.

Table III/1-5 will be revised. The clarification of the apparent violation is provided in the response to Question 8.

In clarifying 3.8.2 on page V/3-10, we propose to replace the fourth sentence with: By Amendment 10, reactor operations are limited to an energy generation of 43800 kwt per year.

Amendment 10 does not precisely state the foregoing, it was phrased more nearly in terms of hours per year. However, it has been interpreted as permissive of that energy production, the reactor could generate that energy if all operations were conducted at 100 kwt. The clear intent of the restriction is to limit argon-41 releases, and because argon-41 production is closely related to energy production, the interpretation appears to be in accord with fulfilling that clear intent.

Assuming the acceptability of this explicit statement, the last sentence of the fourth paragraph on page III/8-1 should be amended to read: The UCLA reactor is currently limited to an average annual power level of 43800/8766 or 5 kwt, a factor of 2 less than the 10 kwt used in the original calculations.

Question 7. 4-17-80

Page IV/1-3 gives emergency procedures for evacuation of the adjacent building. The names of all those evacuated and checked should be obtained before allowing them to leave the site. Change these procedures accordingly.

In answer to this question, the last sentence in paragraph 1.2.10, page IV/1-3 shall be changed to read as follows:

> The health physicist can release all non-contaminated and non-essential personnel after recording their names and any other pertinent data.

Question 8. 4-17-80

Table III/1-3 provides hours/year of reactor operation for research, class instruction, and maintenance. Class instruction accounts for only 8% of the total hours of operation. Please provide a breakdown in hours/year of the types of research programs conducted and the types of customers for whom this service was performed.

Table III/1-3 will be retitled REACTOR USAGE and will be replaced with the table and explanations which follow here
Detailed figures for years prior to 1976 are not available.

REACTOR USAGE					
ACTIVITY	HOURS PER YEAR				
	1976	1977	1978	1979	AVG.
Engineering Classes	17	83	52	31	46
NEL Experiments	4	31	9	1	11
Maintenance	23	14	34	1	18
UCLA Users	109	106	105	91	103
Colleges & Universities	45	47	37	53	46
Demonstrations	10	6	7	5	7
Commercial	1	5	95	264	91
Total Port-Hours*	208	290	340	446	321
Actual Run Time	184	238	271	372	278
Equiv. Full Power Hours	131	159	203	294	197

*Port-Hours are a measure of user demand, two concurrent users for one hour contribute two port hours. Instructional and maintenance hours are counted as one port-hour per hour.

Engineering Classes include both graduate and undergraduate laboratory work which includes basic counting, activation analysis, reactor parameter determinations and operator training and requalification.

NEL Experiments are conducted by the reactor staff and include seed irradiations, gem coloring experiments, activation analysis, tracer studies, isotope production using the N-P reaction.

UCLA Users include the Chemistry, Geology, Geophysics, Meterology, and Nuclear Medicine Departments. The types of experiments include activation analysis, tracer studies, delayed neutron counting.

Colleges and Universities include California Polytechnic Institute, California Institute of Technology, California State University - Los Angeles, California State University - Northridge, Harvey Mudd College, Mt. San Antonio College, Pierce College, University of California - Santa Barbara and University of California - San Diego. The types of experiments performed are activation analysis, fission track counting, tracer studies, reactor parameter determinations, reactor operating characteristics, reactor operations, shielding studies and health physics training.

Demonstrations were actual reactor runs in which the reactor was taken critical to demonstrate reactor parameters, characteristics or operation. Tours in which the reactor was shut down are not included. High schools, Pierce College, the press, Southern California Edison Co. and the University of California Extension were recipients of reactor demonstrations.

Commericial Users include geochemists, gem dealers and engineering firms. Mineral assay through activation analysis and delayed neutron counting, gem color alterations, and radiation shielding studies typify the types of experiments performed.

NOTE: Total Port-Hours, Actual Run Time and Equiv. Full Power Hours are included in this table. Deviations between the reported port-hours and the Total Port-Hours are due to round off errors.

Question 9. 4-17-80

Page V/ii provides justification for a Technical Specification Change to delete "unauthorized reactivity change" as an example of an abnormal occurrence. NRC does not agree that sufficient justification has been provided. For instance, if an excess of $.10 were expected for a particular configuration, an excess of $3.50, provided the operator controlled the reactor so as not to exceed a trip point, would not be considered abnormal.

Again, if $2.50 were expected and only $.50 were found, the new Technical Specification would define this as an "abnormal occurrence". However, both events are indicative of a lack of understanding of the situation within the reactor, and may indicate a condition where the safety analysis provided is no longer applicable.

Though the examples (a,b,c,d) that were presented fall within your proposed change, the proposed change eliminates situations that should be reported. Accordingly, your proposed Technical Specification Change is not acceptable.

We would entertain a change to that Technical Specification which eliminates certain unanticipated reactivity changes that would not detrimentally affect safety and if they are analyzable, or can be calculated and explained satisfactorily. If you wish, resubmit such a Technical Specification Change for our consideration.

Receipt of verbal notification of two typographical errors in the question is acknowledged and hereby confirmed. In the first paragraph, second sentence, the word "unauthorized" should read "unanticipated". In the second paragraph, the second line should read "Specification would not define this as... ."

UCLA is not disappointed at rejection of the proposed modification. Informal discussions with NRC Licensing indicate substantial agreement in the interpretation of anticipation and control as those words apply to the control and safety systems.

As applied to control and safety systems, UCLA proposes to add two definitions to Section 1 of the Technical Specifications:

1.23 ANTICIPATED

If the controller and/or safety systems function according to the designers intent and expectations, including any failure modes that "fail safe", then this performance shall be deemed to be anticipated.

1.24 CONTROLLED

An event shall be deemed controlled by the controller and/or safety systems if, when called upon, an anticipated response is implemented.

Other areas are less well defined. In particular, UCLA "anticipations" are largely based upon operating practices and procedures applicable to the UCLA facility. These anticipations are not likely to coincide with the more broadly based anticipations of the NRC.

Some distinctions in individual anticipations are apparent in the reactivity examples of the reviewer's question. It is not clear in either example whether the anticipation refers to the absolute value of the sum of reactivities or the "sum of the absolute reactivities" required by Technical Specification 3.5.1.3.B. The "finding" of the reviewer's second example might be quite unremarkable. It should also be clear that UCLA must and does have, internal procedures designed to provide compliance with the $0.92 limitation of Technical Specification 3.5.1.3.A. Thus anticipations may change during the required reactivity checks of the individual experiments and the largest "unanticipated" reactivity change that can occur without a procedural violation is $0.92. Neither of the reviewer's examples could be directly realized without committing a reportable violation of procedures.

This subject involves subjective interpretation, and UCLA has no further specific proposals to offer at the present time.

Question 10. 4-17-80

Page V/5-1 provides a Technical Specification which will permit the use of U_3O_8-Al fuel meat. However, the Safety Analysis Report (Appendix III) does not address this possibility. Your safety analysis is for the present UCLA reactor, and this analysis is based upon a comparison with other reactors that utilize your current fuel. These comparative reactors have never used U_3O_8-Al. If you intend to utilize U_3O_8-Al in the UCLA reactor, the safety analysis should address this directly. Accordingly, until such a safety analysis is provided, the use of U_3O_8-Al will be deleted from proposed Technical Specification Section .

The U_3O_8-Al matrix was included in anticipation of DOE and NRC interests in a shift to low enrichment fuel. UCLA is ill-informed on that program, and has no other specific desire to use U_3O_8 fuel. That sentence on Page V/5-1 which reads "The fuel matrix may also be fabricated from uranium oxide - aluminum (U_3O_8-Al) using the powder metallurgy process" will be deleted.

Question 11. 4-17-80

Page III/6-4 - Alarms (light and horn). Please justify the radiation alarm setting indicated in this section. The set points appear high and would preclude annunciating except at very high radiation concentrations.

The reactor room alarm (detectors) are within a controlled radiation area. Access by key is limited to faculty and staff of the Nuclear Energy Laboratory. These individuals are trained in radiation safety and are thereby considered qualified to enter the high-bay.

The bulk of the reactor usage consists of either sample irradiations, reactor demonstrations and/or parameter determinations which do not require personnel to be present in the high-bay during operations. If an experiment requires that personnel be present in the high bay during operations, the personnel are monitored and the area surveyed by a qualified health physicist to assure minimal radiation exposure.

Communications with the University of Florida and the University of Washington indicate a nominal area reading of 0.4-0.8 mR/hour compared to 0.4-0.6 mR/hr at full power at UCLA. The Florida and Washington installations have viewing windows open to the public, although the windows at the University of Florida reactor room have been sealed. The UCLA reactor is surrounded on all sides by a limited access area. Therefore the setting of 5 mR/hr was chosen as the alarm point as it designates a radiation area, and the area monitors have only one high trip point. If tripped, the reactor operator has to take actions described in procedures.

The Radiation Storage monitor is located in a remote high security area and is designated a radiation area. This area contains the new reactor fuel, the natural uranium fuel for subcritical assemblies and all of the high level sources. The nominal reading on this meter is 0.3-0.5 mR/hr. Because radiation sources can and are moved around in this area and drastically change the nominal reading, 10 mR/hr was designated as a reasonable setting since access to this room is limited to two people, both senior operators. This alarm is also used as a criticality indicator and a greater spread from nominal to alarm reduces false alarms and thereby enhances this functional aspect.

In regard to the Rabbit Monitor, a conversation with the University of Washington indicates that their rabbit monitor is located approximately 18 inches from the rabbit receiver, whereas the UCLA monitor is located as close as is physically possible to the rabbit receiver. If it is assumed that the rabbit is a point source and that our detector is 3" from the rabbit, then the 100 mR/hr alarm point on the UCLA monitor corresponds to 3 mR/hr on the University of Washington rabbit monitor.

Since this limit was set, the rabbit receiver has been redesigned as an automatic load and eject system, with the hot sample being ejected either into a shielded area or into a shielded neutron counter. The closest an operator gets to the sample is 3', the length of the remote sample handling tool he uses to convey the sample to the shielded storage, handling or counting area. The experimenter also has a portable GM meter with audio clicker in his immediate vicinity to further warn him of any abnormally hot sample.

Past experience suggests that the detector is not placed in the most optimal position. Any full power irradiation of samples containing micrograms of elements with short half lived isotopes such as Al will constantly set off this alarm. Therefore a proposal to relocate the detector on the ceiling of the rabbit closet directly above the rabbit receiver will be brought before the reactor use committee for approval. This is a more realistic location since the detector will be looking at an unshielded rabbit at a distance of approximately 1 meter. The alarm setting may then be lowered to 5 mR/hr, the lower limit defining a radiation area which is the designation of the counting room containing the rabbit closet.

Question 12. 4-18-80

Page IV/C-1 Section C.2.1 and C.2.2 state following contamination "such persons are no hazard to attendants, other patients and the environment." This is not always true since a person may be irradiated by neutrons in addition to x- or gamma rays.

The related sentences should be rephrased, to wit: "the possibility that a person will receive that type or quantity of dose to become a source and subsequent hazard to attendents, patients or the environment is extremely remote."

In addition, delete the phrase concerning comparison to the x-ray patient.

This question references a Radiation Accident Procedure developed and implemented by the UCLA Center for Health Sciences Emergency Hospital. The procedures were drafted by the Director of th Emergency Hospital, Dr. Larry Baroff (M.D.) for the purpose of certification as a class "A" Emergency Hospital. Dr. Baroff was trained in nuclear emergencies at the Oak Ridge National Laboratories and has designed his program to cope with the majority of nuclear radiation or contamination type accidents. To change the procedure would involve many agencies and many months of negotiation.

We all recognize that a very large accidental neutron exposure (similar to the SL-1 accident in 1960) would activate such materials as gold fillings, body sodium, etc., causing the victim to be a source of radiation which could potentially expose the medical attendants. The probability of such an exposure is extremely small and coupled with the fact that the overall plan requires that radiation qualified personnel be on the scene prior to the medical attendants, removes the necessity of negotiating changes in this procedure. The radiation qualified personnel will have the time and knowledge to pass such information on to the medical attendants at the scene should an incident of this type occur.

The purpose of incorporating the Emergency Hospital Radiation Accident Procedure into the NEL Emergency Response Plan was to point out the coordination that exists between the two organizations. It was to further amplify the fact that the UCLA Emergency Hospital is aware, prepared and trained in dealing with radiation emergency accidents and has, on 24-hour call, a back-up team of health physicists (See page IV/C-6) to help them with severe and unusual cases such as the type suggested by this question.

The staff of the Nuclear Energy Laboratory does not feel justified in requesting a change in these Emergency Hospital Procedures, especially since the accident in question is of very low probability and the hospital personnel are adequately trained in in radiation type accidents, and the Emergency Plan requires the presence of health physics qualified personnel to direct the medical attendants.

Question 13. 4-17-80

Page II/2-1 discusses and "NEL radiation controlled area." Where are the boundaries on this area in relation to Figures II/2-1 and -2?

With the exceptions noted below, all areas shown in Figures II/2-1 and II/2-2 are deemed NEL radiation controlled areas.

1) Figure II/2-1
   The corridor directly to the north of the Tokamak and the corridor to the south of the 1500 series of rooms, are not under NEL's lock and key system.

2) Figure II/2-1
   The transformer vault (Room 1004) is under NEL's lowest level of key control. The key is checked out to people on a temporary basis if they are not A, B or C level qualified with keys.

3) Figure II/2-1
   The Men's Room between Room 1561 and 1549 is open to the general public and not under NEL's key control. The janitor's closet directly west of the Men's Room is under the key control of the Physical Plant and is accessible by a G-6 Master Key (issued to custodians and plumbers).

4) Figure II/2-2
   Same as the above (#3) applies to the janitors closet and Men's Room between Rooms 2567C and 2549.

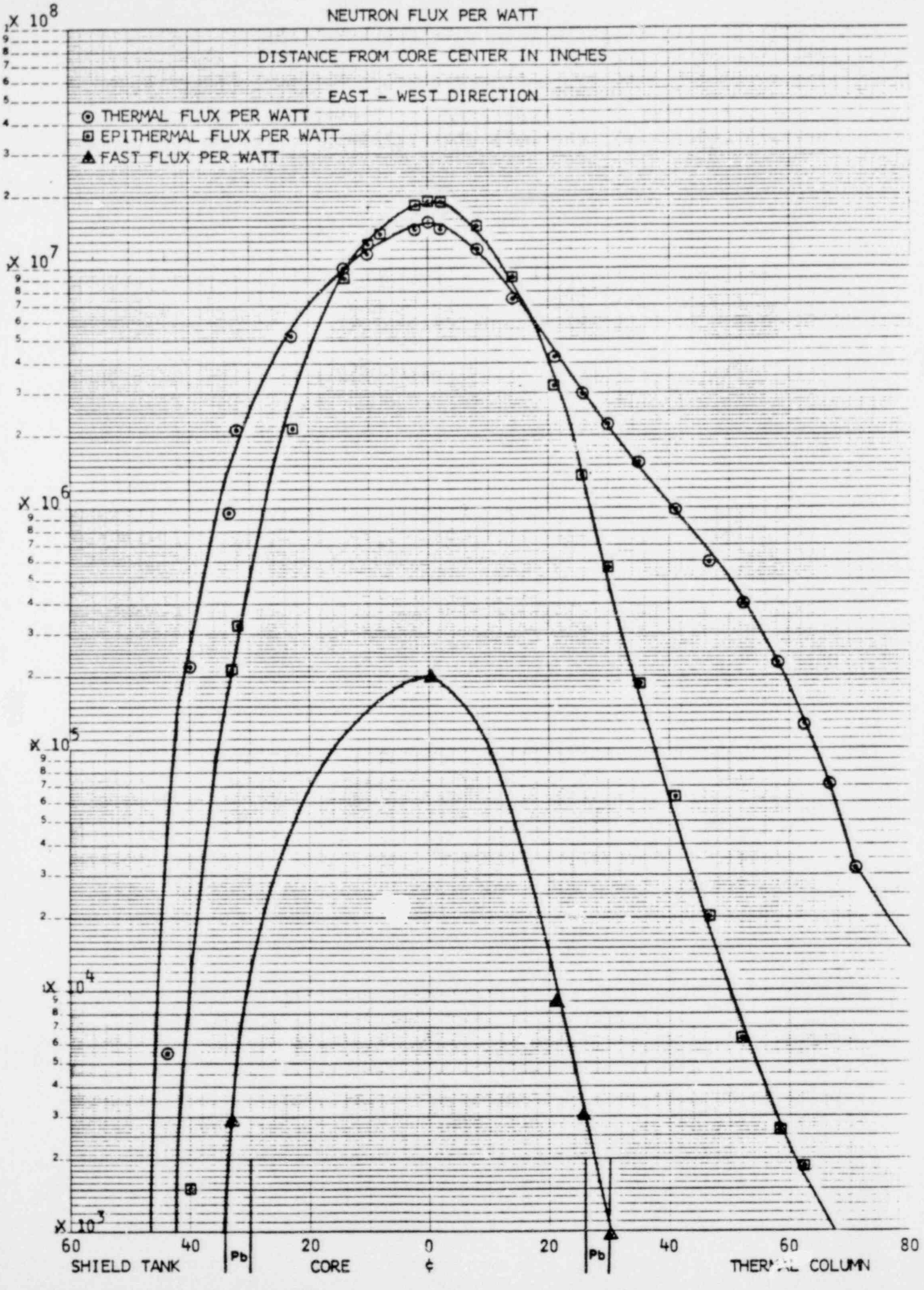
Question 14. 4-17-80

Table III/6-1 presents comparisons between the UCLA reactor and those of the University of Florida and University of Washington. Although not actually defined, presumably a "" in the table indicates similar characteristics within a line of the table. Why do UCLA and UW reactors have different fast/thermal flux ratios? Why do UCLA and UF reactors have different void reactivity coefficients?*

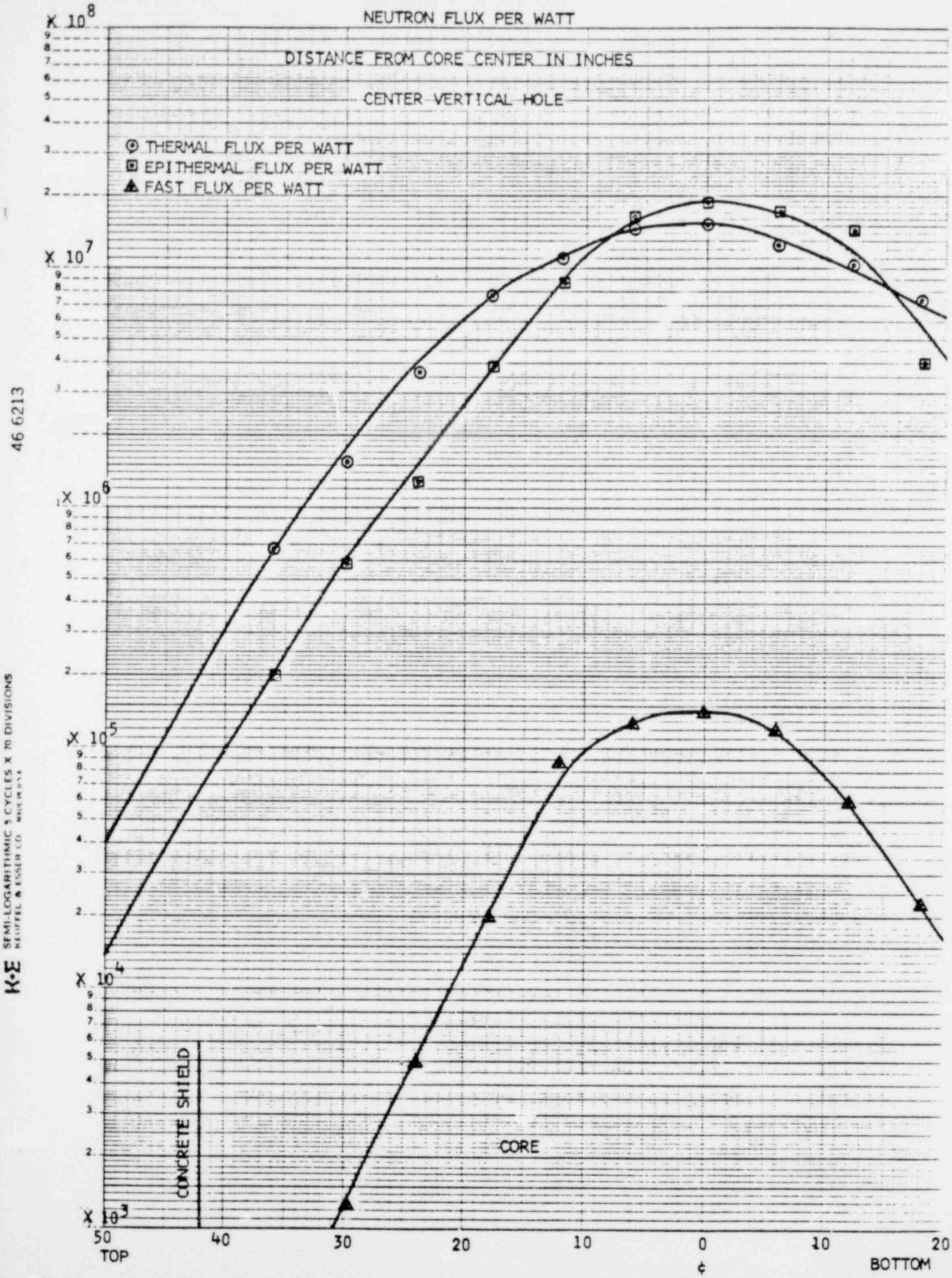
Table III/6-1 is a General Comparison Table of the Argonaut Reactors at UCLA, UF and UW. The "*" means "same as UCLA" and was inadvertently omitted during final typing.

The fast and thermal flux ratios are similar in the above reactors but the definition of thermal, intermediate, epithermal and fast may vary somewhat depending upon how the measurements were taken. At UCLA, we used wires, foils and compounds of Cadmium, Indium, Gold and Sulfur to determine the various fluxes throughout the reactor. The following three graphs are UCLA resultant flux plots of the reactor performed in 1963. In addition, research reactors calibrate the thermal power by $m \cdot C_p \cdot \Delta T$ across the core. In our heat balance we assume a 5% radiative heat loss which is not retrieved by the reactor coolant.

The void reactivity coefficients for UCLA is in error due to a typing error. $\%\Delta K/K/\%$ void should read $\Delta K/K/\%$ void since -25¢ is approximately equal to -0.164×10^{-2} $\Delta K/K$. The rest of the deviation between UCLA and UF can be attributed to the difficulty in performance and the inaccuracies involved during a void reactivity coefficient measurement experiment.



NEUTRON FLUX PER WATT
DISTANCE FROM CORE CENTER IN INCHES
EAST - WEST DIRECTION
THERMAL FLUX PER WATT
EPITHERMAL FLUX PER WATT
FAST FLUX PER WATT
X 10^8
X 10^7
X 10^6
X 10^5
X 10^4
X 10^3
60
40
20
0
20
40
60
80
SHIELD TANK
Pb
CORE
¢
Pb
THERMAL COLUMN
46 5213
K·E SEMI-LOGARITHMIC 5 CYCLES X 70 DIVISIONS


NEUTRON FLUX PER WATT
DISTANCE FROM CORE CENTER IN INCHES
CENTER VERTICAL HOLE
THERMAL FLUX PER WATT
EPITHERMAL FLUX PER WATT
FAST FLUX PER WATT
X 10^8
X 10^7
X 10^6
X 10^5
X 10^4
X 10^3
CONCRETE SHIELD
CORE
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TOP
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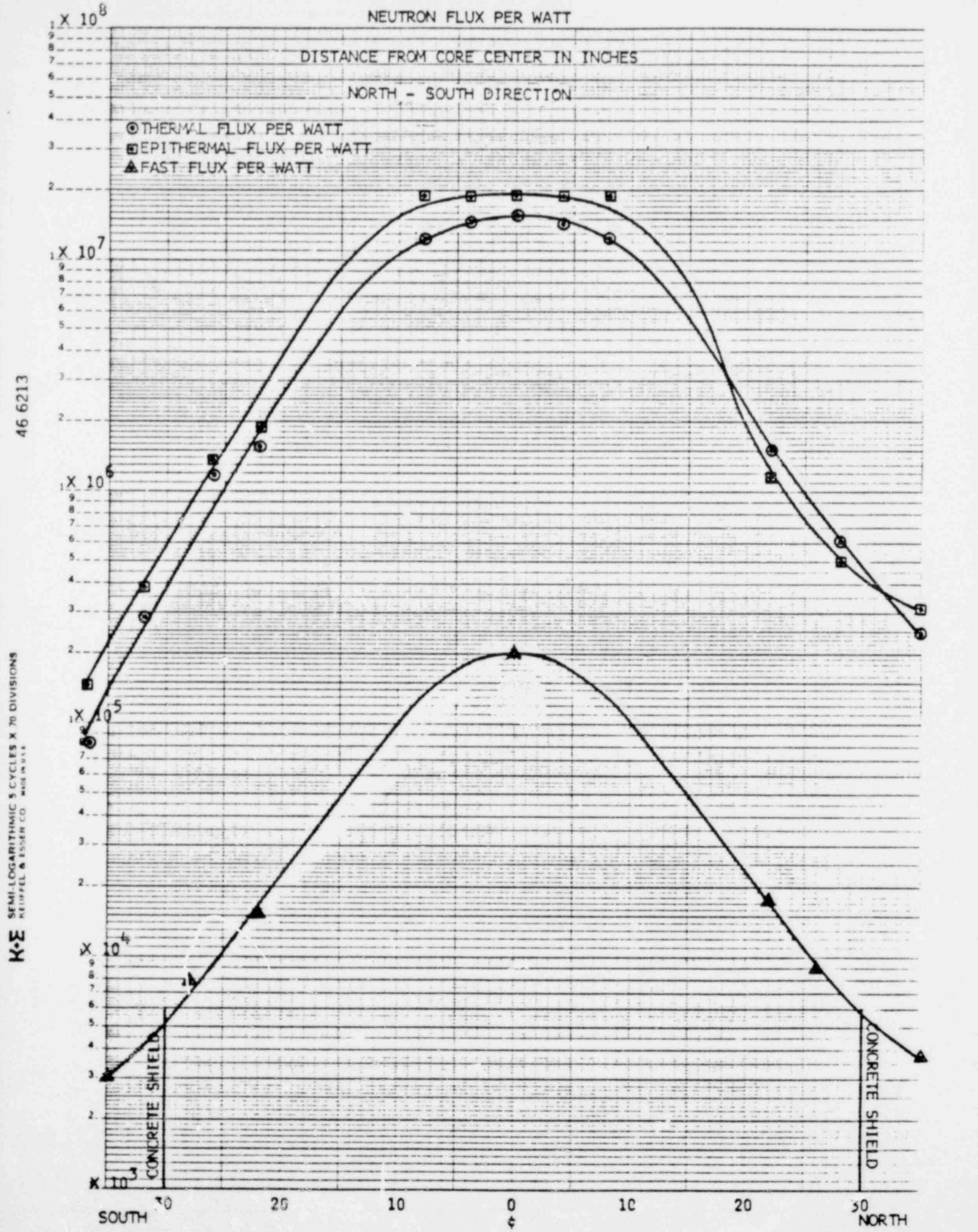
BOTTOM
46 6213
K·E SEMI-LOGARITHMIC 5 CYCLES X 70 DIVISIONS
KEUFFEL & ESSER CO.


NEUTRON FLUX PER WATT
DISTANCE FROM CORE CENTER IN INCHES
NORTH - SOUTH DIRECTION
THERMAL FLUX PER WATT
EPITHERMAL FLUX PER WATT
FAST FLUX PER WATT
X 10^8
X 10^7
X 10^6
X 10^5
X 10^4
X 10^3
CONCRETE SHIELD
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KEUFFEL & ESSER CO.

University of California, Los Angeles Research Reactor License Application

Docket No. 50-142 License R-71

Errata

Item	*Page*	*Correction*
1	IV/1-2	Paragraph 1.2.2, first line, insert operator between "reactor" and "shall".
2	IV/3-1	The first statement commencing with 3.1 should be terminated by a colon instead of a quotation mark.
3	IV/3-1	In the first paragraph of 3.1.A, the second and third lines should be replaced with: of Incidents," and Section V/6.5.2 of the UCLA R-71 Technical Specifications,
4	IV/3-1	In the second paragraph of 3.1.A, the correct telephone number for Region V is (415)943-3700.
5	IV/B-2	The Region V telephone number is (415)943-3700.
6	IV/C-1	Add an asterisk following the title at the top of the page.
7	V/1-2	Under 1.12, the second line should reference Section 6.5.2 (not 6.5.3).
8	V/3-3	The scrams are not well identified in the Function column of the table in Section 3.2.3. The six scrams, in the sequence of that table should be (1) Full Scram, (2) Full Scram, (3) DR Scram, (4) DR Scram, (5) Full Scram, (6) DR Scram. DR is an abbreviation for Drop-Rod Scram, and the definition 1.18 on page V/1-3 should be augmented to read: 1.18 DROP-ROD SCRAM (abbreviated DR SCRAM)
9	V/3-9	Under 3.7.3 SPECIFICATIONS, the first indexing number should be 3.7.3.1 (not 3/7.3.1).
10	V/3-10	The last line 3.8.1.1 reads "so as to increase the effective reduction factor." This is an old typographical error from the existing Technical Specifications. Increases (above 460) are intrinsically desirable, and it is more than likely that the intended word is decrease.
11	V/4-2	Paragraph 4.8.1. Replace the word "pool" with primary.
12	V/6-4	Item G. The reference is to Section 6.5.2 (not 6.5.3).
13	V/6-7	Under 6.4.1 and again under Item C, the reference is to Section 6.5.2 (not 6.5.3).