NORTHEAST UTILITIES

THE CONNECTICUT LIGHT AND POWER COMPANY
WESTERN MASSACHUSETTS ELECTRIC COMPANY
HOLYOKE WATER POWER COMPANY
NORTHEAST UTILITIES SERVICE COMPANY
NORTHEAST NUCLEAR ENERGY COMPANY

General Offices • Seldon Street, Berlin, Connecticut

P.O. BOX 270
HARTFORD, CONNECTICUT 06141-0270
(203) 666-6911

September 6, 1983
Docket No. 50-423
B10887

Director of Nuclear Reactor Regulations
Attn: Mr. B. J. Youngblood, Chief
Licensing Branch No. 1
Division of Licensing
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Gentlemen:

Millstone Nuclear Power Station, Unit No. 3
Transmittal of Amendment 1 to the
Submittal of Probabilistic Safety Study (PSS)

On behalf of the participants in the Millstone Nuclear Power Station Unit No. 3, five (5) copies of Amendment No. 1 to the Probabilistic Safety Study (PSS) are herein submitted.

Very truly yours,

NORTHEAST NUCLEAR ENERGY COMPANY
et. al.

BY

NORTHEAST NUCLEAR ENERGY COMPANY
Their Agent

W. G. Counsil

W. G. Counsil
Senior Vice President

B001
1/1

STATE OF CONNECTICUT)
) ss. Berlin
COUNTY OF HARTFORD)

Then personally appeared before me W. G. Counsil, who being duly sworn, did state that he is Senior Vice President of Northeast Nuclear Energy Company, Applicants herein, that he is authorized to execute and file the foregoing information in the name and on behalf of the Applicants herein and that the statements contained in said information are true and correct to the best of his knowledge and belief.

Lorraine J. D'Amico
Notary Public

My Commission Expires March 31, 1986

INSERTION INSTRUCTIONS FOR AMENDMENT 3

Remove old pages and insert Amendment 1 pages as instructed below (amendment pages bear the amendment number and date at the foot of the page).

Vertical bars (change bars) have been placed in the outside margins of revised text pages and tables to show the location of any technical changes originating with this amendment. A few unrevised pages have been reprinted because they fall within a run of closely spaced revised pages. No change bars are used on figures or on new sections, appendices, questions and responses, etc.

Transmittal letters along with these insertion instructions should either be filed or entered in Volume I of Part I, in front of any existing letters, instructions, distribution lists, etc.

Remove	Insert	Location
V-7 (Table V-1)	V-7 (Table V-1)	Vol. 1, Intro. & Summary
Figure V-1	Figure V-1	Vol. 1, Intro. & Summary
Figure V-2	Figure V-2	Vol. 1, Intro. & Summary
Figure V-3	Figure V-3	Vol. 1, Intro. & Summary
Figure V-4	Figure V-4	Vol. 1, Intro. & Summary
1.1-34	1.1-34	Vol. 2, Section 1.1
1.1-37	1.1-37	Vol. 2, Section 1.1
1.1-40	1.1-40	Vol. 2, Section 1.1
4.1-12	4.1-12	Vol. 8, Section 4.1
4.4-52	4.4-52	Vol. 8, Section 4.4
5.1-12	5.1-12	Vol. 10, Section 5.1
vi	vi	Vol. 11, Section 6.0
vii	vii	Vol. 11, Section 6.0
6.1-9	6.1-9	Vol. 11, Section 6.1
6.1-11	6.1-11	Vol. 11, Section 6.1
6.1-12	6.1-12	Vol. 11, Section 6.1
6.1-13	6.1-13	Vol. 11, Section 6.1
6.1-15	6.1-15	Vol. 11, Section 6.1
6.1-16	6.1-16	Vol. 11, Section 6.1
6.1-17	6.1-17	Vol. 11, Section 6.1
6.1-20	6.1-20	Vol. 11, Section 6.1
6.1-23	6.1-23	Vol. 11, Section 6.1
Figure 6.1-3	Figure 6.1-3	Vol. 11, Section 6.1
Figure 6.1-4	Figure 6.1-4	Vol. 11, Section 6.1
Figure 6.1-5	Figure 6.1-5	Vol. 11, Section 6.1
Figure 6.1-6	Figure 6.1-6	Vol. 11, Section 6.1
Figure 6.1-7	Figure 6.1-7	Vol. 11, Section 6.1
Figure 6.1-8	Figure 6.1-8	Vol. 11, Section 6.1
Figure 6.1-9	Figure 6.1-9	Vol. 11, Section 6.1
Figure 6.1-10	Figure 6.1-10	Vol. 11, Section 6.1
Figure 6.1-11	Figure 6.1-11	Vol. 11, Section 6.1
Figure 6.1-12	Figure 6.1-12	Vol. 11, Section 6.1
Figure 6.1-13	Figure 6.1-13	Vol. 11, Section 6.1

Remove	Insert	Location
Figure 6.1-14	Figure 6.1-14	Vol. 11, Section 6.1
Figure 6.1-15	Figure 6.1-15	Vol. 11, Section 6.1
Figure 6.1-16	Figure 6.1-16	Vol. 11, Section 6.1
Figure 6.1-17	Figure 6.1-17	Vol. 11, Section 6.1
Figure 6.1-18	Figure 6.1-18	Vol. 11, Section 6.1
Figure 6.1-19	Figure 6.1-19	Vol. 11, Section 6.1
Figure 6.1-20	Figure 6.1-20	Vol. 11, Section 6.1
Figure 6.1-21	Figure 6.1-21	Vol. 11, Section 6.1
Figure 6.1-22	Figure 6.1-22	Vol. 11, Section 6.1
Figure 6.1-23	Figure 6.1-23	Vol. 11, Section 6.1
Figure 6.1-24	Figure 6.1-24	Vol. 11, Section 6.1
Figure 6.1-25	Figure 6.1-25	Vol. 11, Section 6.1
Figure 6.1-26	Figure 6.1-26	Vol. 11, Section 6.1
Figure 6.1-27	Figure 6.1-27	Vol. 11, Section 6.1
Figure 6.1-28	Figure 6.1-28	Vol. 11, Section 6.1
Figure 6.1-29	Figure 6.1-29	Vol. 11, Section 6.1
Figure 6.1-30	Figure 6.1-30	Vol. 11, Section 6.1
Figure 6.1-31	Figure 6.1-31	Vol. 11, Section 6.1
Figure 6.1-32	Figure 6.1-32	Vol. 11, Section 6.1
Figure 6.1-33	Figure 6.1-33	Vol. 11, Section 6.1
Figure 6.1-34	Figure 6.1-34	Vol. 11, Section 6.1
Figure 6.1-35	Figure 6.1-35	Vol. 11, Section 6.1
Figure 6.1-36	Figure 6.1-36	Vol. 11, Section 6.1
Figure 6.1-37	Figure 6.1-37	Vol. 11, Section 6.1
Figure 6.1-38	Figure 6.1-38	Vol. 11, Section 6.1
Figure 6.1-39	Figure 6.1-39	Vol. 11, Section 6.1
Figure 6.1-40	Figure 6.1-40	Vol. 11, Section 6.1
Figure 6.1-41	Figure 6.1-41	Vol. 11, Section 6.1
Figure 6.1-42	Figure 6.1-42	Vol. 11, Section 6.1
Figure 6.1-43	Figure 6.1-43	Vol. 11, Section 6.1
Figure 6.1-44	Figure 6.1-44	Vol. 11, Section 6.1
Figure 6.1-45	Figure 6.1-45	Vol. 11, Section 6.1
Figure 6.1-46	Figure 6.1-46	Vol. 11, Section 6.1
Figure 6.1-47	Figure 6.1-47	Vol. 11, Section 6.1
Figure 6.1-48	Figure 6.1-48	Vol. 11, Section 6.1
Figure 6.1-49	Figure 6.1-49	Vol. 11, Section 6.1
Figure 6.1-50	Figure 6.1-50	Vol. 11, Section 6.1
Figure 6.1-51	Figure 6.1-51	Vol. 11, Section 6.1
Figure 6.1-52	Figure 6.1-52	Vol. 11, Section 6.1
Figure 6.1-53	Figure 6.1-53	Vol. 11, Section 6.1
Figure 6.1-54	Figure 6.1-54	Vol. 11, Section 6.1
-----	Figure 6.1-55	Vol. 11, Section 6.1
6c-7	6c-7	Vol. 11, Appendix 6C
-----	6c-13	Vol. 11, Appendix 6C
-----	6c-14	Vol. 11, Appendix 6C

Remove	Insert	Location
7.2-8	7.2-8	Vol. 12, Section 7.2
7.2-9	7.2-9	Vol. 12, Section 7.2
7.2-10	7.2-10	Vol. 12, Section 7.2
7.2-11	7.2-11	Vol. 12, Section 7.2
7.2-12	7.2-12	Vol. 12, Section 7.2
7.2-13	7.2-13	Vol. 12, Section 7.2
7.2-14	7.2-14	Vol. 12, Section 7.2
7.2-15	7.2-15	Vol. 12, Section 7.2
7.2-16	7.2-16	Vol. 12, Section 7.2
7.2-17	7.2-17	Vol. 12, Section 7.2
7.2-18	7.2-18	Vol. 12, Section 7.2
Figure 7.2.2-1A	Figure 7.2.2-1A	Vol. 12, Section 7.2
Figure 7.2.2-1B	Figure 7.2.2-1B	Vol. 12, Section 7.2
Figure 7.2.2-1C	Figure 7.2.2-1C	Vol. 12, Section 7.2
Figure 7.2.2-1D	Figure 7.2.2-1D	Vol. 12, Section 7.2
Figure 7.2.2-1E	Figure 7.2.2-1E	Vol. 12, Section 7.2
Figure 7.3-1A	Figure 7.3-1A	Vol. 12, Section 7.3
Figure 7.3-1B	Figure 7.3-1B	Vol. 12, Section 7.3
Figure 7.3-1C	Figure 7.3-1C	Vol. 12, Section 7.3
Figure 7.3-1D	Figure 7.3-1D	Vol. 12, Section 7.3
Figure 7.3-1E	Figure 7.3-1E	Vol. 12, Section 7.3
7.4-3	7.4-3	Vol. 12, Section 7.4
7.4-5	7.4-5	Vol. 12, Section 7.4
Figure 7.4.3-1	Figure 7.4.3-1	Vol. 12, Section 7.4
Figure 7.5.1-1A	Figure 7.5.1-1A	Vol. 12, Section 7.5
Figure 7.5.1-1B	Figure 7.5.1-1B	Vol. 12, Section 7.5
Figure 7.5.1-1C	Figure 7.5.1-1C	Vol. 12, Section 7.5
Figure 7.5.1-1D	Figure 7.5.1-1D	Vol. 12, Section 7.5
Figure 7.5.1-1E	Figure 7.5.1-1E	Vol. 12, Section 7.5
Figure 7.5.2-1A	Figure 7.5.2-1A	Vol. 12, Section 7.5
Figure 7.5.2-1B	Figure 7.5.2-1B	Vol. 12, Section 7.5
Figure 7.5.2-1C	Figure 7.5.2-1C	Vol. 12, Section 7.5
Figure 7.5.2-1D	Figure 7.5.2-1D	Vol. 12, Section 7.5
Figure 7.5.2-1E	Figure 7.5.2-1E	Vol. 12, Section 7.5
Figure 7.5.3-1A	Figure 7.5.3-1A	Vol. 12, Section 7.5
Figure 7.5.3-1B	Figure 7.5.3-1B	Vol. 12, Section 7.5
Figure 7.5.3-1C	Figure 7.5.3-1C	Vol. 12, Section 7.5
Figure 7.5.3-1D	Figure 7.5.3-1D	Vol. 12, Section 7.5
Figure 7.5.3-1E	Figure 7.5.3-1E	Vol. 12, Section 7.5
Figure 7.6-1	Figure 7.6-1	Vol. 12, Section 7.6
Figure 7.6-2	Figure 7.6-2	Vol. 12, Section 7.6

TABLE V-1

DOMINANT ACCIDENT SEQUENCES CONTRIBUTING TO CORE MELT, EARLY FATALITIES, AND LATENT FATALITIES

(INTERNAL EVENTS)

Rank With Respect To Core Melt	Sequence Designation	Sequence Description	Plant Damage State	Mean Annual Frequency	Percent Contribution to Core Melt Frequency	Percent Contribution to Early Fatalities (at >100 fatalities level)	Percent Contribution to Latent Fatalities (at >1000 fatalities level)
1	E_{2}(1)/R-2	Medium LOCA: Failure of High Pressure Recirculation	ALC	3.87E-6	8.5	<0.1	<0.1
2	E_{18}(2)/AF-1/OA-7	Loss of Vital DC Bus 1 or 2: Failure of Auxiliary Feedwater, Failure of Bleed and Feed Cooling	TEC	2.20E-6	4.9	<0.1	<0.1
3	E_{20}(2)/AF-1/R-2	Loss of Vital AC Bus 1 or 2: Failure of Auxiliary Feedwater, Failure of High Pressure Recirculation	SLC	1.98E-6	4.4	<0.1	<0.1
4	E_{21}(2)/AF-1/R-2	Loss of Vital AC Bus 3 or 4: Failure of Auxiliary Feedwater, Failure of High Pressure Recirculation	SLC	1.98E-6	4.4	<0.1	<0.1
5	E_{16}	Interfacing Systems LOCA: Failure of RHR Inlet Valves	V	1.90E-6	4.2	99.8	27.9
6	E_{14}(7)/E60/E120/E6H/QS	Loss of Offsite Power: Failure of Both Diesel Generators, Failure to Recover Power in 6 Hours, Failure of Quench Spray Recovery	TE	1.65E-6	3.6	<0.1	18.4
7	E_{14}(6)SBI/AF-2/OA-3	Loss of Offsite Power: Failure of One ESF Bus, Steam Line Break Inside Containment, Failure of Auxiliary Feedwater, Failure of Primary Bleed through PORV's	TEC	1.63E-6	3.6	<0.1	<0.1
8	E_{6}(1)/MS-2/OA-3	Steam Line Break Outside Containment: Failure to Isolate Main Steam Line, Failure of Primary Bleed through PORV's	TEC	1.55E-6	3.4	<0.1	<0.1
9	E_{3}(1)/OA-2/R-2	Small LOCA: Failure to Control Primary Depressurization, Failure of High Pressure Recirculation	SLC	1.39E-6	3.1	<0.1	<0.1
10	E_{1}(1)/R-1	Large LOCA: Failure of Low Pressure Recirculation	ALC	1.37E-6	3.0	<0.1	<0.1
19	E_{20}(4)/AF-1/OA-7/QS	Loss of Vital AC Bus 1 or 2: Failure of Opposite Train ESF Cabinet, Failure of Auxiliary Feedwater, Failure of Bleed and Feed Cooling, Failure of Quench Spray	TE	7.23E-7	1.6	<0.1	8.0
20	E_{9}(4)/AF-1/OA-7/QS	Primary to Secondary Power Mismatch: Failure of Both ESF Cabinets, Failure of Auxiliary Feedwater, Failure of Bleed and Feed Cooling, Failure of Quench Spray	TE	6.15E-7	1.4	<0.1	6.9

FIGURE V-1

COMPARISON OF RISK CURVES FOR EARLY FATALITIES WASH-1400 VS. MILLSTONE 3

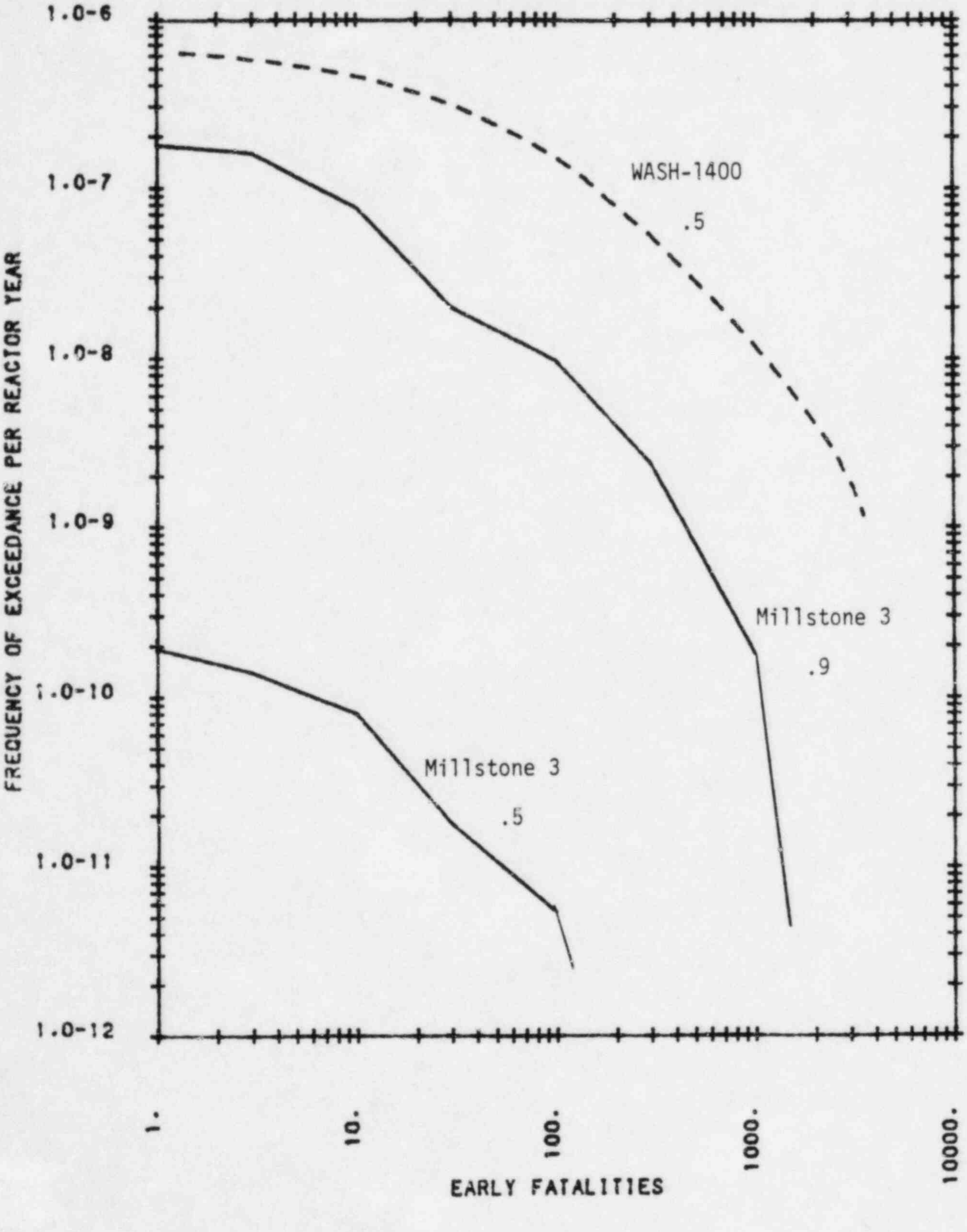
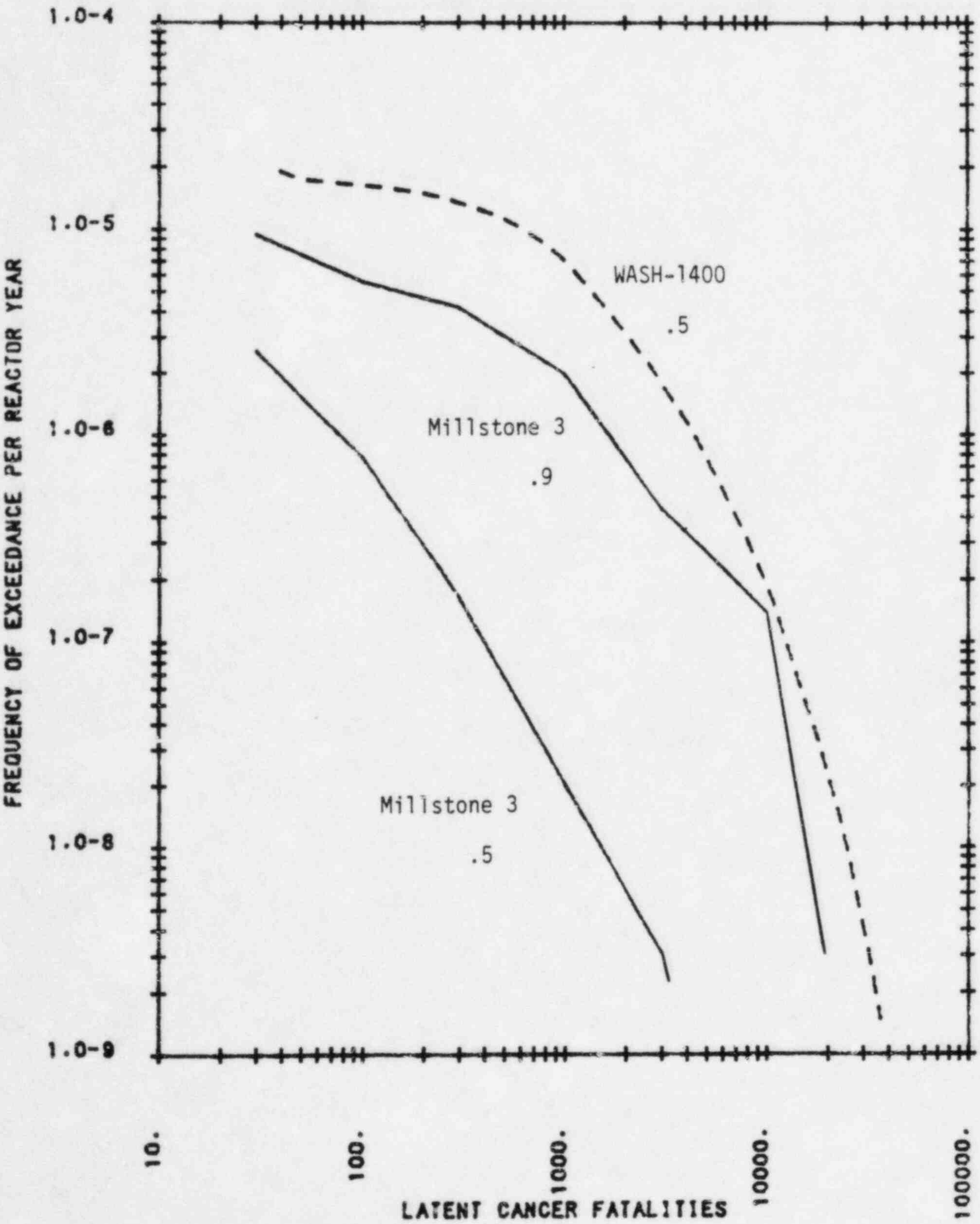


FIGURE V-2

COMPARISON OF RISK CURVES FOR LATENT FATALITIES
WASH-1400 VS. MILLSTONE 3



Amendment 1
September 7, 1983

FIGURE V-3

RISK DIAGRAM FOR EARLY FATALITIES DUE TO EXTERNAL EVENTS

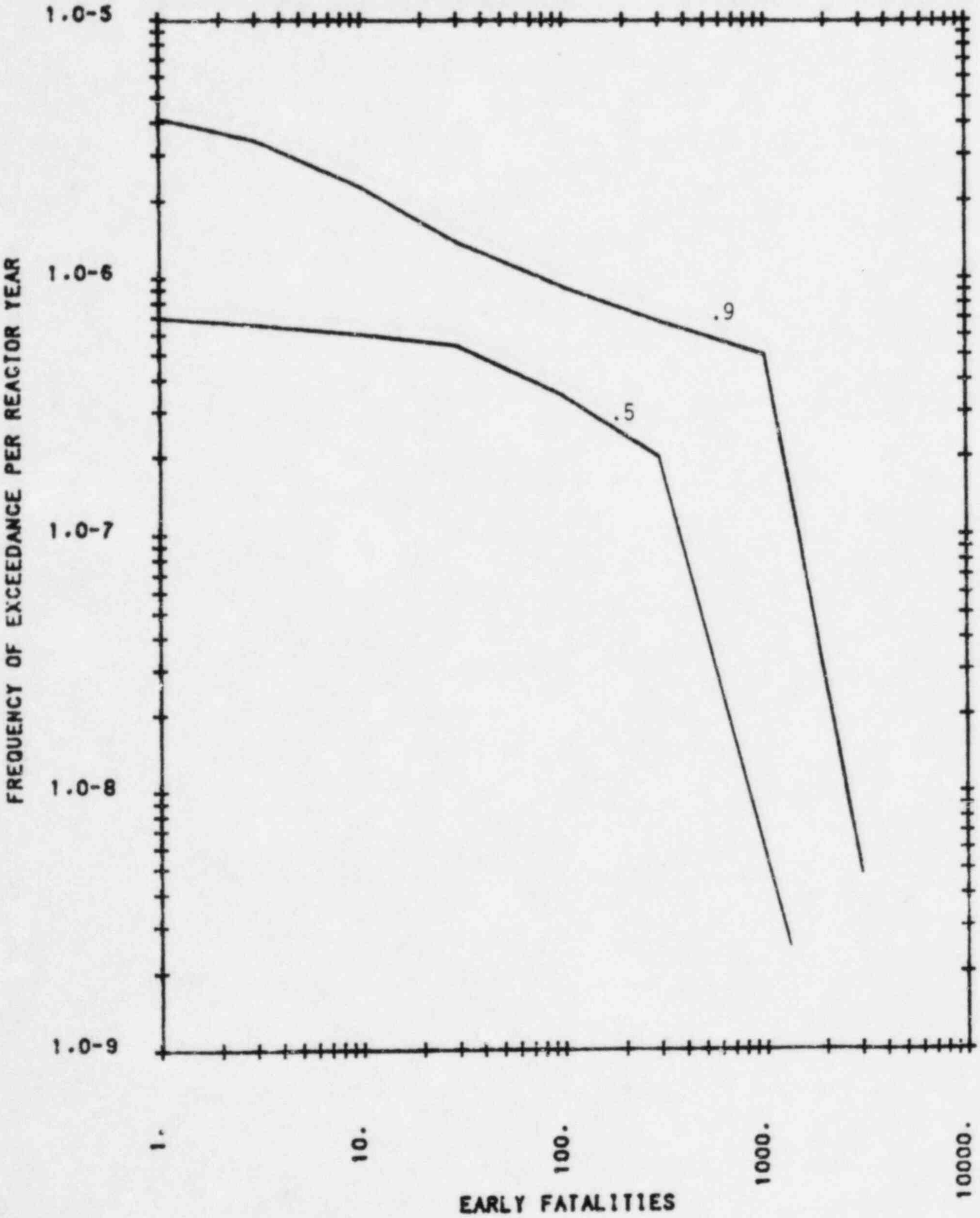
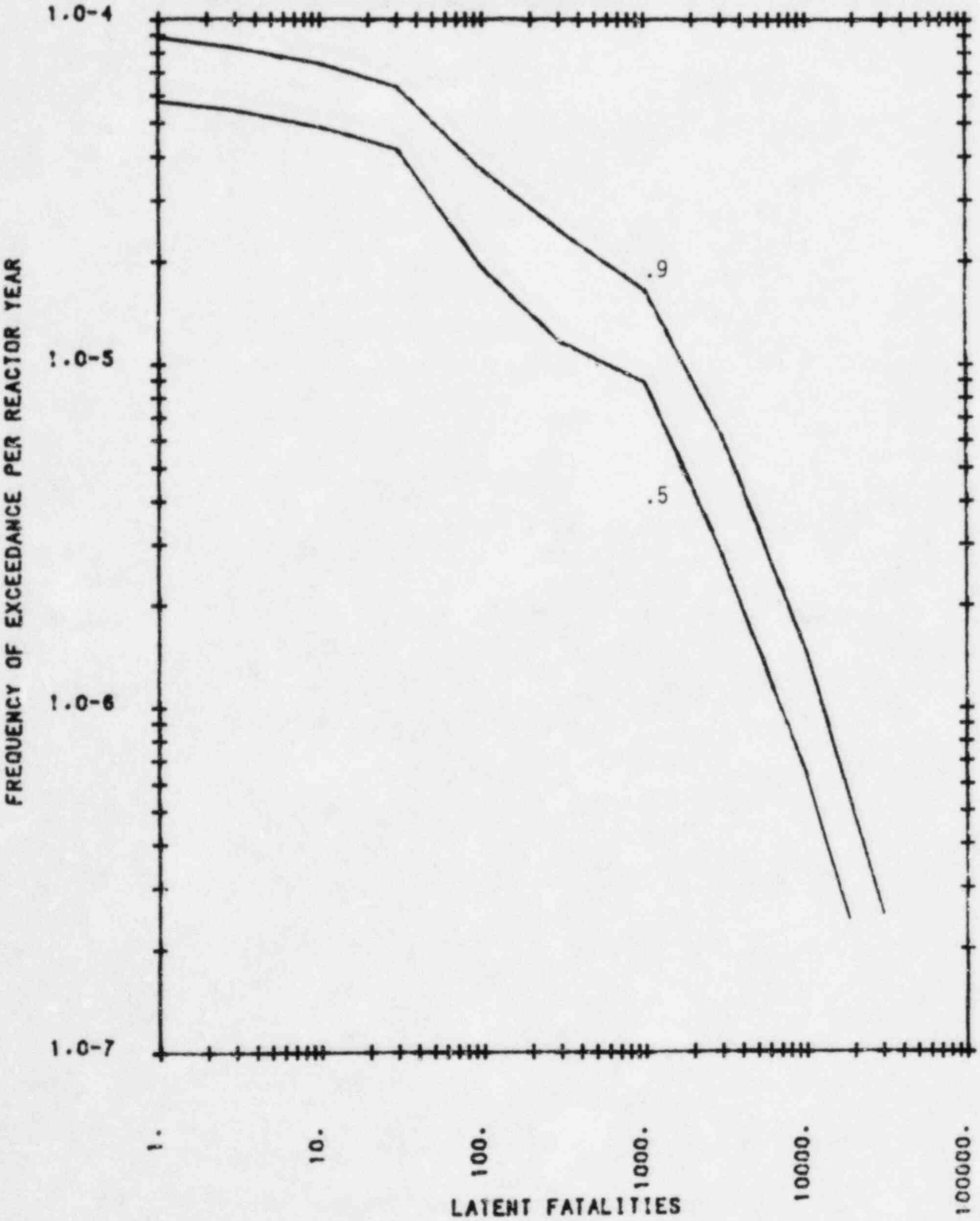


FIGURE V-4

RISK DIAGRAM FOR LATENT CANCER FATALITIES DUE TO EXTERNAL EVENTS



These scenarios have been identified through a review of containment penetrations that was conducted in order to insure that all interfacing systems have been considered. Table 1.1-12 provides a list of the Millstone-3 containment penetrations, along with associated system and piping information. As shown in the table, the only other penetrations for which an interfacing system LOCA might be postulated are those involving the charging and high pressure injection lines. These paths are not considered in detail for several reasons. First, the piping in these lines upstream of the RCS pressure boundary are qualified to relatively high pressures (2375 psig and 1750 psig, respectively) so that there is a probability that such piping will not rupture if exposed to existing RCS pressure. Indeed, insofar as the charging lines are concerned, rupture is judged extremely unlikely to occur based on system piping qualifications. Second, these piping runs range from 2 to 4 inches in diameter, so that the consequences of an interfacing system LOCA via one of these paths would be less severe than the other scenarios under analysis. Third, these paths are virtually identical in valve configuration to the low pressure injection paths analyzed below. It is demonstrated later in this section that the low pressure injection paths contribute negligibly to the overall Event V frequency. The less frequent and less severe paths associated with the charging and high pressure injection systems are, therefore, also judged to be insignificant contributors to plant risk and are not considered further in this analysis.

1. Event V - Cold Leg Injection Lines

Figure 1.1-3 depicts the cold leg injection arrangement for the low pressure injection and recirculation systems at Millstone Unit 3. As shown in the figure, there are four cold leg injection lines, each of which contains three series check valves. There are also two normally open motor-operated valves (one for each pair of lines) located upstream of the check valves. An interfacing systems LOCA via this path would involve failure of three series check valves and subsequent failure to close the appropriate motor-operated valve. The present analysis takes no credit for the possibility of manually closing these valves (MV 8809A and MV 8809B). Timely closure of these valves, once the safeguards signal has cleared (approximately 3 minutes), would terminate the V sequence with no resulting core degradation.

It has been determined, based on consideration of possible check valve failure modes, that disc failing open of the valves in the cold leg injection lines is not a credible failure mode. These check valves are tested for leakage after RCS depressurization to ensure proper disc seating. This leak testing occurs after system use (RHR mode) and prior to reactor startup. The valve operator motors are sized by design to preclude opening at pressures exceeding 600 psia.

Disc rupture, therefore, is the sole failure mode applicable to the check valves in the cold leg injection lines. An interfacing systems LOCA via this path would involve disc rupture of the three valves in one of the four lines. Because disc rupture is more reasonably postulated for valves exposed to relatively high (e.g., RCS) pressures, the accident progression as modeled here involves failure of the last series check valve (i.e., the one farthest downstream) and the sequential failure of the two valves upstream of the initial valve failure.

The frequency of an interfacing systems LOCA via the cold leg injection path can thus be expressed in terms of the following equation:

$$F(V_c) = 4[F(V1) \times P(V2 \mid V1) \times P(V3 \mid V1, V2)] \qquad \text{(Eq. 1.1.3.6.1-1)}$$

where:

$F(V_c)$ = frequency of cold leg V sequence

$F(V1)$ = frequency of initial valve failure

$P(V2 \mid V1)$ = conditional probability of second valve failure

$P(V3 \mid V1, V2)$ = conditional probability of third valve failure

The failure rate distribution associated with check valve disc rupture/ catastrophic leakage is taken from NUREG/CR-2815 and is of the truncated loguniform type with the following characteristics:

through a normally closed containment isolation motor-operated valve (MV 8840). Such an accident sequence would expose the low pressure piping upstream of valve MV 8840 to the existing RCS pressure.

Given the subsystem configuration as shown, there exist six different sequential failure combinations (or cutsets) that would cause an interfacing systems LOCA via the hot leg injection path. Specifically, there are two cutsets involving the sequential ruptures of two series check valves and the motor-operated valve. Four other cutsets involve two series check valve disc ruptures and transfer open/excessive leakage through the motor-operated valve. Because it is highly unlikely that the motor-operated valve could transfer open against RCS pressure, the cutsets that include this failure mode require that the failure occur prior to the rupture of both series check valves. Thus, the total frequency of an interfacing systems LOCA occurring via the hot leg injection path is expressed by the following equation:

$$\begin{aligned} F(V_H) = {} & 2[F(V1)\,P(V2 \mid V1)\,P(MV \mid V1, V2)] + \\ & 2[F(MV)\,P(V1 \mid MV)\,P(V2 \mid MV, V1)] \\ & 2[F(V1)\,P(MV \mid V1)\,P(V2 \mid V1, MV)] \end{aligned} \qquad \text{(Eq. 1.1.3.6.1-3)}$$

The first term in the right-hand side of the above expression accounts for the cutsets involving three successive valve disc ruptures. The second term represents those cutsets in which two series check valve ruptures occur following the MV transfer open failure. The third term accounts for those sequences in which the initial check valve rupture occurs, followed by the MV transfer open failure and, finally, rupture of the second series check valve.

The failure rate distributions for both motor-operated valve failure modes -- i.e., disc rupture and valve transfer open -- are also taken from NUREG/CR-2815 and are identical to that for the check valve disc rupture mode. That is,

Mean $= 7.9 \times 10^{-8}$/hour

Variance $= 1.9 \times 10^{-4}$/hour^2

The check valves in the hot leg injection lines, as those in the cold leg lines, are subject to quarterly testing. The position of the normally closed motor-operated valve is indicated in the control room, so that failure by transferring open would be detected within a normal 8-hour shift. For purposes of this analysis, a detection interval of 24 hours is assumed.

Given the above information, the expression for V_H is quantified, using DPD arithmetic, to obtain the probability distribution of the total frequency of an interfacing systems LOCA occurring via the hot leg injection path:

Mean $= 2.0 \times 10^{-11}$/year

Variance $= 4.9 \times 10^{-21}$/year^2

3. Event V - RHR Suction Lines

Figure 1.1-5 depicts the RHR suction arrangement at Millstone Unit 3. Referring to the figure, an interfacing systems LOCA would be caused by the sequential failure of two series motor-operated valves in either of the two RHR suction lines. Such a sequence would expose the low pressure piping downstream of the failed valves to the existing RCS pressure.

Failure combinations (for cutsets) involving disc rupture of two series motor-operated valves are included in the analysis. Other valve failure modes are judged inapplicable based on system characteristics. Disc failing open is defined as failure of a valve disc to return to the closed position after use. The RHR lines are used during plant shutdown conditions when the RHR system is in operation. If both valves in either line had discs which failed open, this condition would become apparent during the subsequent RCS startup, and corrective action taken. For this reason, the cutsets involving disc failing open in two series MVs are excluded from further consideration. Combinations involving disc failing open of the first MV and subsequent rupture of the second MV downstream of the first valve are also eliminated from consideration because the positions

of these valves are indicated in the control room. Therefore, failure to close the initial valve in either line would be detected during a normal shift. More important, during the assumed 24-hour detection interval, the second valve would not be exposed to pressures that could reasonably be postulated to induce disc rupture.

Each line contains a normally closed valve (MV 8701C and 8702C) as well as a verified and locked closed valve downstream of the first valve. Thus, the potential transferring open failure would exist for only one of the two MVs in each line. These valves, however, would have to transfer open against existing RCS pressure given the command (spurious signal or operator error) to do so. There is an extremely low probability, given the valve motor capabilities, that such valves could change position under such a large pressure differential. On this basis, then, transfer open is considered a negligible failure mode for the MVs in the RHR suction lines.

Based on the information and assumptions given above, the following expression is developed for the frequency of an interfacing systems LOCA occurring via the RHR suction path:

$$F(V_r) = 2[F(V1)\ P(V2 \mid V1)] \qquad \text{(Eq. 1.1.3.6.1-3)}$$

where: $F(V1)$ = frequency of first valve disc rupture

$P(V2 \mid V1)$ = conditional probability of second valve disc rupture

These valves are not tested during the year. As noted in the discussion of the hot leg injection path, the MV disc rupture frequency distribution is identical to that for check valves; that is,

Mean $= 7.9 \times 10^{-8}$/hour

Variance $= 1.9 \times 10^{-14}/\text{hour}^2$

Quantification, using DPD arithmetic, of the above expression then yields the following probability distribution of the frequency of an interfacing systems LOCA occurring via the RHR suction path:

Mean $= 1.9 \times 10^{-6}$/year

Variance $= 2.6 \times 10^{-11}$/year^2

This result is obtained from a series of analytic steps that are outlined in the following paragraphs. First, the MV disc rupture frequency, taken from NUREG/CR-2815, is specified as a truncated loguniform distribution. A discretization is, therefore, performed in order to translate this continuous distribution into appropriate DPD form. In this case, the discretization is accomplished by dividing the loguniform density function into a series of twelve intervals. Eight of the intervals have individual probabilities of 0.1 and occupy the center of the density function. Two intervals, each with 0.05 probability, specify either tail of the density function. The probability associated with each interval is then assigned to the middle percentile of that interval. By examining the sensitivity to various discretization schemes, it has been determined that this specification provides a reasonably accurate characterization of the distribution. The DPD for the hourly MV disc rupture frequency is given below:

Probability	Failure Rate (per hour)
0.05	1.28×10^{-10}
0.05	1.98×10^{-10}
0.1	3.84×10^{-10}
0.1	9.26×10^{-10}
0.1	2.23×10^{-9}
0.1	5.38×10^{-9}
0.1	1.30×10^{-8}
0.1	3.13×10^{-8}
0.1	7.54×10^{-8}
0.1	1.82×10^{-7}
0.05	3.52×10^{-7}
0.05	5.46×10^{-7}

Table 4.1-1 (Continued)

VI. CONTAINMENT FLOOR PARAMETERS

a.	Sump volume (up to containment floor)	115 ft^3
	Volume including RSS pumps and suction piping	338 ft^3
b.	Water volume before spillover into lower reactor cavity area	1.266×10^6 gallons* $\pm$ 73000 gallons
c.	Volume of lower reactor cavity to bottom of vessel	6700 ft^3
d.	Volume of incore instrument tunnel	1300 ft^3

* Spillover occurs into the incore instrument tunnel and then flows into the lower reactor cavity. Refer to containment layout drawings for this area.

Amendment 1
September 7, 1983

Amendment 1
September 7, 1983

TABLE 4.4.2-1

BEST ESTIMATE ACCIDENT CHRONOLOGY

Time in Seconds

Plant Damage State	ECCS Off	Core Uncovery	Core Melt	Vessel Failure	Cavity Dryout	Spray On	Spillover to Cavity	Debris Quench	Quench Spray Off	Cavity Dryout	Flammability Start	Flammability End
AE	0	210	820	1380	1690	---	---	---	---	---	4970	---
AEC	0	210	810	1360	1710	50	17160	20660	17420	---	1370	---
AEC'	0	210	810	1360	1710	50	17080	20580	17420	64420	1370	22100
AEC"	0	210	820	1380	1690	290	---	---	---	---	3300	---
AL	6670	8320	9670	10980	11280	---	---	---	---	---	20500	---
ALC	3880	5260	6520	7500	7960	50	11550	16270	11800	---	7500	---
ALC'	3880	5260	6520	7500	7960	50	11470	16190	11800	55407	7500	16600
ALC"	6670	8320	9670	10980	11280	290	---	---	---	---	10980	---
SE	0	1460	2310	2760	4270	---	---	---	---	---	---	---
SEC	0	1450	2290	2750	4540	880	18040	21040	18300	---	5780	---
SEC'	0	1450	2290	2750	4540	880	17960	20960	18300	58035	6700	23400
SEC"	0	1460	2310	2760	4270	1120	---	---	---	---	7700	---
SL	45480	49180	52370	53670	53780	---	---	---	---	---	61000	---
S'L	48510	57520	60020	61460	90660	---	---	---	---	---	---	---
SLC	11750	13400	15460	16370	16440	950	17460	20700	17720	---	17510	---
SLC'	11750	13400	15460	16370	16440	950	17380	20620	17720	>86400	17600	---
SLC"	45480	49180	52370	53670	53780	1190	---	---	---	---	53640	---
TE	0	17640	18800	20070	21680	---	---	---	---	---	---	---
TEC	0	17640	18800	20070	21680	15500	32610	34710	32870	---	24400	---
TEC'	0	17640	18800	20070	21680	15500	32530	34630	32870	>86400	24400	38000
TEC"	0	17640	18800	20070	21680	15800	---	---	---	---	23750	---

Category	Description
M-4	This release category is used for core-melt sequences with failure of containment isolation function.
M-5 M-6	These release categories are used for core-melt accident sequences which could lead to intermediate containment failure times without containment sprays operational. Release category M-5 accounts for late melt sequences and M-6 for early melt sequences.
M-7	This release category is used for core-melt accident sequences which could lead to late containment failure times without containment sprays operational.
M-8	This release category is used for core-melt accident sequences which could lead to intermediate containment failure times with functional containment sprays.
M-9	This release category is used for core melt accident sequences which could lead to late containment failure times with functional containment sprays.
M-10 M-11	These release categories are used for core-melt accident sequences which could lead to basemat melt through. Release category M-10 is used for the case of containment sprays nonoperational and M-11 for operational sprays in the time frame following core melt and vessel failure.
M-12	This release category is used for core-melt accident sequences where containment remains intact. All sequences in this release category have continuous spray operation.

5.1.3 SOURCE TERM UNCERTAINTIES

Prior estimates of the magnitude of release of fission products from the reactor system following postulated core melt accidents were based on small scale experiments and are reported in the Reactor Safety Study. The approach adopted by the authors of the RSS was determined by the information available to them at that time. For those areas where data and models were inadequate or nonexistent an upper bound or conservative approach was taken. For example the assumption was made that fission products released from the core where released, unatenuated from the primary coolant system.

Several major reviews of the transport of fission products have been undertaken in the two years, these include:

ND-R-610(5) "PWR Degraded Core Analysis", UKAEA issued 1982.

NUREG-0772 "Technical Basis for Estimating Fission Product Behavior During LWR Accidents"

NUS-3808 "Source Terms Investigations of Uncertainties, Magnitudes and Recommendations for Research."

The general conclusion reached by the authors of these documents is that while there is considerable weight of evidence that the release of fission products from the primary coolant-reactor vessel system would be lower than those released given in the RSS, quantitative justification based on experimental data was not presently available.

In order to address uncertainty in the source term, and provide more realistic estimates of fission product release for the various release categories, a method of Discrete Probability Distributions was utilized for this present report.

To provide rationale for the Development of Discrete Probability Distributions for the Millstone-3 release categories, a British report, SRD R 256, "The

LIST OF FIGURES (Continued)

LIST OF FIGURES (Continued)

SECTION 6 OFFSITE CONSEQUENCE ANALYSIS

6.0 OVERVIEW & SUMMARY

The offsite consequence analysis may be broadly classified into three sections. The "airborne pathways consequence analysis" (Section 6.1) estimates the effects on population due to exposure from fission products released through the air pathway and deposited on the ground (cloud, ground, inhalation and ingestion doses). The "airborne rainout to fish flesh pathways consequence analysis" (Section 6.2) accounts for rainout of the airborne fission products into water bodies, contamination of fish and finally, consumption of the contaminated fish by man. The "liquid pathways consequence analysis" (Section 6.3) treats the consequences resulting from fission products released directly into liquid pathways.

6.0.1 AIRBORNE PATHWAYS

Airborne pathways consequence analysis is carried out for estimating the population health effects resulting from the release of fission products from the containment into the environment subsequent to a postulated coremelt accident. The methodology utilized in this study is consistent with other major safety studies on nuclear power plants such as the Reactor Safety Study and the Zion and Indian Point Probabilistic Safety Studies. A modified version of the CRAC computer code (CRAC2) was used here to estimate the consequences.

Base case calculations were performed using the CRAC2 computer code for each release category. The output from this analysis is a conditional cumulative probability distribution for each of the damage indices for each release category. This set of conditional probability distributions constitutes the S Matrix.

In addition to these base case calculations that define the S Matrix, other computations were made for uncertainty and sensivity evaluations.

The uncertainty calculations consisted of cases where release magnitudes were modified by various amounts and their effects on consequences determined. The sensitivity calculations were performed for projected population growth and weekend population. An analysis was also performed to estimate the effects of special evacuation conditions following a seismically induced release.

6.0.2 OTHER PATHWAYS

Two additional dose pathways were investigated in order to determine their importance in determining the consequences of severe accidents at Millstone-3. These were the rainout to fish flesh pathways and liquid pathways. Rainout to fish flesh pathways involves deposition of airborne fission products into an isolated water body wherein fish are contaminated and subsequently eaten by man.

For water bodies other than Long Island Sound at large, a scoping study was conducted. A survey of the coastline within 50 miles of the site revealed that the bays and lagoons in this area are shallow. Flushing from tidal currents should prevent any long term accumulation or retention of fission products in these bodies of water and hence radiological consequences would be small. The only bodies of concern then were nearby ponds, lakes and reservoirs. Probability of wind directions and probability of coincident rain and wind direction were determined from the Millstone site meteorological data. Based on this probabilistic analysis two representative water bodies (Pachaug Pond and Groton Reservoir) were selected for further evaluation. The probability of contamination of these two lakes was estimated. Volumetric turnover rates of water in these lakes were determined in order to estimate flushing rates. From the flushing rates it was judged that the consequences of potential Pachaug Pond contamination are minor. Due to the lower turnover rate (and hence lower depletion rate) of Groton Reservoir, economic consequences from its potential contamination may be significant due to the potential need for long-term pathway interdiction (i.e., prohibition of use of Groton Reservoir for drinking water).

For assessing the consequences of fission product rainout to Long Island Sound, a model was developed to estimate the magnitude of doses to an average individual and to the population due to the consumption of contaminated fish. It was assumed that fission products excluding noble gases released from the containment to the air-pathway would be rained out into Long Island Sound and would mix uniformly in the water body. Depletion of radioactivity from the water body as a function of time after deposition was by radioactive decay, by tidal interchange and by fresh water inflow into the Sound. The population dose estimates were based on fish harvest data for Long Island Sound. Doses to the organ of an individual who consumed the contaminated fish over a two year period, and to the population, were computed and found to be small. The dose estimates were also found to be in reasonable agreement with those published in earlier studies.

Liquid pathways involve the release of fission products into the ground below containment via melt-through of the containment basemat. The mechanisms for such releases were investigated and the one of most concern was found to be the release of highly contaminated sump water into ground water systems. However, it is most likely that basemat melt-through would be followed by the release of only a small volume of sumpwater due to filling of a local system of interconnected cracks; contaminated water would then be trapped in the rock and would not migrate. If the sumpwater should eventually infiltrate a flow system, the rate of movement will be very low and groundwater flow will be into containment for a long period of time following depressurization. Adequate time would be available to remove a large fraction of the contaminated water from containment and to erect effective barriers to prevent the outward spreading of radionuclides. It was therefore concluded that the potential for radionuclide release to the liquid pathways is low, that such a release (should it occur) would be delayed for years, and that the quantity of radioactivity released would be small.

With the possible exception of the economic consequences of pathway interdiction of Groton Reservoir, the public consequences of the rainout to fish flesh and of the liquid pathways were found to be sufficiently small enough (in comparison to consequences from airborne pathways) to be neglected without affecting the validity and usefulness of the risk study.

6.1 AIRBORNE PATHWAYS CONSEQUENCE ANALYSIS

6.1.1 AIRBORNE PATHWAYS CONSEQUENCE MODEL

This section briefly describes the methodology employed for estimating the consequences of airborne releases of fission products subsequent to a postulated coremelt accident. The CRAC2 computer code (Reference 1) was utilized for this purpose and was executed on the CRAY-1 computer. This code is an updated version of the CRAC code that was employed in the Reactor Safety Study.

The CRAC code is developed, supported and continually improved by Sandia National Laboratories. All the modifications recommended by Sandia up through July 1, 1982 (Change 29.83/06/23) have been implemented in this version. Conversion of the code for use on the CRAY-1 computer was carried out. The code has been properly verified using the sample problems provided by Sandia and is under configuration control which assures traceability and documentation. The physical phenomena modeled in the code have been described elsewhere, (References 1 and 3). Therefore, no attempt is made to describe the details of the code in this report. A very brief overview is provided below.

Transport of the fission products released from the containment due to the prevailing wind is modeled. Vertical rise of the plume depends on the release energy associated with the particular release (category). Time dependent motion of the plume is simulated making use of the meteorological data - wind speed, turbulence, etc. Radioactive decay of the nuclides and their daughter buildup are accounted for.

One of the improvements of this code over the original CRAC model is the provision for "bin sampling" of the meteorological data. The meteorological data file contains pertinent information for each of the 8760 hours in a year. Performing plume dispersion calculations for each set of this data would be prohibitively expensive. What is normally done therefore is to pick approximately 100 samples and to perform a calculation for each of those start times. The sampling can be random, at regular

intervals or by bin sampling. In the latter method, all of the hourly data are first classified into groups or bins (there are 29 bins defined in CRAC2) on the basis of similarity of weather sequences. Then samples are picked from each bin. This insures against exclusion of some weather sequences or inappropriate weighting of them. Bin sampling is utilized in the current study using four samples from each bin. As discussed later in Section 6.1.4.4, more samples were selected from certain bins for release categories M1 and M4.

As the plume travels through the atmosphere, deposition of the particulate radioactive material takes place. When rain or snow occurs, the deposition rate is enhanced, depending on the rate of precipitation. The deposition affects both airborne and ground concentrations of the radioactive material. Both dry deposition and wet deposition are modeled by the code. Noble gases are not removed by deposition.

The radiation doses received by individuals are from the passing radioactive cloud (plume) and the material deposited on the ground. The cloud doses could be due to direct radiation and due to inhalation of the radioactive material suspended in the air. These processes will last only during the passage of the cloud over the affected population. Doses from the deposited radioactive material are via three paths: direct radiation from the radionuclides, inhalation of resuspended material and ingestion of contaminated food and water. The CRAC2 code simulates all these dose paths.

In order to assess the effect on the entire population, the individual doses are combined with the population distribution. The area within a 350 mile radius around the reactor is modeled on a circular grid that has finer radial divisions closer to the plant for better resolution. The entire grid consists of 33 rings (or circular intervals) and 16 sectors (radially around the rings) forming a total of 528 discrete areas. The population in each area is modeled based on the 1980 census data as described in Section 6.1.3. The radionuclides remaining in the plume beyond 350 miles is depleted by incident rain in an interval with a radius of 2000 miles.

Several protective action measures to reduce the radiation doses are modeled. These include evacuation of the nearby population to prevent or limit the cloud dose and early ground dose, and sheltering of the non-evacuees to limit the doses they receive. The evacuation model is typically comprised of two evacuation schemes and is described in Section 6.1.4. Long term relocation of people, interdiction and decontamination of land in the contaminated area are the other steps that could limit the radiation doses and are modeled in CRAC2.

The population health effects are determined from individual radiation doses and dose response characteristics. The health effects that are focused upon in this study are acute fatalities, acute injuries, latent cancer fatalities, benign and cancerous thyroid nodules and total population whole body dose. Early fatalities are dominated by bone marrow dose. The latent cancers occur over a period of several decades. CRAC2 also calculates specific economic consequences of radioactive release.

In addition to the base case consequence calculations for each of the release categories, several sensitivity calculations were performed as discussed in Sections 6.1.6, through 6.1.8. In addition, several runs were made by adjusting the fission product release fractions (except noble gases) to estimate the impact of uncertainties in the S matrix. These are discussed in Section 6.1.9.

6.1.1.1 SOURCE TERMS

The radioactive source terms used in the consequence analysis was obtained from Table 5.1-2 of Section 5. The airborne radioactive releases were classified into thirteen release categories - M1A, M1B, and M2 through M12. For each release category, the source terms were listed as fractions of core inventory of fission products released from the containment to the atmosphere. In addition to the magnitude of the release the following parameters were also defined: release start time (hr), warning time (hr), release duration (hr) and release energy

(Btu/hr). These parameters also formed part of the input to the CRAC2 evaluation of consequences.

As discussed earlier, several CRAC2 runs were made by adjusting the fission product release fractions for uncertainty analysis. The magnitude of the source terms (except noble gases) for release category M1B was a factor of 10 smaller than that of M1A whereas all the other parameters were the same for M1A and M1B. Hence M1B was identical to one of the uncertainty evaluation runs identified for M1A and hence its consequences were not evaluated separately during the base case evaluation; but they were properly accounted for in the final risk assembly discussed in Section 7. Thus twelve release categories (M1A and M2 through M12) formed the base case evaluation matrix. In the following discussions in Section 6, release category M1 refers to M1A and M1B.

6.1.2 MILLSTONE SITE CHARACTERISTICS

6.1.2.1 GEOGRAPHICAL CHARACTERISTICS

The Millstone site is located in the town of Waterford, New London County, Connecticut, on Long Island Sound. The 500 acre site occupies the tip of Millstone Point between Niantic Bay on the west and Jordon Cove on the east. The geographical coordinates of the centerline of the Millstone-3 reactor are N 41^{o} 18' 41" by W 72^{o} 10' 06".

The topography around Millstone is characterized by low rolling hills rising inland from the coast. The maximum height of the surrounding terrain within 5 miles of the site is about 250 feet above mean sea level. To the south of the site is open water.

For the purpose of site consequence analysis, the habitable land fraction around the Millstone site was estimated from the "Millstone Nuclear Power Station Emergency Planning Zone Map." The general site location is shown in Figure 6.1-1.

6.1.2.2 METEOROLOGICAL CHARACTERISTICS

The Millstone site is characterized by a continental climate, modified by the maritime influence of Long Island Sound and the Atlantic Ocean. The general eastward movement of air at the middle latitudes transports large air masses into the region. These prevailing westerly winds provide for day-to-day weather changes. The annual frequency of calm winds (less than 2 mph) is less than 3 percent. Precipitation around the Millstone site is well distributed throughout the year with an average annual precipitation of 39 inches. Table 6.1-1 lists the monthly, seasonal and annual frequency distribution of wind direction near the Millstone site.

The meteorological data used in this study was prepared from on-site meteorological measurements with the exception of precipitation measurements which were obtained from the National Weather Service Station at Bridgeport, Connecticut. The measurements consisted of wind speed, wind direction, wind direction variance, and temperature lapse rates taken every 15 minutes for the years 1977 and 1978. A computer program, METDATA, was written to convert the 15 minute readings to 1 hour average and in accordance with Regulatory Guide 1.23, convert the temperature lapse rates to stability classes. The METDATA program produces as output a meteorological data file in the format required by the CRAC2 code.

6.1.3 MILLSTONE OFFSITE POPULATION DISTRIBUTIONS

The population distributions used for the consequence analysis were prepared from 1980 census data as presented in Appendix 6-A. The base case analysis was performed using the actual 1980 population distribution around the Millstone site out to 350 miles. Additional sensitivity analyses were performed for the 1990 projected population distribution and estimated weekend beach population. These sensitivities are described in Sections 6.1.7 and 6.1.8 of this report. The actual population distributions used are given in Appendix 6-A of this report.

In general, the immediate area around the Millstone site has been an area of slow growth for the last 20 years and is expected to continue slow growth for the next 20 years (Reference: Millstone-3 FSAR Section 2.1.3.1).

Seasonal population variations resulting from an influx of summer residents is minimal since most homes in the area have been winterized and are now used as year-round residences. In addition, many of the beaches and recreation facilities in the area are used by residents, and therefore, do not represent any increase in population but instead a slight shift in population (Reference: Millstone-3 FSAR Section 2.1.3.3).

The closest population center to the Millstone site is the city of New London which contained a 1980 population of 28,842 people. The distance between the Millstone site and the nearest boundary of New London is 3.3 miles. The population centers of 25,000 or more within 80 km of the site are shown in Figure 6.1-2 and the population of each center is given in Table 6.1-2.

6.1.4 MILLSTONE EVACUATION CHARACTERISTICS

6.1.4.1 EVACUATION MODEL

The general evacuation model used in this study consists of three evacuation schemes. These are intended for non-seismic initiating events with normal weather conditions, non-seismic initiating events with adverse weather conditions and seismic initiated events irrespective of weather conditions. For release categories that are especially sensitive to evacuation scheme (M1A & M4), special treatment was required, as discussed later in Section 6.1.4.4.

The first two evacuation schemes mentioned above were used for all non-seismic events. Their probability of occurrence was determined on the basis of weather data. The probability of inclement weather used as the

basis was calculated from the data obtained from Millstone-3 FSAR and reproduced here as Table 6.1-3. The third evacuation scheme mentioned above was used for all seismic initiated events, irrespective of weather conditions.

In practice, the direction of evacuation is determined by the location and distribution of population and the wind direction at the time of evacuation. The mathematical model in CRAC2 assumes that the population will always evacuate in the downwind direction, radially away from the plant. The direction of wind affects the evacuation zone from where people evacuate when instructed. The evacuation zone consists of the entire area within five miles from the plant and the area enclosed by a 90^{o} sector in the downwind direction up to ten miles from the plant. These parameters remain the same for all evacuation schemes. The important parameters that vary between evacuation schemes are evacuation speed and delay time. These are discussed below.

6.1.4.2 EVACUATION SPEED

The speed at which the evacuees move radially away from the plant is called the evacuation speed. True value of this parameter will depend on several factors such as the time of day, weather condition, the density of population, the local road network, etc. A detailed analysis conducted by Storch Engineers (see Appendix 6-B) using extremely conservative assumptions estimated the evacuation speed to be of the order of 2 mph. It assumed that only the major highways would be used for evacuation. Values based on such conservative assumptions will provide unrealistic results. Hence realistic values based on more reasonable assumptions should be used in a probabilistic study.

An evacuation speed of 10 mph was used in this study for the first evacuation scheme (non-seismic event, normal weather condition). This is believed to be a realistic value for Millstone. It is also the representative value quoted in Table E-3 of Reference 3. Adverse weather conditions will slow down the evacuation. The Storch study estimates a reduction in speed of 20 to 30%. For the second evacuation scheme (non-

seismic event, adverse weather condition) an evacuation speed of 7.5 mph was used.

To properly assess the consequences of hypothetical severe earthquakes, alternate assumptions on evacuation speed are necessitated. This is because of the fact that certain major highways may become unavailable for evacuation due to bridge collapse, buckling of roadbed sections (in certain areas), and the effects of local dam failures which could potentially washout portions of the roadways. Under such circumstances, it is impossible to predict evacuation speeds with the degree of confidence that exists for non-seismic events. Clearly there will be an appreciable number of secondary roads available for evacuation. For the purpose of this report, calculations were performed assuming an evacuation speed of 2 mph for the third evacuation scheme (seismic initiated events).

6.1.4.3 DELAY TIMES BEFORE EVACUATION INITIATION

6.1.4.3.1 DELAY TIME FOR NON-SEISMIC EVENTS

Given a requirement for evacuation, it is necessary to inform the population and proper authorities and make decisions about which of several evacuation schemes to implement. This duration may be termed notification time. Sirens will be used to notify and alert the surrounding population affected by the evacuation. Under these circumstances the notification time will be less than 15 minutes. Even after being notified, additional time will be used by people as they get ready to evacuate. This duration is termed preparation time and has been determined in the evacuation study performed by Storch Engineers as 40 minutes. Thus the total delay time, comprised of notification time and preparation time, used in this study for normal evacuation is 55 minutes.

6.1.4.3.2 DELAY TIME FOR SEISMIC EVENTS

For seismic initiated events it is likely that the sirens normally used for notification of the population may be incapacitated. Under these conditions mobile notification will be required. Police and fire protection personnel will drive their vehicles to various neighborhoods and directly notify the public. Such notification measures require additional time for execution. The notification time will be short for nearby population, but increases with distance from the site. The Storch Report estimated the notification time to be 163 minutes for a distance of 10 miles. The preparation time needed by people after notification will be the same as for the non-seismic case, namely 40 minutes. Thus the total delay time for evacuation subsequent to a seismic event is estimated to be 203 minutes (3.38 hr).

6.1.4.4 SPECIAL TREATMENT OF M1 AND M4

In the course of evaluating the results of the consequence analyses, an extreme sensitivity to evacuation scheme input data was noted for release categories M1 through M4 for non-seismic events. For example, at 10 mph and 7.5 mph, no fatalities were calculated to occur as a result of release category M1A, while at 2 mph with an extended delay time, a large number of fatalities was indicated. The primary causes of this sensitivity are the short warning time and the low release energy for M1 through M4 which makes the people living in the evacuation areas more likely to be affected by the plume. Conversely, in the other release categories, the long warning time and the lofted plume make the analysis results relatively insensitive to evacuation scheme parameters. Based on the release category frequencies, it was further determined that release categories M2 and M3 would have an insignificant impact on risk. This eliminated any need for addressing evacuation scheme sensitivity for release categories M2 and M3.

In order to take into account the extreme sensitivity to evacuation scheme parameters, a special treatment for evacuation speed and delay time was incorporated for release categories M1 and M4. All

calculations involving categories M1 and M4 were redone using this special treatment such that the uncertainties associated with M1 and M4 were brought into line with the uncertainties associated with the other release categories. In order to further minimize uncertainties in these cases, the number of meteorological samples was also increased. Twelve (12) samples were used from each of the seven rain bins and four samples each from the other bins.

The special treatment for release categories M1 and M4 involves the use of six probability weighted evacuation schemes with varying evacuation speeds and delay times. The parameters for the six schemes were selected by consensus of a team of eight risk assessment experts (two from NUSCO and six from Westinghouse). The same team members, using engineering judgment, individually assigned their estimate of probability that each scheme would result in the "true" consequences. The sum of the six probabilities must always equal 1.0. The mean of the individual estimates were calculated and assigned for each scheme. The six schemes selected are uniquely represented by their associated evacuation speed (mph), and delay time (hours) and probability. The parameters for each scheme are presented in the following section.

6.1.4.5 EVACUATION SCHEME SUMMARY

As discussed earlier, of the three general evacuation schemes used in this study, schemes 1 and 2 were used for non-seismic initiated events. Scheme 3 was used for releases resulting from seismic initiated events. A special treatment of evacuation speed and delay time was incorporated for release categories M1 and M4. Table 6.1-4 lists the values of some important parameters for these evacuation schemes.

6.1.5 POPULATION HEALTH EFFECTS (NON-SEISMIC)

The site consequence analysis performed using the CRAC2 code provides conditional probability distributions for various damage indices. The consequence analysis was performed for each release category defined in Section 5.1.2.3. Appendix 6-C shows a listing of the CRAC2 input data

deck used for a typical calculation. The results presented in this section do not account for the frequency of (attaining) each release category, but rather the consequences assuming the occurrence of each release category.

Figure 6.1-3 shows the conditional cumulative probability distributions for acute fatalities. For each release category, the corresponding curve shows on the ordinate the conditional probability of exceeding the magnitude of damage (acute fatality) represented by the abscissa. Since these plots do not take into account the frequency of each release category, they do not reflect risk. These distributions constitute part of the input (the S Matrix) utilized to assemble the final results discussed in Section 7. No acute fatality is predicted for release categories M7 through M12. Therefore, conditional probability curves are not shown for these release categories.

Referring to Figure 6.1-3, it may be noticed that for the range of 1 to 1,000 fatalities, M1A has the highest conditional probability distribution. The primary reason for this is that among the major releases (M1 through M7), M1A has the lowest release energy. Hence the plume would not be lofted, leading to larger radionuclide deposition closer to the site. Further, M1 has a short warning time of 1 hour thereby limiting the benefits from evacuation. In combination, these factors result in higher doses to the nearby population and hence higher conditional probability of few acute fatalities.

When the release energy is high, the plume is lofted into the wind field. When this occurs, the fission products are likely to be carried farther from the plant before significant deposition takes place. They could then be distributed over larger areas, exposing more people to the radionuclides than if the release energy is low. Release categories M5, M6 and M7 have very high release energies. M7 has a long warning time and has much smaller values of radionuclide release to the environment. Of the remaining (M5 and M6), M6 is more severe on several counts: it has larger release fractions of all fission products and has earlier time of release (4.3 hours vs 8.3 hours for M5) and hence less decay.

The decay time is particularly important for the short lived iodine isotopes I_{132}, I_{133} and I_{134}. Therefore, among the major release categories with long warning times and high release energies, M6 has the highest conditional probability of acute fatalities.

Figures 6.1-4 through 6.1-7 show similar conditional cumulative probability distribution curves for other damage indices - acute injury, latent cancer fatalities excluding thyroid, thyroid nodules (both cancerous and benign) and population whole body dose. In general, absence of a curve for a release category indicates that the particular damage index is not expected to occur for that release category.

6.1.6 POPULATION HEALTH EFFECTS (SEISMIC)

It may be postulated that under certain accident conditions such as seismic induced coremelt, evacuation of the population will not be very effective. A study was conducted to determine the impact of slow evacuation on health effects.

In order to properly model this scenario, the evacuation speed is reduced to 2 miles per hour and the delay time increased to 3.38 hours. Estimation of these evacuation parameters is discussed in Section 6.1.4. Release categories M1 through M7 were selected for this evaluation since these are the significant release categories in terms of risk. CRAC2 runs were made to evaluate the consequences.

The results indicate that there will be no change in latent health effects - the effects will be the same as those for the base case (which models evacuation with higher speeds and lower delay times). However, the deviation on acute health effects is significant.

Figures 6.1-8 through 6.1-13 compare the conditional probability distributions of acute fatalities for the slow evacuation case with those for the base case. Figure 6.1-8 shows this comparison for release category M1A. It may be seen that the conditional probability distribution for the seismic case is higher than that for the base case

by approximately one order of magnitude. It indicates that when evacuation is slow, the conditional probability of acute fatalities increases, signifying the impact of evacuation for release category M1A. For this release category, due to the low release energy, the plume would not be lofted very high and therefore the impact on nearby population would be high. The slow evacuation thus increases the population acute doses and hence the conditional probability of acute fatalities.

Figure 6.1-9 displays the comparison in acute fatalities between post-seismic evacuation and the base case for release category M2. The conditional probability curve moves upward and to the right for the slower (seismic) evacuation. M2 has a short warning time (0.2 hrs). Therefore, the nearby population would receive a higher dose if the evacuation is delayed (3.38 vs 0.92 hr delay time) and slow (2 mph vs 10 mph). The higher dose increases the conditional probability of acute fatality. The conditional probability of a small number of fatalities (1 to 20) increase by an order of magnitude and that for a large number of fatalities (20 to 1000) increases from near zero to a finite fraction of the order of 0.01.

For release category M3, the comparison is shown in Figure 6.1-10. The variation in the conditional probability of acute fatalities for M3 is very large. Conditional probability of a few (1 to 3) acute fatalities increases by about two orders of magnitude. For a larger number of fatalities (in the range of 5 to 700) the conditional probability increases from near zero to a finite fraction (of the order of 0.01) as a result of slow evacuation.

Figure 6.1-11 illustrates the comparison for release category M4. The impact on acute fatalities are very similar to M1A - the conditional probability distribution curve shifts upward for the seismic case when the evacuation is slower and delayed.

Figures 6.1-12 and 6.1-13 show the comparison for release categories M5 and M6. It may be noted that only one curve is shown in each of these

figures. That is because the two sets of data (acute fatalities for seismic and non-seismic evacuation) are identical and the curves are superimposed. Release categories M5 and M6 have large release energies associated with them so that the plume is lofted high into the atmosphere. In addition they have a warning time of over four hours. Due to the larger warning time, evacuation is more effective for these release categories since the evacuating population receives a head start before the release from containment takes place. Even under post-seismic conditions, the evacuation is very effective. Doses received by lagging evacuees are not high enough to cause fatality. Under both evacuation schemes all fatalities would occur outside the evacuation zone; hence the results for seismic conditions are identical to the base case for release categories M5 and M6.

There are no acute fatalities for release category M7 either for the base case or for the seismic case.

Figures 6.1-14 through 6.1-20 provide similar comparisons for acute injuries. The highest variation in conditional probability of acute injuries occurs for release categories M2 and M3. See Figures 6.1-15 and 16. At the low consequence (1 to 1000 injuries) end of the curve, the increase in conditional probability over the base case is approximately one order of magnitude. Thereafter the two curves tend to converge. Following is the reason for the large variation at the low consequence end. In terms of evacuation effectiveness these two release categories are quite similar. They have low warning times (.2 to .5 hour) and nearly same release energies. Due to the low warning time, the evacuation would not be as effective as for release categories with large warning times. In the seismic evacuation scheme, the delay time is 3.38 hours and the speed is only 2 mph. Hence the adjacent population will receive higher radiation doses for a few hours, significantly increasing the conditional probability of acute injuries. For people in the non-evacuating zone there will be no difference in radiation exposure between the two evacuation schemes. Hence the two curves tend to converge at the high consequence end.

It may be noted from Figures 6.1-8, -11 and -17, that for release categories M1A and M4 conditional probability of acute fatalities and injuries within certain ranges is greater for the non-seismic case than for the seismic evacuation case. This may appear odd and unexpected. However, it is explainable: for all release categories, the seismic evacuation scheme had an evacuation speed of 2 miles per hour and a delay time of 3.38 hours. For release categories M1 and M4 only, the non-seismic evacuation model consisted of six evacuation schemes as discussed in Section 6.1.4.4. Two of these had evacuation speeds of only 1.2 miles per hour. Although the probability associated with these evacuation schemes were low (.05 and .07), they do model the entire population within the designated zone as evacuating at this slow rate. This results in a large number of people calculated as receiving higher acute doses. Thus the non-seismic evacuation model for M1 and M4 would be overpredicting the acute effects, thereby causing this curve to cross the corresponding curve for seismic evacuation.

Release categories M5 and M6 have relatively large warning times (4.1 hours). Therefore the base case evacuation is quite effective in protecting the population within the evacuation zone. In the post-seismic evacuation scheme also, most people in the evacuation zone would escape from the cloud shine before being severely exposed. However, a small number of lagging evacuees could receive sufficient doses to cause acute injuries. This increases the conditional probability of acute injuries at the low consequence (1 to 100) end over the base case. This is seen in Figures 6.1-18 and 19. At the high consequence end of the curve, the conditional probabilities of acute injuries are approximately the same under the seismic and non-seismic evacuation schemes.

For release category M7, the warning time is very large--16 hours. With so much time available, both the seismic and non-seismic evacuation schemes are very effective. The evacuating population is protected in both cases. Further, people outside the evacuation zone are assumed to be exposed the same amounts in both cases. Therefore, the consequence curves are identical. This is evident from Figure 6.1-20, where the only curve shown represents the results for both evacuation schemes.

In conclusion, the effect of slow and delayed evacuation is dependent on the release categories. Of particular interest is the warning time. For release categories with large warning times, evacuation would be completed before exposure of the population, somewhat independent of evacuation speed and delay time. Thus, no appreciable variation in health effects between the two cases would be expected. For release categories with very short warning times, the cumulative conditional probability curves for the seismic case are expected to be higher than the base case, particularly at the low consequence end.

6.1.7 SENSITIVITY TO PROJECTED POPULATION GROWTH

As discussed earlier, the base case analysis was conducted using the 1980 census data. A sensitivity analysis was performed to estimate the effect of population change on consequences. A projected 1990 population distribution based on the 1980 census data was used for this evaluation.

From the base case evaluation and knowing the preliminary frequency estimates for each release category, it was determined that M1 through M7 would dominate the risk. Therefore, the sensitivity analysis was performed for these seven release categories.

The results indicate that for the 1990 projected population the health effects will be approximately 8% greater than for the 1980 population. This observation is appropriate for both the acute and the latent effects and is consistent with expectations since the projected 1990 population reflects an increase of approximately 8% over the base case. Table 6.1-5 shows the percentage increase in mean health effects for the projected 1990 population over the 1980 population (base case) for each of the seven release categories. The increases in acute fatalities are in the range of 3 to 12%, those in acute injuries 6 to 11% and those in latent effects 8%.

6.1.8 SENSITIVITY TO TRANSIENT (SUMMER WEEKEND) POPULATION

A sensitivity analysis was conducted to determine the effect of the shift in population during summer weekends. As discussed in Section 6.1.3, a shift in population from the inland to the beaches and shores is expected during the summer weekends. The beach population was raised by an amount equal to the expected inflow from the in-land areas while the populations in the in-land sectors were conservatively assumed to remain unchanged. Using the same rationale as in Section 6.1.7, CRAC2 runs were made for release categories M1 through M7.

The results indicated that the influence of weekend population on latent health effects is negligible (less than 1%). The acute effects on the other hand, may change significantly. Table 6.1-6 lists the percentage increase in the mean acute fatalities and injuries over the base case results. For release categories M1A and M4, the increases in mean values of fatalities were 40%. M1A and M4 have low release energies associated with them and their warning time is 1 hour or less. Due to the low release energy the plume height would be small and hence the radionuclide deposition closer to the site would be greater. Consequently, the increase in nearby beach population leads to higher acute effects. For the other release categories the increases in mean fatalities range from 0 to 6 percent over the base case. The increases in mean acute injuries are in the range of 7 to 26 percent over the base case.

6.1.9 UNCERTAINTY ANALYSIS

The consequence analysis is performed using CRAC2, a complex computer model which treats a large number of diverse factors. These include site meterology, radionuclide depositon parameters, population distribution (within 350 miles), plume dispersion, site evacuation characteristics, shielding factors, radionuclide dose pathways, and dose conversion factors to calculate population health effects. Point estimate values (as opposed to a distribution of values) are used for most of the CRAC2 inputs. Although the intent was to use best estimate values for inputs, there is a tendency to select conservative estimates

when values are uncertain. The input values used in the consequence calculations would thus tend to be conservative.

A rigorous treatment of uncertainties associated with the CRAC2 calculations would require the identification of the uncertainties for all of the inputs as a minimum, and propagation of these uncertainties through the CRAC2 calculations. Such a detailed treatment would be both unwieldy, if not impossible, and very expensive. In the current study, a subjective discrete probability distribution (DPD) was applied. The distribution is based on engineering judgment regarding the magnitude of the uncertainties in the calculations.

The models describing atmospheric processes are based on substantial observational data. Variability in weather is treated by statistical sampling of a large body of weather data and performing consequence calculations for each sample. Thus uncertainties in the weather data are relatively small. The processes of atmospheric dispersion and of radionuclide deposition on the other hand are treated by models based on experimental data. For atmospheric dispersion processes, the model represent a fit to data which has a significant degree of variability, and hence uncertainties. The large sampling base employed in CRAC2 tends to reduce overall uncertainty in dispersion calculations to a relatively low level. Deposition processes on the other hand depend on particle size of the material being treated. Particle sizes for radionuclides once they reach the atmosphere are not clearly known; hence there is significant uncertainty in calculations of the rate of desposition. Of particular concern are weather conditions which produce high early fatality estimates. These scenarios are a result of rain washing out radioactive material and depositing it in a local area; principal dose effects result from ground shine from the deposited radioactivity. Estimates of concentration associated with ground deposition are probably skewed to the high side since the variability in rainfall in a storm is not accounted for in the model (deposition over a larger area than calculated is likely).

Also critical is modeling of evacuation. There is appreciable uncertainty associated with such modeling. One problem with modeling of evacuation processes is the lack of data regarding the way an evacuation would proceed under the variety of possible dose exposure regimes. For rain scenarios this is particularly critical. For example, no credit is taken for the potential for avoidance of rain areas in the evacuation path based on either dose surveys and/or directions to the evacuating population. Dose effects would be smaller for some scenarios if people are sheltered in place rather than evacuated. Such distinctions are not accounted for in the evacuation and dose models.

The biological transport models and dose models employed were developed from a substantial data base and represent the state-of-the-art. They have relatively low levels of uncertainty associated with them.

Considerations of the above factors and engineering judgment were employed in estimating a probability distribution for the uncertainties associated with the CRAC2 calculations. Such estimates were initially made in conjunction with the Indian Point and Zion Risk Assessment Studies. Discussion among personnel performing the source term and consequence calculations for Millstone did not identify any basis for altering those earlier DPD estimates (Westinghouse personnel participated in the initial estimation for Indian Point and Zion). The primary reason for this is that there have not been significant advances in the state-of-the-art for propagation of the consequence uncertainties since the Zion and Indian Point DPD estimates were made.

After considering the effect of uncertainties in radionuclide deposition, population evacuation, and other aspects of the dose calculations, it was judged that there is a small chance that doses are underestimated by a factor greater than 2, a reasonable chance that the doses computed are correct, a slightly higher chance that the doses are overestimates by about a factor of 2, and a small chance that the doses are overestimated by a factor larger than 10. The specific DPD values are 0.35 for the point estimate, 0.45 for a reduction by a factor of 2, and 0.1 each for an increase by a factor of 2 or a decrease by a factor

of 10 relative to the point estimate. These are probabilities which add up to 1.0. An inherent assumption is made that this representation of the uncertainty in the dose also reflects the uncertainty in the consequences.

The skewed nature of the distribution will be reflected in the risk curves presented in Section 7 where the point estimate values are nearer to the .90 percentile values than the .50 percentile values (see Section 7). As discussed earlier, a rigorous treatment of all the uncertainties in the consequence analysis was not performed and would have been costly. Expert judgment was therefore employed to evaluate the impact of model uncertainties and conservatisms in the input variables and to produce the discrete probability distribution values used in the study. Table 6.1-7 lists the discrete probability distributions. They are used in the final risk assembly discussed in Section 7.

6.1.10 UNCERTAINTY PROPAGATION

As discussed in Section 6.1.9, the uncertainty analysis is performed using the DPD (Discrete Probability Distribution) technique. The DPDs associated with various source term multipliers, to account for the uncertainties in the consequence model, were also discussed in that section. The source term uncertainty analysis was also performed using the DPD technique as discussed in Section 5.1.3. These DPDs were combined with those from the consequence analysis.

It was necessary to evaluate the consequences resulting from modifying the source terms using the multipliers. This was performed via several DPD runs using the CRAC2 code. The DPD runs to be made were first identified on the basis of the risk significance of various release categories. These are tabulated in Table 6.1-8. The results of these runs were then incorporated into the final risk assembly as conditional cumulative probability distributions.

These conditional probability distributions are shown in Figures 6.1-21 through 6.1-55. For example, Figure 6.1-21 shows the conditional

probability distributions of acute fatalities for each of the DPD runs made for release category M1A. Each curve is identified by the source term multiplier from which it resulted.

6.1.11 REFERENCES

1. Ritchie, L.T., J.D. Johnson and R.M. Blond, "Calculations of Reactor Accident Consequences Version 2 - CRAC2 - Computer Code Users Guide," NUREG/CR-2326, SAND81-1994, Sandia National Laboratories.

2. Lemaster, R.D., "CRAC2 Meteorological Data Sampling," Telecon with Mr. J.D. Johnson, E-NLE-200, December 10, 1982.

3. "PRA Procedures Guide," NUREG/CR-2300, U.S. Nuclear Regulatory Commission, January 1983.

TABLE 6.1-1

MONTHLY, SEASONAL, AND ANNUAL FREQUENCY DISTRIBUTIONS
OF WIND DIRECTION ON LONG ISLAND SOUND NEAR MILLSTONE SITE
(1949-1978)

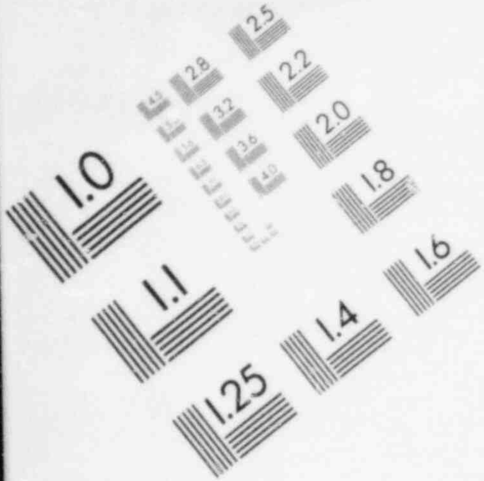
	FREQUENCY DISTRIBUTION (%) OF WIND DIRECTION																		
	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Calm	Total	TOTAL HOURS
December	8.8	5.5	9.6	5.9	2.4	1.6	1.3	1.3	1.5	1.8	4.0	5.3	11.7	14.7	12.6	8.9	3.1	100.0	10,120
January	8.3	5.2	9.7	5.7	3.3	1.4	1.0	0.9	1.6	2.0	4.9	7.9	12.5	12.3	11.9	8.6	3.0	100.0	10,630
February	8.9	5.0	8.0	6.3	4.8	1.9	1.6	1.1	2.0	2.4	4.9	7.6	9.4	11.0	13.1	9.2	2.9	100.0	9,684
Winter	8.7	5.2	9.1	6.0	3.5	1.7	1.3	1.1	1.7	2.1	4.6	6.9	11.2	12.7	12.5	8.9	3.0	100.0	30,434
March	8.6	5.0	6.9	6.7	7.6	3.8	2.1	1.6	2.8	3.5	6.4	5.9	7.4	8.4	11.1	9.6	2.9	100.0	10,149
April	7.0	4.1	5.5	5.3	7.1	3.2	2.4	2.5	4.7	5.3	8.3	9.0	7.9	7.8	9.1	8.5	2.7	100.0	9,824
May	5.5	4.3	5.6	5.8	10.5	5.5	3.4	3.0	5.6	6.4	9.0	9.1	6.7	5.0	5.6	5.9	3.1	100.0	10,150
Spring	7.0	4.5	6.0	5.9	8.4	4.2	2.6	2.4	4.4	5.1	7.9	8.0	7.3	7.1	8.6	8.0	2.9	100.0	30,123
June	5.3	3.6	4.5	3.8	6.5	4.8	3.6	3.3	7.0	7.4	14.0	12.9	7.2	4.1	4.9	4.3	2.8	100.0	9,813
July	5.6	3.9	4.8	2.7	4.3	3.6	3.4	3.6	7.2	8.1	14.7	13.3	7.9	4.8	4.6	4.2	3.2	100.0	10,148
August	7.3	5.3	6.7	3.1	4.1	3.3	3.1	3.4	6.9	7.9	13.4	10.6	6.4	4.8	5.4	5.1	3.5	100.0	10,148
Summer	6.1	4.3	5.3	3.2	5.0	3.9	3.4	3.4	7.1	7.8	14.0	12.3	7.2	4.6	5.0	4.5	3.2	100.0	30,109
September	8.3	7.4	11.3	4.9	4.0	3.7	2.9	2.8	4.4	5.2	9.9	7.1	6.5	6.0	7.0	5.9	2.9	100.0	9,811
October	9.0	6.6	11.2	4.7	3.4	2.5	2.4	2.2	3.3	3.7	8.4	8.2	8.8	8.3	8.0	7.0	2.4	100.0	10,149
November	8.8	6.1	9.5	4.1	3.5	1.9	2.0	1.9	2.5	3.0	6.1	7.0	9.7	11.5	10.9	9.1	2.4	100.0	9,811
Fall	8.7	6.7	10.7	4.6	3.6	2.7	2.4	2.3	3.4	3.9	8.1	7.5	8.4	8.6	8.6	7.3	2.6	100.0	29,771
Annual	7.6	5.2	7.8	4.9	5.1	3.1	2.4	2.3	4.1	4.7	8.7	8.7	8.5	8.2	8.7	7.2	2.9	100.0	120,437

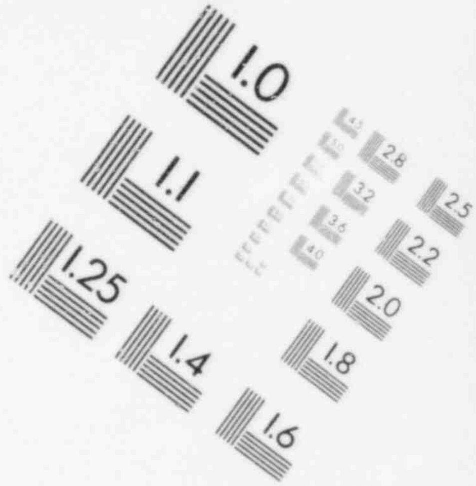
IMAGE EVALUATION TEST TARGET (MT-3)

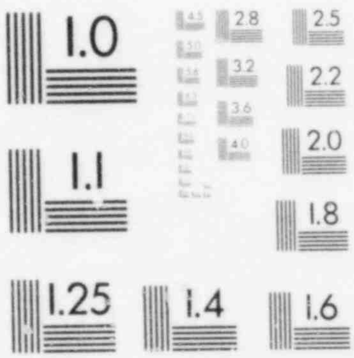
150mm

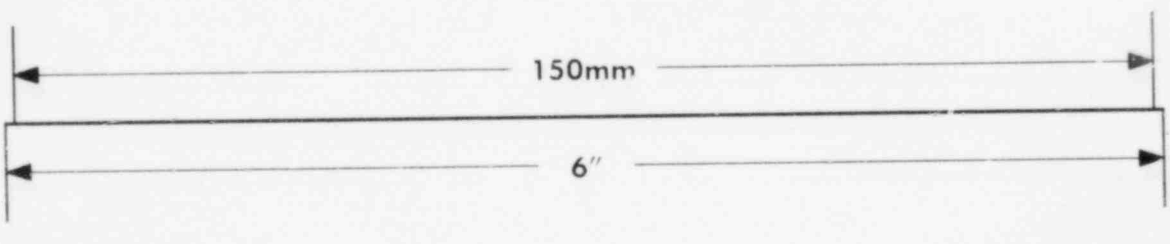
6″

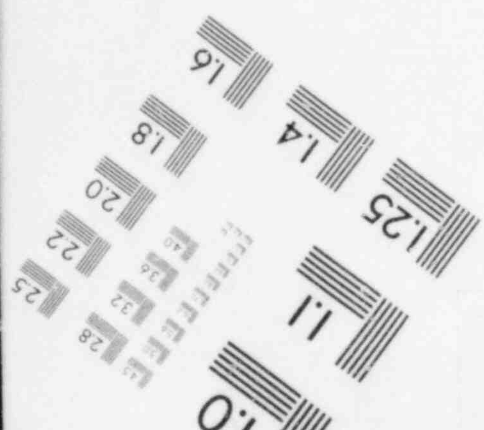
IMAGE EVALUATION TEST TARGET (MT-3)











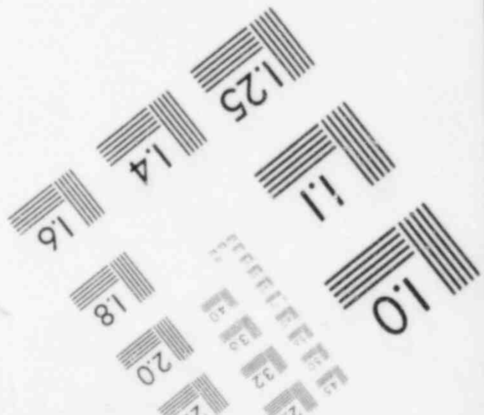


TABLE 6.1-2

1980 POPULATION IN POPULATION CENTERS* WITHIN 80 km**

Name	1980 Population
Bristol	57,370
Hartford	136,392
New Britain	73,840
Milford	49,101
Middletown	39,040
Meridan	57,118
New Haven	126,109
Waterbury	103,266
West Haven	53,184
New London	28,842
Norwich City	38,074
Naugatuck	26,456
Shelton	31,314
Warwick (RI)	87,123
Newport (RI)	29,259
Cranston (RI)	71,992
Providence (RI)	50,980

* Cities with over 25,000 people in 1980

** Entire city population is given even though some cities are only partially within 80 km. (See Figure 6.1-2 locations).

TABLE 6.1-3

AVERAGE MONTHLY, SEASONAL, AND ANNUAL FREQUENCIES OF VARIOUS FOG CONDITIONS ON LONG ISLAND SOUND NEAR MILLSTONE SITE (1949-1978)

	FREQUENCIES OF VARIOUS FOG CONDITIONS (%)			
	FOG	GROUND FOG	HEAVY FOG	TOTAL NUMBER OF HOURS
December	14.6	1.6	2.2	10,168
January	15.0	2.0	2.1	10,664
February	13.3	1.1	2.0	9,707
Winter	14.3	1.6	2.1	30,539
March	14.2	1.5	2.0	10,168
April	12.7	1.2	1.5	9,840
May	16.1	1.8	3.2	10,168
Spring	14.4	1.5	2.2	30,176
June	14.5	3.1	2.1	9,840
July	11.5	2.9	0.9	10,168
August	12.7	3.3	0.4	10,168
Summer	12.9	3.1	1.1	30,176
September	11.2	3.2	0.3	9,840
October	8.8	3.5	1.0	10,168
November	11.6	2.1	0.5	9,840
Fall	10.5	2.9	0.6	29,848
Annual	13.0	2.3	1.5	120,739

TABLE 6.1-3 (CONTINUED)

MONTHLY SEASONAL AND ANNUAL AVERAGES AND EXTREMES OF SNOWFALL

ON LONG ISLAND SOUND NEAR MILLSTONE SITE (1921-1973)

	SNOW, ICE PELLETS (INCHES)			
	MEAN TOTAL	MAXIMUM MONTHLY	MAXIMUM IN 24 HOURS	MEAN NUMBER OF DAYS WITH 1.0 INCH OR MORE SNOW AND SNOW PELLETS
Length of Record	*	**	*	*
December	5.2	25.3	7.3	2
January	7.8	30.3	16.7	2
February	8.4	47.0	16.7	2
Winter	21.4	47.0	16.7	6
March	5.4	21.8	11.1	1
April	0.4	8.1	3.7	+
May	T	T	T	0
Spring	5.8	21.8	11.1	1
June	0.0	0.0	0.0	0
July	0.0	0.0	0.0	0
August	0.0	0.0	0.0	0
Summer	0.0	0.0	0.0	0
September	0.0	0.0	0.0	0
October	T	T	T	0
November	0.5	14.1	5.4	+
Fall	0.5	14.1	5.4	+
Annual	27.7	47.0	16.7	7

NOTES: T = trace

+ Less than 1 day every 2 years

* 1949 through 1978 (30 years) (NOAA 1970, 1974, 1975, 1978)

** 1921 through 1978 (58 years) (NOAA 1970, 1974, 1975, 1978)

TABLE 6.1-3 (CONTINUED)

AVERAGE MONTHLY SEASONAL AND ANNUAL HOURS OF

FREEZING RAIN AND DRIZZLE ON LONG ISLAND SOUND NEAR MILLSTONE SITE

	FREEZING RAIN (HR)		FREEZING DRIZZLE (HR)
	LIGHT*	MODERATE**	LIGHT*
December	5.7	0.1	3.1
January	3.0	0.0	2.3
February	3.3	0.0	1.6
Winter	17.0	0.1	7.5
March	2.1	0.0	1.3
April	0.1	0.0	0.0
May	0.0	0.0	0.0
Spring	2.2	0.0	1.3
June	0.0	0.0	0.0
July	0.0	0.0	0.0
August	0.0	0.0	0.0
Summer	0.0	0.0	0.0
September	0.0	0.0	0.0
October	0.0	0.0	0.0
November	0.1	0.0	0.1
Fall	0.1	0.0	0.1
Annual	19.3	0.1	8.9

NOTES: * Less than 0.1 iph

** 0.1 to 0.3 iph

TABLE 6.1-3 (CONTINUED)

MEAN NUMBER OF DAYS OF THUNDERSTORM OCCURRENCE

ON LONG ISLAND SOUND NEAR MILLSTONE SITE (1949-1978)

	NUMBER OF DAYS
December	*
January	*
February	*
Winter	*
March	1
April	2
May	3
Spring	6
June	4
July	5
August	4
Summer	13
September	2
October	1
November	*
Fall	3
Annual	22

NOTE: * Less than 1 day every 2 years

TABLE 6.1-4

SUMMARY OF EVACUATION SCHEMES AND THEIR PROBABILITIES

ANALYSIS CATEGORY	GENERAL		SEISMIC	SPECIAL TREATMENT FOR M1 AND M4					
Evacuation Scheme	1	2	3	S1	S2	S3	S4	S5	S6
Initiating Event	Non-Seismic	Non-Seismic	Seismic	Non-Seismic	Non-Seismic	Non-Seismic	Non-Seismic	Non-Seismic	Non-Seismic
Weather Condition	Normal	Adverse	Any	Any	Any	Any	Any	Any	Any
Radius of Evacuation Sector (Mi)	10	10	10	10	10	10	10	10	10
Radius of Evacuation Circle (Mi)	5	5	5	5	5	5	5	5	5
Distance traveled by evacuees (Mi)	15	15	15	15	15	15	15	15	15
Evacuation Speed (Mph)	10	7.5	2	1.2	3.0	10	1.2	3.0	10
Delay Time before evacuation (Hr)	0.92	0.92	3.38	0.92	0.92	0.92	2.0	2.0	2.0
Probability	0.88	0.12	1.0*	0.07	0.19	0.39	0.05	0.14	0.16

*Probability is 1.0 for Evacuation Scheme 3 if the release is from a seismic induced event. Otherwise it is zero. Also, the probability of Evacuation Schemes 1 and 2 and S1 through S6 will be zero for seismic initiated releases.

TABLE 6.1-5

Sensitivity of Health Effects to 1990 Projected Population

Release Category	Percentage increase in health effects for the 1990 Projected population over the base case			
	Acute Fatalities	Acute Injuries	Latent Cancer Fatalities	Population Whole Body Dose
M1A	5%	6%	8%	8%
M2	3%	10%	8%	8%
M3	4%	10%	8%	8%
M4	5%	7%	8%	8%
M5	12%	11%	8%	8%
M6	12%	11%	8%	8%
M7	N.A.	11%	8%	8%

TABLE 6.1-6

Sensitivity of Health Effects to Weekend Population

Release Category	Percentage Increase Over Base Case	
	Acute Fatalities	Acute Injuries
M1A	40%	26%
M2	0%	9%
M3	0%	7%
M4	40%	21%
M5	6%	8%
M6	6%	7%
M7	N.A.	7%

Influence of weekend population on latent health effects is negligible.

TABLE 6.1-7

SUBJECTIVE DISCRETE PROBABILITY DISTRIBUTION

FOR SITE CONSEQUENCE UNCERTAINTY EVALUATION

RELEASE FRACTION ADJUSTMENT FACTOR*	DISCRETE PROBABILITY
2	0.10
1	0.35
0.5	0.45
0.1	0.10

*Adjustment Factor of 1 is always used for noble gas releases.

TABLE 6.1-8

LIST OF DPD RUNS PERFORMED

Release Category \ Source Term Multiplier*	2	1	1/2	1/4	1/10	1/30	1/100
M1A	X	X	X	X	X	X	X
M2		X	X	X			
M3		X		X			
M4	X	X	X	X			
M5		X		X			
M6	X	X	X	X	X		
M7	X	X	X	X	X	X	X
M8		X					
M9		X					
M10		X					
M11		X					
M12		X					

*Multiplier for noble gases remains 1.0 for all runs.

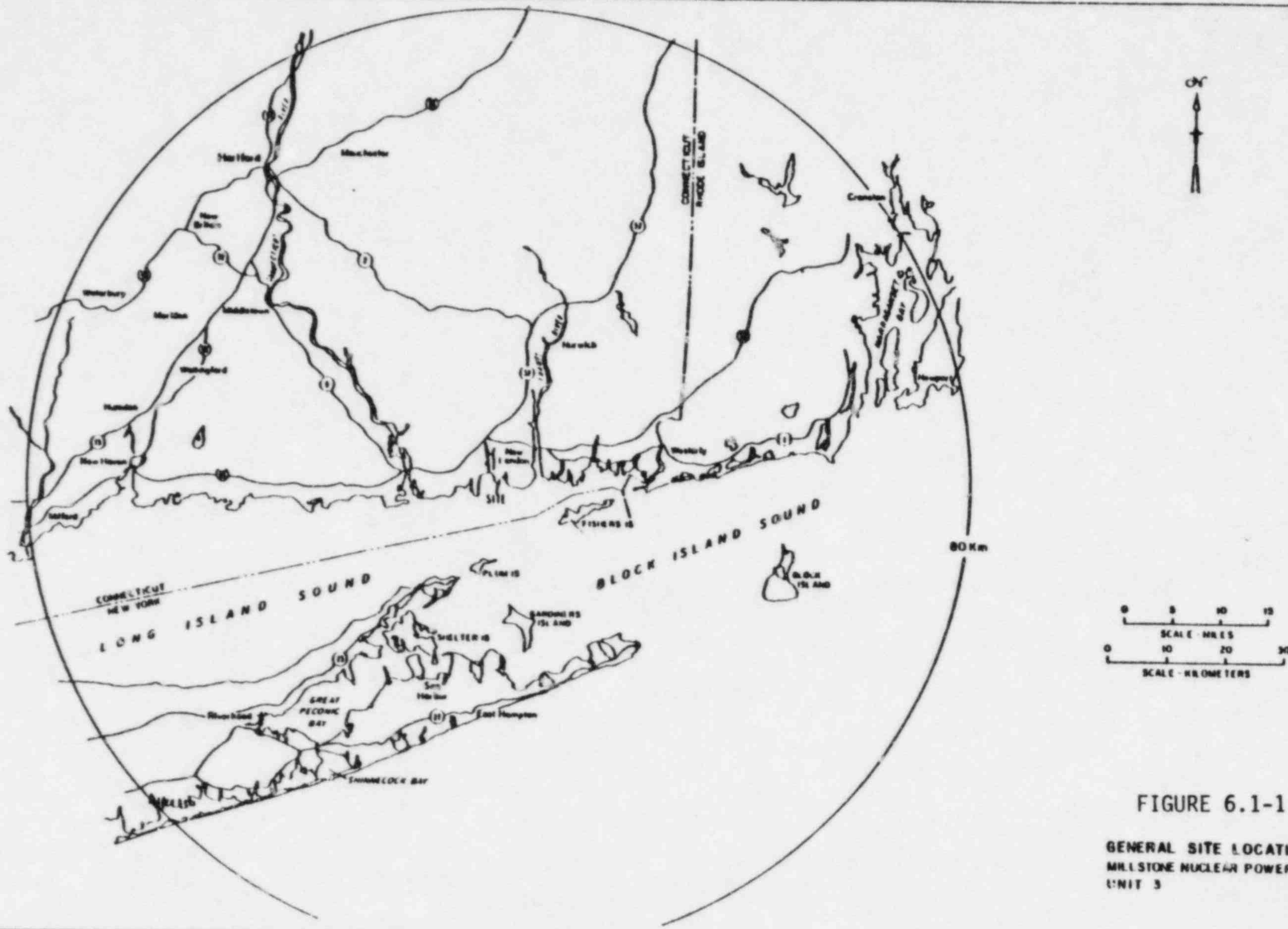


FIGURE 6.1-1

GENERAL SITE LOCATION
MILLSTONE NUCLEAR POWER PLANT
UNIT 3

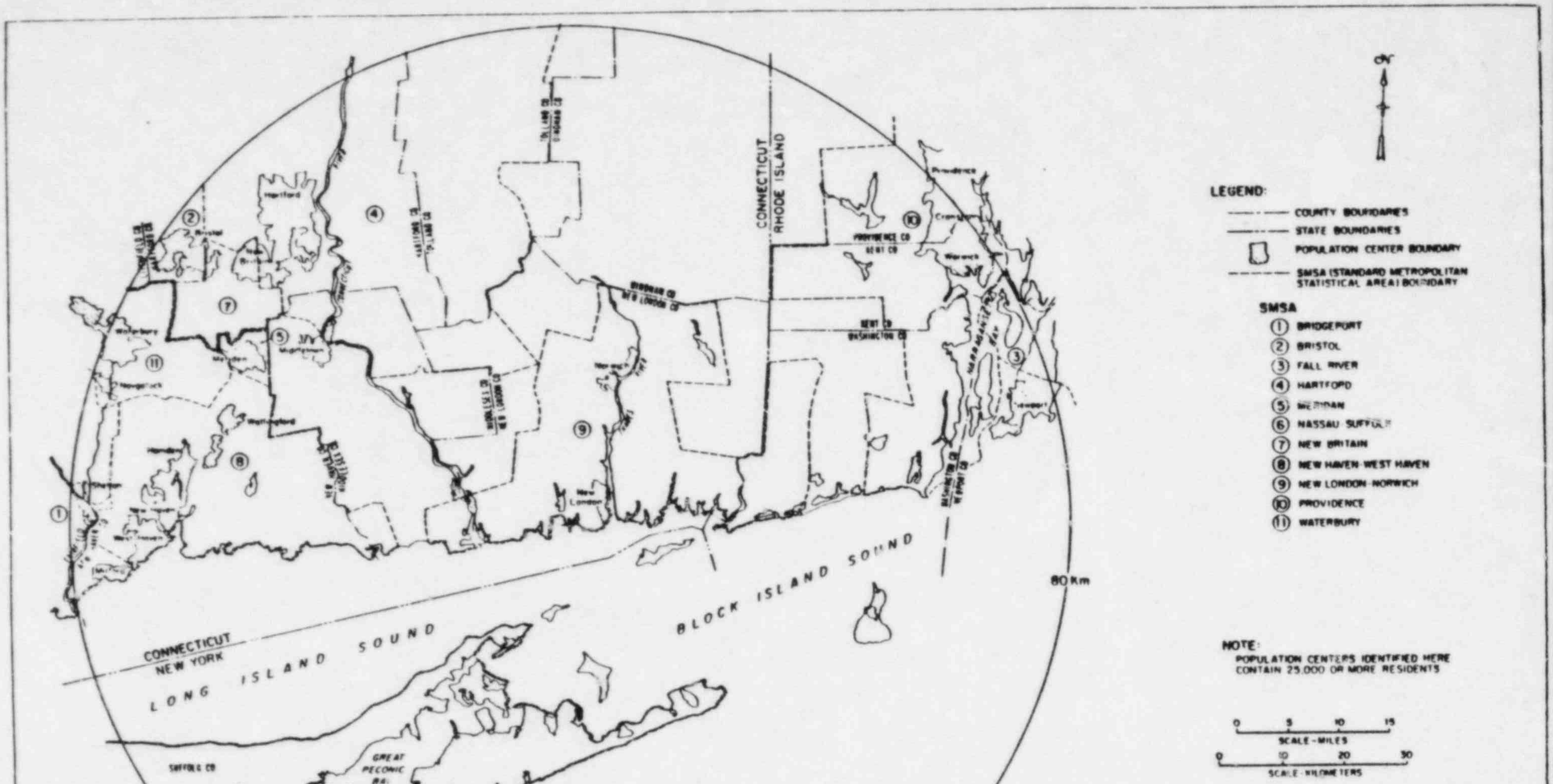


FIGURE 6.1-2

SMSA AND POPULATION CENTER BOUNDARIES WITHIN 80 km
MILLSTONE NUCLEAR POWER STATION
UNIT 3

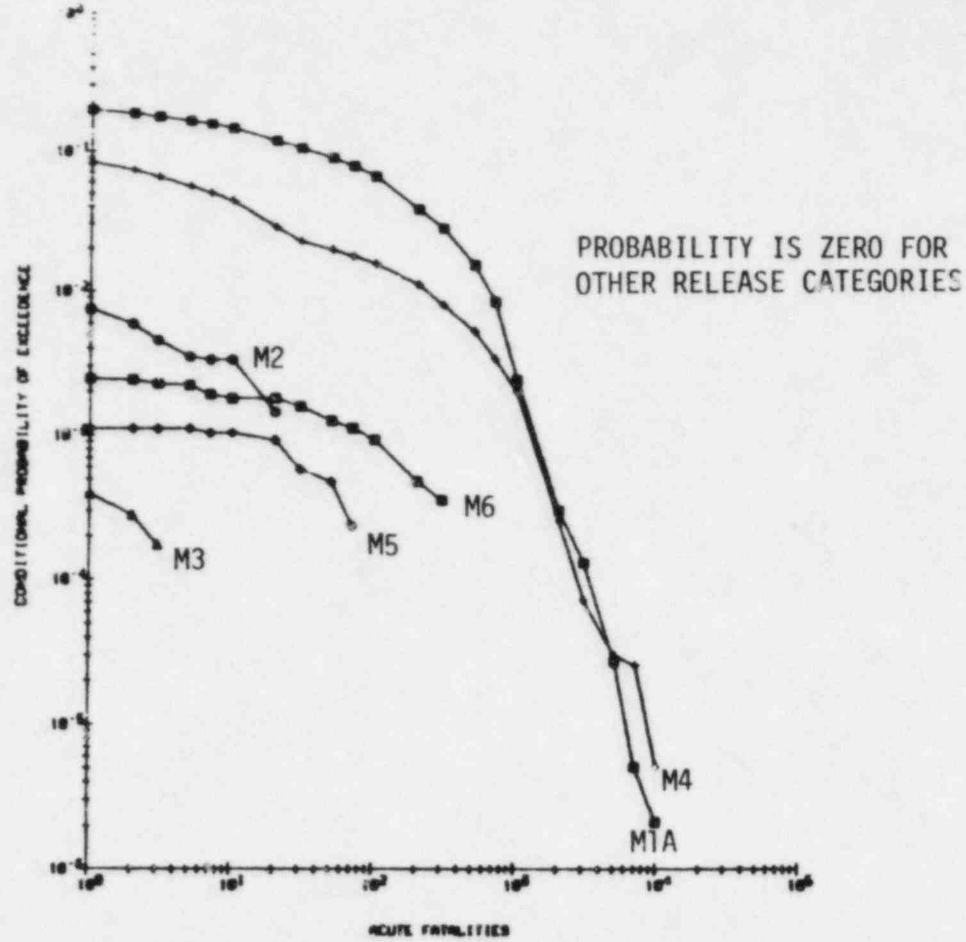


FIGURE NO. 6.1-3 POINT ESTIMATE CONDITIONAL PROBABILITY DISTRIBUTION FOR ACUTE FATALITIES

NOTE: This figure shows conditional probabilities, and the values must be multiplied by the frequency of release in order to obtain risk.

Amendment 1
September 7, 1983

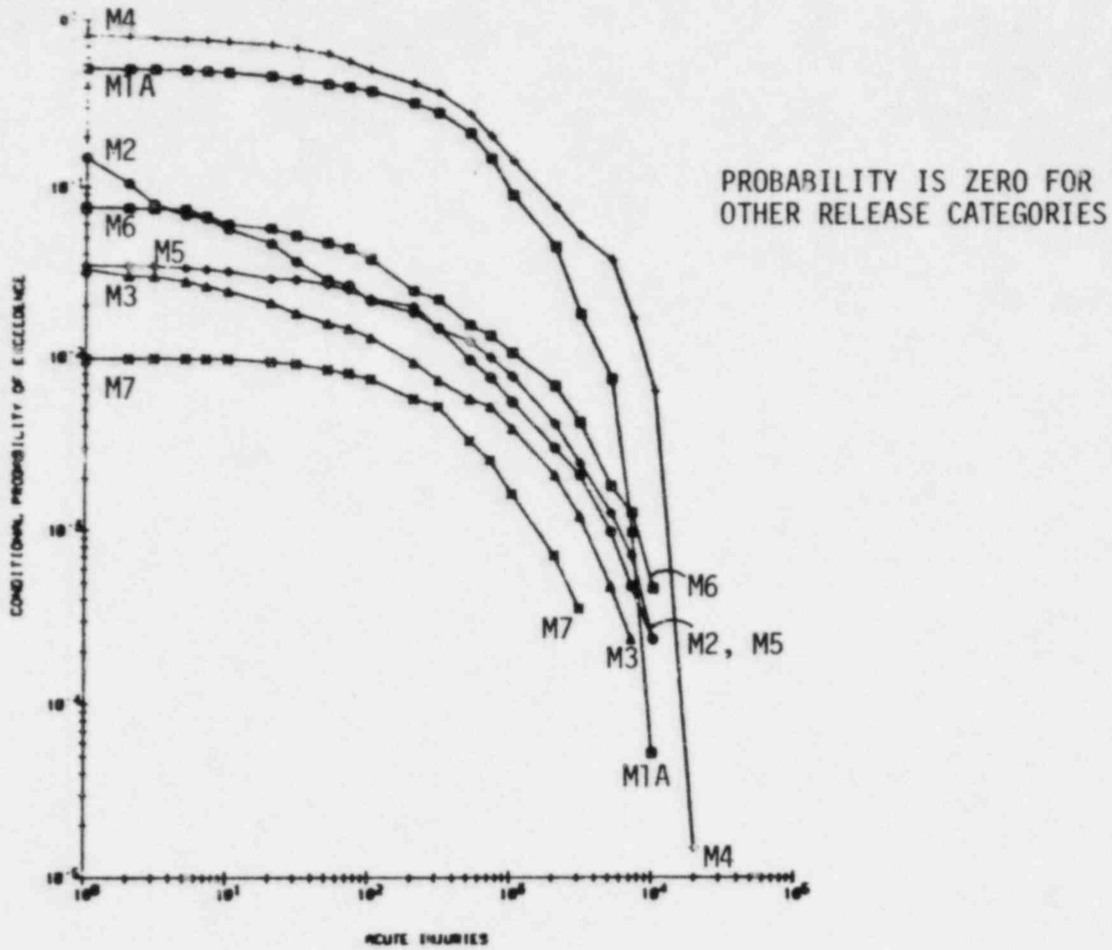
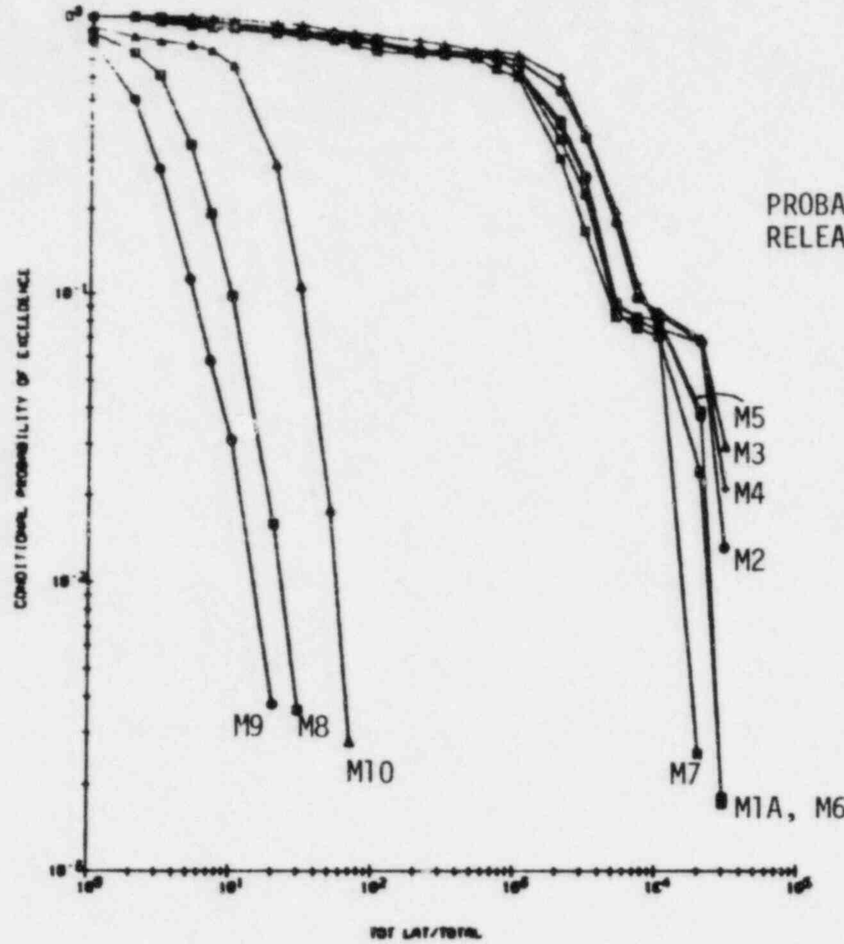


FIGURE NO. 6.1-4 POINT ESTIMATE CONDITIONAL PROBABILITY DISTRIBUTION FOR ACUTE INJURIES

NOTE: This figure shows conditional probabilities, and the values <u>must</u> be multiplied by the frequency of release in order to obtain risk.



PROBABILITY IS ZERO FOR RELEASE CATEGORIES M11 AND M12

FIGURE NO. 6.1-5 POINT ESTIMATE CONDITIONAL PROBABILITY DISTRIBUTION FOR TOTAL LATENT FATALITIES OTHER THAN THYROID

NOTE: This figure shows conditional probabilities, and the values <u>must</u> be multiplied by the frequency of release in order to obtain risk.

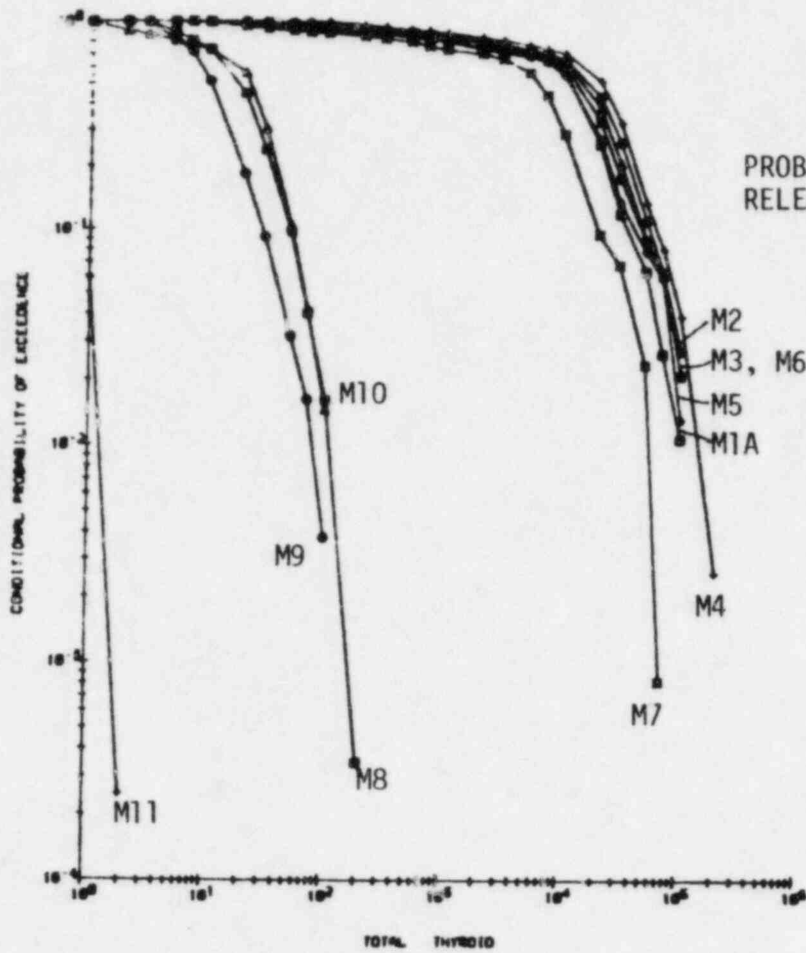
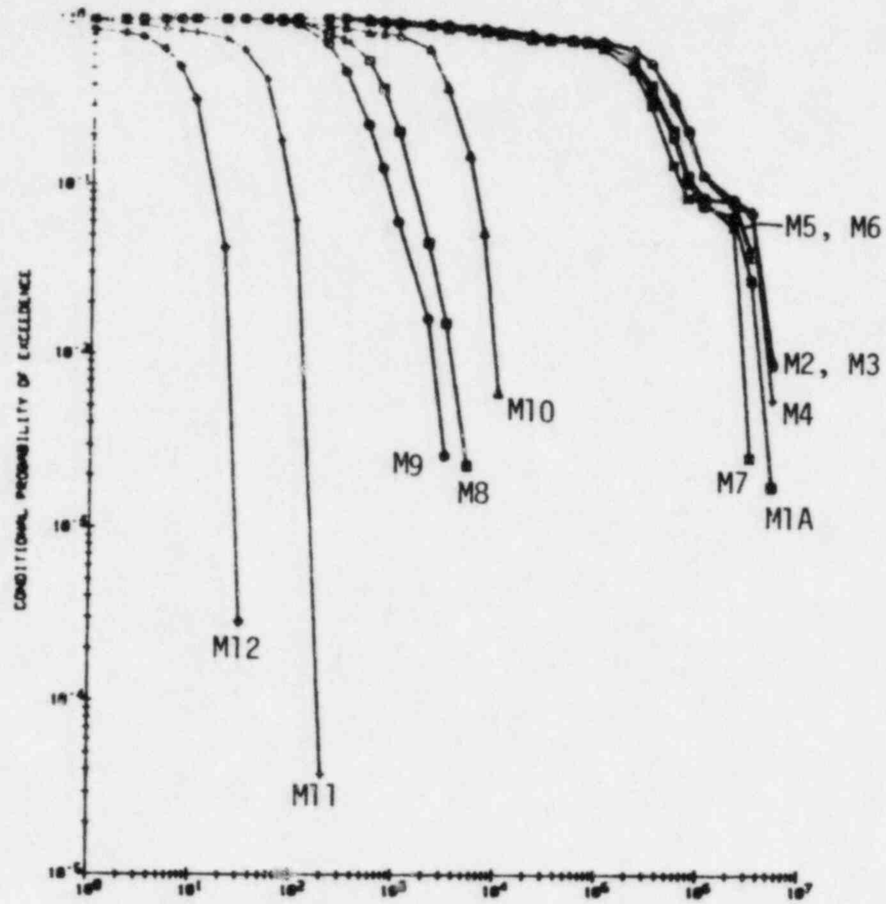


FIGURE NO. 6.1-6 POINT ESTIMATE CONDITIONAL PROBABILITY DISTRIBUTION FOR TOTAL THYROID NODULES (BENIGN AND CANCEROUS)

NOTE: This figure shows conditional probabilities, and the values <u>must</u> be multiplied by the frequency of release in order to obtain risk.



TOTAL WHOLE BODY DOSE, 100 MAN REM

FIGURE NO. 6.1-7 POINT ESTIMATE CONDITIONAL PROBABILITY DISTRIBUTION FOR TOTAL POPULATION WHOLE BODY DOSE

NOTE: This figure shows conditional probabilities, and the values must be multiplied by the frequency of release in order to obtain risk.

Amendment 1
September 7, 1983

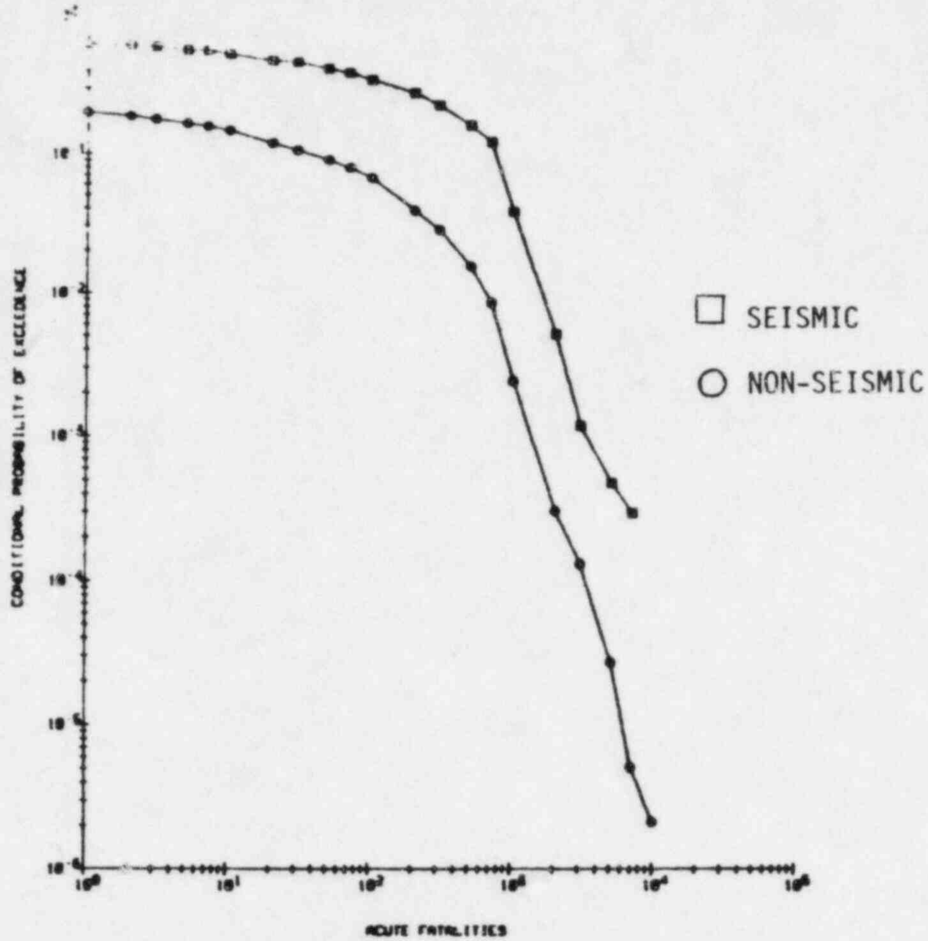


FIGURE NO. 6.1-8 COMPARISON OF ACUTE FATALITIES FOR RELEASE CATEGORY M1A: SEISMIC VS. NON-SEISMIC EVACUATION

NOTE: This figure shows conditional probabilities, and the values must be multiplied by the frequency of release in order to obtain risk.

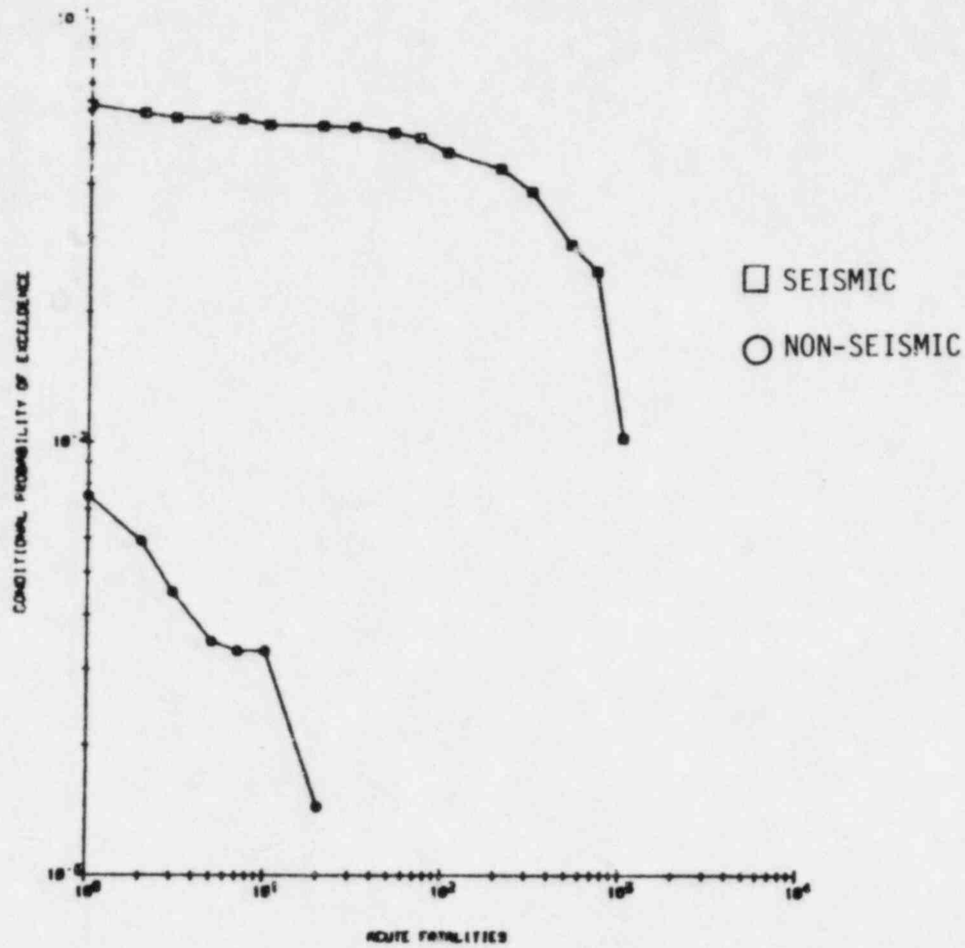


FIGURE NO. 6.1-9 COMPARISON OF ACUTE FATALITIES FOR RELEASE CATEGORY M2: SEISMIC VS. NON-SEISMIC EVACUATION

NOTE: This figure shows conditional probabilities, and the values must be multiplied by the frequency of release in order to obtain risk.

Amendment 1
September 7, 1983

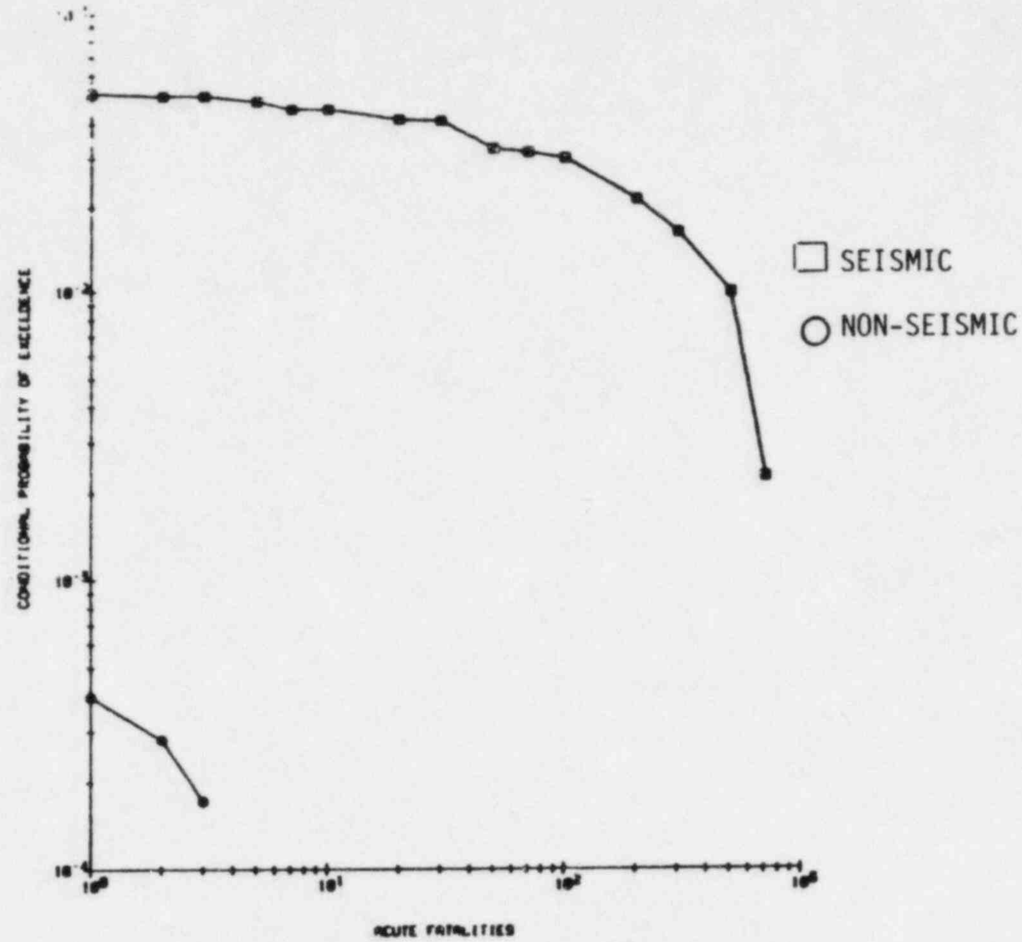


FIGURE 6.1-10 COMPARISON OF ACUTE FATALITIES FOR RELEASE CATEGORY M3: SEISMIC VS. NON-SEISMIC EVACUATION

NOTE: This figure shows conditional probabilities, and the values must be multiplied by the frequency of release in order to obtain risk.

Amendment 1
September 7, 1983

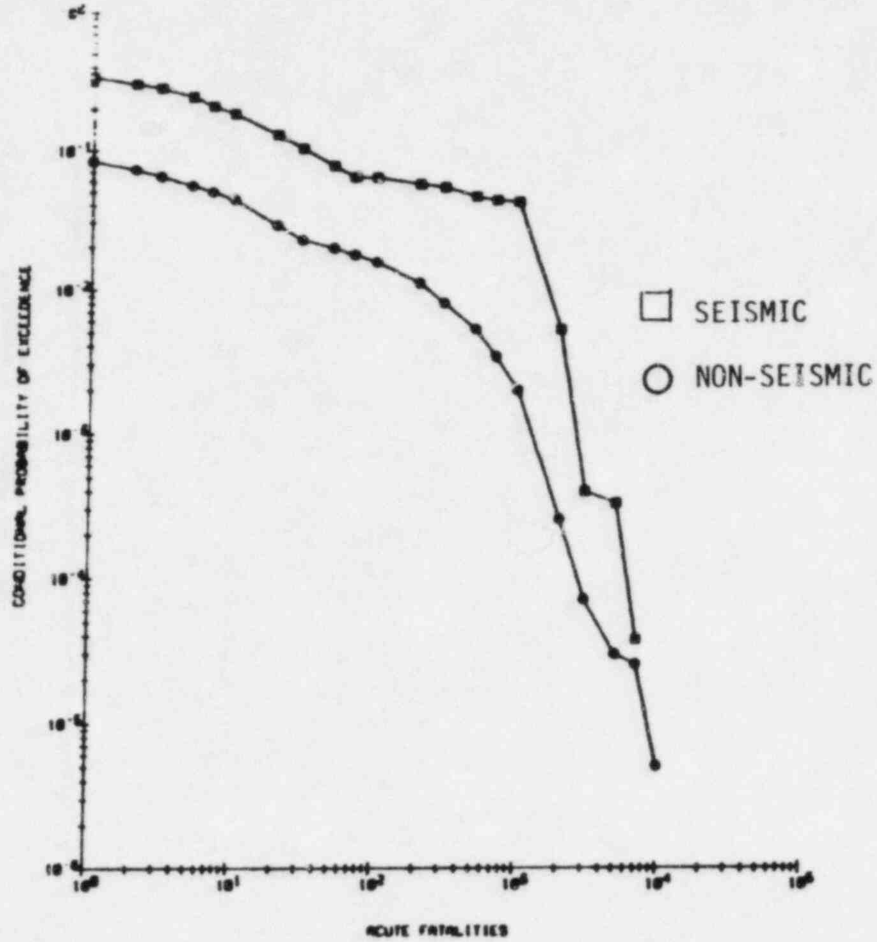


FIGURE NO. 6.1-11 COMPARISON OF ACUTE FATALITIES FOR RELEASE CATEGORY M4: SEISMIC VS. NON-SEISMIC EVACUATION

NOTE: This figure shows conditional probabilities, and the values must be multiplied by the frequency of release in order to obtain risk.

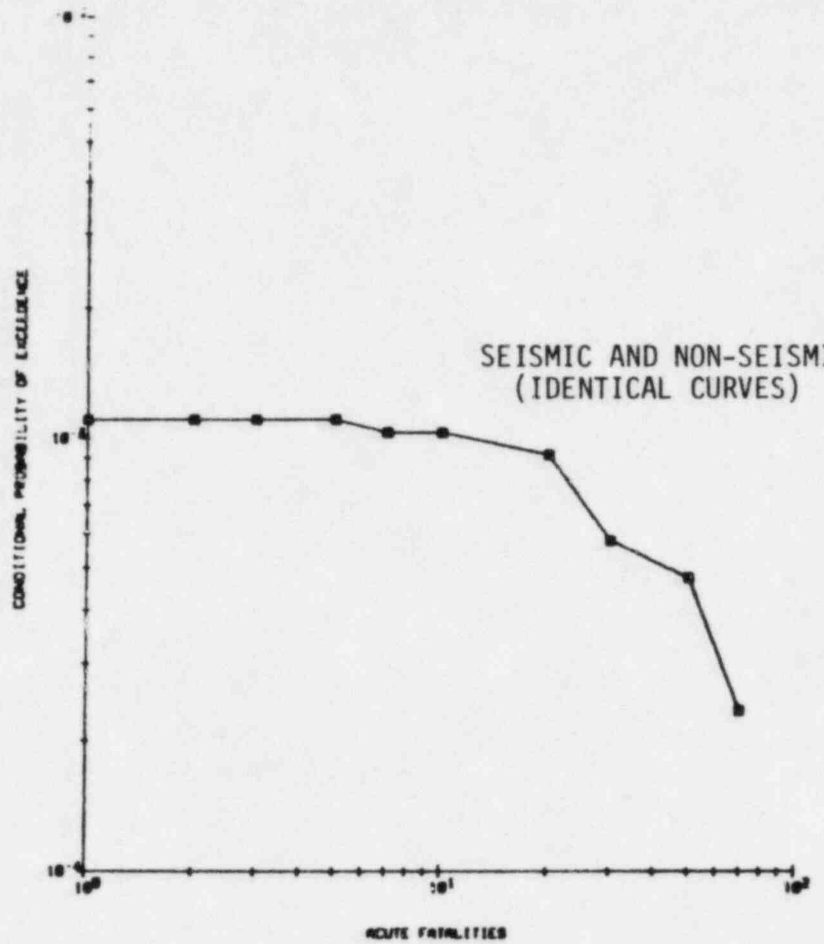


FIGURE NO. 6.1-12 COMPARISON OF ACUTE FATALITIES FOR RELEASE CATEGORY M5: SEISMIC VS. NON-SEISMIC EVACUATION

NOTE: This figure shows conditional probabilities, and the values <u>must</u> be multiplied by the frequency of release in order to obtain risk.

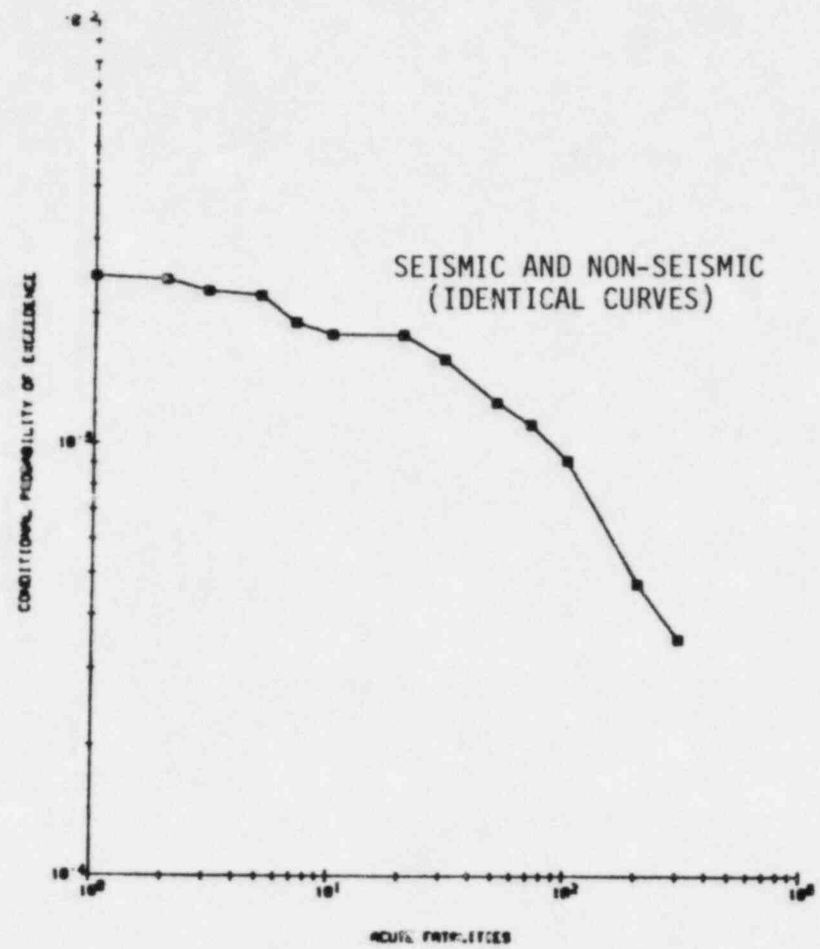


FIGURE NO. 6.1-13 COMPARISON OF ACUTE FATALITIES FOR RELEASE CATEGORY M6: SEISMIC VS. NON-SEISMIC EVACUATION

NOTE: This figure shows conditional probabilities, and the values must be multiplied by the frequency of release in order to obtain risk.

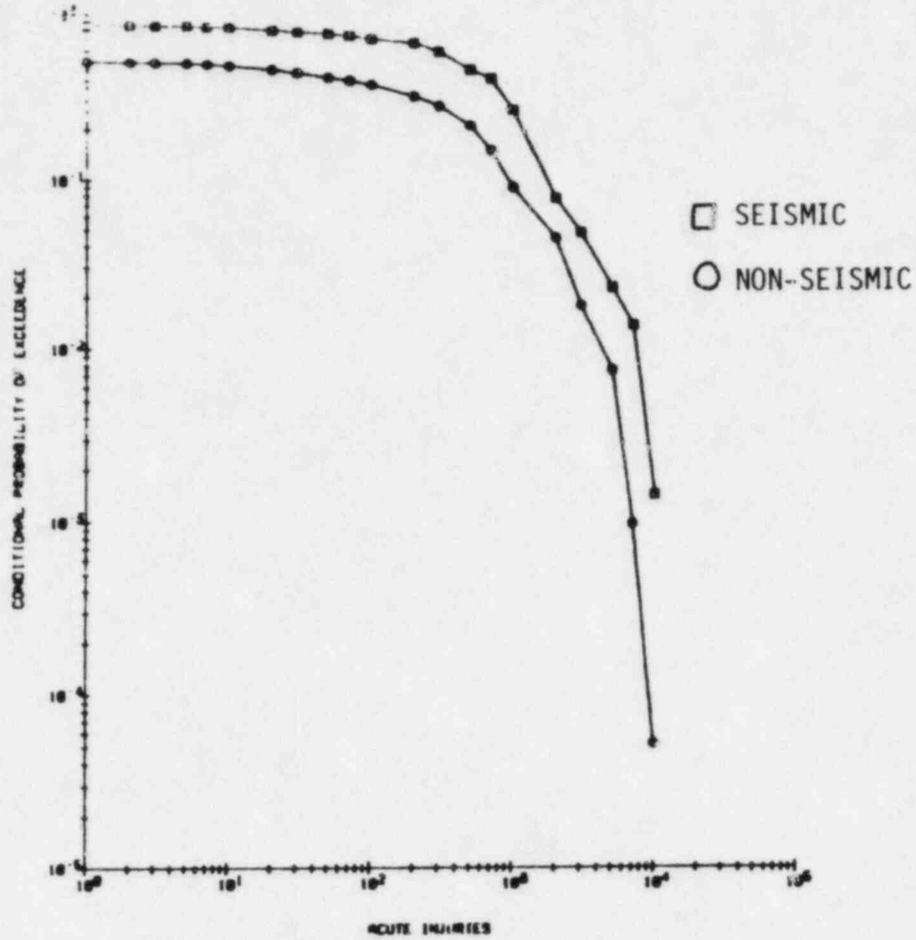


FIGURE NO. 6.1-14 COMPARISON OF ACUTE INJURIES FOR RELEASE CATEGORY M1A: SEISMIC VS. NON-SEISMIC EVACUATION

NOTE: This figure shows conditional probabilities, and the values must be multiplied by the frequency of release in order to obtain risk.

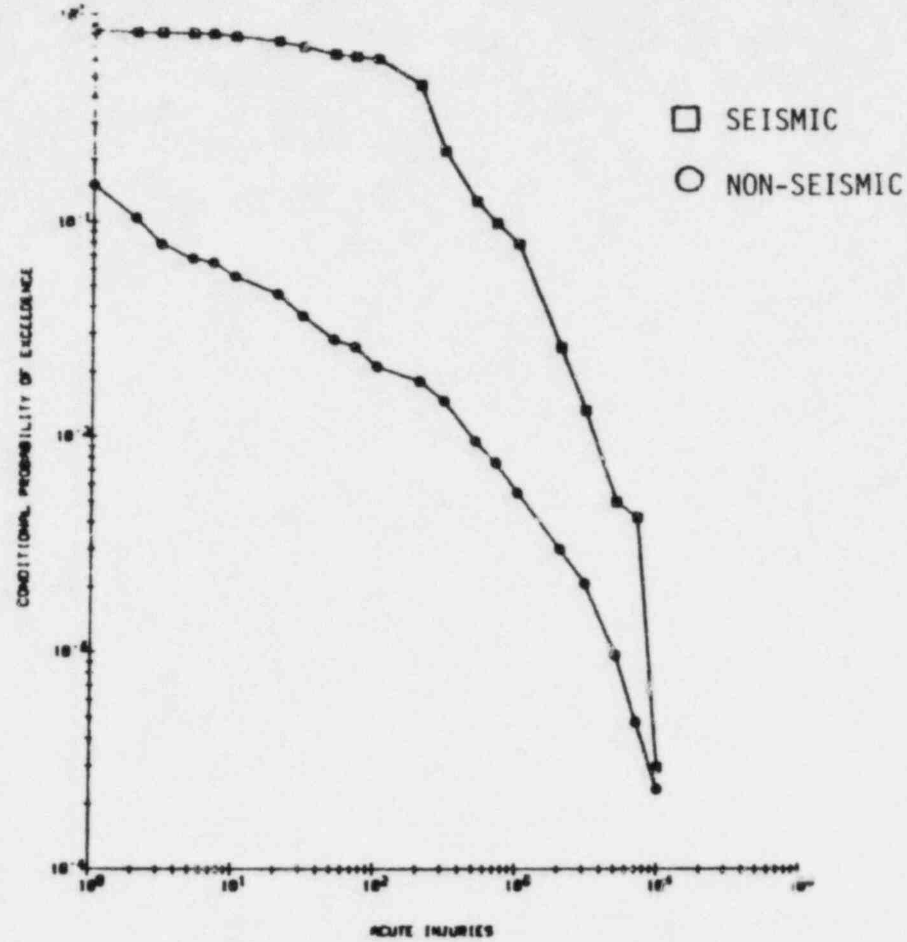


FIGURE NO. 6.1-15 COMPARISON OF ACUTE INJURIES FOR RELEASE CATEGORY M2: SEISMIC VS. NON-SEISMIC EVACUATION

NOTE: This figure shows conditional probabilities, and the values <u>must</u> be multiplied by the frequency of release in order to obtain risk.

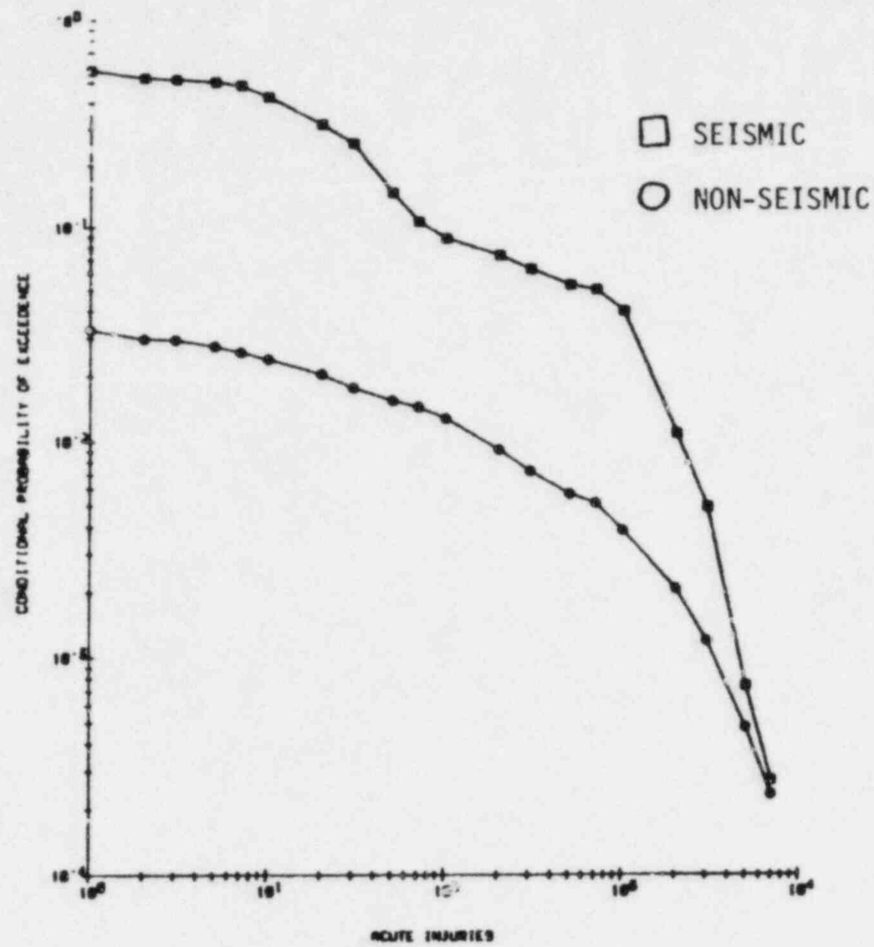


FIGURE NO. 6.1-16 COMPARISON OF ACUTE INJURIES FOR RELEASE CATEGORY M3: SEISMIC VS. NON-SEISMIC EVACUATION

NOTE: This figure shows conditional probabilities, and the values must be multiplied by the frequency of release in order to obtain risk.

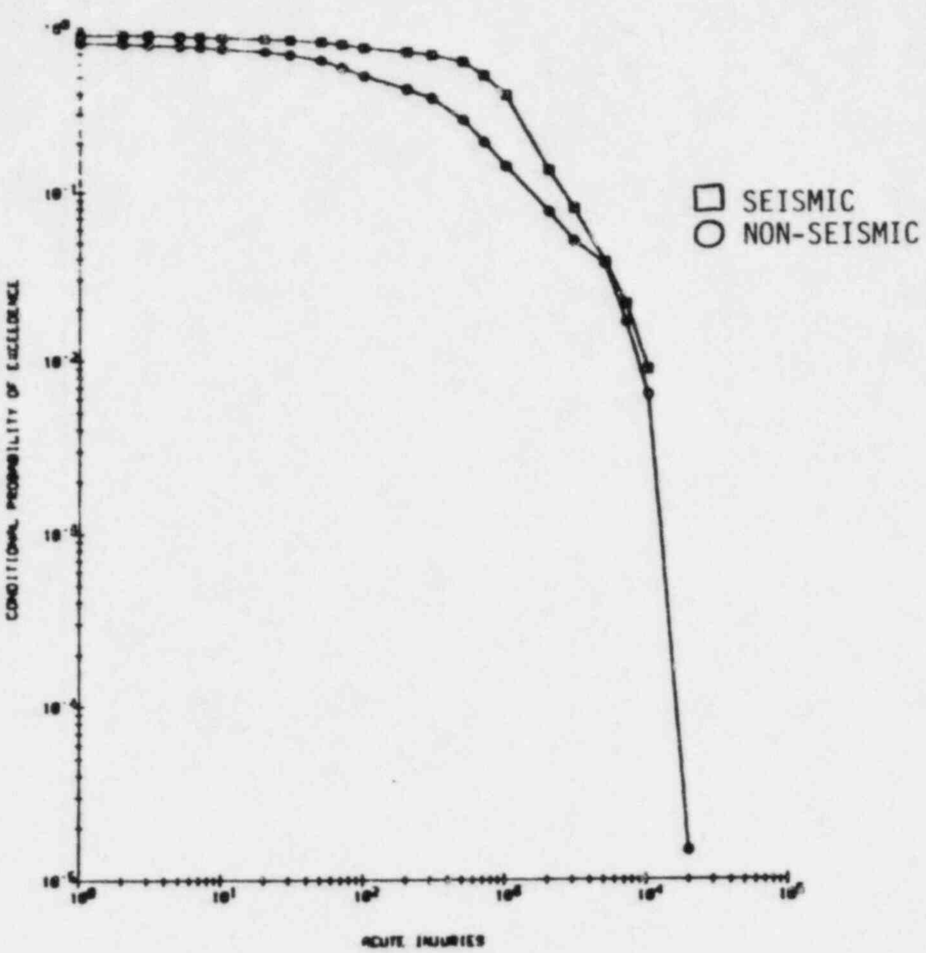


FIGURE NO. 6.1-17 COMPARISON OF ACUTE INJURIES FOR RELEASE CATEGORY M4: SEISMIC VS. NON-SEISMIC EVACUATION

NOTE: This figure shows conditional probabilities, and the values <u>must</u> be multiplied by the frequency of release in order to obtain risk.

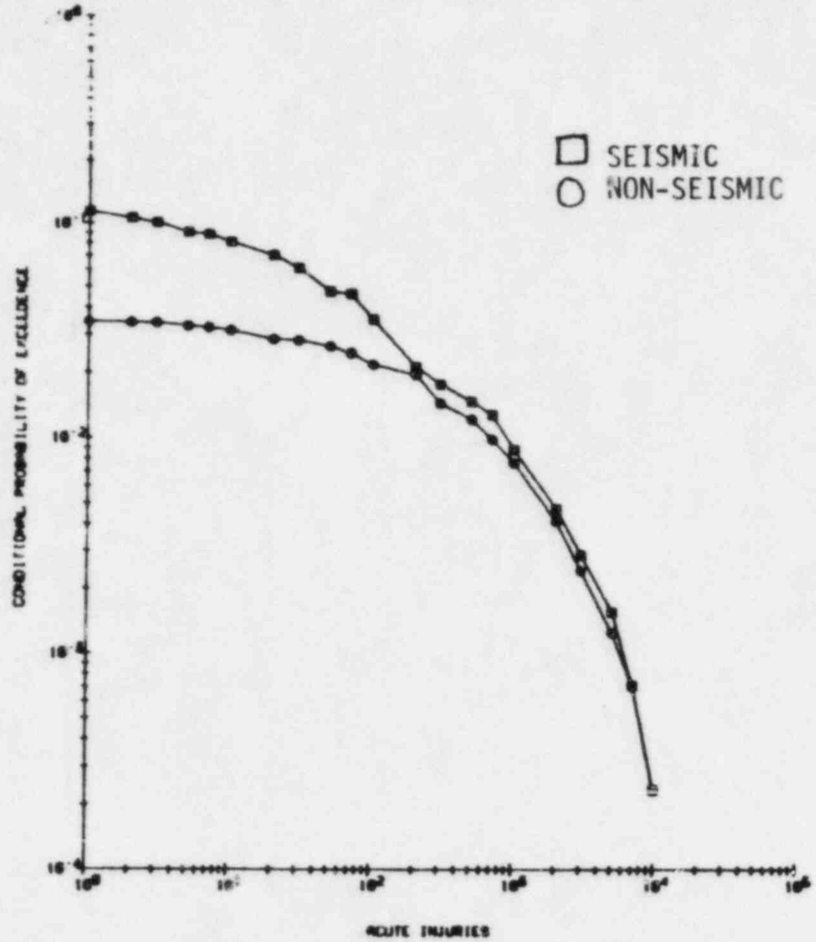


FIGURE NO. 6.1-18 COMPARISON OF ACUTE INJURIES FOR RELEASE CATEGORY M5: SEISMIC VS. NON-SEISMIC EVACUATION

NOTE: This figure shows conditional probabilities, and the values must be multiplied by the frequency of release in order to obtain risk.

Amendment 1
September 7, 1983

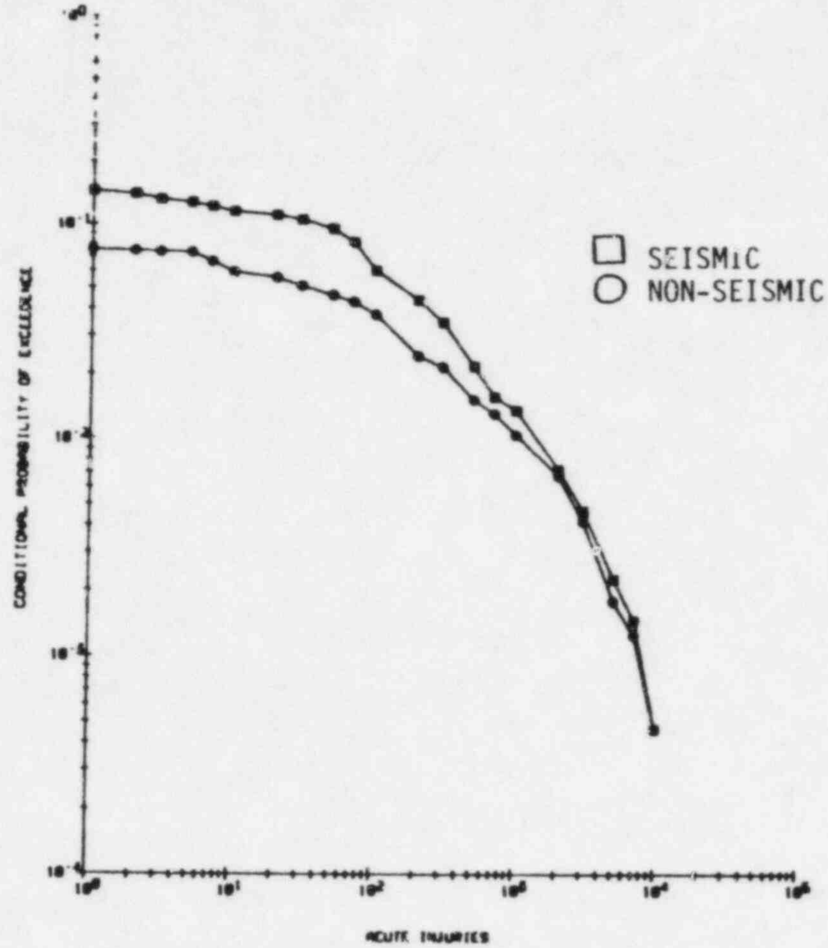


FIGURE NO. 6.1-19 COMPARISON OF ACUTE INJURIES FOR RELEASE CATEGORY M6: SEISMIC VS. NON-SEISMIC EVACUATION

NOTE: This figure shows conditional probabilities, and the values must be multiplied by the frequency of release in order to obtain risk.

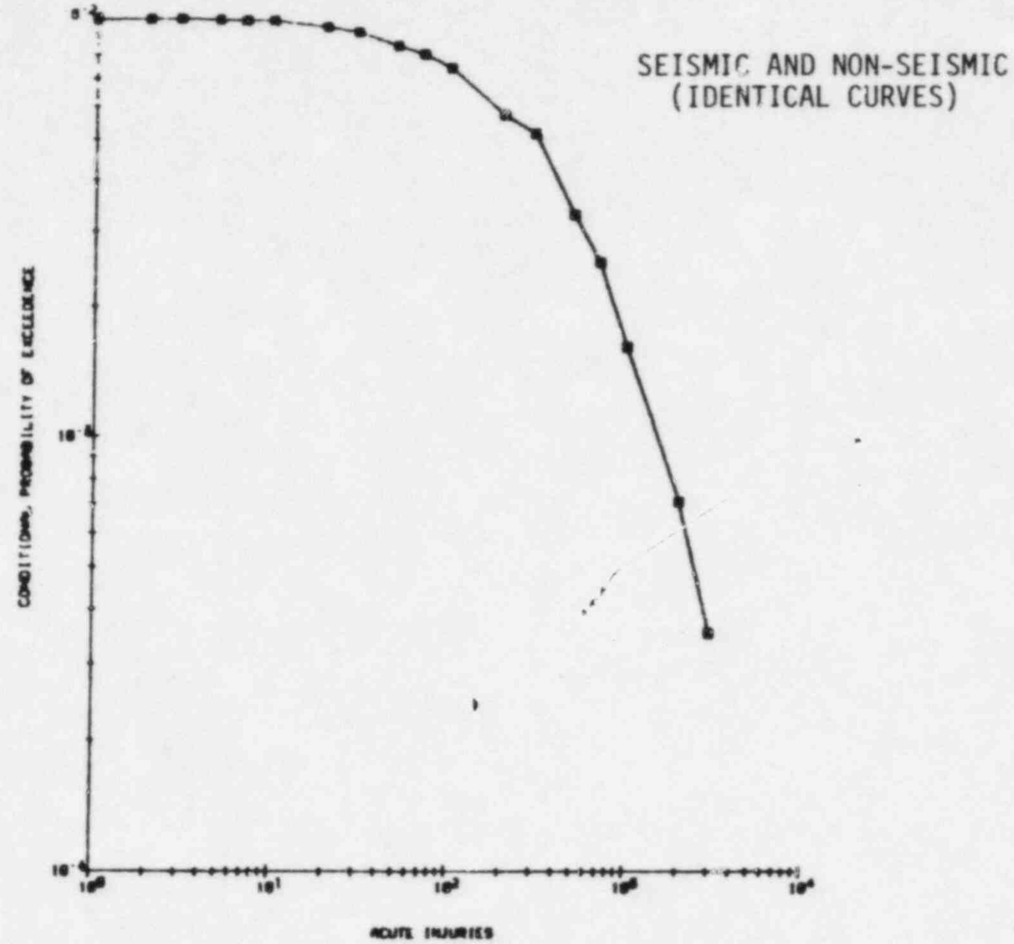


FIGURE NO. 6.1-20 COMPARISON OF ACUTE INJURIES FOR RELEASE CATEGORY M7: SEISMIC VS. NON-SEISMIC EVACUATION

NOTE: This figure shows conditional probabilities, and the values must be multiplied by the frequency of release in order to obtain risk.

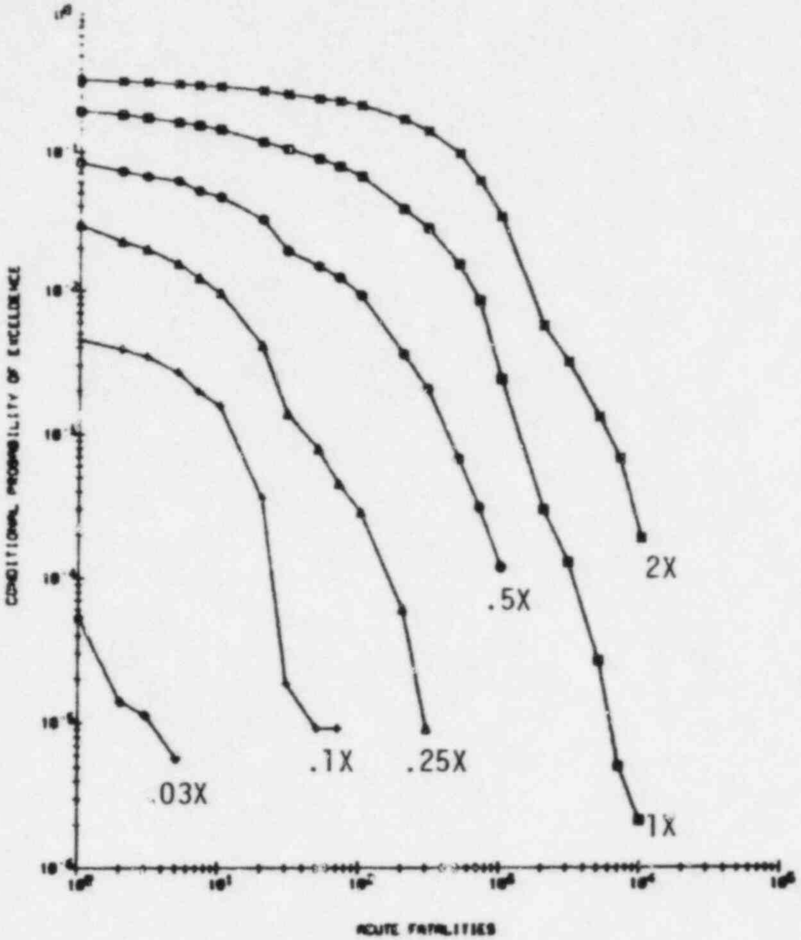


FIGURE NO. 6.1-21 RESULTS OF DPD RUNS FOR RELEASE CATEGORY M1A -- ACUTE FATALITIES

NOTE: This figure shows conditional probabilities, and the values must be multiplied by the frequency of release in order to obtain risk.

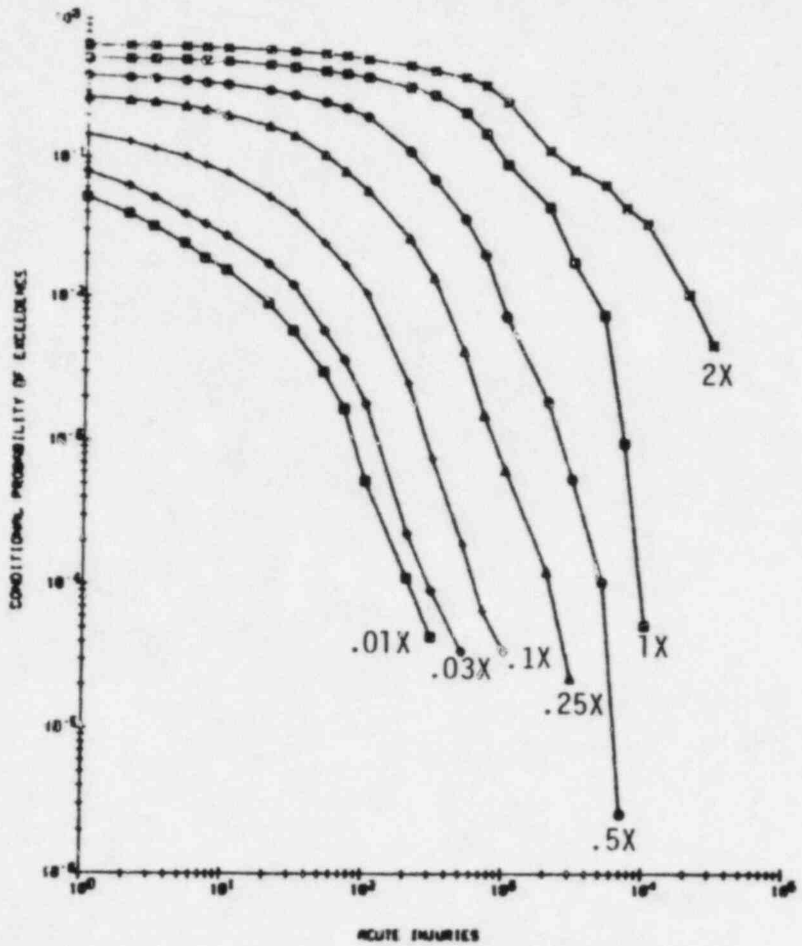


FIGURE NO. 6.1-22 RESULTS OF DPD RUNS FOR RELEASE CATEGORY M1A -- ACUTE INJURIES

NOTE: This figure shows conditional probabilities, and the values must be multiplied by the frequency of release in order to obtain risk.

Amendment 1
September 7, 1983

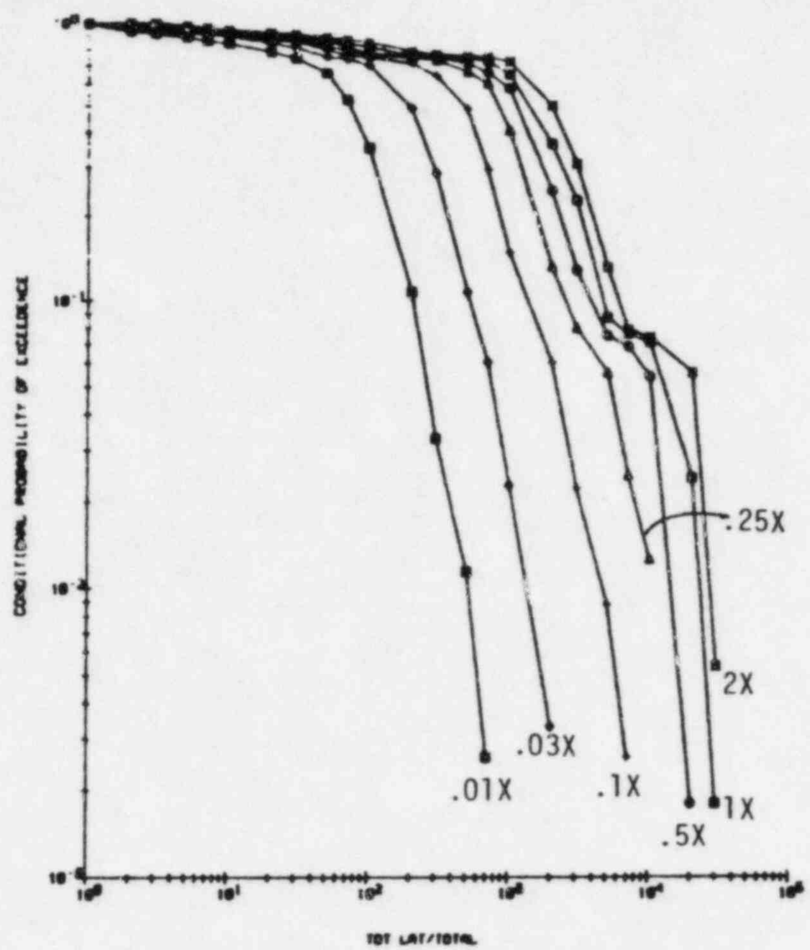


FIGURE NO. 6.1-23 RESULTS OF DPD RUNS FOR RELEASE CATEGORY M1A -- TOTAL LATENT FATALITIES EXCLUDING THYROID

NOTE: This figure shows conditional probabilities, and the values must be multiplied by the frequency of release in order to obtain risk.

Amendment 1
September 7, 1983

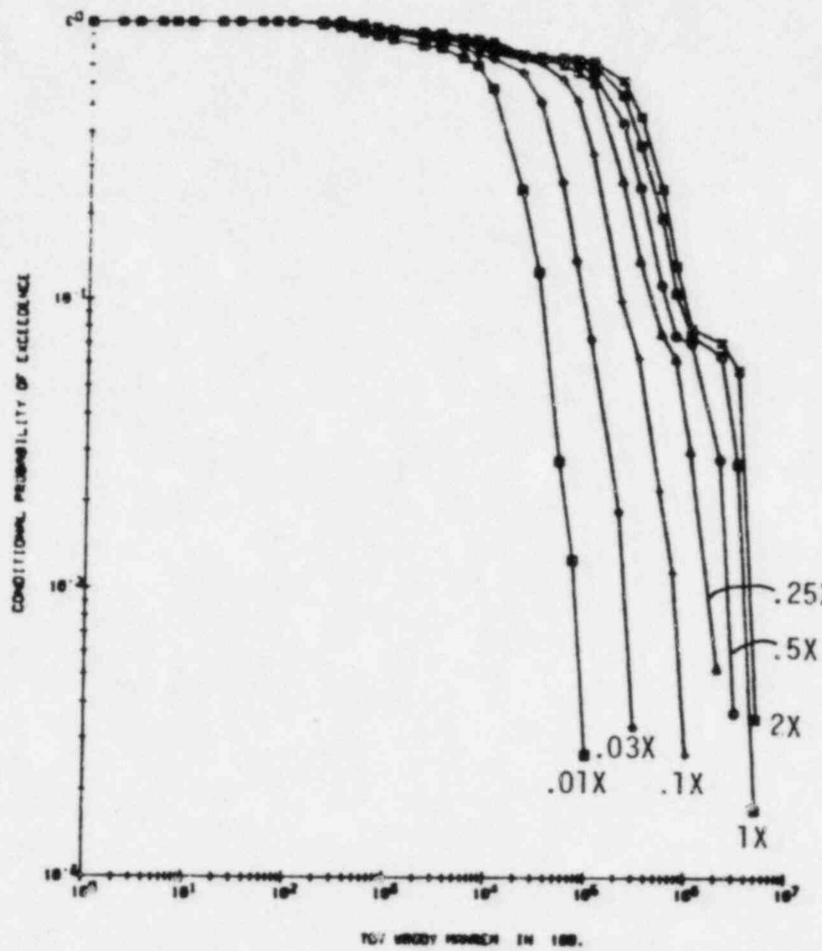


FIGURE NO. 6.1-24 RESULTS OF DPD RUNS FOR RELEASE CATEGORY M1A -- POPULATION WHOLE BODY DOSE

NOTE: This figure shows conditional probabilities, and the values <u>must</u> be multiplied by the frequency of release in order to obtain risk.

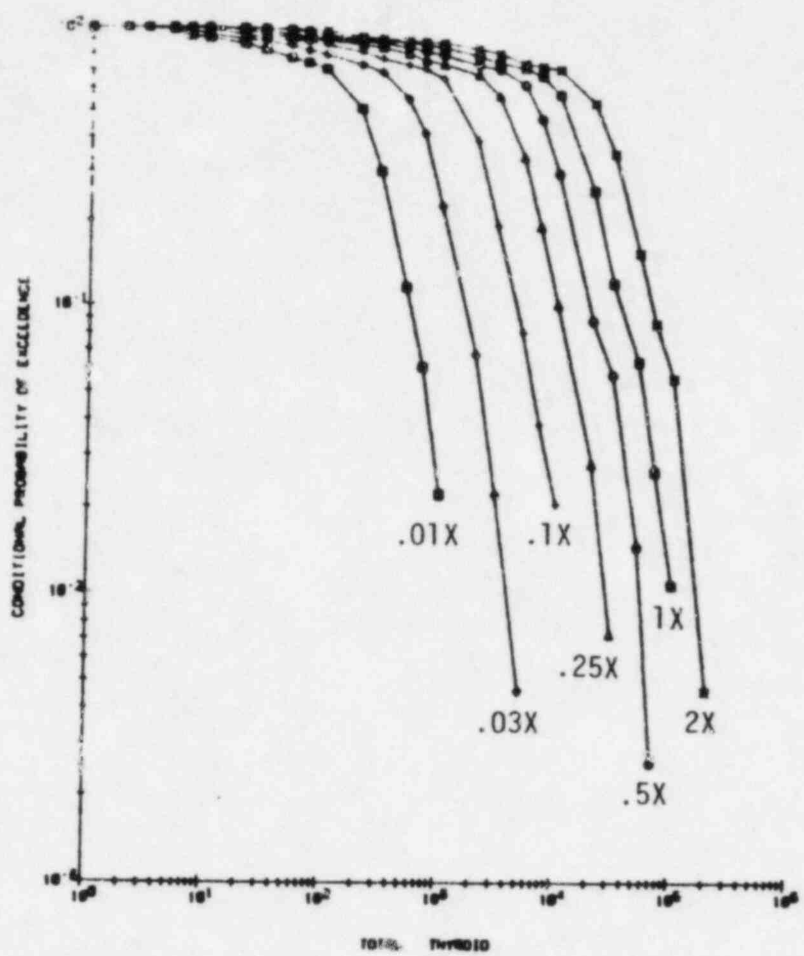


FIGURE NO. 6.1-25 RESULTS OF DPD RUNS FOR RELEASE CATEGORY M1A -- TOTAL THYROID NODULES

NOTE: This figure shows conditional probabilities, and the values <u>must</u> be multiplied by the frequency of release in order to obtain risk.

Amendment 1
September 7, 1983

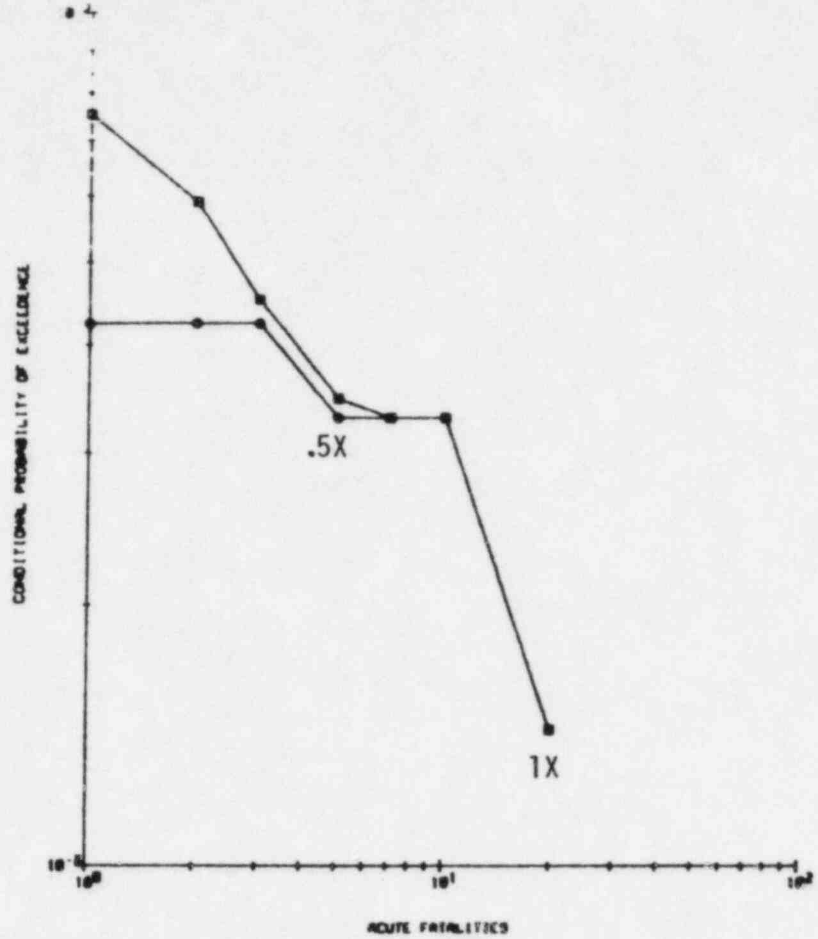


FIGURE NO. 6.1-26 RESULTS OF DPD RUNS FOR RELEASE CATEGORY M2 -- ACUTE FATALITIES

NOTE: This figure shows conditional probabilities, and the values <u>must</u> be multiplied by the frequency of release in order to obtain risk.

Amendment 1
September 7, 1983

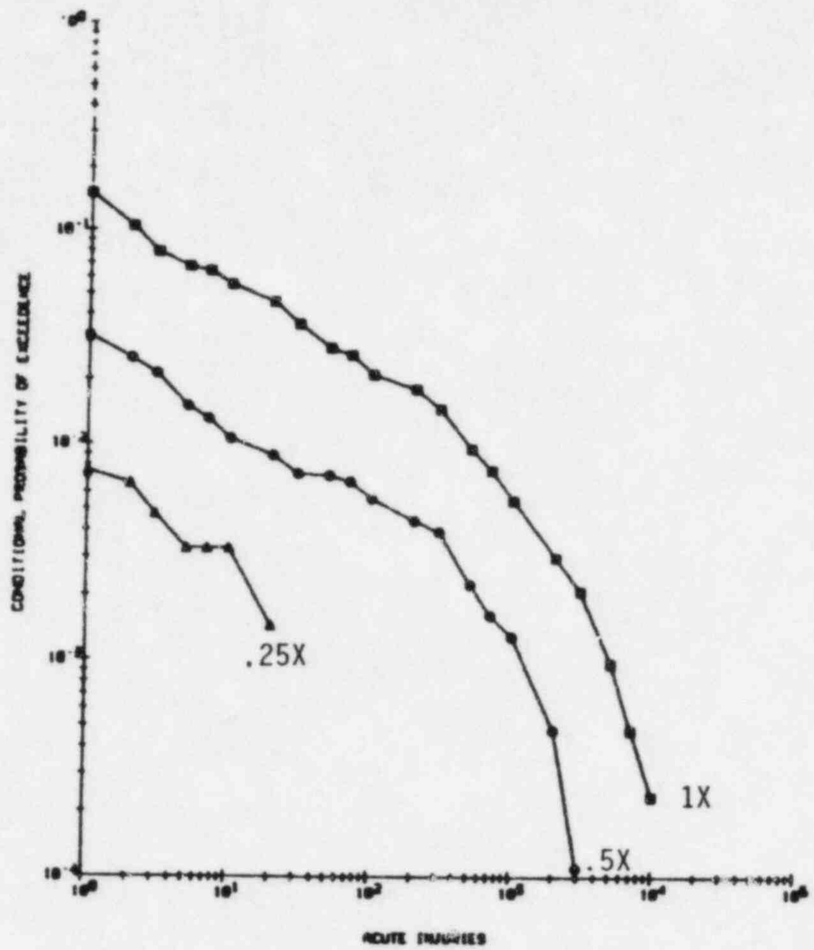


FIGURE NO. 6.1-27 RESULTS OF DPD RUNS FOR RELEASE CATEGORY M2 -- ACUTE INJURIES

NOTE: This figure shows conditional probabilities, and the values must be multiplied by the frequency of release in order to obtain risk.

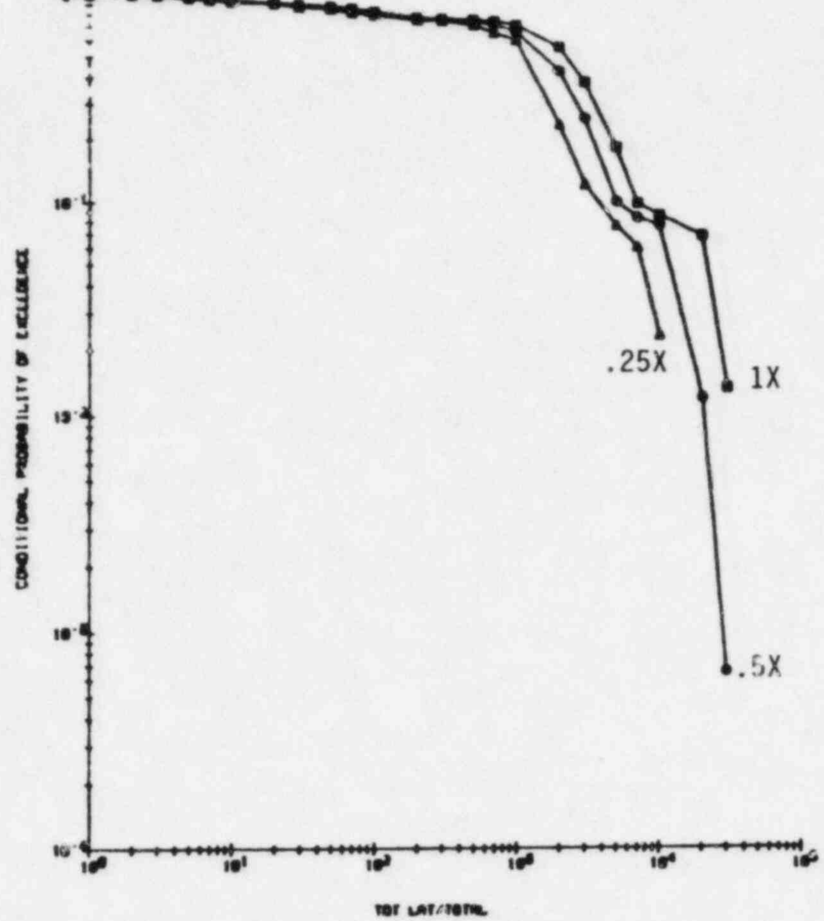


FIGURE 6.1-28 RESULTS OF DPD RUNS FOR RELEASE CATEGORY M2 -- TOTAL LATENT FATALITIES EXCLUDING THYROID

NOTE: This figure shows conditional probabilities, and the values <u>must</u> be multiplied by the frequency of release in order to obtain risk.

Amendment 1
September 7, 1983

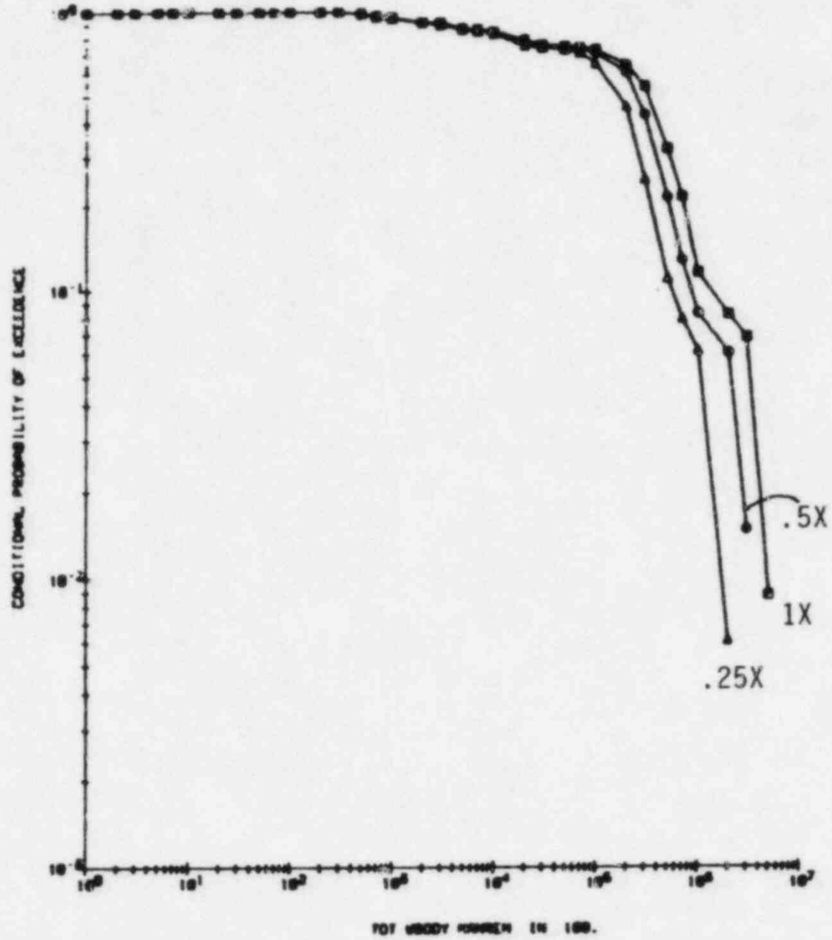


FIGURE 6.1-29 RESULTS OF DPD RUNS FOR RELEASE CATEGORY M2 -- POPULATION WHOLE BODY DOSE

NOTE: This figure shows conditional probabilities, and the values <u>must</u> be multiplied by the frequency of release in order to obtain risk.

Amendment 1
September 7, 1983

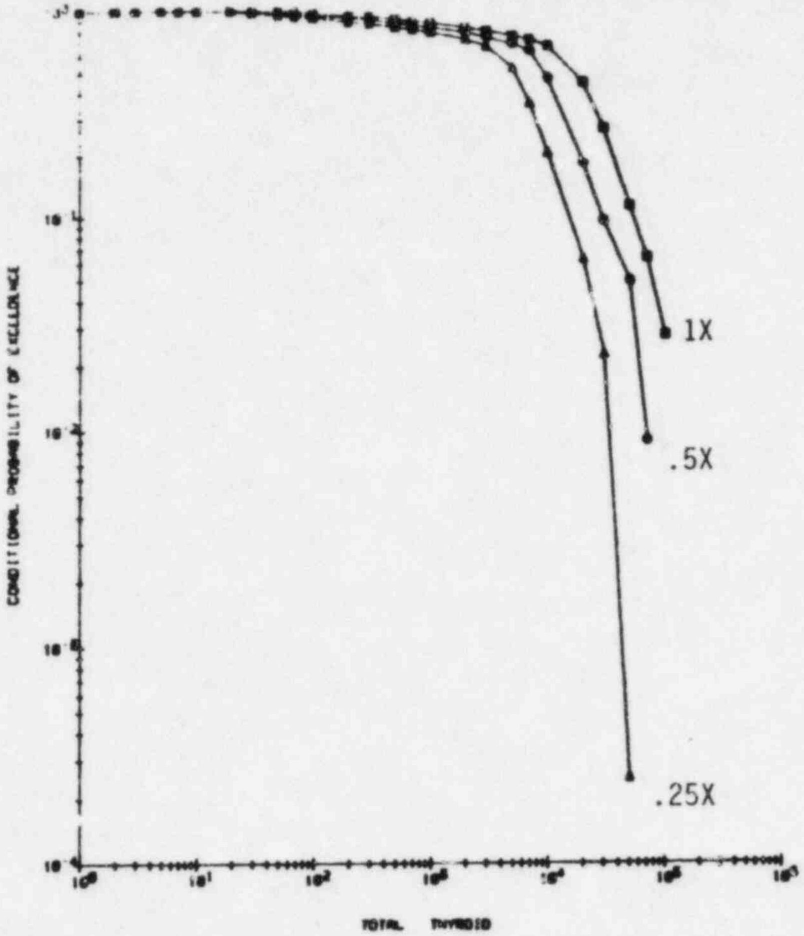


FIGURE NO. 6.1-30 RESULTS OF DPD RUNS FOR RELEASE CATEGORY M2 -- TOTAL THYROID NODULES

NOTE: This figure shows conditional probabilities, and the values <u>must</u> be multiplied by the frequency of release in order to obtain risk.

Amendment 1
September 7, 1983

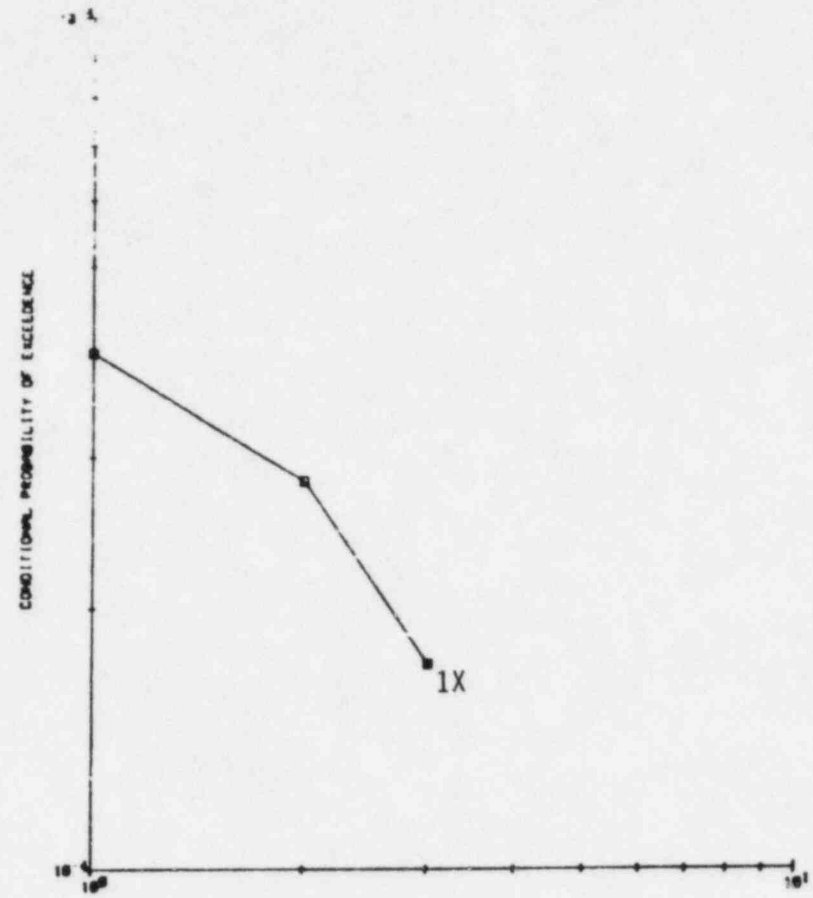


FIGURE 6.1-31 RESULTS OF DPD RUNS FOR RELEASE CATEGORY M3 -- ACTUTE FATALITIES

NOTE: This figure shows conditional probabilities, and the values must be multiplied by the frequency of release in order to obtain risk.

Amendment 1
September 7, 1983

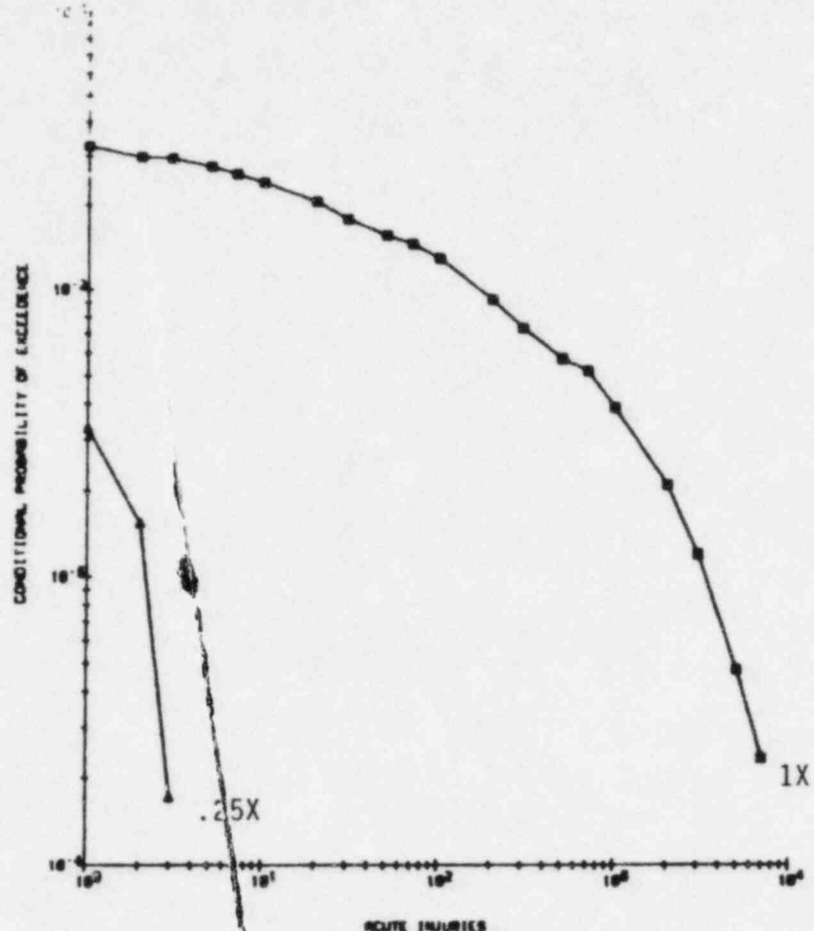


FIGURE 6.1-32 RESULTS OF DPD RUNS FOR RELEASE CATEGORY M3 -- ACUTE INJURIES

NOTE: This figure shows conditional probabilities, and the values must be multiplied by the frequency of release in order to obtain risk.

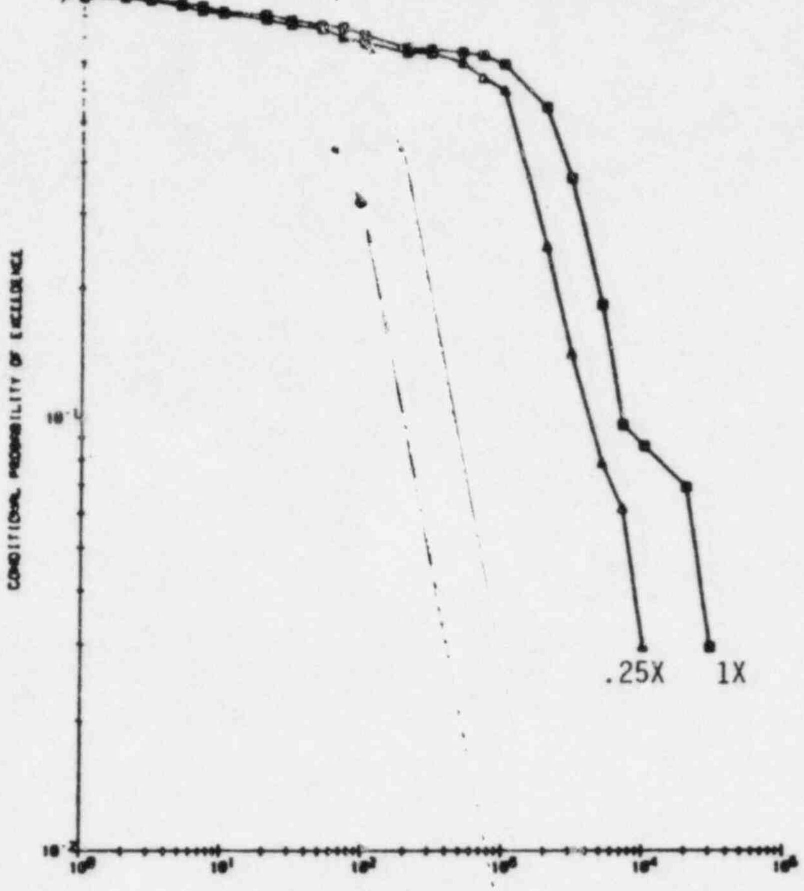


FIGURE 6.1-33 RESULTS OF DPD RUNS FOR RELEASE CATEGORY M3 -- TOTAL LATENT FATALITIES EXCLUDING THYROID

NOTE: This figure shows conditional probabilities, and the values <u>must</u> be multiplied by the frequency of release in order to obtain risk.

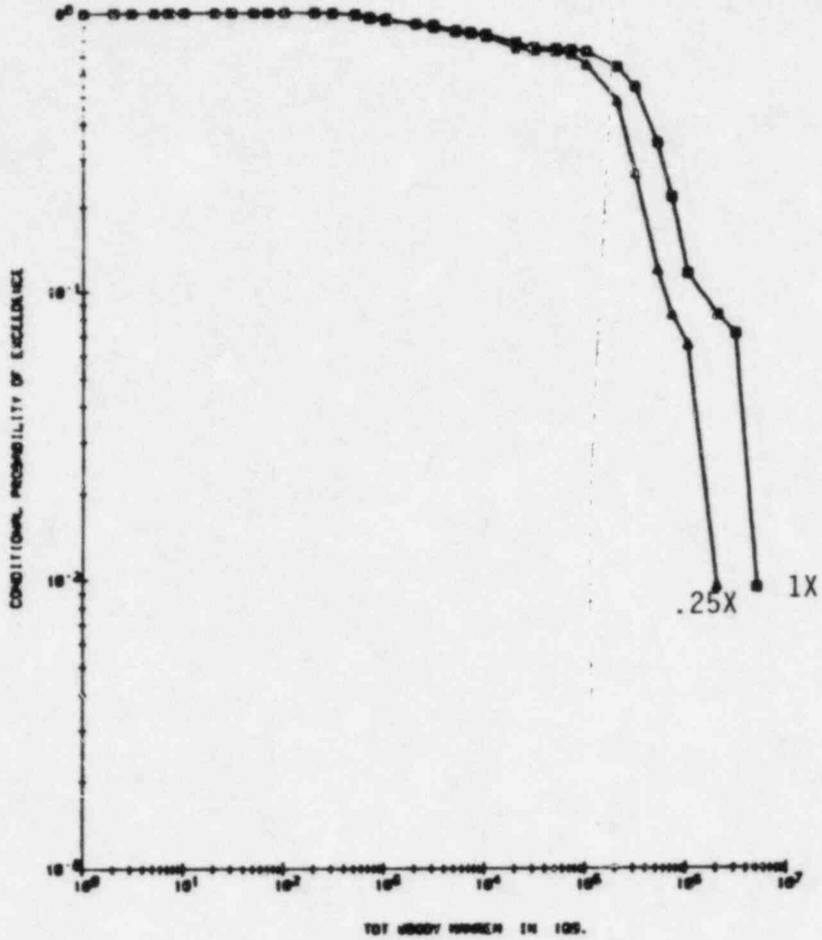


FIGURE 6.1-34 RESULTS OF DPD RUNS FOR RELEASE CATEGORY M3 -- POPULATION WHOLE BODY DOSE

NOTE: This figure shows conditional probabilities, and the values must be multiplied by the frequency of release in order to obtain risk.

Amendment 1
September 7, 1983

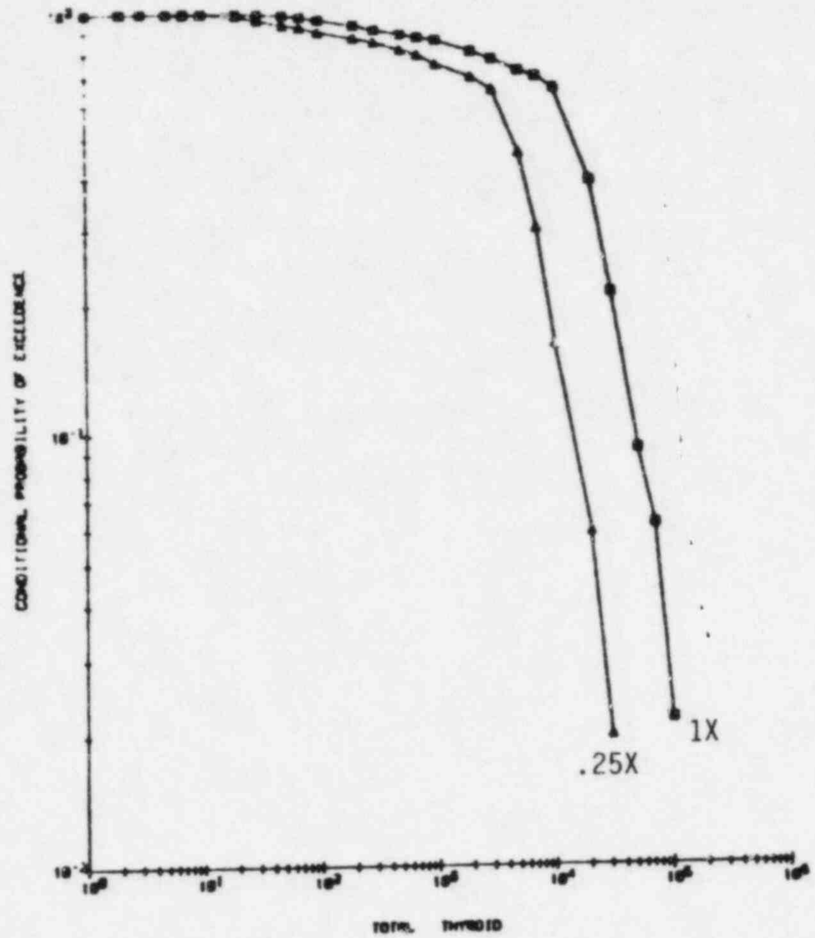


FIGURE 6.1-35 RESULTS OF DPD RUNS FOR RELEASE CATEGORY M3 -- TOTAL THYROID NODULES

NOTE: This figure shows conditional probabilities, and the values must be multiplied by the frequency of release in order to obtain risk.

Amendment 1
September 7, 1983

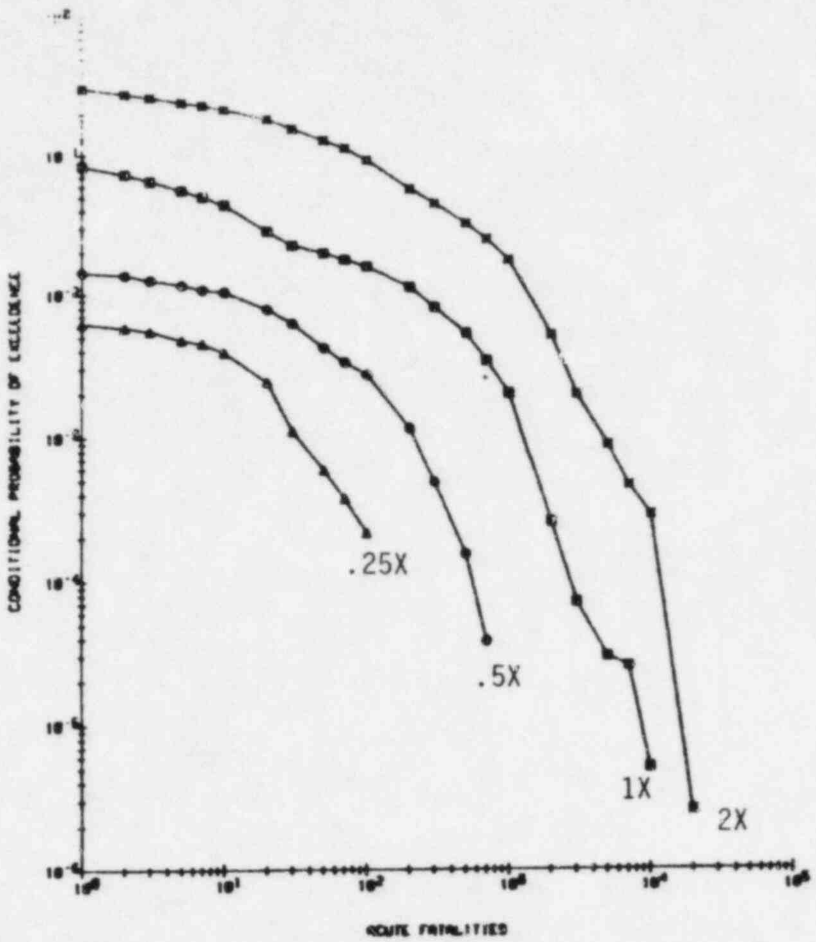


FIGURE 6.1-36 RESULTS OF DPD RUNS FOR RELEASE CATEGORY M4 -- ACUTE FATALITIES

NOTE: This figure shows conditional probabilities, and the values must be multiplied by the frequency of release in order to obtain risk.

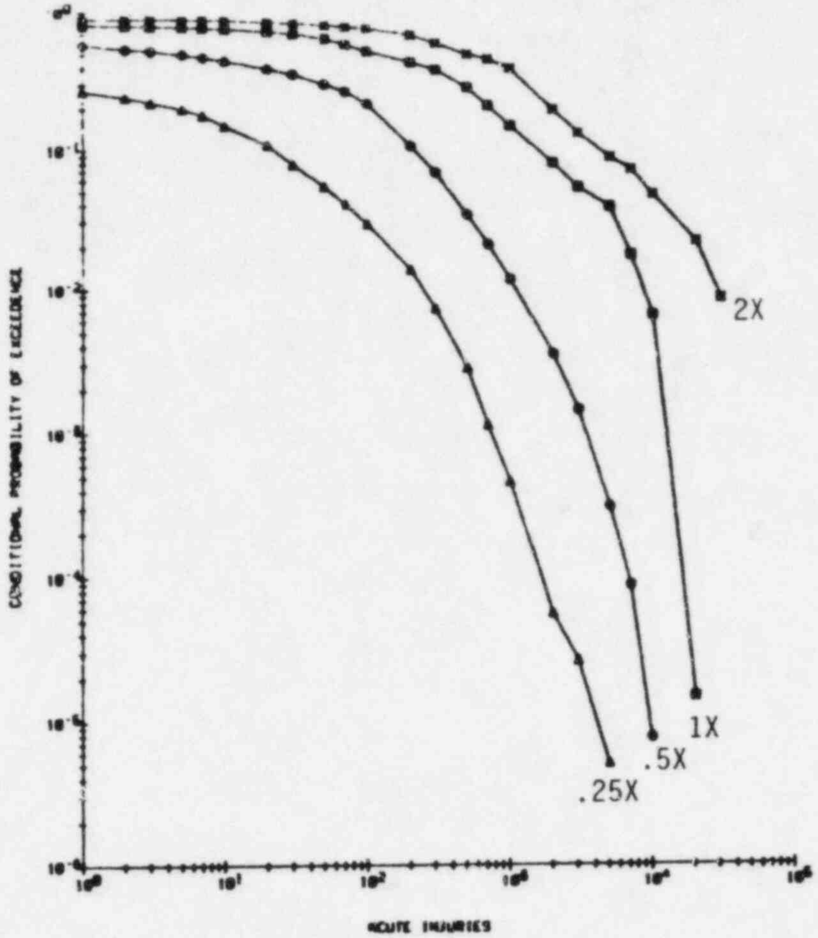


FIGURE 6.1-37 RESULTS OF DPD RUNS FOR RELEASE CATEGORY M4 -- ACUTE INJURIES

NOTE: This figure shows conditional probabilities, and the values must be multiplied by the frequency of release in order to obtain risk.

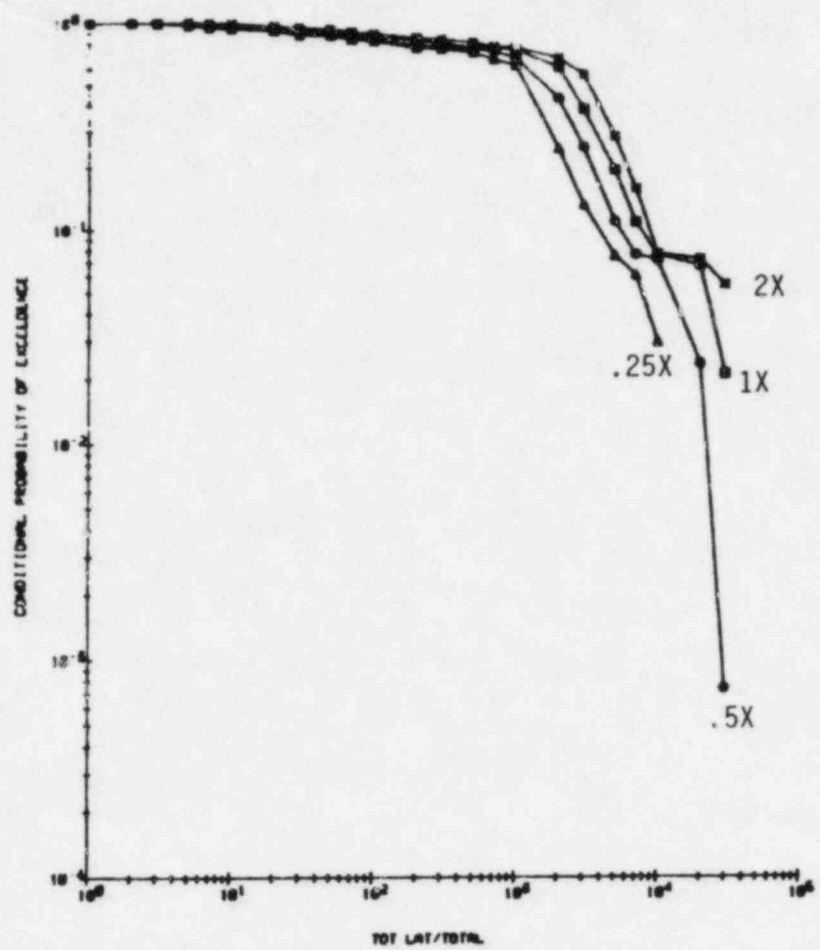


FIGURE 6.1-38 RESULTS OF DPD RUNS FOR RELEASE CATEGORY M4 -- TOTAL LATENT FATALITIES EXCLUDING THYROID

NOTE: This figure shows conditional probabilities, and the values must be multiplied by the frequency of release in order to obtain risk.

Amendment 1
September 7, 1983

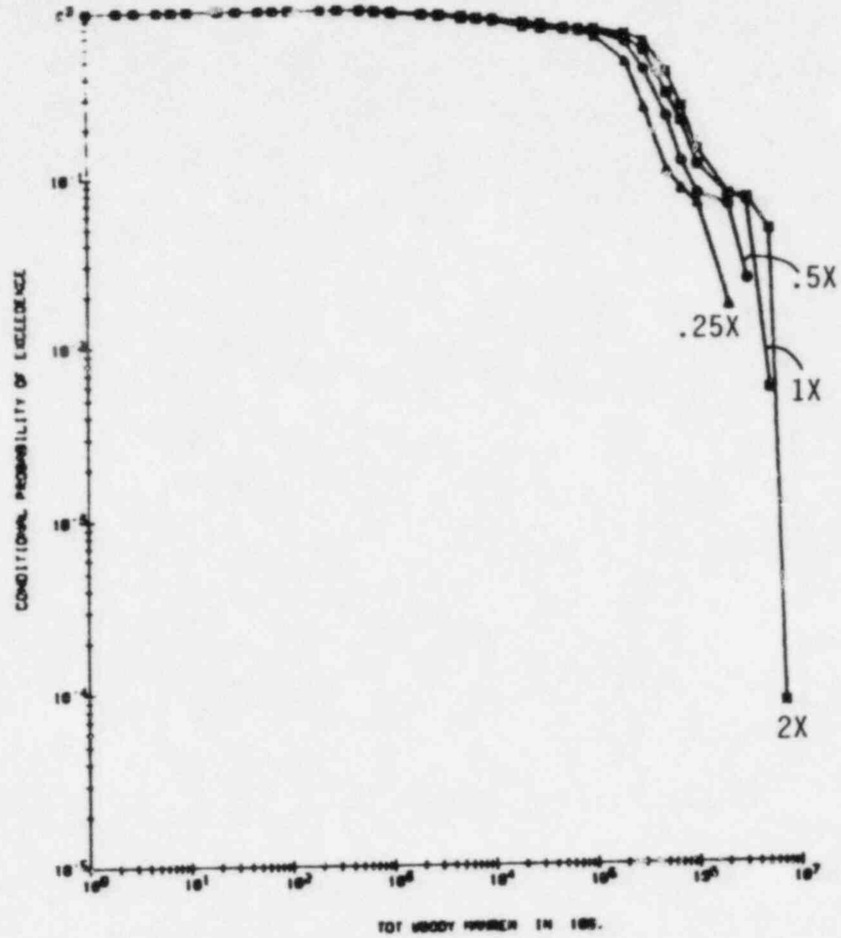


FIGURE 6.1-39 RESULTS OF DPD RUNS FOR RELEASE CATEGORY M4 -- POPULATION WHOLE BODY DOSE

NOTE: This figure shows conditional probabilities, and the values <u>must</u> be multiplied by the frequency of release in order to obtain risk.

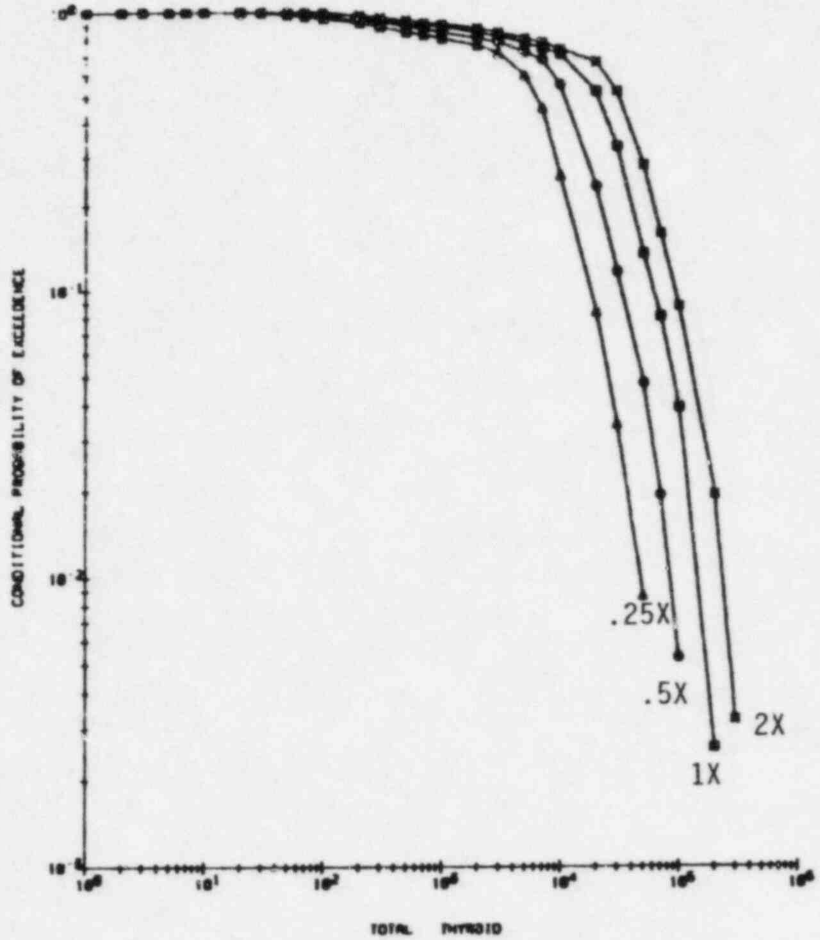


FIGURE 6.1-40 RESULTS OF DPD RUNS FOR RELEASE CATEGORY M4 -- TOTAL THYROID NODULES

NOTE: This figure shows conditional probabilities, and the values <u>must</u> be multiplied by the frequency of release in order to obtain risk.

Amendment 1
September 7, 1983

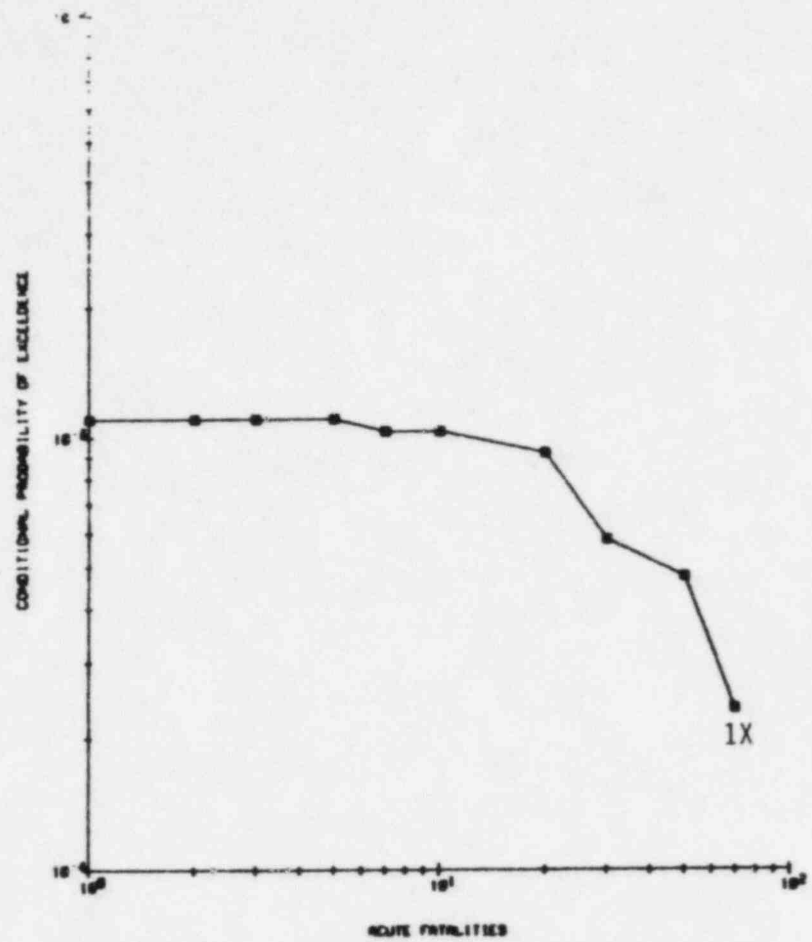


FIGURE 6.1-41 RESULTS OF DPD RUNS FOR RELEASE CATEGORY M5 -- ACUTE FATALITIES

NOTE: This figure shows conditional probabilities, and the values must be multiplied by the frequency of release in order to obtain risk.

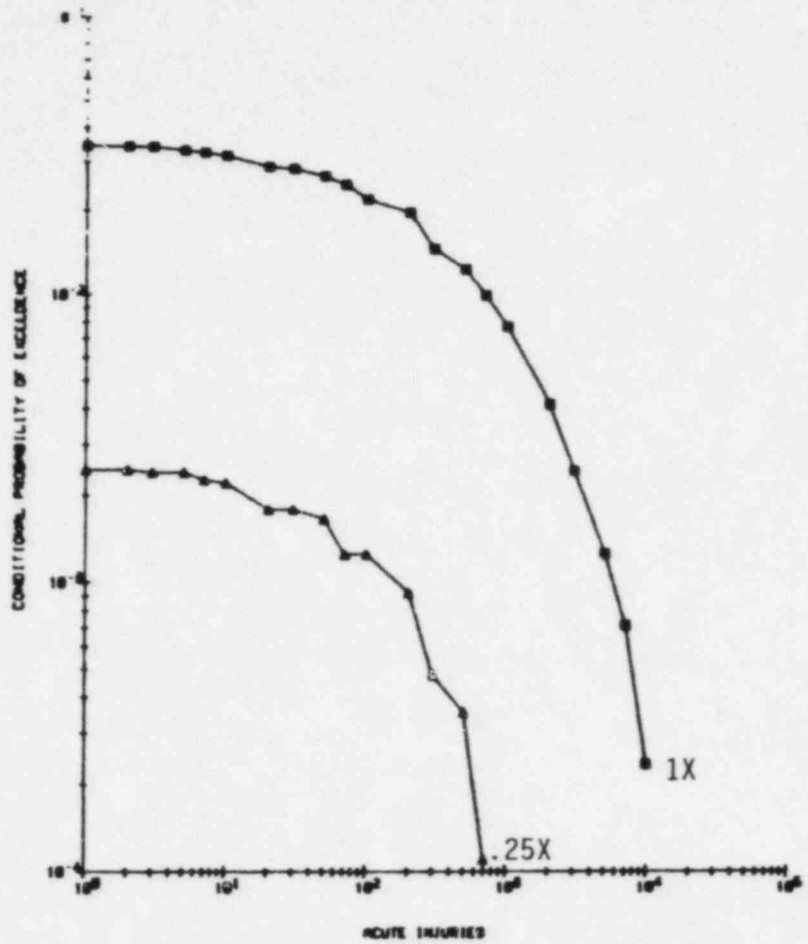


FIGURE 6.1-42 RESULTS OF DPD RUNS FOR RELEASE CATEGORY M5 -- ACUTE INJURIES

NOTE: This figure shows conditional probabilities, and the values must be multiplied by the frequency of release in order to obtain risk.

Amendment 1
September 7, 1983

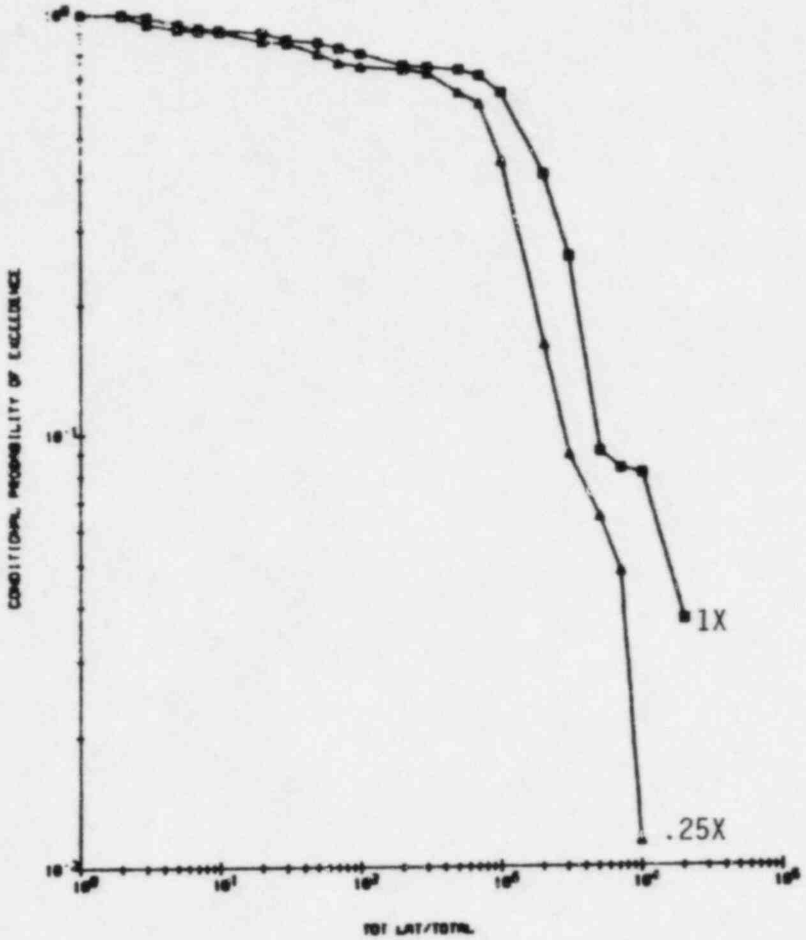


FIGURE 6.1-43 RESULTS OF DPD RUNS FOR RELEASE CATEGORY M5 -- TOTAL LATENT FATALITIES EXCLUDING THYROID

NOTE: This figure shows conditional probabilities, and the values must be multiplied by the frequency of release in order to obtain risk.

Amendment 1
September 7, 1983

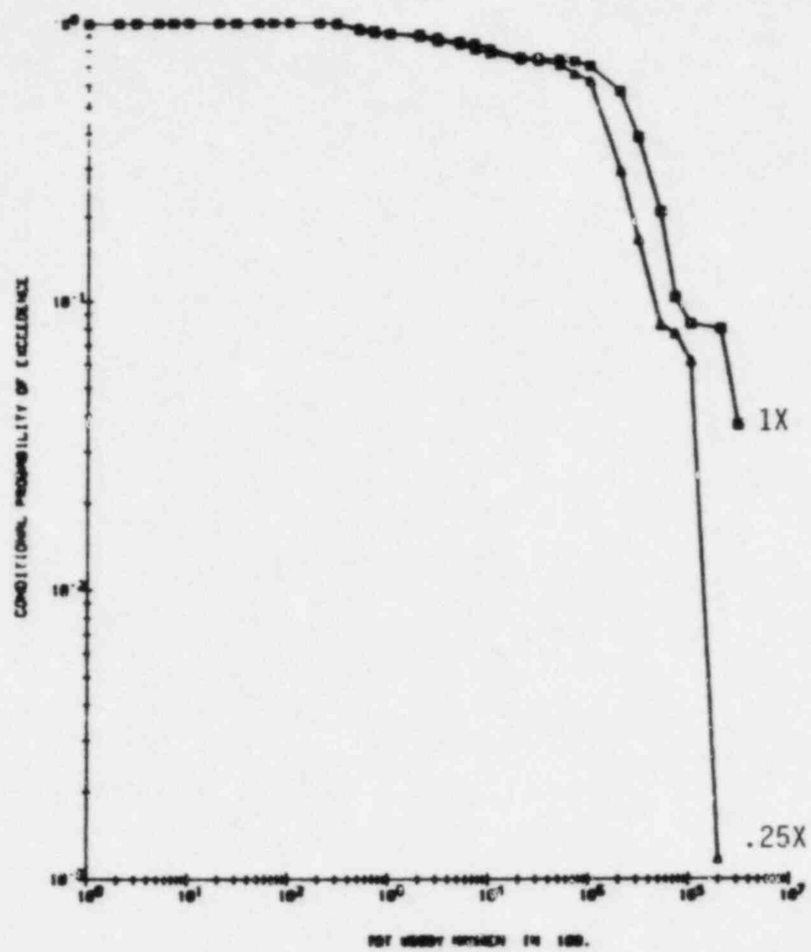


FIGURE 6.1-44 RESULTS OF DPD RUNS FOR RELEASE CATEGORY M5 -- POPULATION WHOLE BODY DOSE

NOTE: This figure shows conditional probabilities, and the values must be multiplied by the frequency of release in order to obtain risk.

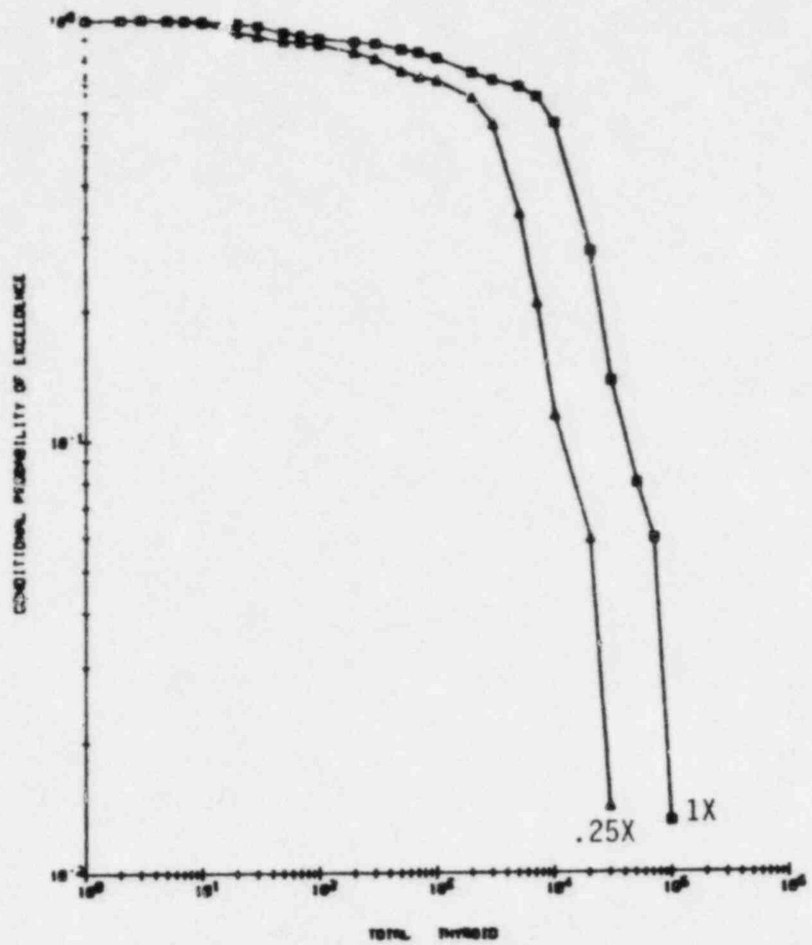


FIGURE 6.1-45 RESULTS OF DPD RUNS FOR RELEASE CATEGORY M5 -- TOTAL THYROID NODULES

NOTE: This figure shows conditional probabilities, and the values must be multiplied by the frequency of release in order to obtain risk.

Amendment 1
September 7, 1983

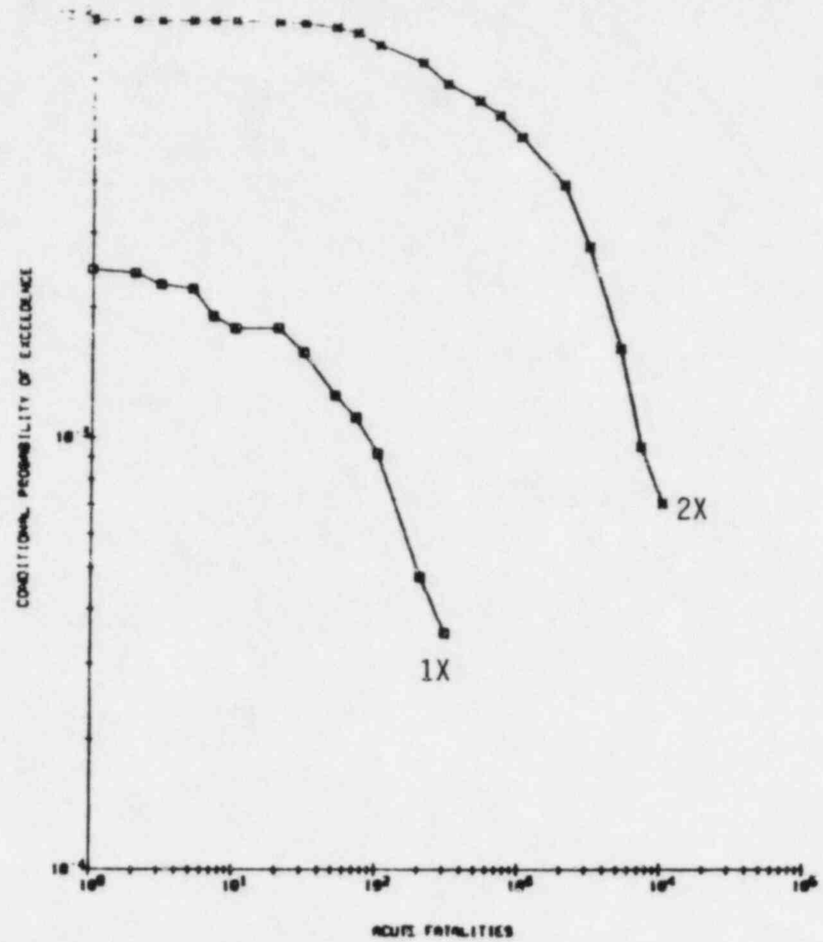


FIGURE 6.1-46 RESULTS OF DPD RUNS FOR RELEASE CATEGORY M6 -- ACUTE FATALITIES

NOTE: This figure shows conditional probabilities, and the values <u>must</u> be multiplied by the frequency of release in order to obtain risk.

Amendment 1
September 7, 1983

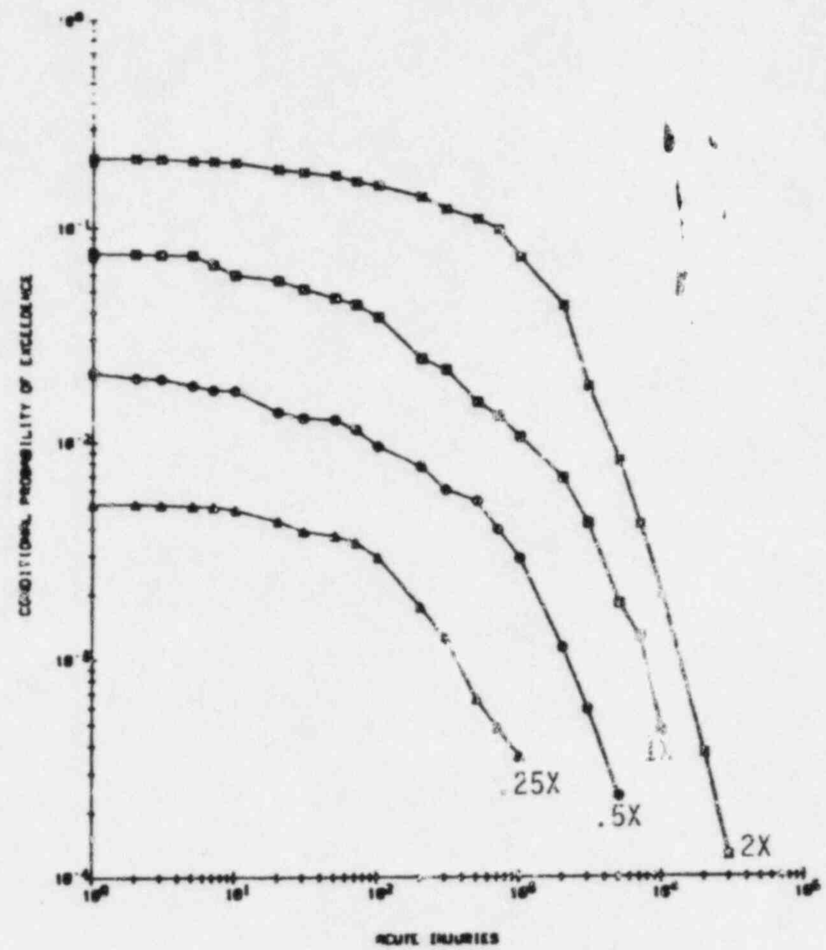


FIGURE 6.1-47 RESULTS OF DPD RUNS FOR RELEASE CATEGORY M5 -- ACUTE INJURIES

NOTE: This figure shows conditional probabilities, and the values <u>must</u> be multiplied by the frequency of release in order to obtain risk.

Amendment 1
September 7, 1983

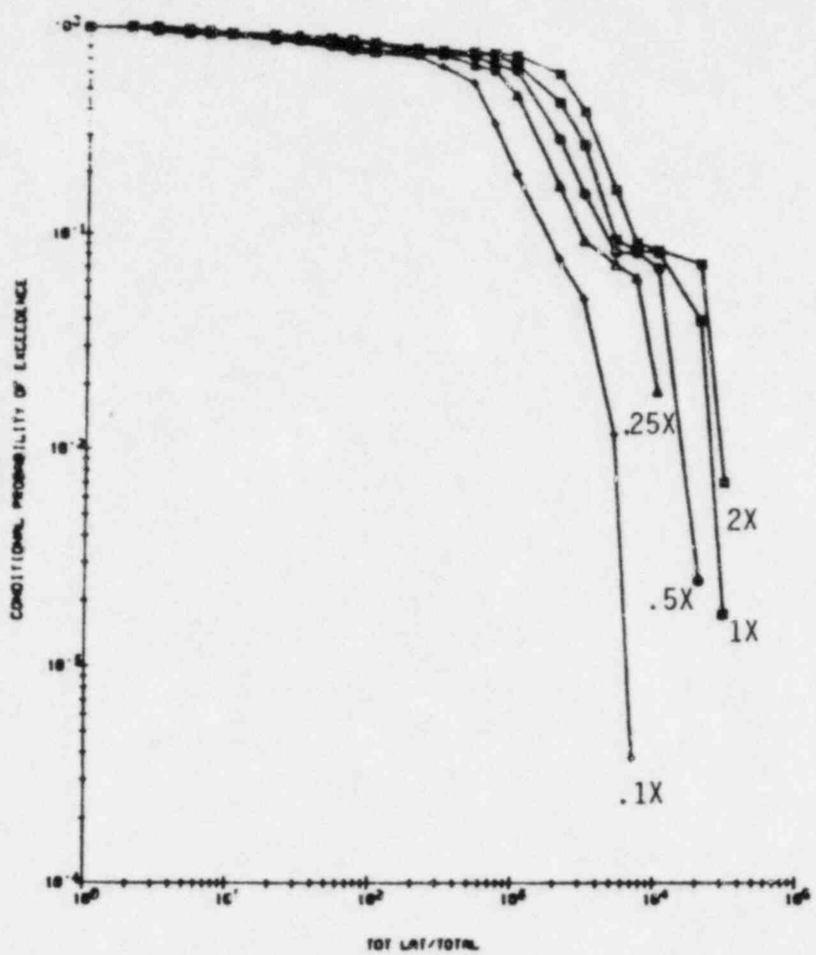


FIGURE 6.1-48 RESULTS OF DPD RUNS FOR RELEASE CATEGORY M6 -- TOTAL LATENT FATALITIES EXCLUDING THYROID

NOTE: This figure shows conditional probabilities, and the values must be multiplied by the frequency of release in order to obtain risk.

Amendment 1
September 7, 1983

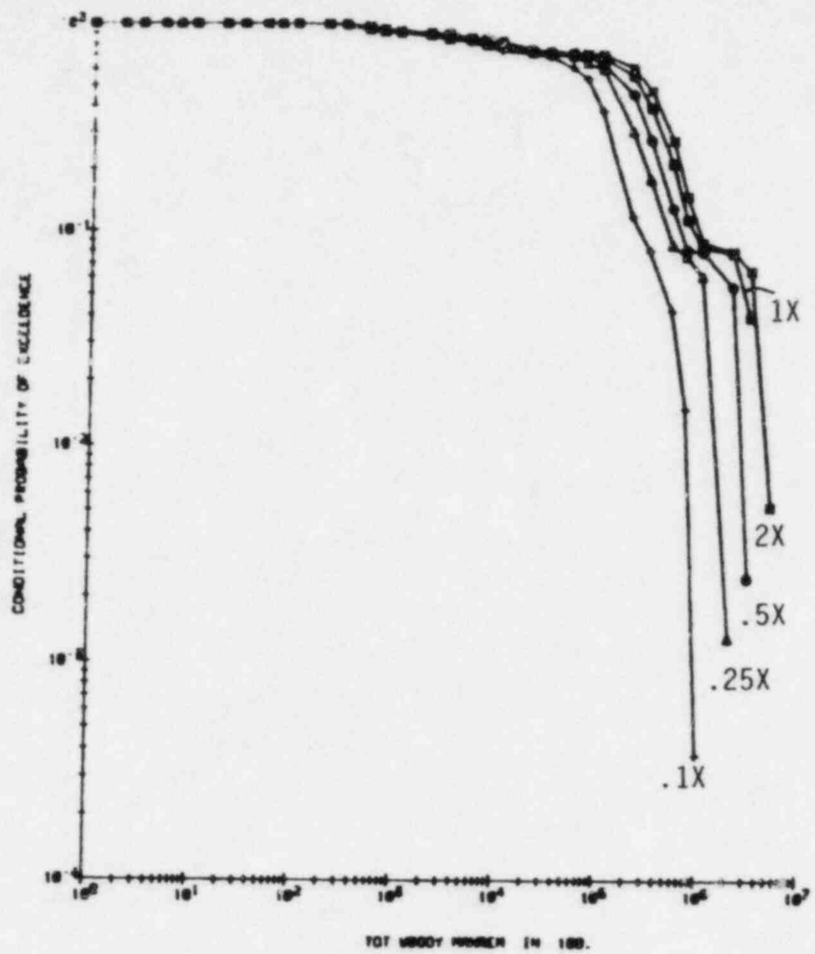


FIGURE 6.1-49 RESULTS OF DPD RUNS FOR RELEASE CATEGORY M6 -- POPULATION WHOLE BODY DOSE

NOTE: This figure shows conditional probabilities, and the values <u>must</u> be multiplied by the frequency of release in order to obtain risk.

Amendment 1
September 7, 1983

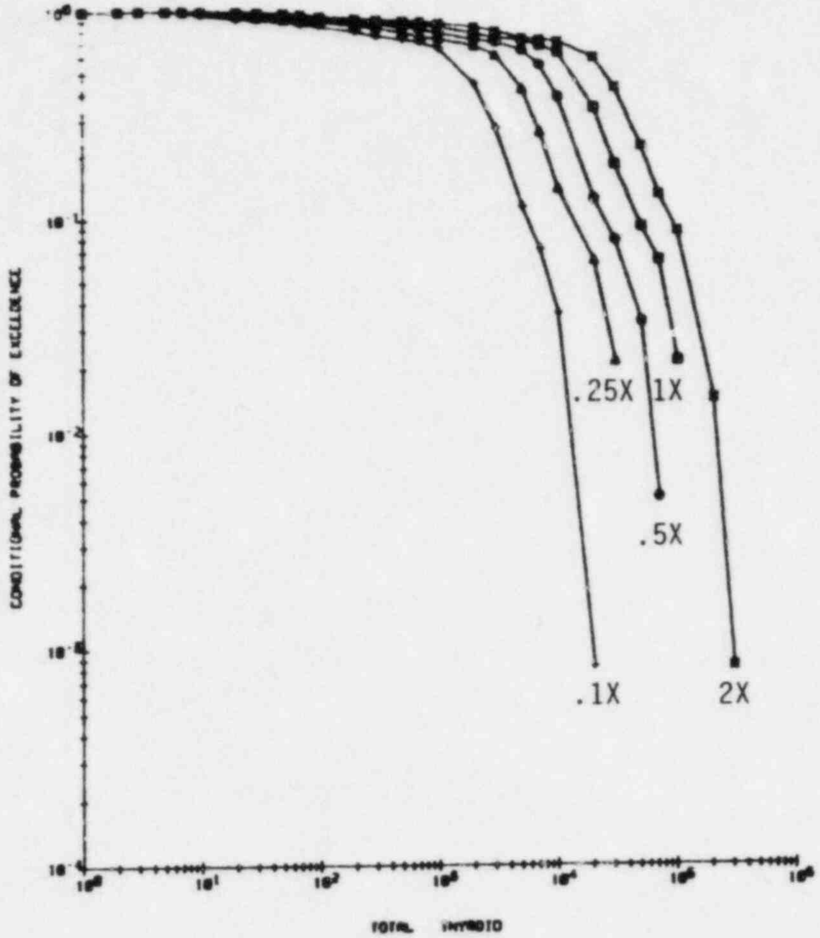


FIGURE 6.1-50 RESULTS OF DPD RUNS FOR RELEASE CATEGORY M6 -- TOTAL THYROID NODULES

NOTE: This figure shows conditional probabilities, and the values must be multiplied by the frequency of release in order to obtain risk.

Amendment 1
September 7, 1983

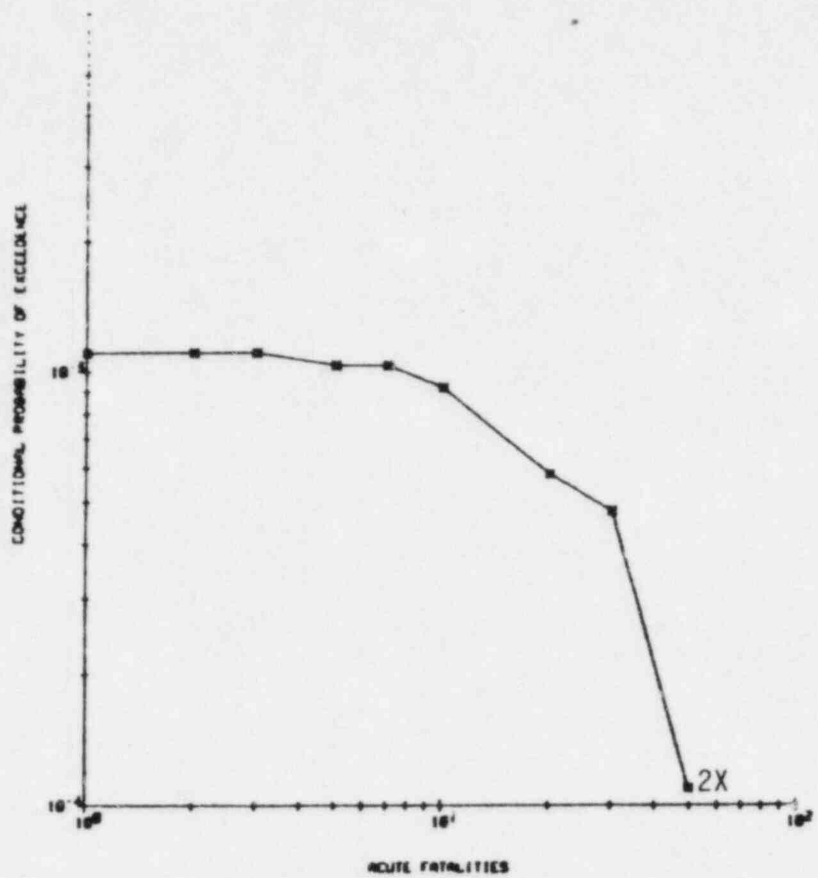


FIGURE 6.1-51 RESULTS OF DPD RUNS FOR RELEASE CATEGORY M7 -- ACUTE FATALITIES

NOTE: This figure shows conditional probabilities, and the values <u>must</u> be multiplied by the frequency of release in order to obtain risk.

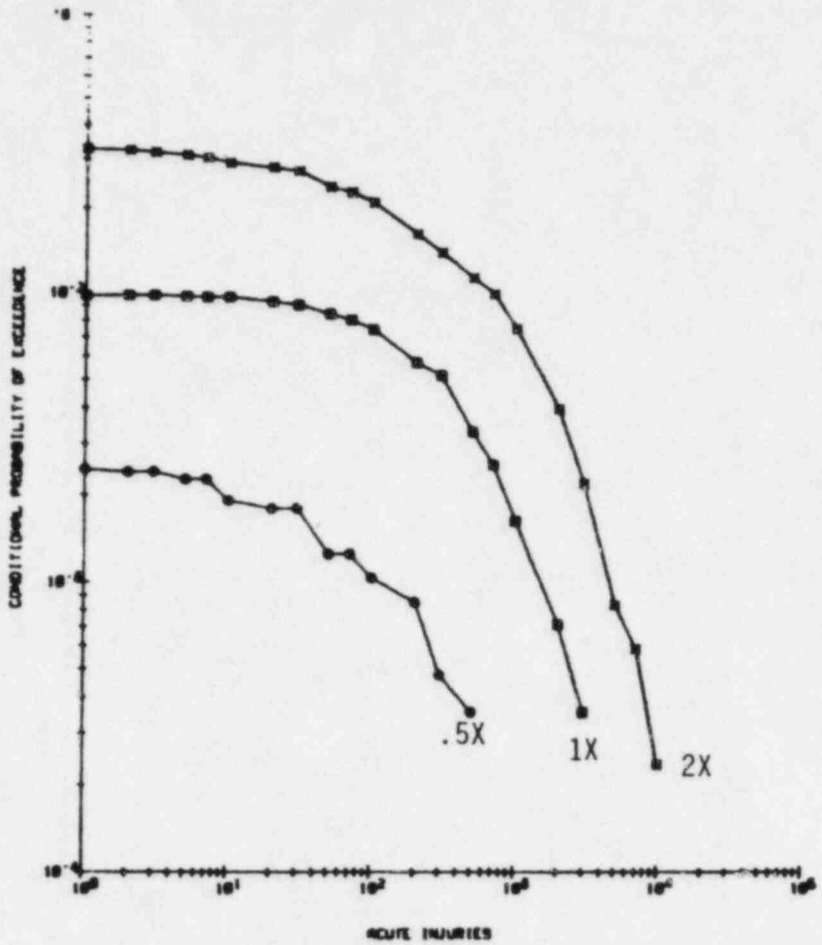


FIGURE 6.1-52 RESULTS OF DPD RUNS FOR RELEASE CATEGORY M7 -- ACUTE INJURIES

NOTE: This figure shows conditional probabilities, and the values must be multiplied by the frequency of release in order to obtain risk.

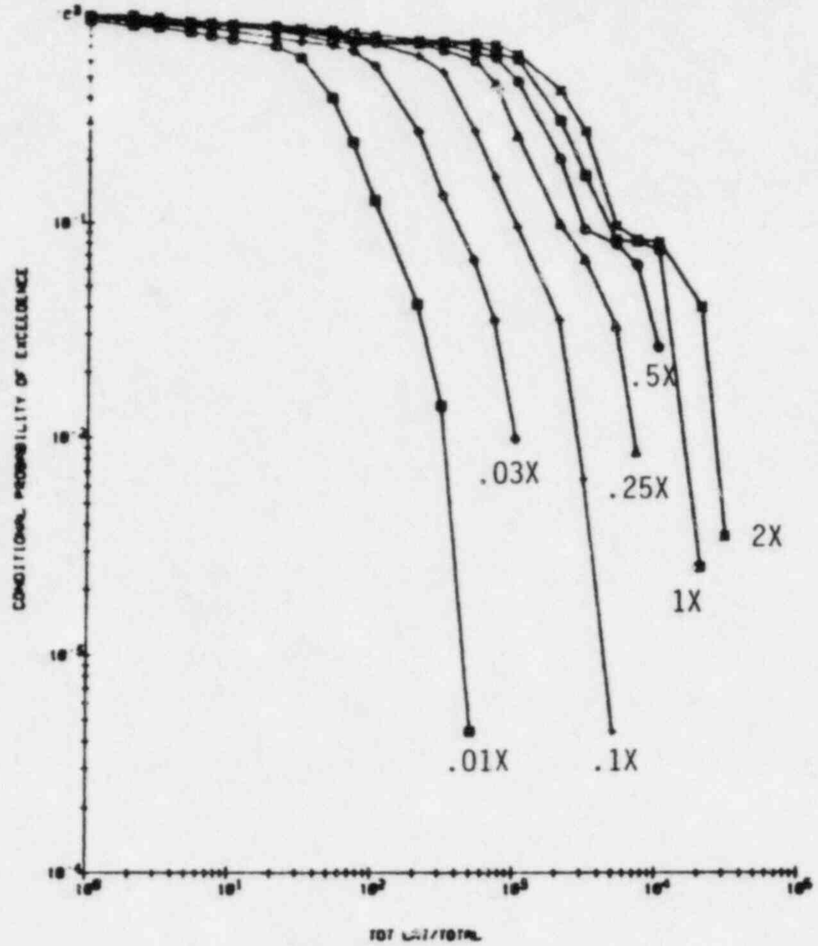


FIGURE 6.1-53 RESULTS OF CPD RUNS FOR RELEASE CATEGORY M7 -- TOTAL LATENT FATALITIES EXCLUDING THYROID

NOTE: This figure shows conditional probabilities, and the values must be multiplied by the frequency of release in order to obtain risk.

Amendment 1
September 7, 1983

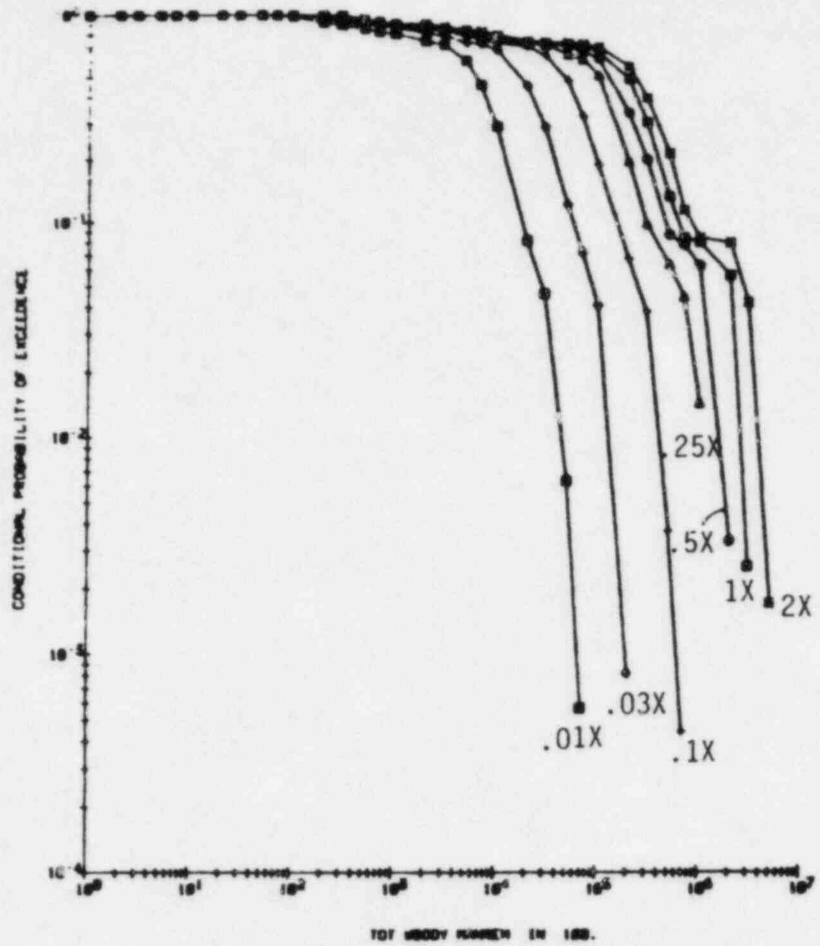


FIGURE 6.1-54 RESULTS OF DPD RUNS FOR RELEASE CATEGORY M7 -- POPULATION WHOLE BODY DOSE

NOTE: This figure shows conditional probabilities, and the values <u>must</u> be multiplied by the frequency of release in order to obtain risk.

Amendment 1
September 7, 1983

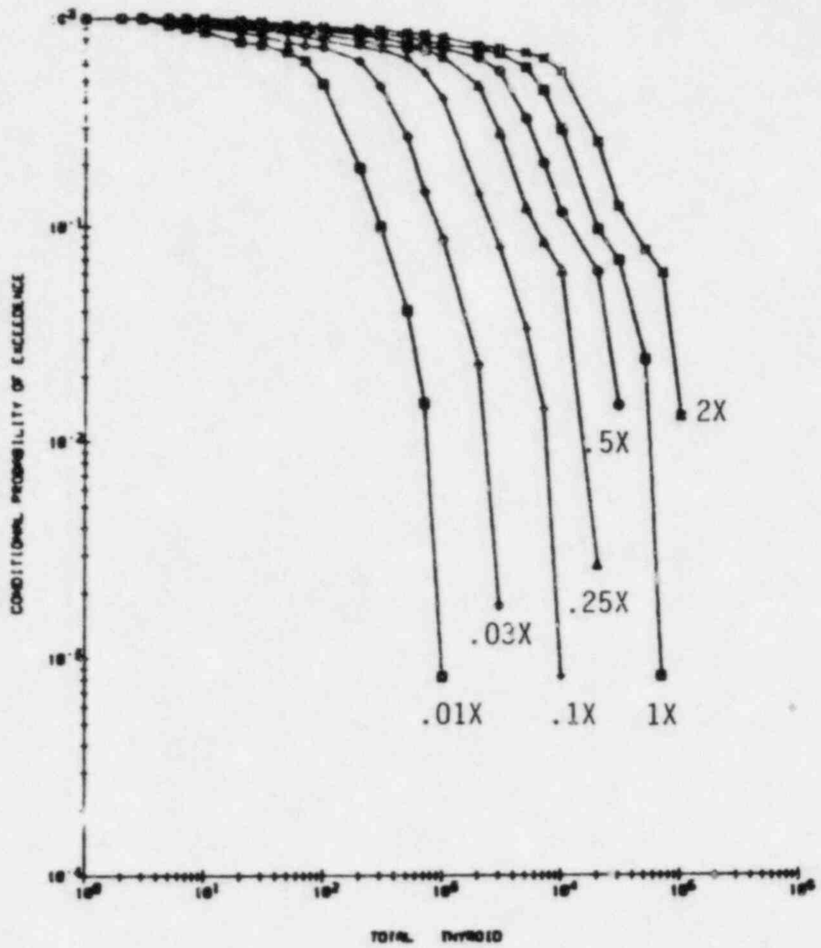


FIGURE 6.1-55 RESULTS OF DPD RUNS FOR RELEASE CATEGORY M7 -- TOTAL THYROID NODULES

NOTE: This figure shows conditional probabilities, and the values must be multiplied by the frequency of release in order to obtain risk.

```
PU-241     8                6.06 E+06 5.333E+03 1.000E-02 1.000E-04
AM-241     8 PU-241         3.52 E+03 1.581F+05 1.000E-02 1.000E-04
CM-242     8                1.42 E+06 1.630E+02 1.000E-02 1.000E-04
CM-244     8                1.16 E+05 6.611E+03 1.000E-02 1.000E-04
LEAKAGE                    12      NO
PWR = M1  1.0          2.5          1.0          1.0          1.4   E 06 0.
   9.0E-01    7.0E-03    5.0E-01    5.0E-01    3.0E-01    6.0E-02    2.0E-02    4.0E-03
PWR = M2  1.0          0.75         2.0          0.2          10.5  E 06 12.6
   6.9E-01    4.8E-03    5.9E-01    5.9E-01    2.4E-01    6.9E-02    2.3E-02    2.6E-03
PWR = M3  1.0          6.0          2.0          0.5          13.3  E 06 12.6
   7.6E-01    5.3E-03    6.3E-01    6.3E-01    1.7E-01    7.7E-02    2.6E-02    2.9E-03
PWR = M4  1.0          0.2          2.0          0.0          4.9   E 06 12.6
   8.6E-01    6.0E-03    6.3E-01    6.3E-01    5.3E-01    7.1E-02    4.5E-02    7.1E-03
PWR = M5  1.0          8.3          0.5          4.1          31.5  E 06 12.6
   9.0E-01    6.3E-03    4.5E-01    4.5E-01    4.6E-01    4.9E-02    3.7E-02    6.1E-03
PWR = M6  1.0          4.3          0.5          4.1          30.8  E 06 12.6
   9.1E-01    6.4E-03    4.8E-01    4.8E-01    5.0E-01    5.3E-02    4.0E-02    6.5E-03
PWR = M7  1.0          20.1         0.5          16.0         37.8  E 06 12.6
   9.0E-01    6.3E-03    2.7E-01    2.7E-01    2.8E-01    3.0E-02    2.2E-02    3.6E-03
PWR = M8  1.0          4.5          0.5          4.0          1.54  E 06 12.6
   9.4E-01    6.6E-03    1.0E-05    1.0E-05    1.4E-05    1.1E-06    1.0E-06    1.8E-07
PWR = M9  1.0          21.          0.5          20.          1.54  E 06 12.6
   9.0E-01    6.3E-03    1.5E-06    1.5E-06    9.5E-07    1.6E-07    8.9E-08    1.3E-08
PWR =M10  1.0          95.          10.          80.          0.         0.
   3.0E-01    2.0E-03    8.0E-04    8.0E-04    1.0E-03    9.0E-05    7.0E-05    1.0E-05
PWR =M11  1.0          95.          10.          80.          0.         0.
   6.0E-03    2.0E-05    1.0E-05    1.0E-05    2.0E-05    1.0E-06    1.0E-06    2.0E-07
PWR =M12  1.0          0.5          5.0          0.           0.         0.
   1.3E-03    9.1E-06    1.4E-06    1.4E-06    8.8E-07    1.6E-07    8.3E-08    1.2E-08
DISPERSION
 47.0      49.0              0    34     0
EVACUATE                     6    NO            NO
      0.05         2.00        0.536      14.0        24135.     19.0            2.       1.
      0.07         0.92        0.536      14.0        24135.     19.0            2.       1.
      0.14         2.00        1.34       14.0        24135.     19.0            2.       1.
      0.19         0.92        1.34       14.0        24135.     19.0            2.       1.
      0.16         2.00        4.47       14.0        24135.     19.0            2.       1.
      0.39         0.92        4.47       14.0        24135.     19.0            2.       1.
       .75         1.           .5          .75         .33         .5          .08      .33
   2.66E-4    2.66E-4    1.33E-4    2.66E-4
     8045.        90.        165.         3.       1
ACUTE                       7
T MARROW   320.        400.        510.        615.        .03         .5          1.
LLI WALL   2000.       5000.       5000.       5000.       1.          1.          1.
LUNG       5000.       14800.      22400.      24000.      .24         .73         1.
W BODY     55.         150.        280.        370.        .30         .8          0.
LUNG       3000.        3000.1      6000.       6000.      .05         1.0         0.
LLI WALL   1000.        1000.1      2500.       2500.      .05         1.0         0.
THYROID         1.E10      1.E10      1.E10      1.E10        1.0        1.0        0.0
```

INITIAL OTHER		
INITIAL W BODY		
TOTAL LEUKEMIA		
TOTAL LUNG		
TOTAL BREAST		
TOTAL BONE		
TOTAL GI TRK		
TOTAL THYROID		
TOTAL OTHER		
TOTAL W BODY		
INTERD POP		
INTERD COST		1.0E+06
INTERD AREA		
INTERD DIST		
INTERD RSK-INT14		1.0E-06
INTERD RSK-INT20		1.0E-06
INTERD RSK-INT24		1.0E-06
DECON POP		
DECON COST		1.0E+06
DECON AREA		
DECON DIST		
DECON RISK-INT14		1.0E-06
DECON RISK-INT24		1.0E-06
DECON RISK-INT30		1.0E-06
INT CROP COST		1.0E+06
INT CROP AREA		
INT CROP DIST		
INT CRPRSK-INT14		1.0E-06
INT CRPRSK-INT24		1.0E-06
INT CRPRSK-INT30		1.0E-06
INT CRPRSK-INT32		1.0E-06
INT MILK COST		1.0E+06
INT MILK AREA		
INT MILK DIST		
INT MLKRSK-INT14		1.0E-06
INT MLKRSK-INT24		1.0E-06
INT MLKRSK-INT30		1.0E-06
INT MLKRSK-INT32		1.0E-06
RELOCATION COST		1.0E+06
EVACUATION COST		1.0E+06
TOT COST W/O DEC		1.0E+06
TOT COST W/DECON		1.0E+06
OPTIONS	NO	
	1	

END

```
MCC191: MILLSTONE CRAC2 RUN, SPECIAL TREATMENT  FOR M1A AND M4
LEAKAGE                 2        NO
PWR = M1  1.0        2.5        1.0        1.0        1.4   E 06 0.
   9.0E-01   7.0E-03   5.0E-01   5.0E-01   3.0E-01   6.0E-02   2.0E-02   4.0E-03
PWR = M4  1.0        0.2        2.0        0.0        4.9   E 06 12.6
   8.6E-01   6.0E-03   6.3E-01   6.3E-01   5.3E-01   7.1E-02   4.5E-02   7.1E-03
SITE                    1
MILLSTONE MET DATA             5 0 0 0 1
   29
   12   10   12   12   12   12   12    4    4    4    4    4
    4    4    4    4    4    4    4    4    4    4    4    4
    4    4    4    4    4
END
```

TABLE 7.2.1-4A

TRANSPOSED SITE MATRIX (S MATRIX) FOR EARLY FATALITIES (INTERNAL EVENTS)

RELEASE CATEGORY

EARLY FATALITIES (EXCEEDED)	M1A M10	M1B M11	M2 M12	M3	M4	M5	M6	M7	M8	M9
1.00E+00	2.00E-01 0.00E-01	4.50E-03 0.00E-01	4.23E-03 0.00E-01	2.81E-04	8.36E-02	1.16E-03	3.61E-03	0.00E-01	0.00E-01	0.00E-01
2.00E+00	1.88E-01 0.00E-01	3.86E-03 0.00E-01	4.23E-03 0.00E-01	0.00E-01	7.25E-02	1.16E-03	3.50E-03	0.00E-01	0.00E-01	0.00E-01
3.00E+00	1.77E-01 0.00E-01	3.40E-03 0.00E-01	4.23E-03 0.00E-01	0.00E-01	6.45E-02	1.16E-03	3.50E-03	0.00E-01	0.00E-01	0.00E-01
5.00E+00	1.64E-01 0.00E-01	2.67E-03 0.00E-01	3.29E-03 0.00E-01	0.00E-01	5.52E-02	1.10E-03	3.36E-03	0.00E-01	0.00E-01	0.00E-01
7.00E+00	1.56E-01 0.00E-01	1.94E-03 0.00E-01	3.29E-03 0.00E-01	0.00E-01	4.95E-02	1.10E-03	3.06E-03	0.00E-01	0.00E-01	0.00E-01
1.00E+01	1.45E-01 0.00E-01	1.55E-03 0.00E-01	3.29E-03 0.00E-01	0.00E-01	4.35E-02	1.10E-03	2.99E-03	0.00E-01	0.00E-01	0.00E-01
2.00E+01	1.17E-01 0.00E-01	3.57E-04 0.00E-01	1.44E-03 0.00E-01	0.00E-01	2.80E-02	1.10E-03	2.76E-03	0.00E-01	0.00E-01	0.00E-01
3.00E+01	1.04E-01 0.00E-01	1.83E-05 0.00E-01	0.00E-01 0.00E-01	0.00E-01	2.20E-02	1.03E-03	2.56E-03	0.00E-01	0.00E-01	0.00E-01
5.00E+01	8.78E-02 0.00E-01	9.03E-06 0.00E-01	0.00E-01 0.00E-01	0.00E-01	1.92E-02	1.03E-03	1.79E-03	0.00E-01	0.00E-01	0.00E-01
7.00E+01	7.69E-02 0.00E-01	9.03E-06 0.00E-01	0.00E-01 0.00E-01	0.00E-01	1.73E-02	9.16E-04	1.53E-03	0.00E-01	0.00E-01	0.00E-01
1.00E+02	6.47E-02 0.00E-01	0.00E-01 0.00E-01	0.00E-01 0.00E-01	0.00E-01	1.53E-02	8.46E-04	1.21E-03	0.00E-01	0.00E-01	0.00E-01
2.00E+02	3.75E-02 0.00E-01	0.00E-01 0.00E-01	0.00E-01 0.00E-01	0.00E-01	1.09E-02	4.75E-04	1.10E-03	0.00E-01	0.00E-01	0.00E-01

TABLE 7.2.1-4A (CONTINUED)

RELEASE CATEGORY

EARLY FATALITIES (EXCEEDED)	M1A / M10	M1B / M11	M2 / M12	M3	M4	M5	M6	M7	M8	M9
3.00E+02	2.72E-02	0.00E-01	0.00E-01	0.00E-01	7.87E-03	1.09E-04	1.03E-03	0.00E-01	0.00E-01	0.00E-01
	0.00E-01	0.00E-01	0.00E-01							
5.00E+02	1.50E-02	0.00E-01	0.00E-01	0.00E-01	5.19E-03	0.00E-01	1.03E-03	0.00E-01	0.00E-01	0.00E-01
	0.00E-01	0.00E-01	0.00E-01							
7.00E+02	8.28E-03	0.00E-01	0.00E-01	0.00E-01	3.32E-03	0.00E-01	9.16E-04	0.00E-01	0.00E-01	0.00E-01
	0.00E-01	0.00E-01	0.00E-01							
1.00E+03	2.36E-03	0.00E-01	0.00E-01	0.00E-01	1.95E-03	0.00E-01	9.16E-04	0.00E-01	0.00E-01	0.00E-01
	0.00E-01	0.00E-01	0.00E-01							
2.00E+03	2.96E-04	0.00E-01	0.00E-01	0.00E-01	2.52E-04	0.00E-01	4.75E-04	0.00E-01	0.00E-01	0.00E-01
	0.00E-01	0.00E-01	0.00E-01							
3.00E+03	1.28E-04	0.00E-01	0.00E-01	0.00E-01	7.10E-05	0.00E-01	2.34E-04	0.00E-01	0.00E-01	0.00E-01
	0.00E-01	0.00E-01	0.00E-01							
5.00E+03	2.66E-05	0.00E-01	0.00E-01	0.00E-01	2.94E-05	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
	0.00E-01	0.00E-01	0.00E-01							
7.00E+03	5.04E-06	0.00E-01	0.00E-01	0.00E-01	2.51E-05	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
	0.00E-01	0.00E-01	0.00E-01							
1.00E+04	2.10E-06	0.00E-01	0.00E-01	0.00E-01	5.04E-06	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
	0.00E-01	0.00E-01	0.00E-01							
2.00E+04	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
	0.00E-01	0.00E-01	0.00E-01							

THE VALUES IN THIS TABLE REPRESENT THE CONDITIONAL PROBABILITY OF A GIVEN RELEASE CATEGORY EXCEEDING A PARTICULAR NUMBER OF EARLY FATALITIES. TO GET THE RISK PERSPECTIVE, THIS MATRIX MUST BE MULTIPLIED BY THE VECTOR OF FREQUENCIES OF EACH RELEASE CATEGORY.

TABLE 7.2.1-4B

TRANSPOSED SITE MATRIX (S MATRIX) FOR EARLY INJURIES (INTERNAL EVENTS)

RELEASE CATEGORY

EARLY INJURIES (EXCEEDED)	M1A M10	M1B M11	M2 M12	M3	M4	M5	M6	M7	M8	M9
1.00E+00	5.21E-01 0.00E-01	1.46E-01 0.00E-01	5.25E-02 0.00E-01	2.44E-02	8.10E-01	2.40E-02	4.08E-02	1.13E-02	0.00E-01	0.00E-01
2.00E+00	5.13E-01 0.00E-01	1.29E-01 0.00E-01	4.90E-02 0.00E-01	2.27E-02	7.94E-01	2.35E-02	4.08E-02	1.13E-02	0.00E-01	0.00E-01
3.00E+00	5.08E-01 0.00E-01	1.15E-01 0.00E-01	4.56E-02 0.00E-01	2.16E-02	7.79E-01	2.33E-02	3.99E-02	1.13E-02	0.00E-01	0.00E-01
5.00E+00	5.03E-01 0.00E-01	1.00E-01 0.00E-01	4.14E-02 0.00E-01	1.97E-02	7.62E-01	2.30E-02	3.98E-02	1.12E-02	0.00E-01	0.00E-01
7.00E+00	4.96E-01 0.00E-01	8.62E-02 0.00E-01	3.82E-02 0.00E-01	1.83E-02	7.53E-01	2.21E-02	3.94E-02	1.11E-02	0.00E-01	0.00E-01
1.00E+01	4.86E-01 0.00E-01	7.62E-02 0.00E-01	3.06E-02 0.00E-01	1.79E-02	7.36E-01	2.19E-02	3.90E-02	1.11E-02	0.00E-01	0.00E-01
2.00E+01	4.60E-01 0.00E-01	5.09E-02 0.00E-01	2.58E-02 0.00E-01	1.52E-02	7.05E-01	2.07E-02	3.69E-02	1.01E-02	0.00E-01	0.00E-01
3.00E+01	4.40E-01 0.00E-01	3.92E-02 0.00E-01	2.09E-02 0.00E-01	1.35E-02	6.72E-01	2.02E-02	3.66E-02	9.13E-03	0.00E-01	0.00E-01
5.00E+01	4.11E-01 0.00E-01	2.39E-02 0.00E-01	1.69E-02 0.00E-01	1.28E-02	6.19E-01	1.88E-02	3.41E-02	8.36E-03	0.00E-01	0.00E-01
7.00E+01	3.94E-01 0.00E-01	1.66E-02 0.00E-01	1.47E-02 0.00E-01	1.21E-02	5.60E-01	1.79E-02	3.25E-02	8.11E-03	0.00E-01	0.00E-01
1.00E+02	3.72E-01 0.00E-01	1.04E-02 0.00E-01	1.44E-02 0.00E-01	1.15E-02	4.96E-01	1.64E-02	2.64E-02	7.38E-03	0.00E-01	0.00E-01
2.00E+02	3.15E-01 0.00E-01	2.47E-03 0.00E-01	1.28E-02 0.00E-01	9.66E-03	4.12E-01	1.42E-02	1.95E-02	5.91E-03	0.00E-01	0.00E-01

TABLE 7.2.1-4B (CONTINUED)

RELEASE CATEGORY

EARLY INJURIES (EXCEEDED)

	M1A / M10	M1B / M11	M2 / M12	M3	M4	M5	M6	M7	M8	M9
3.00E+02	2.76E-01	7.48E-04	1.21E-02	7.99E-03	3.63E-01	1.26E-02	1.59E-02	5.37E-03	0.00E-01	0.00E-01
	0.00E-01	0.00E-01	0.00E-01							
5.00E+02	2.07E-01	1.90E-04	9.25E-03	6.07E-03	2.69E-01	1.10E-02	1.35E-02	3.59E-03	0.00E-01	0.00E-01
	0.00E-01	0.00E-01	0.00E-01							
7.00E+02	1.47E-01	6.54E-05	8.02E-03	5.53E-03	1.99E-01	9.50E-03	1.19E-02	2.87E-03	0.00E-01	0.00E-01
	0.00E-01	0.00E-01	0.00E-01							
1.00E+03	8.78E-02	3.41E-05	6.37E-03	4.79E-03	1.41E-01	7.65E-03	1.01E-02	2.22E-03	0.00E-01	0.00E-01
	0.00E-01	0.00E-01	0.00E-01							
2.00E+03	4.35E-02	0.00E-01	4.06E-03	2.69E-03	7.53E-02	4.71E-03	6.70E-03	8.27E-04	0.00E-01	0.00E-01
	0.00E-01	0.00E-01	0.00E-01							
3.00E+03	1.76E-02	0.00E-01	2.69E-03	1.62E-03	5.05E-02	3.19E-03	4.79E-03	4.75E-04	0.00E-01	0.00E-01
	0.00E-01	0.00E-01	0.00E-01							
5.00E+03	7.39E-03	0.00E-01	1.62E-03	7.09E-04	3.66E-02	1.51E-03	2.13E-03	0.00E-01	0.00E-01	0.00E-01
	0.00E-01	0.00E-01	0.00E-01							
7.00E+03	9.64E-04	0.00E-01	8.27E-04	3.53E-04	1.66E-02	8.27E-04	1.40E-03	0.00E-01	0.00E-01	0.00E-01
	0.00E-01	0.00E-01	0.00E-01							
1.00E+04	5.17E-05	0.00E-01	3.53E-04	1.09E-04	6.29E-03	2.34E-04	5.87E-04	0.00E-01	0.00E-01	0.00E-01
	0.00E-01	0.00E-01	0.00E-01							
2.00E+04	0.00E-01	0.00E-01	0.00E-01	0.00E-01	1.47E-05	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
	0.00E-01	0.00E-01	0.00E-01							
3.00E+04	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
	0.00E-01	0.00E-01	0.00E-01							

THE VALUES IN THIS TABLE REPRESENT THE CONDITIONAL PROBABILITY OF A GIVEN RELEASE CATEGORY EXCEEDING A PARTICULAR NUMBER OF EARLY INJURIES. TO GET THE RISK PERSPECTIVE, THIS MATRIX MUST BE MULTIPLIED BY THE VECTOR OF FREQUENCIES OF EACH RELEASE CATEGORY.

TABLE 7.2.1-4C

TRANSPOSED SITE MATRIX (S MATRIX) FOR THYROID NODULES (INTERNAL EVENTS)

RELEASE CATEGORY

THYROID NODULES (EXCEEDED)	M1A	M1B	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12
1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	9.99E-01	9.99E-01	9.97E-01	1.00E+00	9.99E-01	9.90E-01	5.86E-02	0.00E-01
2.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	9.98E-01	9.98E-01	9.93E-01	9.99E-01	9.99E-01	9.01E-01	2.48E-04	0.00E-01
3.00E+00	1.00E+00	1.00E+00	9.98E-01	9.97E-01	1.00E+00	9.93E-01	9.94E-01	9.85E-01	9.92E-01	9.77E-01	8.67E-01	0.00E-01	0.00E-01
5.00E+00	1.00E+00	9.98E-01	9.94E-01	9.93E-01	1.00E+00	9.80E-01	9.83E-01	9.56E-01	8.61E-01	8.01E-01	8.10E-01	0.00E-01	0.00E-01
7.00E+00	9.98E-01	9.95E-01	9.92E-01	9.92E-01	9.99E-01	9.61E-01	9.69E-01	9.41E-01	7.88E-01	6.79E-01	7.76E-01	0.00E-01	0.00E-01
1.00E+01	9.98E-01	9.87E-01	9.90E-01	9.84E-01	9.99E-01	9.47E-01	9.54E-01	9.23E-01	7.09E-01	4.51E-01	7.29E-01	0.00E-01	0.00E-01
2.00E+01	9.95E-01	9.36E-01	9.71E-01	9.64E-01	9.98E-01	9.15E-01	9.20E-01	8.93E-01	3.76E-01	1.48E-01	5.66E-01	0.00E-01	0.00E-01
3.00E+01	9.91E-01	9.14E-01	9.59E-01	9.51E-01	9.97E-01	8.99E-01	9.03E-01	8.79E-01	1.87E-01	7.45E-02	3.06E-01	0.00E-01	0.00E-01
5.00E+01	9.76E-01	8.97E-01	9.37E-01	9.18E-01	9.95E-01	8.78E-01	8.82E-01	8.60E-01	7.63E-02	2.72E-02	1.05E-01	0.00E-01	0.00E-01
7.00E+01	9.55E-01	8.87E-01	9.19E-01	8.99E-01	9.94E-01	8.66E-01	8.75E-01	8.45E-01	3.22E-02	1.04E-02	4.15E-02	0.00E-01	0.00E-01
1.00E+02	9.34E-01	8.62E-01	8.92E-01	8.83E-01	9.91E-01	8.55E-01	8.62E-01	8.32E-01	1.35E-02	1.69E-03	1.45E-02	0.00E-01	0.00E-01
2.00E+02	9.09E-01	8.14E-01	8.69E-01	8.65E-01	9.60E-01	8.24E-01	8.35E-01	7.31E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
3.00E+02	8.96E-01	7.70E-01	8.54E-01	8.37E-01	9.39E-01	8.09E-01	8.14E-01	7.62E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
5.00E+02	8.86E-01	7.30E-01	8.20E-01	8.15E-01	9.09E-01	7.74E-01	7.76E-01	7.37E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01

TABLE 7.2.1-4C (CONTINUED)

RELEASE CATEGORY

THYROID NODULES (EXCEEDED)	M1A	M1B	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12
7.00E+02	8.67E-01	7.07E-01	8.05E-01	7.90E-01	8.97E-01	7.52E-01	7.58E-01	7.26E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
1.00E+03	8.46E-01	6.54E-01	7.82E-01	7.71E-01	8.81E-01	7.32E-01	7.41E-01	6.91E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
2.00E+03	7.90E-01	3.89E-01	7.25E-01	7.18E-01	8.36E-01	6.94E-01	7.02E-01	5.60E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
3.00E+03	7.43E-01	1.92E-01	7.10E-01	6.99E-01	8.10E-01	6.33E-01	6.51E-01	4.35E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
5.00E+03	7.16E-01	8.05E-02	6.70E-01	6.46E-01	7.70E-01	4.83E-01	5.22E-01	2.88E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
7.00E+03	6.70E-01	3.87E-02	6.32E-01	5.95E-01	7.36E-01	3.89E-01	4.26E-01	1.90E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
1.00E+04	5.75E-01	2.05E-02	5.58E-01	4.85E-01	7.05E-01	2.70E-01	3.12E-01	1.08E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
2.00E+04	2.58E-01	0.00E-01	2.90E-01	2.25E-01	5.20E-01	1.06E-01	1.33E-01	5.49E-02	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
3.00E+04	1.20E-01	0.00E-01	1.66E-01	1.24E-01	3.26E-01	7.20E-02	8.21E-02	4.66E-02	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
5.00E+04	6.39E-02	0.00E-01	8.74E-02	7.89E-02	1.35E-01	5.16E-02	5.49E-02	1.15E-02	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
7.00E+04	2.65E-02	0.00E-01	6.75E-02	5.49E-02	8.07E-02	3.28E-02	4.01E-02	1.74E-04	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
1.00E+05	1.07E-02	0.00E-01	4.15E-02	2.70E-02	3.92E-02	8.53E-03	1.68E-02	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
2.00E+05	0.00E-01	0.00E-01	6.16E-04	0.00E-01	2.58E-03	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
3.00E+05	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01

THE VALUES IN THIS TABLE REPRESENT THE CONDITIONAL PROBABILITY OF A GIVEN RELEASE CATEGORY EXCEEDING A PARTICULAR NUMBER OF THYROID NODULES. TO GET THE RISK PERSPECTIVE, THIS MATRIX MUST BE MULTIPLIED BY THE VECTOR OF FREQUENCIES OF EACH RELEASE CATEGORY.

TABLE 7.2.1-4D

TRANSPOSED SITE MATRIX (S MATRIX) FOR LATENT CANCER FATALITIES (INTERNAL EVENTS)

RELEASE CATEGORY

LATENT CANCER FATALITIES (EXCEEDED)	M1A	M1B	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12
1.00E+00	1.00E+00	9.99E-01	9.96E-01	9.96E-01	1.00E+00	9.88E-01	9.90E-01	9.74E-01	8.39E-01	7.82E-01	9.09E-01	2.48E-04	0.00E-01
2.00E+00	9.98E-01	9.87E-01	9.90E-01	9.90E-01	9.99E-01	9.55E-01	9.61E-01	9.41E-01	7.06E-01	4.31E-01	8.44E-01	0.00E-01	0.00E-01
3.00E+00	9.92E-01	9.45E-01	9.75E-01	9.67E-01	9.99E-01	9.31E-01	9.35E-01	9.27E-01	5.35E-01	2.23E-01	8.12E-01	0.00E-01	0.00E-01
5.00E+00	9.47E-01	9.20E-01	9.48E-01	9.47E-01	9.94E-01	9.12E-01	9.13E-01	9.04E-01	2.66E-01	8.85E-02	7.88E-01	0.00E-01	0.00E-01
7.00E+00	9.30E-01	9.14E-01	9.27E-01	9.20E-01	9.82E-01	9.06E-01	9.07E-01	8.97E-01	1.43E-01	4.54E-02	7.51E-01	0.00E-01	0.00E-01
1.00E+01	9.19E-01	9.08E-01	9.11E-01	9.14E-01	9.67E-01	8.96E-01	8.97E-01	8.89E-01	7.72E-02	2.47E-02	6.63E-01	0.00E-01	0.00E-01
2.00E+01	9.09E-01	8.62E-01	8.91E-01	8.91E-01	9.39E-01	8.65E-01	8.66E-01	8.63E-01	1.35E-02	1.69E-03	2.90E-01	0.00E-01	0.00E-01
3.00E+01	8.75E-01	8.48E-01	8.66E-01	8.67E-01	9.27E-01	8.51E-01	8.53E-01	8.44E-01	1.94E-03	0.00E-01	1.06E-01	0.00E-01	0.00E-01
5.00E+01	8.59E-01	7.91E-01	8.48E-01	8.45E-01	8.79E-01	8.15E-01	8.16E-01	8.14E-01	0.00E-01	0.00E-01	1.76E-02	0.00E-01	0.00E-01
7.00E+01	8.30E-01	7.50E-01	8.19E-01	[illegible]	8.67E-01	7.99E-01	8.00E-01	7.86E-01	0.00E-01	0.00E-01	2.79E-03	0.00E-01	0.00E-01
1.00E+02	8.03E-01	7.41E-01	7.93E-01	7.95E-01	8.46E-01	7.82E-01	7.82E-01	7.72E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
2.00E+02	7.51E-01	7.03E-01	7.56E-01	7.65E-01	8.11E-01	7.67E-01	7.71E-01	7.47E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
3.00E+02	7.45E-01	6.33E-01	7.48E-01	7.52E-01	7.83E-01	7.47E-01	7.51E-01	7.25E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01

TABLE 7.2.1-4D (CONTINUED)

RELEASE CATEGORY

LATENT CANCER FATALITIES (EXCEEDED)	M1A	M1B	M2	M3	M4	M5	M6	M7	M8	M9
5.00E+02	7.29E-01	4.78E-01	7.39E-01	7.42E-01	7.49E-01	7.26E-01	7.30E-01	6.78E-01	0.00E-01	0.00E-01
7.00E+02	7.11E-01	2.90E-01	7.21E-01	7.28E-01	7.40E-01	6.78E-01	6.86E-01	6.03E-01	0.00E-01	0.00E-01
1.00E+03	6.38E-01	1.45E-01	6.82E-01	6.82E-01	7.25E-01	6.17E-01	6.18E-01	5.40E-01	0.00E-01	0.00E-01
2.00E+03	3.59E-01	5.98E-02	5.30E-01	5.38E-01	6.00E-01	3.96E-01	3.97E-01	2.61E-01	0.00E-01	0.00E-01
3.00E+03	2.25E-01	2.21E-02	3.64E-01	3.76E-01	3.78E-01	2.24E-01	2.39E-01	1.45E-01	0.00E-01	0.00E-01
5.00E+03	8.62E-02	8.74E-03	1.75E-01	1.86E-01	1.92E-01	9.20E-02	9.49E-02	7.06E-02	0.00E-01	0.00E-01
7.00E+03	7.55E-02	2.58E-03	9.64E-02	9.73E-02	1.08E-01	7.92E-02	7.85E-02	6.41E-02	0.00E-01	0.00E-01
1.00E+04	7.06E-02	0.00E-01	8.43E-02	8.38E-02	7.51E-02	6.55E-02	6.56E-02	5.16E-02	0.00E-01	0.00E-01
2.00E+04	2.40E-02	0.00E-01	7.25E-02	7.18E-02	6.71E-02	2.87E-02	3.00E-02	2.22E-03	0.00E-01	0.00E-01
3.00E+04	1.81E-03	0.00E-01	2.08E-02	2.59E-02	2.09E-02	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
5.00E+04	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01

LATENT CANCER FATALITIES (EXCEEDED)	M10	M11	M12
5.00E+02	0.00E-01	0.00E-01	0.00E-01
7.00E+02	0.00E-01	0.00E-01	0.00E-01
1.00E+03	0.00E-01	0.00E-01	0.00E-01
2.00E+03	0.00E-01	0.00E-01	0.00E-01
3.00E+03	0.00E-01	0.00E-01	0.00E-01
5.00E+03	0.00E-01	0.00E-01	0.00E-01
7.00E+03	0.00E-01	0.00E-01	0.00E-01
1.00E+04	0.00E-01	0.00E-01	0.00E-01
2.00E+04	0.00E-01	0.00E-01	0.00E-01
3.00E+04	0.00E-01	0.00E-01	0.00E-01
5.00E+04	0.00E-01	0.00E-01	0.00E-01

THE VALUES IN THIS TABLE REPRESENT THE CONDITIONAL PROBABILITY OF A GIVEN RELEASE CATEGORY EXCEEDING A PARTICULAR NUMBER OF LATENT CANCER FATALITIES. TO GET THE RISK PERSPECTIVE, THIS MATRIX MUST BE MULTIPLIED BY THE VECTOR OF FREQUENCIES OF EACH RELEASE CATEGORY.

TABLE 7.2.1-4E

TRANSPOSED SITE MATRIX (S MATRIX) FOR MAN-REM (INTERNAL EVENTS)

RELEASE CATEGORY

HUNDREDS OF MAN-REM (EXCEEDED)	M1A	M1B	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12
1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	9.91E-01	8.55E-01
2.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	9.35E-01	8.21E-01
3.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	9.15E-01	7.78E-01
5.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	9.99E-01	1.00E+00	1.00E+00	1.00E+00	8.66E-01	6.55E-01
7.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	9.99E-01	1.00E+00	1.00E+00	1.00E+00	8.41E-01	5.13E-01
1.00E+01	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	9.99E-01	9.99E-01	9.99E-01	1.00E+00	1.00E+00	1.00E+00	8.25E-01	3.26E-01
2.00E+01	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	9.99E-01	9.99E-01	9.99E-01	1.00E+00	1.00E+00	1.00E+00	7.52E-01	4.15E-02
3.00E+01	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	9.99E-01	9.99E-01	9.98E-01	1.00E+00	9.99E-01	9.98E-01	6.45E-01	2.85E-04
5.00E+01	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	9.99E-01	9.99E-01	9.98E-01	9.99E-01	9.99E-01	9.89E-01	4.28E-01	0.00E-01
7.00E+01	1.00E+00	1.00E+00	9.99E-01	9.99E-01	1.00E+00	9.95E-01	9.97E-01	9.92E-01	9.99E-01	9.93E-01	9.63E-01	1.85E-01	0.00E-01
1.00E+02	1.00E+00	1.00E+00	9.97E-01	9.97E-01	1.00E+00	9.92E-01	9.93E-01	9.87E-01	9.51E-01	8.84E-01	9.43E-01	6.10E-02	0.00E-01
2.00E+02	9.99E-01	9.98E-01	9.95E-01	9.95E-01	9.99E-01	9.82E-01	9.84E-01	9.66E-01	7.86E-01	6.56E-01	9.05E-01	3.73E-05	0.00E-01
3.00E+02	9.98E-01	9.91E-01	9.91E-01	9.90E-01	9.99E-01	9.59E-01	9.62E-01	9.45E-01	7.07E-01	3.99E-01	8.76E-01	0.00E-01	0.00E-01
5.00E+02	9.64E-01	9.51E-01	9.69E-01	9.64E-01	9.96E-01	9.29E-01	9.33E-01	9.29E-01	4.77E-01	1.72E-01	8.19E-01	0.00E-01	0.00E-01

TABLE 7.2.1-4E (CONTINUED)

RELEASE CATEGORY

HUNDREDS OF MAN-REM (EXCEEDED)

	M1A M10	M1B M11	M2 M12	M3	M4	M5	M6	M7	M8	M9
7.00E+02	9.45E-01	9.30E-01	9.49E-01	9.49E-01	9.84E-01	9.15E-01	9.18E-01	9.12E-01	3.04E-01	9.12E-02
	8.06E-01	0.00E-01	0.00E-01							
1.00E+03	9.24E-01	9.17E-01	9.33E-01	9.29E-01	9.69E-01	9.07E-01	9.10E-01	9.00E-01	1.57E-01	4.57E-02
	7.87E-01	0.00E-01	0.00E-01							
2.00E+03	9.16E-01	9.02E-01	9.06E-01	9.09E-01	9.34E-01	8.84E-01	8.85E-01	8.78E-01	3.44E-02	9.54E-03
	6.53E-01	0.00E-01	0.00E-01							
3.00E+03	8.96E-01	8.65E-01	8.92E-01	8.92E-01	9.18E-01	8.65E-01	8.66E-01	8.63E-01	1.34E-02	1.58E-03
	3.85E-01	0.00E-01	0.00E-01							
5.00E+03	8.65E-01	8.46E-01	8.63E-01	8.64E-01	8.87E-01	8.45E-01	8.49E-01	8.32E-01	7.87E-04	0.00E-01
	1.51E-01	0.00E-01	0.00E-01							
7.00E+03	8.60E-01	8.01E-01	8.52E-01	8.52E-01	8.70E-01	8.16E-01	8.16E-01	8.17E-01	0.00E-01	0.00E-01
	5.18E-02	0.00E-01	0.00E-01							
1.00E+04	8.15E-01	7.67E-01	8.26E-01	8.26E-01	8.63E-01	7.99E-01	8.00E-01	7.89E-01	0.00E-01	0.00E-01
	5.98E-03	0.00E-01	0.00E-01							
2.00E+04	7.57E-01	7.36E-01	7.75E-01	7.79E-01	8.14E-01	7.75E-01	7.77E-01	7.60E-01	0.00E-01	0.00E-01
	0.00E-01	0.00E-01	0.00E-01							
3.00E+04	7.50E-01	7.10E-01	7.55E-01	7.65E-01	7.67E-01	7.65E-01	7.69E-01	7.49E-01	0.00E-01	0.00E-01
	0.00E-01	0.00E-01	0.00E-01							
5.00E+04	7.43E-01	6.25E-01	7.46E-01	7.51E-01	7.55E-01	7.43E-01	7.47E-01	7.23E-01	0.00E-01	0.00E-01
	0.00E-01	0.00E-01	0.00E-01							
7.00E+04	7.28E-01	5.21E-01	7.39E-01	7.42E-01	7.47E-01	7.29E-01	7.33E-01	6.94E-01	0.00E-01	0.00E-01
	0.00E-01	0.00E-01	0.00E-01							
1.00E+05	7.08E-01	3.35E-01	7.29E-01	7.30E-01	7.37E-01	6.88E-01	6.89E-01	6.28E-01	0.00E-01	0.00E-01
	0.00E-01	0.00E-01	0.00E-01							
2.00E+05	5.48E-01	9.95E-02	6.39E-01	6.40E-01	6.58E-01	5.33E-01	5.46E-01	4.47E-01	0.00E-01	0.00E-01
	0.00E-01	0.00E-01	0.00E-01							

TABLE 7.2.1-4E (CONTINUED)

HUNDREDS OF MAN-REM (EXCEEDED)

3.00E+05	3.62E-01	6.25E-02	5.48E-01	5.40E-01	5.42E-01	3.95E-01	4.03E-01	2.78E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
5.00E+05	1.96E-01	2.20E-02	3.39E-01	3.48E-01	3.02E-01	2.00E-01	2.10E-01	1.22E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
7.00E+05	1.06E-01	1.14E-02	2.17E-01	2.16E-01	2.06E-01	9.92E-02	1.03E-01	7.66E-02	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
1.00E+06	7.56E-02	2.66E-03	1.15E-01	1.14E-01	1.13E-01	8.72E-02	8.73E-02	6.67E-02	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
2.00E+06	6.44E-02	0.00E-01	8.13E-02	8.33E-02	7.42E-02	6.31E-02	6.32E-02	4.33E-02	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
3.00E+06	2.72E-02	0.00E-01	7.32E-02	7.25E-02	6.90E-02	2.93E-02	3.21E-02	2.22E-03	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
5.00E+06	1.72E-03	0.00E-01	1.11E-02	1.14E-02	5.42E-03	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
7.00E+06	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01

THE VALUES IN THIS TABLE REPRESENT THE CONDITIONAL PROBABILITY OF A GIVEN RELEASE CATEGORY EXCEEDING A PARTICULAR NUMBER OF MAN-REM. TO GET THE RISK PERSPECTIVE, THIS MATRIX MUST BE MULTIPLIED BY THE VECTOR OF FREQUENCIES OF EACH RELEASE CATEGORY.

FIGURE 7.2.2-1A
POINT ESTIMATE RISK CURVE FOR EARLY FATALITIES
INTERNAL RISK ONLY

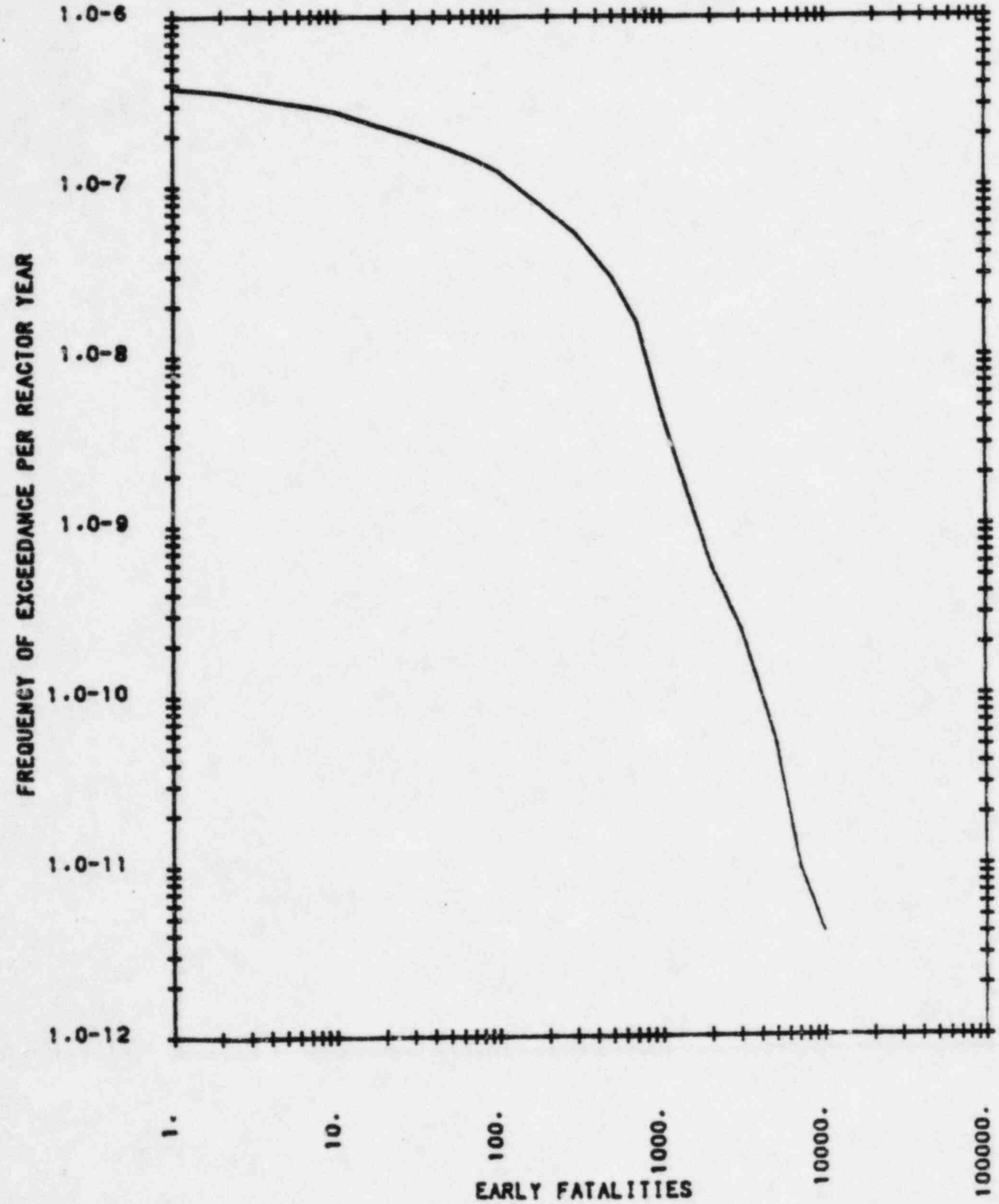


FIGURE 7.2.2-1B
POINT ESTIMATE RISK CURVE FOR EARLY INJURIES
INTERNAL RISK ONLY

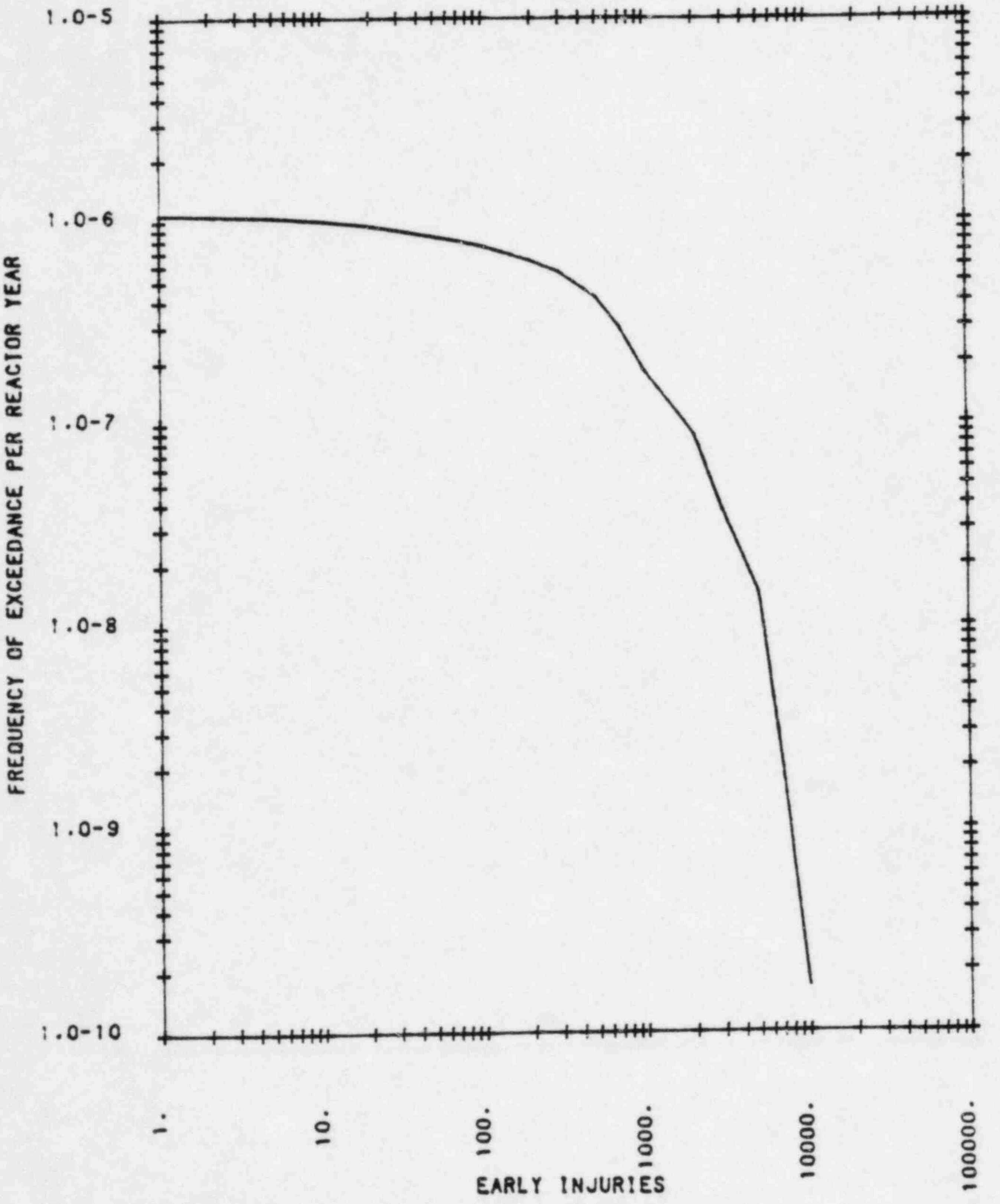


FIGURE 7.2.2-1C
POINT ESTIMATE RISK CURVE FOR THYROID NODULES
INTERNAL RISK ONLY

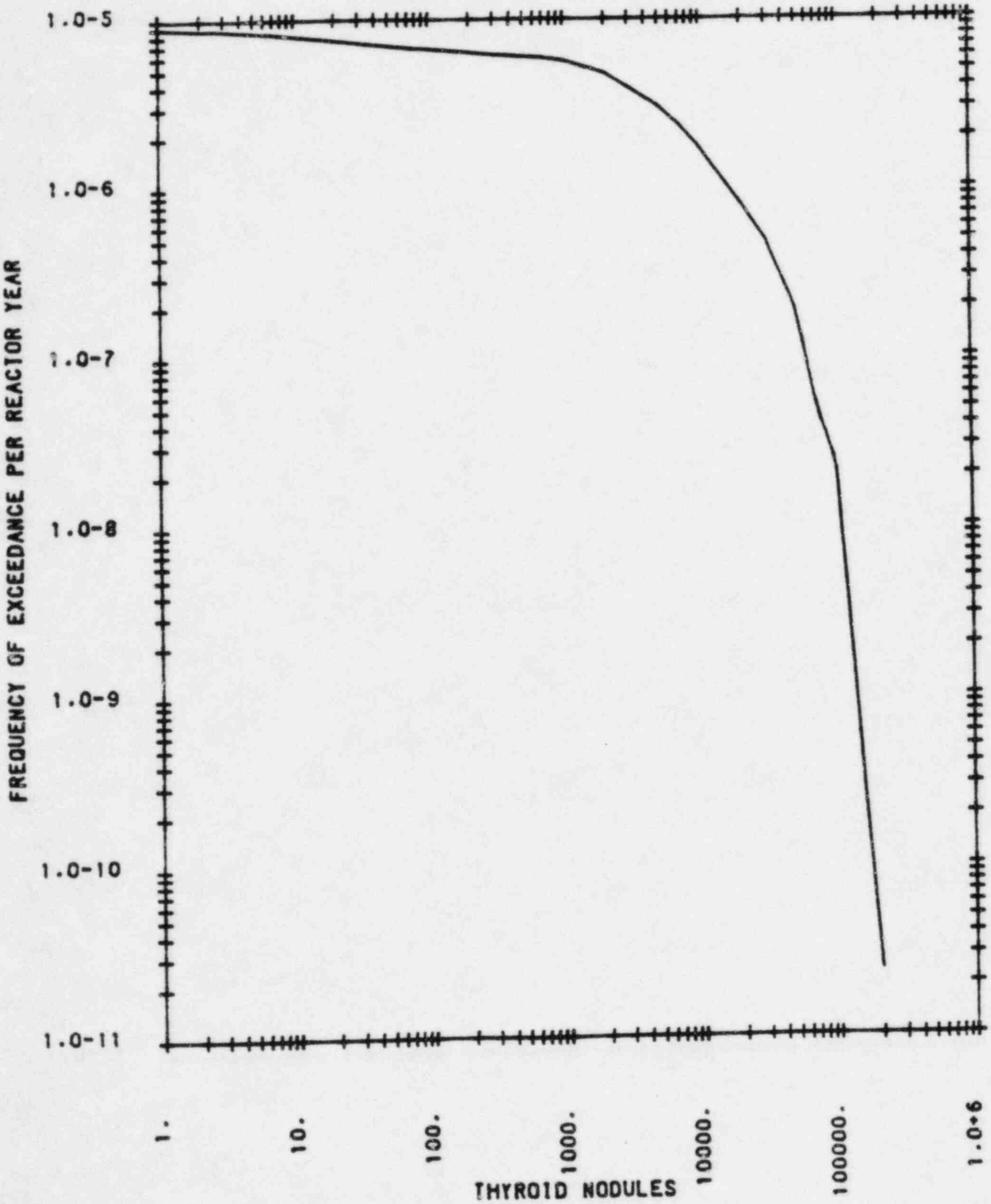


FIGURE 7.2.2-1D
POINT ESTIMATE RISK CURVE FOR LATENT CANCER FATALITIES
INTERNAL RISK ONLY

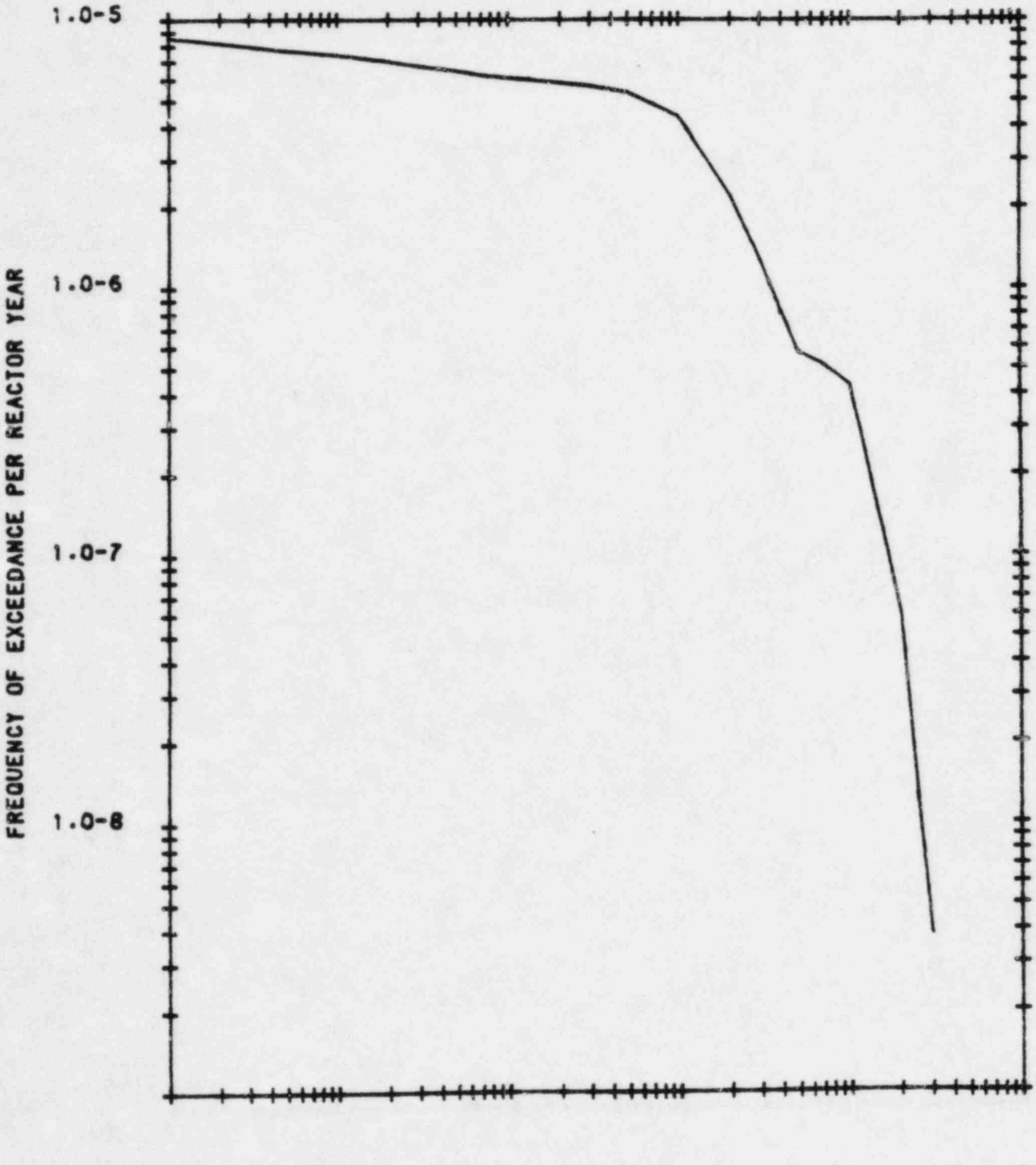


FIGURE 7.2.2-1E
POINT ESTIMATE RISK CURVE FOR MAN-REM
INTERNAL RISK ONLY

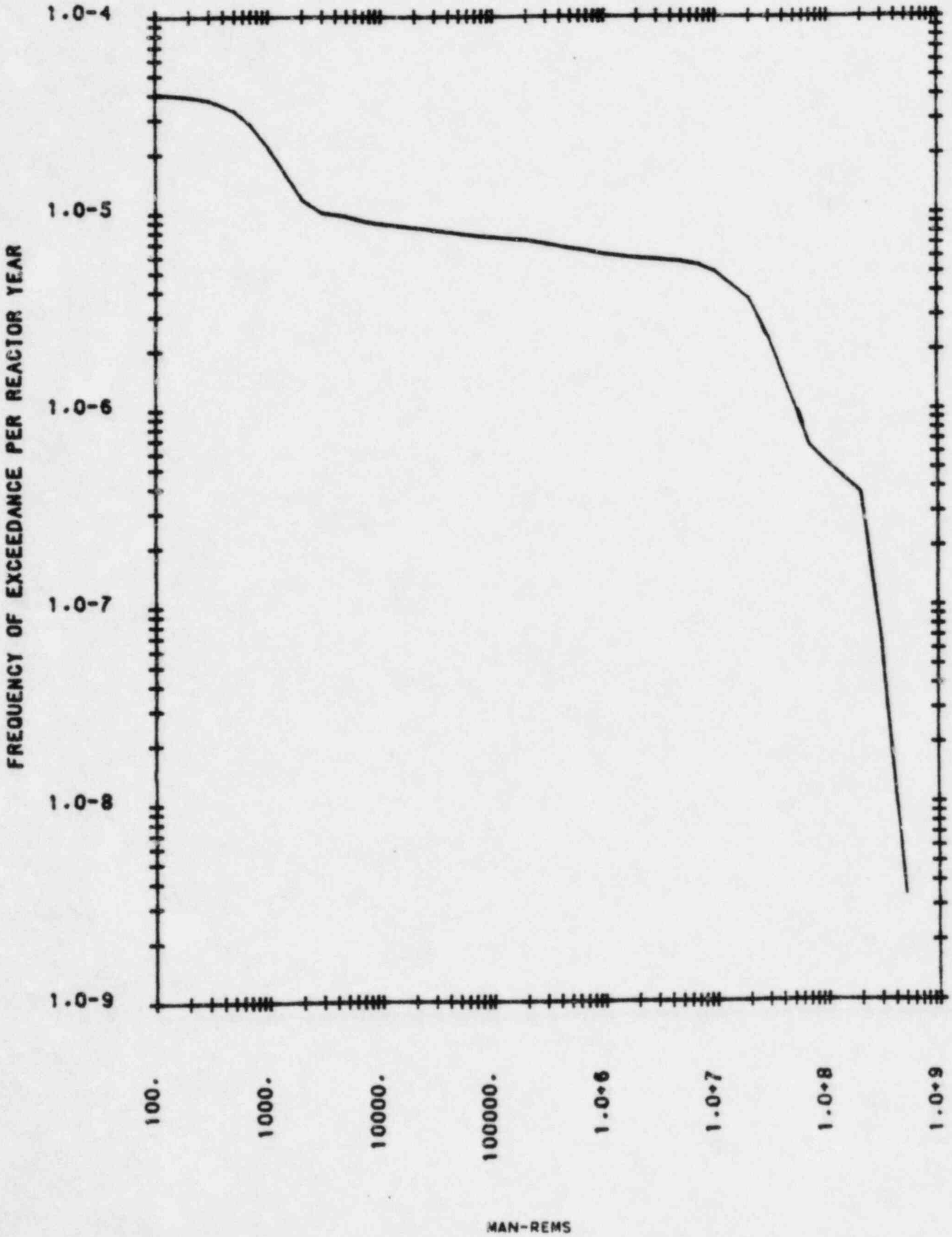


FIGURE 7.3-1A
RISK DIAGRAM FOR EARLY FATALITIES
DUE TO INTERNAL EVENTS

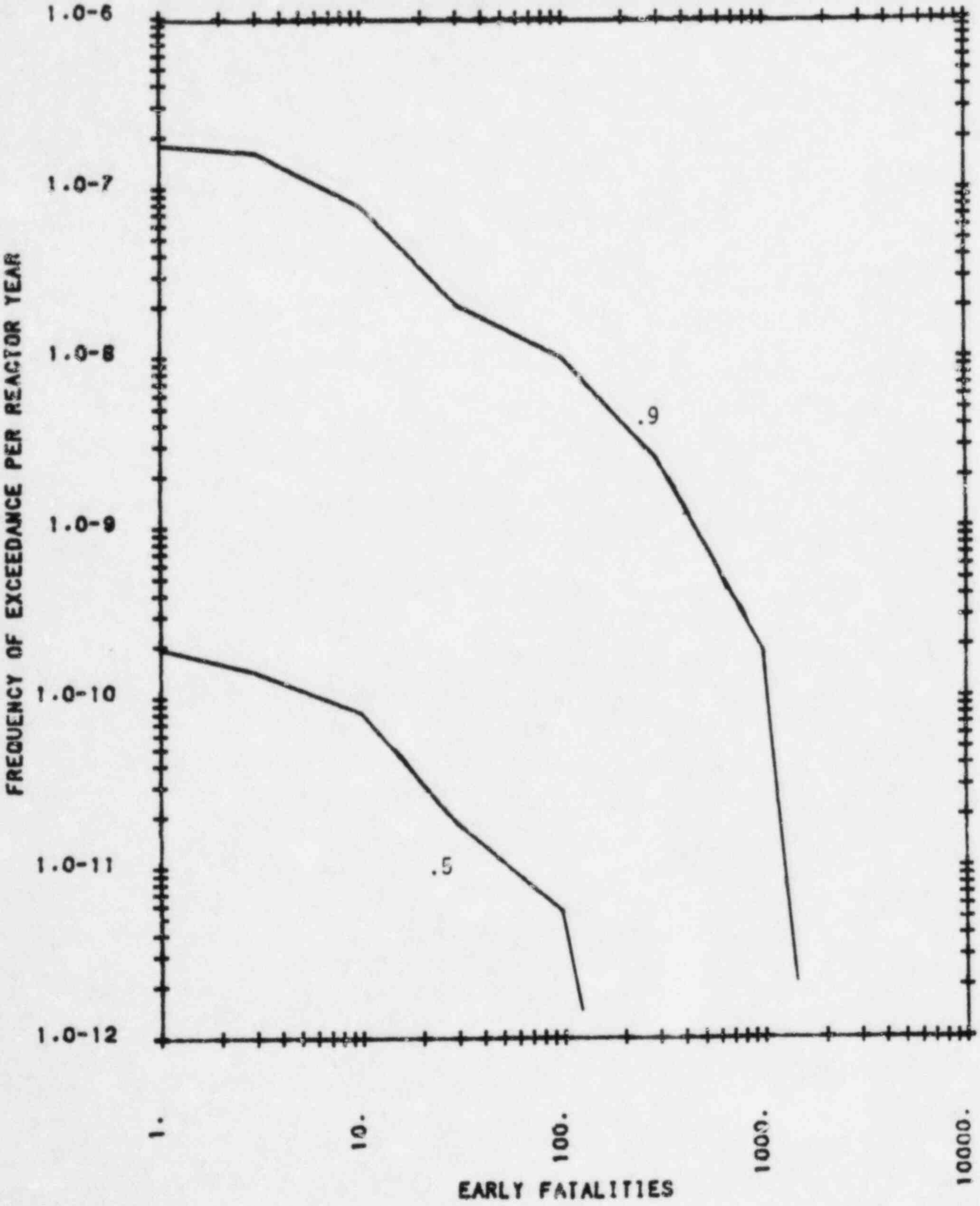


FIGURE 7.3-1B
RISK DIAGRAM FOR EARLY INJURIES
DUE TO INTERNAL EVENTS

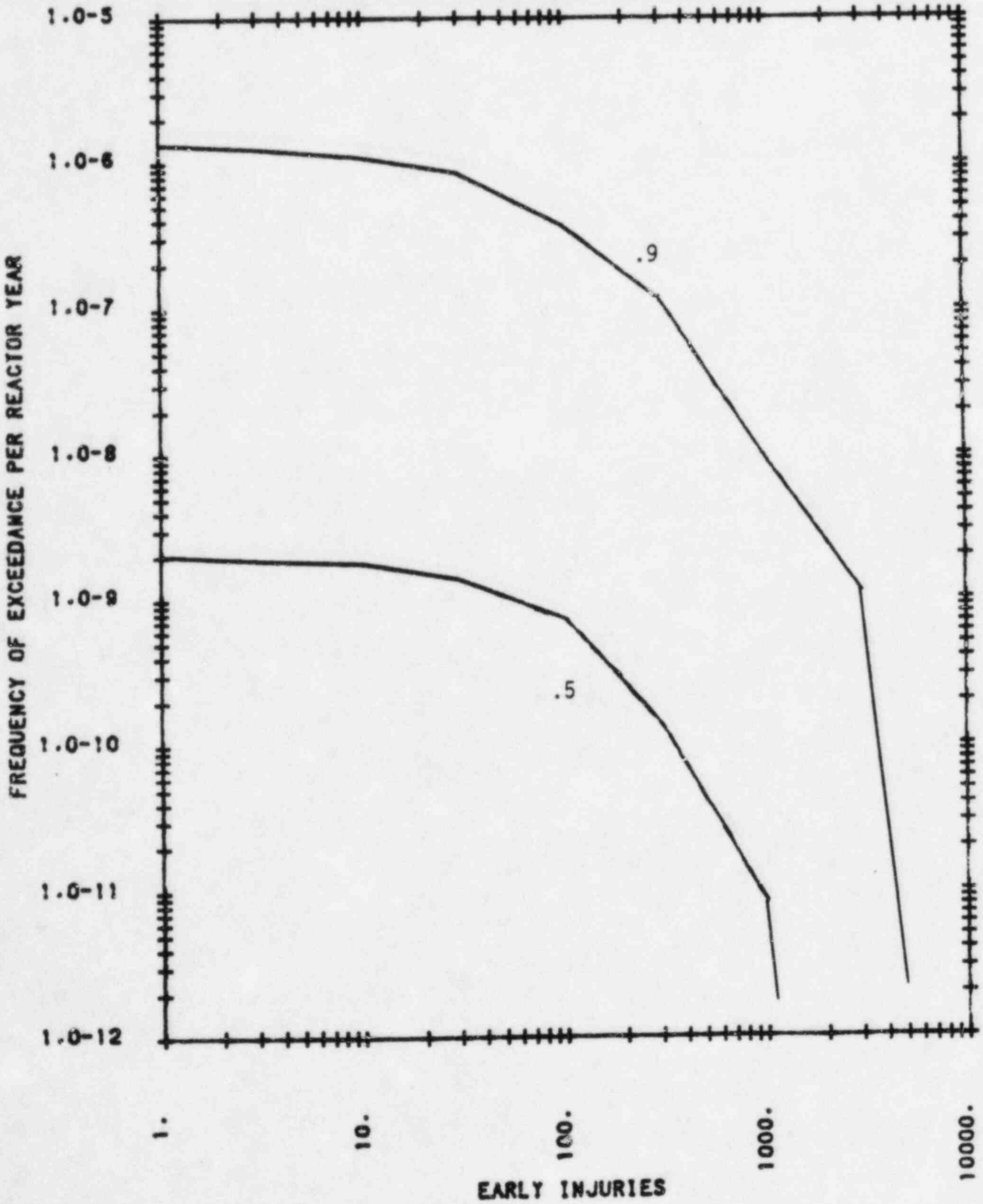


FIGURE 7.3-1C
RISK DIAGRAM FOR THYROID NODULES
DUE TO INTERNAL EVENTS

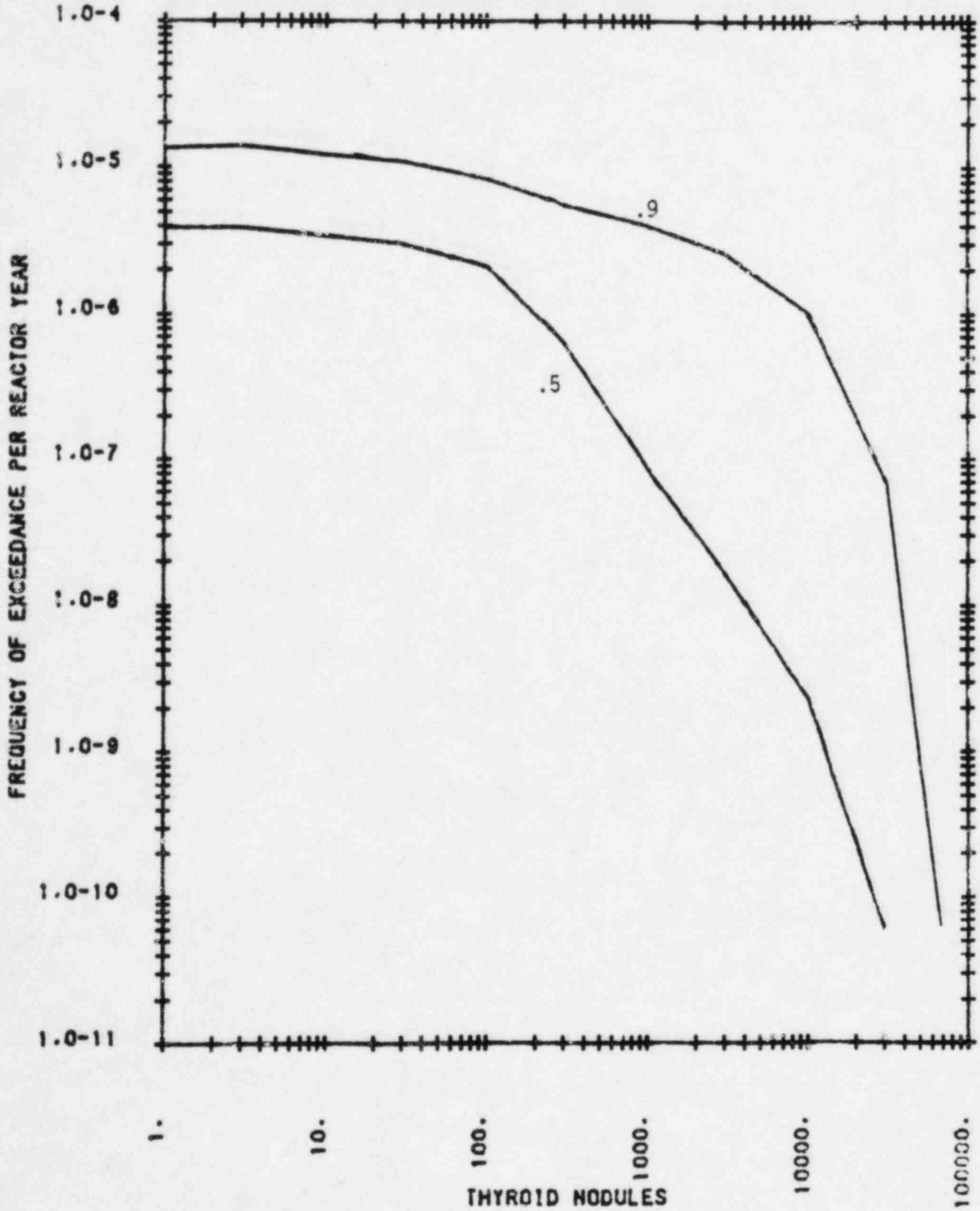


FIGURE 7.3-1D
RISK DIAGRAM FOR LATENT CANCER FATALITIES
DUE TO INTERNAL EVENTS

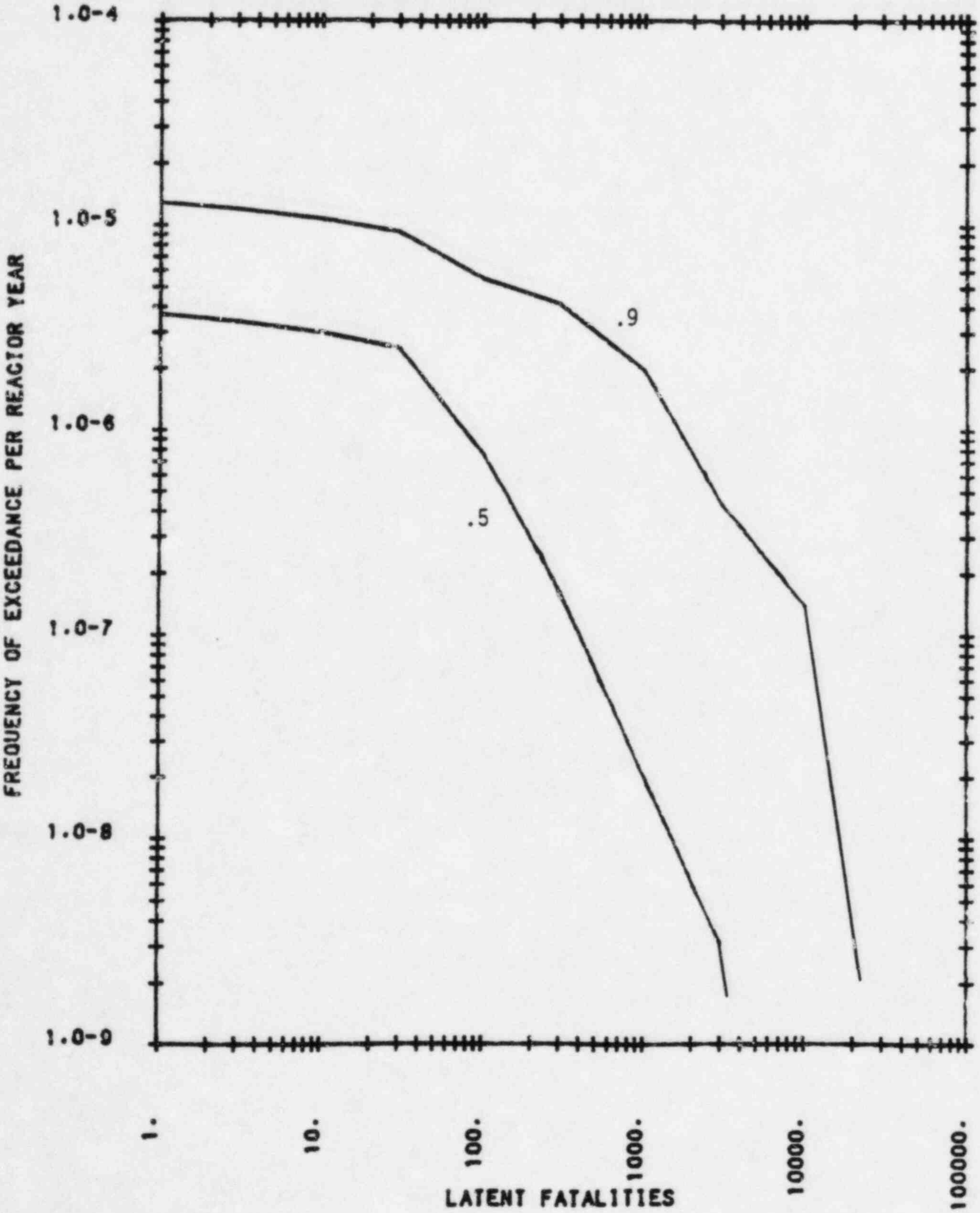
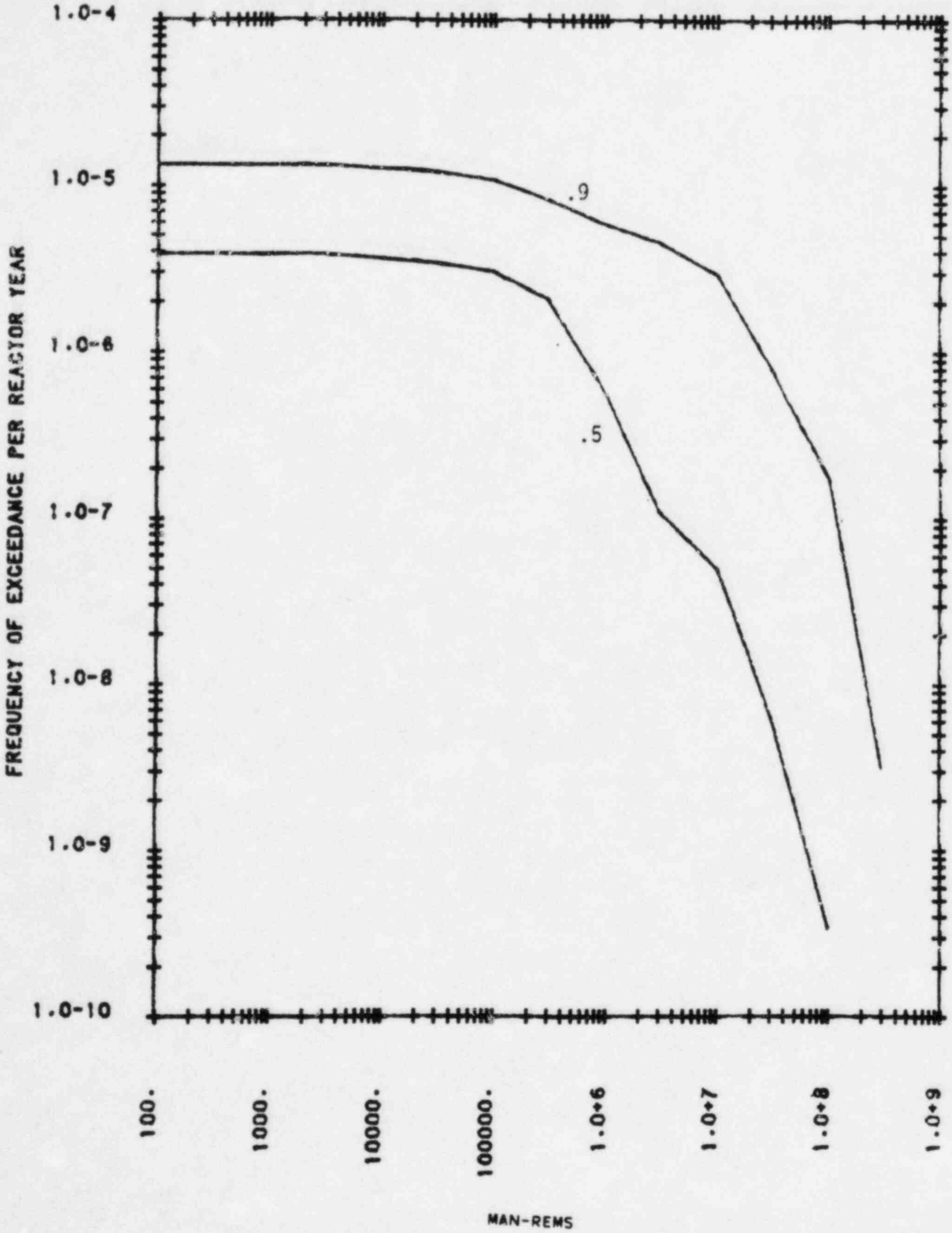


FIGURE 7.3-1E
RISK DIAGRAM FOR MAN-REM DUE TO INTERNAL EVENTS



7.4.3 DOMINANT CONTRIBUTORS TO RISK FROM INTERNAL INITIATORS

In this section, the major contributors to point estimate risk from internal initiators are identified. The early fatalities and latent cancer fatalities indices are used as the basis for identification.

The major contributors to the point estimate risk can be identified by considering the matrix products which uniquely identify the contribution of a state (initiating event, plant damage, or release states) to the final damage index. Evaluation of the matrix products for early fatalities shows that Categories M1A and M4 are the dominant release states. As shown in Figure 7.4.3-1, Category M1A releases account for approximately 99 percent of the risk at the greater than 100 early fatalities level, while Category M4 releases contribute about 1 percent.

As shown in Figure 7.4.3-2, the interfacing systems LOCA, which bypasses the containment, makes up 100 percent of release Category M1A. Transients with early melt and containment cooling dominate Category M4.

Categories M1B, M7, M8, M9, M10, and M11 do not contribute to the early fatalities index. Since 81 percent of core melt sequences which lead to containment failure are in these release categories, the majority of core melt sequences do not contribute to the point estimate risk of early fatalities.

In summary, a majority of the core melt sequences do not result in containment failure and do not contribute to the risk of early fatalities. The interfacing system loss of coolant accident resulting in containment bypass and a Category M1A release dominates the early fatalities risk from internal events.

Table 7.4-1 provides a list of dominant sequences on a system level with respect to core melt frequency and risk in terms of early fatalities and latent cancers. The dominant sequences with respect to core melt frequency are not as important in terms of risk, and vice versa.

Figure 7.4.3-3 shows the dominant release categories contributing to latent cancer fatalities. Category M7 makes up 71 percent of the risk at the greater than 1000 latent fatalities level, while Category M1A releases contribute 28 percent.

As shown in Figure 7.4.3-4, transient sequences with early melt and no containment cooling make up 84 percent of release Category M7. The remaining 16 percent is contributed by small LOCA's with late melt and failure of recirculation cooling, and transients with early melt and failure of recirculation cooling.

As described above, the V-sequence makes up 100 percent of Category M1A.

With respect to core melt frequency, no single sequence accounts for more than 10 percent of the core melt frequency. The sequences with highest frequency are medium LOCA's with failure of high pressure recirculation (8.5 percent) and transients with failure of auxiliary feedwater and bleed and feed cooling (4.9 percent).

Table 7.4-2 provides a list of the dominant accident sequences for each release category for internal events. Each accident sequence is defined by an event tree number, a support state number, and a sequence notation showing the failed nodes in the event tree. Information related to the containment response can be obtained from the definition of the release categories themselves. For example, release Category M1A represents containment bypass, while M7 represents a late containment failure with no sprays, and M12 no containment failure.

TABLE 7.4-1

DOMINANT ACCIDENT SEQUENCES CONTRIBUTING TO CORE MELT, EARLY FATALITIES, AND LATENT FATALITIES
(INTERNAL EVENTS)

Rank With Respect To Core Melt	Sequence Designation	Sequence Description	Plant Damage State	Mean Annual Frequency	Percent Contribution to Core Melt Frequency	Percent Contribution to Early Fatalities (at >100 fatalities level)	Percent Contribution to Latent Fatalities at >1000 fatalities level)
1	E_2(1)/R-2	Medium LOCA: Failure of High Pressure Recirculation	ALC	3.87E-6	8.5	<0.1	<0.1
2	E_{18}(2)/AF-1/OA-7	Loss of Vital DC Bus 1 or 2: Failure of Auxiliary Feedwater, Failure of Bleed and Feed Cooling	TEC	2.20E-5	4.9	<0.1	<0.1
3	E_{20}(2)/AF-1/R-2	Loss of Vital AC Bus 1 or 2: Failure of Auxiliary Feedwater, Failure of High Pressure Recirculation	SLC	1.98E-6	4.4	<0.1	<0.1
4	E_{21}(2)/AF-1/R-2	Loss of Vital AC Bus 3 or 4: Failure of Auxiliary Feedwater, Failure of High Pressure Recirculation	SLC	1.98E-6	4.4	<0.1	<0.1
5	E_{16}	Interfacing Systems LOCA: Failure of RHR Inlet Valves	V	1.90E-6	4.2	99.8	27.9
6	E_{14}(7)/E60/E120/E6H/QS	Loss of Offsite Power: Failure of Both Diesel Generators, Failure to Recover Power in 6 Hours, Failure of Quench Spray Recovery	TE	1.65E-6	3.6	<0.1	18.4
7	E_{14}(6)SBI/AF-2/OA-3	Loss of Offsite Power: Failure of One ESF Bus, Steam Line Break Inside Containment, Failure of Auxiliary Feedwater, Failure of Primary Bleed through PORV's	TEC	1.63E-6	3.6	<0.1	<0.1
8	E_6(1)/MS-2/OA-3	Steam Line Break Outside Containment: Failure to Isolate Main Steam Line, Failure of Primary Bleed through PORV's	TEC	1.55E-6	3.4	<0.1	<0.1
9	E_3(1)/OA-2/R-2	Small LOCA: Failure to Control Primary Depressurization, Failure of High Pressure Recirculation	SLC	1.39E-6	3.1	<0.1	<0.1
10	E_1(1)/R-1	Large LOCA: Failure of Low Pressure Recirculation	ALC	1.37E-6	3.0	<0.1	<0.1
19	E_{20}(4)/AF-1/OA-7/QS	Loss of Vital AC Bus 1 or 2: Failure of Opposite Train ESF Cabinet, Failure of Auxiliary Feedwater, Failure of Bleed and Feed Cooling, Failure of Quench Spray	TE	7.23E-7	1.6	<0.1	8.0
20	E_9(4)/AF-1/OA-7/QS	Primary to Secondary Power Mismatch: Failure of Both ESF Cabinets, Failure of Auxiliary Feedwater, Failure of Bleed and Feed Cooling, Failure of Quench Spray	TE	6.15E-7	1.4	<0.1	6.9

Amendment 1
September 7, 1983

FIGURE 7.4.3-1

MAJOR RELEASE CATEGORIES CONTRIBUTING TO EARLY FATALITIES (GREATER THAN 100 FATALITIES)
INTERNAL EVENTS

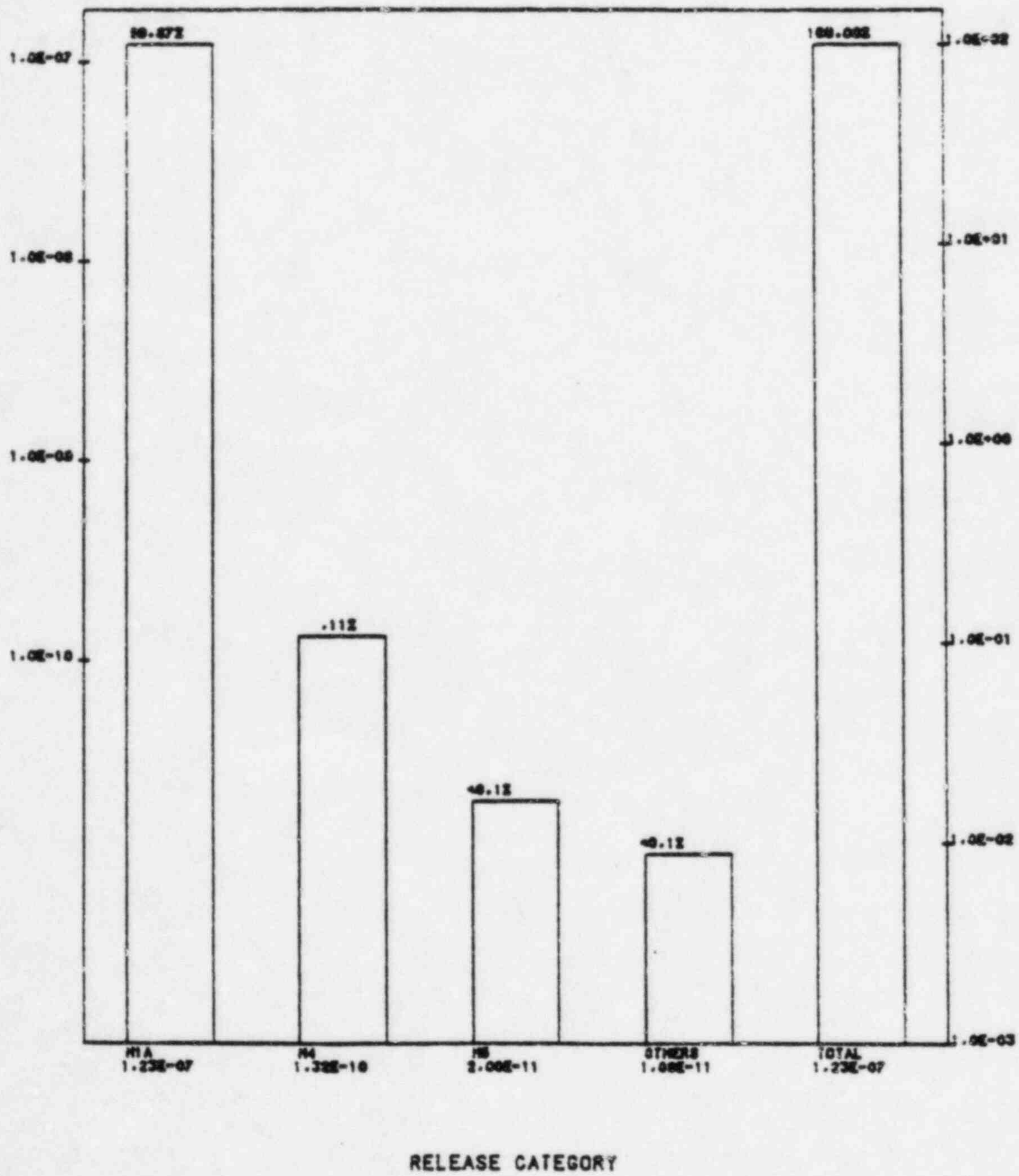


FIGURE 7.5.1-1A
POINT ESTIMATE RISK CURVE FOR EARLY FATALITIES
SEISMIC RISK ONLY

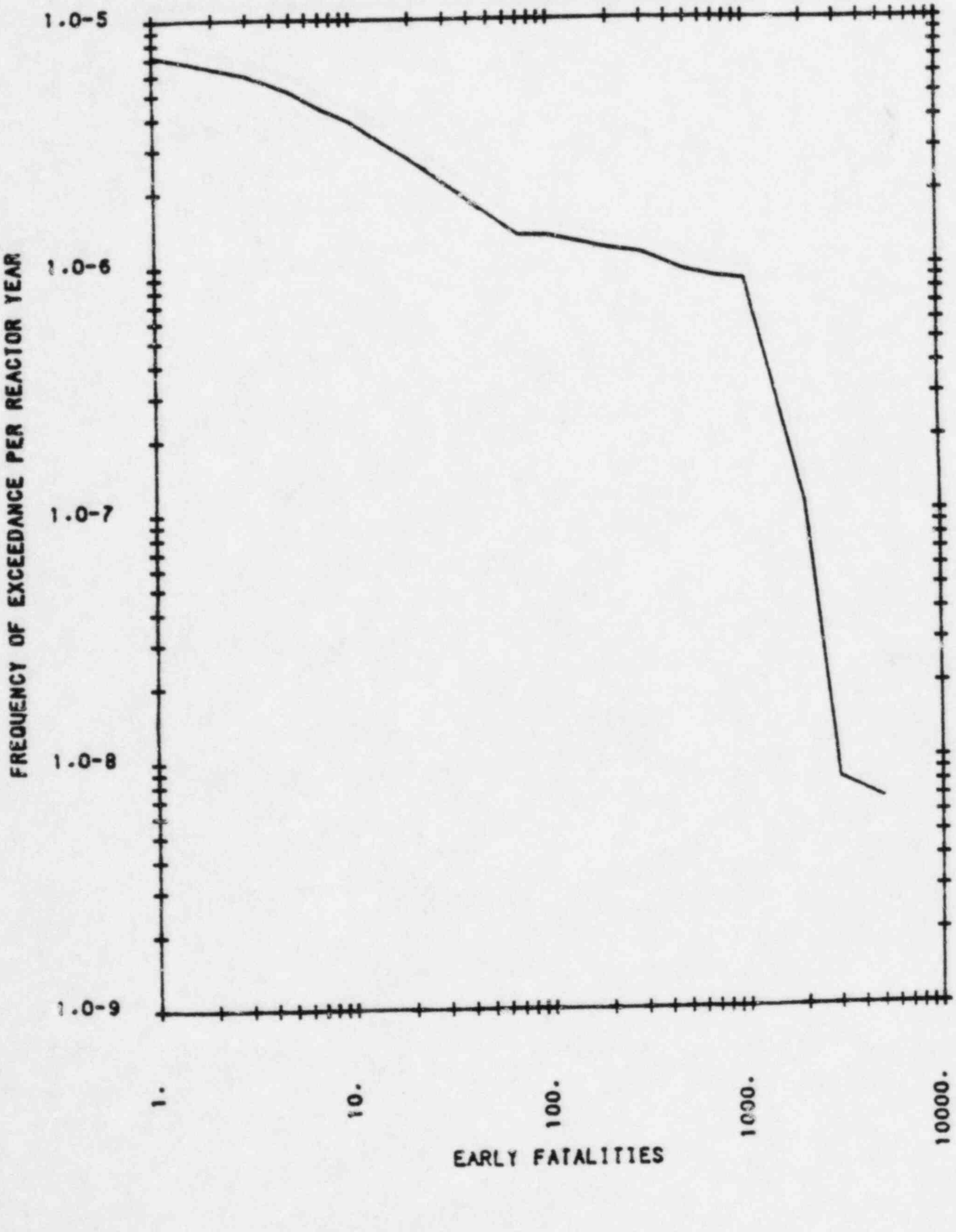


FIGURE 7.5.1-1B
POINT ESTIMATE RISK CURVE FOR EARLY INJURIES
SEISMIC RISK ONLY

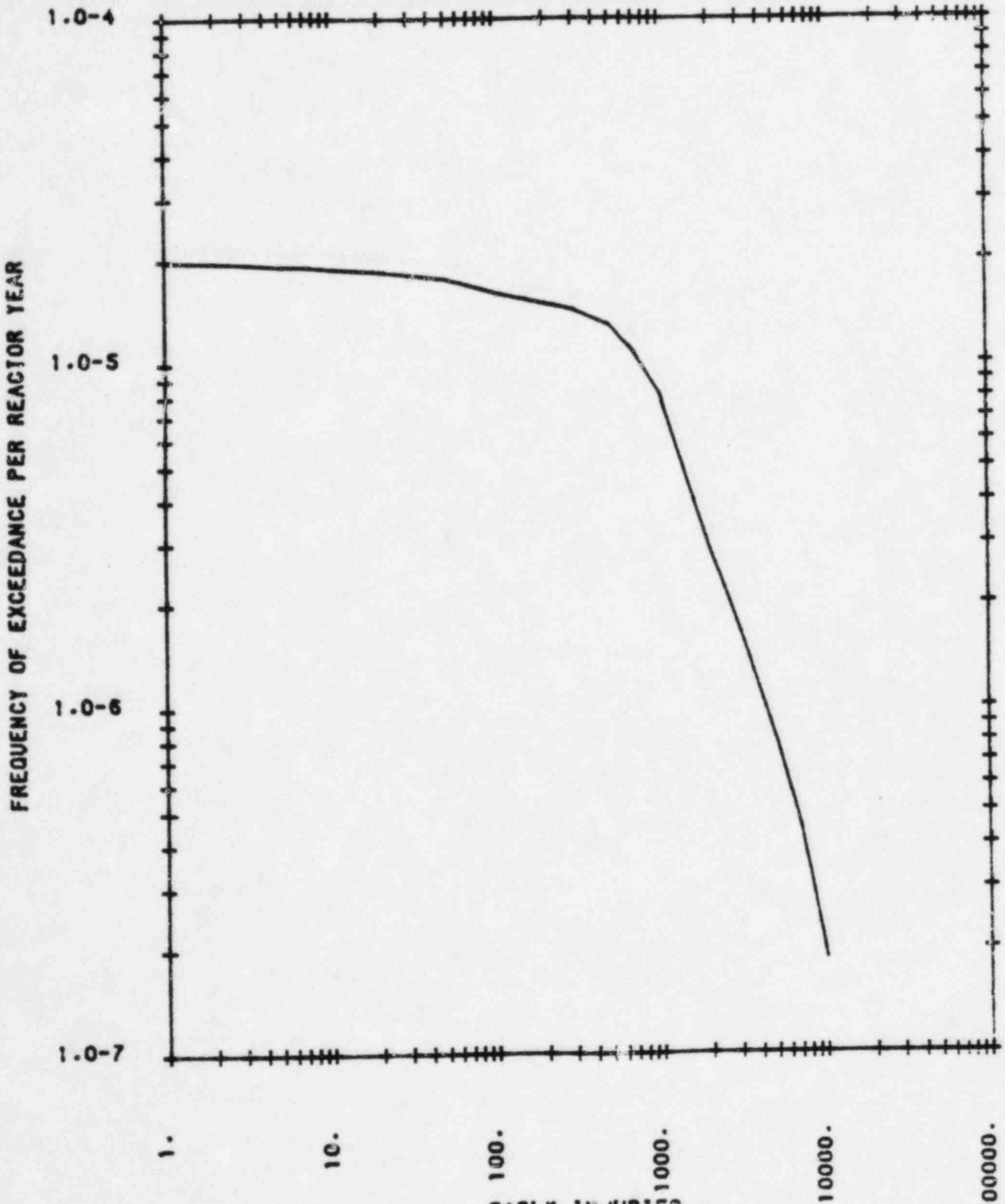


FIGURE 7.5.1-1C
POINT ESTIMATE RISK CURVE FOR THYROID NODULES
SEISMIC RISK ONLY

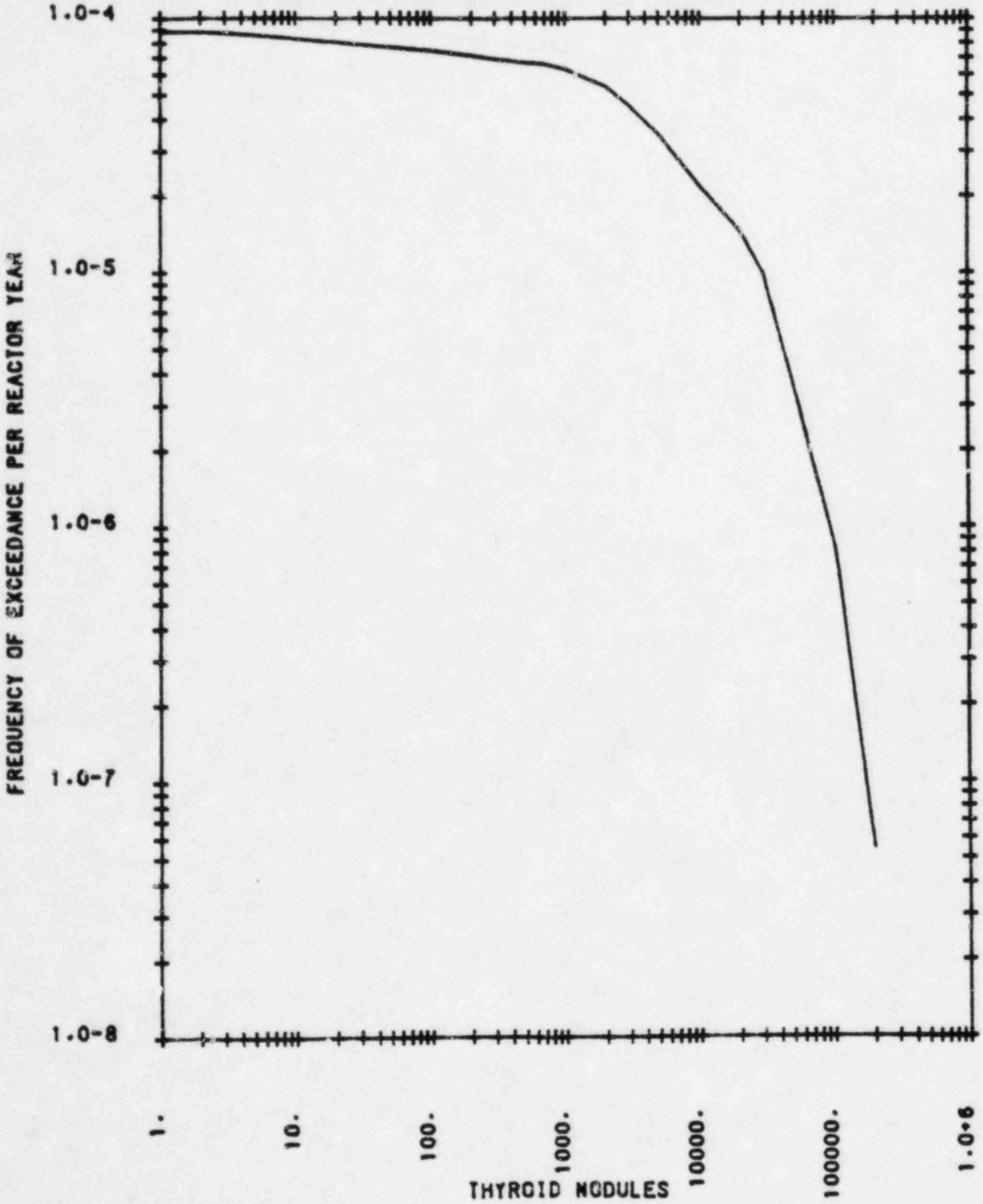


FIGURE 7.5.1-1D
POINT ESTIMATE RISK CURVE FOR LATENT CANCER FATALITIES
SEISMIC RISK ONLY

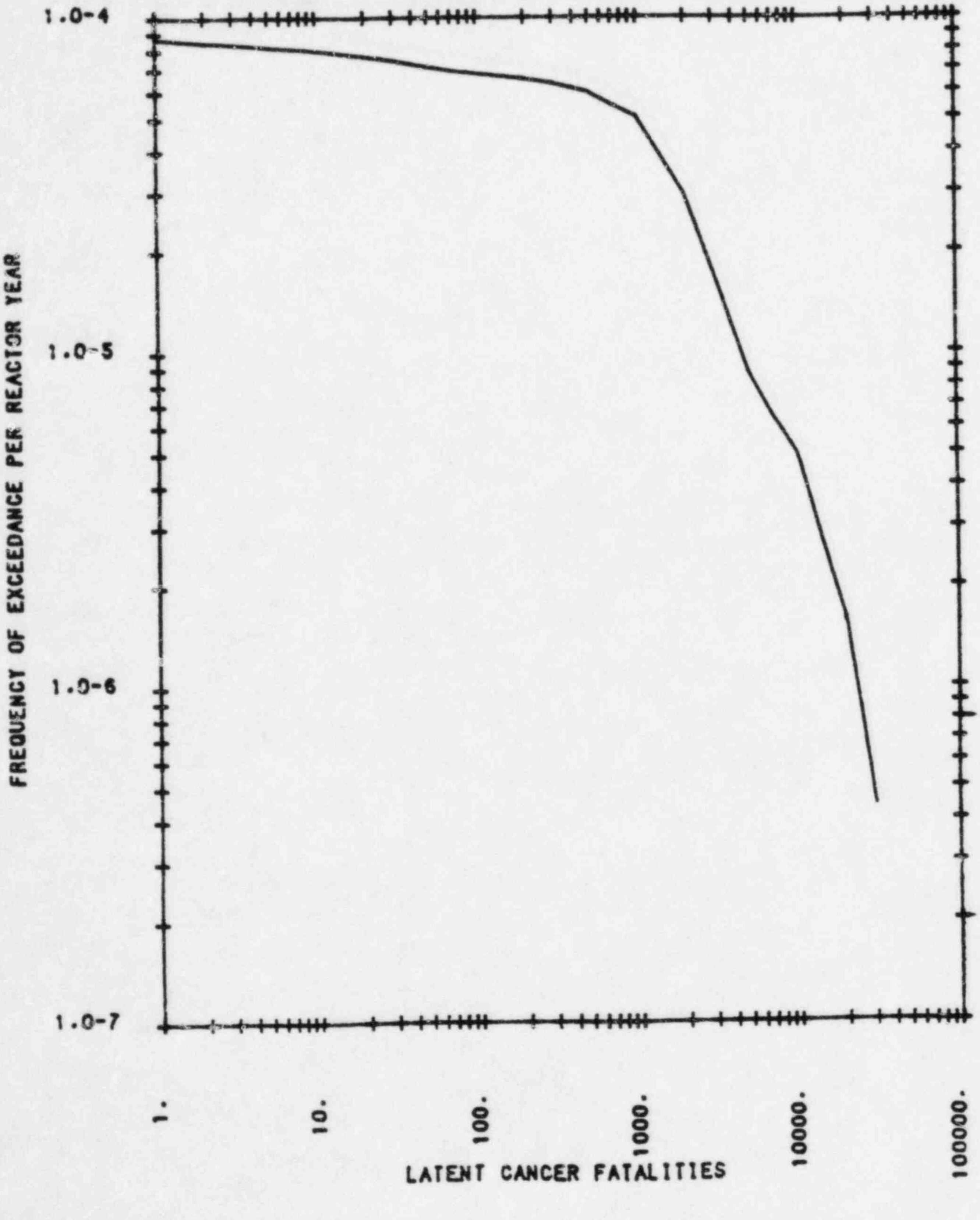


FIGURE 7.5.1-1E
POINT ESTIMATE RISK CURVE FOR MAN-REM
SEISMIC RISK ONLY

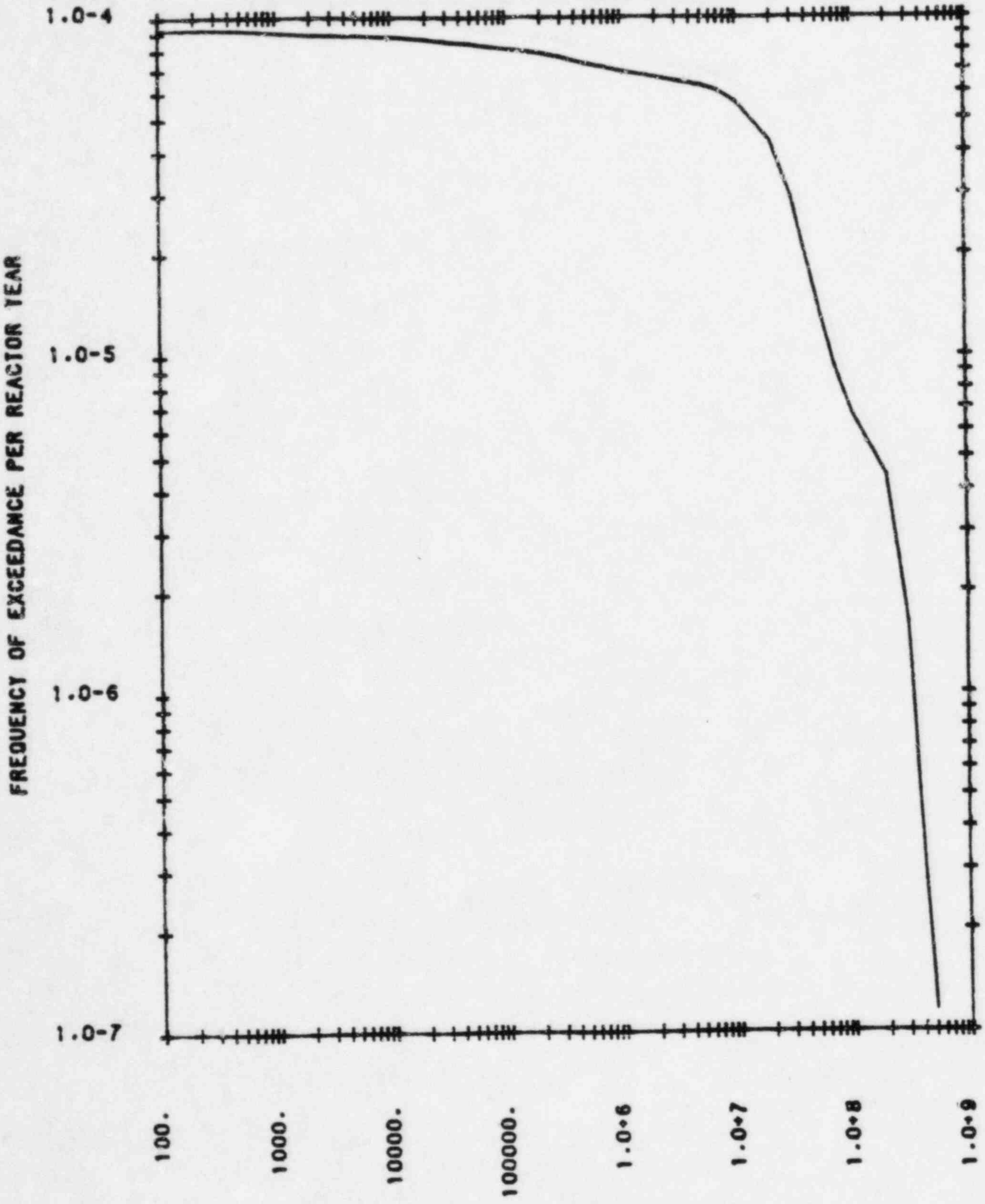


FIGURE 7.5.2-1A
POINT ESTIMATE RISK CURVE FOR EARLY FATALITIES
FIRE RISK ONLY

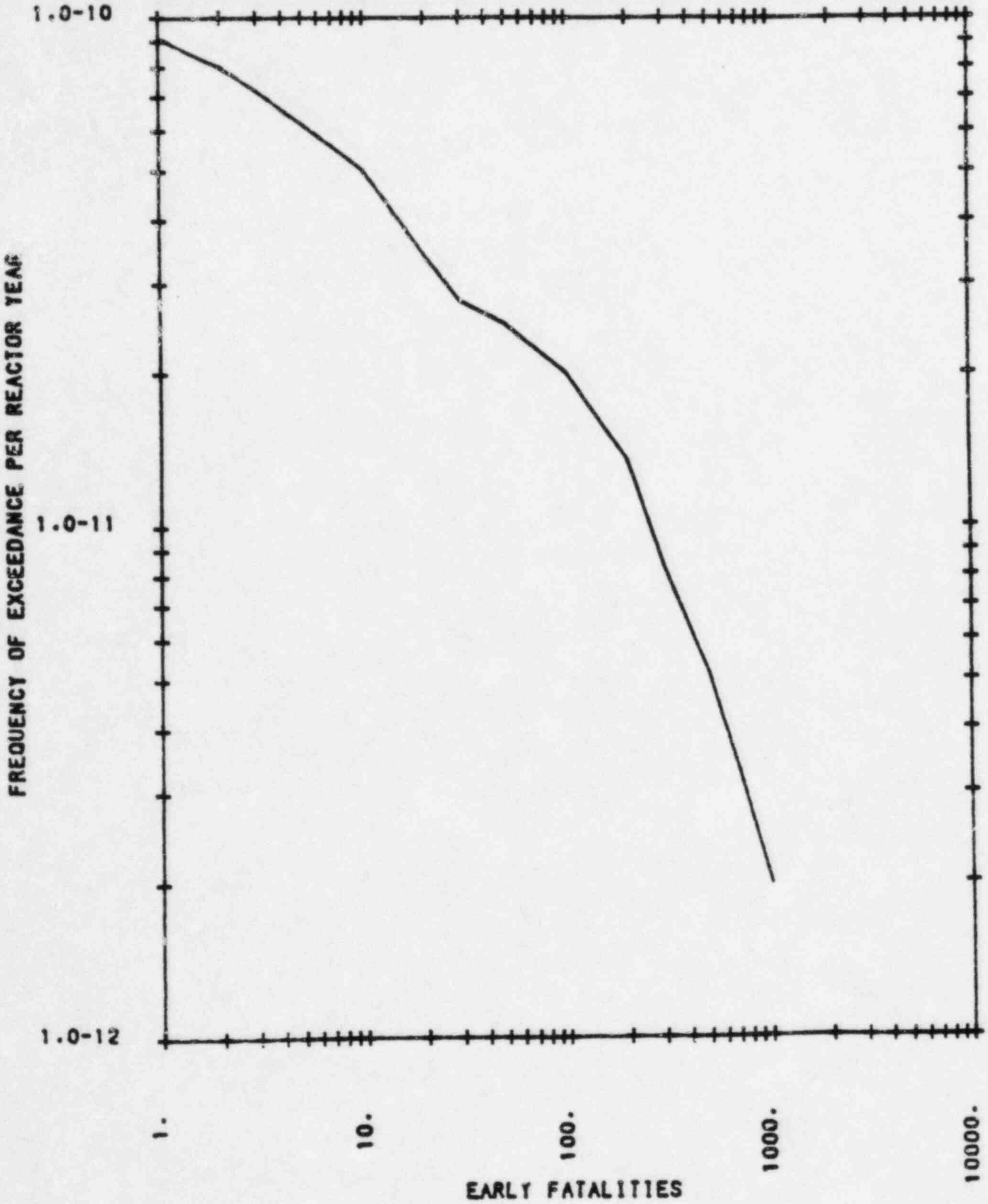


FIGURE 7.5.2-1B
POINT ESTIMATE RISK CURVE FOR EARLY INJURIES
FIRE RISK ONLY

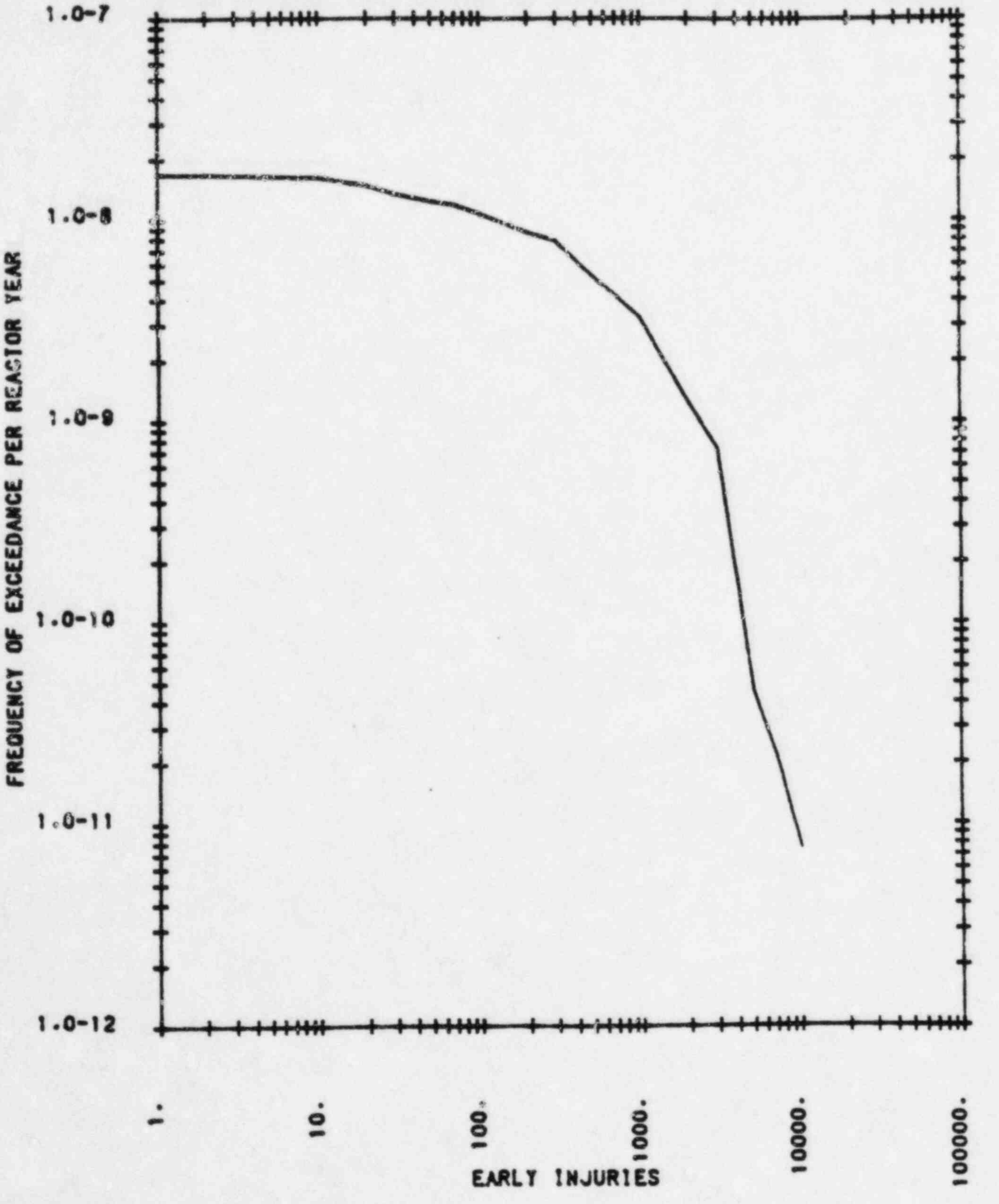
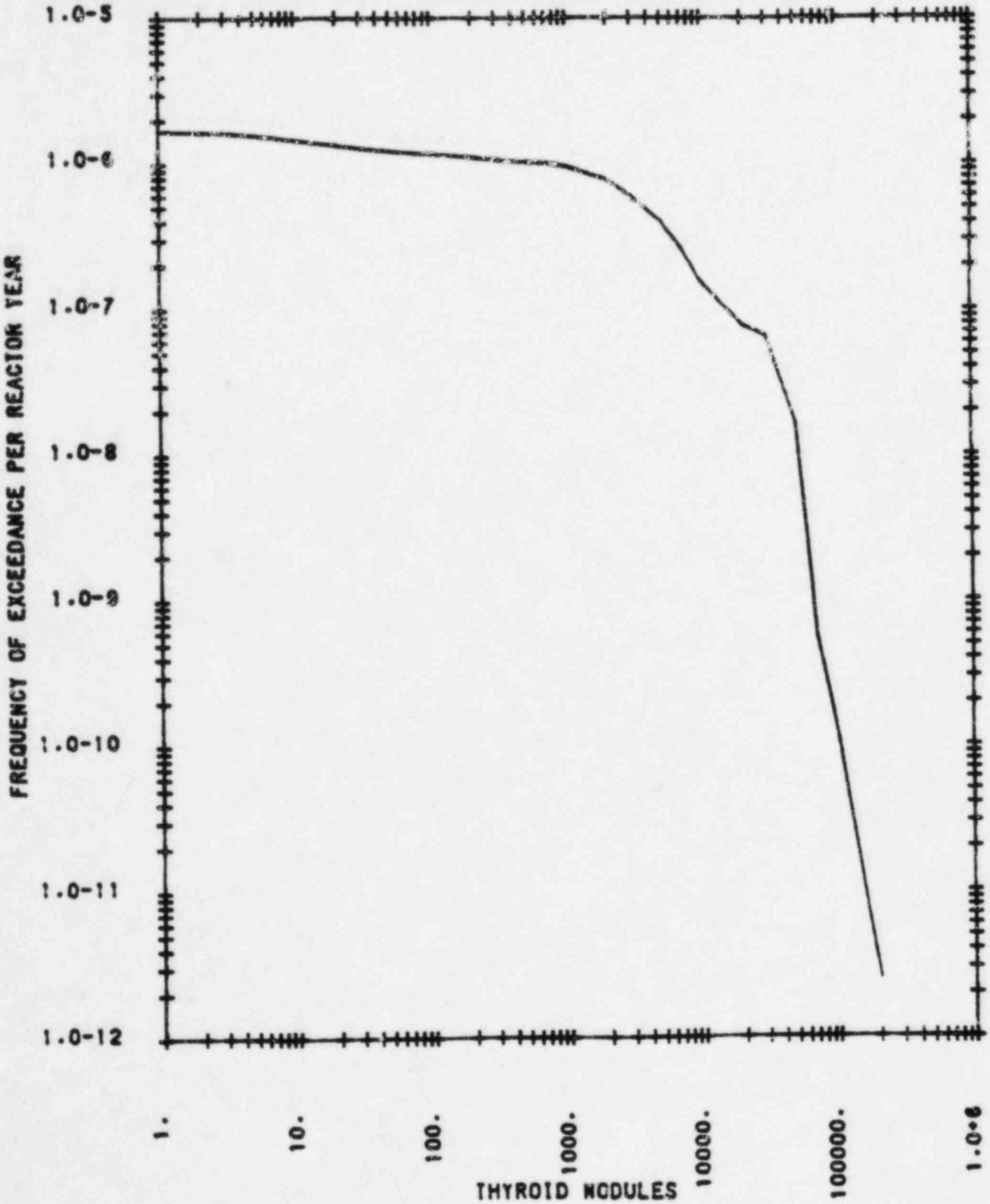


FIGURE 7.5.2-1C
POINT ESTIMATE RISK CURVE FOR THYROID NODULES
FIRE RISK ONLY



Amendment 1
September 7, 1983

FIGURE 7.5.2-1D
POINT ESTIMATE RISK CURVE FOR LATENT CANCER FATALITIES
FIRE RISK ONLY

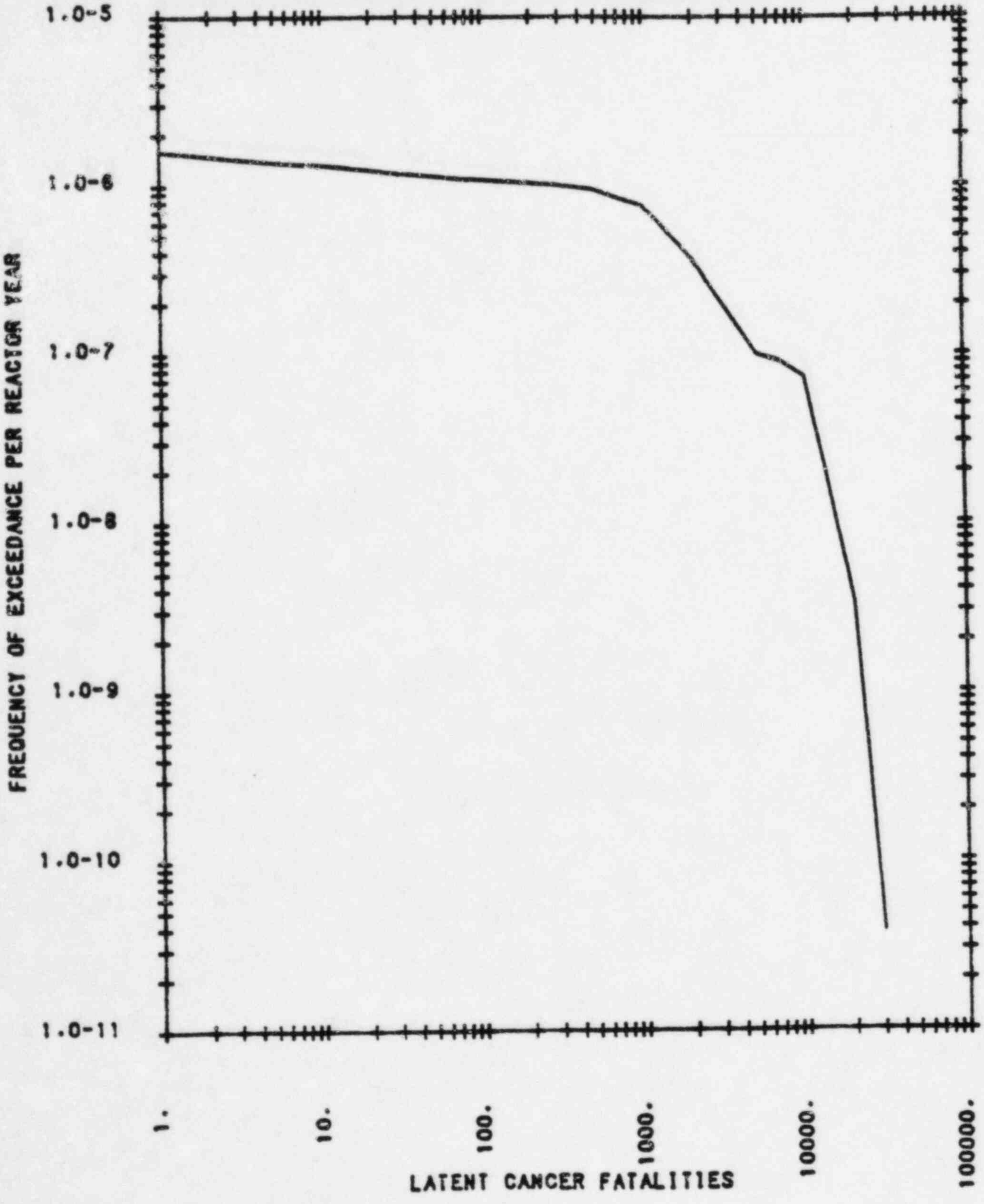


FIGURE 7.5.2-1E
POINT ESTIMATE RISK CURVE FOR MAN-REM
FIRE RISK ONLY

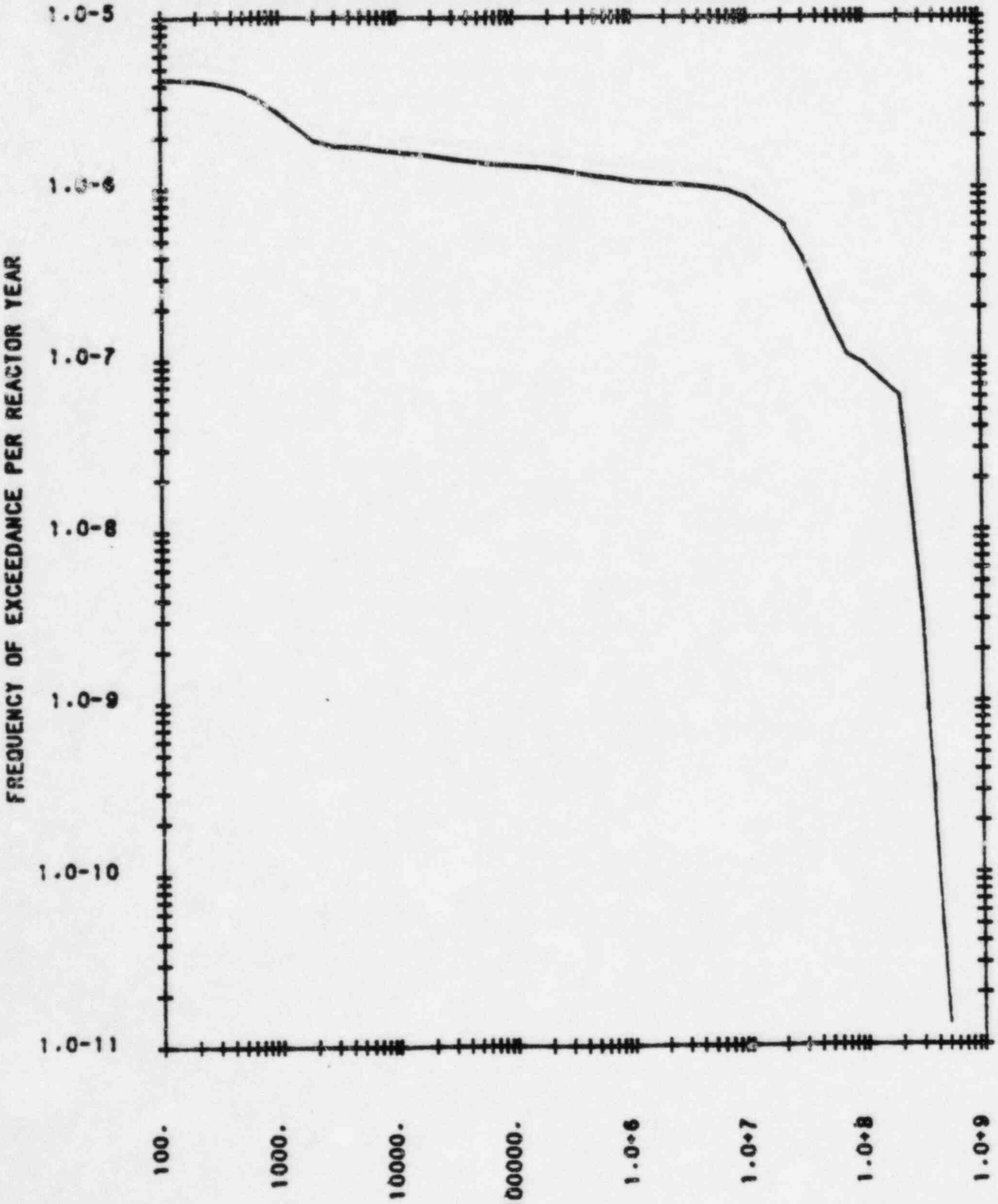


FIGURE 7.5.3-1A
RISK DIAGRAM FOR EARLY FATALITIES
DUE TO EXTERNAL EVENTS

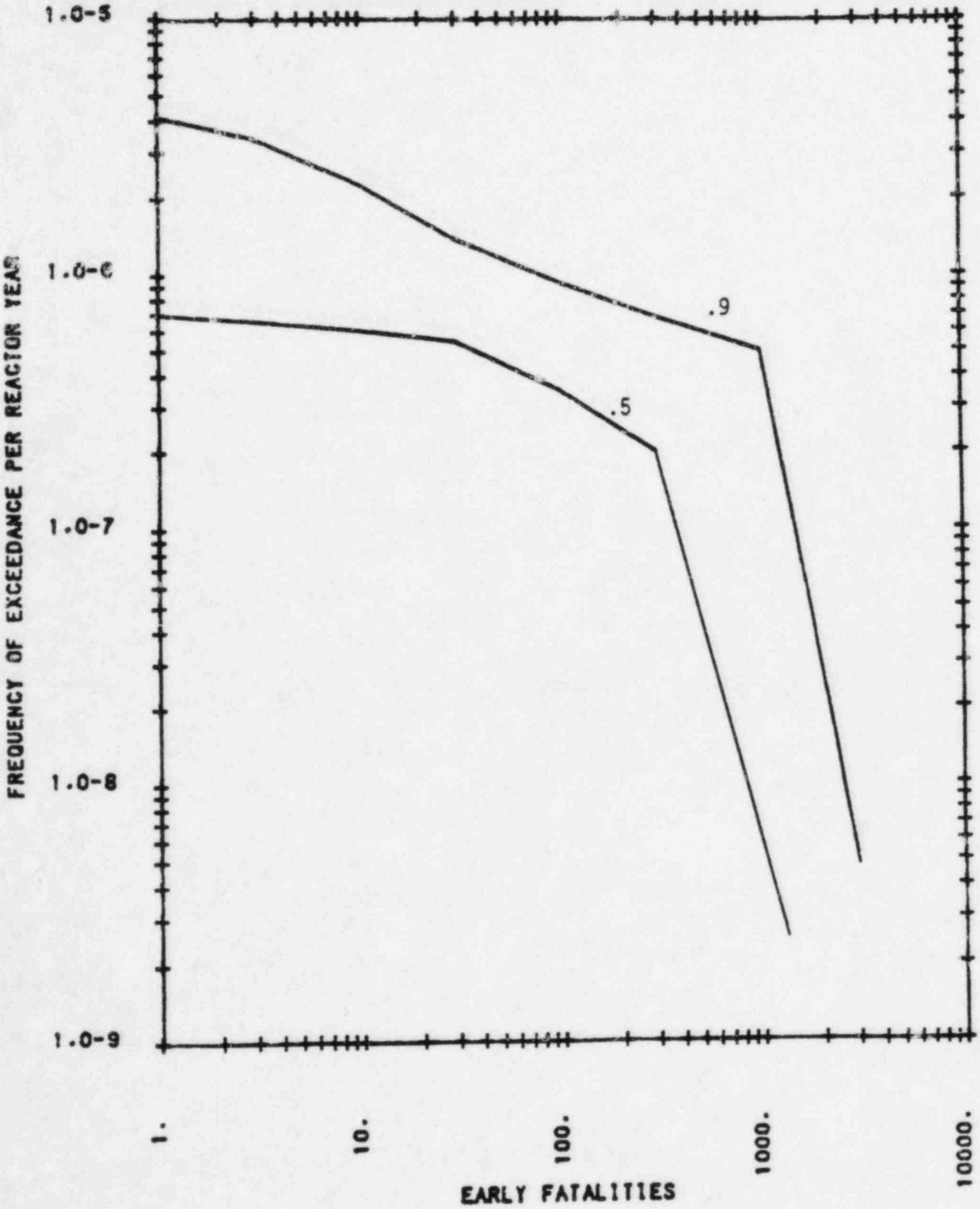


FIGURE 7.5.3-1B
RISK DIAGRAM FOR EARLY INJURIES
DUE TO EXTERNAL EVENTS

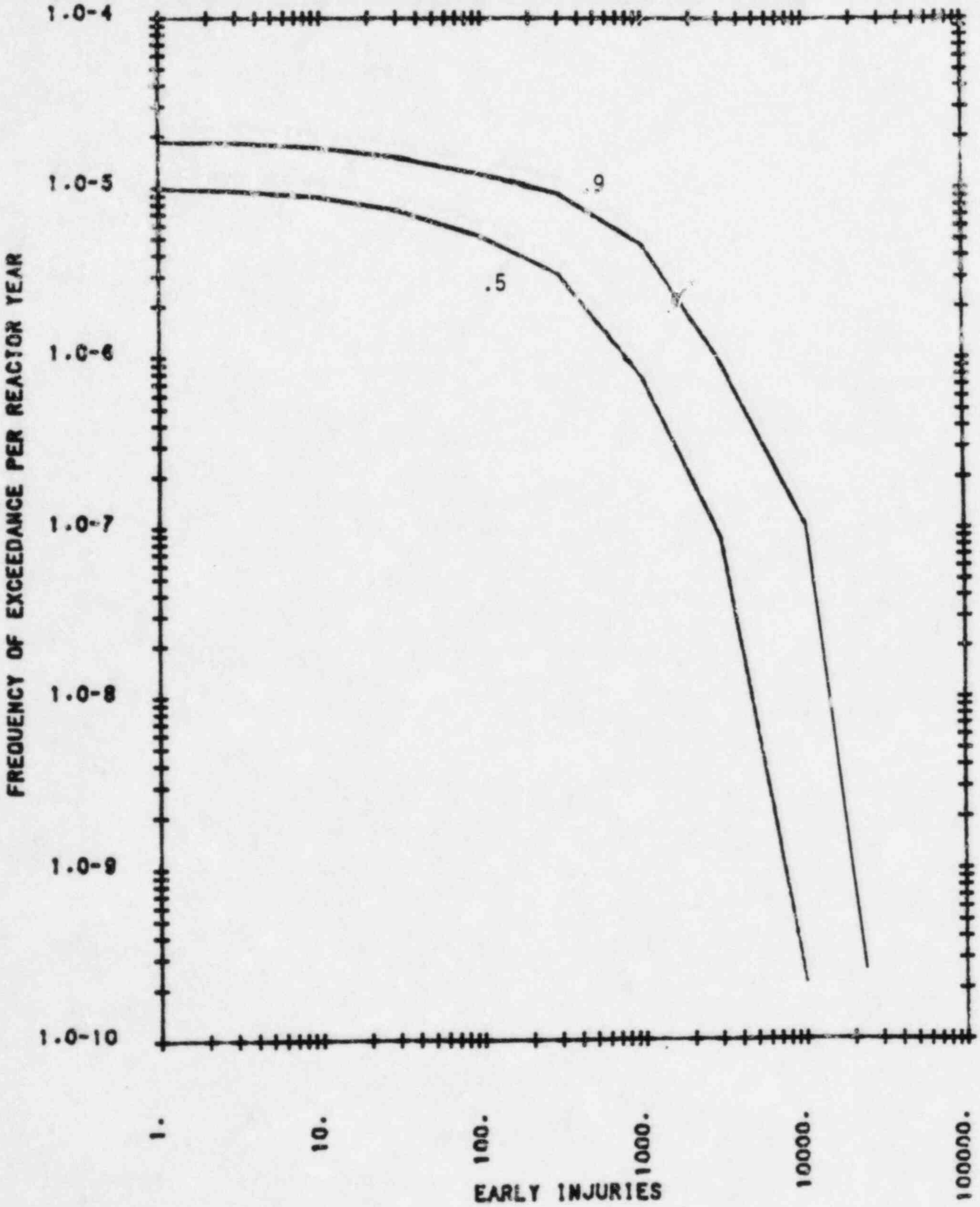


FIGURE 7.5.3-1C
RISK DIAGRAM FOR THYROID NODULES
DUE TO EXTERNAL EVENTS

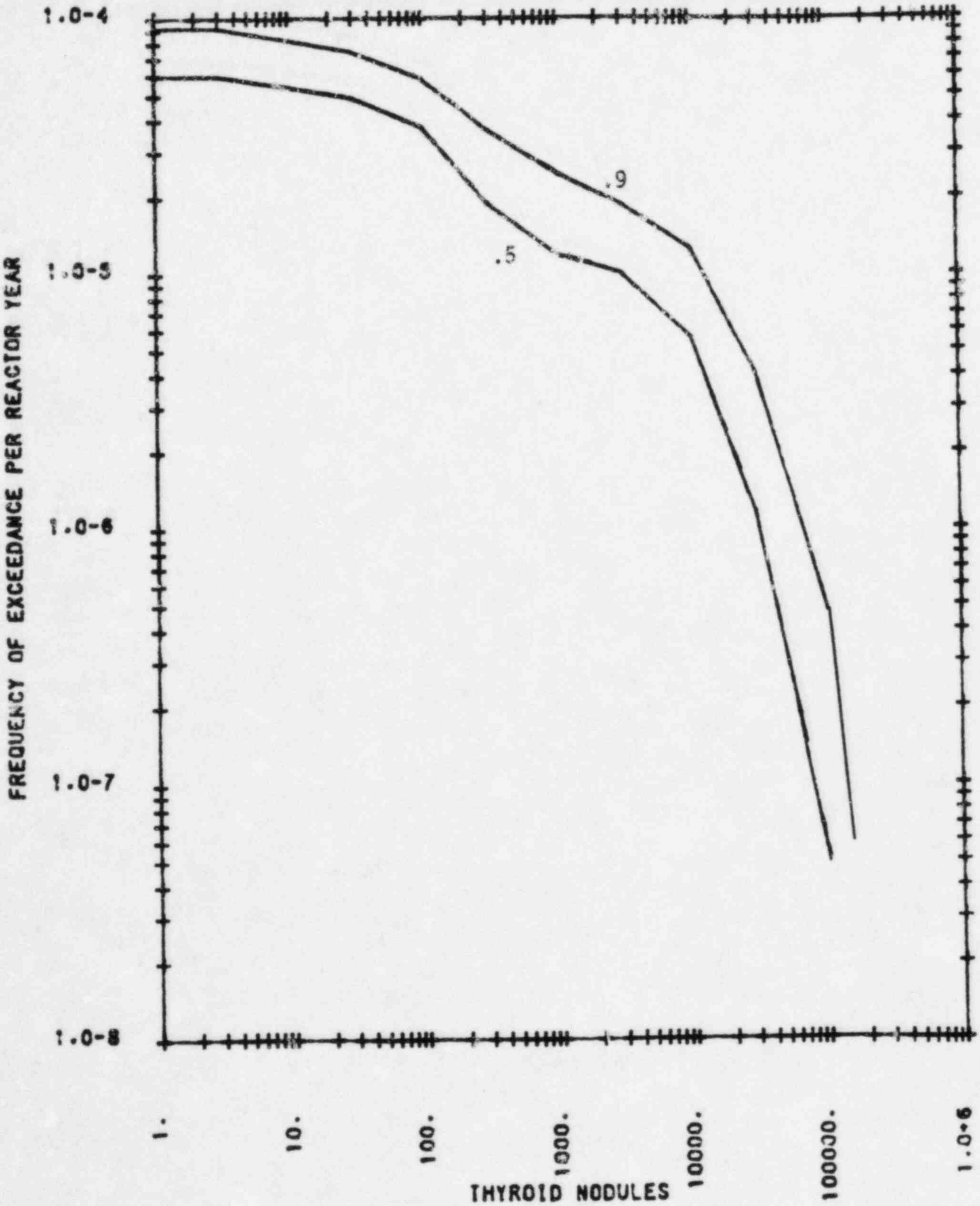


FIGURE 7.5.3-1D
RISK DIAGRAM FOR LATENT CANCER FATALITIES
DUE TO EXTERNAL EVENTS

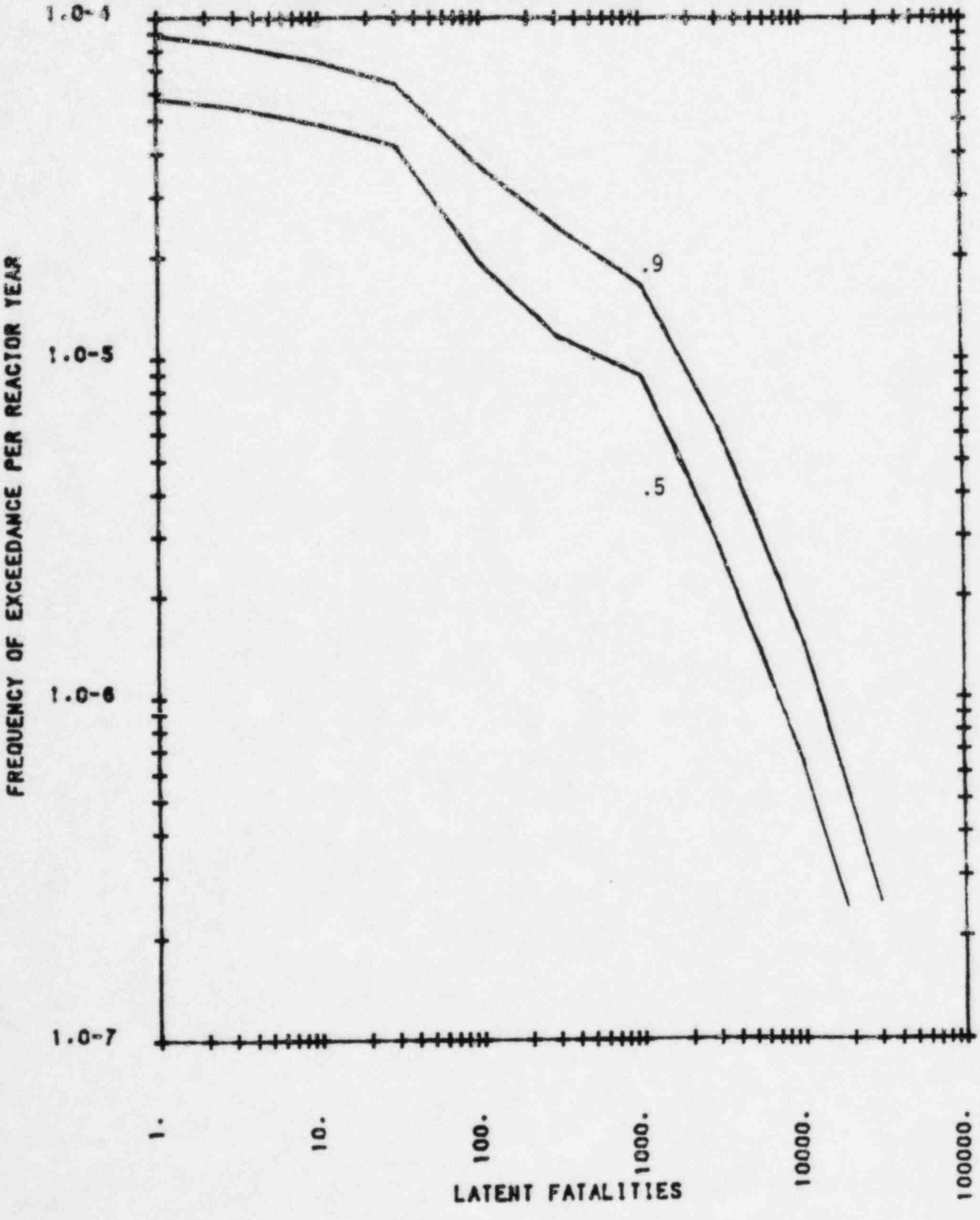


FIGURE 7.5.3-1E
RISK DIAGRAM FOR MAN-REM
DUE TO EXTERNAL EVENTS

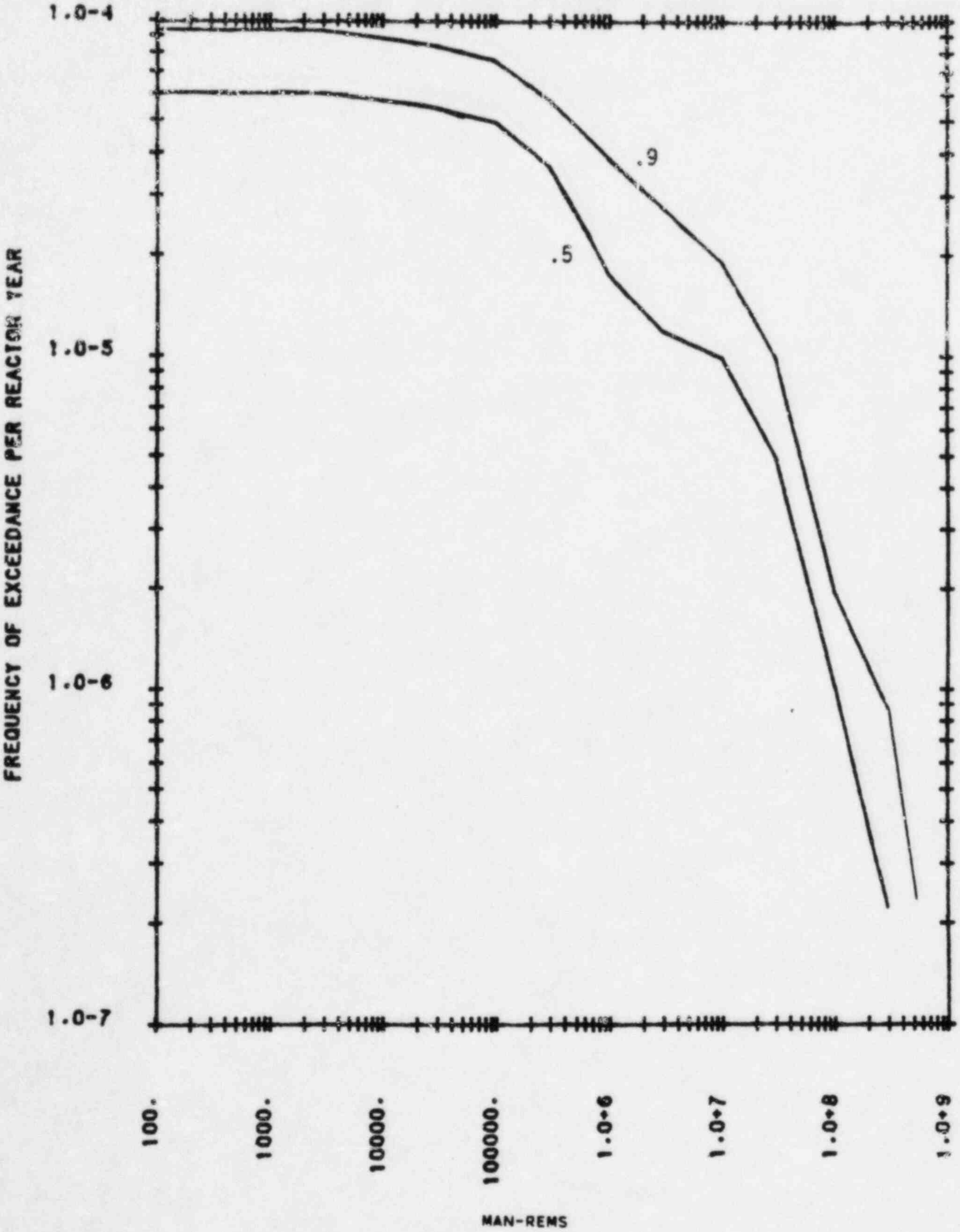
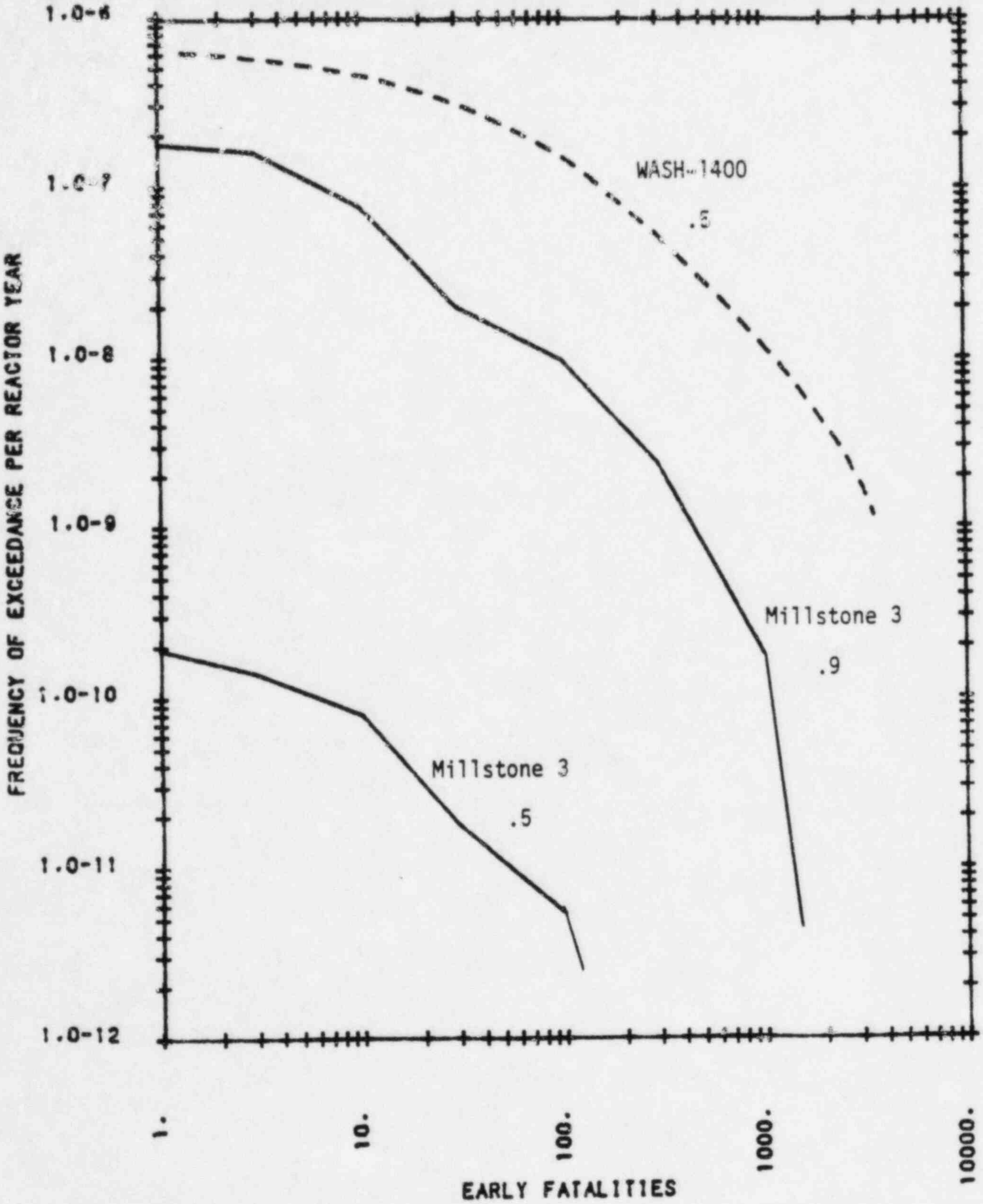


FIGURE 7.6-1
COMPARISON OF RISK CURVES FOR EARLY FATALITIES WASH-1400 VS. MILLSTONE 3



Amendment 1
September 7, 1983

FIGURE 7.6-2
COMPARISON OF RISK CURVES FOR LATENT FATALITIES WASH-1400 VS. MILLSTONE 3