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ILLUSTRATIONS ACCOMPANYING A PRESENTATION

BY

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TO

THE ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

ON

2 NOVEMBER 2000

REGARDING

RISKS ASSOCIATED WITH SPENT FUEL STORAGE IN HIGH-DENSITY POOLS

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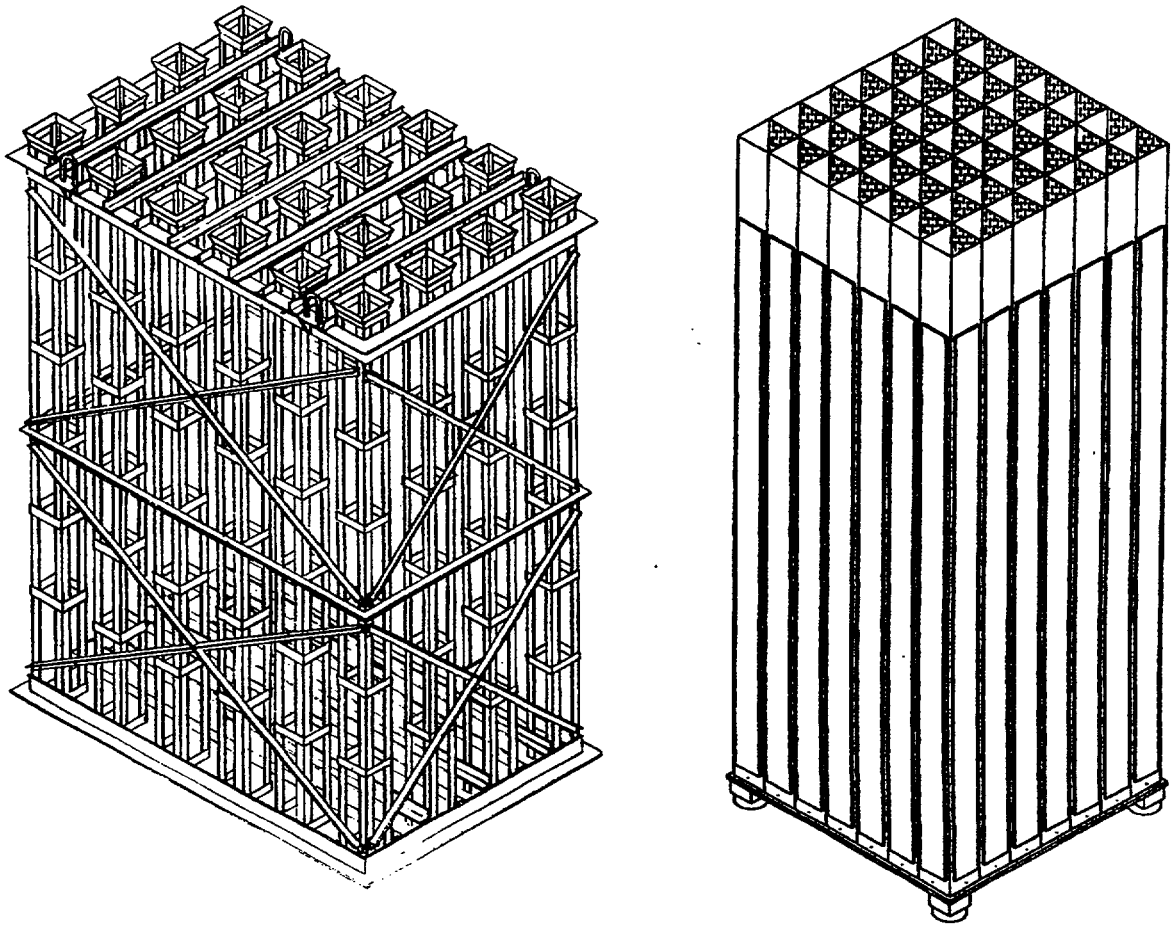


(1) LOW AND HIGH-DENSITY RACKS FOR POOL STORAGE OF SPENT FUEL

• The potential for a runaway exothermic reaction of cladding in a high-density spent fuel pool, following water loss, has been known since the late 1970s. (For convenience, this event is described here as a "pool fire".)

• The potential for a pool fire can exist at any high-density pool but may be especially significant for pools at operating nuclear power plants, due to: (a) the presence of recently-discharged fuel with a high decay heat; and (b) the potential for a reactor accident to initiate a pool accident.

• Pool fires have not been studied to the same extent as reactor accidents (e.g., NUREG-1150, IPEs).

• There are major gaps in knowledge about the probability of pool fires, their phenomenology, and their consequences.

• Pool fires deserve attention because they could contaminate large areas of land with comparatively long-lived radioisotopes (e.g., Cesium-137), leading to significant health, economic, social and political impacts.

• Pools generally have a low inventory of short-lived radioisotopes; as a result, pool fires would generally have a comparatively low potential for causing early fatalities.

• The potential for pool fires could be almost completely eliminated by storing spent fuel using a combination of low-density pool storage and dry storage.

(2) SOME OBSERVATIONS ABOUT POOL FIRES

REACTORS

• WASH-1400 core inventory of Cs-137:	4.7 MCi
• WASH-1400 release fraction of Cs: (PWR2 release category)	0.5
• NUREG-1150 release fraction of Cs: (Surry, containment bypass, mean)	0.2
• Chernobyl release of Cs-137: (Livermore estimate)	2.4 MCi

POOLS

• Illustrative pool inventory of Cs-137: (1,000 PWR assemblies @ 0.05 MCi/assy at discharge, av. age 15 yrs)	35 MCi
• Pool fire release fraction of Cs: (NUREG/CR-4982)	1.0

CONCLUSION

• The release of Cesium-137 from a pool fire could exceed the release from a reactor accident, by a factor of 10 or more.

(3) POTENTIAL RELEASES OF CESIUM-137

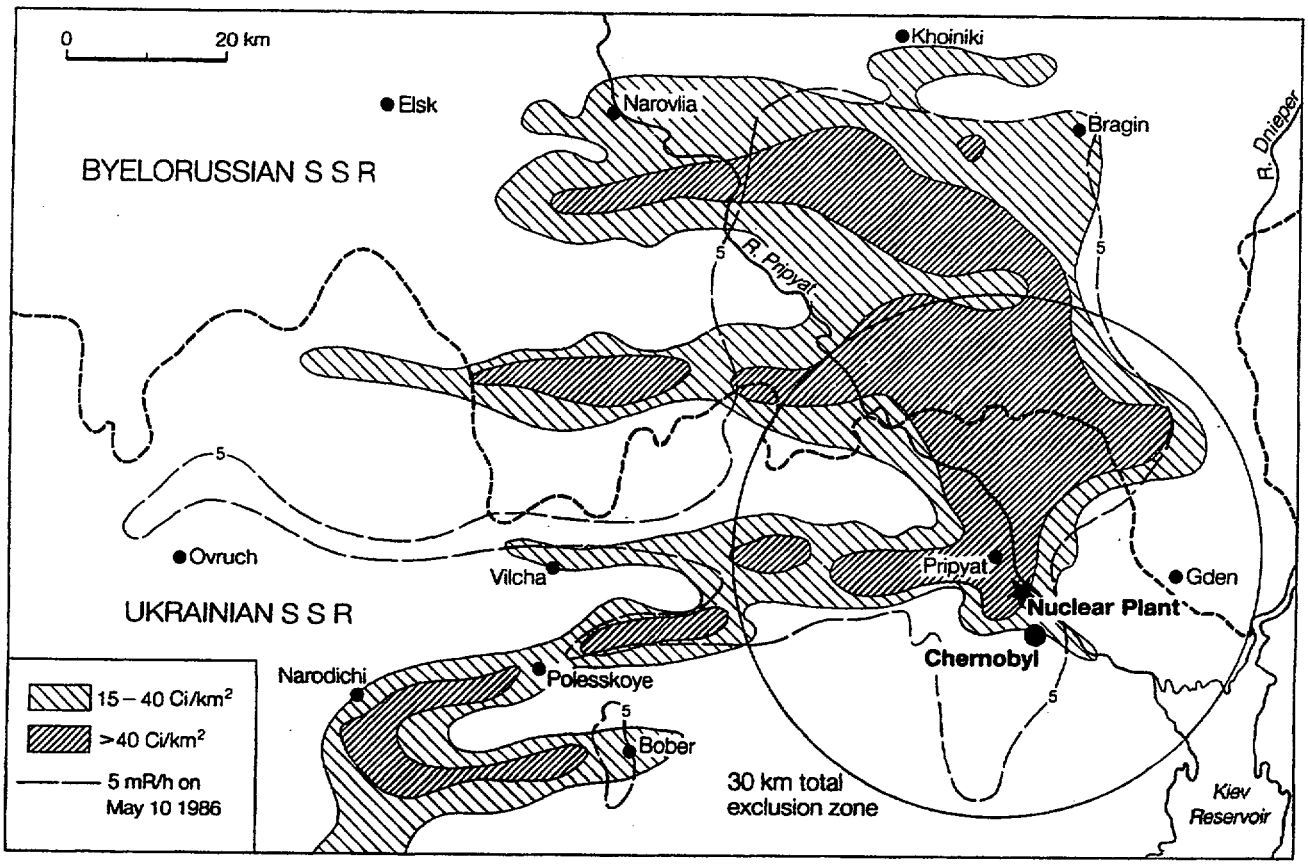
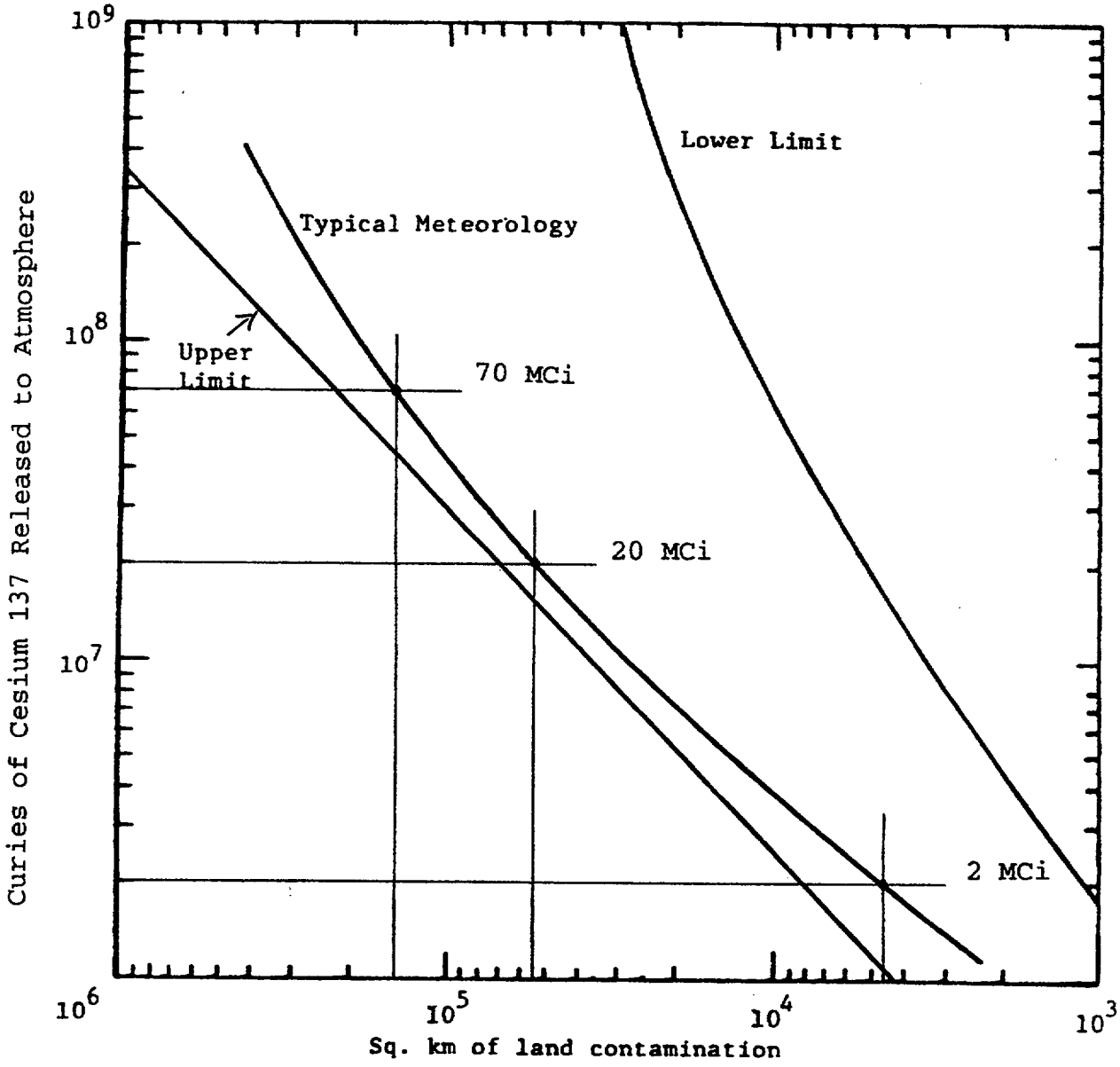


Figure 3.3b Areas of heavy contamination around the exclusion zone (marked by a 30 km radius circle) with the caesium-137 as measured during 1988. Only two levels are indicated. The contour marked by isolines indicates the territory which was contaminated above 5 mR/h of gamma radiation on 10 May, 1986.

(from Medvedev, 1990)

(4) LAND CONTAMINATION BY CESIUM-137 IN THE VICINITY OF CHERNOBYL



(from Beyea, 1979)

(5) ESTIMATED AREA OF CONTAMINATION BY Cs-137 (THRESHOLD OF 10 REM PER 30 YR, SHIELDING FACTOR 0.25)

ESTIMATED LIFETIME RISK PER 100,000 PERSONS EXPOSED TO 1 mSv (0.1 REM) PER YEAR, CONTINUOUSLY THROUGHOUT LIFE

	Males	Females
• Point estimate of excess mortality	520	600
• 90 percent confidence limits	410-980	500-930
• Normal expectation	20,560	17,520
• Excess as percent of normal	2.5	3.4
• Average years of life lost per excess death	16	18

(6) EXCESS CANCER MORTALITY FROM CONTINUOUS EXPOSURE TO RADIATION: BEIR V ESTIMATE

NRC SAFETY GOALS

- "Individual members of the public should be provided a level of protection from the consequences of nuclear power plant operation such that individuals bear no significant additional risk to life and health."

- "Societal risks to life and health from nuclear power plant operation should be comparable to or less than the risks of generating electricity by viable competing technologies and should not be a significant addition to other societal risks."

NRC STAFF ANALYSIS ON POOL RISK AT DECOMMISSIONING PLANTS

- The NRC Staff's analysis has not addressed land contamination, which is the most important indicator of pool risk; accordingly, the analysis does not provide a credible basis for decision making.

NEXT STEPS

- The NRC should declare a moratorium on any decisions or licensing actions that could increase the risk of a radioactive release from any spent fuel pool, pending the completion of new studies on pool accident risk.

- The NRC should perform studies and supporting experiments, to at least the depth of NUREG-1150, on the probability of pool fires, their phenomenology, and their consequences; for operating plants, this work should address interactions between reactor accidents and pool fires.

- Licensees should be required to extend IPEs and IPEEEs to address pool fires.