TENNESSEE VALLEY AUTHORITY
CHATTANOOGA, TENNESSEE 37401
400 Chestnut Street Tower II

May 22, 1981

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

Dear Mr. Denton:

In the Matter of the) Docket No. 50-259
Tennessee Valley Authority)

By letter from T. A. Ippolito to H. G. Parris dated January 13, 1981, TVA received Order for Modification of License concerning modification of the pressure suppression chamber or torus on Browns Ferry Nuclear Plant unit 1. The order required implementation of all plant modifications needed to ensure compliance with NUREG-0661 by October 31, 1981. We are performing many modifications to the torus during the outage now in progress. However, for reasons outlined in the enclosure, we are not able to complete the torus modifications in accordance with the January 13, 1981 orders. TVA hereby requests an extension to the order deadline for completion of all torus modifications.

The next scheduled refueling outage for Browns Ferry unit 1 is to begin in early March 1983. TVA requests extension of the order to accommodate completion of the torus modifications during that outage. Reasons and justification for the requested extension are also provided in the enclosure. Information regarding safety/relief valve confirmatory testing to be performed as part of the Browns Ferry plant unique analysis and its schedule is also provided in the enclosure.

During the unit 1 cycle 4 outage the manpower devoted to the outage, not including the plant's permanent maintenance force, will total 1,204. This force will be averaging 42 percent overtime to finish the outage as scheduled. It is our conclusion that those modifications to the torus that we intend to perform will increase the margin of safety of the torus. It is also our conclusion that operation of unit 1 during cycle 5 with the torus modified as described in the enclosure will not present any undue risk to public health and safety.

Mr. Harold R. Denton May 22, 1981

Refilling of the torus is scheduled to begin June 30, 1981. Therefore, to avoid adverse impact on completion of the remaining outage work, we need your decision on our request no later than June 22, 1981. Your cooperation in this matter will be greatly appreciated. If additional information is needed, we will be happy to meet with your staff. If necessary, please get in touch with us through the Browns Ferry Project Manager.

Very truly yours,

TENNESSEE VALLEY AUTHORITY

L. M. Mills, Manager
Nuclear Regulation and Safety

Subscribed and sworn to before
me this 22nd day of May 1981.

Paulette H. White
Notary Public

My Commission Expires 9-5-84

Enclosure

ENCLOSURE
REQUEST FOR EXTENSION OF ORDER
CONCERNING TORUS MODIFICATION
BROWNS FERRY NUCLEAR PLANT UNIT 1

I. Modifications

A. Modifications That Will Be Postponed
B. Modifications That Will Be Performed
C. Nature of Problem

II. History of TVA Mark-I Analysis and Delays in the Design Effort

III. Length of Torus Modification Outage

IV. Schedule for Completion of Unit 1 Torus Modifications and Justification

V. Safety Implications of Incomplete Torus Modification Program

VI. Safety Relief Valve Testing

I. MODIFICATIONS

A. MODIFICATIONS THAT WILL BE POSTPONED

1. Modification of existing external piping supports and addition of new external supports and/or snubbers.

2. Reroute of small piping and addition of flexible metal hose.

3. Addition of external dynamic snubbers.

4. Nozzle reinforcements of Pressure Suppression Chamber Emergency Core Cooling System header and tee reinforcement and snubbers.

5. Modify end of RHR recirculation lines.

6. Replace RHR test line supports.

7. Modify RCIC turbine exhaust support.

8. Modify HPCI turbine exhaust support.

9. Modify core spray internal support.

10. Replace 90° miters with elbows.

11. Modify torus spray header supports.

12. RHR test line additional support.

13. Replace SRV 70° miter with elbows.

14. Truncate vent pipe drain line and resupport.

15. Reinforcement of vent header penetration of line M and N.

16. Modify existing support in vent pipe.

17. Add shielded electrical penetration to torus.

B. TORUS INTEGRITY MODIFICATIONS THAT WILL BE PERFORMED

1. TORUS CONTAINMENT MODIFICATIONS

a. Add torus tiedowns
b. Add ring girder reinforcement

c. Reinforce attached piping nozzles

2. ATTACHED PIPING SYSTEM MODIFICATIONS

a. Modify ECCS header support

3. SRV PIPING SYSTEM MODIFICATIONS

a. Add quencher arms o ramshead.
b. Add quencher arm supports and modify ramshead supports.
c. Add ten-inch vacuum valves.
d. Replace MSS-7 Rigid Restraint on SRV line N with snubber.
e. Reroute line E inside torus.
f. Add support below SRV penetration of vent pipe.
g. Add new quencher-end support.
h. Modify RS-1 through RS-13 restraints, and add RS-14 and RS-15.
i. Reinforce ring girder at SRV hanger attachment.

4. VENT SYSTEM MODIFICATIONS

a. Shorten downcomers - reset differential pressure
b. Add local reinforcement to vent header
c. Add new tie bars to downcomers

5. INTERNAL STRUCTURES MODIFICATIONS

6. TORUS TEMPERATURE MONITORING SYSTEMS MODIFICATION

Replace internal catwalk

C. NATURE OF PROBLEM

TVA has undertaken every effort possible to expedite implementation of the required modifications. Prefabrication work has been very extensive. An in-depth detail planning effort has been ongoing for a year. We have rearranged our torus implementation team onsite to have no other responsibility but torus modification work. However, performance of the voluminous amount of modification work is being hampered by the unavailability of all drawings and materials.

The modifications listed above under I.A. cannot be implemented on unit 1 during the present outage because of problems with material delivery and late or delayed finalization of design data, i.e., criteria and drawings. These problems are explained in more detail in the following section II.

II. HISTORY OF TVA MARK-I ANALYSIS AND DELAYS IN THE DESIGN EFFORT

TVA initiated analysis activity for the Browns Ferry torus integrity long-term program in March 1977. The first design activity for required torus integrity modifications began in March 1978. These activities have continued until the present time.

Primary problem areas which have been encountered are summarized below.

1. Load definitions have been a severe problem throughout the program. General Electric Company (GE) and the Mark I Owners Group have worked together to provide load definitions and structural acceptance criteria which are generically acceptable to the NRC. A partially complete Load Definition Report was issued by GE in December 1978. Before that time, TVA was working with the best available preliminary information. In March 1979, the initial Load Definition Report was completed and submitted to NRC for review. We expected early approval of this document since the staff had been consulted with throughout its development. In October 1979, the NRC issued their initial "acceptance criteria." This necessitated extensive changes to the Load Definition Report and effectively increased some of the load definitions by an order of magnitude, for example, the submerged dragload definitions for condensation oscillation and chugging. Responding to requests from the owners group and GE, certain portions of the NRC acceptance criteria were revised, particularly those related to the safety relief valve (SRV) loading analysis. In July 1980, NRC's safety evaluation report, NUREG-0661, was published. It included revision 1 of the acceptance criteria which allows conduction of SRV tests "to calibrate a coupled structural model." The application guides for load definitions were subsequently revised and published by GE in September 1980. At that time an NRC-approval definition for all load cases except condensation oscillation lateral load on the downcomers was available. The revised condensation oscillation lateral load definition has not yet been approved by NRC but is still in preliminary form.

2. Application of the load definitions has been more difficult and time consuming than expected because of the extreme conservatisms which result from direct application of the load definitions and analytical

techniques, as recommended. We have had to refine our analytical techniques beyond those initially anticipated for virtually every case.

3. Use of the approved structural acceptance criteria has also caused some severe difficulties. There are 27 different load combinations for which the entire torus, vent system, torus internals, SRV piping, and attached piping must be analyzed. Modifications are defined after initial evaluation of the existing systems and refinement of the analytical techniques as required to make the analysis as realistic as possible. The NRC has not allowed the use of normal considerations for combination of dynamic load effects, i.e., square root of the sum of squares techniques. They have permitted use of cumulative distribution function techniques whereby two dynamic load effects for a given location in a structure may be combined, provided that time history data is available for both cases. This cumulative distribution function technique is not practical for general use because in most cases five or six dynamic load effects must be combined and time history data is not available.

   In order to obtain realistic modification designs on a timely basis, we have shortened the iterative process between analysis and design as much as possible. This required extraordinary cooperative effort between our analysis and design organizations because the loading is primarily dynamic and member sizes and weights significantly influence the loads for all modifications which are attached to the torus. The iterative process was shortened by agreeing on basic modification design concepts before issue of design requirements documents.

4. Escalation of the scope of the analysis and design work since our original manpower projections were made and the long delay in obtaining approved load definitions has caused considerable difficulty in allocation of appropriate manpower levels. The primary effect of this difficulty was to cause a delay in final checking of analysis calculations which, in turn, delayed issuing final drawings for installation of modifications. This occurred despite a large commitment of our manpower resources, particularly over the past 6 to 9 months. Many drawings were issued "for procurement and prefabrication only" until the checking was complete in accordance with TVA quality assurance procedures.

   Checking of analysis calculations which support the

documentation of modification design requirements for unit 1 is now complete with one or two minor exceptions. The corresponding design drawings are being released for installation at this time.

Field-routed branch line attachments to external unit 1 piping systems are being evaluated now on the basis of recently obtained field inspection information. The resulting modifications, if any, will not affect the major attached piping modifications which have been defined.

In summary, we believe that TVA has made an extraordinary effort to define reasonable and acceptable torus integrity modifications for unit 1 in a timely manner. The final design drawings for installation of many modifications are just now being issued. Analysis has been completed as necessary to define modifications with the exception of the external piping branch lines. We believe that we have been as responsive as possible in the analysis and design activity which supports the defined modifications. Increases in projected scope of modification work and delays in issue of drawings for installation were unavoidable consequences of late receipt of approved load definitions and structural acceptance criteria, as well as conservatism in those documents.

III. LENGTH OF TORUS MODIFICATION OUTAGE

The Browns Ferry unit 1 cycle 4 refueling outage is currently scheduled for 113 days, lasting from April 11 to August 2, 1981. It is not practicable to extend the unit 1 outage beyond this to perform additional torus modification work for reasons of safety, outage overlap, and cost. These reasons are described in more detail below.

A. Safety

With the magnitude of the torus integrity modification and the fact that 67 other modifications will be done in addition to normal periodic refueling and maintenance activities, there are a record number of people onsite. The manpower devoted strictly to the outage not including the plants' permanent maintenance force is as follows: 94 managers and engineers, 1,046 craftsmen, 41 contractor personnel, and 23 administrative personnel for a total of 1,204. This task force will be averaging 42 percent overtime to finish the outage as scheduled. The number of injuries and lost-time accidents could increase as the outage progresses attributable primarily to fatigue. We believe that an extension beyond 113 days is pushing the safe management of personnel beyond the practical limits. Table 1 gives a listing of all the modifications we intend to perform this outage. Figure 1 shows the average number of accidents that have occurred on past outages and the projected number for an outage of approximately 113 days.

It shows a significant increase in the number of accidents for an increase in outage length beyond that planned.

B. Outage Overlap

The current outage on unit 1 is scheduled for 113 days between April 11, 1981 and August 2, 1981. The next outage will be on unit 3 and is scheduled for 105 days between September 25, 1981 and January 9, 1982. The unit 3 outage presently has 163 modifications scheduled to be done in addition to the torus integrity modification. Several of these modifications require extensive prefabrication work in order to be done during the scheduled outage. It is not feasible for the engineers to complete the unit 1 outage modifications, finish the documentation for that work, and write workplans and supervise prefabrication efforts for the unit 3 outage in a period of time much less than 60

days.

Additionally, from a safety standpoint, there should be a period of approximately two months for the craft, engineering personnel, and managers to work normal eight-hour shifts. Any significant extension of the unit 1 outage significantly reduces the time available that personnel can rest and recuperate before the next intense 105-day outage begins.

C. Cost

The projected end date of the BFNP unit 1, cycle 4 outage is August 2, 1981. This period is one of the heaviest load demand times TVA experiences. Replacement power costs during this time run from an expected $383,333 per day up to $2,700,000 per day for a unit at Browns Ferry, depending on the type of power available for replacement. In addition, outage manpower costs exclusive of material place an additional $100,000 per day to the burden on our ratepayers.

IV. SCHEDULE FOR COMPLETION OF UNIT 1 TORUS MODIFICATIONS AND JUSTIFICATION

It is expected that modification of the unit 1 torus will be completed during the cycle 5 refueling outage. This outage is currently scheduled to start in early March 1983. It is not feasible to complete the remaining torus work before that refueling outage. This conclusion is reflected in the following discussion.

Based on the current outage schedules at Browns Ferry Nuclear Plant, we have essentially back-to-back refueling outages planned for the torus modification on all three units. In fulfilling these commitments, the torus modification started with the unit 1 outage on April 11, 1981, running through the unit 3 outage during Fall-Winter 1981 and ending with unit 2 outage (startup projected for July 12, 1982). This amounts to approximately 457 days of continuous outage worktime which includes prefabrication work, writing workplans, and performing maintenance repairs and other NRC required modifications. This is in addition to a projected 21-day outage on unit 2, scheduled to begin May 22, 1981 for addition of Unit Station Service Transformer. If an early shutdown is made on unit 1 during operating cycle 5 to complete the torus modifications, this will increase the amount of back-to-back outage worktime by 65 days. As pointed out in III.A. above, this would decrease the degree of safety during the outage mainly because of cumulative effects of manpower fatigue from working long hours on the three preceeding torus outages.

Shutdown of unit 1 during cycle 5 would add a four to seven million dollar fuel penalty cost by reducing the operating cycle based on the present core design. Additionally, a unit 1 early shutdown would place units 1 and 2 on the same operating cycle as well as synchronizing the shutdown time for routine refueling. This would place a significant burden on refueling manpower and resources.

During the cycle 5 refueling outage for unit 1, it is planned to drain the torus, sandblast, and apply a new complete application of the torus protective coating. Because the torus will be drained, implementation of any internal modifications can be accommodated at that time with the least impact on the outage length. A forced outage on unit 1 during cycle 5 would have significant impact on our systems power availability. Such a forced outage would be of significant duration because of the necessity of draining and filling the torus as well as preparation of the torus internals.

V. SAFETY IMPLICATIONS OF INCOMPLETE TORUS MODIFICATIONS

The TVA Division of Engineering Design has considered the safety implications of not implementing all torus modifications required for compliance with the Mark I Load Definition and the Long Term Program Safety Evaluation Report (NUREG-0661, July 1980). Of specific concern was whether partial modification of the Browns Ferry unit 1 torus created any unsafe condition with regard to pressure suppression and maintaining of containment integrity during all expected accidents and transients. It is our conclusion that the modifications which we intend to perform improve the margin of safety of the torus. Operation of unit 1 during cycle 5 with the torus modified as defined in the earlier section I.B. is safe based on the Mark I Short Term Program criteria.

VI. SAFETY RELIEF VALVE TESTING

A plant unique safety/relief valve (SRV) discharge test will be performed as part of the Browns Ferry Nuclear Plant unique analysis as requested by the NRC in NUREG-0661. This test will confirm the methods used to calculate containment loads from the various SRV discharge cases for the results of this test to be completely acceptable, all modifications significantly influencing torus motion must be in their final configuration.

Large dynamic restraints (snubbers) are required to mitigate torus movement caused primarily by condensation oscillation (CO) induced loads. The supplier of these components has indicated that they cannot be delivered until late 1982. Since the snubbers will dampen SRV-discharge-induced torus movement to some extent, they must be installed before the SRV confirmatory test. It follows that the earliest possible date for this test is September 1982 immediately following the unit 2, cycle 4 outage. The SRV test data will be submitted after this date.

TABLE 1

UNIT 1, CYCLE 4 MODIFICATION LIST*

Replace limit switches on MSIV's

Install scram discharge header water level instrumentation

Install cross-tie between vent lines on east and west scram discharge headers (NRC)

LPCI modification (NRC)

Install 480v reactor MOV boards 1E, 2E, 3E, 3D

Supplement existing containment radiation monitors (TMI) (may not work due to material problems)

Install Hays Republic H_2-O_2 analyzer (TMI)

Replace H_2-O_2 sample return pumps in panels 25-336 and 25-337

Replace interim FW sparger with double piston ring seal improved fit spargers

Offsite power supplies in place unit station service transformer

Install generator breakers (NRC)

Modification for long-term torus integrity program (NRC)

Long-term torus integrity mods - piping - PSC (NRC)

Long-term torus integrity mods - piping - MSD's (NRC)

PCIS modification (TMI)

Containment water levels (TMI)
(may not work due to material problems)

Containment pressure system (5 psig to 225 psig replacement) (TMI) (may not work due to material problems)

*This table provides further insight regarding the magnitude of work planned for this outage. However, unforseen problems may arise which would preclude performance of some of this work.

UNIT 1, CYCLE 4 MODIFICATION LIST (Continued)

Torus integrity mods (NRC)

Change stroke time on containment purge valves to five seconds or less (TMI)

Install Hypochlorite generator

Logic changes (CRD system)

Long-term solution bus failure fix (NRC IE 79-27)

161-kV capacitor bank controls

79-01B contingency plan

Install protective screens inside piping that penetrates primary containment between cont. and first isolation valves outside cont. (TMI)

Add bypass contacts to MOV control circuits to bypass thermal overload on critical systems

Provide for distance annunciator in control room

Add high speed computer links between process computer and planning trailer

Install additional grating over condenser tube bundles

Remove all ventilation ducts within MS tunnel in reactor building to the point duct passes through east wall

Bypass on LPCI MG-sets

Replace acoustic accelerometer mounting stud at each MSRV tail pipe

Provide auto backwash system for RCW strainers

Provide for alternative protective coating for torus (NRC)

Enlarge ring girder weep hole opening (NRC)

Bolt, dowell, instead of welding steel guide blocks to HPCI sole plate

Change HTR drain tank level control valve characteristics

Install 4" line from RWCU to "A" FW line

UNIT 1, CYCLE 4 MODIFICATION LIST (Continued)

Condensate short cycle mod

CCW tunnel modification

Install a motor operated bypass valve around the outboard containment isolation valve FCV73-3

Replace tubes bundles on stator coolers

Install bracket assemblies to in-vessel core spray spargers in vicinity of cracks (contingency)

Replace ACME type M2 limit switches

Inspect and repair of required condenser expansion joints (contingency mod)

26-inch Atwood-Morrill globe valve 1-51 (MSIV) (contingency mod)

Rotate valves operators on valves 68-1, 3, 77, and 79 (contingency mod)

Drill and tap bolt holes drywell equipment hatches (contingency mod)

Change out core spray piping in DW from stainless steel to carbon steel (contingency mod)

Torus access hatch

CST's Tie-in

Union Cordova Line Installation

MSIV Packing Bleed Off Lines

Install flange on CRD header for hydrolaze

Provide over voltage protection device directly across the +28v output of RMCS power supply 3A-PS6

Modify and reposition differential expansion detector in main turbine front standard.

Change RCIC turbine exhaust line rupture disc

Reverse silicone reference diode across indicator input FI-3-6, 12, and 20

UNIT 1, CYCLE 4 MODIFICATION LIST (Continued)

Replace the existing control valve diode

Replace the still 300 MCM battery cable with flex 1/10 cables

Replace standoff insulators

Install connectors on EHC oil tanks for connecting filters

Install handrails and grating around top of feedwater pump rooms

Install shutoff valves on all controlling type PAC's on turbine valves (saves shutdowns on repair SERVO valves--economically essential)

Replace present EHC fluid pressure gau ges with new improved gauges

Remove existing silver grounding shoes and their holder and add coverplates

HPCI/RCIC pump seal cavity holes

Condenser expansion joints replacement (contingency plan)

Connect discharge of radwaste floor over sump pump to solid radwaste

Install low flow feedwater control valve (contingency for this outage)

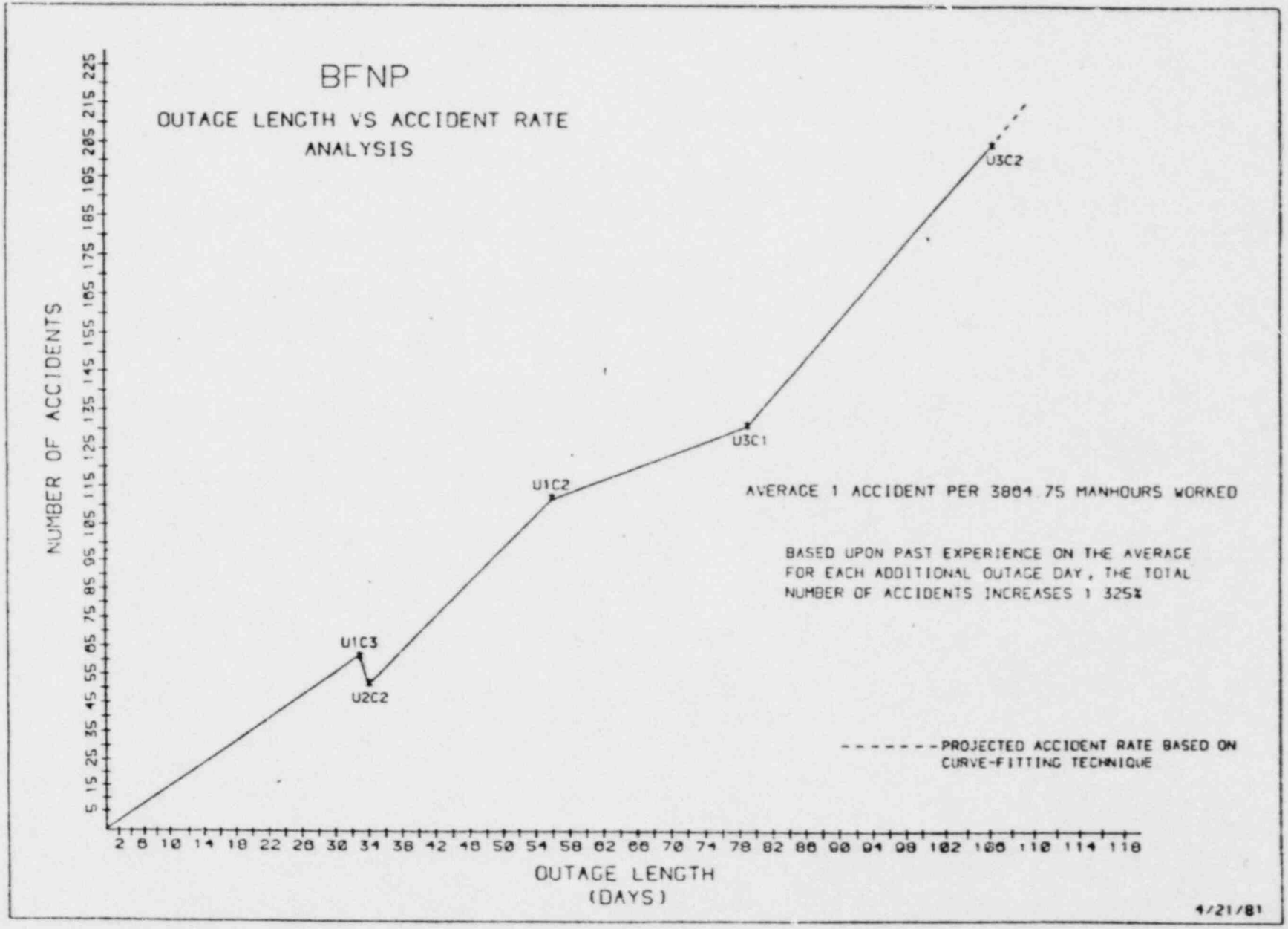
BFNP
OUTAGE LENGTH VS ACCIDENT RATE
ANALYSIS
NUMBER OF ACCIDENTS
5 15 25 35 45 55 65 75 85 95 105 115 125 135 145 155 165 175 185 195 205 215 225
2 6 10 14 18 22 26 30 34 38 42 46 50 54 58 62 66 70 74 78 82 86 90 94 98 102 106 110 114 118
OUTAGE LENGTH
(DAYS)
U1C3
U2C2
U1C2
U3C1
U3C2
AVERAGE 1 ACCIDENT PER 3864.75 MANHOURS WORKED
BASED UPON PAST EXPERIENCE ON THE AVERAGE FOR EACH ADDITIONAL OUTAGE DAY, THE TOTAL NUMBER OF ACCIDENTS INCREASES 1.325%
- - - - - - - PROJECTED ACCIDENT RATE BASED ON CURVE-FITTING TECHNIQUE
4/21/81

FIGURE 1