

Illinois Power Company

U-0667
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Docket No. 50-461

September 16, 1983

Director of Nuclear Reactor Regulation
Attention: Mr. A. Schwencer, Chief
Licensing Branch No. 2
Division of Licensing
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

- References:
1. IP letter U-0608, from G. E. Wuller to A. Schwencer (NRC), "SER Outstanding Issue #1"; dated March 4, 1983
 2. IP letter U-0658, from R. M. Nelson to A. Schwencer (NRC), "Transportation Accidents"; dated August 26, 1983

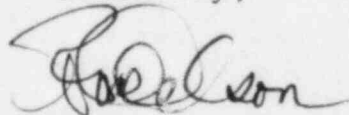
Subject: Clinton Power Station Unit 1
SER Outstanding Issue #1 (NUREG-0853)

Dear Mr. Schwencer:

Illinois Power Company previously responded to the subject SER issue on transportation accidents by the above referenced letters. This submittal provides additional and clarifying information relative to the conservatisms inherent in the reference 1 probability risk analysis which was requested by Mr. A. J. Sinisgalli during a telephone conference held on September 14, 1983.

The information requested is provided in the attached report. We believe that this additional information is adequate to fully resolve SER Outstanding Issue #1 for closeout in the next SER Supplement. Please inform us if you have any additional concerns regarding this matter.

Sincerely,



R. M. Nelson
Director-Nuclear Licensing
and Configuration Management
Nuclear Station Engineering

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Attachment

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cc: H. Abelson, NRC Clinton Licensing Project Manager
A. J. Sinisgalli, NRC SAB
H. H. Livermore, NRC Senior Resident Inspector
Illinois Dept. of Nuclear Safety

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Conservatism Inherent in the Clinton Probability
Risk Assessment of Postulated Releases
of Toxic Materials Shipped by Rail

Reference: IP Letter U-0608, from G. E. Wuller to A. Schwencer (NRC), "SER Outstanding Issue #1 (NUREG-0853)"; dated March 4, 1983

The referenced letter provided the NRC Staff with the Illinois Power Company report entitled "Evaluation of Control Room Habitability during a Postulated Release of Toxic Materials Shipped by Rail", prepared for the Clinton Power Station (CPS).

The purpose of this report is to provide, as requested by the NRC Staff reviewer (A. J. Sinasgalli), a more detailed discussion of the conservatism inherent in the probability risk assessment included in the referenced study.

Anhydrous ammonia and bromine were the only chemicals remaining for further consideration following the HAZCHEM evaluation (a computer-run diffusion analysis used to calculate control room chemical concentrations following a toxic chemical release near the plant).

The NRC Standard Review Plan, NUREG-0800, Section 2.2.3 provides criteria for determining if a toxic release need be considered a design basis event. Specifically, NUREG-0800 states:

"The probability of occurrence of the initiating events leading to potential consequences in excess of 10 CFR Part 100 exposure guidelines should be estimated using assumptions that are as representative of the specific site as is practicable. In addition, because of the low probabilities of the events under consideration, data are often not available to permit accurate calculation of probabilities. Accordingly, the expected rate of occurrence of potential exposures in excess of the 10 CFR Part 100 guidelines of approximately 10^{-6} per year is acceptable if, when combined with reasonable qualitative arguments, the realistic probability can be shown to be lower."

The risk assessment analysis in the referenced report employed two conservative and cross-checking methods to calculate the probability of a railcar rupture and toxic material release serious enough to affect the habitability of the CPS Control Room. The first probability calculation was a function

of the probability of release per car mile and the shipping frequency in cars per year. The second probability calculation was a function of the probability of release per ton mile and the shipping frequency in tons per year. The details of these calculations are not repeated here but can be found on pages 8-11 of the referenced report. To summarize the results of these calculations:

<u>TOXIC MATERIAL</u>	RELEASE PROBABILITY [$\frac{\text{release}}{\text{year}}$]	
	<u>CAR-MILE BASIS</u>	<u>TON-MILE BASIS</u>
Anhydrous Ammonia	4.06×10^{-7}	4.86×10^{-7}
Bromine	1.77×10^{-6}	8.50×10^{-7}
Totals (summed probability)	2.18×10^{-6}	1.34×10^{-6}

These probabilities demonstrate that the expected rates of occurrences for the initiating events leading to potential consequence in excess of 10 CFR Part 100 exposure guidelines are approximately 10^{-6} per year. These frequencies are acceptable if, when combined with reasonable qualitative arguments, the realistic probabilities can be shown to be lower.

The use of this probability assessment is conservative and the realistic probability can be shown to be lower because of following conservatisms:

1. Tank Car Modifications

No credit was taken in the release probabilities for the improved safety from recent tank car modifications. The release probability data were from 1971-77, before the tank car modifications were complete. As stated in the referenced report, these modifications are required by federal law, specifically title 49CFR. The details of these changes are noted on pages 11 and 12 of the Clinton analysis (reference).

Railroad tank cars transporting bromine or ammonia have been retrofitted to include safety features. The safety features consist of 1) head shields to deflect objects and strengthen tank heads to reduce the chance of tank puncture by couplers and other

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projectiles and/or 2) addition of shelves on the couplers to prevent coupler separation in a vertical direction when subject to compressive loads.

A NUS Corporation report entitled "Analysis of Hazards for Rail and Highway Transportation Routes Near the San Onofre Nuclear Generating Station Unit 1" provided an evaluation of the railcard modifications. Applicable portions of the report are summarized below.

Engineering assessments of the effectiveness of shelf couplers and head shields were made from National Transportation Safety Board proceedings.*

"According to AAR, Association of American Railroads, testimony, shelf couplers provide adequate protection in 60 percent of the accident situations." "FRA, Federal Railroad Administration, research concluded that the head shields would protect the tank car from punctures in the tank head in 85 percent of accident situations. The AAR believes that 50 percent reflected a more accurate figure for head shield protection." During these hearings, referenced above all parties agreed that installing both shelf couplers and head shields would provide the best protection, with puncture protection provided in over 85 percent of accident situations involving coupler override.

At present, there has not been sufficient accident experience to draw statistical conclusions about the effectiveness of the safety modifications; however, expert analysis of accident sequences has yielded encouraging results in support of the safety features.

An NTSB (National Transportation Safety Board) accident study**provides analysis of a rail accident in Paxton, Texas involving tank cars with and without protective head shields and shelf couplers. With respect to shelf coupler performance, a post-accident investigation showed that 21 of 21 shelf couplers remained coupled, while only 1 of 27 nonshelf couplers remained coupled. The shelf couplers were so effective that the head shields were not subjected to a test. In another accident, 5 of 6 hazardous material cars were equipped with head shields and shelf couplers. All 5 retained their loads.

* Safety Effectiveness Evaluation", Analysis of Proceedings of the National Transportation Safety Board into Derailments and Hazardous Materials April 4-6, 1978, Report Number: NTSB-SEE-78-2, National Transportation Safety Board.

** Heidzeberg, "Loss Prevention Symposium", European Fed. Chemical Industries, September 1977.

Initial accident experience does not refute the engineering assessment that the safety modifications could be 85 percent effective. For this assessment, a factor of two reduction in spill rate has been assumed.

2. No credit was taken for unstable winds. Stability classes A, B and C were considered even though these Pasquill Categories result in highly unstable atmospheric conditions that would not be conducive to a slow diffusion of the toxic chemicals.
3. Measurements of local meteorological data were taken over a 5-year period, from April 1972 through April 1977. Joint frequency distribution of wind according to stability class, speed, and direction were taken from the CPS FSAR (Tables 2.3-15 through 21). The data encompass seven stability conditions (A through G), six speed ranges, and 16 discrete directions. The stability Categories A through G are defined in Regulatory Guide 1.23.

After the meteorological measurements were taken, a man made lake, Lake Clinton, was formed. Lake Clinton surrounds three sides of the plant and covers approximately 5,000 acres. Most of the year the temperature of the lake is greater than the surrounding air. Therefore, it would have a destabilizing effect on the air mass.

No credit was taken for the effects of the lake. One control room air intake faces Lake Clinton. A significant impact of the lake will be the warm surface it presents to the atmosphere which, during nighttime and the winter, will be significantly warmer than the surrounding ground. This increase in temperature will cause the layer of air in contact with the lake to achieve a neutral lapse rate, especially when stable conditions prevail over the land. Thus, material released from a ground-level source would receive additional diffusion in the vertical over the lake than would be computed using a stable delta T stability category determined from the meteorological tower.

4. A study conducted for the NRC by Sandia National Laboratories, NUREG/CR-2650, entitled "Allowable Shipment Frequencies for the Shipment of Toxic Materials Near Nuclear Plants", relates allowable shipping frequencies for chemicals directly to the regulatory criteria of NUREG-0800 for determining if a toxic release need be considered a design basis event.

The criterion established in NUREG/CR-2650 evaluates toxic gas hazards analyses based upon a specification of an acceptable probability per year of operator incapacitation. The direct use of a probability of operator incapacitation then separates from the toxic hazards analysis the consideration of exceeding 10CFR100 radioactivity release guidelines (as specified by R.G. 1.70 and NUREG-0800).

Illinois Power Company believes as supported by NUREG/CR-2650, that some allowance for operator incapacitation events that do not result in exposures in excess of 10CFR100 guidelines is appropriate. That is, it would be overly conservative to use a value of one for the probability of exceeding 10CFR100 guidelines given incapacitation of operators. NUREG/CR-2650 utilizes a value of 0.1 for reducing the calculated toxic release probabilities based upon these considerations. These considerations are simply based upon the fact that an offsite transportation accident and a plant accident are not expected to occur from the same initiating event.

There is regulatory precedent for assuming that only one out of ten operator incapacitation events would result in an overexposure. A Stone & Webster report prepared for the Duquesne Light Company's Beaver Valley Station entitled "Control Room Habitability Study", dated Dec. 1, 1981, utilizes a factor of 10X reduction in the overall calculated toxic release accident probability. It is Illinois Power Company's understanding that this approach was found acceptable to the NRC for Beaver Valley.

5. For the purpose of the accident probability calculations, release probabilities used in the referenced report were taken from Materials Transportation Board Data (1971-77). The release probabilities used were for those releases that resulted in at

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least \$5000 in damages (e.g. loss of lading, property damage, emergency response efforts, etc.). This approach is conservative since not all releases causing \$5000 damage would necessarily mean a major release occurred. A major release as defined here is consistent with R.G. 1.78 in that it is a maximum concentration accident (i.e. an accident that results in the instantaneous release of the tank car contents). Although, from the data used, the amount of conservatism here cannot be quantified, it is certainly obvious that there is conservatism in the approach. For example, the cost of a car derailment alone, with no toxic chemical release, would exceed \$5000 but would not threaten control room habitability.

Of the major conservatisms previously discussed, items 1 and 4 have been quantified as noted. The following tabulation illustrates how the conservative factors discussed above would reduce the calculated total toxic release probabilities:

(1) Total Calculated Release Probabilities (release/yr.)

Car-Mile Basis = 2.18×10^{-6}

Ton-Mile Basis = 1.34×10^{-6}

(2) Quantified Conservatisms (reduction factors)

Tank-car Modifications = 2X

Operator Incapacitation = 10X

Total Reduction Factor = 20X

(3) Total Release Probabilities (release/yr) following application of reduction factors:

Car-Mile Basis = 1.09×10^{-7}

Ton-Mile Basis = 6.7×10^{-8}