

UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
OFFICE OF NUCLEAR REACTOR REGULATION  
WASHINGTON, D.C. 20555

February 1, 1990

NRC INFORMATION NOTICE NO. 90-08: KR-85 HAZARDS FROM DECAYED FUEL

Addressees:

All holders of operating licenses or construction permits for nuclear power reactors and holders of licenses for permanently shutdown facilities with fuel on site.

Purpose:

This information notice alerts addressees to potential problems resulting from the accidental release of Kr-85 from decayed fuel. It is expected that recipients will review the information for applicability to their facilities and consider actions, as appropriate, to avoid similar problems. However, suggestions contained in this information notice do not constitute NRC requirements; therefore, no specific action or written response is required.

Description of Circumstances:

During the licensing reviews for the Oconee independent spent fuel storage installation, and in the decommissioning of the La Crosse and Dresden Unit 1 power reactors, the NRC staff analyzed the radiological hazards associated with the gases in decayed spent fuel. The age of the nuclear power industry and the lack of a permanent repository for spent fuel have resulted in the accumulation of decayed spent fuel. Decayed spent fuel is manipulated after long shutdowns of operating reactors, during spent fuel pool re-racking, during movement to alternate reactor sites or independent spent fuel storage installations, and during decommissioning. Analysis of hypothetical accidents involving decayed spent fuel has focused attention on potential difficulties that could be associated with the exposure of onsite personnel to an accidental release of Kr-85. Kr-85 is a noble gas fission product that is present in the gaps between the fuel pellets and the cladding. It has a 10.76-year half-life, and, as a result of the considerably shorter half-lives of virtually all other gaseous fission products (I-129 being the exception, but in low abundance), Kr-85 becomes increasingly the dominant nuclide in the accident source term for gap releases as decay times increase. After 2 weeks of decay, Kr-85 is a significant nuclide in the source term, and after 190 days of decay, it is the predominant gaseous nuclide for a gap release. The unusual decay characteristics of Kr-85 give cause for focusing attention on the onsite consequences of a gap release from decayed fuel.

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Discussion:

Kr-85 emits beta radiation with a maximum energy of 0.67 MeV for 99.6 percent of the decays and 0.51 MeV gamma radiation for 0.4 percent of the decays. Consequently, direct exposure to this gas would result in a dose to the skin approximately 100 times the whole-body dose. Analysis of the relative consequences (in terms of radiological doses) of a cask-drop accident as a function of decay time of the fuel is illustrated in Figure 1. In the event of a serious accident involving decayed spent fuel, protective actions would be needed for personnel on site, while offsite doses (assuming an exclusion area radius of 1 mile from the plant site) would be well below the Environmental Protection Agency's Protective Action Guides. Accordingly, it is important to be able to properly survey and monitor for Kr-85, and to assess the skin dose to workers who could be exposed to Kr-85 in the event of an accident with decayed spent fuel.

Licensees may wish to reevaluate whether Emergency Action Levels specified in the emergency plan and procedures governing decayed fuel-handling activities appropriately focus on concern for onsite workers and Kr-85 releases in areas where decayed spent fuel accidents could occur, for example, the spent fuel pool working floor. Furthermore, licensees may wish to determine if emergency plans and corresponding implementing procedures address the means for limiting radiological exposures of onsite personnel who are in other areas of the plant. Among other things, moving onsite personnel away from the plume and shutting off building air intakes downwind from the source may be appropriate.

This information notice requires no specific action or written response. If you have any questions about the information in this notice, please contact one of the technical contacts listed below or the appropriate NRR project manager.



Charles E. Rossi, Director  
Division of Operational Events Assessment  
Office of Nuclear Reactor Regulation

Technical Contacts: Charles S. Hinson, NRR  
(301) 492-3142

Robert A. Meck, RES  
(301) 492-3737

Attachments:

1. Figure 1, Dose Consequences of a Spent Fuel Drop Accident
2. List of Recently Issued NRC Information Notices

# DOSE CONSEQUENCES OF A SPENT FUEL DROP ACCIDENT

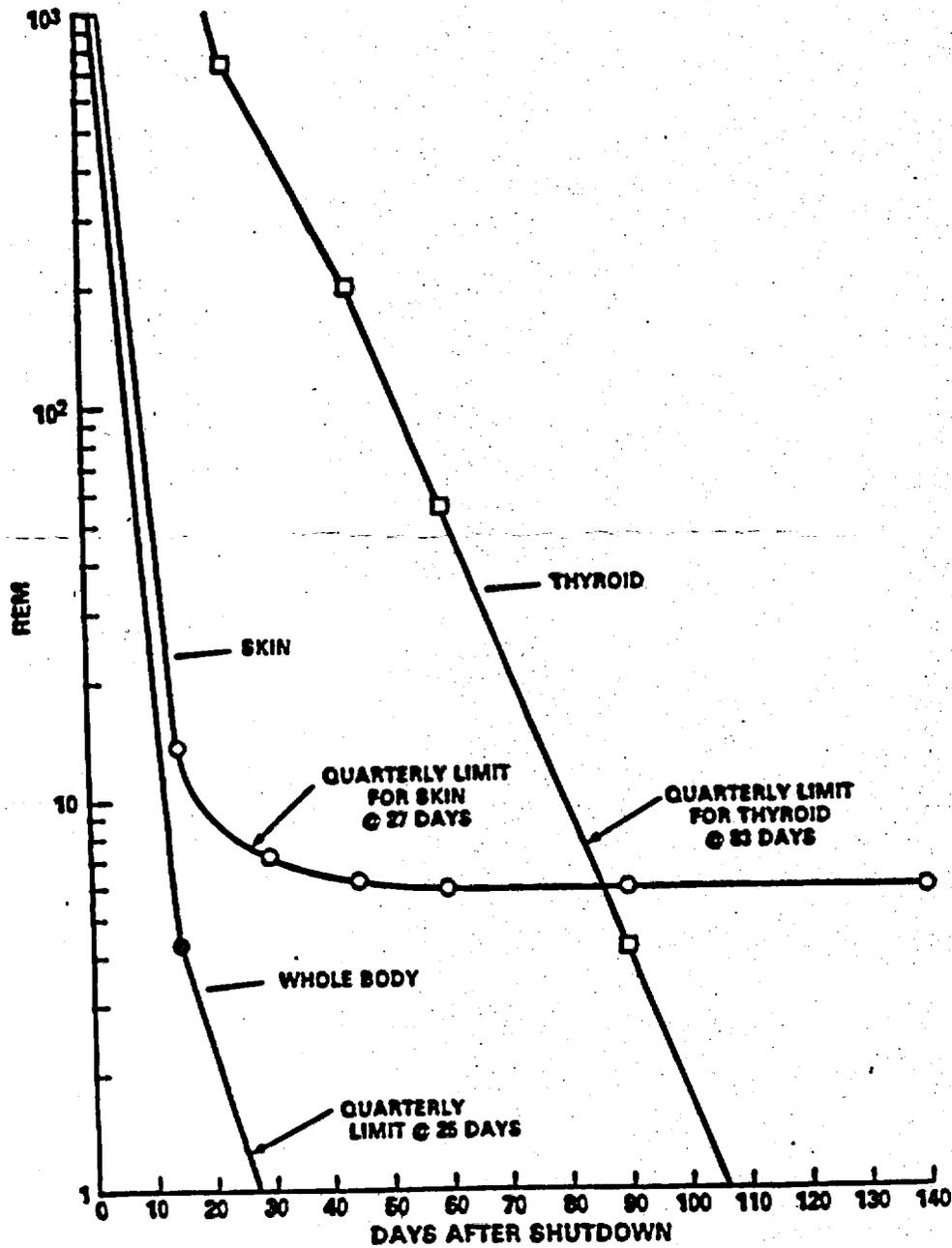


Figure 1

LIST OF RECENTLY ISSUED  
 NRC INFORMATION NOTICES

Information Notice No.	Subject	Date of Issuance	Issued to
88-23, Supp. 2	Potential for Gas Binding of High-Pressure Safety Injection Pumps During a Loss-of-Coolant Accident	1/31/90	All holders of OLS or CPs for PWRs.
90-07	New Information Regarding Insulation Material Performance and Debris Blockage of PWR Containment Sumps	1/30/90	All holders of OLS or CPs for nuclear power reactors.
90-06	Potential for Loss of Shutdown Cooling While at Low Reactor Coolant Levels	1/29/90	All holders of OLS or CPs for nuclear power reactors.
90-05	Inter-System Discharge of Reactor Coolant	1/29/90	All holders of OLS or CPs for nuclear power reactors.
90-04	Cracking of the Upper Shell-to-Transition Cone Girth Welds in Steam Generators	1/26/90	All holders of OLS or CPs for Westinghouse-designed and Combustion Engineering-designed nuclear power reactors.
90-03	Malfunction of Borg-Warner Bolted Bonnet Check Valves Caused by Failure of the Swing Arm	1/23/90	All holders of OLS or CPs for nuclear power reactors.
90-02	Potential Degradation of Secondary Containment	1/22/90	All holders of OLS or CPs for BWRs.
90-01	Importance of Proper Response to Self-Identified Violations by Licensees	1/12/90	All holders of NRC materials licenses.
89-90	Pressurizer Safety Valve Lift Setpoint Shift	12/28/89	All holders of OLS or CPs for PWRs.
89-89	Event Notification Worksheets	12/26/89	All holders of OLS or CPs for nuclear power reactors.

OL = Operating License  
 CP = Construction Permit

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FIRST CLASS MAIL  
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 USNRC  
 PERMIT No G-67

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Attachments:

1. Figure 1, Dose Consequences of a Spent Fuel Drop Accident
  2. List of Recently Issued NRC Information Notices
- \*See Previous Concurrence

*Changes to the final draft were discussed with and agreed to by J Wigginton on 1/26/90.*

RPB:DREP	SC:RPB:DREP	SC:RPB:DREP	DREP	D:DREP	RPB:ARM	C/OGCB:DOEA:NRR
CSHinson*	JEWigginton*	LJCunningham*	LCohen*	FJCongel*	TechEd*	CHBerlinger*
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RPB:DREP	SC:RPB:DREP	SC:RPB:DREP	DREP	D:DREP	RPB:ARM	C/O <sup>RPB</sup> SCB:DOEA:NRR
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01/ /90

DOCUMENT NAME: INFORMATION NOTICE MECK

No specific action or written response is required by this information notice. If you have any questions about this matter, please contact one of the technical contacts listed below or the Regional Administrator of the appropriate regional office.

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Division of Operational Events Assessment  
Office of Nuclear Reactor Regulation

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Attachments: 1. Figure 1  
2. List of Recently Issued NRC Information Notices

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