~~OFFICIAL USE ONLY~~

Sent to ACRS for comment.

September 20, 1960

TITLE 10 - ATOMIC ENERGY

Chapter 1 - Atomic Energy Commission

Part 50 - Licensing of Production and Utilization Facilities

Reactor Site Criteria

The following proposed amendment is designed to establish the criteria for evaluation of the acceptability of sites for power and testing reactors licensed under the provisions of this part.

For power and testing reactors currently in operation or under construction pursuant to licenses issued by the Commission, the probability of a major accident, i.e., one which would release from the reactor a substantial portion of the fission product inventory, is exceedingly small. The probability and magnitude of major accidents which may credibly occur in operation of reactors, for which licenses may be granted in the future, are not expected to depart from the probability and magnitude of such postulated accidents in power and testing reactors already licensed.

The criteria set forth below may be satisfied by selecting a reasonably isolated site or by incorporating in the design of a proposed reactor extensive and well proven safeguards designed to contain or adequately control fission products released as a consequence of a maximum credible accident.

Power and testing reactors presently being operated, or under construction, near inhabited areas, pursuant to licenses issued by the Commission, are enclosed within external containment vessels. Although the safeguards provided by such a containment vessel are considered in establishing the consequences of a maximum credible accident, the inclusion of such a containment vessel in the design of a proposed reactor will not necessarily be required if the criteria set forth below can be otherwise satisfied.

~~OFFICIAL USE ONLY~~

Notice is hereby given that adoption of the following rule is contemplated.

1. Add the following new § 50.46:

§ 50.46. Criteria for Approval of Sites for Power and Testing Nuclear Reactors

(a) In determining the acceptability of a site for a testing facility or a facility of a type described in § 50.21 (b) or § 50.22, the Commission will be guided by the following considerations:

(i) The distance from the facility to the nearest boundary of the exclusion area should not be less than the distance at which the total radiation dose received by an individual located on such boundary for two hours immediately following the onset of the maximum credible accident would be 25 rem to the whole body or 300 rem to thyroid from iodine exposure.

(ii) The distance from the facility to the nearest outside boundary of the evacuation area should not be less than the distance at which the total radiation dose received by an individual located on such boundary and exposed, through the whole course of the maximum credible accident, to the radioactive cloud resulting from the accident would be 25 rem to the whole body or 300 rem to the thyroid from iodine exposure.

(iii) The distance from the facility to the nearest boundary of a population center containing 25,000 or more inhabitants in an area of five square miles or less should not be less than the distance at which the total radiation dose from the maximum credible accident received by an individual located on such boundary would be 50 rem to the thyroid from iodine exposure.

(iv) The facility should not be located nearer than 0.5 miles to the surface location of a known earthquake fault.

(v) The facility should be so located that radioactive liquids escaping as a consequence of the maximum credible accident would not flow directly into nearby streams or rivers and would not have easy access to underground water tables.

(b) A site which satisfies the criteria specified in paragraph (a) of this section may be found to be unacceptable for the proposed facility if the hazards assessment is made uncertain either because the site has unique or abnormal features or because the proposed facility contains novel features.

(c) A site may be found to be unacceptable if the criteria specified in paragraph (a) of this section are only marginally satisfied. A site which fails to satisfy all the criteria specified in paragraph (2)

nevertheless may be found to be acceptable if it contains compensating features (e.g. topographical or meteorological features).

(d) Notwithstanding the existence of a particularly unfavorable feature of the site (e.g. hydrology or meteorology) which fails to satisfy one or more of the criteria specified in paragraph (a) of this section, the proposed site may be found to be acceptable if the design of the facility includes appropriate and adequate compensating engineering safeguards.

(e) Where the design of the facility incorporates extensive and well-proven engineering safeguards a proposed site may be found to be acceptable notwithstanding its failure to satisfy some of the criteria set forth in paragraph (a) of this section.

(f) As used in this section:

(i) "Exclusion Area:" means the area surrounding the facility access to which is under the full control of the facility owner. This area may be traversed by a highway or railroad, provided such highway or railroad is not so close to the facility as to interfere with normal operations, and provided appropriate arrangements are made to control traffic on the highway or railroad to protect the public health and safety. Residence within the exclusion area shall be minimal and

residents shall be subject to ready evacuation in case of necessity to minimize hazard. Activities unrelated to operation of the facility may be permitted in an exclusion area provided that no significant hazards to the public health and safety will result from the location of the activity in the exclusion area.

(ii) "Evacuation area" means the area immediately surrounding the exclusion area. The evacuation area must contain a sufficiently small number of people such that their evacuation could take place within a reasonably short period of time. Thus the total number of residents within the entire evacuation area should not exceed the product of the total area in square miles multiplied by 100. The total number of residents in any 45° sector should not exceed the product of the total area of the sector in square miles multiplied by 200. Where the outer boundary of the evacuation area is five miles or more from the facility, the total number of residents in any sector of the evacuation area who are within five miles of the facility should not exceed two thousand.

(iii) "Maximum credible accident" means that accident which would result in the most hazardous release of fission

products; the potential hazard from this accident would not be exceeded by that of any other accident whose occurrence during the lifetime of the facility would appear to be credible.

For pressurized and boiling water reactors, the maximum credible accident shall assume an initial pressure inside the reactor building equivalent to adiabatic expansion of the coolant upon rupture of a major pipe with an accompanying release to the atmosphere of the reactor building of 75% of the noble gases, 25% of the halogens, and 1% of the solids in the fission product inventory. For other types of reactors similar conservation shall be used in calculating the maximum credible accident.

(g) The release of radioactivity from the reactor building to the environment shall be considered to occur at the leak rate established for that building under conditions of maximum internal pressure. It is assumed that the leakage and pressure conditions persist throughout the effective course of the accident, which, for practical purposes, is until the iodine activity has decayed away.

In calculation of dosages which determine the exclusion distance, radioactivity decay may be assumed to occur only during the

transit time for the iodine to the boundary of the exclusion area; no ground deposition is assumed.

In calculation of dosages which determine the minimum distances established in Section 50.46 (a) (ii) and (iii), radioactivity decay may be assumed to occur only during hold-up time within the containment vessel.

In calculation of dosages which determine the evacuation distance, no ground deposition may be assumed; for the minimum distance established in § 50.46 (a) (iii), a ground deposition velocity of 0.2 cm/sec. may be assumed.

(h) The atmospheric dispersion of material from the reactor building is assumed to occur according to the relationship developed by O. G. Sutton:

$$X = \frac{2Q}{\pi U C_y C_z d^{2-n}} \exp\left(-\frac{4 V d^{n/2}}{n U \pi^{\frac{1}{2}} C_z}\right)$$

where Q is rate of release of radioactivity from the containment vessel

X is the atmospheric concentration of radioactivity at distance d from the reactor

U is the wind velocity

h is the atmospheric stability parameter

C_y and C_z are horizontal and vertical diffusion parameters resp.

V is the deposition velocity

and π is a constant 3.1416.

(i) Meteorological conditions of atmospheric dispersion are to be assumed which are characteristic of the average "worst" (most unfavorable) 20% of weather conditions for average meteorologic regimes over the country. For the purposes of these calculations, the appropriate parameters for this are:

$U = 1$ m/sec; $Cy = 0.40$; $Cz = 0.07$; $n = 0.5$.

(j) In calculating the thyroid doses which result from exposure of an individual to an atmosphere containing concentrations of radioactive iodine, the following conversion factors will be used:

I^{131}:	10^{-6} c/m^3	results in a total thyroid exposure of 1.203 rem per hour of exposure.
I^{132}:	10^{-6} "	results in a total thyroid exposure of 0.0457 rem per hour of exposure.
I^{133}:	10^{-6} "	results in a total thyroid exposure of 0.284 rem per hour of exposure.
I^{134}:	10^{-6} "	results in a total thyroid exposure of 0.0221 rem per hour of exposure.
I^{135}:	10^{-6} "	results in a total thyroid exposure of 0.0788 rem per hour of exposure.

(k) In calculating the whole body doses at the exclusion and evacuation distances it is assumed that 75% of the noble fission gases, 25% of the halogens and 1% of the fission solids is equal to 10.8% of the total fission product inventory and that this

results in an exposure dose D (roentgens) per kilowatt of reactor power, at distance r meters) of

$$D = 3.3 \frac{Be^{-ur}}{4\pi r^2} \int_0^t t^{-0.21} \, dt$$

where $B = 1 + ur + \frac{ur^2}{3}$ is the scattering factor,

u is the attenuation factor 0.01 for this case

t is the exposure time in seconds.

It may be assumed that the shielding and building structures afford an additional attenuation factor of 10.