MAR 2 1 1979

MEMORANDUM FOR: Larry White
Division of Waste Management

FROM: W. Mark Grayson, WM

SUBJECT: REVISION OF 10CFR60 SUBPART B

Here are the revised design criteria which I promised you by March 21, 1979. They are necessarily incomplete as the development of criteria isn't synchronized with the technical support program. Please refer back to my previous memo dated March 5, 1979 for additional comments on structure and specific comments on criteria.

If you have any comments or questions on my previous memo or the revised criteria, don't hesitate to ask for clarification.

W. Mark Grayson
Division of Waste Management

Enclosure: As stated

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Capability to Function Under Expected Environmental Conditions

Structures, systems, and components important to safety should be designed and located to withstand the effects of, and to be compatible with, the environmental conditions associated operational occurrences, accident conditions, maintenance and testing.

Design Bases for Protection Against Natural Phenomena

Repository structures, systems, and components important to safety should be designed to withstand the effects of natural phenomena such as earthquakes, tornadoes, and floods without loss of capability to perform their safety functions to the maximum extent practicable. The design bases for these structures, systems and components should reflect: (i) appropriate consideration of the most severe of natural phenomena that have been historically reported for the site and surrounding area, with sufficient margin for the limited accuracy, quantity, and period of time in which the historical data have been accumulated, (ii) appropriate combinations of the effects of normal and accident conditions with the effects of the natural phenomena and (iii) the importance of the safety functions to be performed.

Nuclear Criticality and Safety Margins

The design of process, handling, storage and disposal systems should include margins of safety for the nuclear criticality parameters associated with those activities or functions that

are commensurate with the uncertainties in (i) the process, handling, storage and disposal conditions for normal operation, anticipated operational occurrences and accident conditions and (ii) the data and methods used in the calculations.

All process, handling, storage, and disposal systems should be designed to be maintained subcritical by virtue of favorable geometry and to assure that no nuclear criticality accident can occur unless at least two unlikely, independent, and concurrent or sequential changes have occurred in the conditions essential to nuclear criticality safety.

Monitoring

(1) Operational phase monitoring: The facility design shall include instrumentation to monitor safety related parameters during normal repository operations, anticipated operational occurrences, and potential accident conditions. These monitoring systems shall be redundant, independent, and testable as appropriate. Operational phase monitoring systems should not adversely affect the long-term containment capabilities of the repository.

(2) Isolational phase monitoring: Monitoring post-decommissioning performance should not be prerequisite to assuring the health and safety of the public. However, to the extent that monitoring and surveillance may be accomplished without compromising the site integrity, means should be provided to permit the monitoring of

state of the repository with regard to its geological containment/ isolation capabilities following decommissioning to the extent permitted by state-of-the-art technology. Any monitoring capabilities provided should not adversely affect the long-term containment capabilities of the repository.

Retrievability of Wastes

Wastes should be emplaced in a manner which permits their retrievability until such time as the Commission grants a license or amends an existing license to permit irretrievable disposal. During the retrievable phase of operations, the integrity of the waste containers should be insured by virtue of the impervious nature of the waste canister or its overpack container, by shields incorporated into the facility design which are designed to protect the integrity of the waste/canister, by some combination thereof, or by some other method or methods which can be shown to permit safe retrieval of the wastes with a minimum chance of contamination. Structures, systems, and components in the facility should be designed to maintain safe access to areas where the wastes have been emplaced to be retrieved as required. The integrity of the excavations in the retrievable storage areas should be ensured by appropriate excavation techniques and support during the retrievable storage phase.

Radioactive Materials Handling Systems

Systems for handling and transporting radioactive wastes should be designed to reduce to the maximum extent practicable the potential for events which could adversely affect: (i) the performance of the waste form to facilitate retrieval; (ii) the performance of the waste form as an engineered barrier to radionuclide migration; or (iii) adversely affect operator health and safety.

Engineered Barriers to Radionuclide Release

In addition to the natural barriers to radionuclide migration which exist at a repository site multiple engineered barriers shall be incorporated into the repository design to: (i) keep radiological releases to ALARA during the operational phase; (ii) maximize the isolational phase performance of the repository system; and (iii) to reduce the uncertainties inherent in predicting repository performance over the time frames for which containment is necessary. These barriers shall be designed, constructed, and located to maximize their performance as barriers to radionculide migration during the isolational phase and to enhance the isolational phase performance of the sites natural barriers.

Structures and Systems Important to Safety

Those apsects of the natural geologic environment or repository design including engineered barriers to waste migration whose failure could increase the probability of or magnitude of radioactive release from the repository shall be considered important to safety.

This determination by the Commission will be based on a conservative analysis of repository performance and will consider the range of environments and conditions that the Commission feels are reasonably likely to exist during the time frames for which containment is necessary.

Inventory Control and Accountability

Provisions shall be implemented to control and provide a record of waste form thermal and radiation characteristics prior to shipment to a Federal repository. An inventory control and accountability system shall be established at the repository to verify waste type with shipping records to preclude acts of sabotage or substitution. Records shall be maintained of these waste characteristics and their location within the repository and shall be maintained for a period specified by the appropriate regulation or license condition.

Excavations and Shafts

(1) The methods used for exploration and excavation shall be selected and controlled to provide reasonable assurance that excavation will neither create substantial additional pathways for radioactive waste migration, nor increase the migration rate through existing pathways.

(2) Shafts shall be designed and constructed to minimize the probability of rock failure and to facilitate their eventual sealing.

Water Control Systems

(1) Engineered systems shall be provided to control surface and ground water movement. These systems shall be designed to: (i) permit safe operation of the repository; (ii) preclude unplanned intrusions of water into the repository; and (iii) to permit inspection and testing as needed to assure reliable operation.

(2) These systems shall be of appropriate capacity and capability to minimize the adverse effects of water intrusion on systems important to safety and waste retrieval operations should this be required by the Commission.

Borehole Seals

(1) Borehole seals shall be designed to: (i) preclude unplanned water intrusions into the repository, (ii) preclude hydraulically connecting aquifers above or below the repository and (iii) to maximize the performance of the borehole seal as an engineered barrier to radionuclide migration from the repository.

(2) Borehole seals shall be of proven design by analysis and testing under in-situ conditions.

(3) Borehole seals shall be designed to facilitate testing and verification of the in-situ seal performance against design bases. This shall be accomplished to the maximum extent practical without jeopardizing the performance of those seals as barriers to radionuclide migration.

Shaft/Aquifer Seals

(1) Shaft to aquifer seals shall be designed to: (i) preclude unplanned water intrusions into the repository; (ii) prevent the creation of additional pathway for radionuclide release by solutioning or other mechanisms; and (iii) be designed to maximize the performance of that seal as an engineered barrier to radionuclide release release from the repository.

(2) Shaft to aquifer seals shall be of proven design by analysis and testing under in-situ conditions.

(3) Shaft to aquifer seals shall be designed to facilitate testing and verification of the in-situ seal performance against design bases. This shall be accomplished to the maximum extent practical without jeoparadizing the performance of those seals as barriers to radionculide migration.

Fire Protection and Explosion Control

Structures, systems, and components important to safety shall be designed and located to minimize the effect of fires and explosions. Noncombustible materials shall be utilized to the maximum extent possible in all underground workings. Equipment utilized in underground workings shall minimize the possibility of fires or explosions. Fire detection and fighting systems of appropriate capacity shall be provided and designed to minimize the adverse effects of fires and explosions to repository structures, systems and components important to safety and to protect the health and safety of the workers.

Site Characterization Methods (To site suitability section)
Methods of site characterization shall be selected to minimize the potential impact they may have on the natural geologic formations radionuclide containment capabilities. Emphasis should be given to site characterization methods which minimize the number of exploratory boreholes which penetrate repository barrier layers or overlying or underlying aquifers.

Separation of Mining and Waste Emplacement Operations
To the maximum extent practicable mining operations and activities should be separated from waste transport and emplacement operations.

Surface Facility, Structures, Systems and Components
(1) Surface facility structures shall be designed and constructed to facilitate their eventual decommissioning by means or methods specified by the appropriate regulation or license condition.

(2) The design of surface facilities for the handling, temporary surface storage, repackaging, overpacking, treatment, or chemical alteration of waste shall satisfy the general design criteria of 10 CFR Part 72 for licensing of Independent Spent Fuel Storage Installations and 10 CFR Part 50, Appendix A, General Design Criteria, as appropriate.

(3) The repository design shall provide for adequate surface storage and degraded waste form handling capability to handle unexpected waste retrieval.

Emergency Capability

Structures, systems, and components important to safety should be designed to assure capability for safe termination of operations and evacuation during an emergency. The design should assure capability for use of onsite facilities and services, and should facilitate the use of available offsite services such as fire and police protection, medical and ambulance service, and other services as may aid in recovery from emergencies.

Radiation Alarm Systems

Radiation alarm systems should be provided to warn facility personnel of significant increases in radiation levels in normally accessible spaces and of excessive radioactivity released in plant effluents. Such systems should be designed with redundancy and with in-situ testing capability.

Utility Services

The design of utility service for systems important to safety should provide for the meeting of safety demands under both normal and abnormal conditions. The design of utility services and distribution systems should include appropriate back-up measures to the extent necessary to maintain the capability of systems important to safety to perform their required safety functions under normal and single failure conditions. Where utility services are essential to the proper functioning of a system or component identified as being important to safety,

the utility service system(s) required should also be identified as being important to safety.