



UNITED STATES
NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
WASHINGTON, D. C. 20555

October 18, 1983

Honorable Nunzio J. Palladino
Chairman
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Dr. Palladino:

SUBJECT: NEED FOR RAPID DEPRESSURIZATION CAPABILITY IN NEWER COMBUSTION
ENGINEERING, INC. PLANTS

During its 282nd meeting, October 13-15, 1983, the Advisory Committee on Reactor Safeguards (ACRS) reviewed analyses of the NRC Staff and of a Combustion Engineering Owners Group (CEOG) regarding the need for addition of power operated relief valves (PORVs) to certain nuclear power plants designed by Combustion Engineering, Inc. (CE). This matter had been reviewed previously by a Subcommittee of the ACRS on October 4, 1983, and earlier on January 27, 1983 and March 16, 1982. PORVs are automatic and remotely operable valves installed on the reactor coolant system (RCS) pressurizer in most PWRs. The valves were originally intended to intercept overpressure challenges to code safety valves. These latter valves are prone to failure to automatically reclose tightly following pressure relieving actuation. The PORVs were perceived to be more manageable in this respect in that they can be closed on demand and can be isolated by a block valve.

Analysis and experience have shown RCS pressure to be more easily controlled than had been recognized earlier so that the need for PORVs in avoiding code safety valve actuation is not now believed to be an important consideration. For that reason, CE, in its most recent plant designs, has not included PORVs in the RCS. Their reasoning is that leakage and the potential for spurious actuation of PORVs (creating, in effect, a small or medium break LOCA) are detrimental to both safety and operating efficiency.

However, within the past few years the PORV has come to be seen as offering other advantages. For one, it is a means to rapidly depressurize the RCS when desired, for example, to minimize leakage to the secondary side following failure of a steam generator tube. A second advantage is as a controlled means to remove steam or hot water from the RCS so that cooler water can be injected by the high pressure safety injection (HPSI) pumps. This is the so-called "feed and bleed" cooling process by which heat can be removed from the RCS and hence the reactor core. Because these advantages must be weighed against the disadvantages mentioned above and the cost of installing PORVs, the NRC Staff and CEOG each have made an extensive analysis of the pros and cons.

The NRC Staff has concluded that the CE plants without PORVs meet all regulatory requirements, with some minor exceptions which can be rather easily corrected. Further, they have concluded that these CE plants, which are equipped with reliable, auxiliary pressurizer sprays (APS) can effect moderate rates of depressurization to accommodate certain transients more effectively than can be done in other PWRs which have PORVs, but which do not have APS. The NRC Staff has also analyzed on a probabilistic basis accidents beyond the design basis accidents, including:

- multiple steam generator tube failures,
- total loss of feedwater,
- small break LOCA without HPSI,
- pressurized thermal shock, and
- ATWS.

The NRC Staff has concluded that addition of PORVs could be advantageous in permitting "feed and bleed" heat removal following loss of all feedwater, and that there would be some advantage in having PORVs provide additional pressure relief for ATWS, and in the case of failure of a large number of steam generator tubes. For the other accident sequences, they conclude that PORVs would provide no improvement over existing systems in the CE plants. The NRC Staff's overall cost-benefit analysis concludes there would be a slight advantage in adding PORVs over not adding PORVs. They acknowledge that the advantage is small compared with uncertainty in the analysis. However, the Staff also states it is their judgment that PORVs will provide an additional margin of safety in providing an effective, alternative means for depressurizing the RCS and thus provide greater flexibility in means for emergency core cooling.

Based on this judgment, the NRC Staff has concluded that PORVs should be required to be backfitted to the CE plants in question. However, they have also concluded that implementation of this requirement need not be hurried, and should be integrated with new requirements for decay heat removal systems that evolve from Task Action Plan A-45.

Analysis by the CEOG has produced results similar to those of the NRC Staff. They conclude the plants meet all regulatory requirements with the minor exceptions alluded to above. Their cost-benefit analysis shows a very small disadvantage in adding PORVs. Several differences in assumptions and data used by CEOG and those used by the NRC Staff apparently account for this conclusion, opposite from that of the NRC Staff. These differences have not been resolved. However, as with the cost-benefit analysis by the NRC Staff, the calculated margin is small compared with uncertainties.

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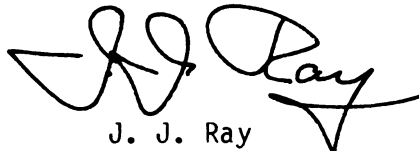
Although the CEQG acknowledges that PORVs could provide an emergency means to depressurize the RCS, they have concluded that depressurization by the APS or by rapid secondary side cooldown is much to be preferred. It is their judgment that PORVs should not be added.

The Committee believes there is so nearly a standoff between costs and benefits that extensive efforts to resolve differences or improve assumptions in the analyses are not warranted. A decision to require or not to require addition of PORVs must hinge on largely nonquantitative judgments.

Under some circumstances there might be significant safety advantage in having available an effective backup means to depressurize the RCS. On the other hand, maintaining integrity of the primary pressure boundary and removing heat through systems designed for that purpose, i.e., the steam generators, is generally preferable, even in emergency situations.

The Committee agrees with the NRC Staff's recommendation to integrate any new requirements for rapid depressurization into the more comprehensive new requirements for improvements to decay heat removal systems expected to be forthcoming from Task Action Plan A-45 within one year. We see no need for earlier resolution of the PORV issue.

Sincerely,

A handwritten signature in black ink, appearing to read "J. J. Ray". The signature is stylized with large, sweeping loops and a long, trailing flourish extending to the right.

J. J. Ray
Chairman