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 FACIL:50-261 H. B. Robinson Plant, Unit 2, Carolina Power and Ligh 05000261  
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 HALL,R.E. Brookhaven National Laboratory  
 RECIP.NAME RECIPIENT AFFILIATION  
 FERGUSON,R.L. Plant Systems Branch

SUBJECT: Forwards detailed evaluation of Item 3..3, re propane tank & piping of facility design review & suppl evaluation submitted on 791211.

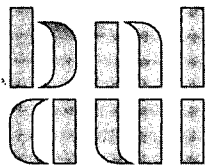
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## NOTES:

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January 9, 1980

50-261

Mr. Robert L. Ferguson  
Plant Systems Branch  
U.S. Nuclear Regulatory Commission  
Washington, D.C. 20555

RE: H.B. Robinson Fire Protection Review Item 3.2.3

Dear Bob:

On December 11, 1979 we mailed you our Design Review and Supplement evaluation for H.B. Robinson. Included in these was our evaluation for item 3.2.3 - Propane Tank and Piping.

At Mr. Tim Lee's request we have written a more detailed evaluation of this item which is attached hereto.

We concur with these conclusions and recommend that they be adopted.

Very truly yours,

Robert E. Hall, Group Leader  
Reactor Engineering Analysis

REH:EAM:sd  
attachment

cc.: R. Cerbone      wo/att.  
     W. Kato            "  
     E. MacDougall  
     V. Panciera      wo/att.

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H.B. Robinson Unit 2  
Fire Protection Review

The staff does not agree with the licensee's contention that the arrangement of the propane storage tank and other equipment is satisfactory in relation to safety-related equipment on the intake structure for the following reasons:

1. Although detonation of an unconfined propane-air cloud may be difficult, it is not impossible. Accidental and experimental detonations of propane-air vapor clouds have been reported by Strehlow and Baker ("The Characterization and Evaluation of Accidental Explosions", NASA report CR-134779, June, 1975), Lee et al ("Blast Effects from Vapor Cloud Explosions", presented at the 1977 AIChE Loss Prevention Symposium, March, 1977, Houston, Texas) and others. Lee et al reports that Kogarko et al (International Chemical Engineering, Volume 6, No. 3, page 93, 1966) found pressures of 0.5 atmosphere at distances of about five times the vapor cloud radius in detonations of spherical stoichiometric propane-air mixtures.
2. Confinement of the propane-air vapor cloud by the missile shields and other barriers on the intake structure could alter significantly the severity of damage produced by ignition of the vapor cloud.
3. The licensee has not provided the basis for concluding that the indicated peaked pressures and fireballs will not damage any safety-related equipment on the intake structure. No details are provided regarding the applicability of the U.S. Department of the Interior 12 psig damage limit to this situation.
4. The 500 gallon propane storage tank probably represents the least amount of propane which must be considered in the analysis. Refilling the tank from time to time will introduce the additional hazard of a much larger quantity of propane carried on the tank truck, plus the hazard of transferring the propane to the storage tank.
5. It is doubtful that the special needs of nuclear power plants were considered in the separation distances specified in NFPA 58.
6. Damage to equipment other than pumps and piping, such as wiring and control equipment, may be sufficient to impair the operability of safety-related pumps on the intake structure.

H. B. ROBINSON UNIT 2  
FIRE PROTECTION REVIEW

3.2.3 Propane Tank and Piping

SER Section 3.2.3 indicates that the licensee would provide an analysis of the fire hazard associated with the propane tank supplying the propane engine-driven fire pump.

By letter dated June 23, 1977, the licensee discussed the consequences of a postulated BLEVE (Boiling Liquid Expanding Vapor Explosion) of the 500 gallon propane storage tank. The licensee estimated that the shock wave resulting from tank rupture would decay to less than 1 psig at about 40 feet from the tank and that the fireball would release energy at a rate sufficient to ignite wood at 66 feet and last nearly 10 seconds. The licensee concluded that these effects presented no hazard to safety related equipment at the intake structure.

By letter dated October 27, 1977, the licensee discussed the consequences of a break in the fuel supply line from the propane storage tank to the fire pump engine. Two scenarios were considered: Immediate ignition of the leaking propane, and delayed ignition. The licensee concluded that in case of immediate ignition, the missile shield on the intake structure and the distance between safety-related pumps and the postulated fire would preclude significant damage to safety-related equipment on the intake structure. The licensee further concluded that in the case of a delayed ignition of the vapor cloud a deflagration, rather than a detonation, would occur. The licensee cited three technical articles which claimed that detonation of unconfined propane-air vapor clouds is not possible, and stated that the modest overpressures due to a deflagration would not damage the safety-related pumps. However, the licensee proposed to install an automatic fuel shut-off valve at the propane storage tank connection to the fuel supply line in accordance with the requirements of NFPA 37 and 58.

By letter dated March 30, 1978 the licensee reiterated his contention that detonation of a propane-air mixture was not possible, and also revised earlier estimates of the overpressure produced during a postulated BLEVE. The licensee concluded that the peak pressures of 1 to 1 1/2 psig produced by a BLEVE or a vapor cloud deflagration would not damage safety-related pumps or piping because the U.S. Department of the Interior has stated that at least 12 psig is necessary to cause such damage. The licensee further argued that the 50 foot separation between the tank and the safety-related pumps and piping was adequate because it exceeded the 10 foot minimum separation between above ground tanks of this size and important buildings specified in NFPA 58.

H.B. Robinson Unit 2  
Fire Protection Review

Therefore, we recommend that the licensee:

- Replace the propane tank and associated supporting equipment with a diesel engine, or
- Relocate the propane engine-driven fire pump and associated equipment to a location substantially remote from any safety-related equipment.