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March 9, 1988

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D.C. 20555

Subject: LaSalle County Station Units 1 and 2
Proposed Technical Specification Change for
Facility Operating Licenses NPF-11 and NPF-18
Ammonia Detection System
NRC Docket Nos. 50-373 and 50-374

References (a): Letter dated March 6, 1987 transmitting
Proposed Technical Specification Change to
Allow Removal of Ammonia Detectors

(b): Letter dated January 6, 1988 transmitting
Revision 5 of the Report "Habitability of the
LaSalle County Station Control Room Following
Postulated Accident Involving Shipments of
Anhydrous Ammonia in the Vicinity of LaSalle
County Station."

Dear Sir:

Commonwealth Edison transmitted a proposed technical specification amendment (Reference (a)) which would allow removal of the requirement for the Ammonia Detection System at LaSalle County Station. Subsequent, additional information became available which enhanced the basis for that request. That information was transmitted in Reference (b).

Members of the NRC Staff requested clarification of the material presented in References (a) and (b) and that a detailed description be provided of the conservatisms involved in the calculations. Those descriptions, a cross reference between this supplement and Reference (b) are included in the attachment to this letter.

If you have any questions, please contact this office.

Very truly yours,

C M Allen

C. M. Allen
Nuclear Licensing Administrator

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1.0 SUMMARY

Section 9.0 of Revision 5, "Discussion of Results", described the magnitudes of conservative and realistic probabilities of causing uninhabitable conditions in the LaSalle Control Room due to accidental release of anhydrous ammonia in the vicinity of the LaSalle County Station. The conservatisms involved in calculating the aggregate probability of 2.85×10^{-6} per year were also described and presented in Exhibit 13 of Revision 5.

The purpose of this supplement is to present a detailed description of the conservatisms involved in the calculations, and to show that these probabilities are indeed lower, when combined with realistic assumptions.

Methods of calculating realistic probability are also described in this Supplement. The realistic aggregate probability has been calculated to be 2.0×10^{-7}/year (Exhibit 15S). Exhibits 14 and 15 presented in Revision 5 have been revised and two new exhibits have been included to support the realistic aggregate probability presented in this Supplement. Finally, a cross-reference of exhibits between Revision 5 and this Supplement, and an errata sheet for Revision 5 are also included for clarification of information presented.

2.0 CALCULATION OF REALISTIC AGGREGATE PROBABILITY

The calculated individual conservative probability of offsite and onsite sources of anhydrous ammonia that could result in uninhabitable conditions in the control room was shown in Exhibit 13 of Revision 5. The maximum individual probability of such an event was shown to be 8.44×10^{-7} per year in Exhibit 10 of Revision 5. Similarly, aggregate probability of these sources was shown to be 2.85×10^{-6} per year in Exhibit 13 of Revision 5.

To calculate the realistic aggregate probability, presented in this Supplement, each event contributing to this conservative aggregate probability of 2.85×10^{-6}/year was analyzed in terms of conservatisms involved in the Revision 5 assessment. Based on realistic accident conditions, a probability assessment was made of individual events in the following manner:

2.1 Barge Traffic

The probability of causing uninhabitable conditions due to release of anhydrous ammonia from 121 ammonia barges was shown to be 3.15×10^{-7}/year in Exhibit 9 of Revision 5. This probability is based on accidents involving complete rupture of an 1800-ton pressurized anhydrous ammonia carrying barge which instantly releases its contents.

Anhydrous ammonia, when spilled on water, produces a buoyant plume of ammonia vapor (Reference 27). On the basis of spill studies of liquid ammonia on water and corresponding numerical models developed (Reference 27), the concentration at the control room intake and the height of rise of the ammonia plume can be predicted. The concentrations of ammonia at the control room intake due to an 1800-ton spill at a distance from the Illinois River to the plant have been calculated. These concentrations range between negligible and 6.6 ppm depending upon atmosheric stability conditions (Exhibit S-1). The concentration of 6.6 ppm is well below the toxicity limit of 100 ppm. The heights of rise of the ammonia plume due to this 1800-ton spill are estimated to range approximately between 900 and 5000 feet (Exhibit S-1). These concentrations and heights of rise are based on the wind velocity which results in maximum control room concentration of ammonia under neutral and stable atmospheric conditions. As shown in Exhibit S-1, an ammonia plume released due to barge accidents would not cause uninhibitable conditions in the control room under the stable dispersion conditions (stability Class F) which represent the worst five percent meteorlogy at the LaSalle County Station site.

Therefore, the conservative probability of causing uninhabitable conditions in the control room due to 121 barge shipments per year can be reduced from 3.15×10^{-7}/year (Exhibit 9 of Revision 5) to zero.

2.2 Off-site Storage Tanks (Kaiser Agricultural and Seneca Port Authority)

The conservative probability of causing uninhabitable conditions due to release of anhydrous ammonia from the refrigerated storage tanks was shown in Exhibit 12 of Revision 5. This is based on accidents involving complete rupture and subsequent release of the entire tank contents. This calculation also assumed that all stability classes would be sufficient to cause the control room to become uninhabitable (See Section 7.0 of Revision 5). The realistic probability of causing uninhabitable conditions due to release of anhydrous ammonia from these refrigerated storage tanks is shown in Exhibit 14 of Revision 5.

A reevaluation of the assumptions has determined that the probability attributable to the Kaiser Agricultural tanks would not change and it remains at 2.0×10^{-7} per year (Exhibit 14 of Revision 5). However, further investigations of the Seneca Port Authority Tank (30,000 tons) indicated that there is an earthen dike of sufficient height to contain the entire contents of the tank (Reference S-1). Therefore, the realistic probability attributable to the Seneca Port tank was revised. Assuming a complete rupture of the tank and using NRC NUREG-0570 (Reference S-2), it is shown in Exhibit S-2 that under stability Class F, the concentration in the control room is

79.4 ppm. This concentration is lower than the toxicity limit of 100 ppm. Therefore, the conservative probability of causing uninhibitable conditions in the control room due to releases from the Seneca Port tank can be reduced from 4.87×10^{-7} (Exhibit 12 of Revision 5) to zero (Exhibit 14S).

2.3 Tank Trucks on County Road 6

The conservative probability of causing uninhibitable conditions due to release of anhydrous ammonia from tank trucks on County Road 6 was shown in Exhibit 10 of Revision 5 to be 8.44×10^{-7}/year. This calculation assumed 50 tank truck shipments on County Road 6. This assumption is conservative because according to the owner of Walter Seed and Fertilizer Inc., located at Grand Ridge, Illinois, most of the annual shipments to his distribution center are supplied by W. R. Grace Company, located in Henry, Illinois on Illinois Highway 18, approximately 35 miles southwest of the LaSalle County Station (Reference 15). Even if some anhydrous ammonia is supplied by Kaiser Agricultural located in Marseilles, Illinois on U.S. Highway 6 approximately 5 miles northwest of the LaSalle County Station, the tank trucks would haul anhydrous ammonia to Walter Seed and Fertilizer Inc. via U.S. Highway 6 and Illinois Highway 23 (Reference 15). Illinois Highway 23 is more than 5 miles west of the station.

Therefore, based on the location of distribution centers and wholesale and retail suppliers, it can be concluded that County Road 6 would not be used to transport anhydrous ammonia in tank trucks and the conservative probability of causing uninhabitable conditions in the control room due to tank truck shipments on County Road 6 can be reduced from 8.44×10^{-7}/year to zero.

2.4 Fertilizer Tanks on Station Service Road and on Leased Land

As discussed in Sections 3.2.1 and 6.0 of Revision 5, approximately 300 acres of land within the exterior fenced area of the station are leased to farmers. Currently, these farmers use 28% granular nitrogen to fertilize the leased lands. However, to account for the potential use of anhydrous ammonia, a conservative probability to cause uninhabitable conditions in the control room due to accidental releases from farm fertilizer containers on the LaSalle Station service road and the leased lands were calculated. This was shown to be 2.70×10^{-7}/year and 2.74×10^{-7}/year in Exhibit 11 of Revision 5, for the respective events.

The assumption that anhydrous ammonia is used as a fertilizer on the leased lands is conservative because Commonwealth Edison Company has the option to stipulate a condition in the lease agreement with the farmers which would prohibit the use of anhydrous ammonia. The text of this condition would be similar to one listed below:

> Tenant agrees not to use or transport across the leased premises, anhydrous ammonia fertilizer NH_3, or any trailers, tanks and storage facilities containing this fertilizer.

Based on this stipulation, the probabilities of 2.70×10^{-7}/year and 2.74×10^{-7}/year due to accidental releases from farm fertilizer containers on LaSalle Station service road and the leased lands, respectively, can be reduced to zero for both events.

In summary, based on a realistic probability assessment of individual events described above, the conservative aggregate probability shown in Exhibit 13 of Revision 5 of 2.85×10^{-6}/year can be reduced to 2.0×10^{-7}/year (Exhibit 15S).

3.0 CONCLUSIONS

An evaluation of transportation of anhydrous ammonia and the impact of accidents on the LaSalle County Station per Regulatory Guide 1.78 and NUREG-0800, using realistic assumptions, has been performed. The conservative aggregate probability of causing uninhabitable conditions at the LaSalle County Station control room has been calculated to be 2.85×10^{-6}/year as shown in Exhibit 13 of Revision 5. This probability is of the same order of magnitude as the probability criteria specified by NUREG-0800. However, as discussed in this Supplement, when the conservatism in the calculated probability is removed by reasonable assumptions, the exposure risk becomes 2.0×10^{-7}/year (Exhibit 15S). This probability is shown to be an order of magnitude less than the conservative probability criteria specified by NUREG-0800. Therefore, the toxic hazard posed by the accidental release of anhydrous ammonia in the vicinity of the LaSalle County Station is not considered a significant risk to the safe operation of the station.

4.0 REFERENCES

S-1. Glen McDonald, Plant Operations Manager, Seneca Port Authority, in Telephone Conversation with Sargent & Lundy Engineers, January 18, 1988.

S-2. NUREG-0570, Toxic Vapor Concentrations in the Control Room Following a Postulated Accidental Release, prepared by J. Wing, June 1979.

CROSS-REFERENCE OF EXHIBITS

Some of the exhibits in Revision 5 have been revised. The following cross-reference table lists the new exhibit numbers, included in Supplement 1, and the corresponding exhibits, if any, in Revision 5.

Revision 5	Supplement 1
	Exhibit S-1 (new)
	Exhibit S-2 (new)
Exhibit 14	Exhibit 14S*
Exhibit 15	Exhibit 15S*

*A revision is indicated on Exhibits by a bar on the right-hand margin.

EXHIBIT S-1

HEIGHT OF RISE OF PLUME FROM ANHYDROUS AMMONIA BARGE SPILL*

Mass of ammonia spilled, tons		1800
Maximum radius of spill, ft		374
Time for complete vaporization, te, sec		109
Fraction vaporized %		40
Density of vapor ($-28.1^{o}F$), lb/ft^3, Pv		0.05556
Volume of vapor, V_v, ft^3		2.59×10^7
Fractional density of vapor relative to air $(1 - Pv/Pa) = \Delta v$		0.259
Buoyancy flux, $FP = Vv\ g\ \Delta v/\pi\ te$, ft^4/sec^3		6.33×10^5
Atmospheric stability	Neutral	Stable
Wind speed, U, ft/sec	16.4	5
Buoyancy length, $lp = F_p/U^3$, ft	144	5066
Plume rise coefficient $C = (1.5\ lp)^{1/3}$	5.99	19.7
Distance to control room, L, ft	22700	22700
Height of rise $Z = CL^{2/3}$, ft	4805	NA
Concentration of ammonia at intake under neutral conditions	negligible	NA
Brunt Vaisalla frequency, ω		0.01304
Stratification parameter, $So = V/lp\,\omega$		0.0757
Maximum height of rise, $Z_\infty = lp\ (So)^{2/3}$, ft		906
Horizontal travel distance to reach maximum plume height, $X_\infty = (Z_\infty/C)^{1.5}$, ft		313
Atmospheric stability		Stable
Height of control room intake above Illinois River, ft		372
Plume dispersion coefficient (vertical) σ_z, ft		131
Distance of intake from plume center, Zd, ft		534
Concentration of ammonia at plume center Co, ppm		26960
Concentration of ammonia at intake under stable conditions $C = C_o\, e^{-Zd^2/2\sigma_z^2}$, ppm		6.6

*Analysis based on Reference 27, Page 227
NA = Not Applicable

EXHIBIT S-2
REALISTIC PROBABILITY
OF UNINHABITABLE CONDITIONS IN CONTROL ROOM DUE TO ACCIDENTAL RELEASE
OF AMMONIA AT SENECA PORT AUTHORITY STORAGE TANK*

Chemical	Anhydrous Ammonia (refrigerated)
Quantity, tons	30,000
Diameter of area enclosed by dike, ft.	500
Area of surface within dike, ft^2	196350
Temperature of soil, ^oF	70
Temperature of ammonia, ^oF	-28.1
Heat transfer from soil to NH_3, cal/m sec	$197 \times 54.5/\sqrt{t}$
Heat transfer by convection, cal/m sec	87
Heat Transfer by soil Radiation, cal/m sec	97
Heat transfer by atmospheric radiation, cal/m sec	115
Heat transferred to ammonia 1st 2 minutes of spill, cal/m^2	271105
Quantity of ammonia evaporated during 1st 2 minutes, lb	32800
Rate of heat transfer to ammonia at 2 minutes, cal/m sec	1279
Rate of ammonia boil off at 2 minutes, lb/sec	155
Distance from control room, miles	6
Stability class	F
Horizontal dispersion coefficient, ft.	904
Vertical dispersion coefficient, ft.	130
Wind speed, ft/sec.	3.28
Concentration at control room intake, Co, ppm	3017
Control room air exchange rate, R, hr^{-1}	0.8
Concentration in control room after 2 (t) minutes, $C = Co\ (1-e^{-Rt/60})$, ppm	79.4

*Analysis based on NUREG-0570, Reference S-2

EXHIBIT 14S

REALISTIC PROBABILITY OF UNINHABITABLE CONDITIONS IN LASALLE COUNTY STATION CONTROL ROOM DUE TO ACCIDENTAL RELEASE OF ANHYDROUS AMMONIA FROM OFFSITE STORAGE TANKS

Source	Kaiser Agricultural Chemical	Seneca Port Authority
Quantity	1 - 20,000 ton tank 1 - 25,000 ton tank	30,000 tons
Distance from LaSalle Station	5 miles	
Wind Sector	N	
Probability of wind blowing from sector (stability classes E, F, & G & all wind speeds)	0.01	
Estimated accident frequency per year (Reference 33)	10^{-5}	
PROBABILITY OF CONTROL ROOM BECOMING UNINHABITABLE	2.0×10^{-7}/year	- - - - -

EXHIBIT 15S

REALISTIC AGGREGATE PROBABILITY OF UNINHABITABLE CONDITIONS IN LASALLE COUNTY STATION CONTROL ROOM

Event	Probability/Year	
Barge Traffic	___ ___ ___	(Exhibit S-1)
Kaiser Agricultural Chemical Tanks	2.0×10^{-7}	(Exhibit 14S)
Seneca Port Authority Tank	___ ___ ___	(Exhibit 14S)
Tank Trucks on County Road 6	___ ___ ___	(Section 2.3)
Fertilizer Tanks on Station Service Road	___ ___ ___	(Section 2.4)
Fertilizer Tanks on Leased Land	___ ___ ___	(Section 2.4)
	2.0×10^{-7}/year	