Commonwealth Edison
One First National Plaza, Chicago, Illinois
Address Reply to: Post Office Box 767
Chicago, Illinois 60690

September 13, 1985

Mr. Harold R. Denton, Director
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Subject: Zion Nuclear Power Station Units 1 and 2
Proposed Amendment to Facility Operating
License Nos. DPR-39 and DPR-48
Specimen Capsules
NRC Docket Nos. 50-295 and 50-304

Reference: August 19, 1985 letter from P. C. LeBlond
to H. R. Denton.

Dear Mr. Denton:

The referenced letter transmitted a proposed change to Zion's specimen capsule withdrawal schedule. This change is largely based upon WCAP-10902, "Plant Specific Neutron Fluence Evaluation for Zion Units 1 and 2." 11 copies of this report are included with this letter for your review.

Examination of Figures II.1-1 and II.2.-2 in WCAP 10902 clearly show that the 4° capsules (S, V, W, Z) will not attain the projected EOL inner wall fluence of 1.8×10^{19} n/cm^2 until approximately 22 EFPY of reactor operating time has elapsed. However, the 40° capsules will attain the same fluence level after only 8.5 EFPY of operation. Since the Unit 2 X capsule is the only remaining uncommitted 40° capsule, it must be retained so that the material properties of Zion's vessels can be measured at fluences beyond 1.8×10^{19} n/cm^2.

This would be required if Commonwealth Edison should decide to justify reactor operation beyond an inner wall fluence of 1.8×10^{19} n/cm^2. Note that the Unit 2 X capsule would provide the needed information approximately 13.5 EFPY sooner than any of the 4° capsules. This additional operating time could be used to devise and implement additional flux reduction programs, if they should be required.

Mr. B. J. Elliot of your office has expressed a concern regarding the accuracy of fluence projections subsequent to the implementation of Low Leakage core loading patterns. Tables II.2-6 and II.2-12 of WCAP 10902 demonstrate the excellent historical agreement between the fluence projections for conventional core patterns and the measured fluences obtained from the installed dosimetry. Future confirmation of this agreement will be obtained from the scheduled withdrawal of the Y capsule from each unit, the potential withdrawal of the Unit 2 X capsule, and the results of Zion's excore dosimetry program.

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Zion's excore dosimetry program is described in the attachment. The Cycle 9 exposures on each of the units will be compared against the predicted fluences to provide reassurance of the validity of the neutron transport analyses.

As provided by 10 CFR 50.91, the State of Illinois is being notified of this amendment request by transmittal of a copy of this letter and the attachment.

If you have any further questions regarding this matter, please direct them to this office.

Three (3) signed originals and thirty-seven (37) copies of this letter and its attachment are hereby provided for your review.

Very truly yours,

Peter LeBlond

P. C. LeBlond
Nuclear Licensing Administrator

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Attachment

cc: Resident Inspector - Z w/o Enc.
J. A. Norris - NRR
M. C. Parker - State of Ill.

SUBSCRIBED AND SWORN to
before me this 13th day
of September, 1985

Notary Public

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ATTACHMENT

REACTOR CAVITY NEUTRON DOSIMETRY

ZION UNITS 1 and 2

BACKGROUND

The purpose of this measurement program is to establish, for the beltline region of the Zion Units 1 and 2 reactor pressure vessels, the azimuthal and axial gradients of fast neutron fluence ($E > 1.0$ MeV) and dpa (displacements per atom) that will be accrued during Cycle 9; and to provide the capability for long term monitoring of the fast neutron exposure that will occur during subsequent fuel cycles. These measurements will also provide a vehicle for the verification of the ability of neutron transport analyses to predict through wall embrittlement gradients.

The Cycle 9 measurements will be accomplished by installing passive neutron dosimeters in the reactor cavity annulus located between the pressure vessel and the primary biological shield. These dosimeter packages will remain in place for the entire fuel cycle and will provide neutron spectral coverage sufficient to allow the determination of exposure parameters in terms of both neutron fluence ($E > 1.0$ MeV) and dpa. Following analysis at the conclusion of Cycle 9, the measured data will be used in conjunction with the results of neutron transport calculations to project exposure gradients through the vessel wall.

The attachment fixtures to be used to position the Cycle 9 dosimetry will remain in place following irradiation. Therefore, dosimeters designed for long term monitoring of the pressure vessel could be reinstalled to establish the capability to follow and verify the effects of any changes in fuel management strategy on pressure vessel exposure.

DESCRIPTION OF DOSIMETRY

The passive neutron detectors used in this program will include six advanced dosimeter capsules containing radiometric monitors and solid state track recorders to provide spectral coverage at selected locations in the beltline region. In addition, stainless steel gradient wires will be used to complete the determination of the azimuthal and axial exposure gradients. Since the reactors are intended to exhibit 1/8 core symmetry, the six spectral sets will be concentrated to provide a neutron spectrum map within a single 45° azimuthal sector. Axial coverage will encompass ± 6 feet relative to the core midplane.

The locations of all dosimetry within the reactor cavity are shown schematically in Figures 1 and 2. In Figure 1, the azimuthal locations of four strings of dosimeters are depicted relative to the primary loop layout. The axial locations of dosimeter packages within the reactor cavity annulus are depicted in Figure 2. Placement of the six multiple foil advanced

dosimeter sets will be such that spectra determinations can be made at four locations on the midplane of the active core with the intent to measure changes in spectra caused by varying amounts of water located between the outer core boundary and the pressure wall. Due to the irregular shape of the reactor core, water thickness varies significantly as a function of azimuthal angle within a given octant. The remaining two multiple foil sensor sets will be positioned opposite the top and bottom of the active core at the azimuthal angle corresponding to the maximum neutron flux. Here the intent is to measure axial variations in neutron spectra over the core height, particularly near the top of the fuel where backscattering of neutrons from primary loop nozzles and vessel support structures could produce significant pertubations.

At each of the four azimuthal locations selected for core midplane spectra measurements stainless steel gradients wires will extend over the full twelve foot height of the active fuel. Following irradiation, these wires will be segmented to provide neutron flux information at 6 inch intervals for each traverse. The data obtained from these gradient wires will be correlated directed with iron, nickel, and cobalt foil measurements obtained from the multiple foil sensor sets.

The multiple foil sensor sets used during the first irradiation cycle to characterize the neutron spectra within the reactor cavity and during subsequent cycles to provide long term monitoring of vessel exposure are retained within 3.5" x 1.0" x 0.5" reactangular aluminum 6061 capsules. A description of these individual sensor set holders is shown in Figure 3. These capsules are designed to accommodate radiometric foils and solid state track recorders within holes drilled in the aluminum block. The dosimeter materials will be retained within the aluminum block by a cover plate held in place by eight small screws.

Aluminum 6061 was selected for the irradiation capsules in order to minimum neutron flux perturbations at the sensor set locations as well as to limit the radiation levels associated with shipping and handling of the capsules following irradiation. Each capsule represents an aluminum mass of approximately 60 grams. Thus, each set of six capsules will result in an increase in the aluminum inventroy in the containment building of only 360 grams ($\sim$0.8 lb.). An increase of this magnitude should be insignificant relative to the total aluminum inventory already present in the containment.

The contents of the dosimeter capsules to be used during the Cycle 9 irradiations are illustrated on Figure 4. Solid state track recorders containing deposits of fissionable isotopes of U-235, U-238, Np-237, and Pu-239 in minute quantities ($\sim 10^{-9}$ grams) are included in all irradiation cycles for the cavity dosimetry programs. There are several advantages to the use of SSTR's in a long term monitoring situation. The minute deposits of fissionable material required for the radiator not only minimize the inventory of nuclear material, but also eliminate paperwork associated with

the shipping and handling of larger quantities of fissible and fissionable isotopes. Since the track recorder readout is actually accomlished with the mica cover, the deposits themselves are not destroyed and may be reused from cycle to cycle. Furthermore, the mica recorders serve as a permanent record of the neutron exposure incurred during the irradiation.

ATTACHMENT IN THE REACTOR CAVITY

The four dosimeter strings described in the preceding sections will be attached to 0.040 inch diamter type 304 stainless steel wire that will in turn be secured to and suspended from the pressure vessel mirror insulation near the elevation of the primary loop nozzles and will extend down to the elevation of permanent scaffolding located in the sump area below the reactor pressure vessel.

Attachment at the nozzle elevation will be via the insertion of 1 inch stainless steel sheet metal screws into the mirror insulation. One screw will be sufficient to hold each dosimeter string. Attachment in the sump area will be accomplished by tying the stainless steel wire directly to the permanent scaffolding located below the pressure vessel.

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Figure 1

AZIMUTHAL LOCATION OF CAVITY DOSIMETRY

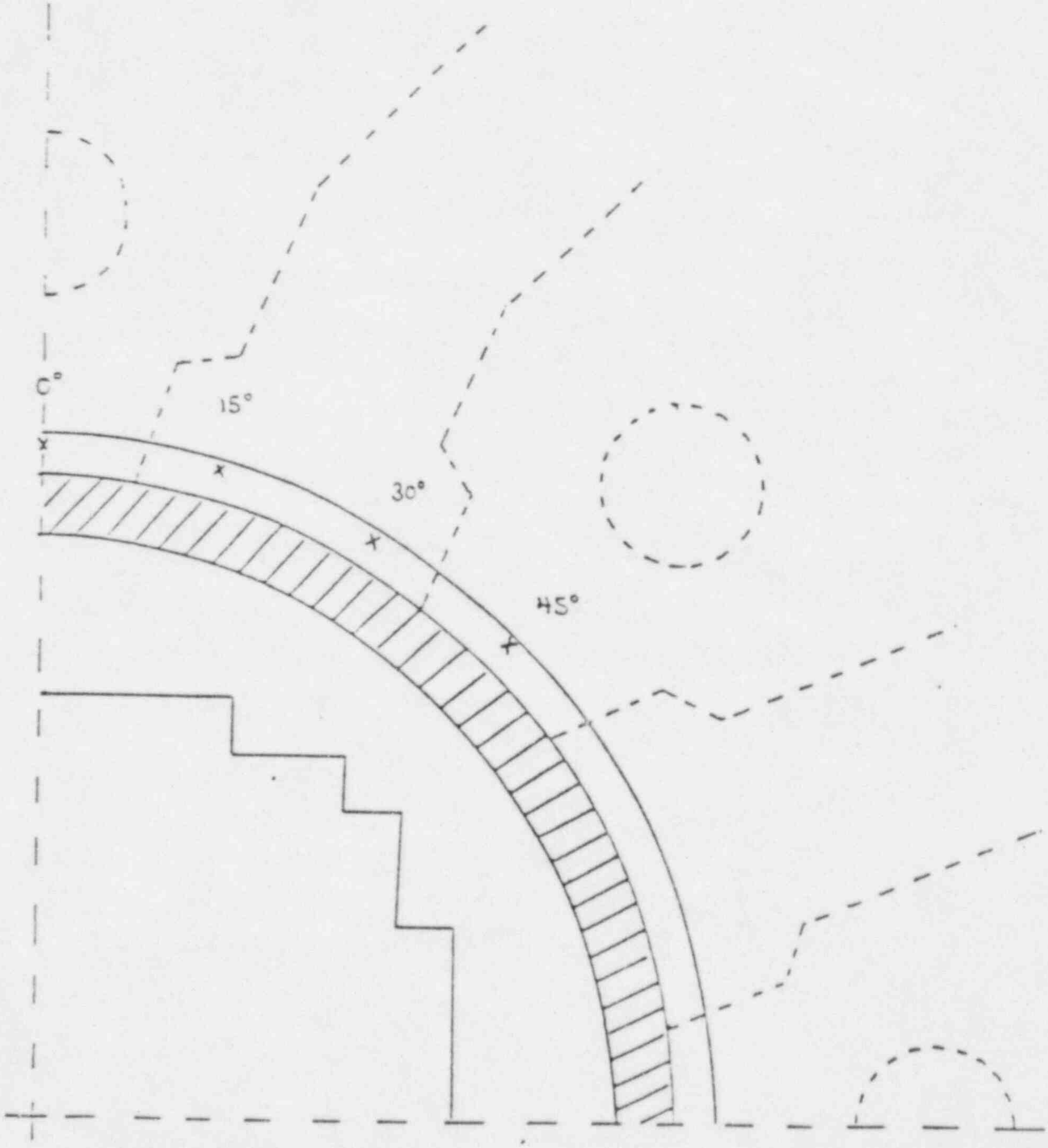


Figure 2

AXIAL LOCATION OF CAVITY DOSIMETRY

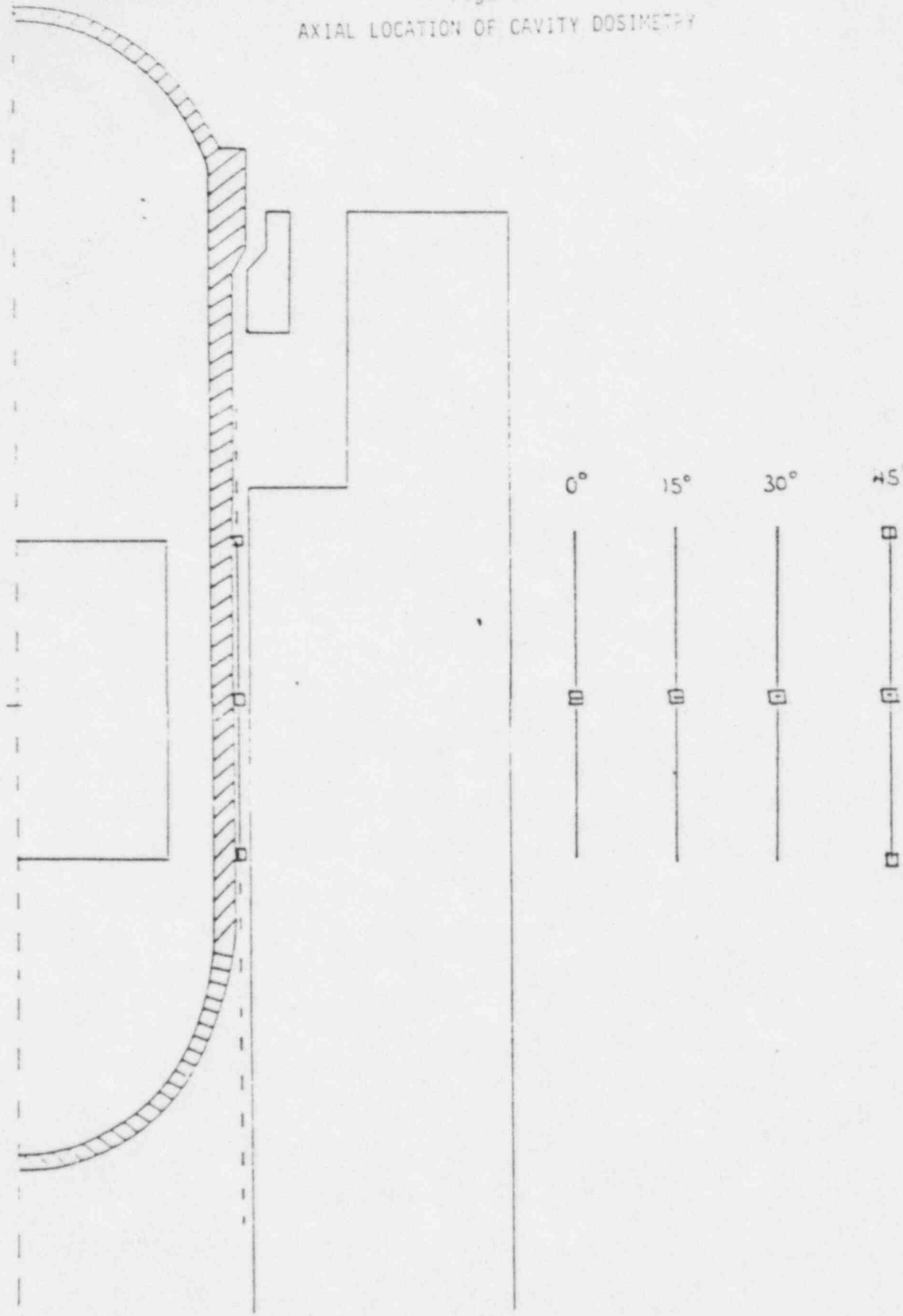
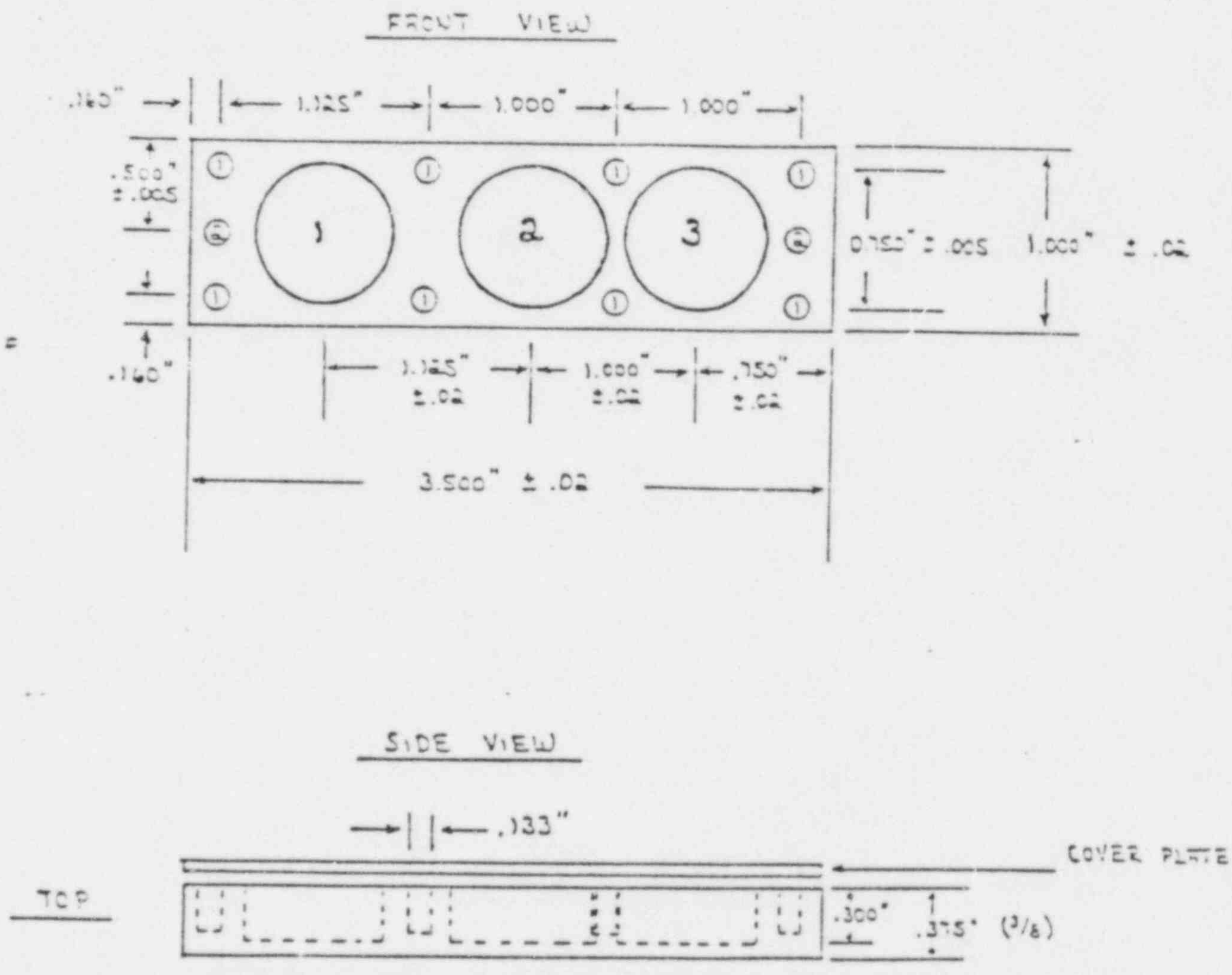


Figure 3

MULTIPLE FOIL DOSIMETRY HOLDER



BUILD TWELVE (12) EACH - 6061 Al MATERIAL

① 8 HOLES - DRILL AND TAP FOR 8-32 x 1/4 FLAT HEAD Al MACHINE SCREWS, COUNTER SINK COVER PLATES

② 2 HOLES (.135" DIA) - DRILL COMPLETELY THROUGH COVER PLATE AND BASE BLOCK

Figure 4

CONTENTS OF MULTIPLE FOIL HOLDERS FOR

CYCLE 9 IRRADIATION