BROOKHAVEN NATIONAL LABORATORY
ASSOCIATED UNIVERSITIES, INC.
Upton, New York 11973

Department of Nuclear Energy

(516) 345-2144

September 21, 1978

Division of Operating Reactors
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Attention: Mr. R.L. Ferguson
Plant Systems Branch

Dear Bob:

Subject: Fire Protection in Turkey Point Nuclear Power Plant - Units 3 & 4, Request for Additional Information

At your request, a review has been conducted of Turkey Point Nuclear Power Plant and its respective Draft Safety Evaluation Report, dated August 15, 1978. This analysis examined the relationship of safety-related components, systems and structures with both combustibles and the associated fire detection and suppression systems. Our review has been limited to the aspects of fire protection related to the protection of the public from the standpoint of radiological health and safety. We have not considered aspects of fire protection associated with life safety of onsite personnel and with property protection, unless they impact the health and safety of the public due to the release of radioactive material. We have utilized the fire protection program report as submitted by Florida Power and Light Company for Turkey Point as basis data for this analysis. In addition, Mr. M. Antonetti and Mr. J. Townley, under contract to Brookhaven National Laboratory (BNL), have inspected the plants along with members of your staff.

This letter is being written as a result of a meeting between Mr. M. Antonetti and Mr. I. Asp of Gage-Babcock and Associates, Inc., under contract to BNL, and Mr. E. MacDougall and myself of BNL. In addition, discussions were held with Mr. J. Townley, consultant to BNL, regarding the manual fire protection analysis of the two plants. In general, we conclude that there remains four areas within the Turkey Point evaluation that require further analysis. We at this time recommend that these areas, as discussed in attachment 1 to this letter, be held as open items that require additional information and analysis. Upon receipt of the information and completion of the evaluation, the BNL letter report for Turkey Point Nuclear Power Plant will be issued.

Respectfully yours,

Robert E. Hall

Robert E. Hall, Group Leader
Reactor Safety Analysis

sd
Attachment

7812120125

cc: I. Asp
M. Antonetti
R. Cerbone
D. Eisenhut
W. Kato
E. MacDougall
V. Stello
J. Telford

ATTACHMENT 1

1. Water Supply - SER Section 4.3.1.1

The as proposed fire protection water supply consists of two horizontal shaft centrifugal fire pumps, each rated at 2000gpm at 140psig. They take suction from one 500,000 gallon raw water storage tank with a 700gpm make-up capability. At this time no physical dedication is maintained for fire protection requirements, instead the licensee proposed to administratively set aside 150,000 gal. In addition, a 100,000 gallon elevated storage tank, 175 ft. high, floats on the fire protection system as well as others, Again administrative controls are proposed to maintain 30,000 gallons for use during a fire. It should be noted that the licensee has stated that the administrative controls on the total fire water supply of 180,000 gallons will require a water conservation program to be instituted by the two plants.

As a system back up the licensee now proposes to make available a spool piece that will tie the discharge header of the three salt water screen wash pumps, 1600gpm at 86psig each, into the fire protection water supply.

After careful analysis of existing data we conclude that the water supply system, as proposed, is marginal and thereby may not meet all probable demands of the two nuclear units.

Appendix A to the Branch Technical Position, dated August 23, 1976, page 25 requires for operating plants:

2. (c) If pumps are required to meet system pressure or flow requirements, a sufficient number of pumps should be provided so that 100% capacity will be available with one pump inactive (e.g., three 50% pumps or two 100% pumps). The connection to the yard fire main loop from each fire pump should be widely separated, preferably located on opposite sides of the plant. Each pump should have its own driver with independent power supplies and control. At least one pump (if not powered from the emergency diesels) should be driven by non-electrical means, preferably diesel engine. Pumps and drivers should be located in rooms separated from the remaining pumps and equipment by a minimum three-hour fire wall. Alarms indicating pump running, driver availability, or failure to start should be provided in the control room.

   Details of the fire pump installation should as a minimum conform to NFPA 20, "Standard for the Installation of Centrifugal Fire Pumps."

   (d) Two separate reliable water supplies should be provided. If tanks are used, two 100% (minimum of 300,000 gallons each) system capacity tanks should be installed. They should be so interconnected that pumps can take suction from either or both. However, a leak in one tank or its piping should not cause both tanks to drain. The main plant fire water supply capacity should be capable of refilling either tank in a minimum of eight hours.

Common tanks are permitted for fire and sanitary or service water storage. When this is done, however, minimum fire water storage requirements should be dedicated by means of a vertical standpipe for other water services.

(e) The fire water supply (total capacity and flow rate) should be calculated on the basis of the largest expected flow rate for a period of two hours, but not less than 300,000 gallons. This flow rate should be based (conservatively) on 1,000 gpm for manual hose streams plus the greater of:

(1) all sprinkler heads opened and flowing in the largest designed fire area; or

(2) the largest open head deluge system(s) operating.

(f) Lakes or fresh water ponds of sufficient size may qualify as sole source of water for fire protection, but require at least two intakes to the pump supply. When a common water supply is permitted for fire protection and the ultimate heat sink, the following conditions should also be satisfied:

(1) The additional fire protection water requirements are designed into the total storage capacity; and

(2) Failure of the fire protection system should not degrade the function of the ultimate heat sink.

The proposed water supply does not meet the redundancy or volume as required by the BTP guidelines.

Upon further evaluation discrepancies were found in the maximum, fixed plus hose streams, water demand calculation supplied to the Laboratory by the licensee, Ref. Table 1. This maximum probable demand for the required two hours (BTP) ranges from 2739gpm to 1488gpm assuming 750gpm for manual hose streams. Assuming a total of 180,000 gallons available for fire fighting, the time period before the depletion of tank water is from 66 to 121 minutes. It should be noted that the 30,000 gallons from the 175' high head tank may not be able to inject directly into the yard loop at sufficient pressure to supply the demand. Therefore, we have assumed that this water will be available to the system only through the suction side of the fire protection pumps. Because of the minimal nature of the tank water supply for these two plants, a detailed analysis of the maximum water demand should be required. In addition, we recommend that physical dedication of the minimum needed water supply be enforced. This can be accomplished by either interior suction risers or new, hot tap, suctions for all non fire pumps above the lower limits. This conclusion is based on the lack of an accurate water level versus time history of the tanks and the uncertainties of administrative controls in the form of visual checks of tank level.

When reviewing the proposed use of the salt water screen wash pumps, as a secondary water supply, we recommend that if the pressure and flow rate is adequate

to supply the maximum demand for the fire protection system that they be permanently installed with technical specifications to control their testing and operation during the interfacing from the tank supply. At this point in time the uncertainties in the water demand, Table 1, raises the question of whether the system will require one, two, or three screen wash pumps or, if in fact, they will be at all adequate. We require additional information in the form of pump operating curves to reach a final conclusion in this area.

We also request that the staff consider three additional concerns regarding the use of salt water in the system.

1. Has the licensee considered the effect of salt water on the proposed foam system? All foam supplies do not respond favorably to brackish water.

2. Is there a positive means to assure that no salt water back flows into the raw water supply for the plant? If this does occur, what will be the impact on the plants and its personnel?

3. Have detailed operational specifications been developed to utilize the 500gpm portable fire pump effectively with the minimum staffing of the fire brigade of five men? Is this pump tested on line discharging into the yard loop or is the gasoline engine simply test started?

In addition to reviewing Turkey Point 1 & 2 for the adequacy of its water supply, we reviewed the historical requirements of the staff on the following sixteen plants.

Arkansas 2	Haddam Neck	Point Beach 1&2
Brunswick 1&2	Maine Yankee	Rancho Seco
Dresden 1,2&3	Oconee	Three Mile Island 1
Duane Arnold	Oyster Creek	Trojan
H.B. Robinson 2	Palisades	Vermont Yankee
	Pilgrim	

Based on this review, we again conclude that the proposed water supply could represent a minimal fire protection system and therefore at this time recommend augmenting the tank/screen wash pump system as described above. Upon receipt of the needed additional documentation this conclusion will be reevaluated.

2. Cable Protection - SER Section 5.8

There presently exists a main access hallway in the auxiliary building in which essential safety cabling, serving both units 3 and 4, are run - Area 58. Included in this area are the following cables:

Charging pumps 3A, 3B and 3C
Component cooling water pump 4C
Boric acid transfer pumps 3A, 3B, 4A and 4B
Auxiliary feedwater pump steam supply valves (MOV-3-1405, MOV-4-1405)
Boric acid injection stop valves (MOV-3-350, MOV-4-350)
Volume control tank isolation valve (MOV-3-115C, MOV-4-115C)

Auxiliary/Radwaste building exhaust and supply fans 3A, 3B, 3A-V10, 3B-V11
RHR pumps 3A, 3B, 4A and 4B
Accumulator stop valves (MOV-3-865C, MOV-4-865A)
Cold leg safety injection valves (MOV-3-843A, MOV-3-843B, MOV-4-843A)
Feedwater isolation valves (MOV-3-1408, MOV-4-1408)
Residual heat exhanger cooling water isolation valves (MOV-3-749A, MOV-3-749B, MOV-4-749A)
Refueling water stop valve (MOV-3-862A)
RHR to RCS isolation valves (MOV-3-744A, MOV-4-744A)
RCS to RHR isolation valves (MOV-3-751, MOV-4-751)
Component cooling water flow 3A, 3B, 4A and 4B
Steam generator level 4A and 4B
480 V motor control center feeder breakers 3C, 4C, D and D (alt)
Boric acid storage tank heaters A, B and C
Boric acid heat tracing transformers A and B
Unit 3 and 4 emergency lighting panels

Due to the large volume of safety related cables for the two plants in this area, and the constant exposure of these cables to transient flammable liquid and combustible oils we, at this time, recommend a fixed automatic sprinkler system or protection. We do not recommend the licensee proposed solution of administratively controling the transients in the area since there is a necessity of bringing chemicals of this type into the auxiliary building through the area.

If it is desired to reevaluate the presently needed conservatism in this conconclusion in light of plant alternate shutdown capabilities, we recommend the following:

Postulating a flammable liquid fire in this area, which would most probably affect normal shutdown capabilities of both units, evaluate the procedures, locations of controls and number of individuals that are required to shut the two units down through alternate means. Does this scenario allow the five trained members of the recommended fire brigade to fight the fire on all shifts of the plants without being reduced in number?

Based on the answer to the above question, refinements can be made on our present recommendation of a fixed sprinkler system to mitigate a transient exposure fire, if necessary. It should be noted that due to the types of transients being considered detection systems, electrical or fire watch, could prove too slow in responding to prevent major cable exposure.

3. Yard Hydrants - SER Section 3.1.3

There should be a 2-1/2" gate valve provided for each hydrant 2-1/2" outlet as recommended in staff position P.F.-23 submitted to F.P.L. under the date of July 14, 1978. The utility has stated that only one of the two outlets on each hydrant will be fitted with throttling gate valves. This will require both hose lines to be throttled by the hydrant in the event that the ungated portion must be throttled. Based on experience, concern exists that, due to the unusually high fire main pressure, the throttling of the hydrant valve could cause a discharge out of the drain valve which in turn could undermine the hydrant. The utilities contention that this blow down will not occur past one turn of the hydrant should be documented so that an evaluation of the data can be made.

The lack of the second gate valve introduces a second concern. In the event of a need to add hoses or replace damaged hoses to the line fed by the ungated section, both lines could have to be turned off. The licensees suggestion of utilizing a hose clamp to circumvent this scenario should be reviewed closely by the staff. Hose clamps are designed for emergency shutoff and as such do not assure a positive method to control water flow on a routine basis. Additionally there is no assurance that the clamps will be available at the required location when needed.

4. Smoke Venting Equipment - SER Section 3.1.17

Smoke venting equipment should be provided as recommended in staff position P.F.-24 submitted to F.P.L., July 14, 1978. F.P.L.'s response that they can see no measurable benefit by providing a third smoke ejector is in error. Two (2) 5,000 CFM or greater smoke ejectors will not be adequate to remove smoke and heat from areas of the plant, for example: 4160V SWITCHGEAR ROOMS, ELECTRICAL PENETRATION ROOMS, AUXILIARY BUILDING CORRIDOR and adjacent FIRE AREAS 21 and 22. It is recommended to the NRC staff that they require a minimum of three approved portable smoke ejectors for these two plants. The third ejector allows the total system the added versatility to remove isolated pockets of dense smoke by the direction of circulating air currents from three independent sources. In addition, the three unit concept can, if required, control the by product exhaust location by having one ejector discharging into the suction of a second and thereby removed to remote locations. Concurrently, the third unit feeds fresh air into the involved area. The three unit system also affords more portability than two ejectors since each unit can be lighter and smaller in volume and still meet the required air movement needs of the fire brigade. If in a two ejector system one unit malfunctions, smoke ventilation can be defeated. This is not the case with three ejectors since at least minimal air movement can be maintained by the two units that remain. This generic concept, utilized by professional fire fighting organizations, has previously been expressed to the NRC in other plant reviews and in a letter to R. Ferguson from R. Hall dated November 14, 1977.

Smoke Removal

The optimum means of smoke removal is a properly designed fixed ventilation system. This would be a fixed system with smoke removal as one of its prime design parameters. Field experience has shown that it is not always obtainable without extensive plant modification, and therefore portable smoke ejectors are recommended.

A minimum of three portable smoke ejectors with at least 17,500 CFM capacity...

An examination of specific locations at Turkey Point showed that there were areas where the BNL consultant determined that three fans were required due to the large size of these areas. An example of this is the 4160 volt switchgear rooms which contain approximately 14,000cu. feet each, and the long hall in the auxiliary building which contains approximately 21,000cu. feet. These areas and other large areas may require one fan blowing fresh air in and two fans exausting smoke.

A typical large room pre-fire plan is attached showing the recommended fan arrangement, Ref. Figure 1.

TABLE 1 9/18/78

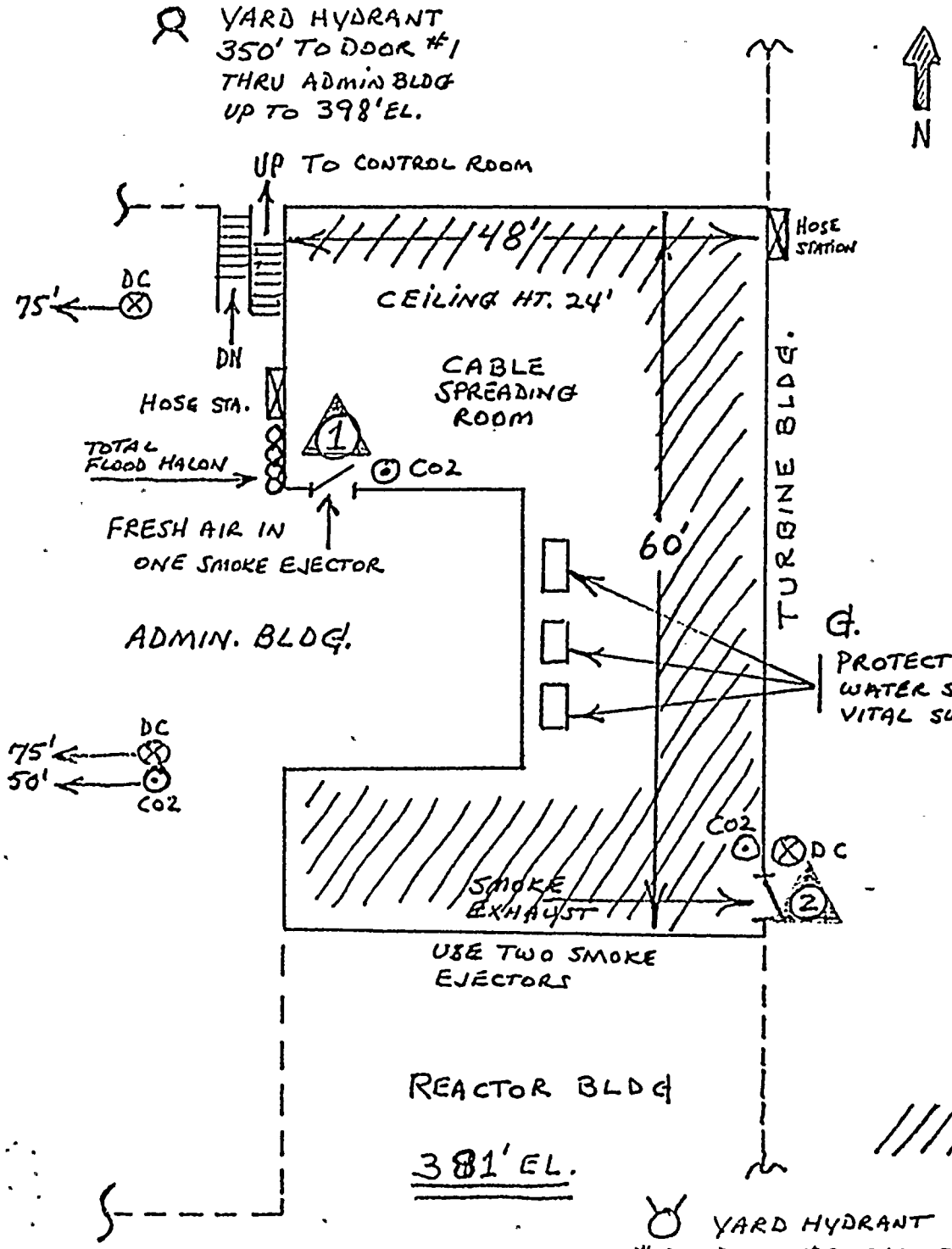
TURKEY POINT FIRE PROTECTION WATER DEMANDS

Fixed System Water Demand (GPM)	Hose Stream Water Demand (GPM)	Total (GPM)	Required Pump Discharge Pressure (psig)	Supply Time of 180,000 gal Dedication of Water (min)	Highhead Tank Head Loss at Fire Protection Header psig/100ft**	Screen Wash pump Discharge Capabilities into Fire Protection yard loop***
1989 Taken from Fire Hazards Analysis Report by F.P.L.	750	2739	100 estimated by BNL	66	29	Screen Wash pumps may not handle water demand
738 Submitted to BNL at Licensee, NRC meeting	750	1488	92 supplied by Lic.	121	9	Two pumps required
874 Discussed with BNL on Telecon with Licensee & NRC (July 14 letter)	750	1624	62 supplied by Lic.	111	11	One pump required
1190 Calculated by BNL based on Licensee submitted data.*	750	1940	100 estimated by BNL	93	15	Three pumps required

*Calculation based on maximum fixed demand of 3,597 $ft.^2$ at .3 density plus a 10% calculation factor.
**Calculation based on "C" factor of 110 and 76psig discharge pressure of high head tank (175ft). FIA quick Reference flow tables were utilized assuming no orifice or elbows.
***The conclusions drawn regarding the capability of the screen wash pumps to maintain fire protection system pressure is based on three pumps at 1600GPM and 86psig each, ref. FSAR. It should be noted that these conclusions are judgmental in basis since the exact pump operational curves were not available to the Laboratory and the details of installation of fire protection connection was not submitted.

FIRE FIGHTING STRATEGY #7

CABLE SPREADING ROOM



NOTES:

A. NORMAL INGRESS THRU DOOR (1).

B. 18' LADDER REQUIRED TO REACH UPPER CABLE TRAYS. LADDERS IN TURBINE BLDG. 360' EL.

C. SELF CONTAINED BREATHING EQUIPMENT NECESSARY. (HALON)

D. NORMAL SMOKE EXHAUST THRU DOOR (2) INTO TURBINE BLDG. - OUT ROOF VENTS.

E. SECONDARY INGRESS THRU DOOR (2) FROM TURBINE BLDG.

F. MANUAL HOSE LINE FROM HYDRANT #8 THRU DOOR #(2)

///// INDICATES CABLE TRAYS FLOOR TO CEILING - 18" CLEARANCES