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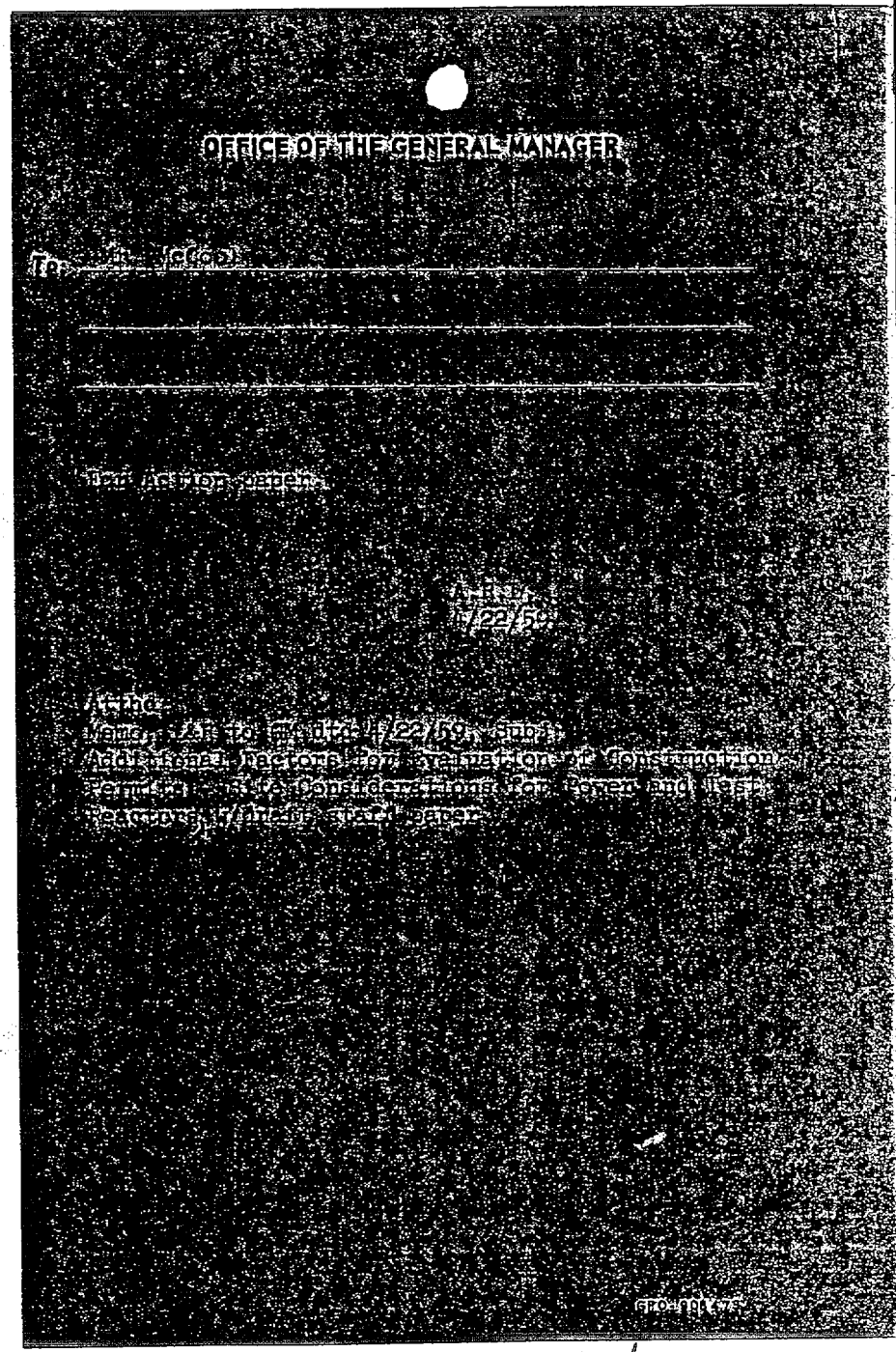

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ATOMIC ENERGY COMMISSION

Report by the Director
Division of Licensing and Regulation

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THE PROBLEM

1. To consider approval of a preliminary draft of factors considered in site evaluation for publishing in the Federal Register in order to invite comments from the public on the subject.

power and test reactor ... publication

SUMMARY

2. Section 50.34 of Part 50, 10, CFR "Licensing of Production and Utilization Facilities", attached as Appendix "C", describes the general subject matter that an applicant is required to furnish to the ~~Commission~~ AEC for its use in determining ~~if~~ whether a reactor facility can be constructed and operated at a given location without undue risk to the health and safety of the public. This section requires:

(a) A description of the process to be ~~constructed~~ performed in detail sufficient to permit evaluation of the radioactive hazard involved,

(b) A description of the facility and the design criteria in detail sufficient to determine the adequacy of the various means proposed to minimize the probability of danger from radioactivity to persons both on and off site,

(c) A description of the site and its environmental character on which the facility will be located,

(d) A description of proposed operating procedures that are useful in evaluating safeguards against radioactive hazards in operation of the facility,

(e) A description of plans for emergencies in event that an accident might occur,

(f) Meteorological, hydrological and seismological data necessary for evaluating the measures proposed for protecting the public against possible radioactive hazards,

(g) An evaluation of the measures for preventing accidents,

(h) A description of procedures for disposal of radioactive liquid and solid wastes, and

(i) A description of means for monitoring discharge of gaseous waste to the atmosphere.

3. The applicant, in supplying the information required by paragraph 50.34, must satisfy the ~~Commission~~ AEC that a nuclear facility can be operated at a particular location without undue risk to the public health and safety; but the factors considered by the ~~Commission~~ AEC in evaluation of the acceptability of a site for a facility and which, at the same time, the applicant needs for guidance in his site selection problems, are not set forth. There has been an increasing need for the ~~Commission~~ AEC to develop these factors in written form to serve this purpose.

4. The wide variation of environmental conditions from one geographic location to another and the wide possible variations in reactor characteristics and associated protection which can be engineered into a reactor facility preclude establishment at this time of rigid quantitative criteria for measuring the acceptability of a site. Discussions during the past year or more between the Division of Licensing and Regulation and the Advisory Committee on Reactor Safeguards have recognized the very complex nature of this problem.

5. In evaluation of a site, ~~there are~~ several general factors ~~which~~ are considered in varying degrees in relation to the character and magnitude of the environmental problems associated with any particular reactor and its operation. These are:

a. Exclusion distance around the reactor.

b. Population density in surrounding areas.

c. Meteorological considerations of the site area.

d. Seismological considerations of the site area.

e. Hydrology and geology of the site area.

Each of the above factors delineate specific parts of the environmental complex which relate to the health and safety of the public from operation of a reactor at any location. Evaluation of a site with respect to these factors points up the character of protection the site offers for operation of the proposed reactor facility or the kinds of restrictions it might impose on the proposed reactor design and operation. A preliminary draft describing these factors was presented by the Hazards Evaluation Branch of the Division of Licensing and Regulation at the January and March (1959) meetings of the Advisory Committee on Reactor Safeguards. Appendix "A" is a modification of the preliminary draft based on detailed discussions between the Staff and the Committee at these meetings.

6. At the March meeting the Advisory Committee on Reactor Safeguards proposed the possibility of developing a mathematical type formula for possible application as a guide to reactor safety evaluation. ~~site selection.~~ A concept was suggested for consideration in which the product of several factors related to the safety of a reactor, its safety components, and the reactor site is equated to the total radiation dosage which the population near the site might receive from an accidental

release of fission products. The concept, as discussed during the March meeting of the Committee, considered the quantity of radioactivity which might be released to the environment as functions of reactor power (MWT), reactor type and its intended usage, the containment, and the amount of fission products which might be released from the irradiated fuel. The number of people exposed was considered as a function of population density and distribution and the meteorology of the area. The product of these factors is the total radiation dosage received by the total population exposed (roentgen units). The number of roentgen units is intended to indicate a measure of the acceptability of a site for a particular reactor facility as related to the population density and distribution in the area surrounding the site. ~~Obviously,~~ limits would need to be established on the number of roentgen units allowable for any reactor site in order that acceptability of a site could be determined.

7. Although the concept was discussed in some detail with the ~~Commission~~ AEC Staff during the March ACRS meeting, it was emphasized that its present status of development does not cover adequately all of the variables, environmental and otherwise, that are associated with the site selection problem. Since it may require a considerable length of time to develop a mathematical type formula, the staff believes it to be in the best interest of the program to publish the proposed draft in the Federal Register in order to start obtaining comments from the public on its subject matter. The staff believes the proposed draft of factors considered in site evaluation to be a good first step in the development of site criteria and consistent with the concept of a formula.

8. The Committee indicated its reluctance to fix distances, either for exclusion radius from the reactor facility to the site boundary or from the

facility to the nearest center of population. The staff agrees with this view and agrees that it probably would not be desirable to set arbitrary distances by regulation at this time. The staff believes the proposed draft to be consistent with this objective of flexibility. At the last ~~Saturday afternoon~~ ACRS session of the March meeting, at which there were only four or five Committee members remaining, the staff proposed that the draft of factors considered in site evaluation be submitted to the Commission for approval for publication in the Federal Register for the purpose of inviting public comment. Also, after these comments have been obtained, it was proposed to discuss the draft further with the Committee. The ~~few~~ Committee members present indicated that they, as individuals, had no objection to this procedure. In order to reflect the ~~Saturday afternoon~~ discussions, a redraft was prepared by the Division of Licensing and Regulation and circulated by the Committee Chairman to all the Committee members for comment. They were advised of the purpose and invited to make comments or suggestions. Comments received from the Committee, attached as Appendix "D", ~~indicate its feeling~~ are that the draft comprises a reasonably fair, though generalized, description of the major factors which are now considered in a site review and if properly interpreted will not jeopardize the health and safety of the public. The present draft (Appendix "A") has some minor editorial changes as suggested by members of the Committee and the staff.

10. On the basis of the comments received from publication in the Federal Register, it is proposed that the draft would be revised as necessary and discussed further with the Advisory Committee on Reactor Safeguards before recommending formal adoption by the Commission as a part of 10 CFR 50.

STAFF JUDGMENTS

12~~10~~. The Office of General Counsel and the Divisions of Biology and Medicine, Reactor Development and Production concur in the recommendations of this paper.

CONCLUSIONS

13~~11~~. It is concluded that this important subject should be exposed to public comment at this time and that the preliminary draft of factors considered in site evaluation should be published in the Federal Register as a notice of proposed rule making.

RECOMMENDATIONS

14~~12~~. The General Manager recommends that the Atomic Energy Commission:

a. Approve the preliminary draft of factors considered in site evaluation substantially as written in Appendix "A" for publication in the Federal Register in order to invite public comments on the contents of the draft for a period of thirty days;

b. ~~Approve the Draft~~ Note that a letter to the JCAE such as Appendix "B" will transmit ~~the~~ a copy of the proposed draft;

c. Note that ~~this proposal~~ the proposed draft regulation will be revised as necessary based upon comments received and resubmitted to the Commission for approval;

d. Note that a press release will be prepared and issued upon publication of the proposed draft; and

e. Note that this paper is unclassified.

APPENDIX "A"

TITLE 10 - ATOMIC ENERGY

CHAPTER I - ATOMIC ENERGY COMMISSION

PART 50 - LICENSING OF PRODUCTION AND UTILIZATION FACILITIES

The following proposed amendment would add a new Section 50.46, to state factors considered by the Commission in evaluating proposed sites for nuclear power and test reactors.

Due to the complex nature of the environment, the wide variation in environmental conditions from one location to another and the variations in reactor characteristics and associated protection which can be engineered into a reactor facility, the proposed amendment does not attempt to set forth definitive criteria which must be met in order for a site to be acceptable. The proposed amendment does describe environmental factors considered in evaluation of the acceptability of a site for a power or test reactor.

Notice is hereby given that the following amendment is under consideration. All interested persons who desire to submit written comments and suggestions should send them to the U. S. Atomic Energy Commission, Washington 25, D. C., Attention: Division of Licensing and Regulation within 30 days after publication of this notice in the Federal Register.

50.46 Factors Considered in Site Evaluation for Power and Test Reactors

a. General. The construction of a proposed power or test reactor facility at a proposed site will be approved if analysis of the site in relation to the hazards associated with the facility gives reasonable assurance that the potential radioactive effluents therefrom, as a result of normal operation or the occurrence of any credible accident, will not create undue hazard to the health and safety of the public.

There are wide possible variations in reactor characteristics and protective aspects of such facilities which affect the characteristics that otherwise might be required of the site. However, the following factors are used by the Commission as guides in the evaluation of sites for power and test reactors. The fact that a particular site may be deemed acceptable for a proposed reactor facility when evaluated in the early phases of the project, does not determine that the reactor will eventually be given operating approval, or indicate what limitations on operation may be imposed. Operating approvals depend on detailed review of design, construction and operating procedures at the final construction stages.

b. Exclusion Distance Around Power and Test Reactors. Each power and test reactor should be surrounded by an exclusion area under the complete control of the licensee. The size of this exclusion area will depend upon many factors including among other things reactor power level, design features and containment, and site characteristics. The power level of the reactor alone does not determine the size of the exclusion area. For any power or test reactor, a minimum radius

on the order of one-quarter mile will usually be found necessary. Usually power reactors of more than 200 thermal megawatts should have an exclusion radius of one-quarter mile. For large power reactors a minimum exclusion radius on the order of one-half to three-quarter miles may be required. Test reactors may require a larger exclusion area than power reactors of the same power.

c. Population Density in Surrounding Areas. Power and test reactors should be so located that thepopulation density in surrounding areas, outside the exclusion zone, is small. It is usually desirable that the reactor should be several miles distant from the nearest town or city and for large reactors a distance of 10 to 20 miles from large cities. Where there is a prevailing wind direction it is usually desirable to avoid locating a power or test reactor within several miles upwind from centers of population. Nearness of the reactor to air fields, arterial highways and factories is discouraged.

d. Meteorological Considerations. The site meteorology is important in evaluating the degree of vulnerability of surrounding areas to the release of air-borne radioactivity to the environment. Capabilities of the atmosphere for diffusion and dispersion of air-borne release are considered in assessing the vulnerability to risk of the area surrounding the site. Thus a high probability of good diffusion conditions and a wind direction pattern away from vulnerable areas during periods of slow diffusion would exhance the suitability of the site. If the site is in a region noted for hurricanes or tornadoes, the design of the facility must include safeguards which would prevent significant radioactivity releases should these events occur.

e. Seismological Considerations. The earthquake history of the area in which the reactor is to be located is important. The magnitude and frequency of seismic disturbances to be expected determine the specifications which must be met in design and construction of the facility and its protective components. A site should not be located on a fault.

f. Hydrology and Geology. The hydrology and geology of a site should be favorable for the management of the liquid and solid effluents (including possible leaks from the process equipment). Deposits of relatively impermeable soils over ground water courses are desirable because they offer varying degrees of protection to the ground waters depending on the depth of the soils, their permeability, and their capacities for removing and retaining the noxious components of the effluents. The hydrology of the ground waters is important in assessing the effect that travel time may have on the contaminants which might accidentally reach them to the point of their nearest usage. Site drainage and surface water hydrology is important in determining the vulnerability of surface water courses to radioactive contamination. The characteristics and usage of the water courses indicate the degree of risk involved and determine safety precautions that must be observed at the facility in effluent control and management. The hydrology of the surface water course and its physical, chemical and biological characteristics are important factors in evaluating the degree of risk involved.

g. Interrelation of Factors. All of the factors ~~and criteria~~ described in paragraphs b. through f. of this section are interrelated and dictate in varying degrees the engineered protective devices for the particular nuclear facility under consideration, and the dependence which can be placed on such devices. It is necessary to analyze each of the environmental factors to ascertain the character of protection it might afford for operation of the proposed facility or the kind of restrictions it might impose on the proposed design and operation.

APPENDIX "B"

DRAFT LETTER TO THE JCAE

1. The attached proposed amendment to Part 50 of the Commission's regulations, to state factors considered by the Commission in evaluating proposed sites for nuclear power and test reactors, has been approved by the Commission for publication in the Federal Register as a notice of proposed rule making in order to invite comments from the public on its subject matter.

2. On the basis of the comments received, it is proposed that the draft would be revised as necessary and ultimately adopted by the Commission as a part of 10 CFR 50, "Licensing of Production and Utilization Facilities", to serve as a guide to industry in selection of potential sites for nuclear power and test reactors.

3. This important subject of site evaluation will be further studied and developed by the Commission and the Advisory Committee on Reactor Safeguards.

APPENDIX "C"

use this as the title of the appendix

Section 50.34 Contents of applications; technical information hazards summary report.

Each application shall state the following technical information:

(a) A description of the chemical, physical, metallurgical, or nuclear process to be performed, and a statement of the kind and quantity of any radioactive effluent expected to result from the process. The description of the process should be sufficiently detailed to permit evaluation of the radioactive hazards involved. The magnitude of the proposed operation should be indicated in terms of the amount and radioactivity of source, special nuclear, or by-product material to be handled per unit of time, and thermal power to be generated if any.

(b) A description of the facility. The description should be based on the design criteria for the facility as a whole and for those major component parts which are essential to the safe operation of the facility, and should be presented in sufficient detail to allow an evaluation of the adequacy of the various means proposed to minimize the probability of danger from radioactivity to persons both on and off-site. The description should also cover any activities, other than those subject to license, proposed to be carried on in the building which will house the facility and on the balance of the site.

(c) A description of the site on which the facility is to be located. This should include a map of the area showing the location of the site and indicating the use to which the surrounding land is put, i.e., industrial, commercial, agricultural, residential; location of source of potable or industrial water supply, watershed area and public utilities; and a scale plot plan of the site showing the proposed location of the facility.

(d) A description of proposed procedures for: routine and non-routine operations, start-up and shut-down, maintenance, storage, training of employees, minimizing operational mishaps (such as locked controls, check-lists, and close supervision), investigating unusual or unexpected incidents; and a description of such other details as may be useful in evaluating the existence and effectiveness of safeguards against the radioactive hazards in the operation of the facility.

(e) A description of plans or proposals in the event that acts or accidents occur which would create radioactive hazards. The description should relate the various operational procedures, the protective devices, and the pertinent features of the site, to such happenings as operational mistakes, equipment or instrument failure or malfunction, fire, electric power failure, flood, earthquake, storm, strike, and riot.

(f) Meteorological, hydrological, geological, and seismological data necessary for evaluating the measures proposed for protecting the public against possible radioactive hazards.

(g) An evaluation of the proposed measures and devices to prevent acts or accidents which would create radioactive hazards or to protect against the consequences should such acts or accidents occur.

(h) A description of procedures for disposal of radioactive solid waste and the final disposal of liquid waste effluent.

(i) A description of means provided to sample atmosphere discharges through stacks where such stacks may emit by-product material or special nuclear material.

APPENDIX "D"

C O P Y

TO : H. L. Price, Director
Division of Licensing & Regulation

April 7, 1959

FROM : C. Rogers McCullough, Chairman
Advisory Committee on Reactor Safeguards

SUBJECT: PRELIMINARY DRAFT OF PROPOSED SITE CRITERIA

In your letter of March 19, 1959, you invited comment upon your Preliminary Draft of Proposed Site Criteria which was prepared subsequent to the March meeting of the ACRS. It is the understanding of the Committee that you desire to publish an interim statement on site criteria in order to expedite your Division's carrying out its responsibilities.

Our Environmental Subcommittee feels that the proposed site criteria, when reviewed in the light of this interim purpose, comprise a reasonably fair, but generalized, description of the major factors which are now considered in a site review. If properly interpreted, the criteria will not jeopardize the health and safety of the public.

It is the Committee's hope and expectation that a more rational basis for evaluating reactors and their sites will be developed in the future. This is an exceedingly complex problem, but there are several promising approaches toward a synthesizing viewpoint which are under exploration within the Committee.

As you are aware, the Committee expects to carry on further discussion of these matters during its April meeting. Subsequent to this meeting the ACRS may have further comments.