4

DOCKET NUMBER
PROPOSED RULE PR-50
General Design Criteria

COMMENTS ON AEC PROPOSED

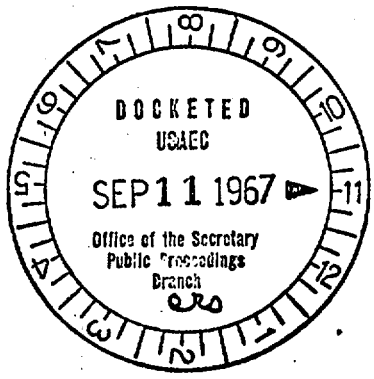
"GENERAL CRITERIA FOR

NUCLEAR POWER PLANT CONSTRUCTION PERMITS"

FEDERAL REGISTER, July 11, 1967

WESTINGHOUSE ATOMIC POWER DIVISIONS

September 8, 1967



C14

I: OVERALL PLANT REQUIREMENTS

CRITERION 1 - QUALITY STANDARDS (Category A)

Those systems and components of reactor facilities which are essential to the prevention or mitigation of the consequences, of nuclear accidents which could cause undue risk to the health and safety of the public shall be identified and then designed, fabricated, and erected to quality standards that reflect the importance of the safety function to be performed. Where generally recognized codes or standards on design, materials, fabrication, and inspection are used, they shall be identified. Where such codes or standards do not apply to assure a quality product in keeping with the safety function, they shall be supplemented or modified as necessary. Quality assurance programs, test procedures, and inspection acceptance levels to be used shall be identified. A showing of applicability of codes, standards, quality assurance programs, test procedures, and inspection acceptance levels used is required. Where such items are not covered by applicable codes and standards, a showing of sufficiency is required.

CRITERION 2 - PERFORMANCE STANDARDS (Category A)

Those systems and components of reactor facilities which are essential to the prevention or to the mitigation of the consequences of nuclear accidents which could cause undue risk to the health and safety of the public shall be designed, fabricated, and erected to performance standards that will enable such systems and components to withstand, without undue risk to the health and safety of the public, the forces that might be imposed by the occurance of an extraordinary natural phenomenon such as earthquake, tornado, flooding condition, wind, or ice. The design bases so established shall reflect: (a) appropriate consideration of the most severe of these natural phenomena that have been recorded for the site and the surrounding area and (b) appropriate margin for withstanding forces greater than those recorded to reflect uncertainties about the historical data and their suitability as a basis for design.

CRITERION 3 - FIRE PROTECTION (Category A)

A reactor facility shall be designed such that the probability of events such as fires and explosions and the potential consequences of such events will not result in the undue risk to the health and safety of the public. Noncombustible and fire resistant materials shall be used wherever necessary to preclude such risk throughout the facility, particularly in areas containing critical portions of the facility such as containment, control room, and components of engineered safety features.

CRITERION 4 - SHARING OF SYSTEMS (Category A)

Reactor facilities may share systems or components if it is shown that such sharing will not result in undue risk to the health and safety of the public.

CRITERION 5 - RECORDS REQUIREMENTS (Category A)

The reactor operator shall be responsible for assuring maintenance records of the design, fabrication, and construction of major components of the plant essential to avoid undue risk to the health and safety of the public, throughout the life of the reactor.

II. PROTECTION BY MULTIPLE FISSION PRODUCT BARRIERS

CRITERION 6 - REACTOR CORE DESIGN (Categories A & B)

A | The reactor core with its related control and protection system shall be designed to function throughout its design lifetime, without exceeding acceptable fuel damage limits. The core design, together with reliable process and decay heat removal systems, shall provide for this capability under all expected conditions of normal operation with appropriate margins for uncertainties and for transient situations which can be anticipated, including the effects of the loss of power to recirculation pumps, tripping out of a turbine generator set, isolation of the reactor from its primary heat sink, and loss of all off-site power. | B

CRITERION 7 - SUPPRESSION OF POWER OSCILLATIONS (Category B)

The design of the reactor core and related control and protection systems, shall ensure that power oscillations which could cause fuel damage in excess of acceptable limits are not possible or can be readily suppressed.

CRITERION 8 - OVERALL POWER COEFFICIENT (Category B)

This criterion should be deleted from the general criteria and treated in the supplementary criteria where adequate definitions for particular reactor types can be incorporated. The general requirement is adequately covered by Criteria 6 and 7.

CRITERION 9 - REACTOR COOLANT PRESSURE BOUNDARY (Category A)

The reactor coolant pressure boundary shall be designed and constructed so as to have a very low probability of gross rupture or abnormal leakage throughout its design lifetime.

CRITERION 10 - REACTOR CONTAINMENT (Category A)

Reactor containment or equivalent protection shall be provided. The containment structure shall be designed (a) to sustain the initial effects of coolant pipe breaks as defined in Criterion No. 37, without loss of required integrity and (b) together with other engineered safety features as may be necessary, to retain for as long as the situation requires the functional capability of the containment to the extent necessary to avoid undue risk to the health and safety of the public.

III. NUCLEAR AND RADIATION CONTROLS

CRITERION 11 - CONTROL ROOM (Category B)

The facility shall be provided with a control room from which actions to maintain safe operational status of the plant can be controlled. Adequate protection from, among other things radiation and fire, shall be provided to permit continued occupancy of the control room, even under any credible post-accident conditions, and access to other areas as necessary to shut down and maintain safe control of the facility without excessive radiation exposures of personnel.

CRITERION 12 - INSTRUMENTATION AND CONTROL SYSTEMS (Category B)

Instrumentation and controls shall be provided as required to monitor and maintain variables essential to avoid undue risk to the health and safety of the public within prescribed operating ranges.

CRITERION 13 - FISSION PROCESS MONITORS AND CONTROLS (Category B)

Means shall be provided for monitoring or otherwise measuring and maintaining control, at a frequency consistent with anticipated rates of change, over the fission process throughout core life and for all conditions that can reasonably be anticipated to cause variations in reactivity of the core, such as indication of position of control rods and periodic chemical analysis of the concentration of soluble reactivity control poisons.

CRITERION 14 - CORE PROTECTION SYSTEMS (Category B)

Core protection systems, together with associated equipment, shall be designed to prevent or to suppress conditions that could result in exceeding acceptable fuel damage limits. The system shall be automatic where such action is necessary to avoid undue risk to the health and safety of the public.

CRITERION 15 - ENGINEERED SAFETY FEATURES PROTECTION SYSTEMS (Category B)

Protection systems shall be provided for sensing accident situations and initiating the operation of necessary engineered safety features.

CRITERION 16 - MONITORING REACTOR COOLANT PRESSURE BOUNDARY (Category B)

Means shall be provided to detect abnormal leakage from the reactor coolant pressure boundary.

CRITERION 17 - MONITORING RADIOACTIVITY RELEASES (Category B)

Means shall be provided for monitoring the containment atmosphere and the facility effluent discharge paths for radioactivity released from normal operations, from anticipated transients, and from accident conditions. An environmental monitoring program shall be maintained to confirm that radioactivity releases to the plant environs have not been excessive.

CRITERION 18 - MONITORING FUEL AND WASTE STORAGE (Category B)

Monitoring and alarm instrumentation shall be provided for fuel and waste storage and handling areas for conditions that might result in loss of decay heat removal capability and to detect excessive radiation levels.

IV. RELIABILITY AND TESTABILITY OF PROTECTION SYSTEMS

CRITERION 19 - PROTECTION SYSTEMS RELIABILITY (Category B)

Protection systems shall be designed to the IEEE Standards for Nuclear Power Plant Protection Systems to provide the high functional reliability and in-service testability necessary to avoid undue risk to the health and safety of the public.

Criteria 20, 21, 22, 23, 24, 25, and 26 are covered by the IEEE Standards aforementioned.

V. REACTIVITY CONTROL

CRITERION 27 - REDUNDANCY OF REACTIVITY CONTROL (Category A)

Two independent reactivity control systems, preferably of different principles, shall be provided.

CRITERION 28 - REACTIVITY HOT SHUTDOWN CAPABILITY (Category A)

The reactivity control systems provided shall be capable of making and holding the core subcritical from any hot standby or hot operating condition, including those resulting from power changes.

CRITERION 29 - REACTIVITY SHUTDOWN CAPABILITY (Category A)

One of the reactivity control systems provided shall be capable of making the core subcritical under any condition (including anticipated operational transients) sufficiently fast to prevent exceeding acceptable fuel damage limits. The shutdown margin should ensure subcriticality with the most reactive control rod fully withdrawn.

CRITERION 30 - REACTIVITY HOLDDOWN CAPABILITY (Category B)

The reactivity control systems provided shall be capable of making and holding the core subcritical under accident conditions in a timely fashion with appropriate margins for contingencies.

CRITERION 31 - REACTIVITY CONTROL SYSTEMS MALFUNCTION (Category B)

The reactor protection systems shall be capable of protecting against any single malfunction of the reactivity control system, such as, unplanned continuous withdrawal (not ejection) of a control rod, by limiting reactivity transients to avoid exceeding acceptable fuel damage limits.

CRITERION 32 - MAXIMUM REACTIVITY WORTH OF CONTROL RODS (Category A)

Limits, which include reasonable margins, shall be placed on the maximum reactivity worth of control rods or elements and on rates at which reactivity can be increased to ensure that the potential effects of a sudden or large change of reactivity cannot (a) rupture the reactor coolant pressure boundary or (b) disrupt the core, its support structures, or other vessel internals to lose capability to cool the core.

VI. REACTOR COOLANT PRESSURE BOUNDARY

CRITERION 33 - REACTOR COOLANT PRESSURE BOUNDARY CAPABILITY (Category A)

The reactor coolant pressure boundary shall be capable of accommodating without rupture, the static and dynamic loads imposed on any boundary component as a result of any inadvertent and sudden release of energy to the coolant. As a design reference, this sudden release shall be taken as that which would result from a sudden reactivity insertion such as rod ejection (unless prevented by positive mechanical means), rod dropout, or cold water addition.

CRITERION 34 - REACTOR COOLANT PRESSURE BOUNDARY RAPID PROPAGATION FAILURE PREVENTION (Category A)

The reactor coolant pressure boundary shall be designed to reduce to an acceptable level the probability of rapidly propagating type failures. Consideration shall be given (a) to the control of service irradiation and temperature effects including operating restrictions where appropriate, (b) to the design and construction of the pressure vessels in accordance with applicable codes and standards including those which establish requirements for energy absorption within the plastic range and by plastic deformation, and (c) to the design and construction of reactor coolant pressure boundary piping and other equipment in accordance with applicable codes and standards.

CRITERION 35 - REACTOR COOLANT PRESSURE BOUNDARY BRITTLE FRACTURE PREVENTION (Category A)

This should be deleted from the general criteria and included in supplementary criteria. Criterion No. 34 covers the general requirements.

CRITERION 36 - REACTOR COOLANT PRESSURE BOUNDARY SURVEILLANCE (Category A)

Reactor coolant pressure boundary components shall have provisions for inspection, testing, and surveillance of critical areas by means appropriate to assess the structural and leakage integrity of the boundary components during their service lifetime. For the reactor vessel, a material surveillance program conforming with ASTM-E-185-66 shall be provided.

VII. ENGINEERED SAFETY FEATURES

CRITERION 37 - ENGINEERED SAFETY FEATURES BASIS FOR DESIGN (Category A)

Engineered safety features shall be provided in the facility to back up the safety provided by the core design, the reactor coolant pressure boundary, and their protection systems. Such engineered safety features shall be designed to cope with any size reactor coolant piping break up to and including the circumferential rupture of any pipe in that boundary assuming unobstructed discharge from both ends.

CRITERION 38 - RELIABILITY AND TESTABILITY OF ENGINEERED SAFETY FEATURES (Category A)

All engineered safety features shall be designed to provide functional reliability and ready testability as is necessary to avoid undue risk to the health and safety of the public.

CRITERION 39 - EMERGENCY POWER FOR ENGINEERED SAFETY FEATURES (Category A)

The plant auxiliary power distribution system shall be provided with an emergency power source under the control of the operator and shall be designed with sufficient redundancy and capacity to permit the functioning of the engineered safety features required to avoid undue risk to the health and safety of the public.

This plant auxiliary power distribution system in combination with the emergency power source, shall provide this capacity with the failure of any single active component.

CRITERION 40 - MISSILE PROTECTION (Category A)

Where plant equipment failures which can produce missiles or other dynamic effects also result in a requirement for engineered safety features to function to avoid undue risk to the health and safety of the public, the design shall provide assurances of proper functioning for those safety features.

CRITERION 41 - ENGINEERED SAFETY FEATURES PERFORMANCE CAPABILITY (Category A)

Engineered safety features such as emergency core coolant and containment heat removal systems shall provide sufficient performance capability to accommodate any single failure of an active component and still function in a manner to avoid undue risk to the health and safety of the public.

CRITERION 42 - ENGINEERED SAFETY FEATURES COMPONENTS CAPABILITY (Category A)

Engineered safety features shall be designed so that the capability of these features to perform their required function is not impaired by the effects of a loss-of-coolant accident to the extent that there would be undue risk to the health and safety of the public.

CRITERION 43 - ACCIDENT AGGRAVATION PREVENTION (Category A)

Any action of the engineered safety features which might accentuate the adverse after-effects of the loss of normal cooling shall be considered in the design, avoided or otherwise appropriately accounted for.

CRITERION 44 - EMERGENCY CORE COOLING SYSTEMS CAPABILITY (Category A)

An emergency core cooling system, with a capability for accomplishing adequate emergency core cooling, shall be provided. Such a core cooling system and the core shall be designed to prevent fuel and clad damage that would interfere with the emergency core cooling function and to limit the clad metal-water reaction to negligible amounts for all sizes of breaks in the reactor coolant piping up to the equivalent of the double-ended rupture of the largest pipe. The performance of the emergency core cooling system shall be evaluated conservatively in each area of uncertainty.

CRITERION 45 - INSPECTION OF EMERGENCY CORE COOLING SYSTEMS (Category A)

Design provisions, where practical, shall be made to facilitate physical inspection of all critical parts of the emergency core cooling system, where the system is interpreted as including elements such as reactor vessel internals and water injection nozzles.

CRITERION 46 - TESTING OF EMERGENCY CORE COOLING SYSTEMS COMPONENTS (Category A)

Design provisions shall be made so that active components of the emergency core cooling system, such as pumps and valves, can be tested periodically for operability and functional performance.

CRITERION 47 - TESTING OF EMERGENCY CORE COOLING SYSTEMS (Category A)

A capability shall be provided to test periodically the operability of the emergency core cooling system up to a location as close to the core as is practical.

CRITERION 48 - TESTING OF OPERATIONAL SEQUENCE OF EMERGENCY CORE COOLING SYSTEMS (Category A)

A means shall be provided to test initially under conditions as close to design and as near the full operational sequence that would bring the emergency core cooling system into action as practical.

CRITERION 49 - CONTAINMENT DESIGN BASIS (Category A)

The containment structure, including access openings and penetrations, and any necessary containment heat removal systems shall be designed so that the leakage of radioactive materials from the containment structure under conditions of the pressure and temperature resulting from the largest credible energy release following a loss-of-coolant accident, which shall include a reasonable margin for effects from metal-water or other chemical reactions that could occur as a consequence of partial failure of emergency core cooling systems will not result in undue risk to the health and safety of the public.

CRITERION 50 - NOT REQUIREMENT FOR CONTAINMENT MATERIAL (Category A)

Selection and use of containment materials shall comply with applicable codes and standards.

CRITERION 51 - REACTOR COOLANT PRESSURE BOUNDARY OUTSIDE CONTAINMENT (Category A)

If part of the reactor coolant pressure boundary is outside the containment, appropriate features, as necessary, shall be provided to avoid undue risk to the health and safety of the public in case of an accidental rupture in that part.

CRITERION 52 - CONTAINMENT HEAT REMOVAL SYSTEMS (Category A)

Where active heat removal systems are needed under accident conditions to prevent exceeding containment design pressure, a system with adequate reliability and capacity, shall be provided.

CRITERION 53 - CONTAINMENT ISOLATION VALVES (Category A)

Penetrations that require closure for the containment isolation function shall be provided with redundant valving and associated apparatus or systems.

CRITERION 54 - INITIAL CONTAINMENT LEAKAGE RATE TESTING (Category A)

Containment shall be designed so that an integrated leakage rate testing can be conducted at the peak calculated accident pressure after completion and installation of all penetrations and the leakage rate measured over a sufficient period of time to verify its conformance with required performance.

CRITERION 55 - CONTAINMENT PERIODIC LEAKAGE RATE TESTING (Category A)

The containment shall be designed so that integrated leakage rate testing can be done periodically at the peak calculated accident pressure during plant lifetime.

CRITERION 56 - PROVISIONS FOR TESTING OF PENETRATIONS (Category A)

Provisions shall be made to the extent practical for testing penetrations which have resilient seals or expansion bellows to permit leaktightness to be demonstrated at the peak calculated accident pressure.

CRITERION 57 - PROVISIONS FOR TESTING OF ISOLATION VALVES (Category A)

Capability shall be provided to the extent practical for testing functional operability of valves and associated apparatus essential to the containment isolation function to determine if failure has occurred and to determine if valve leakage is within acceptable limits during periods of reactor shutdown.

CRITERION 58 - INSPECTION OF CONTAINMENT PRESSURE-REDUCING SYSTEMS (Category A)

Design provisions shall be made to the extent practical to facilitate the periodic physical inspection of all important components of the containment pressure-reducing systems, such as, pumps, valves, spray nozzles, torus, and sumps.

CRITERION 59 - TESTING OF CONTAINMENT PRESSURE-REDUCING SYSTEMS COMPONENTS (Category A)

The containment pressure-reducing systems shall be designed to the extent practical so that active components, such as pumps and valves, can be tested periodically for operability and functional performance.

VIII. FUEL AND WASTE STORAGE SYSTEMS

CRITERION 66 - PREVENTION OF FUEL STORAGE CRITICALITY (Category B)

Criticality in new and spent fuel storage shall be prevented by physical systems or processes. Such means as geometrically safe configuration shall be emphasized over procedural controls.

CRITERION 67 - FUEL AND WASTE STORAGE DECAY HEAT (Category B)

Reliable decay heat removal systems shall be designed to prevent damage to the fuel in storage facilities that could result in radioactivity release that would cause undue risk to the health and safety of the public.

CRITERION 68 - FUEL AND WASTE STORAGE RADIATION SHIELDING (Category B)

Adequate shielding for radiation protection shall be provided in the design of spent fuel and waste storage facilities.

CRITERION 69 - PROTECTION AGAINST RADIOACTIVITY RELEASE FROM SPENT FUEL AND WASTE STORAGE (Category B)

Provisions shall be made in the design of fuel and waste storage to avoid release of radioactivity which would cause undue risk to the health and safety of the public.

IX. PLANT EFFLUENTS

CRITERION 70 - CONTROL OF RELEASES OF RADIOACTIVITY TO THE ENVIRONMENT

(Category B)

The facility design shall include those means necessary to maintain control over the plant radioactive effluents, whether gaseous, liquid, or solid. Appropriate holdup capacity shall be provided for retention of gaseous, liquid, or solid effluents, particularly where unfavorable environmental conditions can be expected to require operational limitations upon the release of radioactive effluents to the environment. In all cases, the design for radioactivity control shall be justified (a) on the basis of 10 CFR 20 requirements for normal operations and for any transient situation that might reasonably be anticipated to occur and (b) on the basis of 10 CFR 100 dosage level guidelines for potential reactor accidents of exceedingly low probability of occurrence.