

UNITED STATES GOVERNMENT

# Memorandum

TO : A. R. Luedecke, General Manager  
*for* (THRU): F. K. Pittman, Director  
Division of Reactor Development, HQ *H. E. Hillman*

DATE: JAN 18 1961

FROM : J. C. Clarke, Manager *JCC*  
New York Operations Office

SUBJECT: COMMENTS ON PROPOSED REACTOR SITE CRITERIA, AEC-R-2/19

RD:CRM

The Staff Paper has been reviewed by this office with extreme interest for this very timely subject. I have assumed you are requesting comments on the general implications of the proposed regulation; the technical content of the document; and possibly other methods of providing site criteria for power and testing reactors to the public. ~~Price - 122~~ *1/2*

From this review I have concluded that:

1. Technical guidance about specific criteria should be provided by the AEC rather than a regulation governing the exclusion areas and the evacuation areas.
2. Revisions to the Federal regulation may be expected to be time consuming and burdensome to an extent not beneficial to the Government nor to the public.
3. Basic R&D programs should be established and coordinated within the AEC to develop site evaluation criteria and to provide for Government acceptance of these programs. Unilateral Federal regulations may discourage industrial development of designs and technical features that may affect site criteria. It is realized that significant funds have been expended by the AEC to evaluate reactor technology and every detail of these investigations should be analyzed by the group responsible for the updating of the proposed guidelines.

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The major points of criticism to the Staff Paper are as follows:

1. The proposed regulation is too dependent upon the data utilized in WASH-740, "Theoretical Possibilities and Consequence of Major Accidents in Large Nuclear Plants," March 1957. The purpose of this report was to evaluate the economic consequences of certain hypothetical major accidents rather than a technical treatise on the various parameters and criteria used to establish the probability and the assumptions of various details used throughout the report. Definitive and improved data concerning many of these assumptions have been developed since the three month study in 1956-1957 as reported in WASH-740. Specific improved data have been developed relative to irradiation effects on materials, the various reactions of reactor metals with water, the operating history of nuclear components, and the characteristics and behavior of nuclear systems which would affect the factors used to evaluate a major accident (pp. 4 and 5, WASH-740). It is suggested that the chief contributors to WASH-740, K. Downes and M. Smith of BNL, be specifically requested to comment on the proposed regulation if comments are ever solicited outside the AEC.
2. The formulas used to establish the bench mark areas and distances in Annexes 1 and 2 to Appendix D (pp. 44-48) are not considered appropriate for the time periods or distances involved for power reactors. In the formula for the exposure dose, D, on page 47 the terms  $\mu$  and B, which depends on  $\mu r$ , strongly affect the calculated dose rate at great distances. First, the representation of a  $\gamma$ -ray spectrum by a single energy, which appears to be implied here, can result in serious error unless the energy is judiciously chosen. The selection of  $\mu = 0.01$  supports this implication. Though units were not specified, presumably they are reciprocal meter, since the dimension of "r" is meter. Hence, it is inferred that  $\mu = 0.01 \text{ m}^{-1}$ , corresponding to a  $\gamma$ -ray energy of roughly 0.6 Mev. Upon examining the energies of the various iodine isotopes, it appears that 0.6 Mev may be too low. Roughly, the weighted average of isotopes 131-135 is about 1 Mev.

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During the preparation of WASH-740, this was considered in some detail. Assuming 0.7 Mev, it was found that one underestimated  $\gamma$ -ray levels by factors of 3 to 10 at distances between 1/2 and 1 mile from the contained activity. A much better approach seemed to involve the use of multi- $\gamma$ -ray energy groups, so that the various  $\mu$  values accounted for the effect of spectrum changes at great distances.

A similar argument may apply to the B-values, though no precise comment can be offered now. However, it would appear desirable to evolve a more sophisticated  $\gamma$ -dose computation, accounting for several energy groups or possibly the individual isotopes.

The meteorological conditions assumed as an average over the entire U. S. are not considered to be appropriate for a Federal regulation. Specific advantages to the Government would be obtained if these factors were evaluated for each reactor site rather than attempting to consider average conditions throughout the 50 states. NY questions the assumption of diffusion parameter values "for average meteorological regime over the country." In WASH-740, the idealized reactor site was chosen to be a shallow valley. To take some account of the effect of "stack height," two H-values were selected for typical inversion. At  $h = 0$ , a 3 m/sec. wind speed was used, somewhat arbitrarily to attempt to obtain better results at great distances. WASH-740 indicates that the ground-level inversion wind speed should be reduced to 1 or 2 m/sec. if only short distances were involved. That is, the 3 m/sec. value attempted to account for the belief that the release would not be at ground level, though near it, and in the study great distances were of principal interest. It seems possible, therefore, that using the 1 m/sec. value given in the proposed criteria might be a little too conservative. It would seem preferable to permit the establishment of bench marks based on local meteorological information if the reactor applicant wishes to obtain this information, rather than some average values.

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Further, we wonder about the effect of ignoring cloud depletion on the bench mark distances. Doing this in the criteria represents additional conservatism at the greater distances.

3. The bench mark tables are not considered applicable for all types of reactors utilizing various fuels and reactor coolants. The AEC and the nuclear power industry needs guidance on the methods of establishing the criteria for each of the various complex reactor designs and the inherent problems of control, operation, management, and safety.
4. Guidelines should be proposed to evaluate specific designs of systems and components. It is suggested that more technical presentations be made by the AEC staff responsible for evaluating the proposed designs. The Hazards Evaluation Branch of DRD and the ACRS should make technical presentations to the public through TISE publications of the very valid criteria presently being used to avoid misunderstandings and misleading generalizations against the AEC such as contained in the November 9, 1960 letter by Oliver Townsend, Director, State of New York, Office of Atomic Development, to the Hon. Chet Holifield, JCAE, AEC-R-2/17.

These guidelines should define the basic maximum credible accidents for each type of reactor. The staff should provide a mechanism to update the methods of evaluating these accidents as experience is developed by operating reactors and R&D programs. Licensed applicants should be informed of acceptable methods of identifying and determining the fission product activity sources, the source term, and the energy spectrum. Reports such as HW 33414 and ANL 4807 as listed on page 28 of WASH-740, ORNL 2127, NDA 2739 and TID 7007 could be referenced.

These guidelines could be issued to the public in a manner similar to the Serious Accident bulletins from the Safety and Fire Protection Branch of the Office of Health and Safety. The bulletins could call attention to administrative and technical criteria and problems applicable to reactor site criteria. A central hazards evaluation information center should be considered to assure coordination of and evaluation of all R&D programs developing information relative to site criteria and other aspects of hazards evaluation.

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5. Appendix B of the staff paper should be modified to defend the policy of not evaluating the conceivably more hazardous factors as listed in Item 13, page 26.
6. Considerations should be given to evaluating the reactor plant throughout its operating period. This would include the inspection of the operating history as well as the reactor system components.

In summary it is felt that the proposed regulations are subject to misinterpretation. The development of nuclear power should be assisted by the issuance of guidelines rather than regulations. It is hoped that consideration of the above comments will assist your office in the study of the criteria of evaluation of reactor sites.

cc: S. Sobol, DRD, HQ

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