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Risk-Reduction Credit for Very Early Warning Fire Detection at Nuclear Power Plants: From FAQ to Fiction

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Abstract

In 2004, the U.S. Nuclear Regulatory Commission (NRC), with support from the commercial nuclear power industry, adopted the 2001 Edition of National Fire Protection Association (NFPA) Standard 805, "Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants," as the means by which commercial nuclear power licensees could comply with Title 10 of the Code of Federal Regulations, Part 50.48(c), to replace deterministic fire protection licensing bases with ones that are risk-informed and performance-based. To facilitate licensee "transitions" to the new licensing bases via NFPA 805, a "Frequently Asked Questions" (FAQs) program, established early during the pilot-plant phase, was expanded to enable use of consensus technical "short-cuts" for fire probabilistic risk assessment (PRA) methods. These "Fire PRA FAQs" enabled licensees, with NRC approval, to bypass more traditional means of establishing acceptable PRA method enhancements on an interim basis, pending eventual confirmation by test programs and/or more detailed analyses. The NRC approved several, of which perhaps the most substantial in providing risk reduction benefits was FAQ 08-0046 on "Incipient Fire Detection Systems," more accurately characterized as "Very Early Warning Fire Detection Systems" (VEWFDSs). Controversial from the start, the hidden story behind this FAQ's initial adoption is relevant to examination of the NRC NUREG report that later replaced it and remains in effect today. This article examines this backstory, tracing recommendations that were proposed and bypassed, then examines alternatives to the current guidance. These alternatives, which maximize possible risk reduction credit for VEWFDSs at nuclear power plants, remain at least a factor of two less than the current peak NUREG-2180 risk-reduction factor even before the latter accounts for the possibility of fire pre-emption altogether.

Keywords: Fire Detection; Early Warning; "Incipient" Fire Stage; Probabilistic Risk Assessment; Reactor Regulation.

1. Introduction

In 2004, the U.S. Nuclear Regulatory Commission (NRC), with support from the commercial nuclear power industry, adopted the 2001 Edition of National Fire Protection Association (NFPA) Standard 805 [1], as the means by which commercial nuclear power licensees could comply with Title 10 of the Code of Federal Regulations, Part 50.48[c], to replace deterministic fire protection licensing bases with ones that are risk-informed and performance-based. To facilitate licensee "transitions" from their existing to the new licensing bases via NFPA 805, a "Frequently Asked Questions" (FAQs) program, established early during the pilot-plant phase, was expanded to enable use of consensus technical "short-cuts" for fire probabilistic risk assessment (PRA) methods in the fire PRAs required to receive approval for transition. These "Fire PRA FAQs" enabled licensees, with NRC approval, to bypass more traditional means of establishing acceptable PRA method enhancements, such as topical reports submitted for NRC review and approval by reactor Owners Groups, on an interim basis, pending eventual confirmation by test programs and/or more detailed

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