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September 7, 1984

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

Before the Atomic Safety and Licensing Board

In the Matter of CLEVELAND ELECTRIC ILLUMINATING COMPANY, Et Al. (Perry Nuclear Power Plant, Units 1 and 2)	Docket Nos. 50-440 OL 50-441 OL (Operating License)

OCRE BRIEF ON THE HISTORY AND INTENT OF THE ATWS RULE

I. Introduction

On June 26, 1984, the Nuclear Regulatory Commission published in the Federal Register (49 FR 26036) its final rule (10 CFR 50.62) on anticipated transients without scram ("ATWS"). This action directly impacted Issue #6 in this proceeding. Issue #6 states:

> Applicant should install an automated standby liquid control system to mitigate the consequences of an anticipated transient without scram.

New 10 CFR 50.62(c)(4) requires BWRs granted a construction permit after July 26, 1984 that have already been designed and built to include this feature to have an automatic SLCS. Based on this new regulation, Intervenor Ohio Citizens for Responsible Energy ("OCRE") moved for summary disposition of Issue #6 on July 6, 1984 on the basis that Applicants' SLCS has automatic capability. On July 30, 1984 Applicants responded, taking a very narrow interpretation of this provision, claiming that the rule should not apply to PNPP as the SLCS was being designed and built for manual initiation. On August 3, 1984 OCRE filed a response to Applicants' assertions, submitting documents showing that the SLCS design was indeed automatic, and if the SLCS was not being built as such, this reflects Applicants' deliberate actions to thwart compliance with the rule. The Licensing Board then instructed the parties

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to file briefs on the legislative history of the ATWS rule to assist it in deciding the matter.

While Applicants have stated that the Perry SLCS has automatic capability and that this capability can be implemented at low cost, they nonetheless claim that it is not being implemented and thus never should be, based on an extremely literal interpretation of the new rule. The issue here can be distilled to: how does one interpret 10 CFR 50.62 (c)(4) in the case of a BWR CP holder with the SLCS having automatic capability under construction and as yet incomplete, but where the CP holder chooses to build the SLCS with manual initiation for the probable purpose of avoiding compliance with the rule? As is shown below, the only interpretation of the ATWS rule consistent with its stated intent, legislative history, and the Commission's mandate to protect the public health and safety, is that, in the instant case, the Applicants be ordered to automate the SLCS.

II. History of the ATWS Rule

Because the new ATWS rule is a culmination of over a decade of NRC work on the issue, a brief examination of the history of the ATWS issue is necessary to place the rule in the proper context. OCRE would refer the Board to Attachments 1 and 2, taken from a Science Applications, Inc. Technical Report submitted December 31, 1981 in support of the Utility Group petition for rulemaking on ATWS, for ease of chronological reference.

The discussion of ATWS began in 1969 when an ACRS consultant raised the question of the effect of common mode failures on the reactor protection system. Further study by the (then AEC) Staff led the Staff to request analyses of ATWS consequences from reactor designers. After receiving these analyses, the Staff concluded that BWRs needed prompt action to secure reactor shutdown in the event of ATWS (see WASH-1270, p. 4).

In September 1973 the Staff issued WASH-1270, Technical Report on Anticipated Transients Without Scram for Water-Cooled Power Reactors. Therein the Staff concluded that (then unspecified) design improvements should be made to plants then under construction or in operation to make the consequences of ATWS acceptable. This class of reactors was further defined as those with CP applications docketed after 1968 but before October 1, 1976. The Staff's licensing position was that these plants should "incorporate any design changes to assure ATWS consequences are acceptable" (p. 86). The Staff also expressed a goal that the probability of ATWS should be less than 1×10^{-7}/year. It should be noted that Perry was specifically identified in WASH-1270 as one of those plants for which the Staff would require design changes.

In response to WASH-1270, General Electric, the Perry NSSS vendor, issued in October 1974 NEDO-20626, Studies of BWR Designs for Mitigation of Anticipated Transients Without Scram. GE stated that:

> several avenues of establishing satisfactory compliance with the requirements of WASH-1270 were considered. The principle new one here, addition of automatic liquid control initiation, has more quickly approached the stage of a complete evaluation which can be presented at this time. (NEDO-20626, p. 3)

Thus, the concept of automatic SLCS initiation was first advanced by GE as a way of meeting the then rather vague Staff requirements for ATWS mitigation.[1/]

On December 9, 1975, the NRC Staff issued its Status Report on Anticipated Transients Without Scram for General Electric Reactors in response to NEDO-20626. The Staff, while expressing some disagreement as to the evaluation methods and assumptions of GE, did not dispute the adequacy of the concept of automatic SLCS initiation as an ATWS mitigation system. The Staff did question

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1/ See also Attachments 3 and 4, internal NRC Staff memoranda, in which it is plainly stated that GE developed the automatic SLCS design to mitigate ATWS consequences, but that the utilities rejected this safety enhancement. Attachments (next page)

whether the GE-submitted design for automatic SLCS initiation was sufficiently diverse from reactor protection system sensors to avoid common mode failure.

In April 1978 the NRC Staff issued Volumes 1 and 2 of NUREG-0460, Anticipated Transients Without Scram for Light Water Reactors, in response to "substantial criticisms from applicants, reactor vendors, and industry groups, principally to the effect that the Staff requirements are unnecessary, or at best overly conservative" (NUREG-0460, Vol. 1, p. 5)[2/]. The industry also complained of the costs involved in implementing ATWS mitigation designs. NUREG-0460 summarized the Staff's review and evaluation of "all the information currently available on the subject of ATWS" with special emphasis on the criticisms from industry (p. 6). NUREG-0460 is the first time value-impact analyses of ATWS designs were performed by the Staff.

While changing its goal for the probability of ATWS to 1×10^{-6}/reactor year, the Staff proposed to use deterministic rather than probabilistic criteria for ATWS licensing requirements. The Staff envisioned that rulemaking would be initiated to codify ATWS accpetance criteria. The proposed criterion for mitigating systems design required ATWS mitigation systems to be automatically initiated unless it could be demonstrated that an operator would reasonably be expected to take correct and timely action (p. 66). The Staff further stated that "safety systems are generally required to be automatic since limited reliance can be placed upon the ability of an operator to respond quickly and correctly to the multitude of signals and alarms resulting from an abnormal event" (p. 67). Also, the Staff stated that for BWRs "an automatic and therefore

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1/ Continued. 5 and 6 (documents only recently obtained from Applicants) demonstrate that this is the case for PNPP as well. In 1981 Applicants accepted GE's ATWS proposal, which included an automatic SLCS. However, they later rejected this feature in favor of manual SLCS initiation.

2/ These industry critics made frequent reference to WASH-1400, the Reactor Safety Study, and the methodology employed therein in attempts to show that ATWS is not a significant risk in light water reactors. However, WASH-1400 did indicate that ATWS is a dominant contributor to risk in BWRs.

more rapidly actuated [SLCS] of larger capacity would be necessary to reduce heat generation to within the capacity of the standby core cooling system before the core becomes uncovered" (p. 48). The Staff's value-impact analysis indicated that the value of all ATWS modifications greatly outweighed the impacts, especially for the BWR/6. These analyses were based on industry-supplied cost estimates, which the Staff suspected were overestimated. (p. 86-87).

In December 1978 the Staff issued Volume 3 of NUREG-0460. Based on new information, the review of the NRC Regulatory Requirements Review Committee, and the findings of the Lewis Committee (NUREG/CR-0400), the Staff revised its position: "we now believe that a numerical safety objective is not satisfactory for use in regulatory decision making in the manner suggested in the first two volumes of NUREG-0460" (p. 3). The Staff then proposed specific plant modifications to be implemented according to the stage of plant construction or operation so as to obtain an appropriate balance of safety and cost. Four alternatives were proposed for all plants. Two of these alternatives (Alternatives 3 and 4) required automation of the SLCS in BWRs. All nuclear power plants were divided into 4 groups: early operating plants, operating plants, plants under construction, and new plants. Plants under construction were defined as those plants with a CP (received prior to January 1, 1978) but not an operating license; for these plants, Alternative 3 was deemed appropriate. (p. 45).

In March 1980 the Staff issued Volume 4 of NUREG-0460. Here the Staff's requirements became more severe than previous proposals. The three action alternatives (Alternative 1 was a "do nothing" option) became expanded and were labelled Alternatives 2A, 3A, and 4A. Both Alternatives 3A and 4A for BWRs required automation of the SLCS. The Staff intended that all plants other than the early operating plants implement Alternative 4A, the most stringent of the options. Specifically, this alternative called for BWRs to "provide actuation circuitry for the SLCS that is automatic and diverse from the reactor trip system. A two-minute delay may be included to decrease the frequency of expensive false actuations" (p. 21).

On September 4, 1980, SECY-80-409, "Proposed Rulemaking to Amend 10 CFR Part 50 Concerning Anticipated Transient Without Scram (ATWS) Events," was submitted to the Commission by the Staff. In this paper the Staff recommended that a proposed ATWS rule be issued for public comment. The draft proposed rule contained in SECY-80-409 had as its stated goal:

> to require improvements in the design of light water cooled nuclear power plants to reduce the likelihood of failure of the automatic protection system to rapidly shut down the reactor (scram) in the event of operational occurrences expected to occur one or more times during the operating life of a nuclear power unit (anticipated transients) and to mitigate the consequences of such anticipated transients without scram (ATWS) events.

The draft proposed rule further stated:

> The principal benchmark for deciding whether and to what extent nuclear power plants should be modified because of ATWS-related safety concerns is set forth in Section 161i(3) of the Atomic Energy Act. That section grants to the Commission the authority to "prescribe such regulations or orders as it may deem necessary . . . in order to protect health and to minimize danger to life or property." Throughout the history of regulating nuclear reactors, the dual concept of preventing accidents and mitigating their consequences should they occur, i.e., defense in depth, has been used to achieve this objective. Thus, conservative design, construction, and operation of plants are required so that accidents will not happen (i.e., have a low probability of occurrence).
>
> Then, to provide defense in depth, the capability to mitigate their consequences is required for accidents that are postulated to occur even though the design is required to include measures to prevent them. It is within this framework that the NRC has concluded that the probability of ATWS events occurring over the lifetime of light-water-nuclear power plants and the potential magnitude of consequences arising from such events, should they occur, are sufficiently great to warrant the imposition of requirements designed to reduce the probability and consequences of ATWS events.

The text of the actual proposed amendments to 10 CFR 50 required only that licensees submit ATWS evaluation models conforming to specified analytical criteria. The SLCS was not specifically mentioned. However, this approach was supposed to implement what the Staff then called Alternative 2d, which was equivalent to Alternative 4A of Volume 4 of NUREG-0460, according to Appendix D of the SECY paper. Thus it can be inferred that the Staff intended to require automation of the SLCS through their acceptance/rejection of licensee evaluation models.

On November 24, 1981 the NRC published in the Federal Register (46 FR 57521) for comment three proposed rules on ATWS. The stated purpose and basis of the rules was virtually identical to those portions of SECY-80-409 quoted above. The three proposed rules were: (1) the Staff rule, an outgrowth of NUREG-0460; (2) the Hendrie rule, a proposal from former NRC Chairman Joseph Hendrie; and (3) a utility-sponsored petition for rulemaking, PRM-50-29, submitted in September 1980.

The Staff rule required evaluation models very similar to those proposed in SECY-80-409. However, additional Mitigating System Criteria were included which required ATWS mitigating systems to be automatically initiated "unless it can be demonstrated that an operator would have adequate information and would reasonable be expected within the time available to take the proper corrective action" (proposed 10 CFR 50.60(b)(3), 46 FR 57525).

The Hendrie rule proposed a reliability assurance program to detect reliability deficiencies in safety systems important for ATWS prevention or mitigation. It also would have required automation of the SLCS in BWRs. (Proposed 10 CFR 50.60(c)(1)(ii), 46 FR 57531). The rationale of the Hendrie rule can best be conveyed by quoting the passage below from former Chairman Hendrie's June 9, 1981 memorandum to his fellow Commissioners on ATWS:

> My aim in starting afresh was to try an approach with several elements: (a) Fix the obvious ATWS problems in BWR's that make ATWS one of the dominant BWR risk sequences. (b) Make people look carefully at their plants for ATWS-related vulnerabilities and then fix the outliers - and do it on a systems analysis or reliability engineering basis, rather than conducting a probability exercise to show nothing is wrong. (c) Accomplish the above without creating a brave new staff industry of ATWS analysis review and endless argument over design details.

The Utility Proposal, PRM-50-29, did not call for SLCS automation. The modifications proposed in PRM-50-29 were similar to those of Alternative 2 of NUREG-0460. Several of these (e.g., recirculation pump trip and scram discharge volume modifications for BWRs) had already been imposed on licensees by order.

The next substantive (and visible) action on the ATWS rule appears to be the ACRS' July 15, 1983 letter-report on the proposed final ATWS rule (Attachment 7). Therein the ACRS Chairman states that the proposed final rule requires for BWRs that the "SLCS must be capable of automatic initiation for new plants and for other BWR plants that already have the capability to automate this system." (Emphasis added.)

On July 19, 1983 the Staff submitted SECY-83-293 to the Commission. This paper recommended that the Commission approve for publication in the Federal Register the proposed final amendment to 10 CFR 50 regarding ATWS, which is virtually identical to the final rule published on June 26, 1984. SECY-83-293 also contains supplemental material in the form of explanatory comments in the body of the paper, a Regulatory Analysis, and a Task Force Report. Each of these will be examined to illuminate the Commission's intent with regard to SLCS initiation.

The SECY paper itself contains the following statement on SLCS design for BWRs:

> The final rule requires an increased capacity for the SLCS on all BWRs. The petitioner [Utilities, PRM-50-29] has proposed the increased capacity for SLCS only for BWRs that are yet to be constructed. The final rule also requires that SLCS initiation be automatic (in lieu of manual initiation by the operator) for new plants and for other plants that have already been designed to include this feature. Automatic initiation of SLCS was not proposed by the petitioner. The staff believes that the SLCS is sufficiently important to reactor safety to require the increased capacity for both present and future reactors and that it would be cost effective to require automatic initiation of SLCS for future reactors. (SECY-83-293, p. 3, emphasis added.)

The ATWS Task Force performed generic value-impact analyses for GE plants (and those of other vendors) to determine the appropriate course of action for ATWS. The Task Force used cost estimates for ATWS modifications provided by the Utility Group petitioner. For automating the SLCS, this cost estimate was \$23.6 million.[3/] The Task Force also performed probabilistic analyses to determine the degree of risk reduction from the proposed design modifications. The base case probability of ATWS for GE plants (generically) was assumed to be 5.3×10^{-5}/year. This probability is reduced to 1.2×10^{-5}/year by installing the Alternate Rod Insertion system and increasing the SLCS flow to 86 gallons/minute. Automating the SLCS further reduces the probability of ATWS to 2.6×10^{-6}/year. The Task Force states that "automatic SLCS actuation would enable the plant to successfully mitigate an ATWS with no operator intervention other than to establish long term, shutdown cooling." (SECY-83-293, Enclosure D, p. 23) The Task Force concludes that:

> If SLCS were automated and the capacity increased above 86 gpm, the P(ATWS) could be reduced to 2.6×10^{-6} with a sizeable value (\$4.6 million). However, the Utility Group's cost estimates to do this are over twenty million dollars and are dominated by downtime for installation in existing plants and by downtime for a spurious actuation. The value/impact ratio for this generic option is unfavorable. For new plants, however, the value/impact would be close to 1 if a reliable system could be designed that would have a high reliability when challenged and a high reliability against spurious actuations. (Enclosure D, pp. 32-33, emphasis added.)

The Task Force has also summarized its findings as follows:

> For General Electric plants the Task Force recommends Option 1, equivalent to the Utility Proposal for New Plants, which includes a manually initiated 86 gpm standby liquid control system (SLCS) plus an alternate rod injection system to be implemented at operating plants and those under construction. The value impact results of this study are favorable for Option 1. For several plants under construction that have installed an automatically actuated SLCS and for plants that have not yet received a construction permit, the Task

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3/ Table 1 of the Task Force Report (Enclosure D to SECY-83-293) gives a breakdown of the Utility Groups's estimated cost of SLCS initiation: \$3.35 million for design, engineering, and installation; \$10.0 million for downtime for installation; \$5.0 million for spurious trip; \$4.2 million for AFDUC, operation, and maintenance.

Force recommends Generic Option 2, which includes automatic initiation of the SLCS. The value/impact results of Option 2 for new plants is close to 1; however, the Task Force has concluded that for a BWR ATWS the consequences are significant enough to warrant this Option. (Enclosure D, pp. 1-3, emphasis added).

The Regulatory Analysis basically summarizes the Task Force findings.

Its conclusions on automation of the SLCS are:

> Automatic SLCS would appear to be reasonable for new plants from a value/impact standpoint, particularly if one considers the apparent vulnerability of BWRs to ATWS sequences potentially having severe consequences. The staff believes that this system could be designed to greatly minimize the likelihood of spurious actuation, which is by far the biggest contributor to the cost estimations for new plants. (Enclosure C, p. 14)

The following conclusions can be drawn from the legislative history of the ATWS rule:

1. The NRC has found that the risk to the public health and safety is sufficiently great, especially in BWRs, to require design improvements to prevent and to mitigate the consequences of ATWS.
2. Applicants have been on notice since 1973 that such modifications would be required for Perry, and since 1978 that automatic SLCS would likely be one such modification.
3. GE proposed automatic initiation of the SLCS as a way to meet the Staff's requirements in WASH-1270.
4. The Staff has continually viewed automatic SLCS initiation as causing a significant reduction in ATWS risk for BWRs.
5. SLCS automation for all GE plants was rejected as a generic option due to the cost estimate ($23.6 million) for automation given by the Utility Group; however, this option is desirable in those cases where installation costs are minimal.
6. The final ATWS rule as approved by the ACRS called for automation of the SLCS in BWR plants having the capability to automate the system.

III. Discussion

The legislative history of the ATWS rule provides the guidance necessary to interpret the phrase "designed and built" of 10 CFR 50.62(c)(4). There is sufficient ambiguity in the use of such words to indicate that a literal interpretation is improper. The text of SECY-83-293 uses the word "designed" only. The Task Force uses the word "installed." The ACRS used the phrase "having the capability to automate" the SLCS. The controversy can be resolved by examining the cost-effectiveness of automating the SLCS at Perry.

The NRC rejected the <u>generic option</u> of requiring automatic SLCS actuation for <u>all</u> BWRs because the <u>generic</u> costs of automation exceeded $20 million, according to Utility Group estimates. Nearly half of that sum is for downtime for installation. For new plants (and for those in which the SLCS is already installed before commercial operation) this cost is non-existant. Undoubtedly this is the basis for requiring SLCS automation in such plants: the cost is so greatly reduced as to make this important safety improvement (which would reduce the probability of ATWS to near the NUREG-0460 goal) cost effective. By Applicants' own admission, automation of the Perry SLCS would cost $100,000.[4/] Compare this to the $3.35 million for design, engineering, and installation of the automatic SLCS as estimated by the Utility Group. The Perry installation costs are thus far less than those of the new plant considered by the Staff. Clearly, what is meant by "designed and built" is that the plant have the

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4/ It is of dubious legality to consider this figure at all, as it obviously stems from Applicants' decision to reject the original GE design for the automatic SLCS in favor of manual operation. Applicants took the risk, when they decided not to implement Perry's automatic SLCS capability, that this decision might be reversed by rulemaking or adjudication. Indeed, to paraphrase the Supreme Court, Applicants have been on notice that they proceed with SLCS construction at their own risk, and that all funds so spent may go for naught. With eyes open, Applicants willingly accepted that risk, however great. <u>Power Reactor Development Co. v. International Union of Electrical, Radio, and Machine Workers</u>, 367 US 396, 415 (1961) [standing for the principle that consideration by the Commission of a CP holder's investments in the issuance of an OL is prohibited as the applicant made such investments at its own risk].

capability to be automated at low cost (i.e., before commercial operation).

Yet another argument compels the rejection of a literal interpretation of "designed and built". If that phrase is literally interpreted, a CP holder could easily evade compliance with the rule by simply not building the facility with an automated SLCS. As a practical matter, the Commission surely did not intend to create a clever loophole through which BWR CP holders could escape its requirements. Had the Commission wanted to limit SLCS automation to new plants only, it simply would have said so. Certainly the Commission expects some BWR CP holders to automate the SLCS. The continual opposition of the utilities to ATWS modifications is a matter of public record. The Commission has had enough dealings with devious licensees to realize that a strict adherence to a literal wording such as this would create an escape hatch for the disgruntled utility petitioners. A literal interpretation serves only to mock the Commission's intention of decreasing the public risk from ATWS.

IV. Conclusion

Applicants have conceded that the Perry SLCS is capable of being automated at low cost. The only interpretation of 10 CFR 50.62(c)(4) consistent with this fact, the Commission's stated intentions in promulgating the ATWS rule, the history of the ATWS rule and issue, the pleadings in this case, and common sense is that a BWR with automatic SLCS capability be required to use it.

For all of the foregoing reasons, OCRE urges the Licensing Board to order Applicants to automate the Perry SLCS.

Respectfully submitted,

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ATTACHMENT 1

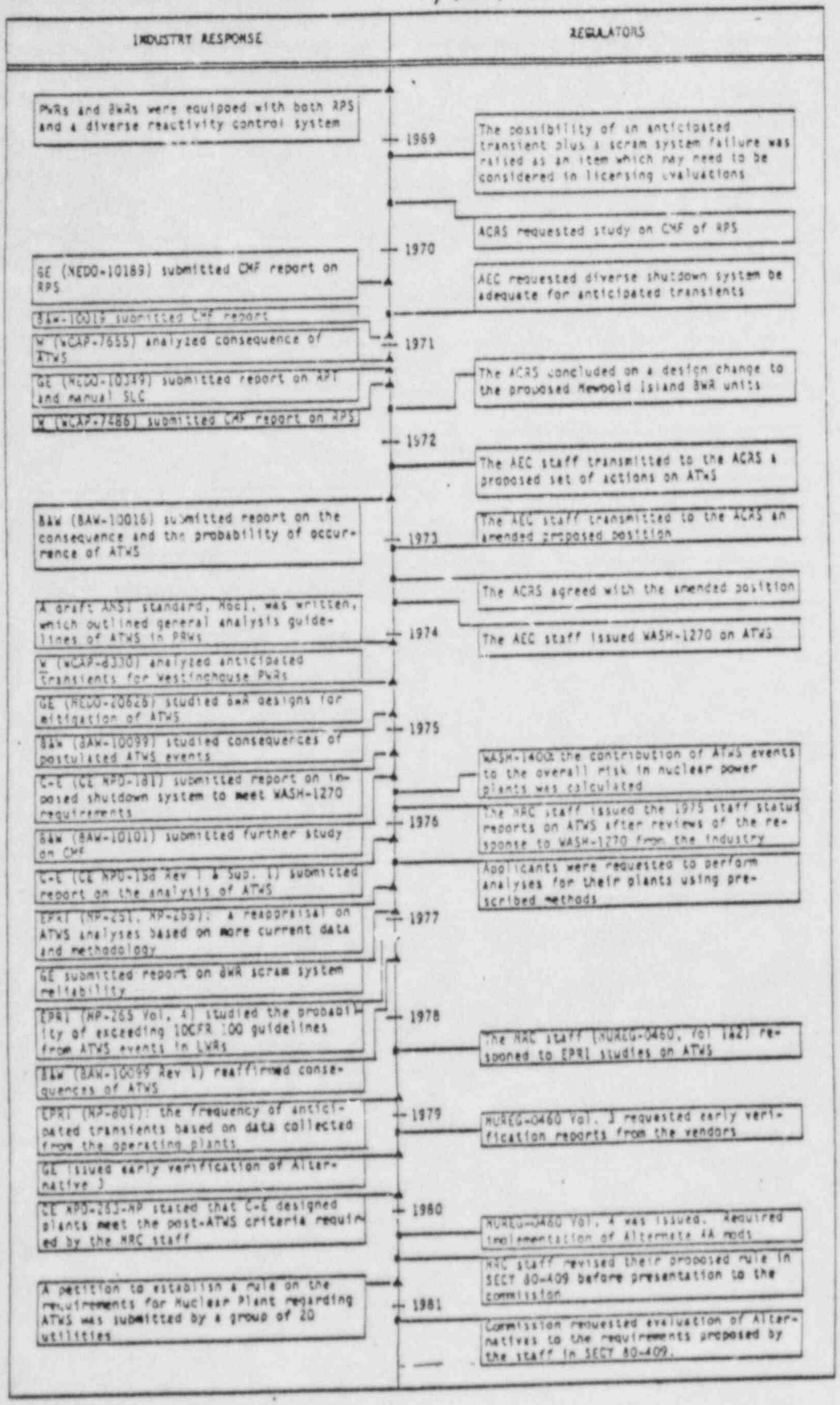

Figure 2.1 Overview Time Line. Historical Sequence of Events Affecting Resolution of the ATWS Issue

ATTACHMENT 2

Table 2.1

HISTORICAL EVENTS SURROUNDING ATWS

Time	Regulators	Industry	Event
Pre-1969			BWRs and PWRs included in design the reactor protection system (RPS) and a diverse reactivity control system to provide safe shutdown.
1969	ACRS		The current discussions of ATWS were initiated by an ACRS statement that the potential for common-mode failure of the scram system should be studied.
July, 1970		GE	GE submitted to the AEC a topical report, NEDO-10189 "An Analysis of Functional Common-Mode Failures in GE BWR Protection and Control Instrumentation", which addressed the potential for common-mode failure.
Sept., 1970	AEC staff ACRS		The AEC staff's preliminary results on ATWS were discussed with the ACRS, and the AEC regulatory requested that the diverse reactivity control system (SLC) be adequate for transient initiation.
Feb., 1971		Westinghouse	WCAP-7555 "Analysis of Anticipated Reactor Transients Without Trip" was published. This dealt with the consequences of an ATWS event, and indicates that in all cases continued core heat removal can be maintained. In certain cases high reactor coolant pressures exist briefly; however, no catastrophic failure of the Reactor Coolant System is likely to occur.
March, 1971		GE	NEDO-10349 "Analysis of Anticipated Transients Without Scram" was submitted by GE to AEC. This report demonstrated that recirculation pump trip (RPT) and manual SLC were adequate to keep BWRs within faulted limits and ultimate capability.
May, 1971		Westinghouse	WCAP-7486 "An Evaluation of Anticipated Operational Transients in Westinghouse Pressurized Water Reactor" was published. This report dealt with the reliability of the reactor protection system with respect to random component failure and systematic or common-mode failures. It was concluded that existing design measures taken in Westinghouse PWR plants give adequate assurance that anticipated transients present no undue risk to public health and safety. Thus, no special provisions were proposed for incorporation in the design to cope with the consequences of the hypothetical case of transients without trip.
Aug., 1971	AEC staff ACRS		The ACRS and the regulatory staff concluded that a design change to the proposed Newbold Island BWR units was appropriate to limit the possible consequences of ATWS.
April, 1972	AEC staff ACRS		The AEC staff transmitted to the ACRS a proposed set of positions and actions to be taken to implement the conclusions of the staff and the ACRS studies on ATWS.

Table 2.1 (Cont.)

Sept., 1972		B & W	BAW-10016 "Analysis of Anticipated Transients Without Trip" was published. This report studied the consequence and the probability of occurrence of ATWS. It was concluded that there is no significant potential for system damage due to such events.
Jan., 1973	AEC staff ACRS		The AEC staff transmitted to the ACRS an amended proposed position on the need of design changes for protection against ATWS.
April, 1973	AEC staff ACRS		The ACRS agreed with the amended position proposed by the AEC staff.
Sept., 1973	AEC staff		WASH-1270 was published. This report considered frequent transient initiators, emergency stress limits and 10CFR100 release limits. Its position on ATWS was (1) Plants with construction permit application docketed from early 1968 to October 1976 are required to provide the capabilities to prevent the occurrence of ATWS, and to mitigate the consequences of ATWS should it occur. (2) Plants with construction permit applications docketed after October 1976 are required to enhance the prevention capability by adding a reactivity shutdown system, independent from the reactor trip system.
1973-1974			After WASH-1270 was issued, reactor manufacturers in conjunction with the staff, began to develop acceptable methods of performing analyses of ATWS events. A draft ANSI standard, N661, was written, which outlined general guidelines for the analysis of ATWS events in PWRs.
Aug., 1974		Westinghouse	WCAP-8330 "Westinghouse Anticipated Transients Without Trip Analysis" was published. Based on previous studies, Westinghouse believed that ATWS should not be assumed to occur at all for design purposes. Nevertheless, anticipated transients were analyzed for Westinghouse PWRs to satisfy the AEC regulatory staff licensing position on ATWS. The results showed that in all cases the DNB ratio is greater than 1.0 and the peak Reactor Coolant System pressure is below the allowable pressure. And the radiological consequences calculated for these postulated events are well within the guideline values set forth in 10CFR100.
Oct., 1974		GE	NEDO-20626 "Studies of BWR Designs for mitigation of ATWS" was published. This report demonstrated that an alternate path to successful shutdown for anticipated transients, as required by WASH-1270, could be achieved by the incorporation of recirculation pump trip (RPT) and automatic boron injection. The standby liquid control (SLC) system would have been unchanged, except for the automatic logic.
Oct., 1974		NSSS vendors	The NSSS vendors submitted reports describing the analysis of ATWS events for their reactor designs.
Dec., 1974		B & W	BAW-10099 "B & W Anticipated Transients Without Scram Analysis" was published. The consequences of postulated ATWS events was studied for nuclear power plants designated in WASH-1270 (Appendix A) as class B. This study also supplements previously submitted analysis in BAW-10016 on plants designated as class C. It is concluded that the consequences of ATWS events are within the acceptable safety limits established for this study and represent no undue risk to the public health and safety.

May, 1975		C-E	CE NPD-181 "ATWS: Improved Shutdown System for ATWS, Class A Plants" was published. This report described an improved reactor shutdown system, with which the ATWS safety objective would be met and all requirements of WASH-1270 would be satisfied.
Aug., 1975		B & W	BAW-10101 "ATWS Program: Common-Mode Failure Analysis of Control Rod Drive Mechanism" was published. This report concluded that a simultaneous mechanical common-mode failure of the trip function in all control rod drive mechanisms (CRDM) is incredible; furthermore, there is no credible mechanical common-mode failure of both trip and powered insertion capability in all CRDMs.
Oct., 1975	NRC staff		WASH-1400 was published. It indicated that: (1) ATWS was not a dominant contributor to risk in a Westinghouse PWR. (2) ATWS may be a dominant contributor to risk in a BWR.
Nov. 1975	NRC staff		The NRC staff proposed in SECY-75-668 and the commission agreed to treat both categories of plants identically as defined in WASH-1270. That is, they were all required to have the capability of prevention and mitigation.
Dec. 1975	NRC staff		The NRC staff's review of responses to WASH-1270 resulted in the issuance of questions and the identification of unresolved issues. These issues could probably have been answered and the ATWS issue, as then defined, could have been resolved had the criteria remained unchanged. Instead, the NRC issued the 1975 staff status reports on ATWS and set forth an additional requirement that the unavailability of the mitigation system, coupled with the frequency of the transient initiation and scram failure demand rate, must meet a 10^{-7}/year frequency of serious consequence. Subsequent discussion revealed that serious consequences were interpreted by the NRC as exceeding the design limits.
May, 1976		C-E	CENPD-158 "Analysis of Anticipated Transients Without Reactor Scram in Combustion Engineering NSSSs" Rev. 1 and its Sup. 1 were published. This study analyzed the transient thermal-hydraulic conditions and radiological release consequences which would occur in power plants employing a Combustion Engineering (C-E) Nuclear Steam Supply System (NSSS) during an ATWS event. Further responses to NRC questions was provided in Sup. 1. And it was concluded that all class B C-E NSSSs can meet all safety criteria.
Mid-1976			Applicants were requested to perform analyses for their plants using the methods developed by the NSSS vendors and modified in the NRC staff status reports issued in December, 1975.
Aug., 1976		EPRI	NP-251 "ATWS: A Reappraisal, Part I. An Examination and Analysis of WASH-1270" was published. This was to upgrade the numerical information presented in WASH-1270 by correcting deficiencies in that document and updating the input data. Two additions were presented in the approach: the use of a demand failure model instead of a time-dependent model for the RPS; and the incorporation of Bayesian inference into the probabilistic treatment of the data.
Aug., 1976		EPRI	NP-265 "ATWS: A Reappraisal, Part II, Evaluation of Societal Risks due to Reactor Protection System Failure" (Vol. 1-3) were published. This was an evaluation for both BWRs and PWRs based on more current data and methodology than used in WASH-1270. Also updated Bayesian estimates of RPS unavailabilities were given.

Table 2.1 (Cont.)

Dec. 1976		GE	The analyses on BWR scram system reliability were performed and documented.
Jan., 1977		EPRI	NP-265 "ATWS: A Reappraisal, Part II. Evaluation of Societal Risks due to Reactor Protection System Failure" (Vol. 4) was published. This document dealt with the probability of exceeding 10CFR100 guidelines from ATWS events in light water reactors. It showed, together with results in other volumes of Part II, that the fractional contribution to the total potential reactor risk due to ATWS is very small (less than 5%), and the probability that an ATWS results in a radiation release exceeding 10CFR100 criteria is on the order of 10^{-7}/year. Therefore, the criteria set up in WASH-1270 had been substantially met and no backfitting or other reactor modifications needed to be considered.
May, 1977		B & W	BAW-10099 Rev. 1 was published. The earlier conclusion on consequences of ATWS was reaffirmed to represent no undue risk to the public health and safety.
April, 1978	NRC staff		NUREG-0460 (Vol. 1, 2) were published. This was NRC staff's response to EPRI studies on ATWS and other related analyses done by the industry. The NRC staff reviewed the information on ATWS that had been developed in the past and evaluated the susceptibility of current nuclear plants to ATWS events using fault tree/event tree analysis techniques as used in WASH-1400. Based on that evaluation, the staff concluded that some corrective measures were required to reduce the risk of severe consequences arising from possible ATWS events. This conclusion was based on the operating experience to date for reactor scram systems. Operating experience was not sufficient to conclusively determine on a statistical basis whether reactor scram systems are reliable enough to make the problem of unacceptable consequences from ATWS events sufficiently small.
July, 1978		EPRI	NP-801 "ATWS: A Reappraisal, Part III. Frequency of Anticipated Transients" was published. This document contains the results of a data collection and analysis task conducted to determine the frequency of those anticipated transients which might require a successful scram.
Dec., 1978	NRC staff		The NRC staff suggested in NUREG-0460 (Vol.3) that plants with construction permits prior to 1/1/78 should implement an automatic SLC system with RPT and an ATWS rod injection scheme.
Jan., 1979	NRC staff		The NRC issued a statement of policy which accepted the recommendation that the use of PRA be avoided for the determination of absolute risk probabilities for subsystems unless an adequate data base exists and it is possible to quantify the uncertainties.

Table 2.1 (Cont.)

Feb., 1979	NRC staff		The NRC staff requested that generic evaluations be performed by the industry to confirm that the modifications specified in NUREG-0460 (Vol. 3) are applicable and would achieve the desired objectives.
1979		GE	As regulated by the NRC staff in NUREG-0460 (Vol. 3), GE issued early verification of Alternative 3 potential capability for the prevention & mitigation of an ATWS event.
Nov., 1979		C-E	The results of ATWS analyses for C-E designed NSSSs, CENPD-263-NP, were published. It was shown that C-E designed plants meet the post-ATWS criteria for reactor coolant system integrity, radiological releases, fuel integrity, containment pressure, and functionability of equipment needed for long term cooling.
March, 1980	NRC staff		NUREG-0460 (Vol. 4) was published by the NRC staff. All plants were required to implement Alternative 4, except a few old plants to be treated on an individual basis. This was to require of all plants the capability to mitigate the severe consequences of an ATWS should it occur.
July, 1980		B & W	BAW-1610 was submitted to the NRC in response to their specific requests on ATWS analyses. This report described a reanalysis of the ATWS events using the most recent NRC guidelines. It was again concluded that in the unlikely instance of an ATWS event, the B & W designed plant can mitigate the consequences of such an event with acceptable results.
Sept. 4, 1980	NRC staff		SECY-80-409 was released by the NRC staff. This document was to address the subject of proposed rulemaking to amend 10CFR50 concerning anticipated transients without scram (ATWS) events. In the staff recommendations: (1) Alternative (2d), i.e. Alternative 4A is for plants receiving their operating license on or after January 1, 1984; (2) Alternative (2b), or 3A, and (2c) are for other plants licensed before January 1, 1984, (3) Alternative (2a), i.e. Alternative 2A, is a plant-specific resolution for a limited number of very early plants.
Sept., 1980		Electric Utility Group	A group of 20 utilities requested the NRC to resolve the ATWS issue according to plant modifications detailed in a petition submitted on September 16, 1980. The major tenets of the petition are: — For existing plants: (1) BWRs: provide the following: (a) Recirculation Pump Trip given an ATWS signal. (b) Independent, redundant, and diverse electrical means to initiate a reactor scram given a signal characteristic of an ATWS. (c) Scram discharge volume modification.

Table 2.1 (Cont.)

			(2) PWRs: Provide the following: (a) Combustion Engineering and Babcock and Wilcox plants shall have an alternate means to shutdown the reactor that is diverse and redundant to the electrical portion of the reactor protection system up to but not including the trip breakers. In addition, automatic initiation of auxiliary feedwater must occur independently of the RPS. (b) Westinghouse plants shall provide automatic initiation of turbine trip and auxiliary feedwater independent of the RPS. -- For new plants: Because of the need to ensure that plant modifications for ATWS are integrated into the plant in a consistent manner with the potential changes, any ATWS modifications for new plants should be determined as part of the degraded core rulemaking process.
Dec., 1980	NRC staff		In a memo from Rowsome to Minogue dated 12/15/80, the following conclusions were stated: -- It appears that the NRC approach to ATWS probabilities is too conservative while the EPRI approach is unduly optimistic. -- Mandating improved prevention and mitigation may reduce the required staff review; however, -- Since it is non-mechanistic,some design or installation flaws may arise. In addition, the staff does not have a good record in the selection of design bases that are intended to envelope broad classes of unanalyzed accident scenarios. In a memo from Minogue, Director of NRR to Chairman John Ahearne, he stated that "EPRI has a valid point in suggesting that the staff is unnecessarily conservative in the treatment of the opportunities to fix or learn from precursors."
Jan., 1981	NRC staff		In a memo from Dircks to the Commissioners, the following alternatives to the rule presented in SECY-80-409 are presented to respond to comments from commissioner Ahearne: -- The requirements for post 1984 plants which had been included in SECY-80-409 could be deleted from the rule. -- The acceptance criteria on primary system stresses could be relaxed to Level D instead of Level C. -- Additional requirements are cited for plants /‹ "high population" sites.

ATTACHMENT 3

A-56

March 14, 1977

ATWS DISTRIBUTION LIST

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B. Weiss
G. Wrobel

8104170106

March 14, 1977

Note to: ATWS Task Force Distribution List

FROM: H. E. P. Krug, Nuclear Engineer, Accident Analysis Branch, DSE

SUBJECT: UPPER BOUND ATWS FIX FOR BWR-6/MARK III INCLUDING DISCUSSION OF ASSOCIATED COMMON MODE FAILURES AND BENEFITS

The text comprises Enclosure 1.

H. Krug, Nuclear Engineer
Accident Analysis Branch
Division of Site Safety and
Environmental Analysis

Enclosure:
As stated

Enclosure 1

insertion

Major Conclusions

For the BWR-6, any modifications needed to mitigate the consequences of a postulated ATWS event should, with respect to negative reactivity ~~interna~~ rates, be limited to modifications to the standby liquid control system (SLCS).

Except for possible minor modifications proposed specifically to reduce the probability of ATWS, the present control rod drive systems should not be modified because of their history of reliable operation. Some of the history of the utilities evaluation of the ATWS threat is briefly summarized in Appendix II.

The probability of inadvertent automatic actuation of the SLCS and its detrimental effects upon the reactor coolant pressure boundary have been excessively pessimistic. In addition, ~~ssss~~ there appears to be no evidence to indicate that the poison cleanup problem has a significant safety significance or intolerable economic impact.

Why ATWS Resolution has been difficult to achieve to date

(Note that the utility industry's past "n[illegible]othing needed" position has been outlined in Appendix II to this note.)

(1) The consequences of ATWS could be major.

(2) Lack of agreement exists with respect to the probabilities associated with ATWS.

(3) Lack of agreement exists as to whether or not additional requirements need to be imposed upon the standby liquid control systems.

(4) Concern over the impact of the loss of offsite power.

(5) Concern that sufficient diversity exists with respect to the initiation of containment isolation systems with respect to ATWS.

(6) Doubt as to whether or not we can ever adequately quantify the risks associated with common mode failure with respect to ATWS (Common mode failure is discussed in Appendix I attached where common mode benefit is also discussed)

II. Proposed ATWS Fixes in BWR-6 which are considered more than adequate to provide additional protection.

Provided that the standby liquid control systems are designed to provide sufficient negative reactivity with respect to time, sufficient evidence exists to conclude that current BWR-6 reactors, with their two diverse and redundant negative reactivity insertion systems, provide sufficient negative reactivity insertion capability against ATWS including taking into account the question of common mode failure.

The use of other soluble poisons or mixtures of soluble poisons should be considered immediately if the information is available, or considered in a development program if it is not; because the impact of alternate soluble poisons on current hardware configurations is likely to be small.

As a result, the ~~pressure~~ presence of the following ATWS fixes, some of which may already be achieved, are proposed as being more than adequate with respect to BWR-6.

(1) Trip of the reactor recirculation pump upon initiation of the ATWS event.

(2) Additional logic for (earlier) automatic initiation of the existing high pressure coolant injection systems (HPCS, RCICS) upon initiation of ATWS.

(3) Automated initiation of the liquid control system should ATWS occur.

(4) Piping, added to supply some of the liquid control flow through the HPCS lines into the vessel.

(5) Sufficiently independent containment isolation systems and signals upon ATWS occurrence.

(6) The addition of a third standby liquid control injection pump with the following features:

(a) 100% capacity

(b) steam driven (perhaps connected to the reactor core isolation cooling system)

(c). different suction and injection points than the electrically driven pumps)

Item 6(might permit one 100% capacity electrically driven pump rather than two 50% capacity pumps. Note that the steam prime mover need not be a turbine; it could be a positive displacement rotary piston pump which would come up to design speed rapidly.

(7) Inclusion of additional soluble poison capacity or substitution of a different soluble poison.

Appendix I

Common Mode Failure and Benefit Discussion

A lucid summary of "common mode failures" is presented beginning on page 3 of WASH-1270. However, there are "common mode benefits" which can be substantial. The basic concern associated with common mode failures is given on the bottom of page 3 of WASH-1270, "One of the difficult aspects of deciding whether or not common mode failures were being adequately accounted for in shutdown system design was that the techniques to analyze a system for common mode failures were not as well-developed as techniques to analyze a system for random failure".

Before addressing common mode influences in reactivity control systems, which is a very complex topic, the following much simpler example clearly illustrates the undesirable aspects of certain common mode failure "fixes" for general aviation (light) aircraft, some of which were identified only by experience. The analogy to a reactor protection system should be clear. This argument is intended to partially support the conclusions presented earlier.

Sample Problem: Decrease the probability of personal injury as a result of forced landings by modifications of light aircraft design.

Basic Fix

One engine on each wing instead of a single engine on the nose.

The pros and cons of the various options associated with this fix are presented in the following tables. The basic concept is that if only one engine becomes inoperative, the second engine will permit sustained flight to an airport or will at least increase the effective glide ratio to permit a forced landing in a more favorable location. The point of the tables is to illustrate that arbitrarily imposed requirements to protect against common mode failures may result in system complexities and additional problems that may substantially eliminate much of the gains originally sought; and, in some instances, eliminate some advantages which already exist.

Twin Engine Design

Option 1 - One Identical Engine on Each Wing

Pro	Con	Con Fix
Remaining Engine either permits sustained height on at least increase glide ratio. Reduction of the probability of propellar induced vertigo.	If improper engine operating and maintenance techniques are used, they will be used in both engines. The pilot may shut down the operating engine by mistake. Restart may not be accomplished before impact. If the pilot permits the aircraft to go below the minimum single engine control speed (Vmc), power on the operating engine will cause a spin to occur which can result in a crash.	(1) Mount both engines on the hull. (2) Reduce power on operating engine until speed greater than Vmc is obtained then reapply full power. This procedure requires a loss of altitude.
Under some circumstances, less immediate danger to personnel as a result of a fire in an engine	Personnel lose the protection of the nose engine against impact. The engires may be closer to the fuel tanks.	Design the rose against impact. Manually actuated fixed engine fire extinguishers combined with operating procedures to stop fuel flow to the burning engine.

Twin Engine Design

Option 2 - One Engine of the same type on each wing but of different manufacture (possibly using two different grades of aviation gas)

Pro	Con	Fix
Reduction in probability of common mode mechanical failure	Pilot technique and maintenance procedures different for each engine. Training requirements increased.	Improved training and more careful independent checks.
Gas comes from different storage tanks at airport	Lower octane fuel cannot be used in engine requiring higher octane fuel but higher can be used in lower. Also, this could lead to pilot error in cross feeding fuel.	Interlock to prevent high octane fuel from being fed to high octane engine. This results in some loss of operating flexibility
	Low octane fuel could accidently be placed in high octane tanks.	More careful refueling procedures.

Appendix II

Problems resulting from the industry perceptions of ATWS

Based on my involvement with industry/vendor meetings on ATWS, I conclude that the vendor's proposed ATWS fixes stems from a policy position of demonstrating the improbability of ATWS. Pragmatic design modifications to substantially improve resitiance to ATWS were considered early on.

GE advised the utilities several years ago that discussions with the staff convinced them that the staff was going to require a reduction in ATWS probability and/or consequences and GE recommended that the provisions of NEDO 20626 (Draft) be proposed to AEC. At first industry seemed inclined to accept the GE proposal even though peeved that the GE proposal was presented to industry less than a month before the utilities were to respond to the AEC concerning the utilities ATWS proposals. As the meeting ended, utility representatives indicated that they thought that an ATWS fix was not necessary and they rejected the GE position. As a result, GE modified its topical on ATWS accordingly. I do not believe that GE, or the utilities have ever pursued ATWS on the basis that our conclusions of ATWS probabilities were well founded. As a result, the proposed fixes appear to have been primarily directed toward the proposal of minimal measures, plus the incorporation of delays, to get the staff to accept a minimum fix, with no modifications at all as their optimum goal.

A-218

ATTACHMENT 4

Distribution:
RSB File
A. Thadani
Thadani chron

FEB 14 1978

NOTE TO: D. Ross

FROM: A. Thadani

SUBJECT: GE PROPOSED ATWS MITIGATION SYSTEM

After listening to GE discuss the Automatic, upgraded standby liquid control system (SBLC) design and performance, I am cautiously optimistic that the proposed system (with some modifications) may well be the most cost/effective acceptable ATWS mitigation system. As a minimum the following concerns have to be resolved:

i) Mixing efficiency
ii) Effects on pumps and pipes
iii) Attaining $\approx 10^{-3}$ unavailability
iv) Seismic qualification
v) Sensitivity to service water temperature
vi) RHR pump failure effects on system performance
vii) Boron effectiveness
iix) Injection locations

All of these concerns would have required resolution for any boron system although the severity of some of the above items increases in the proposed design. In my view the most difficult requirement to meet is the 10^{-3} unavailability criterion.

The potential advantages of this system include not requiring any additional RHR heat exchangers for pool cooling (affects BWR/4s and /5s) and perhaps not requiring any additional high pressure makeup system (affects BWR/4s, /5s, /6s) which was needed to function in the event that HPCI(s) failed. I think we ought to encourage GE to continue development work in this area

Now that we have some additional information which is sort of like "last Thursday's Run," how do we address it or is it even necessary to address it? I think the information is significant enough that some preliminary discussion is warranted. This discussion could be in the Main Report only under Value/Impact to illustrate the potential impact of this type of design. We may even want to quote the preliminary GE cost estimate for the Auto. Boron SBLCS.

Orig. signed by:

Ashok C. Thadani

8104170266

cc: S. Hanauer
R. Mattson
R. Tedesco
T. Novak

OFFICE	DSS:RSB					
SURNAME	AThadani:c					
DATE	02/14/78					

THE [illegible]
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AND KAISER ENGINEERS, INC.

July 2, 1981

ATTACHMENT 5

General Electric Company
1000 Lakeside Avenue
Cleveland, Ohio 44114

Attention: Frank Miotti

RE: Perry Nuclear Power Plant
Units 1 & 2
Anticipated Transients
Without Scram
Quote #149-B

Gentlemen:

In response to your letter dated June 10, 1981, the Owners elect to accept quote 149-B. The clarifications are acceptable. Please incorporate a contract revision to cover ATWS.

Very truly yours,

JCBerman

Jim E. Barron
Purchasing Department

JEB:dms
cc: H.A. Putre
L.O. Beck
File

1778-17

G-2
REV. 8-76

THE CLEVELAND ELECTRIC ILLUMINATING COMPANY

MEMORANDUM

SO/2744

TO D. J. Zupan ROOM S120 FROM H. L. Hrenda DATE September 4, 1981
PHONE 246 ROOM W240
SUBJECT GE Quote No. 149B

Engineering recommends acceptance of GE Quote No. 149B, ATWS Alternate 3A, Design and Equipment.

GE should be requested to provide clarification of the division of responsibility for radiological analyses, per Section 6 and Appendix B of the subject quote.

HLH
HLH/vr

cc: B. L. Barkley - W220
R. P. Jadgchew - W225
H. A. Putre - W240
NDS File - 41.9 SP-M/C41/3.1 MAIN
PO/DC - R290

From 4-13-81 Quote 1495

SCOPE OF WORK FOR

ANTICIPATED TRANSIENTS WITHOUT SCRAM

ALTERNATE 3A

DESIGN AND EQUIPMENT

4/3/81

SECTION 1
INTRODUCTION

This document describes General Electric's proposed scope of work for ATWS Design Work, Project Design Services and supply of ATWS Equipment

a. allow BWR performance to meet acceptanre criteria described in Appendix B including consideration of an ATWS event without ARI;

b. have a reliability objective of 0.96 per demand; ck against proposed req

c. use control-grade equipment; and

d. provide manual operation override to allow an increase in feedwater flow, if needed and available.

2.6 Standby Liquid Control System

The standby liquid control system (SLCS) action is to be initiated automatically on receipt of signals indicating an ATWS event is in progress. Simultaneous operation of both pumps at full capacity (86 gpm total) is required to maintain suppression pool temperatures within specified limits.

The SLCS design will:

a. provide an automatic ATWS injection function for both loops simultaneously;

b. provide a manual ATWS injection function for both loops simultaneously operated only from the Control Room;

c. require replenishment capability of the SLCS tank with mixed sodium pentaborate solution from outside the containment;

d. consider the hydrodynamic pulsation effects of two-pump operation;

e. require automatic SLCS injection through the HPCS lines (BWR/5 and BWR/6) or through the jet pump instrument lines (BWR/4).

f. provide automatic Reactor Water Cleanup System isolation;

g. provide for periodic functional tests of the system in both the manual and the automatic ATWS injection modes;

h. minimize undesired injection of the borated liquid into the vessel by design of the logic and sensors to have a low failure rate;

Unspecified ↗

i. accommodate the containment pressure and temperature environment during the period of needed ATWS operation, and for BWR/6 during any predicted operation of containment spray;

j. meet requirements 1.1 through 1.9 of Appendix A;

k. meet the criteria of Appendix B, in conjunction with other ATWS functions, excluding the ARI;

l. include actuation circuits which have a reliability objective of 0.99 per demand and which are separate from RPS and containment isolation circuits;

CK

m. have a reliability objective for delivering boron at full capacity of 0.95 per demand;

C CK

n. assure that no single active logic component failure can prevent its function; and

Actuation circuitry is equal to mechanical portion per proposed Reg Guide C.2.2.3(2)

172-028

o. use equipment, qualified either by analysis or test, to assure meeting the predicted conditions associated with the ATWS event.

2.7 Containment Ventilation Isolation Valves

To prevent radiological releases to the environs if there are significant fuel failures, the containment ventilation isolation valves are to be closed upon high containment radiation. This isolation logic is to be separate from the RPS.

The containment isolation interface specifications will:

NEW

a. require conformance with Appendix B for the ATWS events given in Appendix C;

b. specify that an electrical failure in the RPS, that could prevent a scram, will not prevent the containment isolation function; and

c. specify that use of circuits and valves, qualified by either analysis or test, to assure meeting the predicted conditions associated with the ATWS event.

2.8 Scram Discharge Volume Modifications

Control rod drive system scram discharge volume modifications will be designed to minimize the potential for common mode failure of the scram function due to drain line failure and thus unavailability of this volume. The design modification will consist of the addition of instrument volume water level sensors to the control rod drive hydraulic system and instrument line piping modifications. The design change will:

E Williams L+A
file L+A
ECC L+A

GENERAL ELECTRIC

NUCLEAR POWER SYSTEMS DIVISION
GENERAL ELECTRIC COMPANY • 175 CURTNER AVENUE • SAN JOSE, CALIFORNIA 95125
MC 399, (408) 925-2755

ATTACHMENT 6

December 29, 1983
PY-GEN/GAI-2002

Responds to: N/A
INFORMATION

Mr. P. B. Gudikunst
Gilbert Associates, Inc.
P.O. Box 1498
Reading, PA 19603

RECEIVED
JAN 5 1984

Dear Mr. Gudikunst:

SUBJECT: ATWS MANUAL SLC INITIATION

Attached is an advanced issued copy of ECN NJ50426 showing changes to Standby Liquid Control elementary 828E234CA. The ECN essentially returns the elementary to Revision 2 except for the trip of the pumps on low tank level and the relocation of pump and valve control from the containment to a local MCC.

Very truly yours,

E. C. Wood for

R. C. Mitchell
Project Manager
Perry Nuclear Power Plant

RCM:rm/A12299

Attachment

cc: J. J. Larsen
W. F. Miotti
P. A. Nichols, w/att.
File: C41

FROM: DOC. CONTROL	DATE: 1-4-84
COPIES TO: ECC	
WDS	Korda
Nichols	Robinson
Salt	
Bloodworth	
Jaquin	
Beck	

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JAN -4 1984
PNPP DOCUMENT CONTROL

ENGINEERING CHANGE NOTICE

NUCLEAR ENERGY BUSINESS OPERATIONS
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SPECIAL INSTRUCTIONS
- ☐ INCORPORATE WITH ISSUE
- ☐ INCORPORATION SIGNOFF REQUIRED 428VF
- ☐ INCORPORATED
- ■ ADVANCE COPIES REQUIRED NO (2)

ECN NO. NJ50426
SHEET 01 OF 1
DATE ISSUED 28 DEC 1983

REASONS FOR CHANGE RESP COMP 707
- ☐ ERROR CORRECTION
- ☐ REQUIREMENT/CONTRACT CHANGE
- ☐ REGULATORY ■ PROJECT/CUSTOMER/AE ☐ ENGRG
- ☐ ASME.IEEE ☐ OTHER-EXPLAIN IN NARRATIVE

DESIGN IMPROVEMENT
- ☐ COST BENEFIT ☐ PERFORMANCE ☐ PRODUCIBILITY

NARRATIVE DESCRIPTION

CUSTOMER REQUESTED REMOVAL OF AUTOMATIC INITIATION FOR SLC SYSTEM.

VERIFICATION STATEMENT

VERIFICATION CONTAINED IN DRF NO. C41-00067 (2)

FDI REQUIRED?	SPARE PARTS AFFECTED?	MR, EI REVISION REQUIRED?	MFG REVIEW REQUIRED?	SAFETY/RELIABILITY ANALYSIS REQUIRED?	CLASSIFICATION OF CHARACTERISTICS AFFECTED?
YES ☐ NO ■	YES ☐ NO ■	YES ☐ NO ■	YES ☐ NO ■	YES ☐ NO ■	YES ☐ NO ■
FDI NO ____ INIT ____	SIGN ____	SIGN ____	INIT ____	INIT ____	INIT ____

MATERIAL/HARDWARE STATUS

PROJECTS	QTY	STATUS	DISPOSITION	EI, MR, PO NO
PERRY 1 & 2	N/A	AT SITE	WORK IMPLEMENTED BY	E.I.
			FDDR KL1-964, REV. 0 &	KL1-964
826E234CA			FDDR KL2-724, REV. 0	KL2-724

COST EFFECT (INCREASE)
- ■ < $1000 TOTAL ALL PROJECTS
- ☐ < $10,000 TOTAL ALL PROJECTS
- DECREASE ☐ > $10,000 TOTAL ALL PROJECTS

ENTER ESTIMATED TOTAL $3000.00

APPROVAL ENDORSEMENTS	COMP	DATE
RESPONSIBLE ENGINEER R. SPOTTS *R. Spotts*	707	11-29-83
MFG		
QC		

COST RESP	ESTIMATED BY	COMP	DATE
☐ NED			
☐ CUSTOMER			
☐ SUPPLIER			
☐ OTHER			

SCHEDULE EFFECT + −
- ____ DAYS ☐ ☐
- ____ WEEKS ☐ ☐
- ____ MTHS ☐ ☐
- NO EFFECT ■

SIGNATURE N/A

JOB # 8Y063/8Y066

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

PDR

July 15, 1983

ATTACHMENT 7

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

SUBJECT: ACRS REPORT ON THE PROPOSED FINAL RULE ON ANTICIPATED TRANSIENTS WITHOUT SCRAM (ATWS)

Dear Dr. Palladino:

During its 279th meeting, July 7-9, 1983, the Advisory Committee on Reactor Safeguards reviewed the proposed Rule on ATWS. A Subcommittee meeting was held with members of the NRC Staff on May 27, 1983. The Committee also had the benefit of the documents listed.

For BWR plants, the Rule requires installation of an alternate rod injection (ARI) system and a standby liquid control system (SLCS) of a specified control capacity. The Rule also requires that the SLCS must be capable of automatic initiation for new plants and for other BWR plants that already have the capability to automate this system. Automatic trip of the recirculation pumps is also specified, although we understand that this feature is already operational on all plants through Commission Order.

PWR plants are required to have equipment diverse from the reactor protection system installed to assure automatic initiation of auxiliary feedwater and of turbine trip. In addition, reactors manufactured by the Babcock & Wilcox Company (B&W) and Combustion Engineering, Incorporated (CE) are required to install a diverse scram actuation system. While not in the current version of the Rule, an amendment will be proposed to require Westinghouse reactors to install a diverse scram actuation system as well.

The NRC Staff is recommending that licensees establish a reliability assurance program for their plants' reactor trip systems. We support efforts to enhance reliability assurance for such critical plant systems; however, we believe a comprehensive program that encompasses all plant safety-related systems would be more effective.

We recommend that instrumentation needed to accomplish safe shutdown of the plant following an ATWS event be qualified to perform acceptably following the high pressure or other environmental effects to which the instrumentation might be exposed during the event. We also recommend that the possible effects of high pressure on the integrity of primary system pump seals and the pressure boundary of instruments or other components not covered by the ASME Boiler and Pressure Vessel Code be explored, and that the NRC Staff assure itself that pump seal or other primary system coolant leakage caused by an ATWS does not significantly increase the likelihood of severe damage to the core.

To further decrease the probability of an ATWS, we recommend that efforts be made by plant operators to decrease the number of transients that challenge the reactor protection system. For example, operating experience has shown that a large portion of plant transients results from malfunctions of the feedwater system. Recent information also indicates that the number of reactor scrams per plant is significantly higher in the U.S. than in certain foreign countries (Japan for example). We recommend an investigation to determine if practical means exist to reduce challenges to the reactor trip system.

We are concerned about the potential for confusion when part of the reactor trip system is safety grade and part is not. Neither the diverse shutdown logic systems required by the Rule nor the heat tracing for boron solution storage systems are safety grade. The same is true for the alarm systems that indicate whether the heat tracers are operative. These matters may warrant further consideration.

The NRC Staff has suggested that an ATWS contribution to core melt frequency of 10^{-5}/reactor year or less would be acceptable. Since the risk to the public from such an accident may vary markedly between PWRs and BWRs, it is not clear that a single core melt probability criterion should be applied uniformly to all LWRs. If a major release of radioactive material from the containment is likely, the criterion of 10^{-5}/reactor year is, at best, marginal for any single cause, such as ATWS, and further reductions in likelihood should be considered. The NRC Staff's estimates of ATWS likelihood are best estimates, with considerable uncertainty, and thus may not reflect a reasonable degree of assurance that the actual risk is as low as it should be. We recommend that considerations of such risk be included, particularly for reactors having high surrounding population densities.

We recommend that designers of new plants give consideration to designs that will reduce reactor trip system challenges as well as enhance reliability. We note that while the Rule requires new BWRs to enhance the capability of the SLCS, it is silent concerning the need for additional mitigating features for PWRs. For example, there is no requirement for additional pressure relieving capability for B&W and CE plants. We disagree with this position and recommend that the NRC require licensees to explore means for enhancing the ATWS mitigative capabilities for new PWR plants.

We support the provision that the schedule for implementation be one negotiated between the licensee and the NRC, but caution that care be exercised to assure the timeliness of the changes required.

We believe that the proposed Rule is an appropriate approach to dealing with the ATWS issue, but recommend that consideration be given to the above comments before a Rule is issued in final form.

The Committee plans a later review of the proposed amendment dealing with the Westinghouse trip system.

Sincerely,

J. J. Ray
Chairman

References:

1. Memorandum from M. L. Ernst, NRC, to R. F. Fraley, ACRS, "Amendments to 10 CFR Part 50 Related to Anticipated Transients Without Scram (ATWS)," dated June 27, 1983.

2. U.S. Nuclear Regulatory Commission, "Generic Implications of ATWS Events at the Salem Nuclear Power Plant," USNRC Report, NUREG-1000, Volume 1, dated April 1983.

3. U.S. Nuclear Regulatory Commission, "Generic Actions for Licensees and Staff in Response to the ATWS Events at Salem Unit 1," USNRC Report, SECY-83-248, dated June 22, 1983.

4. Letter from E. P. Rahe, Jr., Westinghouse Electric Corporation, to H. R. Denton, NRC, Subject: Westinghouse Comments on Proposed Amendment to ATWS Rule, dated June 22, 1983.

CERTIFICATE OF SERVICE

This is to certify that copies of the foregoing were served by deposit in the U.S. Mail, first class, postage prepaid, this 7th day of September, 1984 to those on the service list below.

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