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4410-87-L-0160/0231P

US Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555

Dear Sirs:

Three Mile Island Nuclear Station, Unit 2 (TMI-2)
Operating License No. DPR-73
Docket No. 50-320
Use of Core Bore Machine for Dismantling the Lower Core Support Assembly

As discussed with the NRC TMICPD Staff, GPU Nuclear has developed a concept which would use the core bore machine in conjunction with the Automatic Cutting Equipment System (ACES) to dismantle and defuel the Lower Core Support Assembly (LCSA). The dismantling of the LCSA will also provide access to the Reactor Vessel (RV) lower head for defueling. This letter requests NRC approval for the use of the core bore machine during the first phase of this defueling concept. The remaining details of this concept will be submitted at a later date.

The first phase of this defueling concept will consist of the boring of the 52 incore guide tubes and 48 support posts using the core bore machine. This operation will sever the incore guide tubes and support posts from the LCSA (Attachment 1 is a vertical cross-section drawing of the LCSA). With this accomplished, the sections of the LCSA (i.e., lower grid rib section, lower grid distributor, lower grid forging, incore guide support plate and the flow distributor) would be intact only at the outer diameter of the LCSA. This configuration will facilitate removal of large pieces of the LCSA after cutting with the ACES.

Core Bore Machine

The core bore machine is the same machine that was utilized during the Core Stratification Sample Acquisition activities and also for the drilling of the core region. A general description of the core bore machine is provided in Section 2.4(a) of the Core Stratification Sample Acquisition Safety Evaluation Report (SER) Revision 4 (Reference 1). For this operation, the core bore

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machine will be slightly modified, however, the modifications will not have any safety significance in regards to the proposed operation.

Previous core bore machine operations were performed with drill string components with a welded collar attached to limit the maximum drilling depth to the 293'-0 1/8" elevation. These operations were also limited to locations relatively near the center of the RV. With these limitations, the drill string was unable to approach within 5" of the RV lower head. However, in order to bore all the incore guide tubes and support posts, operations will occur at locations encompassing the entire LCSA area. As a consequence a drill string with the same limitations as noted above (i.e., to preclude drilling lower than elevation 293'-0 1/8") will be too long to use at the outer edge of the LCSA due to the curvature of the RV lower head. Consequently, two (2) different drill string lengths will be fabricated. One (1) for use near the LCSA center and the other for use at the LCSA periphery. It should be noted that the orientation of the core bore machine must also be rotated on its platform in order to bore all incore guide tubes and support posts. Procedures will be established to control the use of the two (2) drill strings in combination with the correct core bore machine orientation.

To sever the incore guide tubes, two (2) different tool assemblies (i.e., drill bits) must be used. The first drill bit [6 3/4" outside diameter (OD) x 3 1/4" or 1 15/16" Inside Diameter (ID)]* will bore a hole through the lower grid rib section and distributor plate. A second drill bit (6 1/2" or 5 1/4" OD x 4 1/4" ID) will bore through the forging, the incore guide support plate, and the flow distributor head. This will sever the incore guide tubes. Only one (1) drill bit (6 3/4" OD x 5 1/4" ID) is necessary to sever the support posts. This drill bit will sever the support posts by boring through the lower grid rib section, the distributor plate, and the forging.

Safety Concerns

Safety concerns related to this operation such as the potential releases of radioactive material, criticality within the RV, and the potential for a pyrophoric event, have been previously addressed in the Core Stratification Sample Acquisition SER. The consequences of these issues are not altered by the use of the core bore machine on the LCSA. Consequently, operating procedures will incorporate the following restrictions:

1. An alarming water level instrument for the internals indexing fixture (IIF)/RV shall be operable.

2. The IIF/RV water level shall be determined and logged every hour.

3. The BWST shall be maintained at a minimum of 390,000 gallons and 4950 ppm Boron.

*NOTE: Exact drill bit sizes have not been determined. However, testing is currently being performed with the sizes referenced. Dimensions are approximate.

4. The Reactor Building sump shall be limited to a maximum of 70,000 gallons of water.

5. The weight on the drill bit shall be limited to 9000 lbs.

Reactor Vessel Integrity

The only unique safety issue associated with this activity is in regards to RV integrity, specifically the integrity of the incore nozzles. Previous GPU Nuclear and NRC correspondence (Reference 2 and 3) established two (2) possible incore nozzle configurations as a result of the 1979 accident. In the worst case, the damage to the RV lower head would consist of an incore nozzle melted to the inside diameter of the RV lower head with a nozzle to vessel weld thickness of only 0.030". The significance of this configuration is that if the weld experienced significant damage, the incore nozzle above the weld would have melted. The other possible configuration is that the incore nozzle was undamaged. Attachment 2 is a drawing of an intact incore guide tube/nozzle. The load bearing capabilities of the two (2) nozzle configurations were established as:

Undamaged Incore Nozzle

Axial (tension and compression)	158,000 lbs
Bending (moment)	42,000 in-lbs
Twisting (torque)	87,000 in-lbs

0.030 Thick Nozzle Weld (damaged)

Axial	5,400 lbs
Bending	1,400 in-lbs
Torque	5,800 in-lbs

A completely bored support post will appear as in Attachment 3. The support post, when boring is complete, will have a cruciformed piece of the lower grid rib section attached to its upper end and a piece of the forging attached to its lower end. The outside diameter of this piece will be 5 1/4" and it will weigh approximately 120 lbs. When the boring is complete, the piece will drop out of the drill bit and fall onto the incore guide support plate; a distance of 1/2". The total energy imparted to the incore guide support plate is 126 lbs. If the support post is filled with core rubble, the maximum impact to the incore guide support plate would be approximately 175 lbs. These forces will not damage the incore guide support plate and consequently, the dropping of the bored support post is completely isolated from the RV lower head and the incore nozzles.

A completely bored incore guide tube will appear as in Attachment 4. Boring of the incore guide tube from the LCSA will cause it to drop when the gussets welded to the lower side of the elliptical flow distributor are cut. The potential for hangup within the tool holder is extremely remote because up to the time the incore guide tube is free to fall, the tool holder has been

moving and the tube has been stationary. It will drop essentially straight down as a result of being confined within the tool holder and cutter head and will impact either the RV lower head debris bed, an intact incore nozzle, or the lower head proper.

A bored guide tube weighs approximately 250 lbs and will drop a maximum of 20" assuming the tapered nozzle section has been melted off. If the incore guide tube is undamaged, it will drop only 8 1/2". A 250 lbs incore guide tube dropped a maximum of 20" may impact the hypothetically melted nozzle and weld imparting a compressive stress of approximately 18,700 psi on the nozzle and weld structure. This stress is approximately one-half of the yield strength and one-quarter of the ultimate strength of the weld material (Reference 4).

If the RV lower head debris bed is present at this time, the above calculated loads will be further reduced. In fact, if the tapered end of the incore guide tube is able to penetrate the debris bed only one foot, the impact would be totally absorbed by the debris bed. Further, if an incore guide tube is already buried in the debris bed, it will most likely not drop at all.

If an incore nozzle is undamaged, a configuration may be postulated in which the incore nozzle and incore guide tube are bridged together by solidified debris. In this configuration torque from the core bore machine could be transmitted directly to the incore nozzle once the guide tube is free from the incore guide support plate. However, as mentioned previously guide tube hangup within the tool holder is extremely remote. Therefore, the transmission of torque from the core bore machine to the incore nozzle is not likely. In addition, the core bore machine has a torque limit of 6000-36,000 in-lbs. This is less than the torque required to damage an intact nozzle weld. Thus, even if torque is transmitted from the core bore machine to an incore nozzle, failure will not occur. If the incore nozzle weld experienced significant damage, the incore nozzle above the weld would have melted to the RV lower head inside diameter and such a bridge is not possible.

During this phase of the LCSA Removal Program, the bored incore guide tubes and support posts will remain in place. With the incore guide tube remaining in the bored hole, dropped, slender objects will not be able to impact the lower RV head. Further, since the cut guide tube does not rest on the incore nozzle weld, impacts to the top of the guide tube will likewise not directly impact the weld.

The drilling of the incore guide tubes from the LCSA may also result in a 5' by 4' piece of the elliptical flow distributor plate being separated. This piece weighs approximately 800 lbs. This slightly curved section will be free to drop onto the RV lower head debris bed unimpeded. For this analysis, it is assumed that the debris bed surface is within a foot of the bottom surface of the elliptical flow distributor. The impact force of this drop is less than one (1) lb. per square inch over the surface of the debris bed. This force will be absorbed within the debris bed and should not impact the RV lower head. A conservative analysis was also made assuming no debris bed is present in the RV lower head, the cut piece drops 27" and an attached drilled incore

guide tube gusset section strikes the hypothetically melted incore nozzle. In this case a compressive stress of approximately 21,700 psi will be imparted to the weld and nozzle structure. Weld failure is again not expected because the impacted material is not stressed beyond its yield strength.

Conclusion

The above discussion demonstrates that the loads imparted to an incore nozzle weld will remain below the minimum loads necessary to cause a failure of the weld. Therefore, it may be concluded that this proposed operation does not represent an unreviewed safety question. The operation does not increase the consequences or the probability of an accident previously evaluated, create the possibility for an accident of a different type then those previously evaluated, or reduce the margin of safety as defined in the Technical Specifications. In addition, this operation does not require a change to the Plant's Technical Specifications. GPU Nuclear believes that this proposed operation can be performed without undue risk to the health and safety of the public.

Per the requirements of 10 CFR 170, an application fee of $150.00 is enclosed.

Sincerely,

F. R. Standerfer
Director, TMI-2

CJD/eml

Attachment

Enclosure: GPU Nuclear Corp. Check No. 008506

cc: Regional Administrator, Region 1 - W. T. Russell
Director, TMI-2 Cleanup Project Directorate - Dr. W. D. Travers

REFERENCES

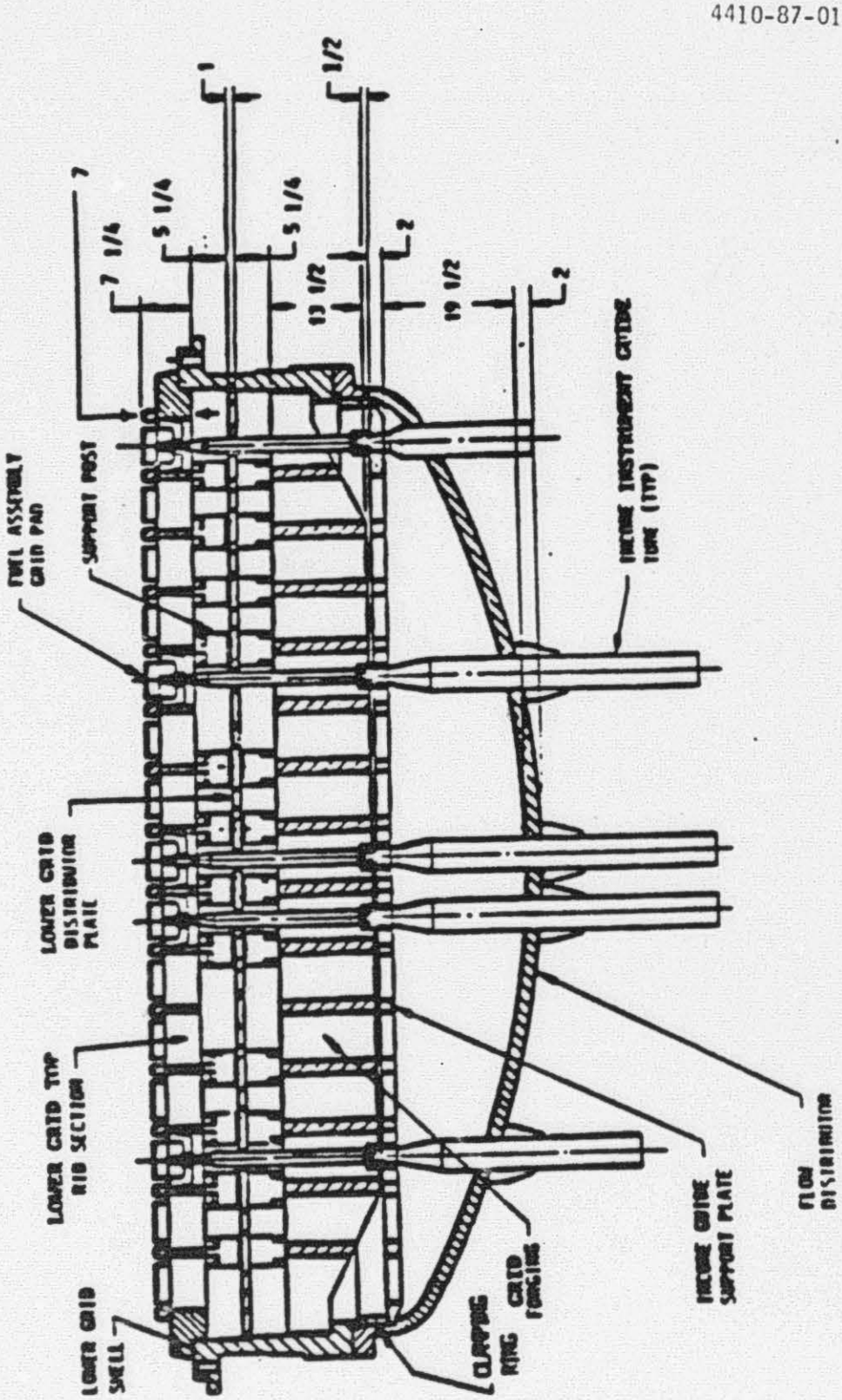
1. Safety Evaluation Report for Core Stratification Sample Acquisition, Revision 4, 15737-2-G07-109, July 3, 1986.

2. GPU Nuclear letter 4410-87-L-0162, dated September 19, 1987, "Core Bore Operations," to W. D. Travers from F. R. Standerfer.

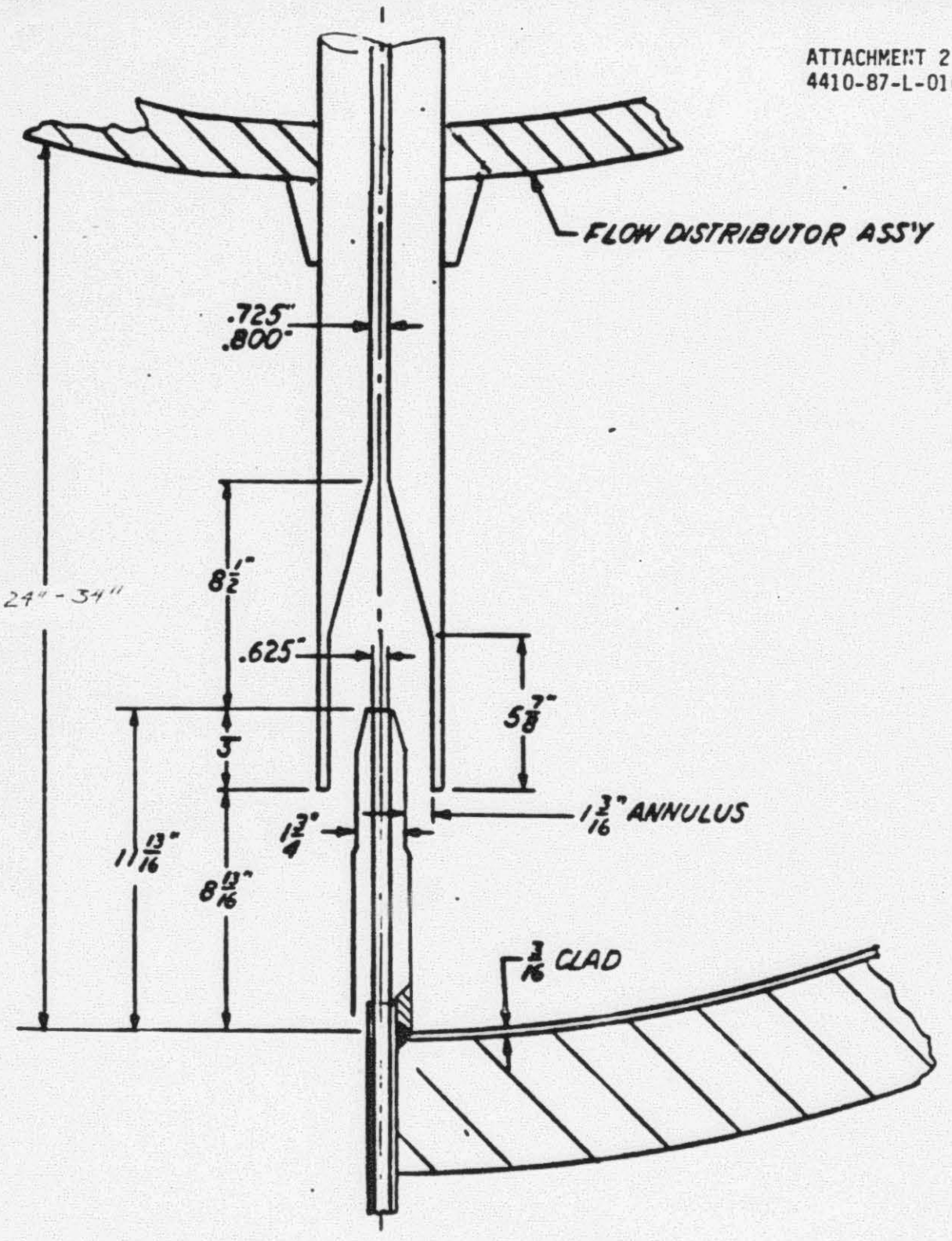
3. NRC Letter NRC/TMI-86-01, dated October 16, 1987, "Core Bore Operations," to F. R. Standerfer from W. D. Travers.

4. ASME Boiler and Pressure Vessel Code, 1983 Edition, Section III, Appendices.

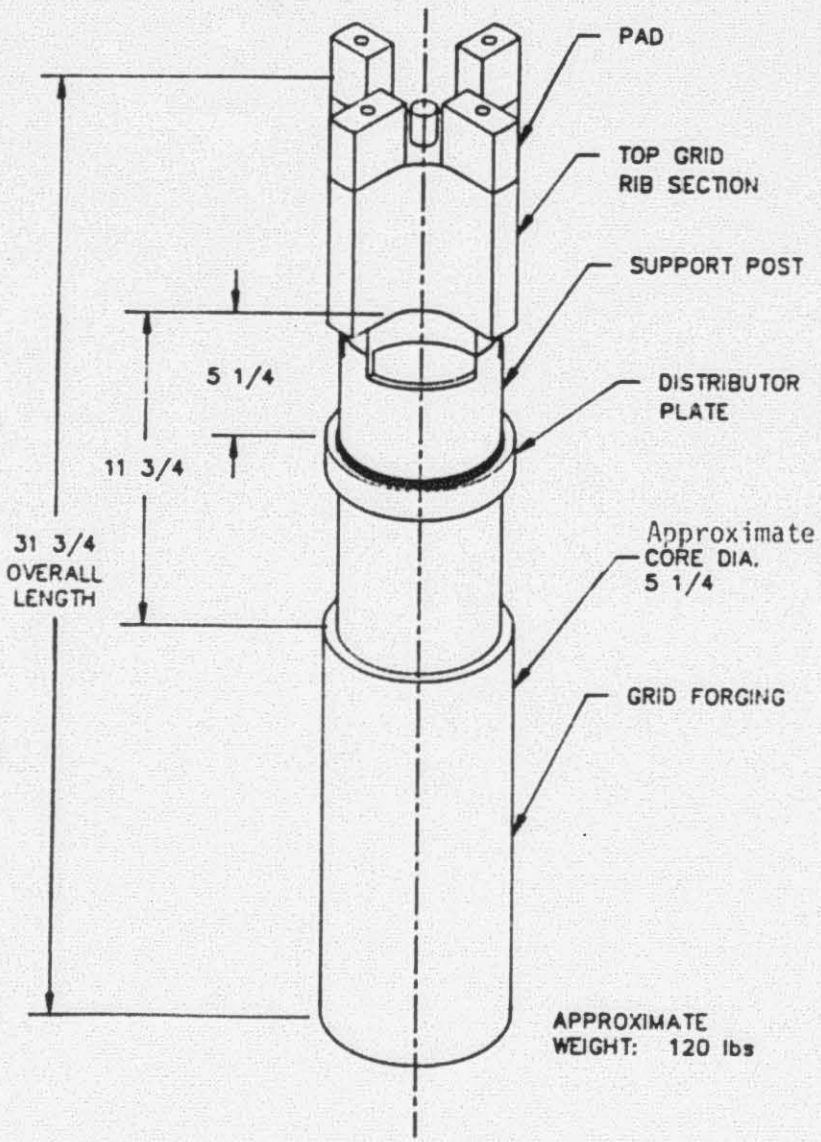
VERTICAL CROSS SECTION OF THE LOWER CSA STRUCTURE



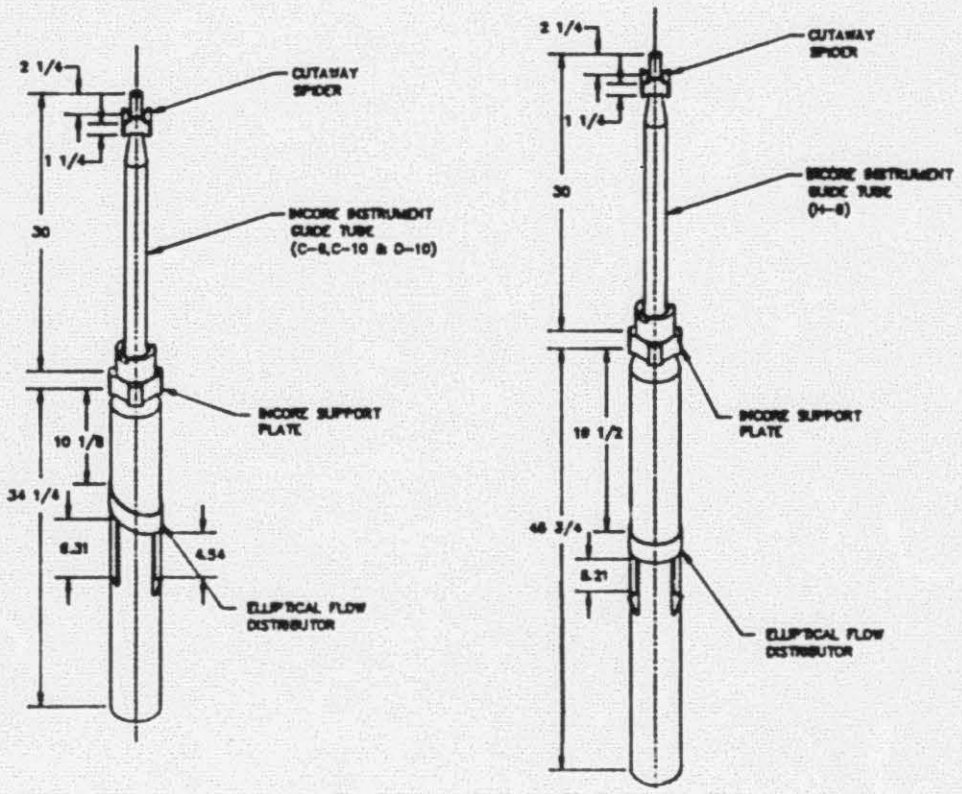
ATTACHMENT 2
4410-87-L-0160



LOWER GRID FLOW DISTRIBUTOR &
GUIDE TUBE ASSEMBLY



BORED SUPPORT POST



BORED INCORE GUIDE TUBE