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51FR11494

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June 20, 1986

Secretary of the Commission
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Attn: Docketing and Service Branch

Subject: Federal Register Notices of Proposed Change to 10CFR Regarding Station Blackout (51FR9829) and Regulatory Guide Task No. SI 501-4 (51FR11494)

The subject Notices and the documents to which they refer have been reviewed by several Subcommittees of the AIF Committee on Reactor Licensing and Safety. We appreciate the opportunity to review these proposals and provide below general comments. Additional detailed comments are included in the enclosure to this letter.

Our review of the proposed requirements and their technical basis results in the conclusion that they are not justified. The bases for this conclusion include:

- The public health and safety benefits are significantly exaggerated by the analysis. Inappropriate use of siting source term SST-1 overestimates by at least an order of magnitude the potential radiation exposure to the public which would be prevented by the proposed requirements (see Enclosure, attachment 2);

- The costs of implementing the proposed requirements have been underestimated. In the particular case of the proposed coping studies, the estimated costs appear to reflect only the conduct of a battery capacity evaluation. It is not clear, however, that such an analysis would be sufficient to demonstrate coping, and special effects analyses which could be required could increase coping study costs significantly. Other costs are underpredicted by factors of two to three (see Enclosure, attachment 3);

- Station Blackout has been found not to be a generic issue. Station blackout risk is plant specific and, according to the staff's own analyses, the proposal requirements are expected to result in modifications at no more than a few facilities, if at any. Requiring all licensees to undertake extensive analyses under the provisions of the proposed rules when only a small group of plants may have a need for remedial action is not appropriate;



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- The assertions of extensive station blackout coping capability at foreign (notably European) nuclear power plants are not sufficiently substantiated to serve as even part of the basis for the proposed requirements. The allusion to changes made at these plants to increase blackout coping is not substantiated in the record of this rulemaking. Based on information in the record, it is not clear that European plants are substantially more "blackout proof" than the current population of US Reactors (See Enclosure, attachment 4); and

- Other considerations presently under review by the NRC make it premature to impose the proposed requirements at this time. Specifically, the results of NRC and industry reevaluations of accident source terms would so significantly reduce the calculated benefit from the proposed changes as to make them unfeasible. Revised source term assumptions are expected to be ready for regulatory use in the near future, perhaps before the proposed requirements would be ready to promulgate in final form (see Enclosure, attachment 2).

We note that the Nuclear Utility Management and Resource Committee (NUMARC) has also performed an assessment of the subject proposal and intends separately to submit detailed comments. We endorse these comments. Further, we note that NUMARC intends to implement an initiative to improve the reliability of emergency AC power sources and to identify and address perceived station blackout vulnerabilities. This initiative encompasses those elements which can be implemented at all facilities to reduce any risk from station blackout and further obviates the need for the proposed requirements.

Additional detailed comments are provided in the enclosure.

The proposed station blackout rules are the first technical rules relating to nuclear power plant design and operation to be proposed since the revised Backfit Rule, 10CFR50.109, became effective. The Backfit Rule provides a framework for considering such proposals and establishes certain standards which must be met in NRC's supporting analyses. A "Backfit Analysis" was published concurrently with the subject proposal. We have reviewed the subject proposal in the context of the Backfit Rule.

he firmly believe that the Backfit Rule provides a long-needed framework for assessing the need for and the justification of new requirements. With this conviction, we were somewhat dismayed by the analysis accompanying these rules which, because of its structure, is somewhat inscrutable. The analysis is principally a loose fabric of references to other documents (e.g., NUREG-1109), which in turn often direct attention to further references to other documents (e.g., NUREG-1032). Thus it is often difficult to determine the precise basis for the conclusion presented. It is our opinion that future backfit analyses should be significantly more self-contained, and should avoid the use of non-specific references entirely. Further comments on the station blackout backfit analysis are contained in the enclosure.

Based on the above comments, and the detailed comments in the enclosure, we believe the proposed regulatory requirements to resolve USI A-44 have not been adequately justified under the Backfit Rule. We further believe that any generic rule would be inappropriate as a resolution of this issue. Therefore, the proposed requirements should not be imposed. We encourage NRC's consideration of these comments in developing its final position.

Sincerely,

Murray R Edelman

Murray Edelman, Chairman
Committee on Reactor
Licensing and Safety

ME/jlc

cc: Chairman Palladino
Commissioner Roberts
Commissioner Asselstine
Commissioner Bernthal
Commissioner Zech
Victor Stello, Jr.
Rules and Procedures Branch, DRR, ADM, USNRC

# Detailed Comments Regarding Proposed Requirements to Resolve USI A-44, Station Blackout

Our review of the proposed regulatory requirements to resolve USI A-44, and the backfit analysis supporting them, results in a conclusion that the proposed requirements have not been adequately justified. We further conclude, based on the nature of this issue, that it is unlikely that any generic requirements can be justified. Our conclusions are based on:

- Deficiencies in the backfit analysis and its technical basis which, taken together, indicate that the required "substantial increase in overall protection" has not been demonstrated;
- Deficiencies in the estimates of benefits and costs associated with the proposed requirements;
- Evaluation of the technical basis for the proposed requirements which demonstrates that the issue is non-generic; and
- The unbounded nature of the proposed coping study requirements.

Comments related to each of these areas are enumerated below. Questions raised by the Commission and individual Commissioners are also addressed in the comments below. In addition, since the station blackout backfit analysis is the first such analysis related to rulemaking, we provide comments intended to improve its usefulness as a precedent for future such actions.

The attachments to this enclosure provide more detailed information in support of specific comments as referenced below.

1. It has not been demonstrated that a "substantial increase in overall protection" would be realized by the proposed requirements:

   a. The NRC Staff has proposed no standard by which to conclude that substantial additional protection will be realized. The backfit analysis concludes that radiological benefits would be realized at a value-impact ratio of 2000 man-rem per $1,000,000. The backfit analysis further concludes that imposition of the proposed requirements is justified. Although no

standard is explicitly stated, the form of the overall value-impact ratio calculated implies a comparison to the standard of $1,000 per person rem in the provisional safety goals policy statement. As discussed elsewhere in these comments, we conclude that the staff has overstated the radiological benefit and underestimated the costs. As a result, we conclude that the provisional safety goal standard has not been met, and that the requirements have not been demonstrated to be justified.

b. Commissioners Roberts and Zech, in their additional comments question whether station blackout is a small percentage of the overall risk, or perhaps a major component of an already small risk. As noted above, the staff's analysis shows that the risk is highly non-uniform. At most plants, it is our conclusion that the overall risk is low and that station blackout is a small contributor. At some plants, station blackout may be a more dominant sequence although the total risk could still be low. The Backfit Rule appropriately places the burden on the Staff to demonstrate that the risk in such instances is such that it must be reduced by specific actions. That demonstration has not yet been made.

c. By letter dated October 15, 1985, the Nuclear Utility Group on Station Blackout (NUGSBO) submitted to NRC technical comments regarding NUREG 1032, "Evaluation of Station Blackout Accidents at Nuclear Power Plants, Technical Findings Related to Unresolved Safety Issue A-44". These comments questioned apparent overstatements of risk. Although the Statements of Consideration accompanying the proposed rules refer to NUREG-1032 as the technical findings of the staff's study of the station blackout issue, and thus as their basis for concluding that a substantial increase in protection will be realized, there has been no public response by the staff to the NUGSBO critique. (The evaluation of NUGSBO work included in SECY-85-163A addresses an earlier proposal to resolve USI A-44, and does not address the group's comments on NUREG-1032). The Staff should be required to publicly respond to detailed criticisms of its technical work before that work is relied upon as the basis for new requirements. We recommend that the NUGSBO comments be addressed formally, e.g., as a supplement to NUREG-1032.

d. The analysis does not define the AC loads which are important in a station blackout and thus apparently misses the point that they are significantly less than the loads which must be accommodated in the event of a design basis loss of coolant accident (LOCA). This is

particularly important in the case of two unit sites having three diesel generators, apparently representing some of the plants perceived to be most at risk. The Staff's analysis assumes that 2 of these 3 diesels would be required to accept load to assure safety in a blackout situation. In fact, proper load management procedures could so significantly reduce required ac power that one diesel could handle the loads or, at a minimum, greatly extend the time available to recover other sources of ac power. Proper consideration of this factor would decrease the number of plants perceived to be at risk and thus the level of increase in protection to be realized.

e. It is not clear to what extent credit is granted for the ability to manually start a diesel generator. Most diesel generator "failure" data reflects the ability of diesels to accept load in very short periods, on the order of seconds, following an automatic start. These requirements, again, are related to LOCAs. In the case of station blackout, much more time would be available to manually recover a diesel. Thermal inertia within the reactor systems can accomodate decay heat for some period. The Staff's own analysis acknowledges a minimum period of two hours coping capability at any nuclear power plant. This provides a significant period in which operator actions to restore AC power could be taken, including manual recovery of a "failed" diesel, and these actions should be credited. So doing would also reduce the perceived level of risk and the degree of increased protection which could be gained.

2. The regulatory analysis referenced in the backfit analysis is flawed:

a. We conclude that the benefits which would result from implementation of the proposed requirements are overestimated in the Staff's backfit analysis. The basis for this conclusion is discussed in Attachment 2.

b. Attachment 3 discusses the Staff's cost estimates and concludes that these are underestimated. This conclusion is reached despite the conservative assumption that costs for a coping study have been accurately estimated. If the costs for potential special effects analyses are considered, the total cost estimate would exceed that presented in this analysis by an even greater margin.

c. Paragraph 3.1.4 of the proposed Regulatory Guide states, in part, "[t]he design adequacy and capability of equipment needed to function in environmental conditions associated with a station blackout should be evaluated."

This should not be difficult for equipment qualified for harsh environments in accordance with 10CFR50.49. Much equipment, however, is located such that pipe break accidents (the concern underlying 50.49) do not subject it to a harsh environment. Equipment located in such mild environments was not encompassed under 50.49, but could be affected to varying degrees by the loss of ventilation which would be a consequence of a station blackout. Experience gained in implementing 10CFR50.49 has shown that the costs of demonstrating equipment qualification is very high. These costs include analyses and tests. In many cases, in fact, costs of demonstrating qualification were found to be prohibitive and equipment was instead replaced. These costs are not considered in NUREG-1109.

d. The regulatory analysis indicates that the value-impact ratio would be improved by consideration of the on-site costs which would be predicted to be saved by averting core-damaging accidents through implementing the proposed requirements (averted on-site costs). We note that the Commissioners addressed the question of whether to base actions on consideration of averted on-site costs in their decision to publish provisional safety goals in 1983 (see NUREG-0880 Rev.1, Section IX). Absent further action by the Commission, present NRC policy appears to be to place no reliance on averted on-site costs in justifying new requirements.

3. The Station Blackout Issue is not Generic:

a. NUREG-1109, "Regulatory Analysis for the Resolution of Unresolved Safety Issue A-44, Station Blackout," reports that only 10 to 15 of 67 reactors considered in the analysis could be expected to require improvements in diesel generator reliability or modifications to increase coping capability. The remaining plants, a significant majority, are expected to require only a coping analysis and improved procedures. Thus, the staff's analysis acknowledges that all but a few operating plants are believed to already incorporate the capability to cope with a blackout for the durations which would be required by the proposed rule. Thus, it is inappropriate to require all licensees to take specific actions in response to this issue. The staff should, instead, utilize other means to further assess those plants having perceived vulnerabilities and/or to require actions at these facilities. The requirements of the Backfit Rule would apply to these plant-specific actions.

b. A generic analysis can be expected to significantly overestimate the cost/benefit for some plants and

similarly underestimate the result for other plants when vulnerabilities are not uniformly distributed, as is the case here. In other words, the cost-benefit analysis is inaccurate for most of the plants to which it is generically applied, and use of a generic analysis is thus inappropriate. It follows that a generic cost-benefit analysis should only be used when there is a relatively small deviation in probable costs and benefits among the plants included in the analysis. This test should be applied before a single generic cost-benefit analysis is used to justify a backfit. If the application fails the test, as it would in this case, plant-specific cost-benefit analyses or separate analyses of groups of plants which are sufficiently similar should be considered.

This should not be construed to be questioning the use of cost-benefit analyses in relation to backfits. It is merely intended to recognize the limitations of such analyses and that their applicability should be examined on a case basis.

4. The Required Coping Study is Not Bounded

a. There is no specification in the rule or its accompanying Regulatory Guide which defines what must be demonstrated to show that a plant can "cope" with a station blackout. It is conceivable that this demonstration could range from simply showing that a means of providing cooling water to remove decay heat is available, to assuring that instrumentation utilized under routine conditions to monitor plant status continues to be available, or to proving that no conditions in the plant will exceed nominal values. Our evaluation of the cost estimates in NUREG-1109 (See Attachment 3) is premised on a coping study which is principally a battery load evaluation. Our cost estimate for performing such an evaluation is consistent with NUREG-1109's estimates for a coping study. There are references elsewhere, however, to possible special effects analyses regarding issues such as environmental qualification of equipment (see Comment 2.c above). This open-ended possibility of a need for special effects analyses raises parallels to the situation which resulted from promulgation of 10CFR50.48 and Appendix R, which also originally contemplated relatively modest analyses. Special effects analyses could significantly increase the resource burden for conducting coping studies beyond the levels predicted in NUREG-1109.

b. It is not appropriate to require the majority of plants with a low risk of injury to the public from station

blackout to spend resources on a coping study. The study itself provides no benefit. NUREG-1109 predicts a significant reduction in core melt probability at all plants, but any such improvement results solely from revised procedures and training, and not from the study. Revisions to procedures to maximize the extent to which DC power supplies can be conserved under station blackout conditions, and to assure that other actions which might be appropriate under such conditions will be taken, can be accomplished without a coping study. This is precisely the type of improvement which will result from the NUMARC initiative regarding this issue irrespective of the outcome of this rulemaking.

5. The additional comments by the Commission, included in the Statements of Consideration accompanying the proposed rule, question the need to make any modifications required "safety grade". As noted above, it is our conclusion that the proposed requirements have not been justified, and should not be imposed. Thus, questions of necessary safety classification are moot in this case.

6. The separate views of Commissioner Asselstine suggest that the proposed requirements do not go far enough. The basis for this conclusion is a comparsion with perceived practice in European nuclear power plants. European practices have not, however, been explained sufficiently within the record of this rulemaking to conclude that they are better than or even significantly different from those in the U.S. In particular, it is not apparent that even the French plants, cited specifically by Commissioner Asselstine, can "cope" with a station blackout for extended periods because of the lack of definition for "coping" (see comment 4.a above). This subject is discussed further in Attachment 4.

7. The backfit analysis prepared for the station blackout rulemaking requires improvements to serve as a precedent for future rulemakings:

   a. While we recognize that there will be disagreements between the Staff and industry on specific technical issues, we believe that the Staff has an obligation to address comments concerning the technical bases for new requirements. In the present instance, the Staff has not addressed the technical comments regarding NUREG-1032 submitted by NUGSBO (see comment 1.c above). We, and the Commission through enactment of the backfit rule, recognize that poorly justified rules may not improve safety and could result in unnecessary backfits. For future rules, the Commission should insist that all legitimate comments regarding technical basis documents be addressed before the documents are relied upon in backfit analyses.

b. The station blackout backfit analysis presents a discussion of the nine factors in 10CFR50.109.(c) in a straightforward manner. However, the discussion of individual factors refers to other documents (e.g., NUREG-1109 or NUREG-1032), which often refer to additional documents (e.g., various NUREG/CR documents relied upon in NUREG-1032). In many cases, these references are not specific; they refer to documents by title only, and not to specific sections or pages within the documents. This makes it difficult to follow the logic of the analysis, and thus tends to make it inscrutable. We suggest that future backfit analyses be organized to more completely address, in a self-contained manner, the nine factors. Where references must be used, they should be keyed to specific sections, chapters, or pages in the supporting documents.

c. The backfit analysis addresses several of the nine factors in 10CFR50.109.(c) in a cursory manner. In particular, potential occupational radiation exposure and the expected burden on NRC have not been seriously assessed. It is recognized that the importance of these factors to an ultimate decision to impose new requirements will vary depending on the issue under consideration, and that they may not be of vital importance in this instance. Failure to adequately assess these impacts, however, does not provide the decisionmaker with an accurate understanding of their relative importance. Cursory treatment also provides an appearance of lack of diligence in conducting and reporting the backfit analysis. The treatment of each of the nine factors is critiqued individually in Attachment 1.

Additional information is provided in the attachments which discuss:

Attachment 1 - Critique of the Backfit Analysis.

Attachment 2 - Review of the Stated Benefits of the Proposed Requirements.

Attachment 3 - Review of the Cost Estimates of the Proposed Requirements.

Attachment 4 - Comments on European Practices Regarding Blackout.

# Critique of the Backfit Analysis

In September 1985, the revised Backfit Rule, 10CFR50.109(c) was published. The final rule specified that rulemaking should be subject to the backfitting requirements. The Commission majority concluded that "the Commission should fully understand the effects of a proposed backfit before its imposition". Section 50.109(c), ennumerates nine factors which must be considered by the Staff in its analysis. The backfit analysis supporting the proposed station blackout requirements was published along with the proposed rules. We conclude that the analysis is flawed as discussed below.

Paragraph 50.109(a)(3) states, "The Commission shall require the backfitting of a facility only when it determines, based on the analysis described in paragraph (c) of this section, that there is a substantial increase in the overall protection of the public health and safety". Based on the Staff's statements regarding expected actions at individual plants and their overall cost estimate of $40 million, it is apparent that they do not expect to find many sites which can not presently cope with a station blackout. NUREG-1109 estimates the total costs for most reactors, on an individual basis, to be $225,000, most of which is the cost of a coping analysis. We interpret this to mean that installed equipment is expected to remain the same, having been proven by the coping analysis to be adequate. Given this interpretation, it is difficult to support a conclusion that a "substantial increase in overall protection" would be realized at most facilities by imposing the proposed requirements.

The backfit analysis is addressed point-by-point in the following paragraphs. Headings correspond to the nine factors required by 10CFR50.109(c). This critique is intended to identify discrepancies which should be resolved before a decision to impose the requirements under consideration and, by example, to identify the degree of completeness we believe should be the norm for future backfit analyses.

## Item c1 - Statement of the Specific Objective

The Staff has described the perceived problem, but has not adequately described the objective. This relates to the need to demonstrate a "substantial increase" in protection as discussed above. Additionally, a cost-benefit ratio was calculated but no standard was specified.

## Item c2 - General Description of Activity Required by Licensees

The Staff has outlined much of the information that they would require for a coping study. The required study is not precisely

bounded, however (See comment 2 of the Enclosure to this letter). Furthermore, the Supplementary Information strongly suggests that safety grade equipment must be used for modifications and the Draft Regulatory Guide implies that equipment must be environmentally qualified. These types of related issues made addressing Appendix R and the constantly "moving target" of requirements, reinterpretations, and compliance inspections difficult at best and frustrating to licensees, the Staff, and the Commissioners. The vague manner in which these proposed actions are described does not reflect the discipline that the revised Backfit rule was to produce.

Item c3 - Potential Change in Risk to the Public

We believe the analysis fails to establish a sufficiently grounded basis to determine public risk reduction. Benefits are acknowledged to be non-uniform and very plant-specific. The use of SST-1 source terms significantly overstates risk and thus potential risk reduction. This is discussed further in Attachment 2.

Item c4 - Potential Impact on Radiological Exposure of Facility Employees

The analysis indicates no increase in occupational exposure is expected because equipment additions and modifications contemplated do not require work in and around the reactor coolant system. This argument is not well founded. Radiation exposure is received in work at nuclear power stations which does not involve work "in and around the reactor coolant system". It is not expected that occupational exposure resulting from the proposed rule would be high enough to be a dominant factor in decisionmaking, but it would not be zero.

Item c5 - Installation and Continuing Costs Associated with the Backfit

The costs of complying with the rule appear to be underestimated. The estimated cost for a coping study is perhaps sufficient to accomplish a battery load evaluation. That estimate is, however, likely well below the amount that would be expended if additional special effects analyses or demonstration of environmental qualification of all equipment is involved (See item c2 above). Even assuming that a battery load analysis would be adequate to fulfill the requirement for a coping study, total costs are still underestimated as discussed in Attachment 3.

The analysis does not address potential delays in construction for Near Term Operating License plants. In fact, the manner in which the proposed rule would be implemented at NTOLs is not discussed

in the rule itself. Obviously, if any rule were to be adopted, NTOL's should have the same period to comply as other plants. If, somehow, it were concluded that compliance with the new requirements must be demonstrated before licensing, delays could result for some facilities. The costs of such a delay at one NTOL could easily exceed the total estimated costs for implementing the rule at 67 reactors.

Item c6 - Potential Safety Impact of Changes in Plant or Operational Complexity Including the Relationship to Proposed and Existing Regulatory Requirements

The analysis states that the proposed rule "should not add to plant or operational complexity". This statement would apply only to the plants at which no modifications are expected. Changes to a plant to increase its ability to cope would necessarily increase complexity, albeit only slightly. The conclusion in the backfit analysis reflects not that such an impact is known to be small, but rather that it has not been considered.

The discussion of the relationship to other requirements addresses other generic issues which are under ongoing review. We believe, however, that this element was included in the backfit analysis requirements, in large part, so that a logical priority could be established for implementing requirements. As such, it should not be limited to issues specifically affecting the same plant systems, but should include related regulatory changes. In this instance, the most important shortcoming of the analysis discussion is the omission of the effect of source term changes, including estimated time of containment failure. If the resolution to the source term question is near at hand, as we believe, a logical approach would have been to defer the station blackout evaluation until its effects were known. In fact, as discussed in Attachment 2, new source term information obviates the need for the proposed station blackout requirements.

Item c7 - Estimated Resource Burden on NRC

The estimate of 120 NRC man-hours per plant is questionable. This level of effort is perhaps sufficient to account for project manager attention to assuring that licensees meet their obligations and to preparing correspondence (the rule would require NRC to prepare at least one letter to each licensee, informing of concurrence or disagreement with the determination of required blackout duration). It appears inadequate to account for technical review and evaluation of the determination of maximun coping capability and of the description of station procedures which the rule would require each licensee to submit. Comparison to the resources required for review of fire hazards analyses required by 10CFR50.48 and Appendix R would be informative. The estimate would also appear to include

no allowance for inspection efforts to verify compliance, particularly if they are to include team efforts such as used for other issues (again fire protection provides a relevant example).

Item c8 - Potential Impact of Differences in Facility Type, Design, or Age on the Relevancy and Practicality of the Proposed Backfit

As noted elsewhere in these comments, the risk from station blackout is expected to be highly non-uniform as a result of precisely the kind of design differences which should be considered under this factor. The backfit analysis essentially states that the rule has been constructed such that licensees will be able to account for the differences. This appears to be an unwarranted shifting of the Staff's burden onto the licensees. Additionally, the effect of plant age is not addressed other than to assume, generically, that 25 years remain in an individual plant lifetime (for purposes of estimating benefits and costs in NUREG-1109). In fact, some facilities have little more than a decade remaining before expiration of their licenses. Performing detailed analyses and implementing any hardware modifications which may be found to be necessary could well take several years, based on past experience. For some facilities, therefore, only a limited amount of time would remain to actually realize any benefit from the changes. If an issue is such that age is immaterial as to whether a backfit should be imposed, that fact should be explicitly stated.

Item c9 - Whether the Backfit is Final or Interim

To the extent that station blackout is a separate issue, the proposal is a final resolution. On the other hand, USI A-45, Shutdown Decay Heat Removal Requirements, is addressing all potential causes for inability to remove decay heat, of which lack of ac power is inherently a subset. Any new requirements resulting from A-45, therefore, have a potential for affecting the need for the proposed A-44 requirements, and thus makes them interim in nature. NUREG-1109 discusses this interrelationship and indicates that the resolution of the two issues is being coordinated. Considering that resolution of A-45 is expected in the relatively near term, we conclude it would be more appropriate to defer implementation of any requirements for station blackout, assuming any could be justified, until the requirements which result from the A-45 program, if any, are known. We note that the discussion in NUREG-1109, although germane, is not referred to in the backfit analysis; this is another example of why we believe that future backfit analyses should be more self-contained.

# Review of the Stated Benefits of the Proposed Requirements

## STATEMENT OF PROBLEM

The consequences for a station blackout incident used in the value-impact analysis in NUREG-1109 are based on the following assumptions:

The siting source term SST-1 fission product release was used to represent this event.

The SST-1 source term was reduced by a factor of three to account for the differences between the station blackout event sequence and that reflected by the SST-1 source term. In particular, containment failure is not predicted to occur for several hours for this event, barring recovery, whereas the SST-1 source term is representative of a prompt containment failure.

The consequences of the event were taken from NUREG/CR-2723, with a reduction by a factor of five to account for the differences in the distance to which consequences are calculated. The NUREG/CR-2723 consequences were calculated for a distance of 350 miles whereas Enclosure 1 of NRR Office Letter No. 16 specifies the use of a 50 mile distance for regulatory analyses of safety issues.

## EVALUATION OF SOURCE TERM METHODOLOGY

The methodology used in the calculation of the consequences of station blackout, while consistent with current NRC policy and procedures, is quite outdated. New source term information, which has been available for several years, would lead to the prediction of much lower consequences for this event. The NRC is presently in the process of updating their policy and procedures to specify the use of this new source term information.

The NRC Regulatory Improvements Branch, Division of Safety Review and Oversight, has prepared a detailed implementation plan for the regulatory use of new source term information. This was discussed at the February 24, 1986 meeting of the ACRS Subcommittee on Class 9 Accidents. Of particular relevance, a revision to NRR Office Letter No. 16 with respect to the use of source terms in safety issue evaluation is scheduled for February, 1987. The major issue preventing the immediate revision of this document was stated to be the completion of NUREG-1150, which is presently scheduled for issuance in the summer of 1986.

The NRC has published a major draft report, NUREG-0956 "Reassessment of the Technical Basis for Estimating Source Terms", in which several major conclusions are stated, including:

Conclusion 1 — "The BMI-2104 suite of computer codes represents a major advance in technology and can be used to replace the Reactor Safety Study methods."

Conclusion 8 — "Source terms were found to be depend strongly on plant design and construction details, thus making development of generic source terms difficult."

Conclusion 10 — "A comparative appraisal for the Surry plant using the Reactor Safety Study accident frequencies, source terms based on BMI-2104 results, and a preliminary reevaluation of the containment shows a reduction in estimated risk compared to the Reactor Safety Study."

The conclusions stated in draft NUREG-0956 are also accompanied by several recommendations, including:

Recommendation 1 — "The new source term analytical methods should be used to reevaluate regulatory practices that are based on Reactor Safety Study methods.... Improvements are so significant that utilization of the new methods is warranted while additional confirmatory research is being completed." (emphasis added)

SOURCE TERM ANALYSIS

The source terms presented in draft NUREG-0956 for the Surry plant for the TMLB' sequence (station blackout) with late containment failure due to overpressure are significantly lower than those in the Reactor Safety Study, as shown in Table 1. (Late failure due to overpressure is the most likely containment failure mode for such a sequence). Also included in Table 1 are release estimates for the TMLB' sequence for the Seabrook plant which were developed during the review of the Seabrook Probabilistic Safety Study, and reported in NUREG/CR-4540, February, 1986. These latter estimates are not based on detailed analyses using the NRC recommended code suite; they are based on extrapolation of previous results to the Seabrook evaluation. Additionally, the results of the IDCOR reference plant analyses for the Zion, Sequoyah, and Peach Bottom plants are included in Table 1. These analyses are based on a MAAP code analysis and are reported in IDCOR Reports 23.1Z, 23.1S, and 23.1PB respectively. Table 2 presents the same information in terms of the fraction of SST-1 values for each species.

## EVALUATION OF CONSEQUENCE METHODOLOGY

The consequence methodology is based on the CRAC-2 computer code, which is the industry standard for calculation of consequences. The methodology used in this particular application interpolates consequence analysis results for 350 miles, as reported in NUREG/CR-2723 to a distance of 50 miles. The estimates were reduced by a factor of five to account for the reduction in distance for consequence calculations. There is no apparent reason to believe that this is not a fair estimate of a generic site consequence evaluation for an average site with a 50 mile consequence radius. However, the use of an average site consequence is questioned since there are a few highly populated sites which would heavily weight the average, and the risk from station blackout has been acknowledged to be non-uniformly distributed across the population of nuclear power plants.

## CONCLUSIONS

The consequence values in NUREG-1109 do not reflect current knowledge of fission product source term behavior for severe accidents. The NRC has advised that a plan for implementation of new source term information into the regulatory process is underway, with an expected completion date of February, 1987. Assuming they could otherwise be justified, implementation of any requirements resulting from resolution of USI A-44 should be deferred until the results of the source term research can be taken into account. This conclusion is supported by the fact that the consequences used in the value-impact analysis of NUREG-1109 would be reduced by an additional factor of approximately 10 or more, thereby rendering any of the alternatives UNFEASIBLE. The factor of 10 is obtained by comparing the results of the recent analyses of station blackout to the NUREG-1109 source term as shown in tables 1 and 2. These recent analyses indicate that the release fractions for station blackout, for the fission product release categories which are dominant contributors to offsite consequences (iodine, cesiums, and telluriums), are overestimated in the NUREG-1109 report.

The Staff's analyses should be reperformed, untilizing the best information presently at hand, before being relied upon as the basis for justifying new requirements.

Table 1
Fission Product Releases for the TMLB' Event
(all values are fraction of core inventory)

| STUDY | Noble Gas | Iodine | Cesium | Tellurium | Barium | Ruthenium | Lanthanum |
|---|---|---|---|---|---|---|---|
| SST-1 | 1.0 | 4.5-1 | 6.7-1 | 6.4-1 | 7.0-2 | 5.0-2 | 9.0-3 |
| RSS (PWR2) | 9.0-1 | 7.0-1 | 5.0-1 | 3.0-1 | 6.0-2 | 2.0-2 | 4.0-3 |
| NUREG 0956 | 1.0 | 7.8-3 | 3.9-4 | 8.5-2 | 1.8-2 | 3.3-6 | 8.1-5 |
| NUREG/CR 4540 | 1.0 | 2.4-2 | 2.4-2 | 3.0-2 | 2.6-3 | 2.3-3 | 3.9-4 |
| IDCOR Zion | 1.0 | 1.7-3 | 1.7-3 | 2.0-5 | 1.0-5 | 1.0-5 | 1.0-5* |
| IDCOR Sequoyah | 1.0 | 5.1-4 | 6.4-4 | 2.6-5 | 1.0-5 | 1.0-5 | 1.0-5* |
| IDCOR Peach Bottom (TQVW) | 1.0 | 5.0-2 | 5.0-2 | 6.0-2 | 8.0-5 | 1.0-4 | 1.0-5* |

*Based on independent calculations performed in support of IDCOR task 23 rather than integrated MAAP analysis.

Table 2

Fission Product releases for the TMLB' Event

(all values are fraction SST-1 source term)

| STUDY | Noble Gas | Iodine | Cesium | Tellurium | Barium | Ruthenium | Lanthanum |
|---|---|---|---|---|---|---|---|
| SST-1 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| RSS (PWR 2) | 0.90 | 1.55 | 0.75 | 0.47 | 0.86 | 0.40 | 0.44 |
| NUREG-0956 | 1.0 | 0.017 | 0.00058 | 0.13 | 0.26 | 0.000066 | 0.44 |
| NUREG-4540 | 1.0 | 0.053 | 0.036 | 0.047 | 0.037 | 0.046 | 0.043 |
| IDCOR Zion | 1.0 | 0.0038 | 0.0025 | 0.000031 | 0.00014 | 0.00020 | 0.00011 |
| IDCOR Sequoyah | 1.0 | 0.0011 | 0.00096 | 0.000040 | 0.00014 | 0.00020 | 0.00011 |
| IDCOR Peach Bottom (TQVW) | 1.0 | 0.11 | 0.075 | 0.094 | 0.0011 | 0.00200 | 0.00011 |

## Review of the Cost Estimates of the Proposed Requirements

The Subcommittee on Cost-Impact generated cost estimates independently to compare to those presented in Table 6 of NUREG-1109. To accomplish this, certain assumptions had to be made regarding workscope or the nature of modifications which might be required. Since specific changes are not incorporated in the proposed requirements, the conclusions drawn from this effort are necessarily quite general and subject to large uncertainties. Specific assumptions and/or conclusions regarding individual elements of this evaluation are summarized below.

The overall conclusion is presented in Table 3, which contrasts our estimates to those of the NUREG. We conclude that the cost of complying with the proposed requirements have been underestimated by nearly a factor of 2 assuming, conservatively, that coping study costs have been correctly estimated by NRC.

As discussed elsewhere in these comments, we are concerned that the effort involved in a coping study could expand greatly as a result of special effects analyses which may be interpreted to be a required part of the study's scope. Experience with previous regulations involving unbounded analyses subject to NRC review (e.g., Appendix R) leads us to conclude that coping study costs could be significantly more than estimated. This would not only increase the total industry impact, but more importantly would increase the burden on every nuclear power plant licensee regardless of the present ability of their facility to accommodate a station blackout event. This would further decrease the plant-specific cost-benefit justification for the majority of facilities which appear to present little risk from station blackout.

### DISCUSSION

1. Coping Study

   - The evaluation of the coping study costs was based on a definition of scope for conduct of a battery load analysis provided within NUREG/CR-3840 and the proposed regulatory guide. Excluded from consideration were component performance analyses or proof tests for operating conditions beyond the equipment's original design criteria, (e.g., performance proof test at degraded voltage levels). Also excluded from consideration were possible special effects analyses. Should such tests and analyses be required to meet coping criteria, the costs could be expected to escalate significantly; perhaps by as much as 5 to 20 times the best estimated values described in this evaluation.

- Our evaluation indicates that the costs for conducting a coping study could range from as little as $40,000 to as much as $250,000. Our best estimate of the cost per reactor is $140,000 which closely approximates the NRC value of $150,000

- We conclude that the NRC best estimate figure of $150,000 per reactor is reasonable given the assumed limitation on scope described above. It is not clear, however, that this limitation accurately reflects the desired coping analysis.

2. Procedures/Training

- Our evaluation indicated a likely cost ranging from $50,000 to as much $200,000 to complete the required procedure development and training. Our expected best estimate value of $90,000 includes both training and procedure development and assumes no credit for procedures which may currently be in place. From our investigations, we conclude that many utilities currently have procedures describing load management practices during loss of AC scenarios. It would not be unreasonable, therefore, to assume that the average cost across the plant population may actually be lower than the expected value provided here. These costs do not include, however, extensive technical defense of the adequacy of procedures in support of a technical NRC review.

3. Improved Diesel Generator Reliability

- Our estimate of the cost to conduct a "reliability investigation" closely approximates the NRC value of $100,000 per reactor.

- The cost estimates for equipment modifications which may alter fuel systems, electronic, sequencing, and/or other equipment, are based on some general assumptions regarding these modifications. Equipment modifications are expected to be complex, and there is a great deal of uncertainty as to the benefit in improved reliability for any of the assumed changes.

- Our evaluation indicates that some modifications might be incorporated for as little as $150,000 as suggested by the NRC. However, it is expected that these costs are more likely to fall in the range $1 - 1.5 million for the majority of the reactors requiring these improvements.

- Our expected value of $1 million per reactor for diesel generator reliability improvements includes both the cost of modifications, as well as the initial reliability investigation. However, specifically excluded are replacement power costs which may be incurred to effect requalification of the diesel generator.

4. Increased Blackout Coping Capability with Plant Modifications

- Due to the lack of design detail associated with the potential modification to station batteries, condensate storage, and/or instrument air systems, we chose to revisit NUREG/CR-3840, "Cost Analysis for Potential Modifications to Enhance the Ability of a Nuclear Plant to Endure Station Blackout". This NUREG provides some detail of the NRC's initial estimates in this regard and is purported to result in expected costs similar to those provided within the NUREG-1109 analysis.

- Our earlier evaluation of NUREG/CR-3840 provided evidence that the proposed modification costs were significantly underestimated (refer to letter from Murray Edelman to the Executive Director for Operations dated November 30, 1984). At that time, we expressed concern that the Dodge Manual for building construction pricing and the R.S. Means Mechanical and Electrical Cost Data Handbook, both used by NRC, were inappropriate sources/references for estimating costs for nuclear power plant construction. The unit rates provided therein for installation are significantly understated as compared to actual nuclear industry experience. The industry provided evidence that the unit prices for installation of mechanical/electrical components, in general, were two to five times lower than what could be expected in nuclear plant construction/modification. In addition, material cost data from these sources has historically been 25% to as much as 125% lower than material pricing experiences for nuclear applications. In a handbook for cost estimating published in October 1984 (NUREG/CR-3971), the NRC adopts the Energy Economic Data Base as a reference source for unit pricing. We believe the methods described within this handbook (NUREG/CR-3971), provide a much more reasonable basis for estimating the cost impact of potential modifications.

- Our evaluation indicates that as a result of the factors discussed above, the NRC best estimate value of $1 million per reactor underestimates by a factor of 2 to 3 the cost which a utility can expect to incur in effecting proposed modifications.

Table 3

COMPARISON OF COST ESTIMATES FOR COMPLIANCE WITH PROPOSED RESOLUTION TO USI A-44

| Modification | # of Reactors Considered | NRC Best Estimate ($000) Per Reactor | NRC Best Estimate ($000) Population | AIF Best Estimate ($000) Per Reactor | AIF Best Estimate ($000) Population |
|---|---|---|---|---|---|
| 1. Coping Study | 67 | 150 | 10,000 | 150 | 10,000 |
| 2. Procedures/ Training | 67 | 75 | 5,000 | 90 | 6,000 |
| 3. Improve D/G Reliability | 15 | 250 | 11,000 | 1,000 | 20,000 |
| 4. Inc. Blackout Coping Capability. w/Plant Mods. | 10 | 1,000 | 10,000 | 2,500 | 25,000 |
| TOTAL INDUSTRY IMPACT | | | 36,000 | | 61,000 |

## Comments on European Practices Regarding Blackout

We support the concept of considering the experience and practices of foreign nuclear power plants in deciding on appropriate actions for U.S. plants. However, it is absolutely necessary that we accurately understand the totality of the resulting comparison. Besides explicit differences, we must know what is being done, how and why it is being accomplished, and how differing regulatory requirements (e.g., single failure, etc.) influence the perceived need for certain requirements.

In the present case, it does not appear that any of this information is available. References to European practices consist of comments within the Statements of Consideration and backfit analysis, and overview summary statements during a November 14, 1985 Commission briefing, all of which are lacking in technical detail. Before using these statements as a basis for regulatory action which will affect each U.S. nuclear power plant, the Commissioners should obtain more complete information from which conclusions can be drawn.

It goes without saying that foreign regulatory agencies occasionally require activities which differ from or exceed those required in the U.S. It is equally true, however, that the basic design of most nuclear power plants regulated by European agencies are fundamentally similar to U.S. designs. They include both PWRs and BWRs, many of which have been constructed under cooperative arrangements involving U.S. reactor vendors.

Commissioner Asselstine, in particular, cites actions reportedly being taken at French nuclear power plants to provide additional protection from core damage resulting from station blackout events. These actions include a turbine-driven pump to provide cooling to reactor coolant pump seals. The motivation for this addition was apparently concern regarding the potential for gross leakage, on the order of several hundred gpm, which might begin soon after loss of seal cooling (as would occur in a station blackout). Subsequent to the decision to install this pump, extensive testing was conducted of the reactor coolant pump seals. This testing demonstrated that the feared gross failures are not likely to occur, and that leakage following a loss of seal cooling is only a small fraction of that expected.

Commissioner Asselstine further refers to a reported ability of French plants to cope with a station blackout for up to three days. Again, the details of this capability have not been provided, although it appears to relate to the availability of water supply for decay heat removal. (There is also some confusion as to whether capabilities are for three days or for 20 hours, both of

which have been referred to in NRC statements). With respect to the availability of water, this capability does not appear to be significantly greater than that which is available at most U.S. plants which could utilize such sources as self-driven fire pumps to provide makeup to decay heat removal systems. Fire trucks could also be utilized in many cases because of the extensive period in which remedial actions could be taken. It is not apparent that the French have addressed other issues which have been referred to in the context of "coping", particularly the issue of qualification of equipment for the conditions which could be hypothesized following a loss of ventilation in a blackout event.

In summary, we are concerned that more is not known than is known about the actual capabilities of European plants and the reasons behind those capabilities. The references to foreign experience which are available in the rulemaking record are too brief. Until more detailed information is provided, we believe that no conclusions can be drawn regarding the effect that European practices should have on station blackout requirements in the U.S.