

paper, hereafter referred to as the Feasibility Study, used the framework described in Attachment 1 to the paper and risk insights from NUREG-1150 and the IPE programs to evaluate the requirements in § 50.44. The Feasibility Study found that combustible gas generated from design-basis accidents was not risk-significant for any containment type, given intrinsic design capabilities or installed mitigative features. The Feasibility Study also concluded that combustible gas generated from severe accidents was not risk significant for: (1) Mark I and II containments, provided that the required inerted atmosphere was maintained; (2) Mark III and ice condenser containments, provided that the required igniter systems were maintained and operational, and (3) large, dry and sub-atmospheric containments because of the large volumes, high failure pressures, and likelihood of random ignition to help prevent the build-up of detonable hydrogen concentrations.

The Feasibility Study did conclude that the above requirements for combustible gas mitigative features were risk-significant and must be retained. Additionally, the Feasibility Study also indicated that some mitigative features may need to be enhanced beyond current requirements. This concern was identified as Generic Safety Issue-189 (GI-189). The resolution of GI-189 will assess the costs and benefits of improvements to safety which can be achieved by enhancing combustible gas control requirements for Mark III and ice condenser containment designs. The resolution of GI-189 is proceeding independently of this rulemaking. In an SRM dated January 19, 2001, the NRC directed the NRC staff to proceed expeditiously with rulemaking on the risk-informed alternative to § 50.44.

In SECY-01-0162, "Staff Plans for Proceeding with the Risk-Informed Alternative to the Standards for Combustible Gas Control Systems in Light-Water-Cooled Power Reactors in 10 CFR 50.44," dated August 23, 2001, the NRC staff recommended a revised approach to the rulemaking effort. This revised approach recognized that risk-informing Part 50, Option 3 was based on a realistic reevaluation of the basis of a regulation and the application of realistic risk analyses to determine the need for and relative value of regulations that address a design-basis issue. The result of this process necessitates a fundamental reevaluation or "rebaselining" of the existing regulation, rather than the development of a voluntary alternative approach to rulemaking. On November 14, 2001, in

response to NRC direction in an SRM dated August 2, 2001, the NRC staff published draft rule language on the NRC Web site for stakeholder review and comment. In an SRM dated December 31, 2001, the NRC directed the staff to proceed with the revision to the existing § 50.44 regulations.

III. Final Action

The NRC is retaining existing requirements for ensuring a mixed atmosphere, inerting Mark I and II containments, and hydrogen control systems capable of accommodating an amount of hydrogen generated from a metal-water reaction involving 75 percent of the fuel cladding surrounding the active fuel region in Mark III and ice condenser containments. The NRC is eliminating the design-basis LOCA hydrogen release from § 50.44 and consolidating the requirements for hydrogen and oxygen monitoring into § 50.44 while relaxing safety classifications and licensee commitments to certain design and qualification criteria. The NRC is also relocating and rewording without materially changing the hydrogen control requirements in § 50.34(f) to § 50.44. The high point vent requirements are being relocated from § 50.44 to a new § 50.46a with a change that eliminates a requirement prohibiting venting the reactor coolant system if it could "aggravate" the challenge to containment.

Substantive issues are addressed in the following sections.

A. Retention of Inerting, BWR Mark III and PWR Ice Condenser Hydrogen Control Systems, Mixed Atmosphere Requirements, and Associated Analysis Requirements

The final rule retains the existing requirement in § 50.44(c)(3)(i) to inert Mark I and II type containments. Given the relatively small volume and large zirconium inventory, these containments, without inerting, would have a high likelihood of failure from hydrogen combustion due to the potentially large concentration of hydrogen that a severe accident could cause. Retaining the requirement maintains the current level of public protection, as discussed in Section 4.3.2 of the Feasibility Study.

The final rule retains the existing requirements in § 50.44(c)(3)(iv), (v), and (vi) that BWRs with Mark III containments and PWRs with ice condenser containments provide a hydrogen control system justified by a suitable program of experiment and analysis. The amount of hydrogen to be considered is that generated from a

metal-water reaction involving 75 percent of the fuel cladding surrounding the active fuel region (excluding the cladding surrounding the plenum volume). The analyses must demonstrate that the structures, systems and components necessary for safe shutdown and maintaining containment integrity will perform their functions during and after exposure to the conditions created by the burning hydrogen. Environmental conditions caused by local detonations of hydrogen must be included, unless such detonations can be shown unlikely to occur. A significant beyond design-basis accident generating significant amounts of hydrogen (on the order of Three Mile Island, Unit 2, accident or a metal water reaction involving 75 percent of the fuel cladding surrounding the active fuel region) would pose a severe threat to the integrity of these containment types in the absence of the installed igniter systems. Section 4.3.3 of the Feasibility Study concluded that hydrogen combustion is not risk-significant, in terms of the framework document's quantitative guidelines, when igniter systems installed to meet § 50.44(c)(3)(iv), (v), and (vi) are available and operable. The NRC retains these requirements. Previously reviewed and approved licensee analyses to meet the existing regulations constitute compliance with this section. The results of these analyses must continue to be documented in the plant's Updated Final Safety Analysis Report in accordance with § 50.71(e).

The final rule also retains the § 50.44(b)(2) requirement that containments for all currently-licensed nuclear power plants ensure a mixed atmosphere. A mixed containment atmosphere prevents local accumulation of combustible or detonable gases that could threaten containment integrity or equipment operating in a local compartment.

B. Elimination of Design-Basis LOCA Hydrogen Release

The final rule removes the existing definition of a design-basis LOCA hydrogen release and eliminates requirements for hydrogen control systems to mitigate such a release at currently-licensed nuclear power plants. The installation of recombiners and/or vent and purge systems previously required by § 50.44(b)(3) was intended to address the limited quantity and rate of hydrogen generation that was postulated from a design-basis LOCA. The NRC finds that this hydrogen release is not risk-significant. This finding is based on the Feasibility Study which found that the design-basis LOCA