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SHIELDS L. DALTROFF
VICE PRESIDENT
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January 3, 1981

Re: Docket Nos. 50-277
50-278

Mr. Darrell G. Eisenhut, Director
Division of Licensing
US Nuclear Regulatory Commission
Washington, DC 20555

SUBJECT: Information Requested by NUREG 0737, "Clarification of TMI Action Plan Requirements"

Dear Mr. Eisenhut:

Several of the TMI related requirements identified in NUREG 0737 request the licensee to submit specific information regarding plant systems and equipment, or the results of engineering studies evaluating new design standards. A response to these requests is presented in the following attachments. The number to the right corresponds with the TMI Action Plan identification numbers.

Attachment A - Shift Technical Advisor Training and Qualification (I.A.1.1)
Attachment B - Emergency Procedures (I.C.1)
Attachment C - Design Review of Plant Shielding (II.B.2)
Attachment D - Post Accident Sampling Capability (II.B.3)
Attachment E - Containment Pressure Setpoint (II.E.4.2(5))
Attachment F - Containment Purge Valve Operability (II.E.4.2(6))
Attachment G - Instrumentation for Inadequate Core Cooling (II.F.2)
Attachment H - Auto Restart of RCIC (II.K.3.13(b))
Attachment I - HPCI/RCIC Break Detection (II.K.3.15)

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Attachment J - Restart of Core Spray & LPCI (II.K.3.21)
Attachment K - Auto Switchover of RCIC Suction (II.K.3.22)
Attachment L - Evaluation of Anticipated Transients (II.K.3.44)
Attachment M - Evaluation of Depressurzation (II.K.3.45)
Attachment N - Inplant Iodine Monitoring (III.D.3.3)
Attachment O - Control Room Habitability (III.D.3.4)

Additional time beyond the January 1, 1981 submittal date identified in NUREG 0737 was required to permit a thorough review of all drafted material and ensure compliance with the NUREG 0737 requests. We discussed this matter with your NRC Licensing Manager for the Peach Bottom Atomic Power Station and a request for additional time to prepare this submittal was found acceptable.

Should you have any questions regarding this matter, please do not hesitate to contact us.

Very truly yours,

Attachment

ATTACHMENT A

Peach Bottom Atomic Power Station

Requirement: Shift Technical Advisor (STA) (I.A.1.1)

1. All licensees of operating reactors shall provide a description of their STA training program and their plans for requalification training. This description shall indicate the level of training attained by STAs by January 1, 1981 and demonstrate conformance with the qualification and training requirements in the October 30, 1979 letter.

2. All licensees of operating reactors shall provide a description of their long-term STA program, including qualification, selection criteria, training plans, and plans, if any, for the eventual phaseout of the STA program. The description shall include a comparison of the licensee program with sections 5 and 6 of the INPO document, "Nuclear Power Plant Shift Technical Advisor - Recommendations for Position Description, Qualifications, Education and Trainirg.

Response

I. The request to defer placing the STA trainees on duty until after the completion of the training program (February 18, 1981) was accepted in a letter dated December 17, 1980, R. W. Reid, NRC to E. G. Bauer, Philadelphia Electric Company. The current STAs will extend their duty period to cover the deferral period.

   The in-training STAs are participating in the long-term STA training program described in Section III below. This program [illegible]ds the training requirements identified in the October [illegible], 1979 letter, and closely parallels the proposed INPO training standard for STAs.

II. The selection criteria and qualification of STAs included the following individual requirements:

   a. The individual shall have a bachelor's degree in a science or engineering discipline applicable to power production from an accredited college or university.

   b. The individual shall successfully complete the STA training program described below.

   The initial Peach Bottom STA candidates do not meet the INPO recommendations on minimum experience due to the present shortage of experienced individuals who meet item IIa above. A minimum experience criteria will be established for the Peach Bottom STA program at a later date in accordance with standards to be issued by the NRC. It is our recommendation that the minimum experience criteria for the STA should be very liberal in recognition of the present shortage of experienced engineering personnel. A restrictive experience criteria would further reduce the availability of potential STA candidates. The primary benefit of the STA program is to complement the experience and knowledge of the licensed operating shift personnel with someone with a technical background who is capable of an analytical evaluation of plant behavior. The academic training requirements (college and STA training) represent the primary means for satisfying this objective. In lieu of the INPO experience criteria, we propose that the NRC standard should require the STA candidate to have a minimum of 12 months of power plant experience, with at least 6 months in a nuclear power plant. Present planning has not addressed itself to the eventual phase-out of the STA program.

Each of the six STA candidates presently in training have a Bachelor of Science degree in either nuclear, mechanical, or electrical engineering. Their engineering job experience ranges from three months to three years.

III. Shift Technical Advisor Training Program

The long term Shift Technical Advisor (STA) Training Program for Peach Bottom is designed to provide personnel possessing engineering and scientific degrees with the training necessary to function as a technical advisor to shift supervision during normal and emergency operating conditions. These phases, along with the length for each one for the training program presently in progress, are listed below:

- Phase I: Basic Academic Phase (6 weeks)
- Phase II: Management Administrative Controls Phase (2 weeks)
- Phase III: Plant Systems Phase (7 1/2 weeks)
- Phase IV: Accident Analysis Phase (2 weeks)
- Phase V: BWR Simulator Training Phase (3 weeks)
- Overall Program Review (1 week)

Upon completion of the training program a written examination will be administered to each trainee. This examination will be patterned after the NRC-administered SRO license examination. The examination for the STA candidates presently in training will be given February 17 - 18, 1981. A description of each phase of the training program follows.

a. Phase I: Basic Academic Phase

This portion of the training program is a condensed version of the course normally presented to candidates for a reactor operator's license. The objective of the Basic Academic Phase is to provide the student with a basic understanding of the scientific and engineering principles of reactor plant operation. The curriculum includes the following topics: classical physics, atomic physics, nuclear physics,, reactor core physics, reactor operations, introduction to nuclear power plant systems, theory and application of nuclear power plant systems, health physics, electricity and electronics, nuclear instrumentation, overall nuclear power plant operations and chemistry.

b. Phase II: Management/Administrative Control Phase

This phase of the training introduces the duties and responsibilities of the Shift Technical Advisor. The objectives are to provide requisite leadership skills as well as an orientation on general plant operations and safety to ensure that each STA is familiar with plant management and administration controls.

c. Phase III: Plant Systems Phase

Plant systems training encompasses essential nuclear steam supply, secondary, and emergency systems. The trainee will learn the general description of the system, instrumentation and controls, interconnections with other systems, operational limits, and basic operation. The provisions of Technical Specifications, including their bases, will be stressed. Classroom sessions will be supplemented with frequent plant tours. The purpose of these tours will be to familiarize the trainees with the locations of plant components and, where appropriate, to observe their operation. An examination will be given once each week. Quizes will be administered each day on which no examination is given.

d. Phase IV: Accident Analysis Phase

The objective of the Accident Analysis Phase is to prepare the Shift Technical Advisor to perform the accident assessment function by developing competence and experience in the analysis of plant conditions. This segment of the program will require the trainee to draw on the knowledge gained during preceding phases to analyze hypothetical situations not covered by procedures. In addition, significant transients or events from other plants will be discussed. An examination will be administered at the completion of this phase. Topics included in this phase are: analysis of design basis accident, analysis of abnormal operational transients, previous BWR transients and significant events, and mitigating reactor core damage.

e. Phase V: BWR Simulator Training Phase

During this phase of the training program each day of instruction will be divided into equal periods of classroom and simulator instruction. In general, evolutions which will be covered are normal operations, moderate-frequency transients, and infrequent and limiting faults. The specific evolutions will be selected so as to effectively familiarize the trainees with plant operation.

f. Requalification Training

An annual requalification program will be conducted for Peach Bottom Shift Technical Advisors. This program will consist of two parts: a lecture series and BWR simulator training. The STAs will attend the license operator requalification lecture series and annual simulator training session. The lecture series will include a review of significant and/or potentially serious Licensee Event Reports (LERs) and industry events and of accident an transient analyses discussed in the Final Safety Analysis Report (FSAR). Both the lecture and simulator portions of the requalification program will emphasize the role of the STA in each situation. This requalification program is consistent with the INPO recommendations.

IV. Comparison of the Peach Bottom STA Training Program with the INPO Recommendations (appendix C of NUREG 0737)

The academic training contact hours and subject material for each Peach Bottom STA candidate is in close agreement with the INPO recommendations. The training is provided by the STA Training Program (approximately twenty-two weeks), plus the college training each STA candidate has previously received. It should be noted that the INPO program would require approximately 26 weeks, excluding the college level mathematics and prerequsites beyond high school academics. However, this comparison does not take credit for the college level courses taken by the STA candidates. Each candidate has taken many of the college level courses recommended, particularly in the areas of thermal sciences, electrical sciences, and reactor theory.

The personnel who are receiving the STA training for Peach Bottom Atomic Power Station are graduate engineers. The possession of an engineering degree by each trainee means that each person previously received some of the training recommended by INPO. Based on our knowledge of engineering college curriculums, it was assumed that the following training had been received, and thus was not repeated during the STA training program:

- High-school level and college-level mathematics
- High-school level chemistry

- Most of the high-school physics (48 hours of classical physics review and atomic and nuclear physics were included in Phase I before proceeding to reactor core physics)

The remaining 430 hours of college-level academics and 120 hours of plant-specific applied fundamentals recommended by INPO are included in the Peach Bottom program. However, they are not included exclusively in Phase I (Basic Academics): some of this training is introduced in Phase I, but continued in another phase where it is more effective. To cite two examples:

1. Plant-specific reactor instrumentation and control is only touched upon during Phase I; it is covered more extensively in Phase III (Plant Systems) and Phase V (Simulator Training).

2. Thermal sciencies (thermodynamics, fluid flow, and heat transfer) are introduced in Phase I. They are discussed in more detail during Phases III (Plant Systems) and IV (Accident Analysis).

All of the INPO-recommended management/supervisory skills topics are presented during week one of Phase II (Management/Administrative Controls).

INPO recommends 200 hours of plant systems training. The recommended systems are covered during Phase III (Plant Systems), along with others considered appropriate. In addition, specific systems are discussed during the classroom segments of Phase V (Simulator Training) when necessary.

All of the topics INPO recommends under the heading "Administrative Controls" are included during week two of Phase II (Management/Administrative Controls) except Technical Specifications. Our experience indicates that discussion of Technical Specifications is more effective when it accompanies the systems training. Thus, Technical Specifications are presented extensively during Phase III (Plant Systems).

The General Operating Procedures segment of the INPO program is included in Phase V (Simulator Training) of the STA program.

INPO suggests 30 hours of training concerning Transient/Accident Analysis and Emergency Procedures. In the Peach Bottom program, part of this training on abnormal and emergency procedures is split between Phases IV (Accident Analysis) and V (Simulator Training). A significant segment of the accident analysis phase (Phase IV) is devoted to discussion of transient and accident conditions, including how to recognize and deal with them.

Phase V (Simulator Training) of the program has been designed to cover those simulator exercises recommended by INPO plus other evolutions which our experience indicates are warranted.

The INPO recommendation to include high school and college level subjects in the qualification requirements for STAs appears to be of little value, and would result in unnecessary administrative work to document the curriculum for each STA. An engineering or scientific degree from an accredited college or university ensures that the STA candidate possesses the necessary technical background.

COMPARISON OF THE PEACH BOTTOM STA TRAINING PROGRAM WITH THE INPO RECOMMENDATIONS

INPO RECOMMENDATIONS			PECO TRAINING PROGRAM
Section	Training/Education	Contact Hours	
6.1.1	Prerequisites beyond High School Diploma --Mathematics - Chemistry - Physics	 90 30 150 270	STA candidates are assumed to have had this training in their previous academic training (based on possession of an engineering scientific degree from an accredited college or university)
6.1.2	College - Level Academics - mathematics - reactor theory - reactor chemistry - Nuclear materials - thermal sciencies - electrical sciences - nuclear instrumentation and control - Nuclear radiation protection and health physics	 90 100 30 40 120 60 40 40 520	STA candidates assumed to have had 90 hours of mathematics for reasons stated above. All other subjects covered in phases I, III, IV, V of the STA Training Program. All STA candidates have had some or all of these subjects in college.
6.2	Applied Fundamentals Plant Specific	120	Phase I: Basic Academics (240 hours)
6.3	Management/Supervisory Skills	40	Phase II: Management Phase (40 hours)

COMPARISON OF THE PEACH BOTTOM STA TRAINING PROGRAM WITH THE INPO RECOMMENDATIONS

INPO RECOMMENDATIONS			PECO TRAINING PROGRAM
Section	Training/Education	Contact Hours	
6.4	Plant Systems	200	Phase III: Plant Systems (300 hours)
6.5	Administrative Controls	80	Phase II: Administrative Control Phase (40 hours) Technical Specifications covered in phase V.
6.6	General Operating Procedures	30	Covered in phase V
6.7	Transient/Accident Analysis and Emergency Procedures	30	Phase IV: Accident Analysis (80 Hours) Also covered in phase V
6.8	Simulator Training	100	Phase V: Simulator (120 hours)

ATTACHMENT B

Peach Bottom Atomic Power Station

Requirement: Guidance for the Evaluation and Development of Procedures for Accidents and Transients (I.C.1)

Reanalysis of transients and accidents, and preparation of guidelines for development of emergency procedures should be completed and submitted to the NRC for review by January 1, 1981.

Response

Philadelphia Electric Company has supported and participated in the General Electric BWR Owners' Group program to comply with this requirement. Engineering personnel from our company have participated in various seminars held to review the proposed guidelines, and have monitored the progress of this effort through their contacts with the NRC Owners' Group. BWR Emergency Procedure Guidelines (Revision 0) was submitted to the NRC on June 30, 1980. In a seminar held with the NRC staff in early August 1980 to review the Emergency Procedure Guidelines, the staff indicated that, except for some technical justification of several items and the details associated with implementing the guidelines, they were satisfied that the material submitted met the requirements of this task. The additional technical justification of the guidelines will be transmitted by the Owners' Group to the NRC sometime early in 1981. Otherwise, we consider our response to this NUREG 0737 requirement to be complete. Plant specific emergency procedures for Peach Bottom are being written to incorporate the content of the guidelines. We will continue to work with the Owners' Group to respond to any requests to provide further analysis and justification of the emergency procedure guidelines.

ATTACHMENT C

Peach Bottom Atomic Power Station

Requirement: Design Review of Plant Shielding (II.B.2)

Perform plant shielding review to determine accessibility to vital areas during post-accident operations.

Response

In our letter of October 15, 1980, S. L. Daltroff to D. G. Eisenhut concerning the reassessment of the shielding study (Attachment A, item II.B.2), it was indicated that post-accident radiation conditions will not impact on reactor building accessibility and the availability of the present radiochemistry laboratory. Based upon the clarified source term design criteria and the expanded vital area criteria of NUREG 0737, the results presented in our submittal of January 31, 1980, S. L. Daltroff to H. R. Denton, indicate that the post-accident radiation conditions will not impact on accessibility to vital areas defined for PBAPS.

ATTACHMENT D

Peach Bottom Atomic Power Station

Requirement: Post Accident Sampling Capability (II.B.3)

Provides additional clarification to the previous requirement to provide post-accident sampling capability. If deviations from these clarifications are necessary, provide detailed explanation and justification for the deviations by January 1, 1981.

Response

The post-accident sampling system previously designed and scheduled to be installed at Peach Bottom meets all NRC requirements identified in NUREG 0737. The design details will be available for review as requested in Section II.B.3.

ATTACHMENT E

Peach Bottom Atomic Power Station

Requirement: Containment Isolation Dependability - Containment Pressure Setpoint (II.E.4.2 position 5)

The containment setpoint pressure that initiates containment isolation for non-essential penetrations must be reduced to the minimum compatible with normal operating conditions. The setpoint should be set within 1 psi above the maximum expected containment pressure.

Response

The present setpoint of the drywell pressure instrumentation that initiates containment isolation of non-essential penetrations is less than or equal to 2.0 psig. Normally the drywell pressure is maintained in the 0.25 to 0.75 psig range. However, a review of the containment pressure operating history at Peach Bottom revealed occassional excursions both above and below this range. During the past two years, the drywell pressure of 1.0 psig was reached or exceeded 0.26% of the time. Therefore, the current setpoint is within 1 psi of the maximum expected drywell pressure, and meets the criteria specified.

ATTACHMENT F

Peach Bottom Atomic Power Station

Requirement: Containment Purge Valve Operability Criteria (II.E.4.2, position 6)

Containment purge valves that do not satisfy the operability criteria set forth in Branch Technical Position CSB 6-4 or the Staff Interim Position of October 23, 1979 must be sealed closed.

Response

Operation of the Peach Bottom containment purge and vent valves is in conformance with the above criteria as discussed in a letter dated December 11, 1979, S. L. Daltroff, Philadelphia Electric Company to T. A. Ippolito, NRC. The valves have been limited to a maximum of 37 degrees open whenever the reactor is not in the cold shutdown or refueling mode. The maximum opening has been conservatively determined such that the isolation function can be successfully carried out in the required time period under DBA-LOCA loads.

ATTACHMENT G

Peach Bottom Atomic Power Station

Requirement: Instrumentation for Detection of Inadequate Core Cooling (II.F.2)

Provide a description of any additional instrumentation or controls proposed for the plant to supplement existing instrumentation (including primary coolant saturation monitors) in order to provide unambiguous, easy-to-interpret indication of inadequate core cooling.

Response

This requirement was originally identified in NUREG 0578, item 2.1.3b. An analysis of existing instrumentation for detection of inadequate core cooling was performed under the auspices of the General Electric BWR Owners Group, and submitted to the NRC as enclosure 1 of a letter dated December 28, 1979, R. H. Buchholz, General Electric Company to D. F. Ross, Jr., NRC. The study concludes that the current design provides an unambiguous, easy-to-interpret indication of inadequate core cooling. Reactor water level is directly measured on wide-range and fuel zone instruments, and represents the primary variable to detect inadequate core cooling. The range of the level instruments overlaps to provide fuel range indication from normal operation to complete core uncovery. Positive indication of injection of one ECC system is an alternative method for verifying adequate core cooling. A primary coolant saturation meter is not required since the BWR always operates under saturated conditions.

Philadelphia Electric Company has reviewed this analysis and agree with its conclusions. However, comparison with the Peach Bottom design identified a need to record the wide range and fuel zone level indication and to recalibrate the fuel zone level instruments to increase their range slightly in order to conform with NUREG 0737, Appendix B, criteria 7. Therefore, we are proposing a modification to record these level signals and recalibrate the fuel zone instruments by January 1, 1982, contingent upon equipment availability.

Additionally, Section II.F.2 of NUREG 0737 requests the licensee to consider the installation of core exit thermocouples. As discussed in the BWR Owners Group comments (letter dated October 8, 1980, D. B. Waters, Chairman - BWR Owners Group to D. G. Eisenhut, NRC), the incorporation of core exit thermocouples into the BWR design has already been considered in the development of Regulatory Guide 1.97. We concur with the Owners Group recommendation that any further need to evaluate core exit thermocouples for BWRs should be pursued only as it relates to future revisions of Regulatory Guide 1.97.

ATTACHMENT H

Peach Bottom Atomic Power Station

Requirement: Auto Restart of RCIC (II.K.3.13(b))

The RCIC system initiation logic should be modified so that the RCIC system will restart on low reactor water level following a high reactor water level trip.

Response

Philadelphia Electric Company participated in the General Electric Boiling Water Reactor Owners Group program to study this recommendation. The Owners Group report was submitted to the NRC in a letter dated December 29, 1980, D. B. Waters, Chairman, BWR Owners' Group to D. G. Eisenhut, NRC. We concur with the reports' conclusion that the proposal will enhance the availability of the RCIC system while having no adverse affect on system function, reliability, or safety. We are planning to implement, with minor revisions incorporated to meet our plant unique design, the modification described in the Owners Group report by July 1, 1981.

ATTACHMENT I

Peach Bottom Atomic Power Station

Requirement: Modify HPCI-RCIC Break Detection Logic (II.K.3.15)

The HPCI and RCIC steam line break detection circuitry should be modified so that pressure spikes resulting from system initiation will not cause inadvertent system isolation.

Response

Philadelphia Electric Company has participated in the General Electric BWR Owners' Group evaluation of this NRC recommendation. Our review of the Owners Group evaluation report concludes that the addition of a time delay in the break detection circuitry should eliminate any spurious isolations that may occur as a result of flow peaks occurring during a normal system start transient. The time delay fully preserves the break detection capabilities of the existing system and does not impact on the design basis accident analysis of HPCI and RCIC steam line breaks. A 13 second valve closure delay period is assumed during the design basis evaluation of a steam supply line break. This delay results from the assumption that the DC isolation valve fails and that no offiste AC power is immediately available to the AC valve. The proposed modification to the HPCI and RCIC break detection circuitry will involve a time delay of approximately 3 seconds. The addition of this time delay will not result in any change in the total reactor fluid mass release when the design basis conditions are considered. Therefore, the proposed modification does not have any adverse safety implications. We are proceeding to implement this change by July 1, 1981.

ATTACHMENT J

Peach Bottom Atomic Power Station

Requirement: Restart of Core Spray and Low Pressure Coolant - Injection Systems (II.K.3.21)

The core spray and LPCI system logic should be modified so that these systems will restart automatically on loss of reactor water level following manual termination of system operation while an initiation signal is present.

Response

Philadelphia Electric Company participated in the General Electric Boiling Water Reactor Owners Group program to study this recommendation. The Owners Group report was submitted to the NRC in a letter dated December 29, 1980, D. B. Waters, Chairman, BWR Owners' Group to D. G. Eisenhut, NRC. We have reviewed this report and concur with its conclusion that the suggested modification would not enhance plant safety. In fact, we believe that if the suggested modification was implemented, the escalation of control system complexity and restricted operator flexibility when dealing with anticipated events would result in a negative impact on plant safety. The report does recommend modifications to plants with a High Pressure Core Spray (HPCS) system, which is not applicable to the Peach Bottom design.

ATTACHMENT K

Peach Bottom Atomic Power Station

Requirement: Automatic Switchover of Reactor Core Isolation Cooling System Suction - Verify Procedures (II.K.3.22)

The Reactor Core Isolation Cooling (RCIC) system takes suction from the condensate storage tank with manual switchover to the suppression pool when the condensate storage tank level is low. The licensee should verify that clear and cogent procedures exist for the manual switchover of the RCIC system suction from the condensate storage tank to the suppression pool.

Response

System procedure S.3.5.J has been implemented to provide the operator with explicit instructions for the manual switchover of the RCIC system.

ATTACHMENT L

Peach Bottom Atomic Power Station

Requirement: Evaluation of Anticipated Transients with Single Failure to Verify No Fuel Failure (II.K.3.44)

For anticipated transients combined with the worst single failure and assuming proper operator action, licensees should demonstrate that the core remains covered.

Response

Philadelphia Electric Company participated in the General Electric boiling Water Reactor Owners Group program to analyze this event. The Owners Group report was submitted to the NRC in a letter dated December 29, 1980, D. B. Waters, Chairman, BWR Owners' Group to D. G. Eisenhut, NRC. We concur with the reports' conclusion that the core remains covered during the worst transient (loss of feedwater) combined with the worst single failure (HPCI failure).

ATTACHMENT M

Peach Bottom Atomic Power Station

Requirement: Evaluation of Depressurization with Other Than Automatic Depressurization System (II.K.3.45)

Evaluate depressurization modes other than full actuation of the automatic depressurization system (ADS) so as to reduce the possibility of exceeding vessel integrity limits by rapid cooldown.

Response

Philadelphia Electric Company participated in the General Electric Boiling Water Reactor Owners Group program to study this recommendation. The Owners Group report was submitted to the NRC in a letter dated December 29, 1980, D. B. Waters, Chairman, BWR Owners' Group to D. G. Eisenut, NRC. We concur with the report's conclusion that rapid depressuzation to avoid prolonged core uncovery is best, and vessel fatigue challenge is not substantially reduced by a slightly slower depressurization. Therefore, no modifications are deemed neccessary as a result of this study.

ATTACHMENT N

Peach Bottom Atomic P wer Station

Requirement: Improved Inplant Iodine Instrumentation Under Accident Conditions (III.D.3.3)

Each licensee shall provide equipment and associated training and procedures for accurately determining the airborne iodine concentration in areas within the facility where plant personnel may be present during an accident.

Response

The present sampling methods and procedures used at Peach Bottom permit the measurement of in-plant iodine concentration during accident conditions. A description of this method follows:

The sampling method uses portable air samplers with a combination (particulate filters and iodine sampling cartridge) sampling head. The sampling heads use a glass fiber particulate filter and a CESCO style (2.25" dia. x 1.04" thickness) iodine charcoal cartridge. The three cartridges (CESCO charcoal model No. 81-70SC727, Rade Co. charcoal model CP-100 and Rade Co. Silver Zeolite model No. GY-130) used at Peach Bottom fit this sample head. The cartridge normally used is the CESCO charcoal cartridge model No. 81-70SC727. When long sampling times are required a Rade Co. Charcoal cartridge model CP-100 is normally used. During emergency conditions with high xenon or krypton concentrations a Rade Co. Silver Zeolite model No. GY-130 may be used. Table 1 describes the types and the number of portable air samplers in use at this time for the Peach Bottom monitoring program.

The iodine activity on the sample cartridge is determined by gamma isotopic analysis using a computer based multi-channel analyzer (Nuclear Data 6620) with three high resolution lithium drifted germanium (Geli) detector which is located in the Peach Bottom Counting Room. The Counting Room is located in the Turbine Building at the ground level elevation. The NRC Region I meeting, held in Arlington, VA, on Septelber 22, 1980, provided additional clarification of the source term design criteria for the plant shielding study. A reassessment of the shielding study, based on this new clarification, indicates that the Counting Room dose rates are low enough to permit sample analysis during accident conditions.

Geli isotopic analysis permits iodine identification in the presence of xenon and krypton. If the analysis of iodine becomes impossible due to interference (high background) from xenon or krypton, then Silver Zeolite cartridges will be used, or the charcoal cartridge will be purged with clean bottled nitrogen or bottled breathing air to reduce the interference. If the use of Silver Zeolite does not sufficiently reduce the xenon or krypton interference, the Silver Zeolite cartridges will also be purged with clean bottled nitrogen or bottled breathing air which is available on site.

Attachment N
Table 1

Peach Bottom Atomic Power Station
Portable Air Samplers

MODEL (1)	Quantity (2)
1. Portable 12/24 VDC Rade Co. Model No. H-809C (available in off-site emergency team kits)	2
2. Portable gooseneck constant flow air sampler Rade Co. Model No. HD 28, 110 VAC with constant flow rate control	8
3. Portable low volume air sampler Rade Company Model AUS-28, 110 VAC with constant flow rate control	15
4. Portable low volume air sampler using Gast carbon vane vacuum pump, 110 VAC with critical flow orifices for flow rate control.	95

(1) All air samplers use Rade Co., Model No. 2500, combination (particulate filter and iodine sampling cartridge) sampling heads. The sampling heads use fiber particulate filter and the CESCO style (2.25" dia. x 1.04" thick) iodine sample charcoal cartridges. The three iodine cartridges used at Peach Bottom fit this sample head.

(2) As of December 1, 1980. Number subject to change based on failure and repair time.

PEACH BOTTOM ATOMIC POWER STATION
NUREG 0737 REQUIREMENTS

Requirement: III.D.3.4 - Control Room Habitability - Review Description

In accordance with Task Action Plan item III.D.3.4 and control room habitability, licensees shall assure that control room operators will be adequately protected against the effects of accidental release of toxic and radioactive gases and that the nuclear power plant can be safely operated or shut down under design basis accident conditions (Criterion 19, "Control Room," of Appendix A, "General Design Criteria for Nuclear Power Plants," to 10 CFR Part 50).

Licensees shall submit the results of their findings as well as the basis for those findings by January 1, 1981. In providing the basis for the habitability finding, licensees may reference their past submittals Licensees should, however, ensure that these submittals reflect the current facility design and that the information requested in Attachment 1 is provided.

All licensees with control rooms that do not meet the criteria shall identify appropriate modifications.

A. Accidental Postulated Released Toxic Gases

The habitability of the control room has been assessed in accordance with NUREG 0737 including Standard Review Plans 2.2.1, 2.2.2, 2.2.3, and 6.4 and Regulatory Guides 1.78 (Hazardous Chemical Releases) and 1.95 (Accident Chlorine Releases).

Off-Site (Rail Transportation Facilities)

Conrail's link and node report identified 455 specific hazardous materials transported along the Columbia-Port Deposit Link (1.5 miles across the Susquehanna River and within 5 miles of the control room air intake) for the 18 month period from January 1978 to June 1979. Regulatory Guide 1.78 establishes 30 shipments per year as being frequent. Thus, this screening criterion eliminated 360 hazardous materials from further consideration. Table 2-2 lists the remaining 95 hazardous materials frequently transported past PBAPS. A secondary screening criterion involved eliminating those materials that are not classified as toxic to humans. After this screening, 57 toxic materials frequently transported past PBAPS remain. Of these 57, some are isomers of each other. Table 2-4 lists the chemicals that were combined.

The 46 remaining toxic chemicals which are transported frequently past PBAPS (equal to or greater than 30 shipments/year) and which may have the potential to cause a control room operation incapacitation are tabulated in Table 3-2. Also tabulated are the parameters required as inputs for the modeling evaluation.

In accordance with NUREG 0737, the 46 toxic materials, transported 30 or more shipments per year and potentially hazardous to humans were assessed. Eighteen chemicals were assessed to be potentially hazardous to the control room, listed in Table 3-4, because control room concentration exceed the stated toxic limits.

Aggregate Probability of Occurrence Estimation

Regulatory Guide 1.78 says, in order to protect control room personnel from the potential toxicity effects of those chemicals, devices which will adequately warn them to initiate protective action must be installed. However, the guidance presented in NUREG-75/087, Standard Review Plan Section 2.2.3 says, design modification may not be required if all potential toxic accidents and other external man-induced events did not occur frequently enough to be considered design basis. The acceptance criteria of this document indicates:

"The probability of occurrence of the initiating events leading to potential consequences in excess of 10CFR100 (10^{-7} per year) exposure guidelines should be estimated using assumptions that are 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 the probabilities. Accordingly, the expected rate of occurrence of potential exposures in excess of 10CFR100 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" (emphasis added).

Seventeen additional less frequently transported toxic chemicals (8.5 to 29 shipments per year) were considered in the aggregate probability analyses and are tabulated in Table 3-5. Twelve of these chemicals are classified as a potential habitability problem to the control room.

The aggregate probabilities of a toxic chemical incapacitation to humans in the control room for chemicals transported more than 8.5 shipments per year are summarized below:

Scenarios	Aggregate Probability Events/Year
1. Design basis meteorology	73×10^{-6}
2. Site meteorology[a]	56×10^{-6}
3. Site meteorology[a] and accident adjustment[b]	0.6×10^{-6}

a. Assumes plume centerline strikes the intake. Concentrations will be less due to plume meander.

b. Not all hazardous material incidents result in an incapacitation. Leaks and minor spills usually only represent a local hazard. There have been few large spills. Incapcitations at distances of 1.5 mile or more are unlikely. A factor of 10^{-2} has been applied for spill severity for this site.

Specific probabilities by material for scenairos 1 and 2 are presented in Tables 3-15 and 3-15A respectively.

Thus, no design modifications to PBAPS are required for off-site rail transportation facilities at PBAPS because the man-induced accident is a low probability event. Of interest, minimum transit time for a toxic plume to reach the control room intake, with 1.0 m/sec. wind velocity, is about 1 hour.

Onsite Toxic Chemicals

The onsite gas sources are identified in Table 2-1 (Quantity Stored, Type of Container, Location and Distance to Control Room Intake). The locations are shown on the site arrangement Figure 2-2. The results of the analysis of onsite toxic chemicals are presented in Table 3-1. Three of the eight chemicals stored on the site pose a potential control room habitability problem: chlorine, carbon dioxide and sulfuric acid. However, the lower inhalation limit for humans is not exceeded for carbon dioxide. The spill area is significantly overestimated for sulfuric acid and sodium hydroxide and the gases are much heavier than air. Spills of sulfuric acid and sodium hydroxide will be confined to the water treatment building sumps. Thus, chlorine is the only significant onsite threat to control room habitability. The transit time for the toxic plume to travel from the water treatment plant to the control room air intake (535 ft.) at the rate of 1 m/sec. is 163 seconds.

Proposed Modifications

We are investigating the following conceptual options for ensuring control room habitability during a chlorine release:

1. Provide chlorine alarms at water treatment facility to signal control room operators of an event and provide self-contained breathing apparatus so that personnel can:

   a. put on self-contained breathing apparatus.

   b. shutoff intake and exhaust fans (about 5-10 minutes).

   c. close dampers

2. Replace liquified chlorine gas system with a solid sodium - hypochlorite chlorine system.

3. Provide in-line detectors and ventilation system isolation capability.

Modifications needed for compliance with the control room habitability requirements and a schedule for completion of the modifications will be submitted to the NRC by April 1, 1981.

B. Accidental Postulated Release of Radioactive Gases

The habitability of the control room has been assessed in accordance with NUREG 0737. The parameters utilized as inputs in the analyses are tabulated in Table 1. The exposures in the control room are within General Design Criteria 19 and 10CFR100 guidelines and are presented in Table 2. Therefore, no design modifications to PBAPS are required.

ATTACHMENT O

Peach Bottom Atomic Power Station

C. Information Requested in NUREG 0737, III.D.3.4, Attachment 1 Control Room Habitability Evaluation

1) Request

Control room mode of operation, i.e., pressurization and filter recirculation for radiological accident isolation or chlorine release.

Response

A radiation monitoring system in the fresh air intake duct work monitors the radioactivity level in the incoming air. If a high activity level is detected, the operating normal fresh air supply fan stops and one emergency air supply fan starts. The makeup air is diverted through one of the two high efficiency and charcoal filter train's automatically. The control room is maintained in a pressurized condition during this emergency mode of operation. If a high - high activity level is detected, all fans on the control room ventilation system trip, terminating all outside air makeup and forced recirculation.

For other forms of contamination, such as smoke, the control room can be purged with 100 percent outside air for a once-through flow using the air conditioning supply fans with the return air fans discharging to atmosphere at the radwaste building roof. Automatic isolation capability for the makeup air is not provided.

2) Control Room Characteristics

a) Request: air volume control room

Response: 176,000 ft^3

b) Request: control-room emergency zone (control room, critical files, kitchen, washroom, computer room etc.

Response: The control room ventilation system described in item (1) above, supplies the control room complex which consists of the control center and several adjacent offices and kitchen. The only other area within the control room complex that involves another ventilation system is the washroom which has its own exhaust system. These are the only ventilation system that need to be considered in analyzing control room habitability.

c) Request: control room ventilation system schematic with normal and emergency air flow rates

Response: See P&ID M-393, Rev. 8, "Ventilation Flow Diagram" enclosed

d) Request: Infiltration leakage rate

Response: In the emergency mode of operation the infiltration leakage rate is zero as the control room is maintained at a slight negative pressure.

e) Request: High efficiency particulate air (HEPA) filter and charcoal absorber efficiencies.

Response: 99.9% and 99.0% respectively

f) Request: Closest distance between containment and air intake.

Response: See figure 2-2. The direct line distance between the control room air intake and both primary containment structures is 120 feet. The distance between the normal drywell point of release (reactor building stack) and the control room air intake is 305 feet.

g) Request: layout of control room, air intakes, containment building, and chlorine, or other chemical storage facility with dimensions.

Response: See Figure 2-2 for the layout, and Table 2-1 for the dimensions (distance between source and control room air intake).

h) Request: control-room shielding including radiation streaming from penetration, doors, ducts, stairways, etc.

Response: The control room is shielded by 2.5 feet thick concrete walls and ceiling, and a 1 foot thick concrete floor.

i) Request: automatic isolation capability - damper closing time, damper leakage and area.

Response: Automatic isolation of the control room ventilation system has not been incorporated into the Peach Bottom design.

j) Request: Chlorine detectors or toxic gas (local or remote)

Response: Chlorine or toxic gas detectors presently have not been installed at Peach Bottom.

k) Request: Self-contained breathing apparatus (SCBA) availability (number)

Response: Approximately twelve self contained breathing units are maintained as part of the station Respiratory Protection Program. They are stored in the Radwaste Building at elevation 116' near the laundry room.

l) Request: bottled air supply (hours supply)

Response: A cascade manifold system is installed at elevation 116' Radwaste Building near the laundry room. Six size 1A (2000 psi) breathing air bottles are provided for recharging the portable air tanks used with the SCBA's.

m) Request: emergency food and portable water supply (how many days and how many people)

Response: Emergency food and water supplies are not provided for the control room. These supplies can be delivered during any emergency expected by relief personnel.

n) Request: control room personnel capacity (normal and emergency)

Response: While no specific capacity level has been identified for the Peach Bottom control room, access is restricted to essential personnel. During accident conditions the control room complement is expected to be 10 persons.

o) Request: potassium iodide drug supply

Response: KI tables are presently stocked on site in the medical room (radwaste Building 135' elevation). A written procedure is available for administration. These KI tablets will be distributed by the Personnel Safety Team Leader as necessary. They are intended only for emergency workers.

3) Onsite storage of chlorine and other hazardous chemicals

a) Request: total amoung and size of container

Response: See Table 2-1

b) Request: closest distance from control room air intake

Response: See Table 2-1 and Figure 2-2

4) Offsite manufacturing, storage, or transportation facilities of hazardous chemicals.

a) Request: identify facilities within a 5 mile radius

Response: Peach Bottom Atomic Power Station is located in a sparcely populated, rural area. The area within the five mile zone is mostly undeveloped or used for farming. Four industries are located within a 5 mile area (D & D Sewing, Star Printing, Snyder Packjng Co., Black Bear Structures and National Mobile Concrete Corp.). To our knowledge these industries do not pose a toxic chemical threat to the habitability of the control room. No interstate highways pass within 5 miles of the control room. Pennsylvania Highway Routes 74 and 372 are the principal paved roads within the 5 mile zone. About a mile of Route 372 passes within 4 1/2 miles of the control room, and Route 74 comes as close as 3 miles. The primary purpose of these roads is to serve the local area, and are not expected to be used to transport materials that would pose a hazard to control room habitability PBAPS is located 8 miles upriver of the Conowingo Dam, and 7 miles downriver of the Holtwood Dam. The presence of the dams inhibit commercial transportation on the Susquehanna River near Peach Bottom.

b) Request: distance from control room

Response: See table 3-6. The closest point to the conrail tracks is 1.5 miles

c) Request: quantity of hazardous chemicals in one container

Response: See Table 2-2.

d) Request: frequency of hazardous chemical transportation traffic.

Response: See Table 3-4.

5) Technical Specifications (refer to standard technical specifications)

a) Request: chlorine detection system

Response: A detection system presently does not exist at Peach Bottom.

b) Request: control room emergency filtration system including the capability to maintain the control room pressurization at 1/8 in. water guage, verification of isolation by test signals and damper closure times, and filter testing requirements.

Response: The Peach Bottom Technical Specifications for the Control Room Emergency Ventilation Systems requires the following

1) Operability requirements for the control room emergency ventilation system

2) Minimum efficiency levels for the HEPA filters and charcoal adsorbers

3) Minimum specifications for the carbon sample

4) Minimum flow characteristics for the emergency fans.

5) Operability and surveillance requirements for the control room intake air radiation monitors.

6) Surveillance requirements to measure pressure drop across the HEPA filters and charcoal adsorbers.

7) Surveillance requirements to determine HEPA filter and charcoal adsorber efficiencies.

8) Surveillance requirement to verify operability of system humidity control

The Peach Bottom Technical Specifications does not address a minimum positive pressure for the control room, nor does it address ventilation damper closure times.

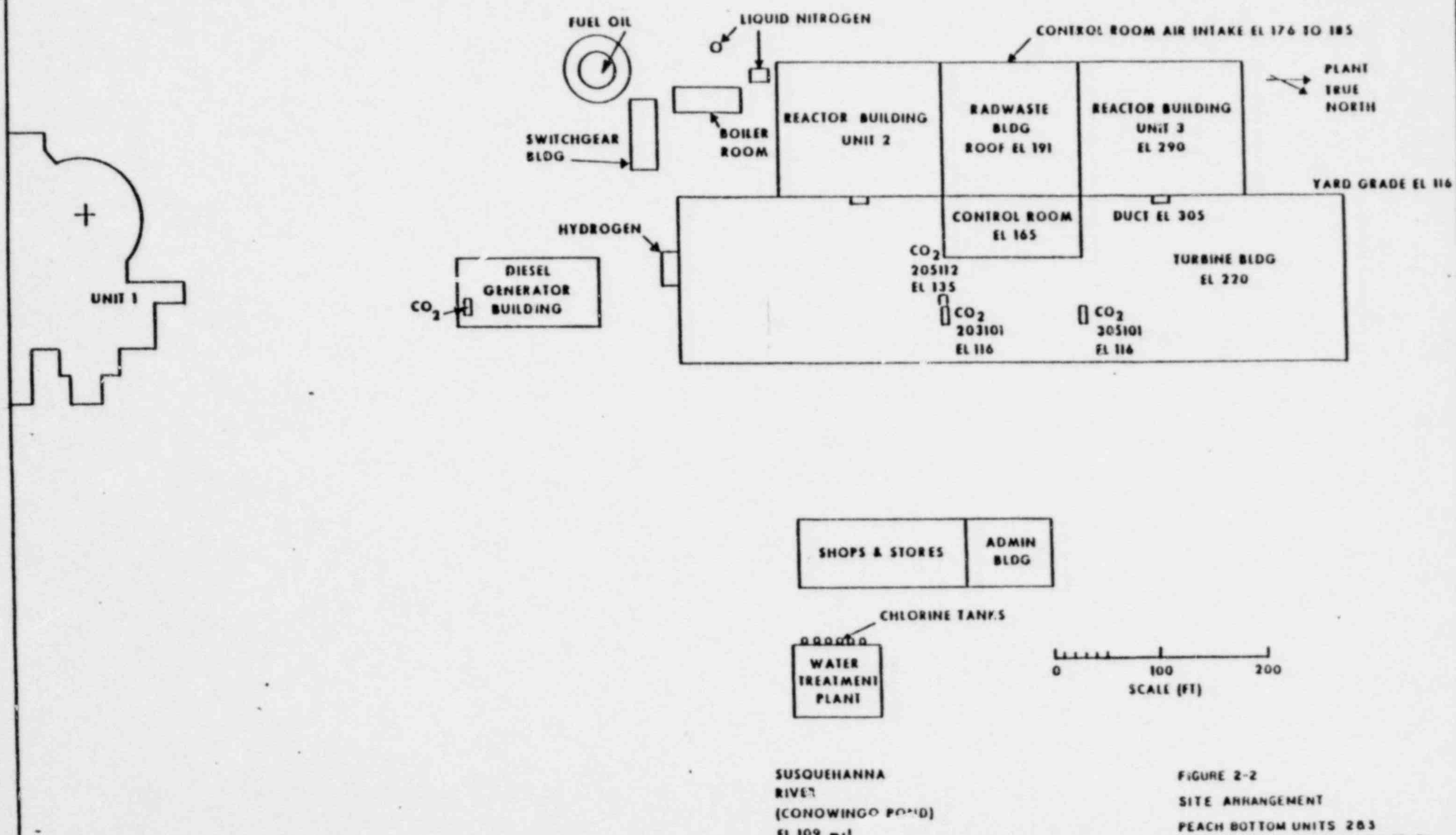

FIGURE 2-2
SITE ARRANGEMENT
PEACH BOTTOM UNITS 2&3
CONTROL ROOM HABITABILITY STUDY
PHILADELPHIA ELECTRIC COMPANY

TABLE 1

LOSS-OF-COOLANT ACCIDENT: PARAMETERS

TABULATED FOR POSTULATED ACCIDENT ANALYSES

	DESIGN BASIS ASSUMPTIONS	
I. Data and Assumptions Used to Estim[illegible] Radioactive Source from Postulated Accidents		
A. Power Level (MWt)	3440	
B. Burnup	NA	
C. Fission Products Releases from Fuel (fuel damaged)	100%	
D. Iodine Fractions		
(1) Organic	0.04	
(2) Elemental	0.[illegible]1	
(3) Particulate	0.[illegible]5	
II. Data and Assumptions Used to Estimate Activity Released		
A. Primary Containment Leak Rate (%/day)	0.5	
B. Volume of Primary Containment (CU ft.)	2.78×10^5	
C. Secondary Containment Release Rate (%/day)	100	
D. Volume of Secondary Containment (CU.ft.)	2.5×10^6	
E. Leak Rate Through MSIV (scfh)	11.5	
F. Numbers of Main Steam Lines	4	
G. Leak Rate form Turbine Condenser Complex (%/day)	1.0	
H. Volume and Surface Area (All 4 Steam Lines)	Ft^3	Ft^2
(1) Between Inboard and Outboard MSIV	228.1	454.4
(2) Outboard and Turbine Stop Valves	3842.6	7653.1
(3) Turbine Condenser Complex	1.8×10^5	7.3 X 1
F. Deposition Velocity for Iodines (Cm/Sec)		
Particulate	0.012	
Elemental	0.012	
Organic	0.0	
G. Valve Movement Times	NA	
H. SGTS Adsorption and Filtration Efficiencies (%)		
(1) Organic Iodines	95	
(2) Elemental Iodine	95	
(3) Particulate Iodine	95	
(4) Particulate Fission Products	95	

TABLE 1 (Continued)

III. Dispersion Data (sec/m^3):

A. CR - Building Wake
X/Q for Time Intervals of

(1) 0-8 hrs	1.01×10^{-3}
(2) 8-24 hrs	5.95×10^{-4}
(3) 1-4 days	3.79×10^{-4}
(4) 4-30 days	1.67×10^{-4}

IV. Data for CR	CR
A. Volume of CR(ft^3)	176,000
B. Filtered intake (cfm)	3,000
C. Efficiency of Charcoal (%) Adsorber	99
D. Efficiency of HEPA (%)	99.9
E. Unfiltered Inleakage (cfm)	10
F. Recirculation Flow Rate	0.0
G. Occupancy Factors:	
0-1 day	1.0
1-4 days	0.6
4-30 days	0.4

TABLE 2

DBA - LOCA RADIOLOGICAL CONSEQUENCES

Control Room	Thyroid	Skin	Whole Body
	Doses (REM)		
a) From Activity Inside CR	2.7×10^{-1}	4.5×10^{-2}	2.0×10^{-3}
b) Plume Shine	—	—	$< 1\times10^{-3}$
c) Direct Shine	—	—	$< 5.9\times10^{-2}$
Total CR Doses	2.7×10^{-1}	4.5×10^{-2}	$< 6.2\times10^{-2}$

TABLE 2-1

ONSITE POTENTIAL GAS SOURCES

Hazardous Material	Stored Quantity and Type Container	Location	Distance to Control Room Intakes (ft)
Chlorine	6 - 1-ton cylinders	West of water plant	535
Carbon dioxide	6-ton tank	Turbine bldg, el 116'	175 from duct
	6-ton tank	Turbine bldg, el 116'	175 from duct
	2 3/4-ton tank	Emergency diesel bldg	540
	2-ton tank	Turbine bldg, el 135'	175 from duct
Nitrogen	11,000-gal tank	South end of Unit 2	265
	6,000-gal tank (stored as a liquid)	Reactor bldg	220
Sulfuric acid	4,000-gal tank 33-gal tank	Inside water treatment plant	540
Concentrated sodium hydroxide	4,000-gal tank 56-gal tank	Inside water treatment plant	540
Hydrogen	24 cylinders	South side of Unit 2 turbine bldg	350
Helium	Individual bottles	Various	Various
Argon	Individual bottles	Various	Various

TABLE 2-2

HAZARDOUS MATERIALS FREQUENTLY (AT LEAST 45 SHIPMENTS PER 18-MONTH DATA PERIOD) TRANSPORTED BY RAIL PAST THE PEACH BOTTOM SITE

STCC Number	Commodity	Number of Carloads	Total Tonnage
49 012 30	Explosive bomb	95	4,787.0
49 041 20	Chlorine	316	150,640.0
49 042 10	Anydrous ammonia	47	22,898.0
49 042 90	Sulfur dioxide	58	4,699.0
49 045 08	CO_2 gas, liquified	50	3,399.0
49 045 09	CO_2, liquified	302	24,644.0
49 045 16	Dichlorodifluoromethane (Freon)	60	5,267.0
49 045 31	11-monofluorotrichloromethane (Freon)	54	3,728.0
49 045 52	Monochlorodifluoromethane (Freon)	75	6,246.0
49 045 70	Refrigerants (Freon)	66	5,729.0
49 057 03	Butadiene, inhibited	77	6,242.0
49 057 04	Butadiene (from petroleum)	63	5,043.0
49 057 06	Butane	62	4,503.0
49 057 25	Dimethyl ether	234	7,656.0
49 057 34	Ethylene	69	4,635.0
49 057 48	Isobutylene	66	4,635.0
49 057 52	Liquified petroleum gas	1,020	73,570.0
49 057 61	Methylchloride	62	2,777.0
49 057 81	Propane	51	3,382.0
49 057 92	Vinyl chloride	4,396	406,788.0
49 066 10	Ethylene oxide	360	28,268.0
49 066 20	Propylene oxide	387	26,642.0
49 068 10	Acrylonitrile	202	13,295.0
49 072 15	Ethylacrylate monomer inhibited	533	41,075.0
49 072 50	Methyl methacrylate	1,032	80,041.0
49 072 65	Styrene monomer inhibited	95	8,015.0
49 072 70	Vinyl acetate	53	4,290.0
49 081 05	Acetone	427	23,704.0
49 081 25	Carbon disulfide	221	53,920.0
49 081 62	Ethylene chloride	359	13,974.0
49 081 83	Hexane	76	5,608.0
49 082 55	Pentane	53	3,594.0
49 091 28	Butyl acetate	65	5,611.0
49 091 29	Butyl alcohol	91	6,871.0
49 091 31	Isobutyl alcohol	61	4,364.0
49 091 41	Denatured alcohol ethanol	59	10,896.0
49 091 60	Ethyl acetate	65	5,010.0
49 092 10	Isopropyl acetate	45	2,411.0
49 092 30	Methanol	141	12,769.0
49 092 43	Methyl ethyl ketone	196	15,785.0
49 092 45	Methyl isobutyl ketone	66	4,136.0
49 092 66	Flammable liquid, n.o.s. (pinene)	48	3,314.0
49 093 50	Xylene	66	1,533.0

TABLE 2-2 (Cont)

STCC Number	Commodity	Number of Carloads	Total Tonnage
49 101 02	Alcohol, n.o.s. (in bond)	119	10,436.0
49 101 34	Coal tar, light oil	150	10,726.0
49 101 47	Compound, cleaning liquid	64	1,607.0
49 101 53	Compound, lacquer, paint	64	2,878.0
49 101 85	Flammable liquid, n.o.s.	177	5,995.0
49 102 57	Petroleum distillate	87	5,665.0
49 102 59	Petroleum naptha	118	7,293.0
49 102 80	Resin solution	119	3,462.0
49 102 97	Solvent, n.o.s.	103	4,123.0
49 131 03	Alcohol, n.o.s.	48	3,248.0
49 131 44	Formaldehyde	99	9,160.0
49 151 13	Fuel oil	64	4,618.0
49 141 85	Combustible liquid	754	52,311.0
49 151 87	Solvent, n.o.s.	53	4,293.0
49 152 10	Insecticide, liquid, n.o.s.	51	2,125.0
49 152 59	Petroleum naptha	76	3,493.0
49 161 41	Phosphorus, white	225	21,145.0
49 164 08	Calcium carbide	68	4,115.0
49 183 10	Ammonium nitrate	119	8,508.0
49 183 35	Hydrogen peroxide	72	3,191.0
49 187 15	Calcium hypochlorite	54	2,323.0
49 187 46	Soldium nitrate	55	2,640.0
49 212 20	Carbolic acid (phenol)	395	34,412.0
49 214 10	Aniline oil, liquid	99	6,458.0
49 214 45	Motor fuel	473	37,024.0
49 214 75	Poisonous liquid	62	5,474.0
49 300 24	Hydrofluoric acid, anhydride	190	15,676.0
49 302 28	Hydrochloric (muriatic) acid	121	11,196.0
49 302 31	Hydrochloric (muriatic) acid, spent	226	21,401.0
49 302 47	Phosphatic fertilizer	280	27,891.0
49 313 03	Acetic acid (glacial)	155	12,280.0
49 313 04	Acetic anhydride	104	8,877.0
49 314 04	Acid, liquid, n.o.s.	184	15,612.0
49 314 48	Propionic acid	64	5,469.0
49 323 40	Chromic fluoride solution	198	18,942.0
49 323 42	Ferric chloride solution	655	61,608.0
49 323 52	Phosphorus oxychloride	62	2,080.0
49 352 20	Alkaline corrosive liquid	50	2,553.0
49 352 25	Potassium hydroxide (dry)	81	1,935.0
49 352 30	Potassium hydroxide (liquid)	692	54,968.0
49 352 35	Sodium hydroxide (dry)	295	13,997.0
49 352 40	Sodium hydroxide, (liquid)	761	67,181.0
49 356 45	Hexamethylene, diamene	282	116,840.0
49 356 65	Monoethamolamine	51	3,634.0
49 361 10	Bromine	72	2,127.0
49 365 40	Corrosive liquid	298	17,200.0
49 365 58	Battery, electric, wet	66	3,942.0

TABLE 2-2 (Cont)

STCC Number	Commodity	Number of Carloads	Total Tonnage
49 501 10	Acids, mixed loads	49	2,663.0
49 501 30	Freight forward traffic	655	10,580.0
49 501 40	Shipper assoc. traffic	1,999	26,862.0
49 501 50	All freight rate shipments	2,080	25,781.0
49 599 28	Mixed metallic loads	45	1,394.0

Key: n.o.s. = not otherwise specified

Source: Conrail letter of October 27, 1980

TABLE 2-4

TOXIC CHEMICALS COMBINED DUE TO THEIR SIMILAR PHYSICAL AND TOXICITY PROPERTIES

Combined Chemical	Component Chemicals	STCC Number
Freon	Dichlorodifluoromethane	49 045 16
	Dichlorodifluoromethane - Monochlorodifluoromethane mixture	49 045 31
	Monochlorodifluoromethane	49 045 52
	Refrigerants	49 045 70
Butadiene	Butadiene, inhibited	49 057 03
	Butadiene, from petroleum	49 057 04
Pentone	Pentone	49 082 55
	Coal tar, light oil	49 101 34
	Petroleum distillate	49 102 57
	Petroleum naptha	49 102 59
	Fuel oil	49 151 13
	Petroleum naptha	49 151 85
Ethyl Alcohol	Denatured alcohol	49 091 41
	Alcohol, n.o.s. (in bond)	49 101 02
	Alcohol, n.o.s.	49 131 03

Total Combined - 11

Key: n.o.s. = not otherwise specified

1 of 1

TABLE 3-1

EVALUATION OF CONTROL ROOM HABITABILITY
FOR ONSITE CHEMICALS

Commodity Onsite Storage	Quantity	Distance From Control Room(m)	Toxicity Limit (g/cu m)	Peak Concentration At Control Room (g/cu m) Outside	Inside
Chlorine	6x1 tons	163	0.045	1130	20.7
Carbon dioxide	6 tons	53	1.840	1393	22.5
Sulfuric acid	4,000 gal	165	0.002	0.139	0.138
Sodium hydroxide	4,000 gal	165	0.002(1)	0.057	0.056
Nitrogen	11,000 gal	80	57.3(2)	502.8	16.6

(1) Occupational Safety and Health Administration (OSHA) standard
(2) Asphyxiant

3LE 3-2

INPUT PARAMETERS UTILIZED IN THE CONTROL ROOM CONCENTRATION MODEL

Case	Toxic Chemical	Molecular Weight (g/mol)	Boiling Point (°C)	Vapor Density (g/l)	Specific Gravity (g/cm^3)	Cp (cal/g)	Hv (cal/g)	Vapor Pressure (mm of Hg)	Diffusion Coefficient (cm^2/sec)	Toxicity Limit (g/m^3)
R-1	Chlorine	70.9	-34.1	2.49	1.57	0.226	68.8	-	-	0.045
R-2	Anhydrous Ammonia	17.0	-33.4	0.597	0.674	1.1	327.4	-	-	0.07
R-3	Sulfur Dioxide	64.1	-10.0	2.26	1.46	0.361	92.8	-	-	0.026
R-4	Carbon Dioxide-Gas	44.0	-78.5	1.53	0.468	0.184	83.2	-	-	18.4
R-5	Carbon Dioxide-Liquid	44.0	-78.5	1.53	0.468	0.184	83.2	-	-	18.4
R-6	Freon	120.9	-28.2	4.85	1.49	-	-	-	-	2.5
R-7	Butadiene	54.1	-4.4	1.92	0.621	0.545	99.8	-	-	2.2
R-8	Butane	58.1	-0.6	2.09	0.600	-	-	-	-	658.
R-9	Dimethyl ether	46.1	-23.7	1.85	-	-	-	-	-	0.74
R-10	Ethylene	28.1	-103.9	1.13	0.566	-	-	-	-	1110.
R-11	Isobutylene	56.1	-6.0	2.25	-	-	-	-	-	415.
R-12	Methyl chloride	50.5	-24.2	2.03	-	-	-	-	-	150,000
R-13	Propane	44.1	-42.2	1.55	0.585	-	-	-	-	1.83
R-14	Vinyl chloride	62.5	-13.9	2.15	0.920	0.380	79.8	-	-	2.6
R-15	Ethylene oxide	44.1	10.7	1.49	0.897	0.476	138.5	-	-	0.180
R-16	Propylene oxide	58.1	34.3	2.00	0.831	-	-	-	-	0.240
R-17	Acrylonitrile	53.1	77.3	1.83	0.806	0.500	-	225	0.20	0.07
R-18	Ethyl acrylate	100.1	99.8	4.01	0.924	-	-	4.7	0.20	1.46
R-19	Methyl methacrylate monomoer	100.1	100.0	4.01	0.936	-	-	4.7	0.20	0.15
R-20	Styrene monomer	104.2	145.2	4.18	0.906	0.416	101.7	20.0	0.20	1.60
R-21	Vinyl acetate	86.1	72.0	3.45	0.932	0.433	95.2	230.0	0.20	0.036
R-22	Acetone	58.1	56.2	2.33	0.791	0.528	128.1	400.0	0.134	4.8
R-23	Carbon disulfide	76.1	46.5	2.64	1.293	0.241	84.1	625.0	0.109	12.6
R-24	Ethylene chloride	99.0	83.5	-	1.240	-	-	238 @32°C	0.20	16.2
R-25	Hexane	86.2	69.0	3.46	0.660	-	-	165.0	0.20	17.9
R-26	Penetane	72.2	36.1	-	0.626	-	-	591@32°C	0.20	264.6
R-27	Butyl acetate	116.2	126.5	-	0.880	-	-	28.@32°C	0.20	0.948
R-28	Butyl alcohol	74.1	100.0	2.97	0.808	-	-	24.0	0.20	0.310
R-29	Isobutyl alcohol	74.1	100.0	2.97	0.808	-	-	24.0	0.20	0.310
R-30	Ethyl acetate	88.1	77.2	3.04	0.895	0.459	102.0	186.0	0.0935	1.44
R-31	Isopropyl acetate	102.1	90.0	-	0.923	-	-	83@32°C	0.20	0.834
R-32	Methanol	32.0	64.7	1.11	0.792	0.600	262.8	260.0	0.162	0.520
R-33	Methyl ethyl ketone	72.1	79.6	-	0.806	-	-	135@32°C	0.20	0.294
R-34	Methyl isobutyl ketone	100.2	128.0	-	0.802	-	-	11.@32°C	0.20	0.209
R-35	Xylene	106.2	140.0	3.66	0.870	0.400	96.0	2.0	0.20	1.74

12/04/80

TABLE 3-2 (Cont)

Case	Toxic Chemical	Molecular Weight (g/mol)	Boiling Point (°C)	Vapor Density (g/l)	Specific Gravity (g/cm^3)	Cp (cal/g)	Hv (cal/g)	Vapor Pressure (mm of Hg)	Diffusion Coefficient (cm^2/sec)	Toxicity Limit (g/m^3)
R-36	Ethanol	46.1	78.5	-	0.789	-	-	81.a32°C	0.20	1.90
R-37	Formaldehyde (37%)	30.0	97.0	1.07	1.10	-	-	198.0	0.20	0.012
R-38	Hydrogen peroxide	34.0	150.2	1.36	1.47	-	-	2.9	0.20	0.0014
R-39	Carbolic acid (Phenol)	94.1	181.9	3.77	1.058	0.561	174.4	1.0	0.20	0.02
R-40	Aniline oil	93.1	184.4	3.22	1.022	-	-	1.5	0.079	0.04
R-41	Hydrofluoric acid	20.0	19.4	0.80	0.987	-	301.0	1.0	0.20	0.04
R-42	Acetic acid	60.1	118.1	-	1.049	-	-	16.0	0.20	1.91
R-43	Acetic anhydride	102.1	140.0	3.52	1.057	0.398	92.2	10.0	0.20	4.17
R-44	Phosphorus oxychloride	153.3	105.0	0.615	1.675	-	-	0.45	0.20	0.31
R-45	Monoethanolamine	61.1	170.0	-	1.02	-	-	1.0	0.20	0.0075
R-46	Bromine	159.8	58.7	6.41	3.12	0.107	44.9	380.0	0.109	6.63

POOR ORIGINAL

TABLE 3-4

TOXIC CHEMICALS THAT MAY RESULT IN A CONTROL ROOM OPERATOR INCAPACITATION

Case	Toxic Chemical	Shipments/Yr	Tons/Yr	Source Quantity (g)	STCC Num
R-14	Vinyl chloride	2,931	271,189.3	8.39×10^7	49 057
R-16	Propylene oxide	258	17,759.6	6.25×10^7	49 066
R-15	Ethylene oxide	240	18,843.4	7.12×10^7	49 066
R-1	Chlorine	211	100,425.7	4.32×10^8	49 041
R-6					
R-9	Dimethyl ether	156	5,103.9	2.97×10^7	49 057
R-42	Acetic acid	103	8,186.7	6.88×10^7	48 313
R-17	Acrylonitrile	135	8,863.2	5.97×10^7	49 068
R-33	Methyl ethyl ketone	131	10,523.3	7.29×10^7	49 092
R-43	Acetic anhydride	69	5,918	7.41×10^7	313
R-32	Methanol	94	8,512.6	8.22×10^7	49 092
R-7	Butadiene	93	7,523.3	7.31×10^7	49 057 49 057
R-46	Bromine	48	1,418.0	2.56×10^7	49 361
R-37	Formaldehyde	66	6,106.1	8.39×10^7	49 131
R-12	Methyl chloride	41	1,815.3	3.89×10^7	49 057
R-3	Sulfur dioxide	39	3,132.6	7.35×10^7	49 042
R-21	Vinyl acetate	35	2,860.0	7.34×10^7	49 072
R-13					
R-2	Anhydrous ammonia	31	15,265.2	4.42×10^8	49 042
R-24	Ethylene chloride	239	9,316.0	3.38×10^7	49 081

TABLE 3-5

LESS FREQUENTLY TRANSPORTED TOXIC CHEMICALS CONSIDERED IN AGGREGATE PROBABILITY ANALYSIS

Toxic Chemical	STCC Number	Shipments/Yr	Control Room Habitability Problem Yes	No
Isopropanol	49 092 05	29		X
Methyl acrylate	49 072 45	25	X	
Tetrahydrofuran	49 082 90	23	X	
Isobutyl acetate	49 092 07	23		X
Toluene	49 093 05	19		X
Hydrogen chloride	49 042 70	15	X	
Pyridine	49 092 77	14	X	
Ethylene dichloride	49 091 66	17	X	
Trimethylamine	49 055 40	13	X	
Dimethylamine	49 055 10	11	X	
Acetaldehyde	49 072 10	11	X	
Propyl acetate	49 092 68	11		X
Ethyl mercaptan	49 081 69	10	X	
Monomethylamine	49 055 30	9.3	X	
Allyl chloride	49 074 12	8.5	X	
Cyclohexane	49 081 32	8.5		X
Diethyl ether	49 081 56	8.5	X	
	49 081 57			

12/04/80

TABLE 3-6

SECTOR DISTANCES AND TRACK LENGTHS
FOR PROBABILITY EVALUATIONS

22 1/2°-Sector	Shortest Distance to Sector (mi)	(km)	Track Length (mi)
NNW	2.8	4.5	2.6
N	2.1	3.4	1.1
NNE	1.6	2.6	0.9
NE	1.5	2.4	0.7
NEE	1.5	2.4	0.6
E	1.6	2.6	1.0
ESE	2.2	3.5	1.1
SE	2.7	4.3	2.6

PHILADEPHIA ELECTRIC COMPANY PEACH BOTTOM NUCLEAR STATION TABLE 3-15

ALL 28 TOXIC CHEMICALS EVALUATED, 1977- 1978 PEACH BOTTOM METEOROLOGICAL DATA

AGGREGATE PROBABILITY OF TOXIC CHEMICAL SPILL TRANSPORTED BY RAILROAD

DESIGN BASIS METEOROLOGY
NO REDUCTION DUE TO SITE AND SECTOR SPECIFIC INFORMATION

DOWNWIND SECTOR CONTRIBUTORS
(DOWNWIND DISTANCE(MILES))

TOXIC CHEMICAL	RANK	NNW 2.60	N 1.10	NNE 0.90	NE 0.70	ENE 0.60	E 1.00	ESE 1.10	SE 2.60	SECTOR TOTAL
VINYL CHLORIDE	1	0.0	0.0	0.260E-05	0.185E-05	0.187E-05	0.481E-05	0.0	0.0	0.111E-04
PROPYLENE OXIDE	2	0.325E-05	0.628E-06	0.228E-06	0.163E-06	0.165E-06	0.423E-06	0.628E-06	0.267E-05	0.815E-05
ETHYLENE OXIDE	3	0.302E-05	0.584E-06	0.213E-06	0.152E-06	0.154E-06	0.394E-06	0.584E-06	0.248E-05	0.758E-05
ETHYL CHLORIDE	4	0.301E-05	0.582E-06	0.212E-06	0.151E-06	0.153E-06	0.392E-06	0.582E-06	0.247E-05	0.755E-05
CHLORINE	5	0.265E-05	0.514E-06	0.187E-06	0.133E-06	0.135E-06	0.346E-06	0.514E-06	0.218E-05	0.666E-05
ACRYLONITRILE	6	0.170E-05	0.329E-06	0.120E-06	0.852E-07	0.863E-07	0.221E-06	0.329E-06	0.140E-05	0.426E-05
CARBON DISULFIDE	7	0.0	0.117E-05	0.426E-06	0.304E-06	0.308E-06	0.789E-06	0.117E-05	0.0	0.417E-05
ACETIC ACID	8	0.130E-05	0.251E-06	0.912E-07	0.650E-07	0.659E-07	0.169E-06	0.251E-06	0.107E-05	0.325E-05
METHANOL	9	0.11[illegible]E-05	0.229E-06	0.832E-07	0.594E-07	0.601E-07	0.154E-06	0.229E-06	0.972E-06	0.297E-05
BUTADIENE-INHIBITED	10	0.117E-05	0.226E-06	0.824E-07	0.587E-07	0.595E-07	0.153E-06	0.226E-06	0.962E-06	0.294E-05
ACETIC ANHYDRIDE	11	0.872E-06	0.169E-06	0.614E-07	0.438E-07	0.443E-07	0.114E-06	0.169E-06	0.717E-06	0.219E-05
FORMALDEHYDE	12	0.830E-06	0.161E-06	0.584E-07	0.417E-07	0.422E-07	0.108E-06	0.161E-06	0.682E-06	0.208E-05
BROMINE	13	0.604E-06	0.117E-06	0.425E-07	0.303E-07	0.307E-07	0.787E-07	0.117E-06	0.496E-06	0.152E-05
METHYL CHLORIDE	14	0.520E-06	0.101E-06	0.366E-07	0.261E-07	0.264E-07	0.677E-07	0.101E-06	0.427E-06	0.130E-05
SULFUR DIOXIDE	15	0.491E-06	0.950E-07	0.345E-07	0.246E-07	0.249E-07	0.640E-07	0.950E-07	0.403E-06	0.123E-05
VINYL ACETATE	16	0.440E-06	0.852E-07	0.310E-07	0.221E-07	0.224E-07	0.574E-07	0.852E-07	0.362E-06	0.111E-05
TETRAHYDROFURAN	17	0.289E-06	0.560E-07	0.204E-07	0.145E-07	0.147E-07	0.377E-07	0.560E-07	0.238E-06	0.726E-06
METHYL ETHYL KETONE	18	0.0	0.0	0.116E-06	0.827E-07	0.838E-07	0.215E-06	0.0	0.0	0.497E-06
HYDROGEN CHLORIDE	19	0.189E-06	0.365E-07	0.133E-07	0.947E-08	0.959E-08	0.246E-07	0.365E-07	0.155E-06	0.474E-06
PYRIDINE	20	0.176E-06	0.341E-07	0.124E-07	0.884E-08	0.895E-08	0.230E-07	0.341E-07	0.145E-06	0.442E-06
TRIMETHYLAMINE	21	0.164E-06	0.317E-07	0.115E-07	0.821E-08	0.831E-08	0.213E-07	0.317E-07	0.134E-06	0.411E-06
ACETALDEHYDE	22	0.138E-06	0.268E-07	0.974E-08	0.695E-08	0.704E-08	0.180E-07	0.268E-07	0.114E-06	0.347E-06
DIMETHYLAMINE	23	0.138E-06	0.268E-07	0.974E-08	0.695E-08	0.704E-08	0.180E-07	0.268E-07	0.114E-06	0.347E-06

TABLE 3-15 (Cont)

ETHYL MERCAPTAN	24	0.126E-06	0.244E-07	0.886E-08	0.631E-08	0.640E-08	0.164E-07	0.244E-07	0.103E-06	0.316E-06
MONOMETHYLAMINE	25	0.117E-06	0.226E-07	0.824E-08	0.587E-08	0.595E-08	0.153E-07	0.226E-07	0.962E-07	0.294E-06
DIETHYL ETHER	26	0.107E-06	0.207E-07	0.753E-08	0.537E-08	0.544E-08	0.139E-07	0.207E-07	0.879E-07	0.268E-06
ALLYL CHLORIDE	27	0.107E-06	0.207E-07	0.753E-08	0.537E-[illegible]	0.544E-08	0.139E-07	0.207E-07	0.879E-07	0.268E-06
METHYL ACRYLATE	28	0.0	0.616E-07	0.224E-07	0.160E-07	0.162E-07	0.415E-07	0.616E-07	0.0	0.219E-06

TOTAL PROBABILITY= 0.727E-04

PHILADEPHIA .ECTRIC COMPANY PEACH BOTTOM NUCLEAR STATION   TABLE 5-15A

ALL 28 TOXIC CHEMICALS EVALUATED, 1977- 1978 PEACH BOTTOM METEOROLOGICAL DATA

AGGREGATE PROBABILITY OF TOXIC CHEMICAL SPILL TRANSPORTED BY RAILROAD   WITH FULL CREDIT FOR SITE AND SECTOR SPECIFIC INFORMATION

DOWNWIND SECTOR CONTRIBUTORS
(DOWNWIND DISTANCE(MILES))

TOXIC CHEMICAL	RANK	NNW 2.60	N 1.10	NNE 0.90	NE 0.70	ENE 0.60	E 1.00	ESE 1.10	SE 2.60	SECTOR TOTAL
CARBON DISULFIDE	1	0.415E-05	0.738E-06	0.248E-06	0.193E-06	0.213E-06	0.552E-06	0.781E-06	0.287E-05	0.975E-05
ETHYL CHLORIDE	2	0.255E-05	0.442E-06	0.150E-06	0.110E-06	0.129E-06	0.304E-06	0.431E-06	0.173E-05	0.585E-05
PROPYLENE OXIDE	3	0.223E-05	0.419E-06	0.152E-06	0.111E-06	0.133E-06	0.317E-06	0.442E-06	0.154E-05	0.534E-05
CHLORINE	4	0.225E-05	0.390E-06	0.132E-06	0.969E-07	0.114E-06	0.268E-06	0.381E-06	0.153E-05	0.516E-05
ETHYLENE OXIDE	5	0.207E-05	0.368E-06	0.124E-06	0.964E-07	0.106E-06	0.276E-06	0.390E-06	0.143E-05	0.486E-05
VINYL CHLORIDE	6	0.312E-06	0.132E-06	0.649E-06	0.421E-06	0.577E-06	0.156E-05	0.132E-06	0.312E-06	0.410E-05
METHYL ETHYL KETONE	7	0.126E-05	0.225E-06	0.773E-07	0.564E-07	0.677E-07	0.161E-06	0.225E-06	0.880E-06	0.2[illegible]5E-05
ACRYLONITRILE	8	0.117E-05	0.207E-06	0.697E-07	0.542E-07	0.598E-07	0.155E-06	0.219E-06	0.806E-06	0.274E-05
ACETIC ACID	9	0.110E-05	0.190E-06	0.646E-07	0.4[illegible]3E-07	0.557E-07	0.131E-06	0.186E-06	0.747E-06	0.252E-05
METHANOL	10	0.812E-06	0.144E-06	0.486E-07	0.378E-07	0.416E-07	0.108E-06	0.153E-06	0.561E-06	0.191E-05
ACETIC ANHYDRIDE	11	0.739E-06	0.128E-06	0.435E-07	0.318E-07	0.375E-07	0.881E-07	0.125E-06	0.502E-06	0.170E-05
FORMALDEHYDE	12	0.704E-06	0.122E-06	0.414E-07	0.303E-07	0.35[illegible]E-07	0.839E-07	0.119E-06	0.478E-06	0.161E-05
BROMINE	13	0.512E-06	0.888E-07	0.301E-07	0.220E-07	0.260E-07	0.610E-07	0.866E-07	0.348E-06	0.117E-05
METHYL CHLORIDE	14	0.440E-06	0.764E-07	0.259E-07	0.190E-07	0.224E-07	0.525E-07	0.745E-07	0.299E-06	0.101E-05
SULFUR DIOXIDE	15	0.416E-06	0.721E-07	0.245E-07	0.179E-07	0.211E-07	0.496E-07	0.704E-07	0.283E-06	0.954E-06
VINYL ACETATE	16	0.373E-06	0.647E-07	0.220E-07	0.161E-07	0.189E-07	0.445E-07	0.631E-07	0.254E-06	0.856E-06
METHYL ACRYLATE	17	0.218E-06	0.388E-07	0.131E-07	0.102E-07	0.112E-07	0.290E-07	0.411E-07	0.151E-06	0.513E-06
TETRAHYDROFURAN	18	0.199E-06	0.353E-07	0.119E-07	0.924E-08	0.102E-07	0.264E-07	0.373E-07	0.137E-06	0.466E-06
BUTADIENE-INHIBITED	19	0.188E-06	0.419E-07	0.206E-07	0.133E-07	0.183E-07	0.496E-07	0.336E-07	0.991E-08	0.376E-06
HYDROGEN CHLORIDE	20	0.144E-06	0.257E-07	0.886E-08	0.646E-08	0.775E-08	0.184E-07	0.257E-07	0.101E-06	0.338E-06
PYRIDINE	21	0.134E-06	0.240E-07	0.827E-08	0.603E-08	0.723E-08	0.172E-07	0.240E-07	0.940E-07	0.315E-06
TRIMETHYLAMINE	22	0.125E-06	0.223E-07	0.768E-08	0.560E-08	0.672E-08	0.160E-07	0.223E-07	0.873E-07	0.293E-06
DIMETHYLAMINE	23	0.117E-06	0.203E-07	0.690E-08	0.505E-08	0.595E-08	0.140E-07	0.198E-07	0.797E-07	0.269E-06

ACETALDEHYDE	24	0.106E-06	0.189E-07	0.649E-08	0.474E-08	0.568E-08	0.135E-07	0.189E-07	0.739E-07	0.248E-06
ETHYL MERCAPTAN	25	0.107E-06	0.185E-07	0.627E-08	0.459E-08	0.541E-08	0.127E-07	0.180E-07	0.725E-07	0.245E-06
MONOMETHYLAMINE	26	0.991E-07	0.172E-07	0.583E-08	0.427E-08	0.503E-08	0.118E-07	0.168E-07	0.674E-07	0.227E-06
ALLYL CHLORIDE	27	0.906E-07	0.157E-07	0.533E-08	0.390E-08	0.460E-08	0.108E-07	0.153E-07	0.616E-07	0.208E-06
DIETHYL ETHER	28	0.734E-07	0.130E-07	0.439E-08	0.342E-08	0.376E-08	0.976E-08	0.138E-07	0.507E-07	0.172E-06

TOTAL PROBABILITY= 0.561E-04

PROBABILITY DUE TO CHEMICALS TRANSPORTED LESS THAN 30 TIMES PER YEAR 0.033E- 04

NOT ALL HAZARDOUS MATERIAL INCIDENTS RESULT IN AN INCAPCITATION. LEAKS AND MINOR SPILLS USUALLY ONLY REPRESENT A LOCAL HAZARD. THERE HAVE BEEN FEW LARGE SPILLS. INCAPCITATIONS AT DISTANCES OF 1.5 MILE OR MORE ARE UNLIKELY. A FACTOR OF 10^{-2} HAS BEEN APPLIED FOR SPILL SEVERITY FOR THIS SITE. THE RESULTANT PROBABILITY IS: 0.561E-06

POOR ORIGINAL