



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION
REGARDING THE PROXIMITY OF COVE POINT LNG FACILITY
BALTIMORE GAS AND ELECTRIC COMPANY
CALVERT CLIFFS NUCLEAR POWER PLANT UNITS NOS. 1 AND 2
DOCKETS NOS. 50-317 AND 50-318

1.0 Introduction

In response to our request⁽¹⁾, Baltimore Gas and Electric Company (BG&E) provided an analysis of the effects on the Calvert Cliffs Nuclear Power Plant (CCNPP) of various hypothetical Liquefied Natural Gas (LNG) accidents⁽²⁾. Two of these hypothetical accidents, the failure of a LNG storage tank at the Cove Point terminal and a major LNG fire at or near the Cove Point facility, were reviewed and found to have no consequences which could interfere with the safe operation of CCNPP. This analysis was documented prior to the issuance of the CCNPP Unit No. 2 license by Supplement No. 5⁽³⁾, dated August 10, 1976, of our Safety Evaluation Report (SER). Two other hypothetical accidents, (a) the LNG release onto water from the largest single ship pipe failure and (b) the rapid release of one tank of LNG from a ship located at the closest approach to CCNPP, were left to be analyzed at a later time. This scheduling was to allow further study of the atmospheric dispersal of cryogenic fluid and of the types of accidents that could occur close to CCNPP. At the time of issuance of the licenses, the following license condition was imposed on each of the CCNPP units^(4,5):

"Liquefied Natural Gas (LNG) Traffic at Cove Point Terminal

The licensee shall provide one of the following items to the Commission 60 days prior to the initiation of LNG ship traffic at the Cove Point LNG Receiving Terminal:

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- a. An analysis to show that the probability of an accident that could affect plant safety due to an LNG tanker approaching closer to the plant than the distances assumed in the safety analyses (discussed in Supplement No. 5 to the Safety Evaluation Report issued August 10, 1976) is acceptably small, as defined in Section 2.2.3 of NUREG-75/087; or
- b. A commitment from the appropriate U.S. Coast Guard Port Authority that administrative limits will be imposed to prevent LNG traffic from approaching Calvert Cliffs Nuclear Plant closer than the distances assumed in the above-referenced analyses.

In addition, the licensee shall establish a mechanism whereby it will be promptly notified by the U.S. Coast Guard of abnormally dangerous occurrences involving LNG traffic in the vicinity of the Cove Point LNG Receiving Terminal."

BG&E provided an LNG Hazards Study⁽⁶⁾ in accordance with Part a. of the above license condition. We have determined that Part b. can be implemented if required by the Part a. analyses. In response to NRC requests for additional information^(7,8), BG&E provided further analyses^(9,10) in which BG&E concluded that the probability of an accident affecting CCNPP safety is acceptably small and meets the NRC Standard Review Plan guidelines.

2.0 Discussion and Evaluation

2.1 Short Term Versus Long Term Hazards

The initial operation of the LNG facility will involve only a small number of operations of tankers. Six tankers are scheduled to dock within the next three months. Various estimates have been made for eventual full capacity operation of the terminal which may exceed 100 tanker-operations per year. We have not yet completed our evaluation of what, if any, additional measures should be required to reduce the likelihood of gas release affecting the nuclear facility, considering the projected long term use of the Cove Point terminal. We have determined that engineering design measures are available which could be taken to further reduce the likelihood of an unacceptable event if required.

Should we obtain adequate assurance that the likelihood of events that could occur at the LNG dock and events that could occur to LNG tankers anchoring or maneuvering within close proximity of CCNPP, in the long term, are low enough with the present facility design, such measures would be unnecessary. We have, therefore, chosen to evaluate the hazard of the facility in two phases. This report treats the first phase of operation, namely the first three months of Cove Point operation which involves only about six tanker dockings.

2.2 Character of the Hazard

Should the Calvert Cliffs nuclear plant be severely damaged as a result of the ignition of gas evolved from an LNG spill, a significant release of radioactivity might result. However, only a small number of postulated scenarios involving the LNG operations could even theoretically produce such a result. Potential hazards to the Calvert Cliffs facility could result only from a large spill of LNG onto water from a major tanker accident. Other scenarios, such as breaks in transfer pipes or failure of land tanks, have been examined and found not to present a hazard to the facility because the rate of gas evolution would be slow enough to assure that dispersal of methane into the air would occur and a hazardous gas cloud could not reach the plant. Ignition of the flammable cloud from a very large spill would not present a hazard to the facility unless the flammable gas were within or among the facility structures. This is because the vital areas of the plant are protected by concrete structures and radiant heat or overpressures which might result from a deflagration of the cloud near the plant would not be harmful.

The small class of spills which could adversely affect the plant is made even smaller by the fact that the cloud must remain unignited while it leaves the ship and transits to the plant. Nearly all impacts or internal ship events large enough to cause a major LNG release would involve fire or ignition sources from electrical equipment. In our analysis we conservatively assumed that only 90% of such cases would involve an ignition source at the time of release. Any hazard to the nuclear facility would be eliminated by ignition at the ship.

2.3 Likelihood of Hazard

We have estimated the likelihood of the hazard to the plant from LNG operations based on an evaluation of the rate of major unignited spills, both in transit and at dock or other anchorage, combined with the likelihood of a spill being blown in the direction of the plant. This analysis was made for various locations near the plant and at the LNG terminal dock. The likelihood of a major event during transit was found to be very low, compared to the likelihood of a major event during docking, anchoring or maneuvers close to the dock, and not a significant consideration for the three-month period of this analysis.

We have concluded that the probability of a large unignited spill leaving the ship is less than about one chance in 100,000 per dockage. Only a very conservative cold-gas dispersion model combined with adverse meteorological dispersion conditions would predict that an unignited cloud would travel as far as the 5.6 Km distance from dock to reactor facility. We have assigned a combined factor between one chance in 10 and one chance in 100 for this aspect. In addition, the likelihood of the wind blowing in a direction from the dock which could endanger the facility is about one chance in 30.

All of these factors combine to indicate that even for as many as 10 dockages, the likelihood of an unignited cloud reaching the facility is significantly less than one in one million and perhaps less than one in ten million over a three-month period. We have concluded that this level of risk is comparable to the level of risk presented by other internal and external facility hazards and is acceptable.

We have also evaluated the potential hazard from temporary anchorage of an LNG tanker much nearer the facility than the terminal dock and have concluded that for anchorages greater than about 3 Km from the facility, the same factors discussed above apply with somewhat higher values for the probability of undesired meteorological conditions. We have therefore concluded that the hazard from anchorages north of the terminal facility under low frequency usage conditions, as projected for the next few months, is acceptable.

Anchorage much closer than 3 Km could potentially present a substantially higher hazard as any unignited plume released as a result of major internal structural damage would be much more likely to reach the nuclear facility. The LNG tankers require, however, about 36 feet of water depth, and an additional four feet of depth is usually sought for anchorage. All areas less than about 2 Km and most areas less than 3 Km from the nuclear plant are, therefore, not feasible anchorage locations.

Considering (1) that use of anchorages very near the plant, i.e., less than about 3 Km, is expected to be unusual, (2) that most of these anchorages are probably unfeasible due to the shallow depth of water, and (3) that the probability of an LNG spill from a single anchorage between 2 and 3 Km affecting the plant does not greatly exceed one in one million, we conclude that no additional measures need be taken at this time.

However, we will continue to consider this matter during the next several months to determine whether it is desirable that the U. S. Coast Guard be requested to prohibit anchorages in the vicinity of the nuclear power plant for operation over the projected lifetime of the nuclear facility.

3.0 Conclusion

We have concluded, based on the considerations discussed above, that over the period of time covered by this SE, there is reasonable assurance that operation of the Cove Point LNG terminal will not jeopardize the safe operation of the facility, and that no operating limitations or other restrictions are necessary at this time in order to provide reasonable assurance that the health and safety of the public will not be endangered by continued operation at the Calvert Cliffs Nuclear Power Plant.

Dated: March 13, 1978

REFERENCES

1. NRC Request for Evaluation of LNG Hazard to CCNPP, letter, O. D. Parr to J. W. Gore, December 5, 1975.
2. BG&E Response to an Investigative Literature Survey on LNG Hazard Implications to CCNPP, letter, J. W. Gore to O. D. Parr, March 15, 1976.
3. NRC Supplement No. 5 to SER for CCNPP, August 10, 1976.
4. NRC License for CCNPP Unit No. 2, August 13, 1976.
5. NRC Amendment No. 20 for CCNPP Unit No. 1, February 11, 1977.
6. BG&E Response on LNG Hazards Study, letter, J. W. Gore to K. Kniel, December 31, 1976.
7. NRC Request for Additional Information, letter, D. K. Davis to A. E. Lundvall, November 9, 1977.
8. NRC Request for Additional Information, letter, R. W. Reid to A. E. Lundvall, February 22, 1978.
9. BG&E Response to Request for Additional Information, letter, A. E. Lundvall to D. K. Davis, December 12, 1977.
10. BG&E Response to Request for Additional Information, letter, A. E. Lundvall to R. W. Reid, March 9, 1978.