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December 13, 1960

Honorable John A. McCone
Chairman
U. S. Atomic Energy Commission
Washington, D. C.

Subject: SITE CRITERIA FOR NUCLEAR REACTORS

Dear Mr. McCone:

Commissioner Olson has observed that in our letter of advice to you dated October 22, 1960, we have furnished guidance relating to the selection of reactor sites but have not clearly identified the criteria contained therein. He has suggested that the Committee summarize such general site criteria as may be appropriate in order that guidance can be provided to the public.

While the Advisory Committee on Reactor Safeguards believes that it would be unwise to publish detailed quantitative site criteria in a regulation at this early stage of technology, we have provided in an attachment to this letter criteria which should be useful in the selection of sites for nuclear reactors.

Sincerely yours,

ORIGINAL SIGNED BY
LESLIE SILVERMAN

Leslie Silverman
Chairman

Enclosure:
Site Criteria for Nuclear Reactors
dated Dec. 13, 1960

cc: L. K. Olson, Commissioner ✓ disp 9am 12/16/60
A. R. Luedecke, GM ✓ " " "
W. F. Finan, AGMRS " "
H. L. Price, Dir., DLSR " "
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SITE CRITERIA FOR NUCLEAR REACTORS

The following site criteria are applicable only to reactors of a type and design on which experience has been developed. For reactors which are novel in design, unproven as prototypes, or which do not have adequate theoretical and experimental or pilot plant experience, these criteria will need to be modified in the direction of specifying isolated sites — the degree of isolation required depending upon the lack of certainty as to the safe behavior of the reactor. It is a prerequisite, of course, that the reactor be carefully and competently designed, constructed and operated, and inspected during all these stages in a manner to assure preservation of the intended protection of the public.

General Concepts

1. The location must be such that everyone off-site has a reasonable chance of escaping serious injury if an unlikely but still credible accident should occur.

2. The exposure of many persons in terms of man-rem should not be such as to cause significant somatic or genetic effects should a credible accident occur. The somatic effects presently recognized are: the occurrence of leukemia and life shortening. In order to be significant, the effect must be statistically great enough to be recognizable among the variations which occur without assignable cause.

3. Even if the most serious accident possible (not normally considered credible) should occur, the number of people killed should not be catastrophic.

4. A site which has characteristics not clearly conforming to the foregoing criteria can only be considered if it is possible to show that there is an advantage to society in locating the reactor at this site rather than in a more isolated area. This is a matter of degree, and no site is acceptable for a non-military reactor which imposes a foreseen risk of serious injury to anyone off-site.

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Specific Criteria

1. The applicant must show that his particular reactor at the chosen site does not violate the general criteria.

2. The demonstration must be based upon the actual barriers provided to contain the radioactive material, upon the means of spreading the radioactive material (meteorology, hydrology, etc.), and upon the actual distribution of population surrounding the site.

3. There must be three or more independent physical barriers unless it can be shown that the particular reactor cannot break through a lesser number. For example, if there were a reactor type with no stored energy, an "incredible" possibility for a nuclear excursion, and either such a low specific power or such a reliable cooling system that the loss of coolant accident need not be considered, one or two barriers might be considered acceptable.

4. The analysis of the applicant presenting the kind of accidents which can happen, the provisions against such accidents, and the estimate of dosage to persons off-site based upon actual meteorology, hydrology and population distribution will be compared to a generalized source term for release of radioactive material. This will be an arbitrary release of a certain fraction of the fission products in the reactor into the containment building or container. The maximum arbitrary value will be used unless the applicant can show good reason to use a lesser quantity. The results to the persons off-site shall not be worse than those set forth in the general criteria.

5. There shall be an area surrounding the reactor, known as the exclusion area, which will be under the control of the applicant and in which no one will reside. Credit can be taken for special geographical characteristics such as a seaside location, the bank of a wide river, the bank of a lake, etc., in reducing the size of the exclusion area if the actual location warrants. Location underground would also be considered as a means of reducing the exclusion area.

Numerical Values

The Advisory Committee on Reactor Safeguards believes strongly that there has not yet been a sufficient critical review of the data available to set such numbers as part of a formal regulation. The ACRS recommended a study of the data applicable to the safety problems and the derivation of criteria for all parts of the reactor systems in a letter dated November 16, 1959. As far as the Committee is aware, there has

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been no such study. Data and numbers applicable to site criteria were suggested as a part of the proposed study. Such a study would permit numbers to be used in defining criteria for site selection. The following numerical values are given as examples to aid in understanding the problem even though their validity is open to question until the study is made.

1. Under the extreme conditions of a serious reactor accident, it should be reasonably possible for persons off-site to take protective steps, such as evacuation and retirement to shelters, within a period of two hours so that within the two hours they will not receive more than a 25 rem whole body gamma dose or the inhalation of radioactive material which will give a dose of 300 rem to the thyroid, or 25 rem to the bones or lung.

2. The integrated man-rem dose for all people off-site receiving a radiation dose above 1 rem whole body, or equivalent thyroid, bone or lung dose, shall not exceed 4×10^5 man-rems.

3. The reactor should be located sufficiently distant from cities (metropolitan areas) of above 10,000 to 25,000 population so that no inhabitant receives more than 300 rems in the extremely improbable accident defined by a complete failure of all containment barriers and a source strength equal to most of the fission product inventory.

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