ARKANSAS POWER & LIGHT COMPANY
POST OFFICE BOX 551 LITTLE ROCK, ARKANSAS 72203 (501) 371-4000

July 5, 1984

2CAN078401

Director of Nuclear Reactor Regulation
ATTN: Mr. James R. Miller, Chief
Operating Reactors Branch #3
Division of Licensing
U. S. Nuclear Regulatory Commission
Washington, DC 20555

SUBJECT: Arkansas Nuclear One - Unit 2
Docket No. 50-368
License No. NPF-6
Impact of ANO-2 2R4 Outage Schedule
on ICC Instrumentation Program

Gentlemen:

As a supplement to our letter dated June 4, 1984 (2CAN068402), we are providing, as attachments to this letter, the following information:

A. Our revised (best estimate) schedule for installation of the ANO-2 ICC monitoring system;

B. Our test program status; and

C. Our plans for accomplishing ICC instrument installation during 2R4.

Attachment A provides the key completion dates (Milestones) for our current installation schedule. Due to the complexity of the schedule, detailed entries are not included on Attachment A however, they will be available at our July 12, 1984, meeting.

As indicated in previous correspondence, installation during the next ANO-2 refueling outage will be difficult due to the earlier than expected outage. In an attempt to expedite the project, authorization has now been given to procure materials and begin fabrication of the instrument probes. This authorization was given based on the satisfactory indication from preliminary test results. It should be noted that the original schedule did

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1/1

not call for authorization of fabrication until after NRC acceptance of the ICC systems. Our authorization of fabrication before NRC approval should not be construed as a bypass of NRC's review, rather as an expediting means and a reflection of our confidence in the system.

If we are to be successful with installation at the next refueling, it is imperative that we work very closely with the NRC during the review and approval of this system. As the schedule is very short, we believe an interactive review process is the best means to this end. We will be providing information as soon as it is available for NRC review in an attempt to expedite the review process.

We wish to discuss the review process in greater detail during our upcoming meeting on July 12.

Very truly yours,

for John R. Marshall
Manager, Licensing

JRM/JM/ac

Attachment

ATTACHMENT A

Schedule For ANO-2 ICC Hardware Installation

The schedule to develop and test our proposed system to monitor inadequate core cooling (ICC) for ANO-2 has been carried out to date essentially as originally planned. The results of this first phase are discussed in Attachment B. This attachment discusses our concern for the need to begin interaction with the NRC in order to accomplish ICC hardware installation during 2R4. As stated in our letter dated June 4, 1984, (2CAN068402), we are currently anticipating that the fourth refueling outage will begin February 2, 1985. Three figures are included as milestone charts of our current schedule (A-1), an original schedule (A-2), and both schedules combined (A-3).

The milestones for the schedule we are now following are depicted in Figure A-1. There are several critical dates on this figure we wish to bring to your attention. Two bars appear in Zone 1 of this figure as " NRC Review & Approve ICC System" and "NRC Approve Detailed Design Specification (DDS)." The end date of the system review directly impacts our planned start date for fabrication of the in-vessel RGTs. The end date of the DDS review directly impacts our planned date for authorizing the in-plant construction activities necessary to install the ICC system hardware.

We believe that the stated interactions with the NRC in the preceding paragraph are essential to the success of the ICC project as currently planned. Many activities, which would normally await the approval of a proposed system by the NRC (see Fig. A-2), are being pursued on the anticipation of approval. However, the RGTs, which are the key components of the in-vessel instrumentation (denoted RLI), depend upon the date of NRC approval as an acceptable means of sensing level under ICC conditions. Should approval of our proposed system not be achieved in time to support the schedule, or should we be required to use some alternate sensor, then there would be insufficient time to accomplish the installation during 2R4. As shown on Figure A-1, the schedule for the final report on the proposed system is to submit our report to you on July 27, 1984 with review assumed to be completed, and approval granted, by September 24, 1984.

The impact on the authorization for construction is similar in that there is significant in-vessel, in-containment, and control room work which must be planned and scheduled to accomplish hardware installation during 2R4. This is complicated further since the system design bases call for a safety-grade and siesmically qualified installation. The information in the DDS is needed to plan for this modification, and must await approval by the NRC as a part of our commitments stated in our letter of December 13, 1983 (2CAN118303). Changes to the DDS will necessitate a change to any plans developed. As the advancement of the outage schedule has already imposed a great hardship on work scheduled for the outage, a delay in receipt of an approved DDS will cause the work schedule for ICC to slip from its current start date. This does not account for additional time lost by delays in material receipt or any event which may cause an early start of the outage, both being possible, or for unanticipated difficulty experienced during installation. Therefore, the schedule for construction planning and installation is extremely sensitive to your response to our efforts. If approval of the DDS can be achieved earlier, then the possibility of accomplishing ICC hardware installation will be correspondingly improved.

To put the schedule in perspective we have included as Figure A-3 a combined chart of the milestones for the current and original schedules based upon the 2R4 outage. As depicted, the original schedule (shown also on Figure A-2) is based on our current knowledge of the project requirements and assuming the start of 2R4 had remained September 15, 1985. The original schedule had a reserve time (float) of approximately 90 days. The dramatic shift in the key dates from the original to the current schedule illustrates that all float was lost when the outage start advanced beyond June 26, 1985. Since then we have had to compress the schedule such that our current schedule is a compromise of many aspects of the project. This was necessary to create an expedient plan to prepare hardware and achieve the installation of the ICC instrumentation during 2R4. This effort is being made, although the anticipated outage has moved up significantly, in the spirit of our commitment as stated in our letter of April 15, 1983, (2CAN048306), to meet the 2R4 schedule.

The milestones depicted in Zone 1 of the figures include target dates for the ten commitments specified in our letter of December 13, 1983. We must emphasize that these dates as they pertain to the ICC hardware are our current schedule to achieve installation during 2R4 with an anticipated outage start date of February 2, 1985; and that the dates for milestones beyond hardware installation are merely based on working values and do not change the commitments previously made. The details of the project were not available when the letter of December 13, 1983, was prepared. We believe that a complete review of our current planning would be useful to the NRC's understanding of the urgency of the schedule. We are making every effort to accomplish our current schedule and achieve completion of the milestones up to and including turning on the system for operator familiarization. A face-to-face meeting would allow us to explain the details on which we base the current schedule and to discuss the completion of all milestones.

PROJECT ** MS **	START 18OCT82	ENGINEERING PROJECTS	WORKING SCHEDULE
PLOT ICC DET	COMPLETION 11JUL88	********* MASTER SCHEDULE *********	MODE
RUN DATE 21JUN84	DATA DATE 31MAY84	ARKANSAS POWER & LIGHT COMPANY	SORT E START / INTER

JUN84: 28 | JUL84: 5, 12, 19, 26 | AUG84: 2, 9, 16, 23, 30 | SEP84: 6, 13, 20, 27 | OCT84: 4, 11, 18, 25 | NOV84: 1, 8, 15, 22, 29 | DEC8[4]: 6, 13

ZONE 1

84D02011 AP&L SUBMIT FINAL REPORT TO NRC

NRC REVIEW & APPROVE ICC SYS. 7/30/84

NRC RECEIVE DDS

NRC APPROVE DDS 11/28/84

FUNCTIO

TURN ON SYSTEM FOR

EOP TECH

ZONE 2
DESIGN

84D02011 PROJECT AUTHORIZATION DESIGN

84D02011 ISSUE DCP TO PLANT

ZONE 3
INSTALLATION

84D02011 PROJECT AUTHORIZATION CONSTR

ZONE 8
A/E DESIGN

84D02011 RECEIVE PREL INTERFACE DWGS

84D02011 FAT PROCEDURE SUBMITTAL

84D02011 MAJOR MATERIAL RECEIPT

84D02011 DDS SUBMITTAL

84D02011 DAS ASSEMBLY COMPLETE

84D02011 COMPLETION OF PROTOTYPE

84D02011 FABRICATION RQTS COMPLETE

84D02011 DAS TEST COMPLETE

84D02011 SYSTEM INTEGRATION TEST COMPLETE

84D02011 AP&L RECEIVE IN-VESSEL

84D02011 FACT ACCEPT TEST/SHIPPIN

LEGEND

REPORTED PROGRESS — MILESTONE

WORKING SCHEDULE

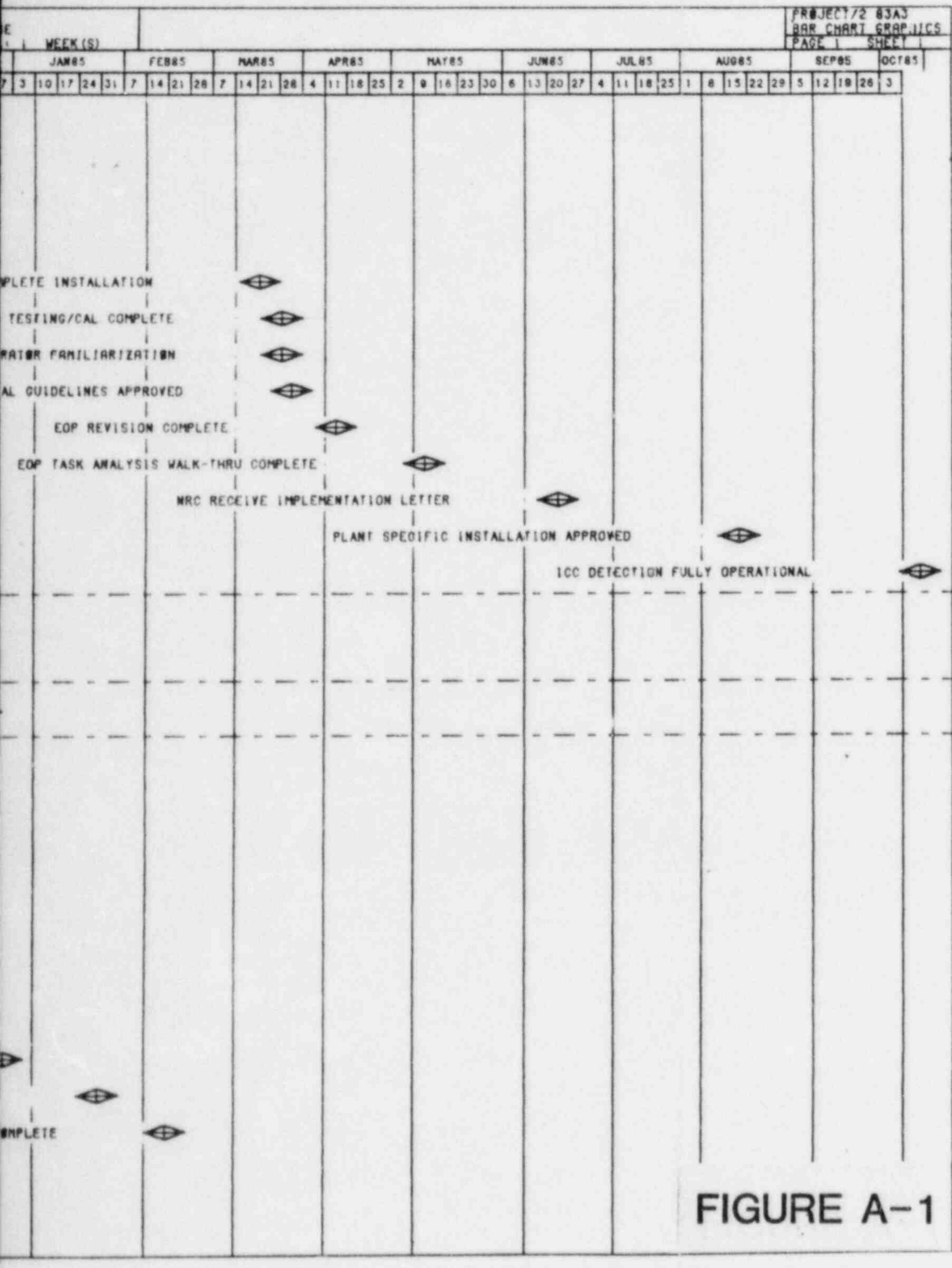
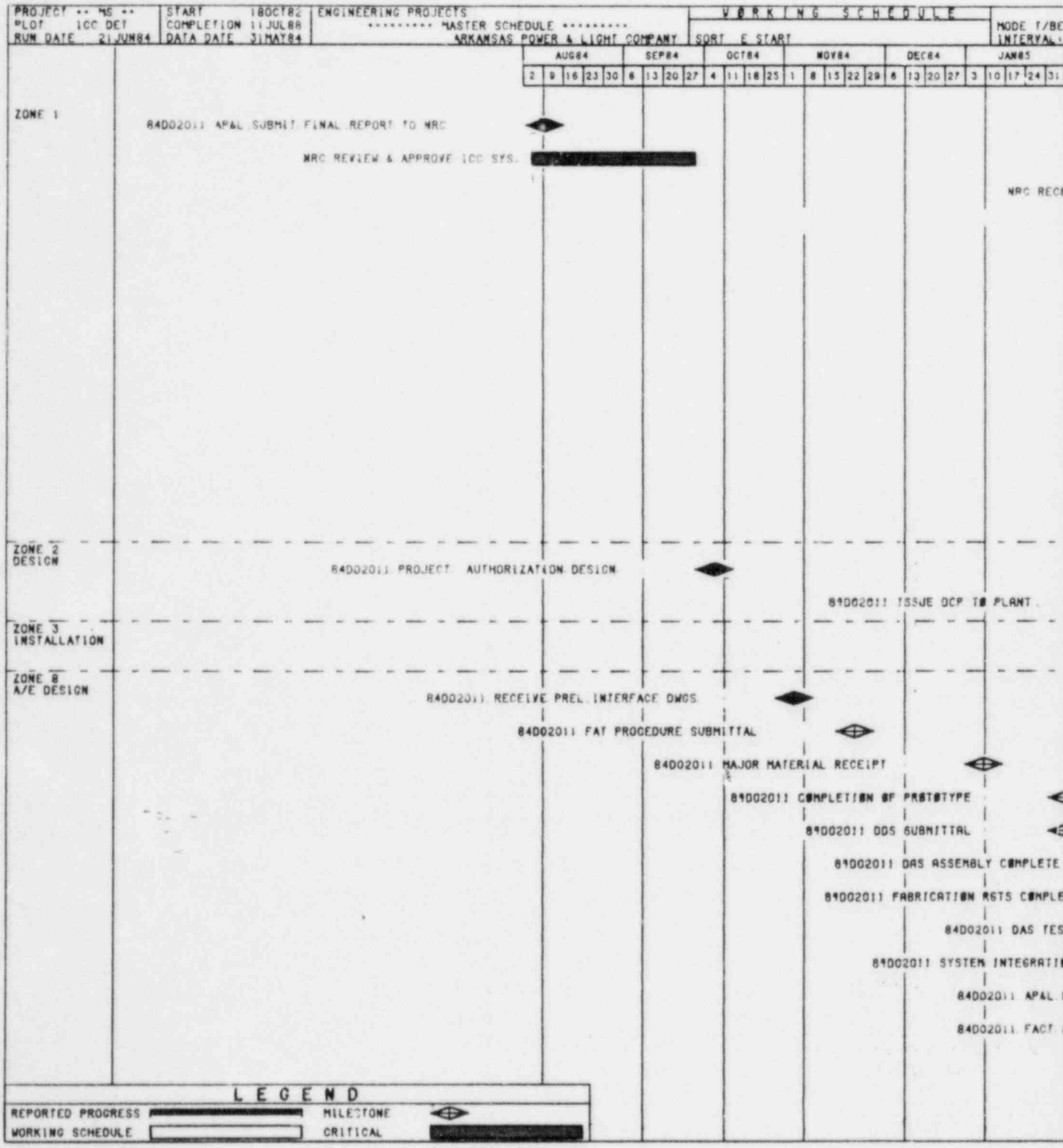

PROJECT/2 83A3
BAR CHART GRAPHICS
PAGE 1 SHEET 1
WEEK (S)
JAN85
FEB85
MAR85
APR85
MAY85
JUN85
JUL85
AUG85
SEP85
OCT85
PLETE INSTALLATION
TESTING/CAL COMPLETE
RATOR FAMILIARIZATION
AL GUIDELINES APPROVED
EOP REVISION COMPLETE
EOP TASK ANALYSIS WALK-THRU COMPLETE
NRC RECEIVE IMPLEMENTATION LETTER
PLANT SPECIFIC INSTALLATION APPROVED
ICC DETECTION FULLY OPERATIONAL
OMPLETE

FIGURE A-1


PROJECT -- MS --
PLOT ICC DET
RUN DATE 21JUN84
START 18OCT82
COMPLETION 11JUL88
DATA DATE 31MAY84
ENGINEERING PROJECTS
********* MASTER SCHEDULE *********
ARKANSAS POWER & LIGHT COMPANY
WORKING SCHEDULE
SORT E START
MODE T/BE
INTERVAL:
AUG84 SEP84 OCT84 NOV84 DEC84 JAN85
2 9 16 23 30 6 13 20 27 4 11 18 25 1 8 15 22 29 6 13 20 27 3 10 17 24 31
ZONE 1
84D02011 AP&L SUBMIT FINAL REPORT TO NRC
NRC REVIEW & APPROVE ICC SYS.
NRC RECE
ZONE 2 DESIGN
84D02011 PROJECT AUTHORIZATION DESIGN
84D02011 ISSUE DCP TO PLANT
ZONE 3 INSTALLATION
ZONE 8 A/E DESIGN
84D02011 RECEIVE PREL. INTERFACE DWGS
84D02011 FAT PROCEDURE SUBMITTAL
84D02011 MAJOR MATERIAL RECEIPT
84D02011 COMPLETION OF PROTOTYPE
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LEGEND
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CRITICAL

Also Available On
Aperture Card

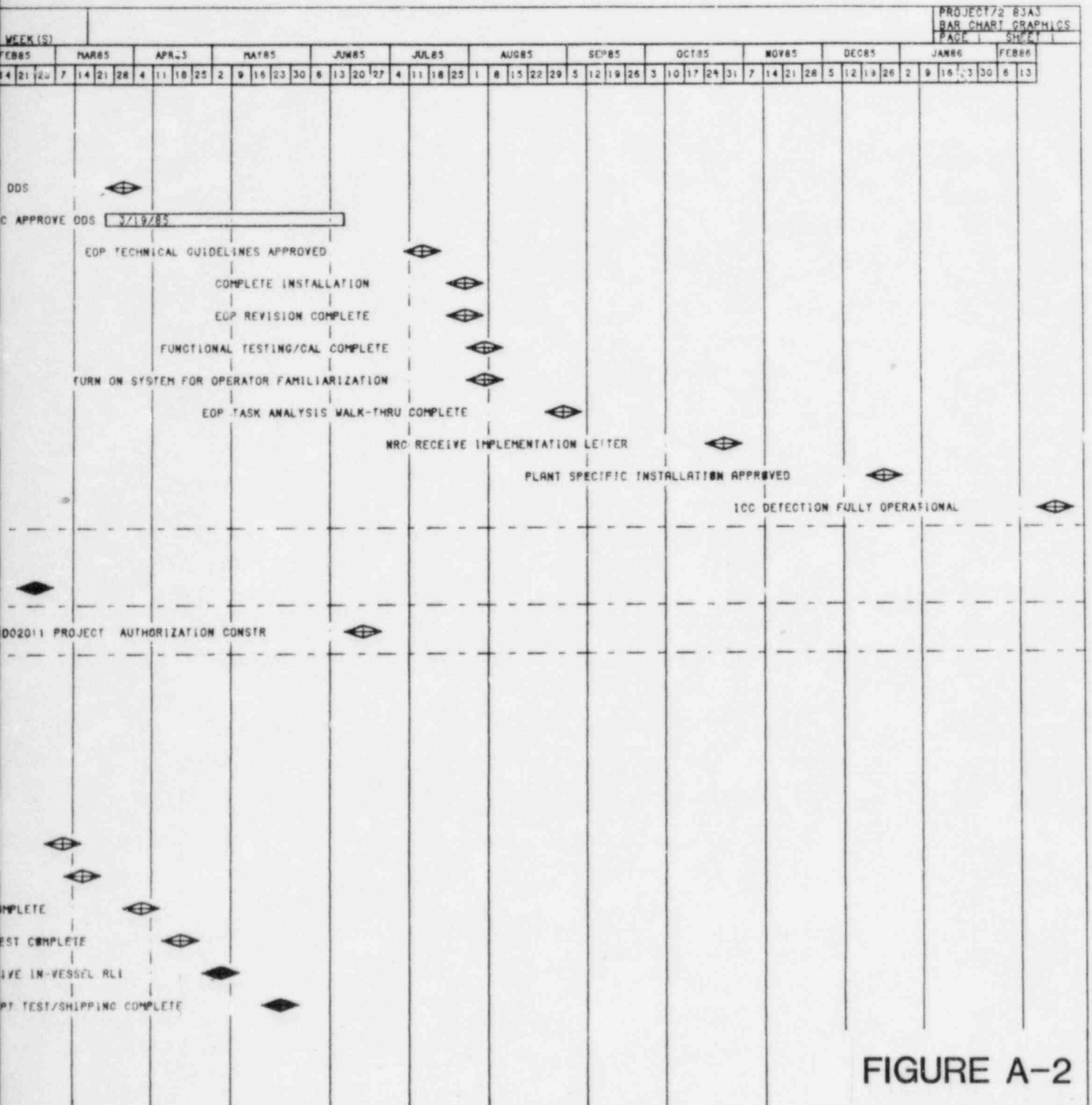

FIGURE A-2

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PROJECT -- MS -- PLOT ICC DET RUN DATE 21JUN84	START 18OCT82 COMPLETION 11JUL88 DATA DATE 31MAY84	ENGINEERING PROJECTS ******** MASTER SCHEDULE ******** ARKANSAS POWER & LIGHT COMPANY

TARGET SCHEDULE

SORT E START

MODE T/FE
INTERVAL: 1 WE

JUN84	JUL84				AUG84					SEP84				OCT84				NOV84					DEC84				JA	
28	5	12	19	26	2	9	16	23	30	6	13	20	27	4	11	18	25	1	8	15	22	29	6	13	20	27	3	10

ZONE 1

NRC RECEIVE DDS

NRC APPROVE DDS 11/28/84

84D02011 AP&L SUBMIT FINAL REPORT TO NRC

NRC REVIEW & APPROVE ICC SYS. 7/30/84

EOP TECHNICAL GUIDE

E

COMPLETE I

FUNCTIONAL TESTING

TURN ON SYSTEM FOR OPERATOR FA

EOP TA

ZONE 2
DESIGN

84D02011 PROJECT AUTHORIZATION DESIGN

84D02011 ISSUE DCP TO PLANT

ZONE 3
INSTALLATION

84D02011 PROJECT AUTHORIZATION CONSTR

ZONE 8
A/E DESIGN

84D02011 RECEIVE PREL INTERFACE DWGS

84D02011 FAT PROCEDURE SUBMITTAL

84D02011 MAJOR MATERIAL RECEIPT

84D02011 DDS SUBMITTAL

84D02011 DAS ASSEMBLY COMPLETE

84D02011 DAS TEST COMPLETE

84D02011 SYSTEM INTEGRATION TEST COMPLETE

84D02011 COMPLETION OF PROTOTYPE

84D02011 FABRICATION RQTS COMPLETE

84D02011 AP&L RECEIVE IN-VESSEL RLI

84D02011 FACT ACCEPT TEST/SHIPPING COMPLETE

TI
APERTURE
CARD

LEGEND

TARGET SCHEDULE		MILESTONES	CURRENT
			ORIGINAL
EARLY SCHEDULE			

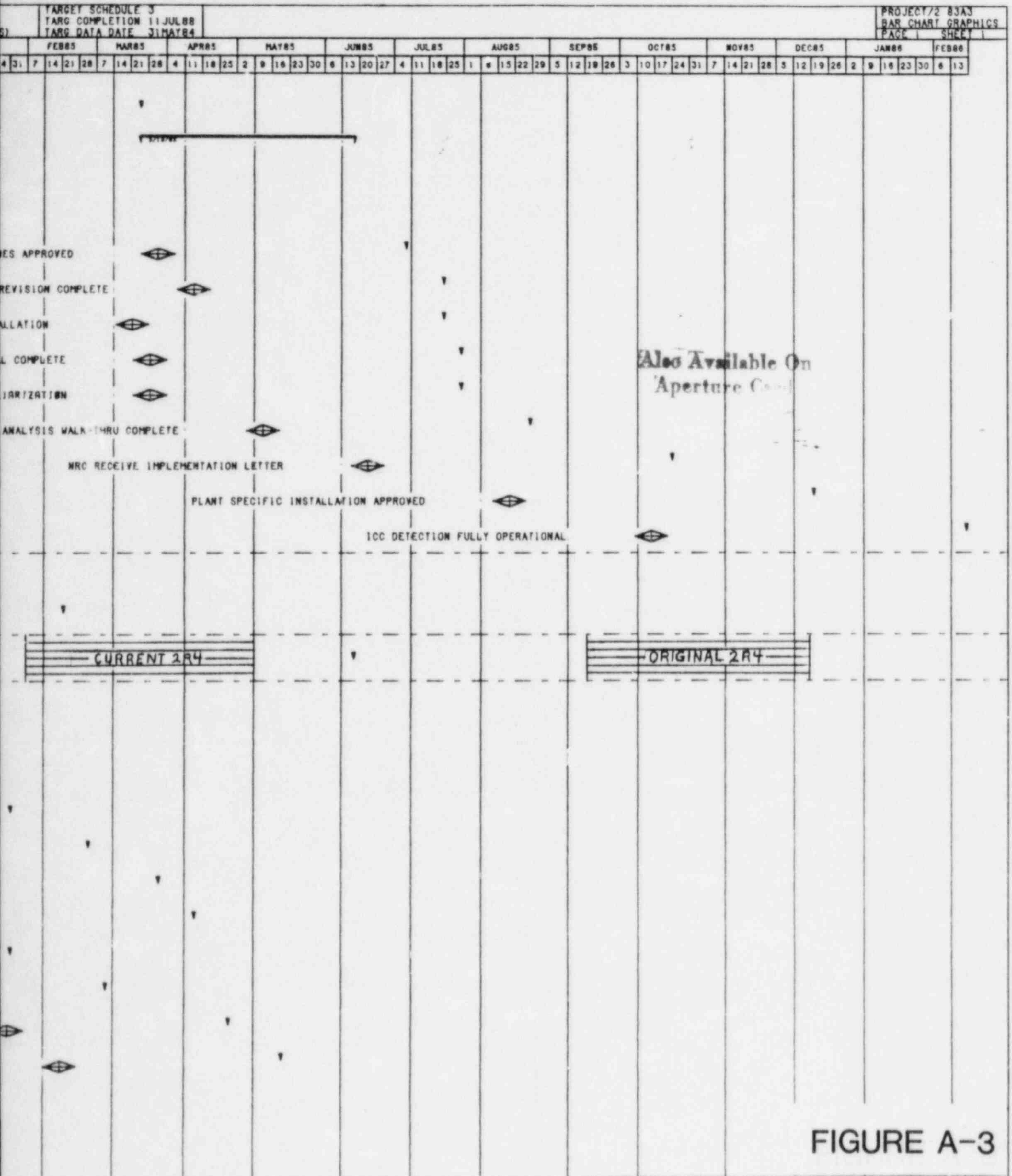

FIGURE A-3

8407100169-03

ATTACHMENT B

Inadequate Core Cooling
Confirmatory Test Program Status

The confirmatory test program consisted of a series of tests to provide a basis for justification that the Radcal Gamma Thermometer (RGT) will adequately perform as an ICC Monitor. Three sets of test series were performed. These tests consisted of the following: (1) Air-Water Test Series, (2) Upper Head Test Series, and (3) In-Core Test Series. A brief discussion of each of the test series follows.

Air Water Test Series

The overall objectives of this test series were:

- To provide basic design data on the manometer tube stilling column and RGT assembly's performance.
- To demonstrate that the final prototype manometer tubes and probes are capable of making level measurements in a variety of air-water mixtures and flows.
- To obtain basic performance data, response time, and fill and drain rates of the manometer tube-probe assemblies, and
- To determine the boundary conditions of flow and void fraction under which the probe assembly can provide unambiguous data to a reactor operator.

Upper Head Test Series

The overall objectives of this test series were:

- Demonstrate that the prototype gamma thermometers can supply measurements to provide effective ICC monitoring of the upper head and upper plenum of the reactor,
- Provide data to determine the boundary conditions on unambiguous gamma thermometer ICC monitoring performance - depressurization rates (break size), flow rates (pumps-off sensitivity), and refill repressurization;
- Confirm that the absolute temperature measurement provides a good indication of coolant temperature above the core in an ICC event; and
- Provide data to select the optimum sensor types and arrangements in the gamma thermometer probe for ANO-1 and ANO-2.

In-Core Test Series

The overall objectives of this series were:

- Demonstrate that the prototype gamma thermometers can supply measurements to provide effective ICC monitoring in the reactor core;
- Provide data to determine the boundary conditions on unambiguous gamma thermometer ICC monitoring performance - depressurization rates (break size), flow rates (pumps-off sensitivity), and refill repressurization;
- Confirm that the absolute temperature measurement provides a good indication of coolant temperature in the core in an ICC event, and obtain data on how closely the RGT reflects fuel thermal performance;
- Obtain data to help confirm that the gamma thermometer can monitor effectiveness of natural circulation cooling; and
- Provide data to select the optimum sensor types and arrangements in the gamma thermometer probe for ANO-1 and ANO-2.

All of the confirmatory testing has been completed. The tests results are presently undergoing analysis. The final report covering all three test sets is currently scheduled to be submitted to NRC in late July.

A preliminary summary of test results for the Air-Water Test Series and the Upper Head Test Series is provided below. The In-Core Test Series has just been completed; hence, test results are not available as of this date.

Air-Water Preliminary Summary of Test Results

The following overall conclusions can be reached regarding the air/water testing of the RGT-manometer assembly:

1. Manometer separation efficiency is approximately a linearly decreasing function of void fraction.
2. There is a strong correlation between bottom slot row vertical spacing and manometer separation efficiency. Greater spacing shows decreasing efficiency.
3. All considerations lead to a bottom manometer port pattern of one row of 3 slots on 120° centerline spacing, 0.031 in. high, and 0.327 in. wide. The top manometer port pattern is 3 vertical slots on 120° centerline spacing, 1.0 in. high, and 0.125 in. wide.

4. The RGT sensors have time constants in air from 3.7 min to 5.2 min and in water from 16.6s to 33.0s. These results are consistent with those obtained in the TEC calibration loop.

5. The ratio of the steady-state outputs in air to those in water for the RGT sensors varies from 1.25 to 12.5.

6. The RGT-manometer system for the variety of sensors tested does not show an output change with void fraction in the range 6% to 32% in the test section.

7. The manometer tube drain time is 6 seconds.

8. The RGT is not sensitive to two-phase flow with void fractions from 6% to 82% and, therefore, will not be a reliable indicator of liquid inventory when the reactor coolant pumps are running, as was expected.

9. The manometer tube clearing time is not a dominant parameter in uncovery response time.

10. The RGT-manometer tube assembly shows an offset from the "real" collapsed liquid level 0-20 in. for all void fractions of interest, filling or draining.

11. All data taken show the RGT-manometer tube assembly can be used as an indicator of liquid inventory for void fractions typical of upper-head small-break LOCA conditions, 0% to 40%, all drain rates between 0.55 and 4.57 ft/min, and all fill rates between 0.125 and 9.23 in./sec.

Upper Head Preliminary Summary of Test Results

The breadth of the parameter space in the Upper Head Test Series was significant. Variations in blowdown rate, reflood rate, initial temperature, and initial flow were included. Further three sensor types and three gas-gap length variations within two of the sensor types were tested. The overall conclusions from this test series are:

1. All RGT rods maintained their mechanical integrity, operability, and performance throughout the test series.

2. All RGT sensor types respond well to blowdown and reflood transients and could be utilized as ICC warning devices with relatively simple type-specific data processing.

3. Inventory loss or gain rate can be determined in addition to inventory.

4. There is no practical difference in response of RGT rods containing different numbers of sensor locations (12- and 16-cable pack designs).

5. The response of the sensors is predictable, including variations in absolute temperature and flow.

The comparison of the performance of sensor types is presented in Table B-1 by category. Best in a category is 1 and worst is 3. The comparison of the performance of gas-gap length by category is presented in Table B-2. The categories are ordered in importance from the most important at the top to the least important at the bottom of the tables. Based on this ranking, the fast-type sensor is the best overall ICC monitor, and the 0.75-inch gas-gap length is the best overall length.

Table B-1

PERFORMANCE OF SENSOR TYPES
DURING UPPER HEAD TEST SERIES

(1 = Best, 2 = Middle, 3 = Worst)

Category	Slow	Fast	Signature of Uncovery
Tracking Collapsed Liquid Level	2	1	3
Splashing Sensitivity	1	2	3
Signal Doubling Time	2	1	3
Uncovery (Blowdown) Signal/Initial Signal	2	1	3
Recovery (Reflood) Signal/Initial Signal	2	3	1
Magnitude of Initial Signal	1	3	2
Accuracy as a Rate Monitor	2	1	3
Absolute Temperature Sensitivity	3	1	2
Flow Sensitivity	1	3	2
TOTAL	16	16	22

Table B-2

PERFORMANCE OF GAS-GAP LENGTHS
DURING UPPER HEAD TEST SERIES

(1 = Best, 2 = Middle, 3 = Worst)

Category	Length (inches) 0.75	1.00	1.25
Tracking Collapsed Liquid Level	1	2	3
Splashing Sensitivity	3	2	1
Signal Doubling Time	1	2	3
Uncovery (Blowdown) Signal/Initial Signal	1	2	3
Recovery (Reflood) Signal/Initial Signal	3	2	1
Magnitude of Initial Signal	3	2	1
Accuracy as a Rate Monitor	1	2	3
Absolute Temperature Sensitivity	1	2	3
Flow Sensitivity	3	2	1
TOTAL	17	1[illegible]	19

ATTACHMENT C

Outline of Current Plan for ANO-2
ICC Monitoring Hardware Installation

The following table is an abbreviated summary of activities as currently scheduled for installing the ANO-2 ICC monitoring system during 2R4. The format is such that the activities performed by AP&L, NRC, or by vendors are grouped by associated time-frames, and so appear in roughly chronological order. The end points of major activities (milestones) are depicted on Figure A-1 of Attachment A.

AP&L	VENDORS	NRC
	Submit Fnl Des Spec; Tubg Spec; Mdl-1 Intrfc & Htr Cbl Dwgs; Incmg Test Prcd for TC, Tubg, & Htr Cbl; Procure Material for RLI and Prototype;	
Prepare Estimate, Sched, & WOs; Issue Proj Auth	Prepare RLI Calib Prcd & Cold Calib Loop; Quick-Lk Rpt	
Issue Task Auth	Sys Blk Diag & RLI Intrfc Dwg; Prepare Fnl Test Rpt; Qualify Connectors; Begin K2 Calculations	
Review Prelim Dwgs & Sys Blk Diag; Prepare Fnl Sys Rpt for NRC; Prepare Schematics & P&ID	Fact Accept Test Prcd; Start RLI Assembly Dwgs	
Cvl & Cab Loc/Mtg; Cct & Rcwy Conn; Ponl Lyt Dwgs;	Bracket Des; Hardwr Dtl Spec; Des Elec Conn; Softwr Des Rev; Procure DAS Hrdwr;	Start review of ICC system
Issue RFPs for Pntrs & Spl Kits; Rev Bracket Des; Begin Cvl Cndt Sup, Mech Des, & I&C Summary	Code Software; RLI Prcs Spec; Test/Insp Proto & RLI Matls; Assemble DAS; Fnl DDS	Complete Sys Rev & Approve ICC Sys
Recv Pntr & Spl Kit Bids; Complete Cvl & Mech Des; Finalize & Rev DCP, Rev Guide Tube Cutting; Prepare NRC-DDS Submittal; Issue DCP	Submit DDS; Fab & Calib Proto; Standoff Spec & Fab; Begin In-Vessel RLI Fab; Transmit K2 Results; Prep Cold Calib Loop	

AP&L	VENDORS	NRC
Plt Approve DCP Fab Pntr Fdthrg & Spl Kits; Rev DDS Submittal; Issue JO;	Unit Test Softwr; Install Stndoffs/Proto; DAS Complete; Begin DAS Test Final Des & Doc Softwr; Softwr Integration; RGT Fab Complete; Bracket Onsite;	Recv DDS Submittal
Plt Est & Schdl; Approve WO; Onsite Equip Complete, Authorize Constr;	Sys Integration Test - Complete; Install Elec Trans & Conn; Prepare Qualification Rpt	Approve DDS
Begin Non-Outage Install; Eng Fld Supt;	Trnsmt Qual Rpt; Install Standoffs; Fact Accept Test & Crate Sys; Ship RLIs	
Begin Outage DCP Install; Test DCP; Funct Test & Calib; Rev DCP & Issue As-Builts; System Turned On	Fact Accept/Shpg Complete	