ENCLOSURE 4

SHEARON HARRIS NUCLEAR POWER PLANT
DOCKET NO. 50-400/LICENSE NO. NPF-63
REQUEST FOR LICENSE AMENDMENT
CHLORINE DETECTION SYSTEM

TECHNICAL SPECIFICATION PAGES

LIMITING CONDITIONS FOR OPERATION AND SURVEILLANCE REQUIREMENTS

INSTRUMENTATION

CHLORINE DETECTION SYSTEMS

Specification 3/4 3.3.7 DELETED

~~LIMITING CONDITION FOR OPERATION~~

3.3.3.7 Two independent Chlorine Detector Trains, with their Trip Setpoints adjusted to actuate at a chlorine concentration of less than or equal to five ppm, shall be OPERABLE. Each train shall consist of: a detector at each Control Room Ventilation System intake (both normal and emergency); and a detector at the chlorine storage area whenever liquid chlorine is present at the storage area in quantities greater than 20 lbs.

APPLICABILITY: All MODES.

ACTION:

a. With one Chlorine Detector Train inoperable, restore the inoperable system to OPERABLE status within 7 days or within the next 6 hours initiate and maintain operation of the Control Room Area Ventilation System in the recirculation mode of operation.

b. With both Chlorine Detector Trains inoperable, within 1 hour initiate and maintain operation of the Control Room Area Ventilation System in the recirculation mode of operation.

c. The provisions of Specification 3.0.4 are not applicable.

SURVEILLANCE REQUIREMENTS

4.3.3.7 Each Chlorine Detector Train shall be demonstrated OPERABLE by performance of a CHANNEL CHECK at least once per 12 hours, an ANALOG CHANNEL OPERATIONAL TEST at least once per 31 days and a CHANNEL CALIBRATION at least once per 18 months.

SURVEILLANCE REQUIREMENTS (Continued)

Revisions 2, March 1978, and the system flow rate is 4000 cfm ± 10% during system operation when tested in accordance with ANSI N510-1980; and

2. Verifying, within 31 days after removal, that a laboratory analysis of a representative carbon sample obtained in accordance with Regulatory Position C.6.b of Regulatory Guide 1.52, Revision 2, March 1978, meets the laboratory testing criteria of Regulatory Position C.6.a of Regulatory Guide 1.52, Revision 2, March 1978, by showing a methyl iodide penetration of less than 0.175% when tested at a temperature of 30°C and at a relative humidity of 70% in accordance with ASTM D3803.

c. After every 720 hours of charcoal adsorber operation, by verifying, within 31 days after removal, that a laboratory analysis of a representative carbon sample obtained in accordance with Regulatory Position C.6.b of Regulatory Guide 1.52, Revision 2, March 1978, meets the laboratory testing criteria of Regulatory Position C.6.a of Regulatory Guide 1.52, Revision 2, March 1978, by showing a methyl iodide penetration of less than 0.175% when tested at a temperature of 30°C and at a relative humidity of 70% in accordance with ASTM D3803.

d. At least once per 18 months by:

1. Verifying that the pressure drop across the combined HEPA filters and charcoal adsorber banks is less than 5.1 inches water gauge while operating the system at a flow rate of 4000 cfm ± 10%;

2. Verifying that, on either a Safety Injection or a High Radiation test signal, the system automatically switches into an isolation with recirculation mode of operation with flow through the HEPA filters and charcoal adsorber banks;

3. Verifying that the system maintains the control room at a positive pressure of greater than or equal to 1/8 inch Water Gauge at less than or equal to a pressurization flow of 315 cfm relative to adjacent areas during system operation;

4. Verifying that the heaters dissipate 14 ± 1.4 kW when tested in accordance with ANSI N510-1980; and

5. *Deleted* ~~Verifying that, on a High Chlorine test signal, the system automatically isolates the control room within 15 seconds and initiates a recirculation flow through the HEPA filters and charcoal adsorber banks.~~

BASES

REMOTE SHUTDOWN SYSTEM (Continued)

This capability is consistent with General Design Criterion 3 and Appendix R to 10 CFR Part 50.

3/4.3.3.6 ACCIDENT MONITORING INSTRUMENTATION

The OPERABILITY of the accident monitoring instrumentation ensures that sufficient information is available on selected plant parameters to monitor and assess these variables following an accident. This capability is consistent with the recommendations of Regulatory Guide 1.97, Revision 3, "Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Plant Conditions During and Following an Accident," May 1983 and NUREG-0737, "Clarification of TMI Action Plan Requirements," November 1980.

3/4.3.3.7 ~~CHLORINE DETECTION SYSTEMS~~ DELETED

~~The OPERABILITY of the Chlorine Detection Systems ensures that sufficient capability is available to promptly detect and initiate protective action in the event of an accidental chlorine release. This capability is required to protect control room personnel and is consistent with the recommendations of Regulatory Guide 1.95, Revision 1, "Protection of Nuclear Power Plant Control Room Operators Against an Accidental Chlorine Release," January 1977.~~

3/4.3.3.8 DELETED

3/4.3.3.9 METAL IMPACT MONITORING SYSTEM

The OPERABILITY of the Metal Impact Monitoring System ensures that sufficient capability is available to detect loose metallic parts in the Reactor System and avoid or mitigate damage to Reactor System components. The allowable out-of-service times and surveillance requirements are consistent with the recommendations of Regulatory Guide 1.133, "Loose-Part Detection Program for the Primary System of Light-Water-Cooled Reactors," May 1981.

3/4.3.3.10 RADIOACTIVE LIQUID EFFLUENT MONITORING INSTRUMENTATION

The radioactive liquid effluent instrumentation is provided to monitor and control, as applicable, the releases of radioactive materials in liquid effluents during actual or potential releases of liquid effluents. The Alarm/Trip Setpoints for these instruments shall be calculated and adjusted in accordance with the methodology and parameters in the ODCM to ensure that the alarm/trip will occur prior to exceeding the limits of 10 CFR Part 20. The OPERABILITY and use of this instrumentation is consistent with the requirements of General Design Criteria 60, 63, and 64 of Appendix A to 10 CFR Part 50.

ENCLOSURE 5

SHEARON HARRIS NUCLEAR POWER PLANT
DOCKET NO. 50-400/LICENSE NO. NPF-63
REQUEST FOR LICENSE AMENDMENT
CHLORINE DETECTION SYSTEM

PROBABILISTIC RISK ANALYSIS OF ACCIDENTS RELATED TO THE TRANSPORTATION OF CHLORINE IN THE VICINITY OF THE SHEARON HARRIS NUCLEAR PLANT

PROBABILISTIC RISK ANALYSIS OF ACCIDENTS RELATED TO THE TRANSPORTATION OF CHLORINE IN THE VICINITY OF THE SHEARON HARRIS NUCLEAR POWER PLANT

1. INTRODUCTION

CP&L has previously performed studies to assess the habitability of the Shearon Harris control room in case of postulated accidental ruptures of stationary or transient sources of chlorine in the vicinity of the Shearon Harris Nuclear Power Plant. The analyses included the postulated rupture of the on-site chlorine storage tank as well as accidents involving a chlorine tank truck on U.S. Highway 1 or a tank car on the Seaboard Cost Line (part of the Seaboard System Railroad, now a part of CSX Transportation), both occurring at the points on these routes nearest to SHNPP. Those analyses took credit for the chlorine detectors, located both in the control room fresh air intake duct and in the vicinity of the on-site chlorine storage tank, which would isolate the control room ventilation system and warn the control room operators in case of a chlorine release accident. Following guidance of Regulatory Guides 1.78 and 1.95, the analyses showed that the control room operators were adequately protected against credible chlorine release accidents.

CP&L has since removed the railway tank car used as the on-site storage tank from the SHNPP site. An amendment to Technical Specification 3.3.3.7 which eliminated the requirement for chlorine detectors in the chlorine storage area when no more than 20 pounds of chlorine are stored there was issued on August 23, 1988. A new study has now been preformed to determine if, in light of the absence of significant quantities of chlorine on site, the requirement for chlorine detectors in the control room ventilation system should be eliminated as well. These new analyses, which took credit for the ability of the control room operators to detect chlorine by odor and to protect themselves by donning breathing apparatus, calculated the probability that accidents involving the transportation of chlorine on U.S. 1 and on the Seaboard Cost Line could pose a hazard to the SHNPP control room.

2. METHODOLOGY

The first part of the study was estimating the frequency of clorine tank trucks on U.S. 1 and railroad tank cars on the Seaboard Cost Line in the SHNPP vicinity. Next, analyses were performed to determine the probability that a shipment along either route could pose a hazard. These analyses utilized Ebasco's TOXCHM computer program, which incorporates the methodology described in Regulatory Guide 1.95.

2.1 Shipment Frequencies

2.1.1 Highway

As far as could be determined, no specific information on the shipment of chlorine over U.S. 1 (nor over any other highway in North Carolina) has ever been published. According to the Director of Zone Operations, State Highway Patrol, the State of North Carolina does not maintain records of shipments of hazardous materials (other than spent nuclear fuel). A study performed by the Office of Technology Assessment of the U.S. Congress [1] showed that no such data on either the state or national level was available.

In the absence of site-specific statistical data, a variety of sources were consulted to enable an estimate of the frequency of chlorine tank trucks on U.S. 1. Studies had been performed on the transportation of hazardous materials in Virginia in 1977-78 [2]. These studies reported the percentage of trucks which carry hazardous materials on various highways in that state, as well as a breakdown of the types of materials carried. Because of the close proximity of the two states, these data can be used to estimate shipments in North Carolina. The North Carolina Division of Highways, furnished the daily vehicular traffic on U.S. 1 in 1986, as well as an estimate of the frequency of truck traffic [8].

The Chlorine Institute [3] reported that there is only one commercial chlorine producer in North Carolina, namely the LCP Co. in Acme, NC. In a telephone conversation, the plant manager of that facility stated that no chlorine was shipped by highway [4]. The 1977 Commodity Transportation Survey, conducted by the U.S. Census Bureau, reported the total tonnage of chlorine shipped from manufacturers to customers in the state, and also furnished a nation-wide split of chlorine transportation by truck, railroad and other means. An inquiry to one other chlorine producer in the area [5] showed that they also did not ship chlorine by truck.

Finally, the Chlorine Institute reported that there are only 100 chlorine tank trucks operating in all of North America, 13 of which are used for short hauls within California.

2.1.2 Railroad

CSX Transportation, the current operator of the Seaboard Coast Line, reported that the line from Raleigh to Hamlet, NC (just south of Sanford) is no longer a main line, due to the closing of the tracks north of Raleigh. The traffic on that section consists entirely of switch trains, involving the local transfer of cars, and does not include long distance trains, such as those that might be expected to carry chlorine cars for out-of-state shippers. A representative of the CSX Hazmat Section estimated that not more than one or two chlorine shipments per year could be expected on this track. A computer log of the traffic on that line during the last ten days of August 1988 showed no chlorine being shipped [7].

The LCP plant in Acme reported that most of their production was sent to a near-by paper mill and that only one to two tank cars per month were shipped elsewhere, one consumer being the CP&L Brunswick plant. In the absence of more specific data, the 1977 Commodity Transportation Study can be used to form a conservative estimate of rail shipment frequencies of chlorine.

2.2 The TOXCHM Computer Program

The hazards posed by postulated chlorine release accidents in the SHNPP vicinity to the control room operators were evaluated using a version of the TOXCHM computer program adapted to this purpose. This program, which is based on a model described in NUREG-0570 [6], was originally written by the NRC staff to evaluate the impact of a chemical release accident on a nuclear power plant. The model predicts toxic gas concentrations at the control room fresh air intake duct as well as inside the control room following an accident.

2.2.1 Joint Frequency Table

A file containing the average joint frequencies for 39 combinations of wind speed and stability class was constructed, using data collected by the SHNPP on site meteorological monitoring program during the years 1976-87. To obtain greater precision than that furnished in the report of these data, the frequencies were recalculated, using the number of hours for each occurrence and the total number of observations.

2.2.2 Meteorological Parameters

A file of meteorological data, including all 39 combinations of stability class and wind speed discussed in Section 2.2.1 (excluding those with a zero frequency) was constructed for use by TOXCHM. Since the consequences of a chlorine release accident for a given wind speed and stability class worsen with increasing temperatures, the highest plausible temperatures were used for each combination of wind speed and stability class. Classes E - G are likely to occur only at night. It was therefore assumed that both the ground and the air temperatures were 86°F, the highest likely nighttime temperature at the SHNPP site. Classes A - D could occur in the daytime. For these cases, the air temperature was assumed to be 104°F, while the ground was 122°F. These temperatures represent extreme conditions and are therefore highly conservative.

Each windspeed range was assigned the average speed in that range. Calms were assumed to represent a range of 0 to .75 mph, while the value 25 mph was assigned to the highest range ($\geq$ 25). The values of 90 and 275 cal/sec/m^2 were assigned to the nighttime (Classes E - G) and daytime (Classes A - D) cases, respectively, as in the original TOXCHM program. The meteorological data used by the program is listed in Table 1.

Table 1

METEOROLOGICAL CASES

CASE No.	STABILITY CLASS	WIND SPEED (mph)	TEMPERATURE AIR	(deg F) GROUND	THERMAL FLUX (cal/sec/m**2)
1	G	.4	86.	86.	90.
2	F	.4	86.	86.	90.
3	E	.4	86.	86.	90.
4	D	.4	104.	122.	275.
5	A	.4	104.	122.	275.
6	G	2.1	86.	86.	90.
7	F	2.1	86.	86.	90.
8	E	2.1	86.	86.	90.
9	D	2.1	104.	122.	275.
10	C	2.1	104.	122.	275.
11	B	2.1	104.	122.	275.
12	A	2.1	104.	122.	275.
13	G	5.5	86.	86.	90.
14	F	5.5	86.	86.	90.
15	E	5.5	86.	86.	90.
16	D	5.5	104.	122.	275.
17	C	5.5	104.	122.	275.
18	B	5.5	104.	122.	275.
19	A	5.5	104.	122.	275.
20	G	10.0	86.	86.	90.
21	F	10.0	86.	86.	90.
22	E	10.0	86.	86.	90.
23	D	10.0	104.	122.	275.
24	C	10.0	104.	122.	275.
25	B	10.0	104.	122.	275.
26	A	10.0	104.	122.	275.
27	F	15.5	86.	86.	90.
28	E	15.5	86.	86.	90.
29	D	15.5	104.	122.	275.
30	C	15.5	104.	122.	275.
31	B	15.5	104.	122.	275.
32	A	15.5	104.	122.	275.
33	E	21.7	86.	86.	90.
34	D	21.7	104.	122.	275.
35	C	21.7	104.	122.	275.
36	B	21.7	104.	122.	275.
37	A	21.7	104.	122.	275.
38	D	25.0	104.	122.	275.
39	B	25.0	104.	122.	275.

2.3 Method of Analysis

2.3.1 Estimation of Shipment Frequencies

Highway

Large highway shipments of chlorine occur primarily in tow forms: tank trucks, which carry 18 tons in a single tank, or trucks which carry one ton containers of the liquified gas. The 1977-78 Virginia surveys [2] showed one truck carrying chlorine out of 9,314 trucks sampled (the amount of chlorine was not specified). The North Carolina Division of Highways reports 7,000 vehicles per day on U.S. 1 with the percentage of trucks is estimated to be between 10 and 15 [8]. Combining these statistics (using the higher figure of 15% for the U.S. 1 truck traffic), we find that 41 chlorine trucks per year can be expected to pass the vicinity of SHNPP.

This value may be compared to the total number of truck shipments of chlorine destined for North Carolina in 1977. The 1977 Commodity Transportation Survey [11] reported that 66,000 tons of chlorine were shipped into the state during that year. Using the nation-wide statistics from the same survey, 16% of these shipments are estimated to have been by truck. If the average truck-load was 18 tons (the capacity of the chlorine tanker truck), then approximately 587 chlorine trucks entered the state that year (not including possible shipments that transited the state). Since U.S. 1 is not part of the interstate system, which is the primary route for long-distance travel by heavy trucks, and is but one of many major highways in the state, the assumption that 41, or approximately 7% of these 587 trucks used this route is conservative. (It is unlikely that chlorine being shipped through North Carolina would travel by tank truck; furthermore, any such trucks would probably not use U.S. 1).

Railroad

Although no shipments of chlorine are currently reported on the Seaboard Coast Line tracks near SHNPP, a conservative estimate can be made by again noting that 66,000 tons of chlorine were shipped into North Carolina in 1977. According to nation-wide statistics, 74% of these shipments would have been by rail. If the average car-load was 90 tons (the capacity of the largest chlorine tank cars), then approximately 543 chlorine tank cars entered the state that year (not including possible shipments that transited the state).

The track in question is no longer a main line and chlorine shipments over this line are not likely [7]. However, in order to perform a conservative analysis, it was assumed that 10%, or approximately 54, of the estimated 543 cars pass over this track annually.

2.3.2 Accident Scenarios

Highway

Tanks trucks traveling on U.S. 1 were assumed to carry 18 tons of chlorine in a single tank. The closest point on the road is 6,965 feet from the control room, at a bearing of 330 degrees. The road is assumed to follow a straight line within a five-mile radius of the plant.

Railroad

Railroad tank cars being transported on the Seaboard Coast Line were assumed to carry 90 tons of chlorine in a single tank. The closest point on the track is 10,740 feet from the control room, at a bearing of 326 degrees. The track is assumed to follow a straight line within a five-mile radius of the plant.

2.3.3 Analytical Procedure

The portion of the given transportation route within a five-mile radius of the control room was divided into 100 segments. An accident involving the total loss of lading of a single chlorine container was postulated to occur at the center of each segment. The probability that such an accident could cause the concentration in the control room to exceed the toxicity level of 15 ppm (in accord with Regulatory Guide 1.78) was calculated, using the meteorological data in Table 1 and the joint frequencies of occurrence of stability class, wind speed and direction, as discussed above. The overall annual probability that chlorine shipments could pose a hazard to SHNPP was calculated, using data on the frequency of shipment of chlorine in the SHNPP vicinity and national accident statistics from NUREG/CR-2650 [10], which utilized a value of 1.3×10^{-8} accidents per vehicle-mile to predict truck accidents causing large releases of hazardous materials, and a corresponding value of 8×10^{-8} for railroad tank cars.

This methodology is similar to the model described in NUREG/CR-3685 [9] while retaining the superior thermodynamic release model embodied in TOXCHM.

3. RESULTS

The results of the analysis showed that the total probability of an accident on the railroad which results in toxic chlorine concentrations in the control room being exceeded before the operators can don breathing apparatus is 2.2×10^{-8} per year. The corresponding value for trucks is 3×10^{-9} per year, for a total probability of 2.5×10^{-8} per year.

4. CONCLUSIONS

Regulatory Guide 1.70 and the Standard Review Plan do not require the consideration of accidents with an annual probability of less than 10^{-7} per year. Accordingly, an accident involving the transportation of chlorine in the SHNPP vicinity need not be considered in the safety evaluation of the plant, provided that control room personnel have access to breathing apparatus and are trained to recognize chlorine by its odor. These results thus justify a petition for relief from the present technical specification, which would require operating chlorine detectors in the control room HVAC system event if there were no chlorine on site and the requirements for chlorine detectors in the chlorine storage area were eliminated.

5. DISCUSSION

5.1 Consequence of Shipment Frequency Estimates

The primary contribution to the calculated probability of a hazard is from the railroad, which accounts for roughly 90% of the total. The actual number of chlorine cars shipped on this track is probably far less than that assumed for this analysis. Were it to be as much as four times higher, however, the probability of a chlorine hazard would still be less than the threshold value of 10^{-7} per year. Similarly, a twenty-five-fold increase in the estimated truck traffic would not cause the threshold to be exceeded, notwithstanding the fact that few, if any, of the estimated number of trucks are chlorine tankers, instead of the more common general purpose vehicles carrying chlorine in one ton or smaller containers. An accident involving the latter type vehicle would have a negligible impact on the SHNPP control room.

5.2 Applicability of Model Assumptions

One aspect of the model which requires justification is the assumption that the route segment within five miles of SHNPP follows a straight line. U.S. 1 does in fact follow a straight line to the northeast of the plant. Northwest of the plant, however, the road bends away from the plant, then bends again to resume its original direction. At all points on this route segment, however, the road either follows the line assumed in the model or is at a greater distance. Since the impact of the postulated accident decreases with distance, the assumption that the road follows a straight line is conservative.

The Seaboard Cost Line generally follows a straight line to the northeast of the plant. A slight curvature first carries the track beyond the hypothetical straight line, then brings it closer to the plant than assumed, at a distance of about 24,500 feet. This has no effect on the results, however, since the analysis shows that an accident at that distance would have no impact on SHNPP. In the northwestern direction, beginning at a point 19,700 feet from the plant, the track begins to curve in a direction that brings it closer to the plant than assumed by the model. The results of the analysis include impacts of accidents up to 23,910 feet away. The straight-line model assumes a length of track of 4,847 feet between these two distances, when in fact measurement of the track on the 1:24,000 U.S. Geological Survey maps of the area show the actual track segment between these two distances from the plant to be less than 7,750 feet, or approximately 2,900 feet more than predicted.

To estimate the contribution that this additional 2,900-foot segment could make to the results of the analysis, it is assumed, for the sake of conservatism, that this entire segment lies at a distance of 19,700 feet from the plant. The analysis shows that an accident at this would have an impact only under meteorological conditions described by case 13 and only if the wind were within a $.96^{\circ}$ fan. The historical meteorological data, discussed in Section 2.2.1, shows that the wind is from the west under the case 13 conditions .014% of the time. Combining these factors with the assumed accident and chlorine tank car frequencies results in an additional annual probability of 1.4×10^{-11}, an increase of less than 0.1%. Thus, the assumption that the route follows a straight line has a negligible effect on the calculated results.

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