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AEC LICENSING GUIDE

PURPOSE, ORGANIZATION, AND CONTENTS OF HAZARDS SUMMARY REPORTS FOR POWER REACTORS

U. S. ATOMIC ENERGY COMMISSION

DIVISION OF LICENSING AND REGULATION

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This guide in its present form is to be considered as a DRAFT and is distributed for the purpose of eliciting comments. It is not intended as an interpretation of Commission regulations within the meaning of Section 50.3 of Title 10, Code of Federal Regulations, Part 50 or of Section 115.4 of Title 10, Code of Federal Regulations, Part 115. Nothing contained in this guide may be construed as having the force and effect of United States Atomic Energy Commission regulations, nor as indicating that applications for appropriate licensing or authorization by the Commission, and supported by hazards summary reports prepared in accordance with the recommendations of this document, necessarily will be approved; nor as relieving any applicant from the requirements of Title 10, Code of Federal Regulations, Parts 50, 115, 100, and 20 or other pertinent regulations.

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I. PURPOSE.

This document is intended to clarify the purpose and importance of hazards summary reports in the licensing and authorization procedures established by the U. S. Atomic Energy Commission, and to provide general guidance as to the type of information the Commission would generally expect to be included in the hazards summary reports filed as a part of an application for a construction permit or an operating license as required by Title 10, Code of Federal Regulations, Part 50 (10 CFR 50), or for a construction or operating authorization as required by Part 115 (10 CFR 115).

For any proposed reactor facility, the performance experiences with the general reactor type, the engineering safeguards, the inherent stability and safety features, the quality of design, materials, construction, management, and operation are all important factors that have a bearing upon safety considerations. For any particular location, the size of the site, and the topography, meteorology, geology, seismology, and land use of the site and surrounding areas all enter into site evaluation as set forth in Title 10, Code of Federal Regulations, Part 100 (10 CFR 100).

Consideration of these, as well as other aspects of hazards evaluations, involve considerable variation in details among reactors and reactor locations. Appendix A presents suggestions as to the format and contents of hazards summary reports for a particular type of nuclear reactor facility. However, the suggestions should be easily adaptable to other types of facilities. Items suggested for inclusion in hazards summary reports by Appendix A may not be pertinent to a given reactor facility and, therefore, should be included, if at all, only to the extent they are appropriate. Conversely, hazards summary reports are expected to include items other than those listed in Appendix A, if such matters could have a significant effect on safety or understanding of plant design, construction, and operation.

Lack of clear understanding by an applicant of what is wanted in a hazards summary report, and the way such reports are used by the Commission, has led to considerable variation in the format and the amount of information presented in these reports. Delays in processing have resulted from the necessity for government request for submittal of required additional data. Closeness to their own individual projects has led to presumptions, by applicants, of general familiarity with novel aspects of design that are at times treated lightly, or described without supporting justification for assumptions made, or without clearly setting forth the problems of safety that were considered in establishing the reference designs. These problems develop because of failure to understand that the applicant must present sufficient information to the Commission evaluators with respect to all safety aspects of a reactor plant to convince them that the reactor can be constructed and operated without undue hazard to the public.

II. APPLICABLE REGULATIONS.

The following regulations are pertinent to the subject of this document:

(1) 10 CFR 50 - (Licensing of Production and Utilization Facilities)

(2) 10 CFR 115 - (Procedures for Review of Certain Nuclear Reactors Exempted from Licensing Requirements)

(3) 10 CFR 100 - (Reactor Site Criteria)

(4) 10 CFR 20 - (Standards for Protection Against Radiation)

Copies of Commission regulations may be obtained from the Division of Licensing and Regulation, U. S. Atomic Energy Commission, Washington 25, D. C., or from any of the Atomic Energy Commission Regional Compliance Offices.

For convenience, the four referenced documents listed above are included in this guide as Appendices B, C, D, and E. Amendments to the regulations are published from time to time in the Federal Register. It is not intended that the appendices of this guide be revised with each amendment of the regulations. In using this guide the current status of Appendices B, C, D, and E should be determined by the user.

III. INTRODUCTION.

The Atomic Energy Act of 1954 assigned to the Atomic Energy Commission the authority and responsibility of regulating the atomic energy industry in a manner that would protect the health and safety interests of the public. Pursuant to this responsibility, the Commission has established licensing procedures for production and utilization facilities, and authorization procedures for certain nuclear reactors exempted from licensing requirements. These basic licensing and authorization procedures are set forth in Parts 50 and 115, respectively, of Title 10, Code of Federal Regulations. Applicants desiring to construct and operate a production or utilization facility are required by 10 CFR 50 to submit, with the application, a hazards summary report. Similarly, applicants desiring to construct and operate certain nuclear reactors exempted from licensing requirements are required by 10 CFR 115 to, also, submit a hazards summary report. The general contents of these reports are listed, respectively, in Section 50.34 of 10 CFR 50, and in Section 115.23 of 10 CFR 115.

IV. LICENSING AND AUTHORIZATION PROCEDURES IN GENERAL.

Licensing or authorization of a reactor facility is accomplished in two major steps: the first, usually quite early in the project when a

Construction Permit or Authorization is granted; the second after construction is completed, when an Operating License or Authorization is issued. A step that precedes either of these two is sometimes initiated at the option of the applicant. This involves a request by the applicant for review of a proposed site for the reactor.

Before a license or authorization to operate is granted, the Commission must determine that there is a reasonable assurance that the facility as designed and constructed, and as proposed to be operated at the chosen site will not result in undue hazard to the health and safety of the public.

The reactor hazards summary report presented by the applicant is the principal technical document upon which the Commission bases its safety reviews.

V. PROCEDURES FOR A CONSTRUCTION PERMIT OR AUTHORIZATION.

At the time of request for a Construction Permit or Authorization, the applicant generally submits a Preliminary Hazards Summary Report. The purpose of this document is to provide sufficient information to the Commission to permit an evaluation of the potential hazards that might be involved from both normal operation of the facility, as well as the consequences of credible accidents. The information presented therein, is expected to include the following:

(1) Sufficient detailed information on the facility, its location and general layout and characteristics to permit an independent hazards analysis by the Commission staff.

(2) Results of the applicant's analysis of credible accidents, the consequences of such accidents, and the safeguards planned to preclude or minimize their occurrence.

At construction permit or authorization stage of project development, it is possible that design details and anticipated reactor behavior have not yet been firmly established. The applicant then is expected to describe some upper boundary for the hazards, beyond which no credible hazard would be expected to fall when later systematic analysis is made and to show that even for this upper limit of hazards adequate safeguards for the protection of the public have been incorporated. Results from such an analysis are generally used as a frame of reference and not as absolute values.

When a construction permit or authorization is granted for a reactor when design details are not completely established, it is generally issued as a "provisional permit or authorization". The Commission's requirements for issuance of construction permits on a provisional basis have been clarified by a recent amendment (published in 27 Federal Register, 2479, March 15, 1962) and is included as a part of

Appendix B. This amendment states that the Commission may issue a provisional construction permit if the Commission finds that:

"(1) The applicant has described the proposed design of the facility, including but not limited to, the principal architectural and engineering criteria for the design, and has identified the major features or components on which further technical information is required;

(2) The omitted technical information will be supplied;

(3) The applicant has proposed, and there will be conducted, a research and development program reasonably designed to resolve the safety questions, if any, with respect to those features or components which require research and development; and that

(4) On the basis of the foregoing, there is reasonable assurance that

(a) such safety questions will be satisfactorily resolved at or before the latest date stated in the application for completion of construction of the proposed facility and

(b) taking into consideration the site criteria contained in Part 100, the proposed facility can be constructed and operated at the proposed location without undue risk to the health and safety of the public."

VI. PRELIMINARY HAZARDS SUMMARY REPORT

A Preliminary Hazards Summary Report should contain as much meaningful information concerning the plant and its safety status as it is practical to develop, considering the conceptual state of design. In general, the following areas of concern are of major significance:

(1) A Description of the Proposed Site.

Factors considered by the Commission in evaluating a proposed site are set forth in 10 CFR 100. The objective should be to give in the hazards summary report a quantitative description of environmental features relative to safety of the facility. This description should include information that will answer such questions as:

(a) What is the size of the site and the location of the reactor on the property? This information fixes the exclusion radius for the reactor with respect to the nearest uncontrolled land.

(b) What is the industrial and population distribution in the surrounding areas? This information is important in assessing the consequences of inadvertent releases of radioactivity. The size of exclusion areas will be affected by many factors including among other

things reactor power level, design features, and containment system and site characteristics.

(c) What are the relevant features of hydrology, including prevalence of nearby supplies of drinking water or bathing facilities? This factor is important in evaluating the liquid waste disposal facilities proposed by the applicant. For example, the hydrology of the ground waters is important in assessing the effect travel time may have on the contaminants which might reach them and be transported to the nearest points of usage. Site drainage and surface water proximity and flow are important in determining the vulnerability of surface water sources to radioactive contamination. The characteristics and usage of the water courses indicate the degree of risk involved and often determine the safety precautions that must be observed at the facility in effluent control and management.

(d) What are the significant meteorological factors? The persistence of inversions, the prevailing wind directions and velocities, and the rainfall become significant parameters in considering effects of airborne radioactivity. Capabilities of the atmosphere for diffusion and dispersion of airborne release are considered in assessing the vulnerability to risk of the areas 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 enhance the suitability of a site. On the other hand, if a site was in a region noted for hurricanes or tornadoes, it would be expected that the design of the facility include safeguards which would prevent significant radioactivity releases should these events occur.

(e) What has been the history of seismological disturbances in the area? Certain areas in the United States are known to have active faulted subsurface structure and the requirements for buildings in such an area may need added attention to protect against the possible consequences of ground tremors and shocks.

(f) What is the subsoil structure for the site? This factor is important not only to design of the structural aspects of the facility but also to safety aspects relating to liquid waste storage and disposal. Highly permeable soils for example could lead to contamination of subsurface aquifers from leaking storage volumes. Impermeable soils on the other hand might lead to quick and uncontrolled runoff of liquid spills into nearby streams.

All the factors described are interrelated and dictate in varying degrees the engineered protective safeguards required for a particular facility.

A simple tabulation of these and other environmental factors is not sufficient, however. The applicant is expected to have analyzed the factors in relation to the proposed plant design and thereby

demonstrated the basis for his conclusion that the site is suitable.

(2) A Description of the Containment System.

In the event of any accident releasing radioactivity from the confines of the reactor coolant system, the containment system is relied upon to prevent subsequent escape to the atmosphere. In this respect, it is usually the final barrier between potentially hazardous concentrations of radioactivity and the general public. As such, the description given should be in keeping with the significant safeguards function it is designed to perform.

In order to establish that the system has an acceptable probability of maintaining its essential structural integrity during the extensive design life of the facility, particular emphasis should be given to identification of design bases, the reasons for selection of these bases, and their relationship to safety considerations. The description should also include specification of materials of construction, discussion of design loading conditions, provision of auxiliary features and systems to ensure proper functioning during normal operation and in event of accident, specification of the estimated permissible leakage rate under accident conditions, provision of missile protection barriers and containment system shielding, and a description of plans for testing for leak tightness throughout the design life of the system. Variations from standard designs should be discussed, as well as incorporation of mitigating assumptions such as time dependent energy release and absorption mechanisms, and activity wash-out and pressure reduction features.

(3) A Description of the Reactor.

The general features of the reactor including purpose, power level, and general plan of utilization should be described. The physical data and nuclear features essential to assessment of potential hazards should be stated, and an indication of accuracy of the estimates given. Particular emphasis should be given to those features that are new or novel, and the basis upon which judgment of suitability has been made by the applicant.

Again, each portion of this information fulfills a need to the safety evaluator. For example, the power level of the reactor enters into calculations of radioactive fission product inventory. This nuclear burden in turn affects the consequences of inadvertent release and determines in large measure the appropriateness of the design leakage rate of the containment system. The type of fuel planned, the heat flux developed, and the temperatures expected are important in assessing the planned operating parameters by providing a basis for comparison with past experience with fuel of a similar type, or identifying areas where research and development are necessary to verify expected performances. The excess reactivity of the core under various conditions, and the

values of temperature, pressure, void, and power coefficients of reactivity provides the safety evaluator with a basis for estimating the reactivity effects of various accidents and errors of operation.

(4) A Description of the Primary Coolant System.

The primary coolant system including mechanical, hydraulic, and heat transfer features should be described and the coolant fluid specified. Major system components should be enumerated and discussed with reference to design, reliability, and operating characteristics. Methods of pressurization, depressurization, and coolant circulation should be stated.

This information is necessary to permit the safety evaluator to assess the reliability of the system integrity during its design life and to provide a basis for determining the consequences of component failures, errors of operation, and credible accidents. The adequacy of safeguards provided by design can only be judged on the basis of a clear understanding of the system design and operating features.

(5) A Description of the Power Conversion System.

The general features of the power conversion system should be described. Major system components should be enumerated and discussed with reference to design and operating characteristics and demands. The coupling of this system to the primary coolant system should be described, and the effects of credible disturbances in one system upon the other should be estimated.

This information is necessary for safety assessment. For instance, the reactor may not have the capacity to directly absorb rapid load demand changes in the power conversion system. The safety evaluator will necessarily have to evaluate the adequacy of steam bypassing or similar protective systems. Conversely, assurance is sought that transients originating in the reactor are not augmented by feedback phenomena, from the power conversion system.

(6) A Description of Auxiliary Systems.

Major auxiliary systems, both for the reactor and for the facility, should be described. If applicable, descriptions should be provided for emergency decay heat removal systems, emergency poison injection systems, fuel handling systems, coolant purification systems, pressurizing and pressure relief systems, failed fuel element detection systems, auxiliary cooling systems, emergency power systems, fire control systems, ventilation systems, waste disposal systems, and other auxiliary systems directly related to plant safety.

Each of the auxiliary systems is of importance in an evaluation of safety. Although not recognized on first thought perhaps, the auxiliary systems and their parameters are often closely allied with reactor plant

safety. For example, the ventilation systems for the containment system and other areas susceptible to radioactive contamination, whether they exhaust through stacks or otherwise, are of interest to an assessment of ability to control the release of radioactivity to the environment within acceptable limits. A similar interest applies to the methods proposed for control and release of radioactive waste gas and liquid effluents from the reactor plant. Similarly, each of the auxiliary systems is of concern to specific areas of safety. It is necessary for the applicant to show that the interacting effects of all reactor power plant systems have been considered and integrated into the overall safeguards provided.

(7) A Description of Instrumentation and Control Systems.

Instrumentation systems and control systems should be described as completely as the status of the proposed design permits. The basic control scheme should be discussed, as well as the reasons that led to its selection. Descriptions should be provided of the control stations, the nuclear instrumentation systems, the nonnuclear instrumentation systems, the reactor control systems, the various plant control systems, and the radiation monitoring systems.

An evaluation of safety must include an assessment of the ability and adequacy of the instrumentation and control systems provided for the plant to maintain the plant within safe design operating limitations. For instance, the safety evaluator must determine that the nuclear instrumentation will provide the operating staff with valid and reliable information as to the reactivity status of the core, and that the reactor control system is capable of controlling the reactor within safe limits in the event of any credible transient.

(8) Other Descriptive Information.

Information should be provided also on other pertinent plant factors, including the provision of experimental and test facilities and any effect they may have on operational safety, the provision of shielding, the provision of maintenance facilities, and health physics facilities. In addition, and within the limitations imposed by the conceptual status of the design, information should be provided on proposed administrative controls and procedures and on operating procedures under both normal and emergency conditions.

(9) A Discussion of Accidents and Potential Hazards.

Potential hazards which could arise from either normal or abnormal operation of the proposed reactor facility should be identified and their consequences analyzed. This requires a systematic review of the interacting systems of the reactor plant and the effects of malfunctioning of any one system or component upon the reactor plant as a whole. System operation in turn must be considered in relationship to the physical layout of the facility and the environmental factors peculiar to the reactor site. An analytical test of the summation of safeguards available

should be made to ascertain the consequences of accidents and should include discussion of an accident having consequences not expected to be exceeded by any other accident arising out of any other credible circumstances. Assumptions upon which these accidents have been postulated should be defined and analysis made of the consequences both to personnel at the facility and inhabitants of the surrounding public area. A summary of conclusions should show clearly results of the applicant's evaluation of the potential hazards which would result from operation of the proposed facility.

In many ways this section of the hazards report represents the climax of a hazards story that has been building up by material discussed earlier. It is realized that the question of safety may have been considered individually by the various technical groups attacking their specific part of the reactor complex; for example, terms such as reliability and safety of rod drive mechanisms, redundancy in scram circuitry, duplication of flux monitoring, hot channel factors, and flux burnout ratio all are part of the safety language, yet, are terms not necessarily of direct common concern to all groups working on a reactor plant design. Each group in facing the question of safety in his own area has arrived at certain conclusions based upon either technical evidence or technical judgment. The hazards report should integrate these individual judgments on reactor plant component parts into an overall safety review, a document that allows the evaluator to follow the logic of the designer's reasoning and hopefully arrive at the same conclusion.

The application for a Construction Permit or Authorization, which is accompanied by a Preliminary Hazards Summary Report, represents the first formal step in the licensing or authorization process. Upon its receipt at the Division of Licensing and Regulation of the Commission, staff evaluation begins. Staff judgment on the proposed reactor facility is based primarily on contents of the report but generally includes results of conferences with the applicant and with consultants as needed, and often a firsthand look at the proposed site. Before review is completed the applicant may forward supplemental information since the applicant's project effort is a continuing one. Such additional data are reviewed along with the original submittal. The applicant's hazards report and supplemental information become a part of the public record.

VII. ROLE OF ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

It has always been the practice of the Commission to utilize the services of experts, not affiliated with the Commission, on important or novel matters of reactor safety. Early in the program of reactor plant development the Commission established a continuing group of experts which has evolved into the present Advisory Committee on Reactor Safeguards. This group is comprised of a panel of consultants representing collectively a wide range of knowledge and experience in the various phases of reactor technology. Congress recognized the value of such independent counsel and advice, and accordingly, in 1957, granted statutory status to the Committee. By amendment to the Atomic Energy Act the Commission was authorized to request the Advisory Committee on Reactor Safeguards for counsel and advice on any reactor safety problem and was required to obtain such counsel and advice on all power and test reactors considered for licensing by the Commission. Subsequently, by issuance of 10 CFR 115 the Commission was required to obtain these services for other nuclear reactors exempted from licensing requirements but considered for authorization by the Commission. The counsel and advice rendered by the Committee to the Commission on such reactors was required by law to be made a part of the public record.

Concurrently, therefore, with review of the Preliminary Hazards Summary Report by the Commission Staff, a review by the Advisory Committee on Reactor Safeguards is also initiated. The Committee may initially assign the project to a subcommittee to develop further details and a preliminary judgment of the case. Upon completion of the review by the Atomic Energy Commission Staff, arrangements are made to place the case on the agenda of a forthcoming meeting of the Advisory Committee on Reactor Safeguards. For this meeting the applicant is generally requested to have available those technical persons qualified to discuss the various aspects of the proposed facility. At the meeting the Advisory Committee and the Commission Staff discuss the case. The full Committee considers the Commission Staff judgment on the project and, also, receives a report from their own subcommittee. The applicant is generally then asked to discuss the project with the Committee. If the Committee decides that additional information is needed before it can render a judgment on the case, it so informs the Commission who in turn will request the applicant to furnish the necessary information through an amendment to the initial application. If no additional information is required, the Advisory Committee submits its advice to the Commission soon after the meeting.

VIII. PUBLIC HEARING

Assuming that the Commission Staff and the Advisory Committee have arrived at a favorable decision with respect to the proposed facility, the case must now go through another step before a Construction Permit or Authorization is granted. This involves a public hearing on the case.

All documents received from the applicant are placed in the Commission's public document room at the time of receipt. By a 1957 amendment to the Atomic Energy Act, the Commission is required to hold a public hearing in all cases involving the licensing of a power or test reactor. This requirement

has subsequently been extended to cases involving authorization of certain nuclear reactors exempted from licensing requirements; i.e., those subject to 10 CFR 115. Through publication of a notice in the Federal Register, the public is notified of the intent to hold a hearing and of the issues to be considered by the hearing examiner. This hearing is held no sooner than 30 days after the notice has been published.

The hearing provides a mechanism whereby interested persons may participate formally in the determination as to whether a Construction Permit or Authorization should be granted and, also, of the safety conditions to be satisfied by the applicant.

For example, in some instances State Departments of Health and State Attorneys General have expressed interest in the matter at issue, and in some instances have even stated their position on the public record of the hearing. From past experiences, the interest of state agencies generally relates to the manner of control of gaseous and liquid radioactive effluents.

At a public hearing the applicant presents testimony to indicate that he--and/or his contractors--possess both technical and financial qualifications to construct and operate the proposed plant and that the plant design and method of operation can be done without undue risk to the health and safety of the public. It is necessary that the applicant satisfy the burden of proof in such hearing.

Following the presentation of the applicant at the hearing, an analysis of the project is presented by the Commission's Regulatory Staff. This presentation includes a report of the advice received from the Advisory Committee on Reactor Safeguards. Where a formal intervention has occurred (e.g., some group or individual has raised some objection) evidence may be presented on behalf of the third party. Witnesses appearing before the Hearing Examiner are normally questioned by the Regulatory Staff and the Hearing Examiner concerning evidence that has been presented. Upon completion of the presentations at the hearing the parties (applicant and AEC) submit proposed conclusions and the proposed form of license which includes the technical specifications for operation of the facility. The Hearing Examiner then takes the matter under consideration. Following his review the Hearing Examiner delivers an Intermediate Decision. Under the Commission's rules this decision will become final after a prescribed period unless a party files exceptions or unless the Commission decides to review the matter further on its own initiative. In the latter event, the Commissioners will deliver a decision on the basis of their review. If this decision is favorable, the Division of Licensing and Regulation of the Atomic Energy Commission is authorized to grant a Construction Permit or Authorization.

Normally a Construction Permit or Authorization for a power or testing reactor is a provisional permit or authorization in that it takes into account the fact that the Commission has not been furnished all the technical information required to complete an analysis for the purpose of determining operational safety. The permit or authorization does include a finding, however, that the Commission is satisfied that it has information sufficient to provide reasonable assurance that a facility of the general type proposed, can be constructed and operated at the proposed location without undue risk to the health and safety of the public.

As design details are firmly established by the applicant, the applicant may request that the Construction Permit or Authorization be amended to incorporate as a Commission-approved technical specification such items as his containment system design, core design, and waste disposal system. After review by the Commission Staff, the matter is referred to the Advisory Committee on Reactor Safeguards for review and advice. These technical specifications, if approved, can be covered in an amendment. Amendments are issued pursuant to published notice and an opportunity for public hearing.

It should be noted that issuance of a construction permit, or authorization does not automatically insure the applicant the right to an operating license or authorization. The Construction Permit or Authorization has been granted on the basis of reasonable assurance that the proposed facility can be designed, constructed, and operated at the proposed site in a manner such that undue hazard to the health and safety of the general public will not result. It remains for the applicant to prove that the facility has, in fact, been designed and constructed in the proposed manner and that trained personnel, provided with adequate operating and emergency procedures, are prepared for the responsibility of operating the facility in the proposed manner. The applicant must provide this assurance upon application to the Commission for an Operating License or Authorization. This application initiates the second major phase in the licensing or authorization procedures established to conform with the Commission's regulatory function.

IX. PROCEDURE FOR AN OPERATING LICENSE OR AUTHORIZATION

Application for an Operating License or Authorization is made when a reactor facility has been completely designed and construction has progressed to the point where the actual time for initial operation is approaching and can be reliably predicted. In the usual instance a Final Hazards Summary Report is submitted by an applicant concurrently with the application for an Operating License or Authorization. The Final Hazards Summary Report, consisting of a single document or of several documents submitted over a considerable period of time, constitutes a part of the formal application for an Operating License or Authorization and, hence, it becomes a part of the public record.

Whereas the Preliminary Hazards Summary Report, submitted in conjunction with the application for a Construction Permit or Authorization, is generally concerned with conceptual design and expected operating characteristics of the reactor facility, the Final Hazards Summary Report is intended to present information on the facility as actually constructed and to include a detailed description of anticipated plans and procedures for operation, together with a body of convincing evidence that operation as proposed will not endanger the health and safety of the general public. It is not required that material presented in the Preliminary Hazards Summary Report and supporting documents be repeated, but it is expected that deviations in plans or systems concepts from those originally described be clearly delineated, particularly if elements of safety are involved either directly or indirectly. The overall emphasis of the Final Hazards Summary Report should, in fact, be concerned with those aspects of the facility as constructed and the plans and procedures for operation actually prepared for the existing facility insofar as they have a bearing on the safety of the facility.

In terms of contents of such a report, an applicant should continuously bear in mind during its preparation the end purpose it must serve; namely, to provide a governmental evaluating staff a sound basis for arriving at a judgment that there is reasonable assurance that the reactor facility as designed and constructed and as proposed to be operated, in the location where situated, will not cause an undue hazard to the health and safety of the general public.

X. FINAL HAZARDS SUMMARY REPORT

Like the Preliminary Hazards Summary Reports, Final Hazards Summary Reports from various applicants have shown considerable variation in format and contents. While it is recognized that complete uniformity in content is not possible because of the differences in plant concepts, certain common and basic elements of coverage are desired. These are as follows:

(1) Description of the Facility as Constructed

Special emphasis should be given to features differing from those originally described with details, numerical and quantitative where appropriate, on systems and components involved in the safety aspects of the facility.

(2) Detailed Descriptions of the Reactor

Characteristics of the reactor as finally designed and constructed are essential to overall evaluation. Presumably the conceptual and original design goals established for the physical, nuclear, thermal, hydraulic, mechanical, and chemical features of the plant have been verified but this stage of the plant development and the results of this progression of effort should be presented as justification of the safety features claimed for the design. Description of the instrumentation should be given with respect to the final choice of performance specifications, the functions to be performed, and the manner in which the instrumentation adds to the inherent safety features of the plant.

(3) Administration, Organization, Plans and Procedures

It is generally recognized that responsibility for the ultimate safety achieved in a nuclear power plant rests not only with the plant designers but equally heavily upon the plant operating staff. "Operating staff" is meant to include all those who take over the plant for fulfillment of its end objective, whether power generation or experimental purposes. It is equally important, therefore, for the evaluator who must judge that a plant can be operated safely to be assured that the men who are to run a nuclear facility are trained and competent, that each man knows what his responsibilities are, that he has been given carefully prepared procedures, and that these procedures include not only the normal operations but cover possible emergency situations also.

In the Final Hazards Report, therefore, it is expected that the information presented shows that particular emphasis has been given to the organizational structure of the operating staff, the principal ground rules and policies of operation, and the plans and procedures to be followed in the case of accidents or emergencies, insofar as these relate to ultimate safety and protection against the consequences of malfunction or misoperation.

(4) Final Estimate of Hazards and Safeguards

Since the plant is approaching the final stage of completion, it should be possible to assess with a greater degree of certainty the likelihood and consequences of potential accidents. Results should therefore be presented of a re-examination of assumptions made earlier with respect to potential hazards, including reappraisal of the accident considered to be the maximum credible one. It should be shown that adequate protection of the public exists even for this accident. This should be done in such a manner that the Commission can clearly understand the specifications, assumptions, and methods used by the applicant in arriving at such a conclusion.

(5) Proposed Technical Specifications

Both 10 CFR 50 and 10 CFR 115 provide that certain significant design and operating limitations and procedures be designated in the license or authorization as technical specifications. The technical specifications represent, in essence, those parameters which define the boundaries of license activities which the Commission has evaluated and approved from a safety standpoint. Each application for an Operating License must include proposed technical specifications to govern operation of the facility. The technical specifications should be included in an appendix to the application and the basis for each should be set forth in the Final Hazards Summary Report. By a recent amendment to 10 CFR 50 (published in 27 Federal Register, 5491, June 9, 1962) a guide was published to the type of matters the Commission would generally be expected to be included in technical specifications.

The processing of the application for an Operating License or

Authorization and the associated Final Hazards Summary Report follow substantially the same path as that for a Construction Permit or Authorization. This includes review of the case by the Commission Staff and by the Advisory Committee on Reactor Safeguards, inspection of the constructed facility by Commission personnel, a public hearing before an Examiner appointed by the Commission, and the subsequent granting or denial of a license or authorization.

XI. IMPORTANCE OF HAZARDS SUMMARY REPORTS.

The importance of Hazards Summary Reports cannot be overemphasized. The previous discussion summarized the critical purpose they serve and the manner in which they are used by the Commission. They have been in the past and will continue to be the major source of information upon which the Commission and the Advisory Committee on Reactor Safeguards base their judgment as to whether or not a license or authorization for construction or operation is warranted. In this respect, it should be of paramount interest to an applicant to submit a report adequate for the purpose it will serve. It should be concise, but not incomplete.

XII. DETAILED GUIDANCE FOR PREPARATION OF REPORTS.

The guide, as presented in Appendix A, is concerned essentially with the requirements associated with a Final Hazards Summary Report. It is recognized that in many instances the extent and detail of information requested is in excess of that which could reasonably be expected to be presented in a Preliminary Hazards Summary Report concerned with a conceptual design. Due allowance will be made for the extent of information provided in view of the status of design. In the event that no meaningful information can be presented on a pertinent item listed in the guide or otherwise considered important to plant safety analysis, an applicant should acknowledge the importance of the information and indicate the intention and, if practical, the methods to be used to develop the information concurrently with development of the conceptual design. In the event that a particular item of consideration relevant to nuclear safety is not covered by the guide, it is again emphasized that such omission does not relieve the applicant of the obligation and responsibility for presentation of appropriate information in the report. Ritualistic adherence to the suggested format and coverage should not be substituted in any case for systematic analysis of individual safety aspects peculiar to a given plant.

APPENDIX A

A GUIDE FOR THE ORGANIZATION AND CONTENTS OF HAZARDS SUMMARY REPORTS

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GENERAL CONSIDERATIONS

This appendix presents suggested guidance as to the organization and contents of final hazards summary reports for power and test reactors. The guidance provided is based primarily on a land-based stationary nuclear facility utilizing water cooled and moderated reactors. However, the guides should be readily adaptable to other types. In addition to suggestions on specific technical content, the following general suggestions on presentation of material should be considered:

A. Special Studies and Supporting Information. Any special studies or voluminous supporting information may be either appended to the hazards summary report or submitted separately, but in any case, they should be clearly and specifically incorporated by reference in the text of the hazards summary report. The inclusion of uncorrelated tabulations of data should be avoided. A bibliography of references cited in the hazards summary report should be provided. Any reference material cited but not readily and generally available should be made available to the Commission upon submission of the hazards summary report.

B. Table of Contents and Index. To facilitate use of the hazards summary reports it is suggested that a table of contents be provided. Consideration should also be given to provision of an index when reports consist of two or more volumes.

C. Manufacturers and Design Lifetimes. It is suggested that names of manufacturers and design lifetimes be provided for principal components.

D. Drawings. Construction drawings, maps, diagrams, sketches and charts should be employed whenever information can be presented more adequately or conveniently by such means. Drawings may be included in the body of the report or may be attached as appendices. Due concern should be taken to insure that all information presented in drawings is legible, symbols of components discussed are defined, and that drawings are not reduced to the extent that visual aids are necessary to interpret pertinent items of information presented thereon.

In a few instances specific drawings and maps are discussed in the principal sections of this appendix. In addition, it is suggested that other essential descriptive drawings be inserted for information purposes, including, for example:

(1) Process flow diagrams for the primary and secondary coolant systems, and for auxiliary systems.

(2) Component assembly drawings (overall assembly and sectionalized views) for each major component in the primary coolant system.

(3) Overall assembly drawings and sectional views of control rods, rod drive mechanisms, fuel elements and assemblies, and pressure vessel internals.

(4) Line diagrams (plan and elevation) of principal piping systems.

(5) Line diagrams of instrumentation and control schemes.

(6) Line diagrams of ventilating flow schemes.

(7) Line diagrams of electric power system circuits.

(8) Equipment and system layout drawings.

E. Technical Specifications. Consideration should be given to including in the hazards summary report a summation of technical information about the facility in a form that might be readily adaptable to technical specifications for the nuclear facility as they are described in Parts 50 and 115 of Title 10, Code of Federal Regulations.

F. Additional Information. In any case in which any item of information not explicitly mentioned in the suggestions presented in Section I to XIV, inclusive, is necessary to a complete hazards analysis of the proposed facility or to an appraisal of safety, that information should be included in the hazards summary report by insertion of additional sections or subsections.

G. Miscellaneous Considerations. The following general guidance on the form of the report is suggested:

(1) The report should be presented in volumes provided preferably with durable covers, and no volume should have an overall thickness greater than approximately two inches.

(2) The page dimensions should be eight and one half inches in width and eleven inches in length.

(3) The assembly of pages into a given volume should be accomplished in a manner permitting the rapid removal and reinsertion of a given page, or insertion of a modified page or of additional pages without undue distortion or damage to the covers or binding of the report.

(4) Abbreviations should be used discriminately, should be consistent throughout the report, and should be consistent with a generally accepted convention for abbreviations. All abbreviations not in general usage, or unique to the proposed facility, should be defined in each volume where they are used.

(5) The volumes, sections, subsections, appendices, pages, and drawings should be identified in accordance with an easily interpreted and consistent system employing any reasonable combination of roman and arabic numerals and upper and lower case alphabetical letters. The system selected should be defined.

(6) Information should be presented on both sides of each page and the identifying notation for each page should be given in the upper outside corner.

SECTION I - INTRODUCTION AND SUMMARY

The first section of the hazards summary report should present an introduction and summary. To the extent that they may be applicable, the following guides are suggested as illustrative of the types of information that should be considered for inclusion in this section:

A. Summary Description. A concise description of the nuclear reactor facility, and of the site, including a brief summary of the principal concepts upon which the design of the facility is based, and the manner in which it is to be operated.

B. Identification of Contractors. Identification of organizations which will be prime contractors for design, construction, operation, or any portion or period of operation, of the nuclear reactor facility.

C. Characteristics. A tabulation of the most important design and operating characteristics of the facility, extracted from succeeding sections of the report, without details of description, calculation, or discussion.

D. Safety Principles. A compilation, and brief discussion of the paramount nuclear safety principles established for the design, construction, and operation of the facility.

E. Safety Questions. Identification of significant novel safety questions presented by the design, including substantial uncertainties relevant to safety.

F. Additional Information. Other general information pertinent to the evaluation of potential hazards, including reference to experimental and theoretical research, testing programs, design studies, and related experience gained in the operation of other reactors.

G. General Conclusions. A summary discussion of the general conclusions on safety established by the applicant.

SECTION II - SITE

A separate section of the hazards summary report should be concerned with the site. It should provide information appropriate to a determination of the safety of operation of the nuclear facility at the site. Factors considered by the Commission in evaluating proposed sites are identified in 10 CFR 100. To the extent that they may be applicable, the following guides are suggested as illustrative of the types of information that should be considered for inclusion in this section:

A. Description of Site and Adjacent Areas. A description and analysis of the site and adjacent areas, including:

(1) The area of the site, the state and county in which it is located, and the orientation of the site with respect to the nearest large cities and well-known geographic locations.

(2) The nature, extent, and basis of control exercised by the applicant over the reactor exclusion zone.

(3) The nature of any activities conducted within the exclusion zone, other than operation of the reactor, including the number of persons associated with each of the activities and the degree of control exercised over these persons.

(4) Contour maps of the site and surrounding areas, showing the location of the reactor, the site, cities, towns, settlements, nearby tall buildings, roads, railroads, rivers, streams, lakes, nearby wells, central water supplies, and other natural and man-made features relevant to analysis of possible exposure of any person to ionizing radiation. One contour map covering an area within a radius of five miles from the reactor and having a scale of at least one inch to each actual mile should be provided. An additional contour map covering a larger area should be provided for facilities utilizing a reactor with a rating in excess of five megawatts, thermal. This additional map should cover an area within a radius based on the reactor power. The following radii are suggested as a function of power level:

Reactor Power, Megawatts, Thermal		Radius,
Greater Than	Equal to or Less Than	Miles
5	10	10
10	100	20
100	1,000	30
1,000		$\sqrt{MW(t)^*}$

*MW(t) = Megawatts, thermal.

(5) The extent to which the proximity of other nuclear facilities, either existing or for which construction permits or authorizations have been granted or requested, has affected design and proposed operating procedures.

(6) A tabulation of the distribution of the resident population in each of sixteen adjacent twenty-two and one-half degree sectors as a function of distance from the reactor. The sectors should be oriented so that the bisector of one sector passes through a cardinal compass point. The distances considered should be:

Distances, in Miles, For Population Distribution Grid				
Reactor Power, P, in Megawatts, Thermal				
$0 < P \leq 5$	$5 < P \leq 10$	$10 < P \leq 100$	$100 < P \leq 1000$	$1000 < P$
0 to 1	0 to 1	0 to 1	0 to 1	0 to 1
1 to 2	1 to 2	1 to 2	1 to 2	1 to 2
2 to 3	2 to 3	2 to 3	2 to 3	2 to 3
3 to 4	3 to 4	3 to 4	3 to 4	3 to 4
4 to 5	4 to 5	4 to 5	4 to 5	4 to 5
*	5 to 10	5 to 10	5 to 10	5 to 10
	*	10 to 20	10 to 20	10 to 20
		*	20 to 30	20 to 30
			*	30 to $\sqrt{MW(t)}$
				*

*In the event the area between the maximum distance indicated and twice this distance is heavily populated this area should be included in the tabulation.

(7) A discussion of any significant effect on the above population distribution due to part time occupancy or seasonal variations.

(8) A discussion of the character of use of the areas within the limiting distances specified in the tabulation presented in subparagraph A.(6), above, for agricultural, industrial, commercial, residential, recreational, or other purposes.

(9) An estimate of anticipated future changes in population density and character of use of the areas within the limiting distances specified in the tabulation presented in subparagraph A.(6), above.

B. Meteorology. Information as to the meteorology of the site and surrounding areas sufficient to appraise the potential hazard to the public in the event of a release of radioactive material, including brief and concise descriptions of the following:

(1) A description of temperatures, including the summer, winter, and annual mean temperatures, the maximum and minimum recorded temperatures, and the average and maximum vertical temperature gradients.

(2) A description of precipitation, including the average and maximum annual, and the maximum daily and monthly rain and snowfall, the frequency and severity of hail, ice, and thunderstorms, the frequency and characteristics of fog formations, and the prevalent wind directions associated with precipitation.

(3) A description of seasonal wind characteristics for winds at the surface and aloft, to heights of several thousand feet, including wind speeds and directions, and the frequency of occurrence and duration of persistence of specific winds in specific directions. The presentation of this information in the form of wind roses should be considered. The wind roses should utilize at least sixteen equally spaced radii including the four cardinal compass directions.

(4) The frequency of occurrence and duration of persistence of essentially calm conditions.

(5) The frequency of occurrence and effects of storms accompanied by high and violent winds, including tornadoes, hurricanes, cyclones, and other storms.

(6) A description of prevalent lapse and inversion conditions, including the frequency of occurrence and duration of persistence of typical conditions.

(7) A description of the effects of terrain on meteorology.

(8) A description of any peculiarities of the local meteorological conditions relevant to the diffusion of radioactive gaseous and airborne particulate matter.

(9) The source of meteorological information and the justification for use of information accumulated at off-site locations.

(10) A discussion of on-site meteorological data collection programs, if any, including the purpose of the programs, the types of data collected, and the methods and frequencies of collection. Particular emphasis should be given to a description of the program for monitoring and continuously recording site wind speeds and directions for the purpose of providing the operations staff with:

(a) Information indicating the existence of acceptable wind conditions during routine discharge of radioactive gaseous and air-borne particulate waste;

(b) Information vital to implementation of emergency and evacuation procedures in event of accident.

(11) A discussion of diffusion parameters selected for determination of the diffusion characteristics of radioactive gaseous and air-borne particulate matter released to the environment routinely and in the event of accident. The extent to which the meteorological information presented in this subsection was used in the determination or selection of the diffusion parameters should be specified.

C. Geology. Geological information pertinent to the site and to the surrounding areas indicated by the radii suggested in paragraph A.(4) above, including, for example:

(1) General geological characteristics.

(2) The capacity of the geological formation to adequately support the structures necessary for the facility.

(3) The type and capacity of the soil, if pertinent, to serve as an ion-exchange and filtering medium in the event radioactive liquids are released to the soil.

(4) The source of geological information.

D. Seismology. Seismological information pertinent to the site and to the surrounding areas indicated by the radii suggested in paragraph A.(4) above, including, for example:

(1) The general earthquake history.

(2) The location nearby of any known, active geological faults.

(3) The anticipated maximum severity of future earthquakes.

(4) Reference to design features provided to cope with possible earth tremors and attendant effects.

(5) The source of seismological information.

E. Hydrology. Hydrological information pertaining to the site and to the surrounding areas indicated by the radii suggested in paragraph A.(4) above, including, for example:

(1) The absorption and drainage characteristics of water in surface and underground areas.

(2) Depths, estimated directions, and rates of flow of underground waters.

(3) Sizes and seasonal and average rates of flow of nearby streams, rivers, lakes, and reservoirs, and the character of their use.

(4) The characteristics of wells within the area, including depths, yields, and usage.

(5) A discussion of aquatic life within the area.

(6) The flood and inundation history of the area, including frequencies and causes.

(7) The source of hydrological information.

SECTION III - CONTAINMENT SYSTEM

This section of the hazards summary report should provide information appropriate to a determination of the effectiveness of the containment system in limiting the release of radioactive materials. To the extent that they may be applicable, the following guides are suggested as illustrative of the types of information that should be considered for inclusion in this section:

A. Description of Containment System. A general description of the containment system, including, for example:

(1) A description of the design bases for the containment system including a concise discussion of any provisions for the venting, suppression, or reduction of pressure.

(2) A description of the circumstances and conditions under which the containment system is to be sealed from the atmosphere, the methods used to detect these circumstances and conditions, and the sequence of events following the signal for closure, including the operation of closure devices and actuation of emergency systems.

(3) A statement as to the principal dimensions and approximate gross and net volumes of the containment system.

(4) A discussion, preferably supported by sketches, describing the containment system, and service and auxiliary facilities.

(5) The extent of occupancy of the containment system which will be permitted during operation, maintenance, testing and experimentation; and measures to control such occupancy.

(6) An explanation of any activities, other than reactor operation, that are to be conducted within the containment system.

(7) The extent to which the containment system integrity is compromised, if at all, during refueling or other maintenance activities, and the condition of the reactor, including degree of shutdown, and temperature and pressure levels during these periods.

(8) A discussion of any planned limitations on operation or maintenance that are prohibited whenever the design integrity of the containment system is not established.

B. Design Loading. A tabulation of the design loading for the containment vessel including, for example:

(1) The internal pressure load.

(2) Thermal loads, including transient loads occurring in the event of accident, and due to condensation of hot vapors on internal surfaces, heat transfer through the system walls, and temperature differentials that may exist at points of embedment or restraint.

(3) Concentrated loads, such as:

(a) Impact loads from internal credible missiles;

(b) Loads due to supporting members, components, and equipment connected to the system;

(c) Live loads from cranes and floor loadings transmitted directly to the containment system walls;

(d) The dead load due to transfer of the containment system weight to the supporting structure;

(e) Loadings from internal flooding of the system.

(4) External loads, such as:

(a) Seismic effects;

(b) Loads due to nonuniform settling of foundations;

(c) Wind, snow, and ice loads;

(d) Vacuum conditions due to effects of barometric and ambient temperature fluctuations on a sealed system;

(e) Vacuum conditions due to internal depletion of oxygen through combustion;

(f) Loadings from external soil and hydrostatic pressures;

(g) Impact loads from external credible missiles.

C. Materials of Construction. A description of the materials of construction, including, for example:

(1) A list of applicable materials specifications for the principal materials of construction.

(2) The extent to which amendments, supplements, or waivers have been applied to standard material specifications, including any modification of the provisions for heat treatment, chemical composition, mechanical properties, or material inspections, tests, and inspection standards.

(3) A description of notch-ductility properties, including:

(a) Results of Charpy V-notch impact tests on vessel material, weld specimens, and component weldments; specified at particular test temperatures;

(b) A description of any heat treatment applied to enhance the notch-ductility properties.

(4) A description of corrosion protection features, including material allowances, provided for the containment system.

D. Structural Design. A description of structural design criteria and features, including, for example:

(1) Codes observed in the design and construction of the containment system, and any exceptions, revisions, addenda, case interpretations, or special rulings by which the application of codes has been qualified.

(2) The design stress limits for combinations of primary and secondary stress in terms of the allowable stress value for the containment system vessel material.

(3) The method of supporting the containment system, including the means employed in transferring the vertical dead loads from within the system to the foundation.

(4) Containment system drawings in sufficient detail to include:

(a) Location and identification of major components within the system;

(b) Basic system dimensions and wall thicknesses;

(c) Allowable deviation from circular or spherical form;

(d) Geometrical configuration of the system;

(e) Identification, location, and size of connections and penetrations;

(f) Internal or external attachments;

(g) Vessel supporting structure;

(h) Location of major welding joints;

(i) Transitions between sections of unequal thickness;

(j) Grade level;

(k) Areas of embedment in concrete, and relation to grade level.

(5) A brief description of fabrication and welding procedures, and of specifications for shop and site fabrication and of welding employed in the containment system manufacture and not included in applicable codes or specifications.

(6) Inspection procedures, such as:

(a) Material inspections;

(b) Inspections during shop fabrication;

(c) Inspections during site erection;

(d) Weld operator qualifications inspections;

(e) Welding procedures inspections;

(f) Heat treatment practices;

(g) Application of, and acceptance standards and procedures for radiographic, ultrasonic, magnetic particle, and liquid penetrant inspections;

(h) Records of inspections.

(7) A copy of the vessel data report prepared by the manufacturer of the containment system vessel.

(8) Details of the design and sealing of joints in the containment system.

(9) Provisions made to integrate piping and ducting penetrations with the containment system wall in order to preclude a rupture between the wall and the closure valves provided for the penetrating lines, or of the wall itself.

(10) The dimensions, location, methods of support, and materials of construction of any secondary or containment radiation shielding associated with the containment system, and of any thermal or weather insulation.

(11) The dimensions, location, methods of support, and materials of construction of any missile barriers associated with the containment system.

(12) Uses made, if any, of the containment system structure for support of equipment.

E. Penetrations. An analysis of penetrations of the containment system, including, for example:

(1) The numbers and types of penetration of the containment system for the entry or exit of electrical wiring, fluid piping, tubing, and ducts, and all airlocks and access ports.

(2) Significant details of design, construction, and operation of penetrations, including:

(a) Location and grouping of penetrations;

(b) Methods and materials for sealing penetrations to the containment system walls and anticipated requirements of maintenance, including removal and replacement of the sealing.

(3) A description of valves and dampers in pipes, tubes, or ducts penetrating the containment system, including:

(a) The locations, and types of valves and dampers;

(b) The closing times of valves and dampers;

(c) Method of actuation of valves and dampers.

(4) A description of airlocks and access ports penetrating the containment system, including, for example:

(a) Dimensions of airlocks and access ports;

(b) Operating methods for airlocks and access ports;

(c) Frequency of operation of airlocks and access ports;

(d) Interlock and bypass provisions in connection with airlocks and access ports;

(e) A detailed description of any emergency escape ports and the occasions for which they are provided.

(5) A description of penetrations for air sampling, and connections for maintenance services.

(6) A description of any temperature, pressure, humidity, radiation, or chemical concentration detection or monitoring system used in conjunction with penetrations.

(7) A description of the methods, minimum acceptance standards, and frequency of inspection and testing of components and systems essential to reliable operation of the containment system in event of an accident, including:

(a) Automatically actuated valves and dampers;

(b) Detection and monitoring systems;

(c) Airlocks;

(d) Spray systems;

(e) Emergency cooling systems.

F. Ventilation. A description of provisions for ventilation of the containment system, and for other air purification facilities servicing the containment system under normal and emergency conditions, including, for example:

(1) Method of ventilation, whether operation is continuous or intermittent, and the basis for selection of the type of operation;

(2) Ventilation flow rates and the basis for selection of these flow rates;

(3) The flow paths of ventilating air, major pressure gradients, and the location of fans and blowers;

(4) A description of filter systems and other air purification equipment, including types of equipment, purpose, location and efficiencies of filters as installed, testing of filter efficiency, inspection and servicing requirements, and accessibility.

(5) Requirements of, and provisions for, separate ventilation of the shielding, or any other individual component or system within the containment system, including the relation of this ventilating system to the main containment system ventilating system.

(6) Maximum anticipated rate of heat release to the containment system air, during normal operation, from systems and equipment installed within the containment system.

(7) A description of the air conditions relative to temperature, humidity, and radioactivity to be maintained in the containment system during periods of normal operation, and of the air treatment systems provided to maintain these conditions, and to dehumidify stagnant regions where corrosion is of concern.

(8) A description of the facilities provided and the methods used to exhaust, monitor, and filter the ventilation air from the containment system in a safe manner, including provisions made to disperse the exhaust so as to preclude re-entry to the facility through any air intake.

(9) A description of design features potentially capable of alleviating the hazards associated with an accident, including any provisions for recirculation of the containment system air through a filter unit following an accident releasing radioactivity to the containment system.

G. Design Pressure. An analysis of the containment system internal design pressure, including, for example:

(1) The basis of choice of the containment system internal design pressure value, including, for example:

(a) Sources and amounts of energy and material released to the containment system as the result of credible ruptures of various sized pipes in the primary coolant system, and the secondary coolant system if a rupture therein could credibly involve the primary system, the time dependencies associated with these releases, justification for the type of release selected for design purposes, and a comparison of the effects resulting from this release with those which would result from a release due to a circumferential rupture of the largest pipe in the primary coolant system with both ends of this pipe, at the point of rupture, free and open;

(b) Mechanisms of energy absorption and transfer, and the associated time dependency of the absorption and transfer;

(c) Graphical presentation of the pressure and temperature within the containment system as a function of time following the assumed maximum credible accident, with and without emergency cooling and spray systems functioning, and extended in time to include all maxima;

(d) Discussion of all principal pressure and temperature maxima, including their cause and effect;

(e) A description and analysis of any conditions that could subject the containment system to a negative pressure, the provisions made for relief of negative pressures, the means of protection against exterior blocking of the relief line, and the methods, and frequency of periodic testing of the relief mechanism.

(2) Pressure tests and inspections for structural integrity, including:

(a) Methods of pressure testing the containment system prior to routine reactor operation, and pressures at which testing will be conducted;

(b) Description of the methods for periodic retesting for strength after routine operation of the reactor;

(c) Methods and frequency of inspection of the containment system for structural integrity, including the extent and standards of inspection applied, and the extent to which both sides of the containment system walls are accessible for inspection.

H. Design Leakage Rate. An analysis of the containment system design leakage rate, including, for example:

(1) The basis of choice of the containment system design leakage rate, including:

(a) The design leakage rate;

(b) The relationship between leakage rate and containment system and environmental pressure.

(2) Leak rate tests, including

(a) Description of leak rate tests to be performed prior to routine reactor operation stating for each test, the extent of construction completed, the condition of penetrations, the pressure at which the test will be conducted, the limitations of the allowable leak rate and a description of the method of testing, including the duration, precision, and accuracy of tests, and corrections made in the reduction of test data to final values;

(b) Description of the methods of retesting for leak tightness after routine operation of the reactor, including frequency, duration, precision, and accuracy of tests, the methods of data reduction, and provisions made for leak testing individual penetrations.

I. Miscellaneous. A discussion, including appropriate descriptions and analyses, of miscellaneous features and considerations associated with the containment system, including, for example:

(1) The methods and criteria used in the stress analysis of the containment system.

(2) An analysis of sources of missiles having a capability of damaging the containment system, the primary coolant and associated high pressure auxiliary systems, or emergency systems essential to the integrity of the containment system.

(3) A description of the types, amounts, locations, and characteristics of materials, in and about the containment system, that are inflammable or explosive in nature under the conditions that may prevail during normal operation and in event of accident.

(4) A description of design features provided to prevent or capable of preventing penetration of the containment system by the worst credible core melt-down.

(5) A description of design features provided for decontamination of the containment system and of equipment therein under normal operating conditions and in event of accident.

(6) Provisions for preserving the integrity of the containment system in the event of fire, flood, electrical storm, earthquake, or other emergency, including, for example:

(a) An analysis of the extent to which such provisions are required;

(b) Systems and equipment to be employed;

(c) Methods of actuation of these systems and equipment, and an analysis of the adequacy of the methods of actuation;

(d) Programs for establishing the reliability of, and for testing these systems.

(7) A description of the means provided for determination of post-accident conditions within the containment system, including pressure, temperature, and radioactivity levels, and the status of critical components and systems.

(8) A description of provisions made to maintain equipment, and components within the containment system in a fail-safe condition following an accident, including protection of valve operators against collapse due to pressure, protection against wet cable runs, protection against wrong-way operation of air actuated valves due to pressure, and protection of essential emergency equipment against damage.

(9) Provisions for secondary methods of actuation, including manual actuation, of safety devices, components, equipment, and systems essential to the continued integrity of the containment system in the event of accident, and the times required for such emergency actuation under conditions when normal actuation does not occur.

(10) A description of the containment system communication facilities.

SECTION IV - REACTOR CORE

This section of the hazards summary report should provide information appropriate to a determination of the inherent safety of the core, and of the effect of associated nuclear characteristics. To the extent that they may be applicable, the following guides are suggested as illustrative of the types of information that should be considered for inclusion in this section:

A. General Description. A general summary description of the reactor core, including:

(1) Type of core, and design power capacity.

(2) Geometrical and dimensional characteristics, including the equivalent diameter, and the active and total height.

(3) The number and type of fuel assemblies, and their array in the core.

(4) The number, type, and array of control elements in the core.

(5) The assembly of the entire core, and the method of support.

B. Fuel Assemblies. A description of the fuel assemblies, and their component parts, including, for example;

(1) A description of variations in types of fuel assemblies, if more than one type is provided.

(2) Geometrical and dimensional particulars.

(3) Number of fuel elements per assembly.

(4) Fuel element array within an assembly, including the matrix, center-to-center distance, spacers, and method of assembly.

(5) Internal and external control rod channels, including channel dimensions, channel wall materials and thicknesses.

(6) Internal coolant channel dimensions and tolerances.

(7) Adjacent external coolant channel dimensions and tolerances.

(8) Assembly side wall materials and thicknesses.

(9) Materials, geometry, and dimensions of assembly end pieces.

(10) A description of locking devices provided to prevent movement of fuel assemblies during operation.

(11) Attachments provided to facilitate handling of fuel assemblies, including any particular features prohibiting the use of fuel assembly handling equipment and tools for any other purpose.

(12) Provisions made to prevent interference with adjacent control rods.

(13) Provisions made for identification of individual fuel assemblies, and to distinguish different types of assemblies.

(14) The method of assembly, including a brief description of any welding and brazing procedures.

(15) A description of the fuel elements, including, for example:

(a) The geometry, and significant dimensions and tolerances;

(b) The type, enrichment, and density of the fuel material;

(c) The type, form, and isotopic enrichment of burnable nuclear poisons;

(d) The geometry and dimensions of the smallest fuel pellet, and if applicable, the number of pellets per element;

(e) The amount of fuel and burnable poison in an element, an assembly, and the complete core;

(f) The element clad, including material, dimensions and tolerances, and methods of sealing or bonding;

(g) Hot and cold radial gaps between clad and fuel, and axial gaps between fuel units, if applicable;

(h) A discussion of material properties and specifications for all significant materials used in the fuel elements, and including melting and boiling temperatures, heat capacities, corrosion characteristics, and irradiation damage characteristics;

(i) Likelihood for occurrence of defects in the course of operation, including the anticipated extent and effects of defects;

(j) Past experience with the same or similar types of elements;

(k) The number, type, and position of any thermocouples imbedded in the fuel or cladding material;

(l) The effects of fuel burnup on material properties, including dimensional stability, ductility, and strength;

(m) Provisions made to ensure rigidity, and to minimize bowing or other modes of deformation of the elements;

(n) Probability for, and extent and effect of, vibrations induced during operation.

C. Control Rods. A description of the control rods, including, for example:

(1) A description of variations in types of control rods, if more than one type is provided, and a definition of the nomenclature used to distinguish between different type of rods.

(2) Geometry, and significant dimensions and tolerances;

(3) The type, amount, and isotopic enrichment of nuclear poisons in the control rods;

(4) The control rod clad, including material, dimensions and tolerances, and methods of sealing or bonding;

(5) A discussion of material properties and specifications for all significant materials used in the control rods, and including melting and boiling temperatures, strength, ductility, corrosion characteristics, irradiation damage effects, and any significant variation in material properties as a function of irradiation exposure;

(6) Past experience with the same or similar types of rods;

(7) A description of shrouds, guides, extension shafts, attachments, and of any positioning, shock-absorbing, locking, or travel limiting mechanisms within the reactor pressure vessel;

(8) A description of any unusual control rod features, including the provision of half-rods or fuel followers, and the purpose and necessity of these features;

(9) The anticipated control rod lifetime.

D. Other Components. A description of other core components, including, for example:

(1) A description of any neutron reflectors and reflector elements, including geometry and arrangement, material properties of any uncommon materials, irradiation effects, and any intended utilization for reactor control purposes;

(2) A description of any moderator materials, including geometry and arrangement within the reactor vessel, a description of physical, chemical and nuclear properties, unless they are well-known, and any intended utilization for reactor control purposes.

(3) A description of any special elements or components, such as stationary poison columns, or spike elements.

E. Core Support Structure. A description of the core support structure, including, for example:

(1) Geometry, and significant dimensions and tolerances.

(2) Properties for the materials of construction.

(3) Design bases including loads imposed from such effects as gravity and differential pressure.

(4) Method of attachment to vessel.

(5) A description of provisions for positioning and alignment of the core.

(6) A description of core locking devices.

(7) The effects of operating conditions on the support structure, including a discussion of rigidity.

F. Core Nuclear Characteristics. An analysis of the nuclear characteristics of the core, including, for example:

(1) The minimum critical mass.

(2) The effective neutron multiplication factor (k_{eff}) of the core under various conditions, including, for example:

(a) In the cold clean condition with all movable nuclear poisons withdrawn;

(b) In the hot clean condition with all movable nuclear poisons withdrawn;

(c) In the cold clean condition with the most effective control rod element fully withdrawn from the core and all other control rod elements in the position which would follow an emergency shutdown of the reactor;

(d) In the cold clean condition with all movable nuclear poisons inserted into the core;

(e) Similar values for the most reactive core condition, if this is not identical with the cold clean condition.

(3) A description of neutron flux, including the distribution, radially and axially and extending through the reactor pressure vessel, of the maximum and average flux of thermal and fast neutrons; and of neutrons with an energy greater than one million electron volts at the pressure vessel wall;

(4) An analysis of the temperature coefficients of reactivity, including a description of the mechanisms producing a temperature coefficient and the value of the coefficient attributable to each mechanism as a function of temperature and core life;

(5) An analysis of the void coefficients of reactivity, including the value of the coefficients as a function of core life and reactor power, and the value and location of the maximum local void coefficient of reactivity;

(6) An analysis of the overall power coefficient of reactivity, including the value of the coefficient as a function of power;

(7) An analysis of the pressure coefficient of reactivity, including the value of the coefficient as a function of pressure;

(8) Proposed variations in the operating power level of the reactor in conjunction with any anticipated modifications in the fuel loading of the core;

(9) The proposed fuel cycle, including the frequency of fuel replenishment or rearrangement; the amounts to be replenished or rearranged, and the patterns of fuel rearrangement;

(10) Maximum and average fuel burnup and enrichment at end of full cycle, and an explanation of the specified burnup value;

(11) The content of plutonium and uranium-233, if applicable, as a function of core life.

(12) An analysis of total excess reactivity and the reactivity requirements to compensate for specific conditions that may prevail in the core at various power levels and at various stages during the fuel cycle, including the reactivity effects of:

(a) Equilibrium concentration of xenon;

(b) Equilibrium concentration of samarium;

(c) Maximum transient concentration of xenon;

(d) Concentration of fission products other than xenon and samarium;

(e) Depletion of original fuel and production of fissionable isotopes;

(f) Increase in core moderator temperature from ambient to operating temperature;

(g) Increase in core power from zero to operating power;

(h) Increase in fuel temperature from moderator operating temperature to full power fuel temperature;

(i) Variations in reactivity due to insertion of materials in the course of experiments;

(j) Operation of the reactor controls;

(k) Depletion or loss of effectiveness of burnable and soluble neutron poisons.

(13) An analysis of the inherent nuclear stability of the reactor including inherent response of the reactor system to disturbances, such as ramp and step insertions of reactivity. Stability criteria used in evaluating the system should be identified, and the method of analysis, analytical assumptions, and assumed values of operating variables should be explained.

(14) Maximum and average reactivity worths of fuel, reflector, and other types of fixed elements.

(15) A summary of the significant nuclear variables used in calculations and analyses, as a function of temperature and core life, and including for example:

(a) The mean life of prompt neutrons;

(b) Delayed neutron fractions, and delay times;

(c) Utilization of thermal neutrons for fission;

(d) Fast fission factor;

(e) Neutron age;

(f) Diffusion length and coefficient;

(g) Probability of resonance escape;

(h) Geometric buckling.

G. Thermal and Hydraulic Characteristics. An analysis of the thermal and hydraulic characteristics of the reactor core, including, for example:

(1) Maximum and design thermal power levels.

(2) Maximum and average temperatures of core coolant, moderator, fuel center, fuel surface, and cladding surface.

(3) Maximum and average heat flux at fuel cladding.

(4) Burnout safety factor and burnout correlation used in analysis, including a discussion presenting justification for the correlation adopted, the basis of its derivation, the limitations of its application, and relationship to power level.

(5) Maximum and average power densities for the core and core coolant, and the ratio of maximum to average power in the radial and axial directions and for the entire core.

(6) Total fuel to coolant heat transfer area.

(7) Coolant flow characteristics, including, for example:

(a) Total core flow area, and channel hydraulic diameter;

(b) Mass flow rates through total core and through the average and hottest channels;

(c) Orificing provisions;

(d) Maximum and average inlet and outlet velocities for the average and hottest channels;

(e) Recirculation flow rates.

(8) An analysis of the hot channel factors and of the possibility of fuel element surface boiling at various power levels and coolant flow rates.

(9) An analysis of the possibility of loss of structural integrity of fuel or cladding as the result of excessive temperatures or thermal gradients at various power levels and coolant flow rates.

(10) Percentage of steam voids in hot channels; and in the total volume of the coolant in the core.

(11) An analysis of the possibility of bowing of fuel elements or other physical deformations which could influence core nuclear characteristics or safety of operation.

(12) An analysis of the extent and effect of deposition of corrosion products on heat transfer surfaces throughout the system.

SECTION V - PRIMARY COOLANT SYSTEM

This section of the hazards summary report should provide information appropriate to a determination of the safety established by the design and operating characteristics of the primary coolant system. To the extent that they may be applicable, the following guides are suggested as illustrative of the types of information that should be considered for inclusion in this section:

A. General Description. A general description of the system, including, for example:

(1) A discussion, if applicable, of the assumed points of separation between the primary coolant system and the power conversion system in a facility employing a direct cycle nuclear plant.

(2) The number of reactors, and the number of primary coolant loops per reactor.

(3) The number of steam generators, intermediate heat exchangers, pumps, and isolation and check valves per loop.

(4) Method of coolant circulation and heat transfer.

(5) Method of pressurization.

(6) A description, with appropriate sketches, of the geometrical and dimensional characteristics of the system, its location and its arrangement.

B. Primary Coolant. A discussion of primary coolant considerations, including, for example:

(1) A description of the physical, chemical, and nuclear properties of the coolant at conditions that may prevail during operation and in the event of accident.

(2) Volumes of coolant in the system and in individual components at operating conditions.

(3) Impurity limitations and coolant chemistry requirements.

(4) Anticipated coolant leakage rates and preventive measures.

(5) Radioactivity concentrations in coolant, including maximum corrosion product activity, maximum anticipated halogen, noble gas, and other fission product activity, and the activity due to activation of the coolant.

C. System Components. A description of major system components, including, for example:

(1) A summary description of the reactor pressure vessel.

(2) A description of heat exchangers and steam generators, including type, capacity, overall dimensions, probability for and effects of tube failures, level control features, blow down rates, and other principal operating features.

(3) A description of the pressurizer, including type, volume, surge capacity, adequacy of surge capacity under all credible conditions, heater capacity, rates of permissible pressurization and depressurization, liquid level control features, and other principal operating features.

(4) A description and analysis of the primary system pumps, including, for example:

(a) A general design description including principal design and operating features such as materials, type, capacity, shut-off head, and net positive suction head;

(b) Drives, and drive arrangements;

(c) Cooling requirements;

(d) Vibration characteristics;

(e) Seal design;

(f) Leakage characteristics;

(g) Operating characteristic curve;

(h) Coastdown characteristics;

(i) Modes of operation and control;

(j) Any operating limitations.

(5) A description of primary system valves, other than relief valves, including types, materials and material properties, leakage characteristics, reseating efficiencies, modes of operation and control, and other principal design and operating features.

(6) A description and analysis of system piping, including, for example:

(a) Applicable design codes;

(b) Materials specifications;

(c) Methods of fabrication;

(d) Method of stress analysis, and design loadings, conditions, and stresses;

(e) Flexibility analysis method and results;

(f) Supports, guides, and expansion anchors;

(g) Method and results of vibration analysis;

(h) Methods and types of connections and penetrations.

(7) A description of relief valves, including their number, types, relief and reset pressures, flow capacities as installed, reseating efficiencies, and the location at or region to which each valve discharges.

D. General System Considerations. Descriptions and analyses of general system considerations, including, for example:

(1) An analysis of the activity problems associated with radioactive corrosion products, including any limitations established with respect to low and trace concentrations of specific elements, such as cobalt and tantalum, in the materials of the reactor core and primary coolant system in order to prevent excessive accumulation of long-lived radioactivity throughout the system.

(2) An analysis of the maximum rates for heat-up and cool-down of the primary coolant system, including a discussion of the conditions establishing the limitations of these rates.

(3) A description of exterior thermal insulation, including materials, dimensions and method of application.

(4) A discussion and description of provisions made to facilitate decontamination of the system.

(5) A discussion of the thermal and hydraulic characteristics of the system, including, for example:

(a) Coolant temperatures and pressures at various significant points in the system;

(b) System maximum and average heat transfer rates;

(c) Effect of sudden check or stop valve closure, or relief valve openings;

(d) A description of the system flow characteristics, including provision of coolant flow orifice plates, and flow directional guides and baffles throughout the system.

(6) A discussion of the ability of the system to be preoperationally tested at design temperatures and pressures.

E. Design and Manufacture of System Pressure Vessels. A design and manufacturing analysis of the reactor pressure vessel, intermediate heat exchangers, steam generators, pressurizer, and any other similar type of pressure vessel in the primary system; including for each vessel the following types of information:

Cyclic Loading Conditions

(1) The operational conditions to which the vessel will be subjected during its expected service life for all anticipated normal and emergency operational cycles; including, for example:

(a) Start-up and shut-down cycle, with and without partial or total reactor scram;

(b) Cycles due to changes in power level demands;

(c) Cycles due to any emergency condition;

(d) Cycles due to hydrostatic tests.

(2) The description and analysis of the operational cycles considered in paragraph E.(1) above should include:

(a) Graphical presentation of coincident temperatures and pressures as a function of cycle time;

(b) A supporting description outlining, for the complete cycle, the conditions producing the coincident values of temperature and pressure;

(c) The intended rates of heating and cooling the vessel for each cycle.

(3) The design service life, including estimates of time the vessel will be subjected to specific levels of power production.

(4) Supplementary information necessary for cumulative fatigue damage analysis, including, for example:

(a) The estimated number of cycles of each type considered in paragraph E.(1) above, for the entire service life of the vessel;

(b) Analyses of transient conditions investigated with respect to fatigue damage.

Mechanical Loading Conditions

(1) A description and analysis of mechanical loadings to which the vessel is subjected, including, for example, the following loads:

(a) Vessel support reactions;

(b) Externally and internally applied loads;

(c) Piping reactions due to thermal expansion;

Dynamic Loading Conditions

(1) A description of dynamic forces which may originate within the vessel or be transmitted to it, including, for example, the following loads:

(a) Impact loads, such as control rod drive shock in reactor vessels;

(b) Fluid flow forces within the vessel or the associated piping system;

(c) Seismic loads.

Thermal Loading Conditions

(1) A description and analysis of vessel thermal loadings resulting either from constraint imposed by external forces or members, or from temperature gradients induced by steady-state and the most severe transient and emergency conditions. The following considerations should be included:

(a) Steady-state heat flow at any level of power generation;

(b) Internal (gamma) heat generation;

(c) Maximum normal and emergency heating and cooling rates;

(d) Differential expansions between dissimilar materials.

(2) Thermal loadings should preferably be reported on thermal loading charts in terms of the calculated temperature profile or gradient.

Neutron Irradiation Exposure

(1) Information concerning the maximum expected neutron irradiation exposure of the vessel, including:

(a) The annual integrated neutron flux for neutrons with energies less than one million electron volts;

(b) The annual integrated neutron flux for neutrons with energies equal to or greater than one million electron volts;

(c) The methods used to obtain the integrated neutron flux estimates;

(d) Irradiation surveillance program during the full service life.

Corrosion

(1) Information concerning corrosion, should include, for example:

(a) The estimated corrosion rates associated with general, galvanic, and intergranular corrosion;

(b) The estimated rate of localized erosion due to fluid flow conditions;

(c) Preventive and corrosion control measures.

Materials of Construction

(1) A description of the materials of construction, including, for example:

(a) A list of applicable materials specifications covering all significant forms of materials used in construction of the vessel;

(b) The extent to which amendments, supplements, or waivers have been applied to standard material specifications, including any modification of the provisions for heat treatment, chemical composition, mechanical properties, or material inspections, tests, and inspection standards;

(c) A description of notch ductility properties, including:

(i) Results of Charpy V-notch impact tests on vessel material, weld specimens, and component weldments submitted to representative vessel heat treatments.

(ii) A description of any heat treatment applied to enhance the notch-ductility properties.

Design Criteria

(1) A description of vessel structural design criteria and features, including, for example:

(a) Codes observed in the design and construction of the vessel, and any exceptions, revisions, addenda, case interpretations, or special rulings by which the application of codes has been qualified;

(b) Specification of the failure stress criterion used and a brief statement of justification for its use;

(c) A summary list of stress analyses performed for the vessel and its components, and including a summary of calculated stresses in critical sections;

(d) A description of tests, such as strain-measurement tests, photoelastic studies, brittle coating tests, and fatigue tests used to substantiate design configurations of critical components whenever such components are not susceptible to rigorous theoretical stress analysis;

Design Specifications

(1) Specification of design pressure conditions that may occur during normal operation or in the event of emergency, including, for example:

(a) Design vessel pressure;

(b) Maximum allowable working pressure;

(c) Normal steady-state operating pressure as a function of power level;

(d) Maximum estimated pressure surges;

(e) Safety and relief valve settings.

(2) Specification of design temperature conditions, including, for example:

(a) Design vessel temperatures;

(b) Normal operating temperature as a function of power level;

(c) Maximum estimated temperature excursions resulting from abnormal power changes.

Design Drawings

(1) Vessel drawings in sufficient detail to include:

(a) Location and details of nozzle connections;

(b) Location of all major welding joints;

(c) All major internal or external attachments to the vessel;

(d) Head configuration;

(e) Penetration pattern through heads for control rods, and other components;

(f) Closure and seal details of vessel;

(g) Core support structure in reactor pressure vessels;

(h) Transitions between sections of unequal thickness;

(i) Basic dimensions and thicknesses;

Manufacturing Specifications

(1) A description of fabrication and welding, inspection, and test procedures, and specifications employed in vessel manufacture, and not included in applicable codes or specifications.

(2) Information concerning the hydrostatic testing of the completed vessel, including, for example, method of testing, the test fluid, test pressures and temperatures, time periods of test, and the number of tests.

(3) A copy of the vessel data report prepared by the vessel manufacturer and signed by the inspectors.

SECTION VI - POWER CONVERSION SYSTEM

This section of the hazards summary report should provide information appropriate to a determination of the safety of the power conversion system having a direct or indirect relation to nuclear safety. To the extent that they may be applicable, the following guides are suggested as illustrative of the types of information that should be considered for inclusion in this section:

A. Secondary Systems. A concise generalized description of the secondary systems, including, for example:

(1) Type and properties of secondary coolants, if pertinent.

(2) Impurity limitations, and coolant chemistry specifications.

(3) A description of the condensate and feed water subsystems, including systems components, principal materials of construction, and design and operating specifications and characteristics.

(4) A description of subsystems for reheating, superheating, desuperheating and attemperation of steam, including system components, principal materials of construction, and design and operating specifications and characteristics.

(5) Steam pressure, temperature, flow rate, and quality as a function of load and reactor power.

(6) Makeup and blowdown requirements, including temperatures and volume flow rates.

(7) Provisions for and methods of control of steam dumping or bypassing features.

(8) A description of circuit flow paths and fluid transit times between major system components.

(9) Anticipated maximum secondary system coolant leakage rate, and the maximum allowable primary to secondary system leakage rate.

(10) Corrosion and erosion characteristics, and preventive measures.

(11) Maximum allowable, and normal operating concentrations of radioactive isotopes in secondary coolant.

(12) Maximum and average rates of radioactivity removal by air ejectors or other means.

(13) Composition of exhaust from air ejectors.

(14) A description of the air ejector exhaust system, including provisions for temporary retention of radioactive exhaust for decay purposes prior to final release.

(15) A description of final heat sinks, including the natural characteristics of the sink under all conditions that may prevail and an analysis of the capacity of heat dissipation components, such as condensers and steam to air heat exchangers, to function reliably under all credible circumstances.

(16) A description of all points at which secondary fluids are or may be released to the environment.

(17) A description of any unusual features of design, construction, or operation which may have a relation to reactor safety.

B. Electric Power Generation System. A concise and generalized description of the electric power generation system, including, for example:

(1) A description of the turbine-generator set, including design and operating characteristics.

(2) The maximum rate at which electrical load may be increased with and without resort to steam bypass features or reactor control rod motion.

(3) The maximum rate at which electrical load may be decreased with and without resort to steam bypass features or reactor control rod motion.

(4) A description of the turbine throttle valve characteristics and mode of operation.

(5) A description of the turbine and generator cooling and lubricating systems, and of the lube oil cooling system.

(6) A description of the electrical power transmission and distribution system including a line diagram showing the principal protective devices.

C. Operating Considerations. A general analysis of the operating characteristics of the power conversion system, including, for example:

(1) Heat balances for full power, maximum power, and base load conditions.

(2) An analysis of system performance reliability including a description of any trips, interlocks, or alarms actuated by potentially harmful deviations of system variables, such as condenser vacuum and steam generator secondary coolant level.

(3) The effects on reactor behavior and stability of load, of pressure and temperature transients originating in the power conversion system.

(4) The possibility of initiating reactor power transients by inadvertent manipulation of controls in the power conversion system, including steam bypass, dump, and throttle valves.

(5) The effects on reactor behavior of sudden variations of flow in individual components and circuits, including the condenser and the reheat or regenerative circuit.

SECTION VII - AUXILIARY SYSTEMS

This section of the hazards summary report should provide information appropriate to a determination of the adequacy of auxiliary systems to perform those required functions necessary to maintain the facility in a safe condition during normal operation and in the event of accident. To the extent that they may be applicable, the following guides are suggested as illustrative of the types of information that should be considered for inclusion in this section:

A. Reactor Emergency Systems. A description and analysis of all reactor emergency systems and their potential effect on safety, including, for example:

(1) Emergency poison injection system, including the type, quantity, and reactivity worth of nuclear poisons, the means of charging poison, the speed of response of the charging system to a signal, and possible failures internal or external to the poison injection system which could impair the effectiveness of the system.

(2) Emergency decay heat removal system, in sufficient detail to permit an evaluation of the adequacy of the system to perform its intended function in the event of a loss of coolant flow accident with and without a simultaneously occurring loss of normal power.

(3) Emergency core water injection system, in sufficient detail to permit an evaluation of the adequacy and limitations of the system to perform its intended function in the event of a loss of coolant accident.

(4) A discussion of the means provided to periodically test the reactor emergency systems.

B. Reactor Auxiliary Systems. A description and analysis of all reactor auxiliary systems and their potential effect on safety, including, for example:

(1) The fuel handling system, in sufficient detail to demonstrate that unirradiated fuel can be safely received, stored, and charged into the reactor with regard to inadvertent criticality, and that irradiated fuel can be removed from the reactor and prepared for safe shipment or storage under all foreseeable conditions requiring fuel removal, without excessive radiation exposure of individuals, undue escape of radioactive materials, or inadvertent criticality. The analysis should consider:

(a) A description of fuel handling techniques, including the provision of special tools and handling equipment, transfer casks, storage vaults and water tanks, working platforms, and temporary shielding;

(b) A description of the nuclear instrumentation used in conjunction with refueling, and the methods used to determine the reactivity status of the reactor during the refueling operation;

(c) A discussion of possible emergency conditions that may develop due to equipment or power failure, wedged fuel elements, human error, and other accidents; and the means provided to manage, and control these conditions;

(d) The effectiveness of systems auxiliary to the fuel handling system for cooling and monitoring irradiated fuel in transfer, storage, and shipment.

(2) The primary coolant purification system, including, for example:

(a) A description of the method of operation and an enumeration of pumps, valves, heat exchangers, demineralizers and controls;

(b) System design pressure, temperature, and flow rate; and any provisions for pressure relief;

(c) Types and amounts of demineralizer resins, resin lifetimes, anticipated decontamination factors, resin regeneration or replacement provisions, and maximum accumulated radioactivity;

(d) Provisions for, and purpose of, hydrogen ion concentration control.

(3) Decay heat removal systems.

(4) Valve operating systems.

(5) Systems for air and gas removal and processing, including the type, method of use, method of recharging or otherwise maintaining effectiveness, method of disposal of gases, and hazards, such as explosion, associated with operation.

(6) Systems for maintaining an atmosphere other than air in the primary system, containment system, and other locations.

(7) Systems for sampling the coolant and moderator.

(8) Auxiliary component cooling systems.

(9) Secondary water treatment systems.

(10) Pressurizing and pressure relief systems.

(11) Auxiliary steam and water supply and collection systems.

(12) Systems for charging and discharging coolant and moderator.

(13) Systems for detection of failed fuel elements and coolant and moderator leakage.

(14) Remote viewing systems.

C. Facility Auxiliary Systems. A description of facility auxiliary systems having a relation to safety, including, for example:

(1) The emergency power system, including specifically:

(a) The sources of emergency electrical power, and related capacities;

(b) The equipment and systems to which that power is available under emergency conditions;

(c) The mechanisms provided for actuation of emergency power sources;

(d) The reliability and independence of available emergency power sources.

(2) Control and warning systems for fire, earthquake, and other emergencies.

(3) Systems for the supply of compressed air and lubricants, and the means provided to prevent, or contain potential explosions.

(4) Equipment and systems for decontamination.

(5) Ventilation and air treatment systems.

(6) Radiation and chemical laboratory systems.

(7) Emergency lighting systems.

D. Waste Disposal System. Methods of handling and disposing of radioactive waste materials and effluents, including, for example:

(1) Sources and physical forms of wastes, their isotopic content, half lives, activity levels, and maximum anticipated rates of accumulation, processing, and disposal.

(2) Methods of routine waste handling, and of waste handling and decontamination procedures following a serious accident.

(3) General methods of waste treatment, including evaporation, incineration, demineralization, degassification, dilution, and retention for purposes of radioactive decay.

(4) Methods of final disposal of waste, including release to the atmosphere, release to drainage systems, packaging and shipment for land or sea disposal, and packaging or containment for indefinite retention.

(5) Details of the treatment of wastes, including, for example:

(a) Identification of radioactive wastes;

(b) Collection systems, drains, piping, and storage facilities;

(c) Monitoring, recording, and alarm equipment;

(d) Analyses performed for the identification of radioactive constituents and the analytical and experimental justification for selection of specific isotopes as control indicators;

(e) Shielding of the waste disposal system;

(f) Equipment for the concentration, dilution, or other treatment of wastes, including the operating specifications and limitations and the principal features of processing or packaging operations;

(g) A list of locations at which radioactive waste is released to the environment;

(h) A design analysis of any stacks provided for the release of gaseous and airborne wastes, including, for example:

(i) Stack dimensions and locations;

(ii) Flow rates, and exit velocities;

(iii) Derivation of dilution factors obtained through diffusion from the stack exit to the site boundary, and other manned or inhabited areas of concern. Supporting data, basic assumptions, and factors of conservatism should be cited. Dilution factors for both instantaneous and continuous releases should be given and the methods of averaging over specific time periods should be presented.

(6) Provisions for emergencies, including, for example:

(a) Equipment and personnel available from areas on or off the site for dealing with contamination emergencies;

(b) Principal emergency decontamination and cleanup procedures;

(c) Provisions for the emergency storage of radioactive materials.

(7) Provisions for collection, storage, and disposal of slightly or nonradioactive wastes that are of concern principally because of their chemical nature, such as decontamination rinses, and chemical reactivity control solutions.

SECTION VIII EXPERIMENTAL AND TEST FACILITIES

This section of the hazards summary report should provide information appropriate to a determination of the safety of all experimental and test facilities. To the extent that they may be applicable, the following guides are suggested as illustrative of the types of information that should be considered for inclusion in this section:

A. Description of Facilities. A concise generalized description of all experimental and test facilities, including, for example:

(1) The number, purpose, type, and location and arrangement of facilities for conducting experiments or tests either in or utilizing the reactor.

(2) The provisions made, if any, for future modification of the facilities for other specific experiments and tests and for the installation of additional experimental and test facilities.

B. Design and Construction. A brief description of the design and construction features of all experimental and test facilities, including, for example:

(1) Containment and shielding requirements.

(2) Missile barriers.

(3) Closure devices.

(4) Provisions for isolation.

(5) Provisions for remote disassembly of experiments or tests.

(6) Cooling systems.

(7) Instrumentation systems, including the methods and extent of integration with the reactor instrumentation and control system.

(8) Provisions for ventilating the facilities, including the design basis and the limitations established with respect to release of radioactivity.

(9) Interlocks prohibiting certain experimental or test operations.

(10) Provisions for insertion or removal of experiments while the reactor is in operation.

(11) Environmental control systems and auxiliary equipment.

(12) Reactor scram or shutdown and alarm devices, including, for example:

(a) Number, types, and locations of such devices;

(b) Manner of connection to reactor control system;

(c) Conditions requiring actuation.

(13) A description and analysis of test facilities provided for intermittent determination of reactor reactivity shutdown margin and the effectiveness of the reactor reactivity control system, including, for example:

(a) Number, types, and locations of such facilities;

(b) Anticipated frequency of use;

(c) Methods of operation;

(d) Test data obtained;

(e) Methods of reduction of test data to final values.

C. Operating Considerations. General analysis of the operating characteristics of the experimental and test facilities, including, for example:

(1) The possibility of nuclear interaction between experiments or tests or related facilities and the reactor, taking into account available individual and collective reactivity worths of experimental and test facilities.

(2) The possibility of initiating reactor power transients by inadvertent operation of experimental or test facilities.

(3) Limitations on the scope or type of experiments to be run.

SECTION IX - INSTRUMENTATION AND CONTROL

This section of the hazards summary report should provide information appropriate to a determination of the adequacy and effectiveness of the instrumentation and control systems. To the extent that they may be applicable, the following guides are suggested as illustrative of the types of information that should be considered for inclusion in this section:

A. Choice of Basic Reactor Control Scheme. A discussion of considerations taken into account in the selection of the basic control scheme, including, for example:

(1) The respective roles of the inherent nuclear characteristics of the reactor and of external controls.

(2) Control requirements peculiar to the particular reactor type and design, and to the purpose of the facility.

(3) Considerations governing or associated with specific aspects of reactor and facility operation, including, for example:

(a) A comparison of manual versus any method of automatic control used during various phases of operation;

(b) Criteria governing the choice of physical phenomenon upon which control is to be based;

(c) A discussion of control requirements and advantages and disadvantages associated with maintaining the selected control parameters of the nuclear plant such as a constant reactor coolant inlet, outlet, or average temperature; constant steam pressure, or a compromise between coolant temperature and steam pressure in which each may be constant or vary within specific limitations over specific intervals of the operating range; or use of a variable reactor coolant flow rate;

(d) The probable effects of disturbances in the electrical or thermal loading;

(e) Requirements associated with the response time of the control system;

(f) Requirements associated with the accuracy of the control system;

(g) Requirements associated with the necessity for continuity of operation;

(h) Requirements associated with the relationship between the control system and start-up sources;

(i) Requirements associated with the necessity for rapid start-up or for rapid load changes;

(j) Requirements associated with a multiple reactor facility;

(k) Requirements associated with utilization of the facility for secondary purposes, including personnel training, demonstrations, development, and testing.

B. Operation Control Stations. A general description of operation control stations, including, for example:

(1) A brief description of the main control room, including, for example:

(a) Location and general arrangement;

(b) A description of the means available for communication between the control room and other areas throughout the facility;

(c) A description of essential information displayed or recorded in the control room and the means utilized to present this information to operating personnel in a manner permitting rapid and unambiguous interpretation and assessment;

(d) A description of audible and visual alarms located in the control room;

(e) A discussion of occupancy requirements and limitations;

(f) A discussion of the extent to which control of the facility during start-up, routine operation, and shutdown is possible from the main control room.

(2) A description of local and emergency control stations.

(3) A description of operating information displayed locally throughout the facility.

(4) A description of audible and visual alarms provided throughout the facility.

C. Nuclear Instrumentation Systems. A description and analysis of nuclear instrumentation systems, including, for example:

(1) The basic safety objectives in the design of the nuclear instrumentation systems.

(2) A discussion of instrumentation used to detect and measure neutron flux levels and rates of change, including, for example:

(a) A brief description of the types of detectors employed, and their locations and number of channels employed during initial loading, start-up tests, normal operation, and refueling; and a discussion of associated advantages and disadvantages;

(b) Sensitivities of detectors;

(c) A description of scales, ranges and means of switching ranges;

(d) Location of detectors relative to neutron sources and a description of any means provided for removal or protection of detectors from neutron fluxes in excess of their design range;

(e) Reliability of detectors, associated cable runs, power supplies, and circuitry;

(f) Channels and instruments operated by each detector.

(3) Trips actuated by neutron flux and reactor period and a discussion of conditions initiating actuation, the methods used to accomplish the trip, and the considerations made in establishing set points.

(4) Methods used to enhance the reliability and availability of instrumentation, including redundancy of instrument channels, coincidence circuitry, averaging and comparator circuits, and independent power supplies.

(5) Interlocks and bypasses, their location, purposes, conditions of use, manner of operation, and means provided to inform operating personnel of their status.

(6) A discussion of the basic principles used in design of the instrumentation, including the extent to which the instrumentation functions with vacuum tubes and solid state devices.

(7) Provision of neutron sources; their type, location, and nuclear characteristics at the time of, and subsequent to, initial start-up.

(8) A discussion of significant factors considered in establishing the relative positions of neutron sources and neutron detectors.

(9) Provisions for reduction and elimination of stray or spurious signals; and methods used to ensure that the instrumentation is not unduly desensitized by damping provisions.

(10) Features provided to permit automatic control, and the modes of operation permitted in automatic or semiautomatic control.

(11) Response characteristics of the scram electronics.

(12) The extent to which fail-safe concepts apply to the nuclear instrumentation.

D. Nonnuclear Reactor Instrumentation Systems. A description and analysis of nonnuclear instrumentation systems, including, for example:

(1) A description and analysis of nonnuclear instrumentation systems with especial emphasis on those systems particularly essential in maintaining nuclear safety, and including for each system:

(a) A description of sensors provided to measure or monitor temperature, pressure, flow rates, fluid levels, power levels, chemical concentrations, or other significant parameters or quantities, and including their locations, characteristics, and reliability; and the means used to transmit the information to indicators or alarms;

(b) Response time of the system and the significance of the response time to nuclear safety;

(c) Fail-safe features of the system;

(d) Alarms and indicators actuated by the instrumentation;

(e) Protective functions performed by the system, including demands for reactor shutdown, partial or complete control rod insertion, injection of neutron poisons, component or system isolation, emergency or auxiliary system shutdown or actuation, and other safety actions.

E. Reactor Reactivity Control Systems. Descriptions and analyses of the reactor control systems and of the mechanisms provided for control of reactivity, including, for example:

(1) A description and analysis of the control rod system, including, for example:

(a) Types and numbers of control rods and distribution into groups or banks;

(b) An analysis of the control effects of reactivity worth of individual control rods and control rod groups under various reactor conditions including temperature and core lifetime;

(c) An analysis of the rates of reactivity insertion and withdrawal available by operation of individual control rods and control rod groups, and the ability of the control rod system to function effectively under various operating conditions, including start-up, routine operation and shutdown, and all credible transient conditions.

(d) Rod position indicators, including the type, range, and accuracy of the instrumentation;

(e) The methods of programming the operation of individual control rods and control rod groups;

(f) Restrictions on control rod operation, including specification, and means of prevention of unacceptable groupings and unacceptable sequences;

(g) A description of interlocks associated with movement of control rods;

(h) A description of means provided for manual and automatic operation of control rods;

(i) Automatic actuation or deactivation of the control rods by changes in reactivity, temperature, pressure, or other signals;

(j) A description of the control rod drive mechanisms, shafts, and seals, including methods of fabrication, material properties, heat treatment specifications, latching mechanisms, drive velocities, provisions for anticipated maintenance, and provisions made to prevent binding or sticking of control rods;

(k) A discussion of the basis for the selection of either top or bottom control rod drive, including the advantages and disadvantages of the selected methods;

(l) A description of conditions and circumstances requiring emergency reactor shutdown and the method utilized to determine the need for and to initiate the required shutdown in each instance.

(2) A description and analysis of provisions for control of reactivity by changes in the moderator or coolant, their flow rates, temperatures, or other conditions.

(3) A description and analysis of provisions for normal control of reactivity through fluid neutron poisons, including, for example:

(a) A description of the poisons and of their nuclear characteristics;

(b) An analysis of the advantages and limitations of fluid poison control;

(c) A description of the methods utilized for injection and removal;

(d) An analysis of possible adverse effects of fluid poisons on the materials and components of various systems;

(e) Operation limitations established with respect to the use of fluid poisons;

(f) An analysis of the reactivity worth of the fluid poisons and of the rates of reactivity insertion and removal associated with their use.

(4) A description of burnable neutron poisons utilized for reactivity control including their form, stability, and reactivity effects throughout the lifetime of the core.

(5) A description and analysis of provisions for control of reactivity through adjustment of the neutron energy spectrum, including the advantages, disadvantages, and limitations of this control method.

(6) A description and analysis of any emergency safety devices or systems provided for the control of reactivity, including, for example:

(a) Injection of solid neutron poisons in pellet or other form;

(b) Injection of liquid neutron poisons;

(c) Movement of neutron reflectors;

(d) Discharge of liquid moderators;

(e) Removal of fuel;

(f) Thermal and pneumatic safety fuses.

F. General Considerations. A discussion of general factors associated with instrumentation and control of the nuclear facility, including, for example:

(1) A description of normal and emergency power sources for the instrumentation and control systems and a detailed evaluation of the reliability of the power sources.

(2) A description of simulation or other tests performed to establish the operating characteristics and capabilities of the instrumentation and control systems.

(3) Requirements and provisions for intermittent testing of the instrumentation and control systems.

(4) A description of the means provided to prevent accidental operation of any control system during normal operation and shutdown periods.

G. Radiation Monitoring Systems. A description and analysis of radiation monitoring systems, including, for example:

(1) Operational radiation monitoring systems, including those provided for the primary coolant system, ventilation systems, waste disposal systems, the primary coolant purification system, the fuel handling system, and the power conversion system. The description of each of the monitoring systems to include:

(a) Types of detectors and their numbers, locations, sensitivities, ranges, calibration, resolution times, alarm settings, and methods of initiating alarms;

(b) Protective functions performed by the system;

(c) Provisions for the determination of potentially hazardous conditions, including fuel element failure, tube failure in heat exchangers and steam generators, and failures in vital components such as shield tanks and radioactive waste storage and processing tanks.

(2) Air and water monitoring systems, and area radiation monitoring systems, including those provided for the containment system, decontamination rooms, waste disposal system rooms, fuel storage facilities, and other areas within the facility buildings and external to these buildings both on and off the site. The description of each of the monitoring systems to include:

(a) Types of detectors and their numbers, locations, sensitivities, ranges, calibration, resolution times, alarm settings, and methods of initiating alarms;

(b) Protective functions performed by the system;

(c) Provisions for the determination of potentially hazardous conditions, including unacceptable increases in the concentration of radioactivity in the air in and about the facility and in liquid and gaseous effluents released from the facility.

(3) A description of portable radiation survey instruments and other health physics instrumentation such as hand and foot counters, sample counters, and multi-channel analyzers, including their numbers, types, and methods of use.

(4) Instrumentation provided primarily or solely for the analysis of conditions following an accident.

SECTION X - SHIELDING

This section of the hazards summary report should provide information appropriate to a determination of the adequacy of, and the safety provided by the shielding. To the extent that they may be applicable, the following guides are suggested as illustrative of the types of information that should be considered for inclusion in this section:

A. Primary and Secondary Shielding. A brief description of the primary and secondary, or containment, shielding, including, for example:

(1) Geometry and location.

(2) Principal dimensions.

(3) Arrangements with respect to radiation sources.

(4) Presentation of the design criteria established for shielding during normal operation, shutdown, and in the event of accident.

(5) An analysis of the principal shield materials, including, for example:

(a) Types of materials and their shielding properties:

(b) Methods of installation and provisions made for cooling, insulating, corrosion protection, canning, supporting, and expansion to insure the continued effectiveness and structural integrity of the shield materials under all credible conditions;

(c) Susceptibility to radiation damage, the extent of such damage, and the means provided to alleviate and remedy any adverse effects.

(6) Provisions made to prevent radiation streaming, including staggering of joints, and penetrating pipes and structure.

(7) A description of methods used to maintain adequate levels in liquid shields, including the methods used to inhibit and remedy leakage from liquid shields, and to provide makeup.

(8) A description of operational shield tests to be performed to establish the adequacy of the shield.

(9) An analysis of the primary and secondary or containment shield designs, including:

(a) Basic calculation methods and models;

(b) Radiation sources and source levels;

(c) Values of significant parameters;

(d) Surface and positional dose rates during normal operation and shutdown, and in the event of accident.

B. Miscellaneous Shielding. A description of shielding, both temporary and permanently installed, available or provided for individual components and systems, including, for example:

(1) The waste disposal system;

(2) The purification system;

(3) Spent resin and spent fuel element shipping casks;

(4) The refueling system, including storage facilities for spent fuel;

(5) The turbine, air ejectors, and coolant or steam piping;

(6) Components, equipment, and systems provided for experiments and tests;

(7) Portable shielding for use in maintenance operations.

SECTION XI - MAINTENANCE

This section of the hazards summary report should provide information appropriate to a determination of the adequacy of the maintenance facilities and design features to safely maintain the operating efficiency of the nuclear reactor facility. To the extent that they may be applicable, the following guides are suggested as illustrative of the types of information that should be considered for inclusion in this section:

A. Maintenance Tasks and Facilities. A brief description of anticipated major maintenance tasks, and of the facilities provided for on-site maintenance, including, for example:

(1) A description of anticipated major maintenance tasks that might result in significant radiation exposure.

(2) A description of anticipated major decontamination tasks and of the methods and facilities to be used in the performance of such tasks.

(3) A description of installed and portable lifting and handling equipment in relation to the possibilities for accidents that could result in exposures to radiation.

(4) A description of special maintenance work areas involving contaminated components, including location, arrangement, installed equipment, and ventilation and drainage requirements.

B. Special Provisions. A description of any special provisions made to facilitate maintenance in a manner to protect maintenance personnel against ionizing radiation, and to enhance the continuity of safe operation, including, for example:

(1) Provision of special maintenance tools designed to limit exposure of personnel to radiation.

(2) Provisions made to limit radiation damage and activation.

(3) Provisions made to inhibit deposition and entrapment of radioactivity on surfaces exposed to contaminated air or liquids.

(4) Provisions made to facilitate decontamination.

(5) Provisions made to permit ready access to components and systems.

(6) Provisions made to permit rapid removal and replacement of subassemblies.

(7) Provision of protective clothing and special personnel air masks and portable air supplies.

(8) Provisions made for the rapid and proper identification of specific components by tagging, color coding, or other means.

(9) Provisions made to prevent accidental reactivity transients or changes during maintenance activities.

SECTION XII - INITIAL TESTS AND OPERATING PROCEDURES

This section of the hazards summary report should provide information relating to initial tests to substantiate that the reactor facility is capable of operation within design limits, and of the degree of safety provided by the proposed operating procedures. To the extent that they may be applicable, the following guides are suggested as illustrative of the types of information that should be considered for inclusion in this section:

A. Preoperational Systems Tests. A tabulation of systems tests to be performed prior to routine operation. The tests should be tabulated in the sequence in which they are proposed to be performed.

B. Initial Reactor Criticality Tests. A description of the methods and procedures to be used in conjunction with the initial reactor criticality tests, including, for example:

(1) Prerequisites for initial loading.

(2) Instrumentation employed in conjunction with initial loading, including positions of neutron sensors as a function of loading, and methods used to ensure that sequential readings of neutron flux are referenced to a common base.

(3) The method used to predict the critical loading, as fuel is added to the core.

(4) A tabulation of major procedures used during the initial core loading.

(5) A discussion of safety precautions.

C. Zero and Low Power Physics Tests. A concise generalized description of zero and low power physics tests, and including the purpose of the tests and any special safety precautions to be observed.

D. Tests at Increasing Power. A concise generalized description of tests to be performed as reactor power is increased to design full power, and including the purpose of the tests and any special safety precautions to be observed. The tests considered should include, for example:

(1) Physics tests.

(2) Stability tests.

(3) Systems and equipment tests.

(4) Radiation surveys.

E. Full Power Tests. A concise generalized description of tests to be performed or initiated at full power, and including the purpose of the tests and any special safety precautions to be observed.

F. Operating Procedures. A summary description of operating procedures, including:

(1) A brief discussion of procedures to be followed during normal operation,

(2) A general description of corrective action procedures to be enacted upon indication, by visual or audible alarm, or other means, of equipment malfunction, or deviation of operating parameters beyond permissible limits.

(3) A general description of procedures to be followed in the event of emergency, including those occasioned by occurrence of a credible accident.

(4) A tabulation of operating records to be maintained.

G. Maintenance Procedures. A summary description of maintenance procedures and schedules, including:

(1) A discussion of post-critical schedule of maintenance and recalibrating tests of safety system components, monitors and other equipment having a potential safeguards function including items such as:

(a) Reactor control instruments;

(b) Reactivity control systems;

(c) Effluent release monitors;

(d) Personnel protection monitors;

(e) Portable detectors;

(f) Building leakage and emergency systems.

SECTION XIII - ADMINISTRATIVE AND PROCEDURAL SAFEGUARDS

This section of the hazards summary report should provide information appropriate to a determination of the competency of the assigned organization to operate the facility in a safe manner, and of the adequacy of administrative procedures to assist in maintaining the facility in a safe operating status. To the extent that they may be applicable, the following guides are suggested as illustrative of the types of information that should be considered for inclusion in this section:

A. Organization and Responsibility. A concise description of the organization assigned for operation of the nuclear reactor facility, including, for example:

(1) A functional description of the structure of both the start-up, and the regular operating organizations.

(2) General qualifications established as prerequisites for key positions within the organization.

(3) The lines of responsibility and authority for both operation and safety, e.g., the specific duties and authority of health physics personnel during operation and maintenance, and in the event of an accident releasing radioactivity within the facility and to its environs.

(4) The approximate number of personnel to be assigned to the organization as a whole, and to individual operating and safety branches.

B. Administrative Controls and Procedures. A concise description and explanation of administration controls and procedures designed to ensure safe operation of the reactor and of the facility, including, for example:

(1) Administrative controls over the operation of the reactor and the facility to the extent that these have a potential effect on safety.

(2) The extent to which detailed written procedures for operations that might effect nuclear safety and for emergencies will be available and how these are reviewed and approved for use.

(3) General operating principles having a potential effect on safety, including those for:

(a) Initial startup;

(b) Routine operations;

(c) Maintenance;

(d) Refueling;

(e) Conduct and operation of experiments;

(f) Power escalations from initial criticality to full design power;

(g) Emergencies.

Staffing requirements for such operations should be discussed.

(4) Provisions, through periodic reviews, practice drills, and other means, for maintaining in force administrative controls and procedures, particularly those pertaining to emergencies.

C. Review and Authorization of Tests, Experiments, Modifications, and Safety Status. A description of the methods used for review and authorization of proposed tests, experiments, and modifications to the nuclear reactor facility, including, for example:

(1) A summation of procedures relevant to recommendations and requests for specific tests, experiments, and facility modifications; and to their subsequent review, approval, and authorization.

(2) The provision and function of any committee, or other group, formed within the organization and exercising operational or advisory responsibility for the request, review, or approval of modifications to the facility, experimental and test programs, and similar projects.

(3) The provision and function of any safeguards review committee or officials, including the degree to which the committee is independent of the operating organization.

D. Training. A brief description of training programs and procedures, including, for example:

(1) Training of the operating crew for initial startup and routine operations.

(2) Training of replacement personnel for the operating organization.

(3) Intermittent training and testing of operating personnel to ensure continued competency of the staff.

(4) Arrangements for coordination with local police, fire, rescue teams, and similar groups.

SECTION XIV - ACCIDENT ANALYSIS

This section of the hazards summary report should be concerned with accident analysis. It should provide analyses of accidents which could directly or indirectly be a causative factor in the creation of a hazard of exposure of any person to ionizing radiation. The analyses should include the conditions, assumptions, methods of calculation, and values of significant variables to an extent necessary to permit independent analyses. To the extent that they may be applicable, the following guides are suggested as illustrative of the types of information that should be considered for inclusion in this section:

A. Accidents Considered in Analysis. A summary description, preferably in tabular form, of all accidents considered. The types of accidents considered should result from a systematic analysis of the facility and should include, for example:

(1) Reactivity accidents, including, for instance, those due to:

(a) Insertion of excessive amounts of nuclear fuel into the core;

(b) Accidental or improper addition of moderator or reflector materials;

(c) Accidental or improper removal of nuclear poisons due to control rod movement as a result of a start-up accident, uncontrolled rod withdrawal, or other event;

(d) Accidental or improper removal, or dilution, of chemical controls, fission product poisons, burnable poisons, coolant, or moderator;

(e) Accidental or improper conduct of experiments and tests;

(f) Modifications of coefficients of reactivity, including those due to temperature changes resulting from cold water or other accidents, those due to changes in void size or location, including void collapse, and those due to changes in pressure and power level;

(g) Deformation or realignment of the core to a more reactive configuration;

(h) Insertion of reactivity due to uncompensated positive coefficients of reactivity;

(i) Transients originating in, or amplified by, reactor auxiliary systems.

(2) Loss of coolant flow accidents resulting from pump failure, valve closure, blocking of a channel or loop, or other cause.

(3) Loss of coolant accidents resulting from rupture of a pipe, or failure of pressure vessel, pressurizer, rupture disc, valve, or pump.

(4) Fuel handling accidents.

(5) Chemical reactions, including metal-water reactions, and attendant reactions of evolved gases.

(6) Ruptures of fuel elements due to excessive heating, depressurization, internal pressurization through steam formation or accumulation of fission gases, or other causes.

(7) Power failure accidents.

(8) Accidents involving the release of stored radioactive wastes.

(9) Fires, earthquakes, storms, floods, high tides, or other similar events.

B. Analysis of Causes. For each accident discussed there should be included a description of events, including equipment malfunctions and failures, and human errors, that must occur, and the order of occurrence required, to occasion that accident.

C. Analysis of Effects. An analysis of the effects attendant upon the occurrence of each accident should be discussed. The analyses should be sufficiently detailed to permit an independent evaluation and determination of the effects of each accident. The analysis should include, for example:

(1) The methods, assumptions, conditions, supporting information, and simplifications employed in estimating the course and consequences of the accident.

(2) Estimates of physical damage resulting from the accident.

(3) Specification of the fission product or other source of direct radiation or transmissible radioactive or toxic material, as to nature, activity, release rate, and other characteristics.

(4) Effects of transmission by air, taking into account atmospheric dilution of air-borne material in view of the possible effects of adverse conditions of meteorology, topography, and other circumstances, and deposition by fall-out or precipitation.

(5) Effects of transmission by water, taking into account surface and subsurface retention and dilution of water-borne material.

(6) Identification of the person or persons whole health and safety may be endangered, as to the following factors:

(a) Classification of those persons, whether employees of the applicant engaged in operation of the proposed facility, employees of the applicant engaged in other activities, or resident or transient members of the general public;

(b) Location inside the containment system, within the exclusion area or other area of limited access, or within or without the low-population zone.

(7) Estimates of dose rates and integrated doses as a function of distance from the containment system and time after the accident. Individual estimates should be presented for various sources and types of irradiation and for various conditions of exposure, including, for example:

(a) The dose rate and integrated dose from direct radiation from a contained source;

(b) The dose rate and integrated dose from direct radiation resulting from the passage of air-borne radioactive material released both instantaneously and continuously from the containment system under typical stable and unstable meteorological conditions;

(c) The dose rate and integrated dose from direct radiation from radioactive material deposited on the ground and other surfaces by natural deposition, rainout, or other means during passage of air-borne radioactivity released both instantaneously and continuously from the containment system;

(d) The dose rate and integrated dose from soluble and insoluble radioactive materials taken into the body by ingestion, inhalation, or other means during passage of air-borne radioactivity released both instantaneously and continuously from the containment system.

(8) In the event evacuation is necessary to limit the integrated dose evacuation histories should be postulated and the integrated dose associated with these histories should be calculated under the most adverse considered conditions of radioactivity release and meteorology.

(9) Conditions, circumstances, or safeguards which may be expected to limit the magnitude or consequences of the accident.

D. Maximum Credible Accident. Specification of an accident, or type of accident, considered to be capable of causing more serious consequences than any other considered credible. The analysis provided for this maximum credible accident should include both causes and effects as described in subsections B. and C. above.

APPENDIX B

PART 50

OF

TITLE 10, CODE OF FEDERAL REGULATIONS

LICENSING OF PRODUCTION AND UTILIZATION FACILITIES

(AEC Reprint Containing Amendments Issued Through September 9, 1960)

TITLE 10 - ATOMIC ENERGY

Chapter I - Atomic Energy Commission

PART 50—LICENSING OF PRODUCTION AND UTILIZATION FACILITIES

GENERAL PROVISIONS

REQUIREMENT OF LICENSE, EXCEPTIONS

CLASSIFICATION AND DESCRIPTION OF LICENSES

APPLICATIONS FOR LICENSES, FORM, CONTENTS, INELIGIBILITY OF CERTAIN APPLICANTS

STANDARDS FOR LICENSES AND CONSTRUCTION PERMITS

ISSUANCE, LIMITATIONS, AND CONDITIONS OF LICENSES AND CONSTRUCTION PERMITS

ALLOCATION OF SPECIAL NUCLEAR MATERIAL

INSPECTIONS, RECORDS, REPORTS

TRANSFER OF LICENSES-CREDITORS' RIGHTS; SURRENDER OF LICENSES

[§§ 50.80 to 50.89 reserved]

AMENDMENT OF LICENSE OR CONSTRUCTION PERMIT AT REQUEST OF HOLDER

REVOCATION, SUSPENSION, MODIFICATION, AMENDMENTS OF LICENSES AND CONSTRUCTION PERMITS, EMERGENCY OPERATIONS BY THE COMMISSION

ENFORCEMENT

AUTHORITY: §§ 50.1 to 50.110 issued under sec. 103, 68 Stat. 936, sec. 104, 68 Stat. 937, sec. 161, 68 Stat. 948, sec. 182, 68 Stat. 953, sec. 183, 68 Stat. 954; 42 U. S. C. 2133, 2134, 2201, 2232, 2233. For the purposes of sec. 223, 68 Stat. 958; 42 U. S. C. 2273, § 50.54 (i) issued under sec. 1611, 68 Stat. 949; 42 U. S. C. 2201 (i) and §§ 50.70 to 50.71 issued under sec. 161p, 68 Stat. 950; 42 U. S. C. 2201 (p).

SOURCE: §§ 50.1 to 50.110 appear at 21 F. R. 355, Jan. 19, 1956, except as otherwise noted.

GENERAL PROVISIONS

§ 50.1 *Basic purpose, and procedures applicable.* The regulations in this part are promulgated by the Atomic Energy Commission, pursuant to the Atomic Energy Act of 1954 (68 Stat. 919), to provide for the licensing of production and utilization facilities.

§ 50.2 *Definitions.* As used in this part,

(a) "Production facility" means:

(1) Any nuclear reactor designed or used primarily for the formation of plutonium or uranium 233; or

(2) Any facility designed or used for the separation of the isotopes of uranium or the isotopes of plutonium, except laboratory scale facilities designed or used for experimental or analytical purposes only; or

(3) Any facility designed or used for the processing of irradiated materials containing special nuclear material, except laboratory scale facilities designed or used for experimental or analytical purposes only.

(b) "Utilization facility" means any nuclear reactor other than one designed or used primarily for the formation of plutonium or U-233.

NOTE: Pursuant to sections 11p and 11v, respectively, of the Act, the Commission may from time to time add to, or otherwise alter, the foregoing definitions of production and utilization facility. It may also include as a facility an important component part especially designed for a facility, but has not at this time included any component parts in the definitions.

(c) "Act" means the Atomic Energy Act of 1954 (68 Stat. 919) including any amendments thereto.

(d) "Agreement for cooperation" means any agreement with another nation or regional defense organization, authorized or permitted by sections 54, 57, 64, 82, 103, 104, or 144 of the act, and made pursuant to section 123 of the act.

(e) "Atomic energy" means all forms of energy released in the course of nuclear fission or nuclear transformation.

(f) "Atomic weapon" means any device utilizing atomic energy, exclusive of the means for transporting or propelling the device (where such means is a separable and divisible part of the device), the principal purpose of which is for use as, or for development of, a weapon, a weapon prototype, or a weapon test device.

(g) "By-product material" means any radioactive material (except special nuclear material) yielded in or made radioactive by exposure to the radiation incident to the process of producing or utilizing special nuclear material.

(h) "Commission" means the Atomic Energy Commission or its duly authorized representatives.

(i) "Common defense and security" means the common defense and security of the United States.

(j) "Government agency" means any executive department, commission, independent establishment, corporation, wholly or partly owned by the United States of America which is an instrumentality of the United States, or any board, bureau, division, service, office, officer, authority, administration, or other establishment in the executive branch of the Government.

(k) "Nuclear reactor" means an apparatus, other than an atomic weapon, designed or used to sustain nuclear fission in a self-supporting chain reaction.

(l) "Person" means (1) any individual, corporation, partnership, firm, association, trust, estate, public or private institution, group, Government agency other than the Commission, any State or any political subdivision of, or any polit-

ical entity within a State, any foreign government or nation or any political subdivision of any such government or nation, or other entity; and (2) any legal successor, representative, agent, or agency of the foregoing.

(m) "Produce," when used in relation to special nuclear material, means (1) to manufacture, make, produce, or refine special nuclear material; (2) to separate special nuclear material from other substances in which such material may be contained; or (3) to make or to produce new special nuclear material.

(n) "Research and development" means (1) theoretical analysis, exploration, or experimentation; or (2) the extension of investigative findings and theories of a scientific or technical nature into practical application for experimental and demonstration purposes, including the experimental production and testing of models, devices, equipment, materials, and processes.

(o) "Restricted Data" means all data concerning (1) design, manufacture, or utilization of atomic weapons; (2) the production of special nuclear material; or (3) the use of special nuclear material in the production of energy, but shall not include data declassified or removed from the Restricted Data category pursuant to section 142 of the act.

(p) "Source material" means source material as defined in section 11s of the act and in the regulations contained in Part 40 of this chapter.

(q) "Special nuclear material" means (1) plutonium, uranium 233, uranium enriched in the isotope 233 or in the isotope 235, and any other material which the Commission, pursuant to the provisions of section 51 of the act, determines to be special nuclear material, but does not include source material; or (2) any material artificially enriched by any of the foregoing, but does not include source material.

(r) "Testing facility" means a nuclear reactor which is of a type described in § 50.21(c) and for which an application has been filed for a license authorizing operation at:

(1) A thermal power level in excess of 10 megawatts; or

(2) A thermal power level in excess of 1 megawatt, if the reactor is to contain:

(i) A circulating loop through the core in which the applicant proposes to conduct fuel experiments; or

(ii) A liquid fuel loading; or

(iii) An experimental facility in the core in excess of 16 square inches in cross-section.

(s) "United States," when used in a geographical sense, includes all Territories and possessions of the United States, the Canal Zone, and Puerto Rico.

[Amended]

CHANGE: § 50.2 amended by redesignating former paragraph (r) as paragraph (s) and adding a new paragraph (r) at 25 F.R. 1072, Feb. 6, 1960.

§ 50.3 *Interpretations.* Except as specifically authorized by the Commission in writing, no interpretation of the meaning of the regulations in this part by any officer or employee of the Commission other than a written interpretation by the General Counsel will be recognized to be binding upon the Commission.

REQUIREMENT OF LICENSE, EXCEPTIONS

§ 50.10 *License required.* (a) Except as provided in § 50.11, no person within the United States shall transfer or receive in interstate commerce, manufacture, produce, transfer, acquire, possess, use, import, or export any production or utilization facility except as authorized by a license issued by the Commission.

[Amended]

CHANGE: Paragraph designation "(a)" added before word "Except" at 25 F.R. 8712, Sept. 9, 1960.

(b) No person shall begin the construction of a production or utilization facility on a site on which the facility is to be operated until a construction permit has been issued. As used in this paragraph, the term 'construction' shall be deemed to include pouring the foundation for, or the installation of, any portion of the permanent facility on the site; but does not include:

(1) Site exploration, site excavation, preparation of the site for construction of the facility and construction of roadways, railroad spurs and transmission lines;

(2) Procurement or manufacture of components of the facility;

(3) Construction of non-nuclear facilities (such as turbo-generators and turbine buildings) and temporary buildings (such as construction equipment storage sheds) for use in connection with the construction of the facility; and

(4) With respect to production or utilization facilities, other than testing facilities, required to be licensed pursuant to section 104a. or section 104c. of the Act, the construction of buildings which will be used for activities other than operation of a facility and which may also be used to house a facility. (For example, the construction of a college laboratory building with space for installation of a training reactor is not affected by this paragraph.)

[Added]

SOURCE: Paragraph (b), (1), (2), (3) and (4) of § 50.10 added at 25 F.R. 8712, Sept. 9, 1960.

§ 50.11 *Exceptions and exemptions from license.* Nothing in this part shall be deemed to require a license for:

(a) The manufacture, production, or acquisition by the Department of Defense of any utilization facility authorized pursuant to section 91 of the act, or the use of such facility by the Department of Defense or by a person under contract with and for the account of the Department of Defense;

(b) The processing, fabricating, or refining of special nuclear material, or the separation of special nuclear material, or the separation of special nuclear material from other substances, under contract with and for the account of the Commission;

(c) The construction or operation of production or utilization facilities under contract with and for the account of the Commission; or

(d) The transportation or possession of any production or utilization facility by a common or contract carrier or warehouseman in the regular course of carriage for another or storage incident thereto.

§ 50.12 *Specific exemptions.* The Commission may, upon application by any interested person, grant such exemptions from the requirements of the regulations in this part as it determines are authorized by law and will not endanger life or property or the common defense and security and are otherwise in the public interest.

CLASSIFICATION AND DESCRIPTION OF LICENSES

§ 50.20 *Two classes of licenses.* Licenses will be issued to named persons applying to the Commission therefor, and will be either class 104 or class 103.

§ 50.21 *Class 104 licenses; for medical therapy and research and development facilities.* A class 104 license will be issued, to an applicant who qualifies, for any one or more of the following: to transfer or receive in interstate commerce, manufacture, produce, transfer, acquire, possess, use, import, or export under the terms of an agreement for cooperation:

(a) A utilization facility for use in medical therapy; or

(b) A production or utilization facility involved in the conduct of research and development activities leading to the demonstration of the practical value of the facility for industrial or commercial purposes; or

(c) A production or utilization facility, which is useful in the conduct of research and development activities of the types specified in section 31 of the act, and which is not a facility of the type specified in subparagraph (b) of this section.

§ 50.22 *Class 103 licenses; for commercial and industrial facilities.* A class 103 license will be issued, to an applicant who qualifies, for any one or more of the following: to transfer or receive in interstate commerce, manufacture, produce, transfer, acquire, possess, use, import, or export under the terms of an agreement for cooperation, a production or utilization facility which is of a type found in writing by the Commission, to have been sufficiently developed to be of practical value for industrial or commercial purposes.

§ 50.23 *Construction permits.* A construction permit for the construction of a production or utilization facility will be issued prior to the issuance of a license if the application is otherwise acceptable, and will be converted upon due completion of the facility and Commission action into a license as provided in § 50.56. A construction permit for the alteration of a production or utilization facility will be issued prior to the issuance of an amendment of a license, if the application for amendment is otherwise acceptable as provided in § 50.91.

§ 50.24 *Effect of finding of practical value upon licenses previously issued.* The making of a finding of practical value pursuant to section 102 of the act will not be regarded by the Commission as grounds for requiring:

(a) The conversion to a Class 103 license of any Class 104 license prior to the date of expiration contained in the license; or

(b) The conversion to a Class 103 license of any construction permit, issued under section 104 of the act, prior to the date designated in the permit for expiration of the license.

[Added]

SOURCE: § 50.24 appears at 21 F. R. 9354, Nov. 30, 1956.

APPLICATIONS FOR LICENSES, FORM, CONTENTS, INELIGIBILITY OF CERTAIN APPLICANTS

§ 50.30 *Filing of applications for licenses, oath or affirmation—(a) Place of filing.* Each application for a license, including whenever appropriate a construction permit, or amendment thereof should be filed with the Atomic Energy Commission, Attention: Division of Licensing and Regulation. Filings made by mail should be addressed to the Commission at Washington 25, D. C. Filings may be made in person at the Commission's offices at 1717 H Street NW., Washington, D. C., or its offices at Germantown, Maryland.

(b) *Oath or affirmation.* Each application for a license, including whenever appropriate a construction permit or amendment thereof, should be executed in three signed originals by the applicant or duly authorized officer thereof under oath or affirmation.

(c) *Number of copies of applications.* Each filing of an application for license authorizing export only or amendment thereof should include, in addition to the three originals, three copies of the application. Each filing of any other application under this section should include, in addition to the three signed originals, 19 copies of the application, except that with respect to that portion of the application containing the information required by § 50.34 (Hazards Summary Report) the filing should include 40 copies.

[Amended]

CHANGE: § 50.30 amended to read as set forth above at 23 F. R. 3115, May 10, 1958.

§ 50.31 *Combining applications.* An applicant may combine in one his several applications for different kinds of licenses under the regulations in this chapter.

§ 50.32 *Elimination of repetition.* In his application, the applicant may incorporate by reference information contained in previous applications, statements or reports filed with the Commission: *Provided*, That such references are clear and specific.

§ 50.33 *Contents of applications; general information.* Each application shall state:

(a) Name of applicant;

(b) Address of applicant;

(c) Description of business or occupation of applicant;

(d) (1) If applicant is an individual, state citizenship.

(2) If applicant is a partnership, state name, citizenship and address of each partner and the principal location where the partnership does business.

(3) If applicant is a corporation or an unincorporated association, state:

(i) The state where it is incorporated or organized and the principal location where it does business;

(ii) The names, addresses and citizenship of its directors and of its principal officers;

(iii) Whether it is owned, controlled, or dominated by an alien, a foreign corporation, or foreign government, and if so, give details.

(4) If the applicant is acting as agent or representative of another person in filing the application, identify the principal and furnish information required under this paragraph with respect to such principal.

(e) The class of license applied for, the use to which the facility will be put, the period of time for which the license is sought, and a list of other licenses, except operator's licenses, issued or applied for in connection with the proposed facility.

(f) The financial qualifications of the applicant to engage in the proposed activities in accordance with the regulations in this chapter. If the application is also for special nuclear material license pursuant to the regulations in Part 70 of this chapter, information should be included with respect to the applicant's financial qualifications to assume responsibility for the payment of Commission charges for special nuclear material.

(g) The technical qualifications of the applicant to engage in the proposed activities in accordance with the regulations in this chapter.

(h) If the applicant proposes to construct or alter a production or utilization facility, the application shall state the earliest and latest dates for completion of the construction or alteration.

(i) If the proposed activity is the generation and distribution of electric energy under a class 103 license, a list of the names and addresses of such regulatory agencies as may have jurisdiction over the rates and services of the proposed activity, and of those municipalities, private utilities, public bodies, and cooperatives, which are within transmission distance and which are authorized to engage in the distribution of electric energy within the area.

(j) If the application contains Restricted Data or other defense information, it shall be prepared in such manner that all Restricted Data and other defense information are separated from the unclassified information.

§ 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 sources of potable or industrial water supply, watershed areas 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, checklists, 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.

§ 50.35 *Extended time for providing technical information.* Where, because of the nature of a proposed project, an applicant is not in a position to supply initially all of the technical information otherwise required to complete the application, he shall indicate the reason, the items or kinds of information omitted, and the approximate times when such data will be produced. If the Commission is satisfied that it has information sufficient to provide reasonable assurance that a facility of the general type proposed can be constructed and operated at the proposed location without undue risk to the health and safety of the public and that the omitted information will be supplied, it may process the application and issue a construction permit on a provisional basis without the omitted information subject to its later production and an evaluation by the Commission that the final design provides reasonable assurance that the health and safety of the public will not be endangered.

§ 50.36 *Designation of technical specifications.* (a) The Commission will indicate, by notice to the applicant, which of the provisions of his hazards summary report or any supplement thereto will be deemed to be technical specifications that become part of the license or construction permit. In giving such notice, the Commission will afford the applicant reasonable opportunity to amend or revise the technical information supplied before proceeding further to process the application.

(b) The Commission may require the applicant to designate those provisions of his hazards summary report or any supplement thereto, which he proposes be incorporated as technical specifications in the construction permit or license.

§ 50.37 *Agreement limiting access to Restricted Data.* As part of his application and in any event prior to the receipt of Restricted Data or the issuance of a license or construction permit, the applicant shall agree in writing that he will not permit any individual to have access to Restricted Data until the Civil Service Commission shall have made an investigation and report to the Commission on the character, associations, and loyalty of such individual, and the Commission shall have determined that permitting such person to have access to Restricted Data will not endanger the common defense and security. The agreement of the applicant in this regard shall be deemed part of the license or construction permit, whether so stated therein or not.

§ 50.38 *Ineligibility of certain applicants.* Any person who is a citizen, national, or agent of a foreign country, or any corporation, or other entity which the Commission knows or has reason to believe is owned, controlled, or dominated by an alien, a foreign corporation, or a foreign government, shall be ineligible to apply for and obtain a license except a license authorizing export only pursuant to an agreement for cooperation.

§ 50.39 *Public inspection of applications.* Applications and documents submitted to the Commission in connection with applications may be made available for public inspection in accordance with the provisions of the regulations contained in Part 2 of this chapter.

STANDARDS FOR LICENSES AND CONSTRUCTION PERMITS

§ 50.40 *Common standards.* In determining that a license will be issued to an applicant, the Commission will be guided by the following considerations:

(a) The processes to be performed, the operating procedures, the facility and equipment, the use of the facility, and other technical specifications, or the proposals in regard to any of the foregoing collectively provide reasonable assurance that the applicant will comply with the regulations in this chapter, including the regulations in Part 20, and that the health and safety of the public will not be endangered.

(b) The applicant is technically and financially qualified to engage in the proposed activities in accordance with the regulations in this chapter.

(c) The issuance of a license to the applicant will not, in the opinion of the Commission, be inimical to the common defense and security or to the health and safety of the public.

§ 50.41 *Additional standards for class 104 licenses.* In determining that a class 104 license will be issued to an applicant, the Commission will, in addition to applying the standards set forth in § 50.40 be guided by the following considerations:

(a) The Commission will permit the widest amount of effective medical therapy possible with the amount of special nuclear material available for such purposes.

(b) The Commission will permit the conduct of widespread and diverse research and development.

(c) In the event that applications for special nuclear material for use in activities licensed by the Commission pursuant to section 140b of the act exceed the amount of special nuclear material available the Commission will give priority to those activities which will, in the opinion of the Commission, lead to major advances in the application of atomic energy for industrial purposes.

NOTE: The Commission has determined, in accordance with section 104b of the Atomic Energy Act of 1954, that the regulations and terms of license applicable to a production or utilization facility in the conduct of research and development activities leading to the demonstration of practical value of such facility for industrial or commercial purposes are compatible with the regulations and terms of license which will apply in the event that a class 103 license were later to be issued for that type of facility.

§ 50.42 *Additional standards for class 103 licenses.* In determining whether a class 103 license will be issued to an applicant, the Commission will, in addition to applying the standards set forth in § 50.40, be guided by the following considerations:

(a) The proposed activities will serve a useful purpose proportionate to the quantities of special nuclear material or source material to be utilized.

(b) Due account will be taken of the advice provided by the Attorney General, pursuant to subsection 105c of the act. For this purpose before issuing the license, the Commission will notify the Attorney General of the proposed license, and the terms and conditions thereof, and request the advice of the Attorney General as to whether or not the proposed license would tend to create or maintain a situation inconsistent with the antitrust laws, as specified in subsection 105a of the act: *Provided*, That this requirement will not apply with respect to the types of class 103 licenses which the Commission, with the approval of the Attorney General, may determine would not significantly affect the applicant's activities under the antitrust laws. Upon receipt of the Attorney General's advice, the Commission will cause such advice to be published in the Federal Register.

§ 50.43 *Additional standards and provisions affecting class 103 licenses for commercial power.* In addition to applying the standards set forth in §§ 50.40 and 50.42, in the case of a class 103 license for a facility for the generation of commercial power:

(a) The Commission will give notice in writing of each application of such regulatory agency as may have jurisdiction over the rates and services of the proposed activity, and to municipalities, private utilities, public bodies, and cooperatives which are within transmission distance and which are authorized to engage in distribution of electric energy; and the Commission will publish notice of the application once each week for four consecutive weeks in the Federal Register. No license will be issued by the Commission prior to the giving of such notices and until four weeks after the last publication in the Federal Register.

(b) If there are conflicting applications for a limited opportunity for such license, the Commission will give preferred consideration in the following order: First, to applications submitted by public or cooperative bodies for facilities to be located in high cost power areas in the United States; second, to applications submitted by others for facilities to be located in such areas; third, to applications submitted by public or cooperative bodies for facilities to be located in other than high cost power areas, and, fourth, to all other applicants.

(c) The licensee who transmits electric energy in interstate commerce, or sells it at wholesale in interstate commerce, shall be subject to the regulatory provisions of the Federal Power Act.

(d) Nothing herein shall preclude any government agency, now or hereafter authorized by law to engage in the

production, marketing, or distribution of electric energy, if otherwise qualified, from obtaining a license for the construction and operation of a utilization facility for the primary purpose of producing electric energy for disposition for ultimate public consumption.

§ 50.44 *Standards for licenses authorizing export only.* Where a license is sought solely to authorize the export of production or utilization facilities, the Commission will determine whether the issuance of the license to the applicant for the facility involved is within the scope of and consistent with the terms of an agreement for cooperation with the nation to which the facility is to be exported.

§ 50.45 *Standards for construction permits.* An applicant for a license or an amendment of a license who proposes to construct or alter a production or utilization facility will be initially granted a construction permit, if the application is in conformity with and acceptable under the criteria of §§ 50.31 through 50.38 and the standards of §§ 50.40 through 50.43.

ISSUANCE, LIMITATIONS, AND CONDITIONS OF LICENSES AND CONSTRUCTION PERMITS

§ 50.50 *Issuance of licenses and construction permits.* Upon determination that an application for a license meets the standards and requirements of the act and regulations, and that notifications, if any, to other agencies or bodies have been duly made, the Commission will issue a license, or if appropriate a construction permit, in such form and containing such conditions and limitations including technical specifications, as it deems appropriate and necessary.

§ 50.51 *Duration of license, renewal.* Each license will be issued for a fixed period of time to be specified in the license but in no case to exceed 40 years from the date of issuance. Where the operation of a facility is involved, the Commission will issue the license for the term requested by the applicant or for the estimated useful life of the facility if the Commission determines that the estimated useful life is less than the term requested. Where construction of a facility is involved, the Commission may specify in the construction permit the period for which the license will be issued if approved pursuant to § 50.56. Licenses may be renewed by the Commission upon the expiration of the period.

§ 50.52 *Combining licenses.* The Commission may combine in a single license the activities of an applicant which would otherwise be licensed severally.

§ 50.53 *Jurisdictional limitations.* No license under this part shall be deemed to have been issued for activities which are not under or within the jurisdiction of the United States except insofar as the export of production or utilization facilities is authorized.

§ 50.54 *Conditions of licenses.* Whether stated therein or not, the following shall be deemed conditions in every license issued:

(a) Title to all special nuclear material utilized or produced by facilities pursuant to the license shall at all times be in the United States.

(b) No right to the special nuclear material shall be conferred by the license except as may be defined by the license.

(c) Neither the license, nor any right thereunder, nor any right to utilize or produce special nuclear material shall be transferred, assigned, or disposed of in any manner, either voluntarily or involuntarily, directly or indirectly, through transfer of control of the license to any person, unless the Commission shall, after securing full information, find that the transfer is in accordance with the provisions of the act and give its consent in writing.

(d) The license shall be subject to suspension and to the rights of recapture of the material or control of the facility reserved to the Commission under section 108 of the act in a state of war or national emergency declared by Congress.

(e) The license shall be subject to revocation, suspension, modification, or amendment for cause as provided in the act and regulations, in accordance with the procedures provided by the act and regulations.

(f) The licensee will at any time before expiration of the license, upon request of the Commission submit written statements, signed under oath or affirmation, to enable the Commission to determine whether or not the license should be modified, suspended or revoked.

(g) The issuance or existence of the license shall not be deemed to waive, or relieve the license from compliance with, the antitrust laws, as specified in subsection 105a of the act. In the event that the licensee should be found by a court of competent jurisdiction to have violated any provision of such antitrust laws in the conduct of the licensed activity, the Commission may suspend or revoke the license or take such other action with respect to it as shall be deemed necessary.

(h) The license shall be subject to the provisions of the act now or hereafter in effect and to all rules, regulations, and orders of the Commission. The terms and conditions of the license shall be subject to amendment, revision, or modification, by reason of amendments of the act or by reason of rules, regulations, and orders issued in accordance with the terms of the act.

(i) The licensee shall not permit the manipulation of the controls of any production or utilization facility by anyone who is not a licensed operator as provided in Part 55 of this chapter.

(j) The licensee shall not, except as authorized pursuant to a construction permit, make any alteration in the facility constituting a change from the technical specifications previously incorporated in a license or construction permit pursuant to § 50.36.

§ 50.55 *Conditions of construction permits.* Each construction permit shall be subject to the following terms and conditions:

(a) The permit shall state the earliest and latest dates for completion of the construction or modification. If the construction or modification is completed before the earliest date specified, the holder of the permit shall promptly notify the Commission for the purpose of accelerating final inspection and any scheduled delivery of materials from the Commission.

(b) If the proposed construction or modification of the facility is not completed by the latest completion date, the permit shall expire and all rights thereunder shall be forfeited: *Provided, however,* That upon good cause shown the Commission will extend the completion date for a reasonable period of time. The Commission will recognize, among other things, developmental problems attributable to the experimental nature of the facility or fire, flood, explosion, strike, sabotage, domestic violence, enemy action, an act of the elements, and other acts beyond the control of the permit holder, as a basis for extending the completion date.

(c) Except as modified by this section, the construction permit shall be subject to the same conditions to which a license is subject.

(d) At or about the time of completion of the construction or modification of the facility, the applicant will file any additional information needed to bring the original application for license up to date.

§ 50.56 *Conversion of construction permit to license; or amendment of license.* Upon completion of the construction or alteration of a facility, in compliance with the terms and conditions of the construction permit and subject to any necessary testing of the facility for health or safety purposes, the Commission will, in the absence of good cause shown to the contrary issue a license of the class for which the construction permit was issued or an appropriate amendment of the license, as the case may be.

§ 50.57 *Provisional operating license.* (a) As an intermediate procedure prior to issuance of an operating license pursuant to § 50.56, the Commission may issue a provisional operating license in a proceeding where findings required for the issuance of a final operating license cannot be made because (1) construction of the facility has not been completed, or (2) there are involved features, characteristics, or components of the proposed facility as to which it appears desirable to obtain actual or further operating experience before issuance of an operating license for the full term, up to forty (40) years, requested in the application.

(b) In any case subject to paragraph (a) of this section, a provisional operating license will be issued by the Commission upon finding that:

(1) Construction of the facility has proceeded, and there is reasonable assurance that the facility will be completed, in conformity with the construc-

tion permit and the application as amended, the provisions of the Act, and the rules and regulations of the Commission; and

(2) There is reasonable assurance (i) that the activities authorized by the provisional operating license can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the regulations in this chapter; and

(3) The applicant is technically and financially qualified to engage in the activities authorized by the provisional operating license in accordance with the regulations in this chapter; and

(4) The applicable provisions of Part 140 of this chapter have been satisfied; and

(5) There is reasonable assurance that the facility will be ready for initial loading with nuclear fuel within ninety (90) days from the date of issuance of such provisional license.

(c) Each provisional operating license will include appropriate provisions with respect to any uncompleted items of construction and such limitations or conditions as are required to assure that operations during the period of the provisional operating license will not endanger public health and safety.

(d) The duration of each provisional operating license will be specified therein, not to exceed eighteen (18) months from the date of issuance; provided, however, that, upon good cause shown, the expiration date of the provisional operating license may be extended.

(e) In cases where hearings have been held in connection with proceedings under this section, the presiding officer may, upon good cause being shown, provide that any intermediate decision and order issued pursuant to this section shall become effective immediately upon issuance subject to (1) the review thereof and further decision by the Commission upon exceptions thereto filed by any party within twenty (20) days after issuance of such intermediate decision, pursuant to the Commission's rules of practice, and (2) such further order as the Commission may enter upon such exceptions or upon its own motion within forty-five (45) days after the issuance of such intermediate decision; provided, however, that in the absence of any further Commission order pursuant to the foregoing and exceptions to the intermediate decision, the intermediate decision of the presiding officer shall become the final decision of the Commission at the end of such forty-five (45) day period. In the event of objection by any party to immediate effectiveness of such intermediate decision and order, the presiding officer may in his discretion stay such effectiveness pending filing by such party within five (5) days of exceptions to the provision for immediate effectiveness and thereafter until decision on such exceptions by the Commission.

[Added]

SOURCE: § 50.57 appears at 25 F.R. 8712, Sept. 9, 1960.

§ 50.58 *Hearing and reports of the Advisory Committee on Reactor Safeguards.* (a) Each application for a license for a production or utilization facility which is of a type described in §§ 50.21(b) or 50.22 and each application for a license for a testing facility shall, and any application for a production or utilization facility which is of a type described in § 50.21 (a) or (c) may, be referred to the Advisory Committee on Reactor Safeguards for review and report thereon. Such report shall be made part of the record of the application and available to the public, except to the extent that security classification prevents disclosure.

(b) The Commission will hold a hearing after 30 days' notice and publication once in the Federal Register on each application for a license for a production or utilization facility which is of a type described in §§ 50.21(b) or 50.22, and on each application for a license for a testing facility.

[Added]

SOURCE: § 50.58 appears as § 50.57 at 25 F.R. 1072, Feb. 6, 1960. Redesignated as § 50.58 at 25 F.R. 8712, Sept. 9, 1960.

ALLOCATION OF SPECIAL NUCLEAR MATERIAL

§ 50.60 *Allocation of special nuclear material.* (a) In construction permits and licenses issued to applicants proposing to operate production or utilization facilities, the Commission may incorporate provisions designating the quantities of special nuclear material available for use by each such facility. Such provisions will normally be in the form of a statement that the Commission has allocated to the applicant, for use in connection with the operation of the particular facility involved, a designated quantity (or quantities) of special nuclear material. The statement will include an estimated schedule for a reasonable period of time for special nuclear material transfers to the applicant and of special nuclear material returns to the Commission.

(b) The request for incorporation of such provisions may be made simultaneously with the submission of an application for construction permit or facility license or at any time thereafter. Such request should be accompanied by at least the following information:

(1) The applicant's financial qualifications to assume responsibility for payment of Commission charges for the materials, and to undertake and carry out the proposed use of special nuclear material for a reasonable period of time;

(2) The estimated date on which the applicant desires to receive the first shipment of special nuclear material and an estimated schedule, by years, for subsequent receipts;

(3) A schedule, by years, showing the estimated production, consumption and operating losses of special nuclear material; and

(4) An estimated schedule, by years, for the transfer of special nuclear material to the Commission or to other licensees.

Supporting data for the estimates required by subparagraphs (2), (3), and (4) of this paragraph shall be included.

(c) A request for the incorporation in a construction permit or license of provisions designating the amount of special material available for use by the facility will be approved by the Commission if:

(1) The quantities of special nuclear material are available for distribution under section 53 of the act; and

(2) The applicant appears to be financially qualified to assume responsibility for the payment of Commission charges for the material and to undertake and carry out the proposed use of special nuclear material for a reasonable period of time; and

(3) The estimated quantities and schedules submitted in response to paragraph (b) of this section are reasonable; and

(4) Approval of the request is consistent with the priority and preference provisions of the act, including sections 53f, 104b, and 182.

(d) The Commission may, in accordance with the procedures provided in Part 2 of this chapter reduce the quantities of special nuclear material allocated to any permittee or licensee pursuant to this section, upon the ground that the quantities allocated exceed those reasonably required, or estimated to be required, for use by the facility involved. The expiration, revocation or other termination of a construction permit or license shall terminate all allocations incorporated in such permit or license.

NOTE: Quantities of special nuclear material allocated pursuant to the provisions of this section will not be distributed to the licensee until needed. At the time the allocation is made, however, the Commission will make appropriate entries in its special nuclear material inventory and accounting records to reflect such allocation.

INSPECTION, RECORDS, REPORTS

§ 50.70 *Inspections.* Each licensee and each holder of a construction permit shall permit inspection, by duly authorized representatives of the Commission, of his records, premises, activities, and of licensed materials in possession or use, related to the license or construction permit as may be necessary to effectuate the purposes of the act, including section 105 of the act.

§ 50.71 *Maintenance of records, making of reports.* Each licensee and each holder of a construction permit shall maintain such records and make such reports, in connection with the licensed activity, as may be required by the conditions of the license or permit or by the rules, regulations, and orders of the Commission in effectuating the purposes of the act, including section 105 of the act.

TRANSFER OF LICENSES—CREDITORS' RIGHTS; SURRENDER OF LICENSES

[Sections 50.80 to 50.89 reserved]

AMENDMENT OF LICENSE OR CONSTRUCTION PERMIT AT REQUEST OF HOLDER

§ 50.90 *Application for amendment of license or construction permit.* When-

ever a holder of a license or construction permit desires to amend the license or permit, application for an amendment shall be filed with the Commission, fully describing the changes desired, and following as far as applicable the form prescribed for original applications.

§ 50.91 *Issuance of amendment.* In determining whether an amendment to a license or construction permit will be issued to the applicant, the Commission will be guided by the considerations which govern the issuance of initial licenses or construction permits, to the extent applicable and appropriate. If the application involves the material alteration of a licensed facility, a construction permit will be issued prior to the issuance of the amendment to the license.

REVOCATION, SUSPENSION, MODIFICATION, AMENDMENT OF LICENSES AND CONSTRUCTION PERMITS, EMERGENCY OPERATIONS BY THE COMMISSION

§ 50.100 *Revocation, suspension, modification of licenses and construction permits for cause.* A license or construction permit may be revoked, suspended, or modified, in whole or in part, for any material false statement in the application for license or in the supplemental or other statement of fact required of the applicant; or because of conditions revealed by the application for license or statement of fact or any report, record, inspection, or other means, which would warrant the Commission to refuse to grant a license on an original application (other than those relating to §§ 50.51, 50.42 (a), and 50.43 (b)); or for failure to construct or operate a facility in accordance with the terms of the construction permit or license, provided that failure to make timely completion of the proposed construction or alteration of a facility under a construction permit shall be governed by the provisions of § 50.55 (b); or for violation of, or failure to observe, any of the terms and provisions of the act, regulations, license, permit, or order of the Commission.

§ 50.101 *Retaking possession of special nuclear material.* Upon revocation of a license, the Commission may immediately retake possession of all special nuclear material held by the licensee.

§ 50.102 *Commission operation after revocation.* Whenever the Commission finds that the public convenience and necessity, or the production program of the Commission, requires continued operation of a production or utilization facility, the license for which has been revoked, the Commission may, after consultation with the appropriate federal or state regulatory agency having jurisdiction, order that possession be taken of such facility and that it be operated for a period of time as, in the judgment of the Commission, the public convenience and necessity or the production program of the Commission may require, or until a license for operation of the facility shall become effective. Just compensation shall be paid for the use of the facility.

§ 50.103 *Suspension and operation in war or national emergency.* (a) Whenever Congress declares that a state of war or national emergency exists, the Commission, if it finds it necessary to the common defense and security, may,

(1) Suspend any license it has issued.

(2) Order the recapture of special nuclear material distributed.

(3) Order the operation of any licensed facility.

(4) Order entry into any plant or facility in order to recapture special nuclear material or to operate the facility.

(b) Just compensation shall be paid for any damages caused by recapture of special nuclear material or by operation of any facility, pursuant to this section.

ENFORCEMENT

§ 50.110 *Violations.* An injunction or other court order may be obtained prohibiting any violation of any provision of the act or any regulation or order issued thereunder. Any person who wilfully violates any provision of the act or any regulation or order issued thereunder may be guilty of a crime and, upon conviction, may be punished by fine or imprisonment or both, as provided by law.

NOTE: The reporting and recordkeeping requirements contained herein have been approved by the Bureau of the Budget in accordance with The Federal Reports Act of 1942.

[Prior History]

Control of facilities for the production of fissionable material, 12 F. R. 7651, Nov. 18, 1947; amended, 14 F. R. 3492, June 28, 1949; amended, 15 F. R. 7137, Oct. 25, 1950; amended, 17 F. R. 10805, Nov. 29, 1952; amended, 18 F. R. 7355, Nov. 20, 1953; amended, 19 F. R. 5628, Sept. 3, 1954; amended, 20 F. R. 6676, Sept. 10, 1955.

Notices of Proposed Rule Making, Licensing of Production and Utilization Facilities, and Licensing of Production and Utilization Facilities; Filing of Applications for Licenses, Oath or Affirmation and Licensing of Production and Utilization Facilities appear respectively at 20 F.R. 2486, April 15, 1955, 23 F.R. 1014, February 15, 1958, 24 F.R. 2449, March 28, 1959, and 25 F.R. 1224, February 11, 1960.

(Published in 26 Federal Register, 4989, June 6, 1961)

Title 10—ATOMIC ENERGY

Chapter I—Atomic Energy Commission

PART 50—LICENSING OF PRODUCTION AND UTILIZATION FACILITIES

Definition of Production Facility

Statement of considerations. The Atomic Energy Act of 1954, as amended, defines "production facility" as "(1) any equipment or device, determined by rule of the Commission to be capable of the production of special nuclear material in such quantity as to be of significance to the common defense and security, or in such manner as to affect the health and safety of the public * * *" (section 11.t.). Pursuant to this provision, the Commission has by rule defined a "production facility", among other things, as "any facility designed or used for the processing of irradiated materials containing special nuclear material, except laboratory scale facilities designed or used for experimental or analytical purposes only." (Section 50.2(a)(3).)

Under this definition, facilities which are designed or used for the processing of irradiated fuel elements are subject to the licensing requirements of Part 50, including, among others, the issuance of a construction permit prior to construction, issuance of operators' licenses, showing of financial protection and execution of a Price-Anderson indemnification agreement. If material containing special nuclear material has been irradiated, the Part 50 requirements are presently applicable regardless of the length or type of irradiation or content or activity of fission products. On the other hand, facilities used for the processing of unirradiated fuel elements are not subject to Part 50 requirements, but are licensed pursuant to Part 70, Special Nuclear Material, Part 40, Licensing of Source Material, and Part 30, Licensing of Byproduct Material.

The Commission has concluded that irradiated materials which contain such small amounts of fission products and have such low levels of fission product activity that no additional radiological safety precautions are required beyond those necessary in connection with the processing of unirradiated materials should be treated similarly to unirradiated materials from a licensing standpoint. Accordingly, the amendment set forth below is intended to exempt the processing of slightly irradiated uranium from the licensing requirements of Part 50. Such processing would still be subject to the requirements of Part 30, Licensing of Byproduct Material and Part 70, Special Nuclear Material.

The limits on concentration and activity specified in the amendment are based upon analysis and calculations described in "AEC Analysis of Appropriate Limits for Exemption," a document which is on file in the AEC's Public Document Room, 1717 H Street NW., Washington 25, D.C. A copy of this document may be obtained at the AEC's Public Document Room or upon request addressed to the Atomic Energy Commission, Washington 25, D.C., Attention: Director, Division of Licensing and Regulation.

The specified limits for concentrations and quantities of induced radioactivity are very low. It is possible that higher concentrations and quantities would not present hazards appreciably greater than those associated with the processing of unirradiated uranium. The specified limits have been selected so as to exempt from the Part 50 regulations only materials with such low concentrations and activities of fission products, including plutonium, that safety equipment, personnel and procedures adequate for unirradiated uranium are obviously sufficient.

The amendment would have the effect of exempting from Part 50 the processing of many fuel elements used in critical facilities, if cooled for an appropriate period of time prior to processing. For example, the activity of a fuel element irradiated in a critical facility operated at 50 watts for 40 days would decrease below the exempted amount after approximately 180 days' cooling time. On the other hand, fuel elements used in research, test or power reactors for any reasonable period of time would require extremely long cooling times to decrease to exempted levels. For example, assuming a reactor containing 4 kg of uranium 235, a fuel element irradiated at 10 kilowatts for 30 days would require cooling for approximately 30 years.

The amended regulation will relieve Engelhard Industries, Inc., from Part 50 licensing requirements for proposed processing at their Newark, N.J., plant of 24 slightly irradiated MTR-type fuel and control elements being returned by the Netherlands Government. Since these elements were used in a reactor for only one week and have been in storage for three years, the content of fission products and level of activity fall within the limits prescribed in the amended regulation. The proposed activities are described in Engelhard Industries, Inc., Application for Exemption, dated January 5, 1961, a copy of which is on file in the AEC's Public Document Room.

Inasmuch as this amendment is intended to relieve from, rather than to impose, restrictions under regulations currently in effect and will not adversely affect the public health and safety, the Commission has found that general notice of proposed rule-making and public procedure thereon are unnecessary and good cause exists why this amendment should be made effective upon publication in the FEDERAL REGISTER.

It may be noted that the amendment set forth below excludes from the definition of "production facility" only facilities used for the processing of slightly irradiated uranium. Public comments are invited with respect to (1) the concentrations of fission products, including plutonium, specified in the amendment with respect to irradiated uranium; (2) possible adoption of exceptions with respect to other irradiated materials containing special nuclear materials; and (3) proposed concentrations of fission products for such additional irradiated materials. Such public comments should be submitted within sixty (60) days of the publication of this amendment in the FEDERAL REGISTER and should be addressed to the Secretary, United States Atomic Energy Commission, Washington 25, D.C.

Notice is hereby given that effective upon the publication in the FEDERAL REGISTER, 10 CFR Part 50, Licensing of Production and Utilization Facilities, is amended by revising § 50.2(a)(3) to read as follows:

(3) Any facility designed or used for the processing of irradiated materials containing special nuclear material, except (i) laboratory scale facilities designed or used for experimental or analytical purposes, and (ii) facilities in which the only special nuclear materials contained in the irradiated material to be processed are uranium enriched in the isotope U-235 and plutonium produced by the irradiation, if the material processed contains not more than 10^{-9} grams of plutonium per gram of U-235 and has fission product activity not in excess of 0.25 millicuries of fission products per gram of U-235.

Dated at Germantown, Md., this 29th day of May 1961.

For the Atomic Energy Commission.

HAROLD D. ANAMOSA,
Acting Secretary.

[F.R. Doc. 61-5165; Filed, June 5, 1961; 8:45 a.m.]

(Reprinted in 26 Federal Register, 9546, October 10, 1961)

Title 10—ATOMIC ENERGY

Chapter I—Atomic Energy Commission

PART 50—LICENSING OF PRODUCTION AND UTILIZATION FACILITIES

Creditors' Rights; and Transfer, Surrender, and Termination of Licenses

On May 9, 1961, the Commission published for public comment proposed amendments to 10 CFR Part 50 which would provide procedures for the transfer of licenses; the enforcement of creditors' rights against licensed facilities; and the surrender and termination of licenses. The amendments would also grant consent to the creation of mortgages or other liens upon licensed facilities. The comments received by the Commission with respect to the proposed amendments have been considered by the Commission and are on file in the Commission's Public Document Room.

Certain clarifying changes have been made in the language of § 50.82 of the amendments as published on May 9, 1961, in the notice of proposed rule making. The changes in language do not significantly modify the purpose or effect of the amendments as originally published.

Pursuant to the Administrative Procedure Act, notice is hereby given that the following amendments to Title 10, Chapter I, Part 50, Code of Federal Regulations, entitled "Licensing of Production and Utilization Facilities," are adopted to be effective upon publication in the FEDERAL REGISTER:

The following centerheading and sections are added to follow § 50.71:

TRANSFERS OF LICENSES—CREDITORS' RIGHTS—SURRENDER OF LICENSES

§ 50.80 Transfer of licenses.

(a) No license for a production or utilization facility, or any right thereunder, shall be transferred, assigned, or in any manner disposed of, either voluntarily or involuntarily, directly or indirectly, through transfer of control of the license to any person, unless the Commission shall give its consent in writing.

(b) An application for transfer of a license shall include as much of the information described in § 50.33 with respect to the identity and technical and financial qualifications of the proposed transferee as would be required by that section if the application were for an initial license. The Commission may require additional information such as data respecting proposed safeguards against hazards from radioactive materials and the applicant's qualifications to protect against such hazards. The application shall include also a statement of the purposes for which the transfer of the license is requested, the nature of the transaction necessitating or making desirable the transfer of the license, and an agreement to limit access to Restricted Data pursuant to § 50.37. The Commission may require any person who submits an application for license pursuant to the provisions of this section to file a written consent from the existing licensee or a certified copy of an order or judgment of a court of competent jurisdiction attesting to the person's right (subject to the licensing requirements of the Act and these regulations) to possession of the facility involved.

(c) After appropriate notice to interested persons, including the existing licensee, and observance of such procedures as may be required by the Act or regulations or orders of the Commission, the Commission will approve an application for the transfer of a license, if the Commission determines:

(1) That the proposed transferee is qualified to be the holder of the license; and

(2) That transfer of the license is otherwise consistent with applicable provisions of law, regulations, and orders issued by the Commission pursuant thereto.

§ 50.81 Creditor regulations.

(a) Pursuant to section 184 of the Act, the Commission consents, without individual application, to the creation of any mortgage, pledge, or other lien upon any production or utilization facility which is the subject of a license or upon any leasehold or other interest in such property: *Provided:*

(1) That the rights of any creditor so secured may be exercised only in compliance with and subject to the same requirements and restrictions as would apply to the licensee pursuant to the provisions of the license, the Atomic Energy Act of 1954, as amended, and regulations issued by the Commission pursuant to said Act; and

(2) That no creditor so secured may take possession of the facility pursuant to the provisions of this section prior to either the issuance of a license from the Commission authorizing such possession or the transfer of the license.

(b) Any creditor so secured may apply for transfer of the license covering such facility by filing an application for transfer of the license pursuant to § 50.80(b). The Commission will act upon such application pursuant to § 50.80 (c).

(c) Nothing contained in this regulation shall be deemed to constitute consent by the Commission to the creation of any mortgage, pledge, or other lien on any special nuclear material, or to affect the means of acquiring, or the priority of, any tax lien or other lien provided by law.

(d) As used in this section:

(1) "License" includes any license or construction permit which may be issued by the Commission with regard to the facility;

(2) "Creditor" includes, without implied limitation, the trustee under any mortgage, pledge or lien on a facility made to secure any creditor, any trustee or receiver of the facility appointed by a court of competent jurisdiction in any action brought for the benefit of any creditor secured by such mortgage, pledge or lien, any purchaser of such facility at the sale thereof upon foreclosure of such mortgage, pledge, or lien or upon exercise of any power of sale contained therein, or any assignee of any such purchaser.

§ 50.82 Applications for termination of licenses.

(a) Any licensee may apply to the Commission for authority to surrender a license voluntarily and to dismantle the facility and dispose of its component parts. The application shall include a statement of the reasons why surrender of the license and dismantling and disposal of the component parts of the facility are proposed. The Commission may require additional information, including information as to proposed procedures for the disposal of radioactive material, decontamination of the site, and other procedures, to provide reasonable assurance that the dismantling of the facility and disposal of the component parts will be performed in accordance with the regulations in this chapter and will not be inimical to the common defense and security or to the health and safety of the public.

(b) If the application demonstrates that the dismantling of the facility and disposal of the component parts will be performed in accordance with the regulations in this chapter and will not be inimical to the common defense and security or to the health and safety of the public, and after notice to interested persons, the Commission may issue an order authorizing such dismantling and disposal, and providing for the termination of the license upon completion of such procedures in accordance with any conditions specified in the order.

Dated at Germantown, Md., this 5th day of October 1961.

For the Atomic Energy Commission.

WOODFORD B. MCCOOL,
Secretary.

[F.R. Doc. 61-9677; Filed, Oct. 9, 1961; 8:45 a.m.]

(Reprinted in 27 Federal Register, 5491, June 9, 1962)

Title 10—ATOMIC ENERGY

Chapter I—Atomic Energy Commission

PART 50—LICENSING OF PRODUCTION AND UTILIZATION FACILITIES

Technical Specifications

Statement of considerations. The following amendments are designed to clarify the extent to which licensees may make changes, and conduct tests and experiments, which are not specifically provided for in their facility licenses. The amendments reflect consideration of comments received following publication of an earlier draft of these amendments in the FEDERAL REGISTER on April 8, 1961. The amendments substantially revise § 50.36 *Designation of technical specifications*, add a new § 50.59 *Author-*

ization of changes, tests and experiments; and add an Appendix A, "Contents of Technical Specifications". The revisions for §§ 50.36 and 50.59 are based upon the provisions incorporated in License No. DPR–1 pursuant to the Commission's Memorandum and Order dated November 2, 1960 (in the matter of General Electric, Vallecitos Boiling Water Reactor, Docket No. 50–18).

Basically the amendments provide that:

(1) Certain significant design and operating limitations and procedures will be designated as technical specifications which must be adhered to in the absence of specific authorization from the Commission. The technical specifications will reflect in such form limits in design and procedures approved by the Commission. They will represent in essence those parameters which define the boundaries of licensed activity which the Commission has evaluated and approved from a safety standpoint.

(2) The licensee may make changes in the facility, make changes in the procedures described in the hazards summary report, and conduct tests or experiments, unless the proposed change, test or experiment involves a change in the technical specifications or "an unreviewed safety question", as defined. Records of changes, tests and experiments which do not involve a change in the technical specifications or "an unreviewed safety question" must be kept and included in those made available for inspection by authorized representatives of the Commission and summarized in reports to be periodically submitted to the Commission.

(3) If a proposed change, test or experiment involves a change in the technical specifications or an unreviewed safety question, it may not be carried out unless authorized by the Commission. The request for such authorization must include an appropriate hazards analysis.

(4) Except as noted in paragraph (5), the Commission may authorize any proposed change, test or experiment upon finding that there is reasonable assurance that the health and safety of the public will not be endangered.

(5) With respect to power and testing reactors, the Commission may authorize a proposed change, test or experiment and a change in technical specifications upon determining that it does not present significant hazards considerations not previously described or implicit in the hazards summary report and upon finding that there is reasonable assurance that the public health and safety would not be endangered. If the proposed change involves significant hazards considerations not previously described or implicit in the hazards summary report, the proposed change, test or experiment must be referred to the Advisory Committee on Reactor Safeguards for report and must be scheduled for public hearing.

In conjunction with the adoption of these proposed amendments, the Commission plans to delegate appropriate authority to the staff to determine whether proposed changes, tests and experiments involve a significant hazards considerations not described or implicit in the hazards summary report and to issue authorization for changes which the rule does not require be referred to the ACRS and to public hearing.

All reports, requests, determinations and authorizations will be made part of the public record of the licensing proceedings.

In order to provide guidance to licensees and applicants, the proposed amendments would add an Appendix A to Part 50 containing a list of matters which are typical of those the Commission would generally expect to be covered by technical specifications in operating licenses. It is emphasized, however, that considerable variation from the subjects listed in Appendix A may be warranted in any particular case. The wide variations found in facility design and operation prevent any listing from being complete. Conversely, it is anticipated that some of the items listed would not be covered in specific operating licenses because of the nature of the particular design or proposed operation.

The proposed amendments would apply to all reactor operating licenses. With respect to existing licenses which do not designate particular portions of the hazards summary report as "technical specifications", the entire report would be designated as "technical specifications". The proposed rules permit amendment of the license upon application by the licensee, or on the Commission's own motion, to designate as "technical specifications" appropriate portions of the hazards summary report.

Notice is hereby given that pursuant to the Administrative Procedures Act and the Atomic Energy Act of 1954, as amended, the following amendments are published as a document subject to codification, to be effective 30 days after publication in the FEDERAL REGISTER.

1. Section 50.36 is amended to read as follows:

§ 50.36 Designation of technical specifications.

(a) Each applicant for a license authorizing operation of a production or utilization facility shall, and each applicant for a construction permit may, designate those provisions of his hazards summary report which he proposes be incorporated as technical specifications in the license or construction permit.

(b) Each license authorizing operation of a production or utilization facility of a type described in § 50.21 or § 50.22 will include technical specifications. The technical specifications incorporated in a license will be designed to include those significant design features, operating procedures and operating limitations which are considered important in providing reasonable assurance that the facility will be constructed and operated without undue hazard to public health and safety. Appendix A is provided as a guide to the type of matters which the Commission would generally expect to be covered by the technical specifications. The Commission may include technical specifications on such additional matters as the Commission finds appropriate to provide reasonable assurance that the facility will be constructed and operated without undue hazard to public health and safety; and may omit items listed in Appendix A if such omission is consistent with the protection of the health and safety of the public.

(c) This section shall not be deemed to modify the technical specifications included in any license issued prior to the effective date of this section. A license issued prior to the effective date of this section in which technical specifications have not been designated, shall be deemed to include the entire hazards summary report as technical specifications. At the initiative of the Commission or the licensee, any license may be amended to include technical specifications of the scope and content which would be required if a new license were being issued.

2. Add the following new § 50.59:

§ 50.59 Authorization of changes, tests and experiments.

(a) The holder of a license authorizing construction or operation of a production or utilization facility may (1) make changes in the facility as described in the hazards summary report, (2) make changes in the procedures as described in the hazards summary report, and (3) conduct tests or experiments not described in the hazards summary report, unless the proposed change, test or experiment involves a change in the technical specifications incorporated in the license or an unreviewed safety question, as defined in paragraph (c) of this section. If the proposed change, test or experiment involves a change in the technical specifications or an unreviewed safety question, it shall not be carried out unless authorized by the Commission pursuant to the procedures set forth in this section.

(b) The licensee shall maintain records of changes in the facility and of changes in procedures made without prior Commission approval pursuant to this section, to the extent that such changes constitute changes in the facility as described in the hazards summary report or constitute changes in procedures as described in the hazards summary report. The licensee shall also maintain records of tests and experiments carried out without prior Commission approval pursuant to this section. The licensee shall furnish annually to the Commission, or at such shorter intervals as may be specified in the license, a report containing a brief description of such changes, tests and experiments.

(c) A proposed change, test or experiment shall be deemed to involve an unreviewed safety question if (1) the probability of occurrence of an accident previously analyzed in the hazards summary report may be increased; or (2) if consequences of an accident previously analyzed in the hazards summary report may be increased; or (3) if a possibility for a nuclear accident of a different type than any analyzed in the hazards summary report may be created.

(d) The licensee shall file a request for authorization of a change in technical specifications or of any change, test or experiment which requires authoriza-

tion by the Commission pursuant to paragraph (a) of this section. The request shall include an appropriate hazards analysis. Each such request shall be filed with the Atomic Energy Commission, Attention: Director, Division of Licensing and Regulation. The licensee shall file three signed originals and 19 additional copies.

(e) With respect to request for changes, tests or experiments or for changes in technical specifications for a facility of a type described in § 50.21(b) or § 50.22, or a testing facility:

(1) If the Commission determines that the proposed change, test or experiment presents significant hazards considerations not described or implicit in the hazards summary report it will refer the request to the Advisory Committee on Reactor Safeguards and will order a public hearing in accordance with applicable procedures. The Commission will promptly notify the licensee of any referral to the Advisory Committee on Reactor Safeguards.

(2) If the Commission determines that the proposed change, test or experiment does not present significant hazards considerations not described or implicit in the hazards summary report, it may authorize such change, test or experiment, without referral to the Advisory Committee on Reactor Safeguards for a report and without a prior public hearing, upon finding that there is reasonable assurance that the health and safety of the public will not be endangered.

(f) With respect to requests for changes, tests or experiments or for changes in technical specifications for a production or utilization facility which is not of a type described in § 50.21(b) or § 50.22 or a testing facility, the Commission may authorize the proposed change, test or experiment upon finding that there is reasonable assurance that the health and safety of the public will not be endangered.

(g) Any report or request for authorization submitted by a licensee, and any determination by the Commission, or authorization issued by the Commission, pursuant to this section, will be made a part of the public record of the licensing proceeding. An authorization issued by the Commission will include appropriate changes in the technical specifications.

3. Add the following Appendix A:

APPENDIX A—GUIDE TO CONTENTS OF TECHNICAL SPECIFICATIONS FOR NUCLEAR REACTORS

1. This Appendix is a guide to matters which are typical of those the Commission would generally expect to be covered by technical specifications in operating licenses for nuclear reactors. The generalized form of the guide results in inclusion of items not common to all reactors, and should be used in preparation of technical specifications for a particular facility only to the extent the matters listed are applicable. Conversely, technical specifications are expected to include items other than those listed if such matters could have an effect on the safety of operations comparable in significance to the effect of the following items:

A. *Site.* 1. Physical location of the reactor plant.

2. Minimum distance to boundary of the exclusion area.

3. Principal activities carried on within the exclusion area.

B. *Containment.* 1. Design pressure and maximum total leakage rate at design pressure of the containment vessel (including penetrations).

2. Overall dimensions, materials of construction and approximate free volume of containment barrier.

3. Principal types of containment vessel penetrations, and for each type, the approximate number and methods of closure and sealing (including piping, duct work, and access openings).

4. Shell maximum design pressure under minimum temperature conditions and methods of protection against the cold.

5. Frequency, pressure, and methods of testing of the containment vessel and penetrations.

C. *Primary coolant system:* 1. General system specifications, and major primary system components including:

(a) Number of loops.

(b) Number of isolation and check valves per loop.

(c) Number of steam generators per loop.

(d) Method of coolant circulation and heat removal.

(e) Number of pumps per loop.

(f) Reactor coolant piping material and size.

(g) Volume of primary coolant.

2. Principal reactor vessel design features including:

(a) Temperature and pressure rating (design and operating).

(b) Materials of construction (base metal and cladding).

(c) Overall dimensions.

(d) Types and locations of nozzle connections with respect to core.

(e) Number of and types of penetrations.

(f) Type of closure and any limiting features.

3. Primary coolant specifications:

(a) Materials.

(b) Method of pressurization.

(c) Coolant chemistry limits.

(d) Impurity limits.

4. Operating variables, including:

(a) Minimum core inlet pressure.

(b) Maximum and minimum flow rate through the core.

(c) Maximum core exit bulk temperature.

(d) Maximum heat up and cool down rates of major components.

(e) Reactor vessel pressure limitations as a function of temperature and integrated neutron flux.

5. Principal design features of major components, including:

(a) Primary heat exchanger type and rating.

(b) Type of pump and pump drive.

(c) Isolation valve type and modes of operation.

(d) Check valve type and pressure design.

6. Materials and general configuration of primary system shielding.

D. *Primary plant auxiliary systems.* 1. Principal design features of major components including:

(a) Relief valve types, minimum capacity, relief settings, points for pressure discharge.

(b) Demineralizer type and product specifications.

(c) Pressurizer type and surge capacity.

(d) Coolant charging pump, number, charging rate and pressure design.

(e) Core water injection and containment spray system pumps, number, capacity, injection rate and design pressure.

(f) Reactor plant component cooling system pumps and heat exchanger, number, capacity and pressure design.

(g) Reactor plant control air design pressure, compressor type and rating.

2. Operating limitations, including:

(a) Water chemistry.

(b) Minimum reserve capacity of core water injection and containment spray systems.

(c) Maximum and minimum ambient operating temperature of reactor room.

(d) Minimum level of primary shield tank water level.

E. *Secondary coolant system.* 1. General system design specifications, including:

(a) Coolant.

(b) Maximum pressure, operating and design.

(c) Maximum temperature, operating and design.

(d) Coolant flow rate—maximum and minimum.

(e) Minimum makeup coolant temperature.

(f) Maximum differential temperature and pressure between primary and secondary systems.

(g) Coolant chemistry limits.

2. Principal operating limitations established from considerations of nuclear safety, including:

(a) Loading.

(b) Turbine control.

(c) Steam dumping or bypassing.

(d) Power network interconnections.

(e) Maximum radioactivity.

F. *Reactor core.* 1. Principal core design features, including:

(a) Moderator material.

(b) Reflector material and thickness.

(c) Fuel material, enrichment, and melting or boiling point.

(d) Minimum number of fuel thermocouples, where provided as a safeguard.

(e) Clad material and method of bonding.

(f) Minimum number of clad thermocouples where provided as a safeguard.

(g) Brief fuel element description including nominal dimensions, overall and internal element supports and orificing.

(h) Maximum total mass of core and of fuel in the core.

(i) Maximum number of fuel elements in the core.

(j) Maximum fuel burnup (MWD).

(k) Maximum or minimum void coefficient of reactivity, and maximum operating void fraction.

(l) Temperature and pressure reactivity coefficients, ambient to operating.

(m) Form of burnable poison and method of attachment.

(n) Maximum and minimum reactivity worth of burnable poison.

(o) Brief description of source including minimum initial strength and type.

(p) Number of passes and flow direction through the core.

2. Principal design core temperatures and thermal characteristics, including:

(a) Maximum thermal power.

(b) Maximum local core heat flux (maximum with respect to all variables at rated power).

(c) Minimum burnout safety factor (on heat flux) and correlation method used.

(d) Maximum fuel surface and central temperatures at designated points.

G. *Control and safety systems.* 1. Reactivity control system design and operating limits, including:

(a) Number installed and minimum number of operative control elements and drives.

(b) Principal design features including control element materials, control rod guides, minimum operating clearances, use of followers, limits on allowable operating temperatures and pressures and rod coupling method.

(c) Maximum reactivity worth of automatic control systems and of entire control system for both operating temperatures (hot) and cold plant conditions.

(d) Maximum reactivity worth of any individual control system component or gang, for hot and cold conditions.

(e) Minimum shutdown control margin for hot and cold conditions.

(f) Minimum number of least reactive control elements corresponding to minimum shutdown margin.

(g) Maximum reactivity addition rate by control elements.

(h) Maximum excess reactivity above cold clean critical.

(i) Automatic modes of reactivity insertion and shutdown and maximum total scram, delay time and safety element insertion time.

(j) Type, minimum reactivity worth, conditions of use, and principal design features of auxiliary poison systems.

(k) Rod position indication method and minimum accuracy limits.

(l) Minimum worth of safety control elements cocked during startup, fuel loading and other core manipulations.

(m) Minimum reactor power for automatic control.

2. Nuclear instrumentation system design and operating limits including:

(a) Brief description of the system including ranges, types, and sensitivities of instrument channels and detectors, their degree of independence of operation, and use of redundancy or coincidence circuitry.

(b) Minimum number and ranges of operative level safety and period safety channels during startup and power operation.

(c) Setting of scram points.

(d) Automatic control system inputs.

3. Characteristics of safety control systems auxiliary to the reactivity control and nuclear instrumentation systems including:

(a) Emergency power supply availability, and total loading with respect to minimum capacity.

(b) Devices which are activated on automatic building closure.

(c) Type, functions, and conditions of use of interlocks.

(d) Items which may be bypassed, method of bypassing, and conditions under which bypassing will be used.

(e) Conditions which would automatically cause reactor scram or building closure and activation points for these actions.

(f) Devices causing scram or partial insertion of rods and scram point settings.

(g) Instrumentation primarily or solely provided for analysis of conditions following an accident.

H. *Monitoring systems.* General design features and specific operating limits, including:

1. Stack, activity discharge rate averaged over a year and minimum number and sensitivity of operating monitors.

2. Maximum instantaneous stack activity discharge rate.

3. Fuel element failure detection equipment sensitivity, localization and sampling interval (if not continuous).

4. Minimum number and sensitivity of monitors for radiation level detection in accessible areas.

5. Minimum number and sensitivity of monitors of liquid radioactive effluents including primary coolant leak detectors.

6. Criticality monitors in fuel storage areas.

I. *Waste disposal systems.* Design and operating features including:

1. Principal features of equipment for removal of gases or other materials from primary and secondary coolant, moderator, reflector, or shield; equipment capacity and mode of use (continuous or intermittent).

2. Stack height.

3. Minimum waste holdup capacities, storage and processing methods and maximum radioactivity inventories during normal operations, maintenance and refueling.

J. *Ventilation systems.* 1. Brief description of principal features of systems providing safeguards functions, including:

(a) Fans used, capacities and approximate numbers.

(b) Direction of atmospheric pressure gradient across walls, doorways, and other important barriers of the facility and minimum atmospheric pressure differentials across principal barriers where pertinent to contamination control.

(c) Minimum ventilation rates where applicable.

(d) Provisions for ventilation system closure.

(e) Provisions for relief of positive or negative pressures within the enclosed areas upon ventilating system closure.

(f) Location of ventilation system inlets and outlets.

(g) Location, type, and procedures for maintenance of filtering or other air cleaning systems.

K. *Emergency cooling and decay heat removal systems.* 1. Principal system design features.

2. Minimum capacity of emergency heat exchangers.

3. Type, minimum coolant supply, flow rate, and power requirement of emergency cooling systems.

4. Total cooling time made available by emergency cooling systems.

5. Conditions which would automatically cause emergency actions.

6. Source and availability of emergency power.

L. *Fuel storage.* 1. Brief descriptions of physical means by which fuel elements are to be transported within the facility, and conditions under which they are stored.

2. Amount and arrangement (spacing) of special nuclear material to be stored.

3. Basic method or methods by which nuclear safety against inadvertent criticality is assured (mass, geometry).

4. Procedural limitations on quantities to be removed or inserted in storage area at any one time.

5. Means of providing personnel protections against radiation hazards from spent fuel.

M. *Experimental facilities including.* 1. Brief description of principal design features of experimental facilities.

2. Maximum excess reactivity allowed for experiments.

3. Maximum individual reactivity increase to be allowed for any experiment or experimental facility by flooding, draining, poison removal, fueled experiment addition, or other method.

4. For each loop or other experimental facility:

(a) Types of sensors for process variables, output actions, and redundant or coincidence provisions.

(b) Minimum cooling capacity to each experiment, method of cooling, and emergency cooling provisions.

(c) General geometry, minimum pressure resistance, and maximum leak rate of experiment containment barriers.

(d) Significant controls, signals, or other safety mechanisms by which experiments or experimenters (manually or automatically) may shutdown the reactor.

(e) Types of experiments to be conducted and limits on experimental programs, considering such effects as corrosion, explosion, and instrument shadowing.

5. Argon and other activation product limitations.

N. *Administrative and procedural safeguards.* 1. Brief coverage of the following:

(a) The availability of detailed written procedures for operations that might affect nuclear safety and for emergencies.

(b) The manner whereby operating procedures are reviewed and approved for use.

2. Brief description of the following controls procedures and tests:

(a) Administrative organization and controls to the extent that these have potential effect on safety.

(b) General operating principles having a potential effect on safety, including those for initial startup, routine operation, maintenance, refueling, conduct and operation of experiments, power escalation from criticality to full design power, and emergencies; minimum staffing requirements for such operations where applicable.

(c) Postcritical schedule of maintenance and recalibrating tests of safety system components, monitors, and other equipment having a potential safeguards function including items such as reactor control instruments, control rod systems, effluent release monitors, personnel protection monitors, portable detectors, building leakage and emergency systems.

(d) Procedures for the review within the licensee's organization of proposed modifications in the facility or in operating procedures, and of the design and conduct of experiments.

(Sec. 103, 68 Stat. 936, sec. 104, 68 Stat. 937, sec. 161, 68 Stat. 948, sec. 182, 68 Stat. 953, sec. 183, 68 Stat. 954; 42 U.S.C. 2133, 2134, 2201, 2232, 2233)

Dated at Germantown, Md., this 31st day of May 1962.

For the Atomic Energy Commission.

WOODFORD B. MCCOOL,
Secretary.

[F.R. Doc. 62-5615; Filed, June 8, 1962; 8:45 a.m.]

APPENDIX C

PART 115

OF

TITLE 10, CODE OF FEDERAL REGULATIONS

PROCEDURES FOR REVIEW OF CERTAIN NUCLEAR REACTORS EXEMPTED FROM LICENSING REQUIREMENTS

(Published in the Federal Register, 4321, May 18, 1961)

Title 10—ATOMIC ENERGY

Chapter I—Atomic Energy Commission

PART 115—PROCEDURES FOR REVIEW OF CERTAIN NUCLEAR REACTORS EXEMPTED FROM LICENSING REQUIREMENTS

On December 2, 1960 (25 F.R. 12367), the Commission issued for public comment a new proposed regulation 10 CFR, Part 115, to establish procedures for review of certain nuclear reactors exempt from licensing requirements. A statement of considerations explaining in general the provisions of the proposed Part 115 was published with the notice of proposed rule making.

In the light of public comments received and on further consideration, certain modifications have been made for purposes of clarification and in order to make this regulation correspond more closely to the provisions of 10 CFR Part 50, "Licensing of Production and Utilization Facilities", which governs licensed reactors.

Pursuant to the Administrative Procedure Act, notice is hereby given that the following regulation is published as a document subject to codification to be effective thirty (30) days after publication thereof in the FEDERAL REGISTER.

GENERAL PROVISIONS

DESCRIPTION OF AUTHORIZATIONS

APPLICATIONS FOR AUTHORIZATIONS, FORM, CONTENTS

STANDARDS FOR OPERATING AND CONSTRUCTION AUTHORIZATIONS

ISSUANCE, LIMITATIONS, AND CONDITIONS OF AUTHORIZATIONS

INSPECTION, RECORDS, REPORTS

AMENDMENT OF AUTHORIZATIONS AT REQUEST OF HOLDER

REVOCATION, SUSPENSION, MODIFICATION, AMENDMENT OF AUTHORIZATIONS

APPLICABILITY OF OTHER REGULATIONS

ENFORCEMENT

AUTHORITY: §§ 115.1 to 115.90 issued under sec. 161(b), 68 Stat. 948, 42 U.S.C. 2201.

GENERAL PROVISIONS

§ 115.1 Purpose.

(a) The regulations in this part are issued by the Atomic Energy Commission pursuant to the Atomic Energy Act of 1954 (68 Stat. 919) to establish public procedures for Commission review of safety considerations involved in the construction and operation by Commission contractors of certain Commission-owned nuclear reactors; to provide opportunity for participation by interested persons in such review of safety considerations; and to establish requirements which must be observed by persons authorized to construct or operate such reactors in order to protect health and minimize danger to life or property.

(b) The procedures and requirements established in this part are designed to parallel those established in Parts 2, 50 and 55 of this chapter for production and utilization facilities subject to the licensing requirements contained in Chapter 10 (42 U.S.C. 2131) of the Atomic Energy Act of 1954.

§ 115.2 Scope.

This part applies to any prime contractor of the Commission to the extent that such contractor proposes to construct or operate a nuclear reactor which:

(a) Is not subject to the licensing requirements set forth in Chapter 10 of the Act and Part 50 of the regulations in this chapter;

(b) Is not located at a Commission installation; and

(c) Is to be operated as part of the power-generation facilities of an electric utility system.

§ 115.3 Definitions.

As used in this part:

(a) "Act" means the Atomic Energy Act of 1954, as amended (68 Stat. 919), including any amendments thereto.

(b) "Applicant" means the prime contractor for construction or the prime contractor for operation, as the case may be.

(c) "Atomic energy" means all forms of energy released in the course of nuclear fission or nuclear transformation.

(d) "Atomic weapon" means any device utilizing atomic energy, exclusive of the means for transporting or propelling the device (where such means is a separable and divisible part of the device), the principal purpose of which is for use as, or for development of, a weapon, a weapon prototype, or a weapon test device.

(e) "Authorization" means an order issued pursuant to this part authorizing construction or operation of a nuclear reactor.

(f) "By-product material" means any radioactive material (except special nuclear material) yielded in or made radioactive by exposure to the radiation incident to the process of producing or utilizing special nuclear material.

(g) "Commission" means the Atomic Energy Commission or its duly authorized representatives.

(h) "Nuclear reactor" means an apparatus, other than an atomic weapon, designed or used to sustain nuclear fission in a self-supporting chain reaction.

(i) "Person" means (1) any individual, corporation, partnership, firm, association, trust, estate, public or private institution, group, Government agency other than the Commission, any State or any political subdivision of, or any political entity within a State, any foreign government or nation or any political subdivision of any such government or nation, or other entity; and (2) any legal successor, representative, agent, or agency of the foregoing.

(j) "Source material" means source material as defined in section 11x of the Act and in the regulations contained in Part 40 of this chapter.

(k) "Special nuclear material" means (1) plutonium, uranium 233, uranium enriched in the isotope 233 or in the isotope 235, and any other material which the Commission, pursuant to the provisions of section 51 of the Act, determines to be special nuclear material, but does not include source material; or (2) any material artificially enriched by any of the foregoing, but does not include source material.

(l) "United States" when used in a geographical sense, includes all Territories and possessions of the United States, the Canal Zone, and Puerto Rico.

§ 115.4 Interpretations.

Except as specifically authorized by the Commission in writing, no interpretation of the meaning of the regulations in this part by any officer or employee of the Commission other than a written interpretation by the General Counsel will be recognized to be binding upon the Commission.

§ 115.5 Specific exemptions.

The Commission may, upon application by any interested person, grant such exemptions from the requirements of the regulations in this part as it determines will not endanger life or property or the common defense and security and are otherwise in the public interest.

DESCRIPTION OF AUTHORIZATIONS

§ 115.7 Construction and operating authorizations.

A construction authorization for the construction of a nuclear reactor will be issued prior to the issuance of an operating authorization, if the application is otherwise acceptable. The construction authorization will be converted upon due completion of the reactor and Commission action into an operating authorization, as provided in § 115.44. If the application involves the material alteration of a reactor for which an operating authorization has been issued, a construction authorization will be issued prior to the issuance of an amendment of an operating authorization, as provided in § 115.61.

§ 115.8 Authorization required.

(a) No person shall begin the construction of a nuclear reactor on a site on which the reactor is to be operated until a construction authorization has been issued.

(b) As used in paragraph (a) of this section, the term "construction" shall be deemed to include pouring the foundation for, or the installation of, any portion of the permanent facility on the site; but does not include:

(1) Site exploration, site excavation, preparation of the site for construction of the reactor and construction of roadways, railroad spurs and transmission lines;

(2) Procurement or manufacture of components of the reactor; and

(3) Construction of non-nuclear facilities (such as turbo-generators and turbine buildings) and temporary buildings (such as construction equipment storage sheds) for use in connection with the construction of the reactor.

APPLICATIONS FOR AUTHORIZATIONS, FORM, CONTENTS

§ 115.20 Applications for authorizations.

(a) *Place of filing.* Each application for an authorization, including whenever appropriate a construction authorization, or amendment thereof, should be filed with the Atomic Energy, Commission, Attention: Division of Licensing and Regulation. Filings made by mail should be addressed to the Commission at Washington 25, D.C. Filings may be made in person at the Commission offices at 1717 H Street NW., Washington, D.C., or its offices at Germantown, Md.

(b) *Execution of applications.* Each application for an authorization, including whenever appropriate a construction authorization or amendment thereof, should be executed in three signed originals by the applicant or duly authorized officer thereof under oath or affirmation.

(c) *Number of copies of applications.* Each filing of any application under this section should include, in addition to the three signed originals, 19 copies of the application, except that with respect to that portion of the application containing the information required by § 115.23 (Hazards Summary Report) the filing should include 40 copies.

§ 115.21 Elimination of repetition.

In his application, the applicant may incorporate by reference information contained in previous applications, statements or reports filed with the Commission: *Provided*, That such references are clear and specific.

§ 115.22 Contents of applications; general information.

Each application shall state:

(a) Name of applicant;

(b) Address of applicant;

(c) Description of business or occupation of applicant;

(d) The use to which the nuclear reactor will be put and the period of time for which the authorization is sought;

(e) The technical qualifications of the applicant to engage in the proposed activities;

(f) If the application contains Restricted Data or other defense information, it shall be prepared in such manner that all Restricted Data and other defense information are separated from the unclassified information.

§ 115.23 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 byproduct material to be handled per unit of time, and thermal power to be generated if any.

(b) A description of the nuclear reactor. The description should be based on the design criteria for the reactor as a whole and for those major component parts which are essentia' to the safe operation of the reactor, 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 or otherwise authorized proposed to be carried on in the building which will house the reactor and on the balance of the site.

(c) A description of the site on which the reactor 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 sources of potable or industrial water supply, watershed areas and public utilities; and a scale plot plan of the site showing the proposed location of the reactor.

(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 reactor.

(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 byproduct material or special nuclear material.

§ 115.24 Extended time for providing technical information.

Where, because of the nature of a proposed project, an applicant is not in a position to supply initially all of the technical information otherwise required to complete the application, he shall indicate the reason, the items or kinds of information omitted, and the approximate times when such data will be produced. If the Commission is satisfied that it has information sufficient to provide reasonable assurance that a nuclear reactor of the general type proposed can be constructed and operated at the proposed location without undue risk to the health and safety of the public and that the omitted information will be supplied, it may process the application and issue a construction authorization on a provisional basis without the omitted information subject to its later production and an evaluation by the Commission that the final design provides reasonable assurance that the health and safety of the public will not be endangered.

§ 115.25 Designation of technical specifications.

(a) The Commission will indicate, by notice to the applicant, which of the provisions of his hazards summary report or any supplement thereto will be deemed to be technical specifications that become part of the construction or operating authorization. In giving such notice, the Commission will afford the applicant reasonable opportunity to amend or revise the technical informa-

tion supplied before proceeding further to process the application.

(b) The Commission may require the applicant to designate those provisions of his hazards summary report or any supplement thereto, which he proposes be incorporated as technical specifications in the construction or operating authorization.

§ 115.26 Public inspection of applications.

Applications and documents submitted to the Commission in connection with applications may be made available for public inspection in accordance with such provisions of the regulations contained in Part 2 of this chapter as would apply if such applications were for licenses under Part 50 of this chapter.

Standard for Operating and Construction Authorizations

§ 115.30 Standards for authorizations.

In determining that an authorization will be issued to an applicant, the Commission will be guided by the following considerations:

(a) The processes to be performed, the operating procedures, the nuclear reactor and equipment, the use of the reactor, and other technical specifications, or the proposals in regard to any of the foregoing collectively provide reasonable assurance that the applicant will comply with applicable regulations in this chapter, including the regulations in Part 20, and that the health and safety of the public will not be endangered.

(b) The applicant is technically qualified to engage in the proposed activities in accordance with the regulations in this part.

(c) The issuance of an authorization to the applicant will not, in the opinion of the Commission, be inimical to the health and safety of the public.

§ 115.31 Standards for construction authorization.

An applicant for an operating authorization or an amendment of an operating authorization who proposes to construct or materially alter a nuclear reactor will be initially granted a construction authorization if the application is in conformity with and acceptable under the provisions of §§ 115.20 to 115.30.

Issuance, Limitations, and Conditions of Authorizations

§ 115.40 Issuance.

Upon determination that an application for an operating authorization meets the standards and requirements of the Act and applicable regulations in this chapter, the Commission will issue an operating authorization, or if appropriate a construction authorization, in such form and containing such conditions and limitations including technical specifications, as it deems appropriate and necessary.

§ 115.41 Duration of authorization, renewal.

Each authorization will be issued for a fixed period of time to be specified in the authorization but in no case to exceed the term specified in the applicable contract with the Commission. Where construction of a reactor is involved, the Commission may specify in the construction authorization the period for which the operating authorization will be issued if approved pursuant to § 115.44. Authorizations may be renewed by the Commission upon the expiration of the period.

§ 115.42 Conditions of authorizations.

Whether stated therein or not, the following shall be deemed conditions in every authorization issued:

(a) Title to all special nuclear material utilized or produced pursuant to the authorization shall at all times be in the United States.

(b) No right to special nuclear material shall be conferred by the authorization except as may be defined by the authorization.

(c) Neither the authorization, nor any right thereunder, nor any right to utilize or produce special nuclear material shall be transferred, assigned, or disposed of in any manner, either voluntarily or involuntarily, directly or indirectly, through transfer of control of the authorization to any person, unless the Commission shall, after securing full information, give its consent in writing.

(d) The authorization shall be subject to revocation, suspension, modification, or amendment for cause as provided in the Act and applicable regulations.

(e) The holder of the authorization will at any time before expiration of the authorization, upon request of the Commission submit written statements, signed under oath or affirmation, to enable the Commission to determine whether or not the authorization should be modified, suspended or revoked.

(f) The authorization shall be subject to the provisions of the Act now or hereafter in effect and to all applicable rules, regulations, and orders of the Commission. The terms and conditions of the authorization shall be subject to amendment, revision, or modification, by reason of amendments of the Act or by reason of applicable rules, regulations, and orders issued in accordance with the terms of the Act.

(g) The holder of the authorization shall not permit the manipulation of the controls of the reactor by anyone who is not a licensed operator as provided in § 115.80.

(h) The holder of the authorization shall not, except as authorized pursuant to a construction authorization make any alteration in the reactor constituting a change from the technical specifications previously incorporated in an operating or construction authorization.

§ 115.43 Conditions of construction authorizations.

Each construction authorization shall be subject to the following terms and conditions:

(a) Except as modified by this section, the construction authorization shall be subject to the same conditions to which an operating authorization is subject.

(b) At or about the time of completion of the construction or modification of the nuclear reactor, the applicant will file any additional information needed to bring the original application for authorization up to date.

§ 115.44 Conversion of construction authorization or amendment of authorization to operating authorization.

Upon completion of the construction or alteration of a nuclear reactor, in compliance with the terms and conditions of the construction authorization and subject to any necessary testing of the reactor for health or safety purposes, the Commission will, in the absence of good cause shown to the contrary, issue an operating authorization.

§ 115.45 Provisional operating authorization.

(a) As an intermediate procedure prior to issuance of an operating authorization pursuant to § 115.44, the Commission may issue a provisional operating authorization in a proceeding where findings required for the issuance of a final operating authorization cannot be made because (1) construction of the facility has not been completed, or (2) there are involved features, characteristics, or components of the proposed facility as to which it appears desirable to obtain actual or further operating experience before issuance of an operating authorization for the full term requested in the application.

(b) In any case subject to paragraph (a) of this section, a provisional operating authorization will be issued by the Commission upon finding that:

(1) Construction of the facility has proceeded, and there is reasonable assurance that the facility will be completed, in conformity with the construction authorization and the application as amended, the provisions of the Act, and the rules and regulations of the Commission; and

(2) There is reasonable assurance (i) that the activities authorized by the provisional operating authorization can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the regulations in this chapter; and

(3) The applicant is technically and financially qualified to engage in the activities authorized by the provisional operating authorization in accordance with the regulations in this chapter; and

(4) There is reasonable assurance that the facility will be ready for initial loading with nuclear fuel within ninety (90) days from the date of issuance of such provisional authorization.

(c) Each provisional operating authorization will include appropriate provisions with respect to any uncompleted items of construction and such limitations or conditions as are required to assure that operations during the period of the provisional operating authorization will not endanger public health and safety.

(d) The duration of each provisional operating authorization will be specified therein, not to exceed eighteen (18) months from the date of issuance; provided, however, that, upon good cause shown, the expiration date of the provi-

sional operating authorization may be extended.

(e) The presiding officer may, upon good cause being shown, provide that any intermediate decision and order issued pursuant to this section shall become effective immediately upon issuance subject to (1) the review thereof and further decision by the Commission upon exceptions thereto filed by any party within twenty (20) days after issuance of such intermediate decision, pursuant to the Commission's rules of practice, and (2) such further order as the Commission may enter upon such exceptions or upon its own motion within forty-five (45) days after the issuance of such intermediate decision: *Provided, however*, That, in the absence of any further Commission order pursuant to the foregoing and exceptions to the intermediate decision, the intermediate decision of the presiding officer shall become the final decision of the Commission at the end of such forty-five (45) day period. In the event of objection by any party to immediate effectiveness of such intermediate decision and order, the presiding officer may in his discretion stay such effectiveness pending filing by such party within five (5) days of exceptions to the provision for immediate effectiveness and thereafter until decision on such exceptions by the Commission.

§ 115.46 Hearings and reports of the Advisory Committee on Reactor Safeguards.

(a) Each application for an authorization to construct or operate a nuclear reactor subject to this part shall be referred to the Advisory Committee on Reactor Safeguards for review and report thereon. Such report shall be made part of the record of the application and available to the public except to the extent that security classification prevents disclosure.

(b) The Commission will hold a hearing after 30 days' notice and publication once in the FEDERAL REGISTER on each application for authorization to construct or operate a nuclear reactor subject to this part.

INSPECTION, RECORDS, REPORTS

§ 115.50 Inspections.

Each holder of an authorization shall permit inspection, by duly authorized representatives of the Commission, of his records, premises, activities, and of materials in possession or use, related to the construction or operating authorization as may be necessary to effectuate the purposes of this part and other applicable regulations or orders of the Commission.

§ 115.51 Maintenance of records, making of reports.

Each holder of an authorization shall maintain such records and make such reports, in connection with the authorized activity, as may be required by the conditions of the authorization or by the rules, regulations, and orders of the Commission in effectuating the purposes of the Act.

AMENDMENT OF AUTHORIZATIONS AT REQUEST OF HOLDER

§ 115.60 Application for amendment of authorization.

Whenever a holder of an authorization desires to amend the authorization, application for an amendment shall be filed with the Commission, fully describing the changes desired, and following as far as applicable the form prescribed for original applications.

§ 115.61 Issuance of amendment.

In determining whether an amendment to an authorization will be issued to the applicant, the Commission will be guided by the considerations which govern the issuance of authorizations, to the extent applicable and appropriate. If the application involves the material alteration of a nuclear reactor, a construction authorization will be issued prior to the issuance of the amendment to the authorization.

REVOCATION, SUSPENSION, MODIFICATION, AMENDMENT OF AUTHORIZATIONS

§ 115.70 Revocation, suspension, modification of authorizations for cause.

An authorization may be revoked, suspended, or modified, in whole or in part, for any material false statement in the application for authorization or in the supplemental or other statement of fact required of the applicant; or because of conditions revealed by the application for authorization or statement of fact or any report, record, inspection, or other means, which would warrant the Commission to refuse to grant an authorization on an original application; or for failure to construct or operate a nuclear reactor in accordance with the terms of the authorization; or for violation of, or failure to observe, any of the applicable terms and provisions of the Act, regulations, authorization or order of the Commission.

§ 115.71 Retaking possession of special nuclear material.

Upon revocation of an authorization, the Commission may immediately retake possession of all special nuclear material possessed by the holder of the authorization.

APPLICABILITY OF OTHER REGULATIONS

§ 115.80 Applicability of other regulations.

(a) The provisions of Subparts A, B, G, and H of Part 2 of this chapter shall apply to authorizations and applications for authorizations, and to proceedings with respect thereto, to the same extent as if such applications were applications for licenses or construction permits under Part 50 of this chapter; and to the same extent as if such authorizations were licenses or construction permits under Part 50.

(b) Each holder of an authorization shall comply with the provisions of Part 20 of this chapter to the same extent as if such authorization were a license or construction permit issued under Part 50 of this chapter.

(c) No individual shall manipulate the controls of any facility authorized pursuant to this part without a valid operator's license issued pursuant to Part 55 of this chapter.

ENFORCEMENT

§ 115.90 Violations.

An injunction or other court order may be obtained prohibiting any violation of any provision of the Act or any regulation or order issued thereunder. Any person who wilfully violates any provision of the Act or any regulation or order issued thereunder may be guilty of a crime and, upon conviction, may be punished by fine or imprisonment or both, as provided by law.

Dated at Germantown, Md., this 11th day of May 1961.

For the Atomic Energy Commission.

WOODFORD B. MCCOOL,
Secretary.

[F.R. Doc. 61-4542; Filed, May 17, 1961; 8:45 a.m.]

GPO 933966

(Published in 27 Federal Register, 2682, March 22, 1962)

Title 10—ATOMIC ENERGY

Chapter I—Atomic Energy Commission

PART 115—PROCEDURES FOR REVIEW OF CERTAIN NUCLEAR REACTORS EXEMPTED FROM LICENSING REQUIREMENTS

Provisional Operating Authorization

The Atomic Energy Commission has adopted a corrective amendment of 10 CFR 115.45 to eliminate the presently stated requirement for a finding of financial qualification of an applicant for a provisional operating authorization for a facility under Part 115 of the Commission's regulations. Part 115 governs the public procedures for Commission issuance of authority for the construction and operation of a Commission reactor which is not located at a Commission installation and is to be operated as part of the power generating facilities of an electric utility system.

The standards for provisional construction and operating authorizations in 10 CFR 115.30 make no reference to financial qualifications as a guide in Commission consideration of an application for a construction and operating authorization for a Commission-owned reactor. 10 CFR 115.45, which states the findings required for the issuance of a provisional operating authorization, inadvertently includes a finding that the applicant is "financially qualified" to engage in the activities to be authorized.

Since 10 CFR Part 115 applies to Commission-owned nuclear reactors operated by Commission contractors, a finding of financial qualification of the operating organization is unnecessary. The requirement of a finding of financial qualification has therefore been deleted from 10 CFR 115.45.

Because of the corrective nature of this amendment and the fact that it eliminates a presently stated requirement, the Commission has found that notice of proposed rule making and public procedure thereon are unnecessary, and that good cause exists why this rule should be made effective without the customary period of prior notice.

Notice is hereby given that pursuant to the Administrative Procedure Act and the Atomic Energy Act of 1954, as amended, the following rule is published to be effective on publication in the FEDERAL REGISTER.

Subparagraph (3) of § 115.45(b) is amended to read as follows:

§ 115.45 Provisional operating authorization.

* * * * *

(b) * * *

(3) The applicant is technically qualified to engage in the activities authorized by the provisional operating authorization in accordance with the regulations in this chapter; and

* * * * *

(Sec. 161, 68 Stat. 948; 42 U.S.C. 2201)

Dated at Germantown, Md., this 9th day of March 1962.

For the Atomic Energy Commission.

WOODFORD B. MCCOOL,
Secretary.

[F.R. Doc. 62-2719; Filed, Mar. 21, 1962; 8:45 a.m.]

APPENDIX D

PART 100

OF

TITLE 10, CODE OF FEDERAL REGULATIONS

REACTOR SITE CRITERIA

(Reprinted in 27 Federal Register, 3509, April 12, 1962)

Title 10—ATOMIC ENERGY

Chapter I—Atomic Energy Commission

PART 100—REACTOR SITE CRITERIA

Pursuant to the Administrative Procedures Act and the Atomic Energy Act of 1954, as amended, the following guide is published as a document subject to codification, to be effective 30 days after publication in the FEDERAL REGISTER.

Statement of considerations. On February 11, 1961, the Atomic Energy Commission published in the FEDERAL REGISTER a notice of proposed rule making that set forth general criteria in the form of guides and factors to be considered in the evaluation of proposed sites for power and testing reactors. The Commission has received many comments from individuals and organizations, including several from foreign countries, reflecting the widespread sensitivity and importance of the subject of site selection for reactors. Formal communications have been received on the published guides, including a proposed comprehensive revision of the guides into an alternate form.

In these communications, there was almost unanimous support of the Commission's proposal to issue guidance in some form on site selections, and acceptance of the basic factors included in the proposed guides, particularly in the proposal to issue exposure dose values which could be used for reference in the evaluation of reactor sites with respect to potential reactor accidents of exceedingly low probability of occurrence.

On the other hand, many features of the proposed guides were singled out for criticism by a large proportion of the correspondents. This was particularly the case for the appendix section of the proposed guides, in which was included an example calculation of environmental distance characteristics for a hypothetical reactor. In this appendix, specific numerical values were employed in the calculations. The choice of these numerical values, in some cases involving simplifying assumptions of highly complex phenomena, represent types of considerations presently applied in site calculations and result in environmental distance parameters in general accord with present siting practice. Nevertheless, these particular numerical values and the use of a single example calculation were widely objected to, basically on the grounds that they presented an aspect of inflexibility to the guides which otherwise appeared to possess considerable flexibility and tended to emphasize unduly the concept of environmental isolation for reactors with minimum possibility being extended for eventual substitution thereof of engineered safeguard.

In consequence of these many comments, criticisms and recommendations, the proposed guides have been rewritten, with incorporation of a number of suggestions for clarification and simplification, and elimination of the numerical values and example calculation formerly constituting the appendix to the guides. In lieu of the appendix, some guidance has been incorporated in the text itself to indicate the considerations that led to establishing the exposure values set forth. However, in recognition of the advantage of example calculations in providing preliminary guidance to application of the principles set forth, the AEC will publish separately in the form of a technical information document a discussion of these calculations.

These guides and the technical information document are intended to reflect past practice and current policy of the Commission of keeping stationary power and test reactors away from densely populated centers. It should be equally understood, however, that applicants are free and indeed encouraged to demonstrate to the Commission the applicability and significance of considerations other than those set forth in the guides.

One basic objective of the criteria is to assure that the cumulative exposure dose to large numbers of people as a consequence of any nuclear accident should be low in comparison with what might be considered reasonable for total population dose. Further, since accidents of greater potential hazard than those commonly postulated as representing an upper limit are conceivable, although highly improbable, it was considered desirable to provide for protection against excessive exposure doses to people in large centers, where effective protective measures might not be feasible. Neither of these objectives were readily achievable by a single criterion. Hence, the population center distance was added as a site requirement when it was found for several projects evaluated that the specification of such a distance requirement would approximately fulfill the desired objectives and reflect a more accurate guide to current siting practices. In an effort to develop more specific guidance on the total man-dose concept, the Commission intends to give further study to the subject. Meanwhile, in some cases where very large cities are involved, the population center distance may have to be greater than those suggested by these guides.

A number of comments received pointed out that AEC siting factors included considerations of population distributions and land use surrounding proposed sites but did not indicate how future population growth might affect sites initially approved. To the extent possible, AEC review of the land use surrounding a proposed site includes considerations of potential residential growth. The guides tend toward requiring sufficient isolation to preclude any immediate problem. In the meantime, operating experience that will be acquired from plants already licensed to operate should provide a more definitive basis for weighing the effectiveness of engineered safeguards versus plant isolation as a public safeguard.

These criteria are based upon a weighing of factors characteristic of conditions in the United States and may not represent the most appropriate procedure nor optimum emphasis on the various interdependent factors involved in selection of sites for reactors in other countries where national needs, resources, policies and other factors may be greatly different.

Sec.

AUTHORITY: §§ 100.1 to 100.11 issued under sec. 103, 68 Stat. 936, sec. 104, 68 Stat. 937, sec. 161, 68 Stat. 948, sec. 182, 68 Stat. 953; 42 U.S.C. 2133, 2134, 2201, 2232.

§ 100.1 Purpose.

(a) It is the purpose of this part to describe criteria which guide the Commission in its evaluation of the suitability of proposed sites for stationary power and testing reactors subject to Part 50 of this chapter.

(b) Insufficient experience has been accumulated to permit the writing of detailed standards that would provide a quantitative correlation of all factors significant to the question of acceptability of reactor sites. This part is intended as an interim guide to identify a number of factors considered by the Commission in the evaluation of reactor sites and the general criteria used at this time as guides in approving or disapproving proposed sites. Any applicant who believes that factors other than those set forth in the guide should be considered by the Commission will be expected to demonstrate the applicability and significance of such factors.

§ 100.2 Scope.

(a) This part applies to applications filed under Part 50 and 115 of this chapter for stationary power and testing reactors.

(b) The site criteria contained in this part apply primarily to reactors of a general type and design on which experience has been developed, but can also be applied to other reactor types. In particular, for reactors that are novel in design and unproven as prototypes or pilot plants, it is expected that these

basic criteria will be applied in a manner that takes into account the lack of experience. In the application of these criteria which are deliberately flexible, the safeguards provided—either site isolation or engineered features—should reflect the lack of certainty that only experience can provide.

§ 100.3 Definitions.

As used in this part:

(a) "Exclusion area" means that area surrounding the reactor, in which the reactor licensee has the authority to determine all activities including exclusion or removal of personnel and property from the area. This area may be traversed by a highway, railroad, or waterway, provided these are not so close to the facility as to interfere with normal operations of the facility and provided appropriate and effective arrangements are made to control traffic on the highway, railroad, or waterway, in case of emergency, to protect the public health and safety. Residence within the exclusion area shall normally be prohibited. In any event, residents shall be subject to ready removal in case of necessity. Activities unrelated to operation of the reactor may be permitted in an exclusion area under appropriate limitations, provided that no significant hazards to the public health and safety will result.

(b) "Low population zone" means the area immediately surrounding the exclusion area which contains residents, the total number and density of which are such that there is a reasonable probability that appropriate protective measures could be taken in their behalf in the event of a serious accident. These guides do not specify a permissible population density or total population within this zone because the situation may vary from case to case. Whether a specific number of people can, for example, be evacuated from a specific area, or instructed to take shelter, on a timely basis will depend on many factors such as location, number and size of highways, scope and extent of advance planning, and actual distribution of residents within the area.

(c) "Population center distance" means the distance from the reactor to the nearest boundary of a densely populated center containing more than about 25,000 residents.

(d) "Power reactor" means a nuclear reactor of a type described in § 50.21(b) or 50.22 of this chapter designed to produce electrical or heat energy.

(e) "Testing reactor" means a "testing facility" as defined in § 50.2 of this chapter.

Site Evaluation Factors

§ 100.10 Factors to be considered when evaluating sites.

Factors considered in the evaluation of sites include those relating both to the proposed reactor design and the characteristics peculiar to the site. It is expected that reactors will reflect through their design, construction and operation an extremely low probability for accidents that could result in release of significant quantities of radioactive fission products. In addition, the site location and the engineered features included as safeguards against the hazardous consequences of an accident, should one occur, should insure a low risk of public exposure. In particular, the Commission will take the following factors into consideration in determining the acceptability of a site for a power or testing reactor:

(a) Characteristics of reactor design and proposed operation including:

(1) Intended use of the reactor including the proposed maximum power level and the nature and inventory of contained radioactive materials;

(2) The extent to which generally accepted engineering standards are applied to the design of the reactor;

(3) The extent to which the reactor incorporates unique or unusual features having a significant bearing on the probability or consequences of accidental release of radioactive materials;

(4) The safety features that are to be engineered into the facility and those barriers that must be breached as a result of an accident before a release of radioactive material to the environment can occur.

(b) Population density and use characteristics of the site environs, including the exclusion area, low population zone, and population center distance.

(c) Physical characteristics of the site, including seismology, meteorology, geology and hydrology.

(1) The design for the facility should conform to accepted building codes or standards for areas having equivalent earthquake histories. No facility should be located closer than one-fourth mile from the surface location of a known active earthquake fault.

(2) Meteorological conditions at the site and in the surrounding area should be considered.

(3) Geological and hydrological characteristics of the proposed site may have a bearing on the consequences of an escape of radioactive material from the facility. Special precautions should be planned if a reactor is to be located at a site where a significant quantity of radioactive effluent might accidentally flow into nearby streams or rivers or might find ready access to underground water tables.

(d) Where unfavorable physical characteristics of the site exist, the proposed site may nevertheless be found to be acceptable if the design of the facility includes appropriate and adequate compensating engineering safeguards.

§ 100.11 Determination of exclusion area, low population zone, and population center distance.

(a) As an aid in evaluating a proposed site, an applicant should assume a fission produce release[1] from the core, the expected demonstrable leak rate from the containment and the meteorological conditions pertinent to his site to derive an exclusion area, a low population zone and population center distance. For the purpose of this analysis, which shall set forth the basis for the numerical values used, the applicant should determine the following:

(1) An exclusion area of such size that an individual located at any point on its boundary for two hours immediately following onset of the postulated fission product release would not receive a total radiation dose to the whole body in excess of 25 rem[2] or a total radiation dose in excess of 300 rem[2] to the thyroid from iodine exposure.

(2) A low population zone of such size that an individual located at any point on its outer boundary who is exposed to the radioactive cloud resulting from the postulated fission product release (during the entire period of its passage) would not receive a total radiation dose to the whole body in excess of 25 rem or a total radiation dose in excess of 300 rem to the thyroid from iodine exposure.

(3) A population center distance of at least one and one-third times the distance from the reactor to the outer boundary of the low population zone. In applying this guide, due consideration should be given to the population distribution within the population center. Where very large cities are involved, a greater distance may be necessary because of total integrated population dose consideration.

(b) For sites for multiple reactor facilities consideration should be given to the following:

(1) If the reactors are independent to the extent that an accident in one reactor would not initiate an accident in another, the size of the exclusion area, low population zone and population center distance shall be fulfilled with respect to each reactor individually. The envelopes of the plan overlay of the areas so calculated shall then be taken as their respective boundaries.

(2) If the reactors are interconnected to the extent that an accident in one reactor could affect the safety of operation of any other, the size of the exclusion area, low population zone and population center distance shall be based upon the assumption that all interconnected reactors emit their postulated fission product releases simultaneously.

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[1] The fission product release assumed for these calculations should be based upon a major accident, hypothesized for purposes of site analysis or postulated from considerations of possible accidental events, that would result in potential hazards not exceeded by those from any accident considered credible. Such accidents have generally been assumed to result in substantial meltdown of the core with subsequent release of appreciable quantities of fission products.

[2] The whole body dose of 25 rem referred to above corresponds numerically to the once in a lifetime accidental or emergency dose for radiation workers which, according NCRP recommendations may be disregarded in the determination of their radiation exposure status (see NBS Handbook 69 dated June 5, 1959). However, neither its use nor that of the 300 rem value for thyroid exposure as set forth in these site criteria guides are intended to imply that these numbers constitute acceptable limits for emergency doses to the public under accident conditions. Rather, this 25 rem whole body value and the 300 rem thyroid value have been set forth in these guides as reference values, which can be used in the evaluation of reactor sites with respect to potential reactor accidents of exceedingly low probability of occurrence, and low risk of public exposure to radiation.

This requirement may be reduced in relation to the degree of coupling between reactors, the probability of concomitant accidents and the probability that an individual would not be exposed to the radiation effects from simultaneous releases. The applicant would be expected to justify to the satisfaction of the AEC the basis for such a reduction in the source term.

(3) The applicant is expected to show that the simultaneous operation of multiple reactors at a site will not result in total radioactive effluent releases beyond the allowable limits of applicable regulations.

NOTE: For further guidance in developing the exclusion area, the low population zone, and the population center distance, reference is made to Technical Information Document 14844, dated March 23, 1962, which contains a procedural method and a sample calculation that result in distances roughly reflecting current siting practices of the Commission. The calculations described in Technical Information Document 14844 may be used as a point of departure for consideration of particular site requirements which may result from evaluation of the characteristics of a particular reactor, its purpose and method of operation.

Copies of Technical Information Document 14844 may be obtained from the Commission's Public Document Room, 1717 H Street NW., Washington, D.C., or by writing the Director, Division of Licensing and Regulation, U.S. Atomic Energy Commission, Washington 25, D.C.

Dated at Germantown, Md., this 5th day of April 1962.

For the Atomic Energy Commission.

WOODFORD B. MCCOOL,
Secretary.

[F.R. Doc. 62-3523; Filed, Apr. 11, 1962; 8:45 a.m.]

APPENDIX E

PART 20

OF

TITLE 10, CODE OF FEDERAL REGULATIONS

STANDARDS FOR PROTECTION AGAINST RADIATION

[Reprint from the FEDERAL REGISTER, November 17, 1960]

Rules and Regulations

Title 10—ATOMIC ENERGY

Chapter I—Atomic Energy Commission

PART 20—STANDARDS FOR PROTECTION AGAINST RADIATION

Statement of considerations. The Atomic Energy Commission's regulation 10 CFR Part 20 is hereby republished for the purpose of incorporating into one document all amendments to the regulation to date, including the amendment published in the FEDERAL REGISTER on September 7, 1960, to become effective January 1, 1961.

GENERAL PROVISIONS

PERMISSIBLE DOSES, LEVELS, AND CONCENTRATIONS

PRECAUTIONARY PROCEDURES

WASTE DISPOSAL

RECORDS, REPORTS, AND NOTIFICATION

EXCEPTIONS AND ADDITIONAL REQUIREMENTS

ENFORCEMENT

AUTHORITY: §§ 20.1 to 20.601 issued under sec. 161, 68 Stat. 948, as amended; 42 U. S. C. 2201.

GENERAL PROVISIONS

§ 20.1 Purpose.

(a) The regulations in this part establish standards for protection against radiation hazards arising out of activities under licenses issued by the Atomic Energy Commission and are issued pursuant to the Atomic Energy Act of 1954 (68 Stat. 919).

(b) The use of radioactive material or other sources of radiation not licensed by the Commission is not subject to the regulations in this part. However, it is the purpose of the regulations in this part to control the possession, use, and transfer of licensed material by any licensee in such a manner that exposure to such material and to radiation from such material, when added to exposures to unlicensed radioactive material and to other unlicensed sources of radiation in the possession of the licensee, and to radiation therefrom, does not exceed the standards of radiation protection prescribed in the regulations in this part.

§ 20.2 Scope.

The regulations in this part apply to all persons who receive, possess, use or transfer byproduct material, source material, or special nuclear material under a general or specific license issued by the Commission pursuant to the regulations in Part 30, 40, or 70 of this chapter.

§ 20.3 Definitions.

(a) As used in this part:

(1) "Act" means the Atomic Energy Act of 1954 (68 Stat. 919) including any amendments thereto;

(2) "Airborne radioactive material" means any radioactive material dispersed in the air in the form of dusts, fumes, mists, vapors, or gases;

(3) "Byproduct material" means any radioactive material (except special nuclear material) yielded in or made radioactive by exposure to the radiation incident to the process of producing or utilizing special nuclear material;

(4) "Calendar quarter" means any period determined according to either of the following subdivisions:

(i) January 1 to March 31, inclusive; April 1 to June 30, inclusive; July 1 to September 30, inclusive; October 1 to December 31, inclusive; or

(ii) The first period in a calendar year of 13 complete, consecutive calendar weeks; the second period in a calendar year of 13 complete, consecutive calendar weeks; the third period in a calendar year of 13 complete, consecutive calendar weeks; the fourth period in a calendar year of 13 complete, consecutive calendar weeks. If at the end of a calendar year there are any days not falling within a complete calendar week of that year, such days shall be included (for purposes of this part) within the last complete calendar week of that year. If at the beginning of any calendar year there are days not falling within a complete calendar week of that year, such days shall be included (for purposes of this part) within the last complete calendar week of the previous year.

No licensee shall change the method observed by him of determining calendar quarters for purposes of this part except at the beginning of a calendar year.

(5) "Commission" means the Atomic Energy Commission or its duly authorized representatives;

(6) "Government agency" means any executive department, commission, independent establishment, corporation, wholly or partly owned by the United States of America which is an instrumentality of the United States, or any board, bureau, division, service, office, officer, authority, administration, or other establishment in the executive branch of the Government;

(7) "Individual" means any human being;

(8) "Licensed material" means source material, special nuclear material, or byproduct material received, possessed, used, or transferred under a general or specific license issued by the Commission pursuant to the regulations in this chapter;

(9) "License" means a license issued under the regulations in Part 30, 40, or 70 of this chapter. "Licensee" means the holder of such license;

(10) "Occupational dose" includes exposure of an individual to radiation (i) in a restricted area; or (ii) in the course of employment in which the individual's duties involve exposure to radiation; provided, that "occupational dose" shall not be deemed to include any exposure of an individual to radiation for the purpose of medical diagnosis or medical therapy of such individual.

(11) "Person" means (i) any individual, corporation, partnership, firm, association, trust, estate, public or private institution, group, Government agency other than the Commission, any State, any foreign government or nation or any political subdivision of any such government or nations, or other entity; and (ii) any legal successor, representative, agent, or agency of the foregoing;

(12) "Radiation" means any or all of the following: alpha rays, beta rays, gamma rays, X-rays, neutrons, high-speed electrons, high-speed protons, and other atomic particles; but not sound or radio waves, or visible, infrared, or ultraviolet light;

(13) "Radioactive material" includes any such material whether or not subject to licensing control by the Commission;

(14) "Restricted area" means any area access to which is controlled by the licensee. "Restricted area" shall not in-

clude any areas used as residential quarters, although a separate room or rooms in a residential building may be set apart as a restricted area;

(15) "Source material" means any material except special nuclear material, which contains by weight one-twentieth of one percent (0.05 percent or more of (i) uranium, (ii) thorium, or (iii) any combination thereof);

(16) "Special nuclear material" means (i) plutonium, uranium 233, uranium enriched in the isotope 233 or in the isotope 235, and any other material which the Commission, pursuant to the provisions of section 51 of the act, determines to be special nuclear material, but does not include source material; or (ii) any material artificially enriched by any of the foregoing but does not include source material;

(17) "Unrestricted area" means any area entry into which is not controlled by the licensee, and any area used for residential quarters.

(b) Definitions of certain other words and phrases as used in this part are set forth in other sections, including:

(1) "Airborne radioactivity area" defined in § 20.203;

(2) "Radiation area" and "high radiation area" defined in § 20.202;

(3) "Personnel monitoring equipment" defined in § 20.202;

(4) "Survey" defined in § 20.201;

(5) Units of measurement of dose (rad, rem) defined in § 20.4;

(6) Units of measurement of radioactivity defined in § 20.5.

§ 20.4 Units of radiation dose.

(a) "Dose," as used in this part, is the quantity of radiation absorbed, per unit of mass, by the body or by any portion of the body. When the regulations in this part specify a dose during a period of time, the dose means the total quantity of radiation absorbed, per unit of mass, by the body or by any portion of the body during such period of time. Several different units of dose are in current use. Definitions of units as used in this part are set forth in paragraphs (b) and (c) of this section.

(b) The rad, as used in this part, is a measure of the dose of any ionizing radiation to body tissues in terms of the energy absorbed per unit mass of the tissue. One rad is the dose corresponding to the absorption of 100 ergs per gram of tissue. (One millirad (mrad) = 0.001 rad.)

(c) The rem, as used in this part, is a measure of the dose of any ionizing radiation to body tissue in terms of its estimated biological effect relative to a dose of one roentgen (r) of X-rays. (One millirem (mrem) = 0.001 rem.) The relation of the rem to other dose units depends upon the biological effect under consideration and upon the conditions of irradiation. For the purpose of the regulations in this part, any of the following is considered to be equivalent to a dose of one rem:

(1) A dose of 1 r due to X— or gamma radiation;

(2) A dose of 1 rad due to X—, gamma, or beta radiation;

(3) A dose of 0.1 rad due to neutrons or high energy protons;

(4) A dose of 0.05 rad due to particles heavier than protons and with sufficient energy to reach the lens of the eye;

If it is more convenient to measure the neutron flux, or equivalent, than to determine the neutron dose in rads, as provided in subparagraph (3) of this paragraph, one rem of neutron radiation may, for purposes of the regulations in this part, be assumed to be equivalent to 14 million neutrons per square centimeter incident upon the body; or, if there exists sufficient information to estimate with reasonable accuracy the approximate distribution in energy of the neutrons, the incident number of neutrons per square centimeter equivalent to one rem may be estimated from the following table:

NEUTRON FLUX DOSE EQUIVALENTS

Neutron energy (Mev)	Number of neutrons per square centimeter equivalent to a dose of 1 rem (neutrons/cm²)	Average flux to deliver 100 millirem in 40 hours (neutrons/cm² per sec.)
Thermal	970×10^6	670
0.0001	720×10^6	500
0.005	820×10^6	570
0.02	400×10^6	280
0.1	120×10^6	80
0.5	43×10^6	30
1.0	26×10^6	18
2.5	29×10^6	20
5.0	26×10^6	18
7.5	24×10^6	17
10	24×10^6	17
10 to 30	14×10^6	10

(d) For determining exposures to X or gamma rays up to 3 Mev, the dose limits specified in §§ 20.101 to 20.104, inclusive, may be assumed to be equivalent to the "air dose". For the purpose of this part "air dose" means that the dose is measured by a properly calibrated appropriate instrument in air at or near the body surface in the region of highest dosage rate.

§ 20.5 Units of radioactivity.

(a) Radioactivity is commonly, and for purposes of the regulations in this part shall be, measured in terms of disintegrations per unit time or in curies. One curie (c) = 3.7×10^{10} disintegrations per second (dps) = 2.2×10^{12} disintegrations per minute (dpm). A commonly used submultiple of the curie is the microcurie (μc). One μc = 0.000001 c = 3.7×10^4 dps = 2.2×10^6 dpm.

(b) For purposes of the regulations in this part, it may be assumed that the daughter activity concentrations in the following table are equivalent to an air concentration of 10^{-7} microcuries of Radon 222 per milliliter of air in equilibrium with the daughters RaA, RaB, RaC, and RaC':

Maximum time between collection and measurement (hours)[1]	Alpha-emitting daughter activity collected per milliliter of air	
	Microcuries/cc	Total alpha disintegrations per minute per cc.
0.5	7.2×10^{-7}	0.16
1	4.5×10^{-7}	0.10
2	1.3×10^{-7}	0.028
3	0.3×10^{-7}	0.0072

[1] The duration of sample collection and the duration of measurement should be sufficiently short compared to the time between collection and measurement, as not to have a statistically significant effect upon the results.

(c) *Natural uranium and natural thorium.* (1) For purposes of the regulations in this part, one curie of natural uranium (U–natural in Appendix B or C) means the sum of 3.7×10^{10} disintegrations per second from U–238 plus 3.7×10^{10} dis/sec from U–234 plus 9×10^8 dis/sec from U–235. Also, a curie of natural thorium (thorium-natural in Appendix B or C) means the sum of 3.7×10^{10} dis/sec from Th^{232} plus 3.7×10^{10} dis/sec from Th^{228}.

(2) For the purpose of the regulations in this part, one curie of natural uranium (U–natural in Appendix B or C) is equivalent to 3,000 kilograms, or 6,615 pounds of natural uranium; and one curie of natural thorium (thorium-natural in Appendix B or C) is equivalent to 9,000 kilograms or 19,850 pounds of natural thorium.

§ 20.6 Interpretations.

Except as specifically authorized by the Commission in writing, no interpretation of the meaning of the regulations in this part by any officer or employee of the Commission other than a written interpretation by the General Counsel will be recognized to be binding upon the Commission.

§ 20.7 Communications.

All communications and reports concerning the regulations in this part, and applications filed under them, should be addressed to the Atomic Energy Commission, Washington 25, D.C., Attention: Division of Licensing and Regulation. Communications and reports may be delivered in person at the Commission's offices at 1717 H Street NW., Washington, D.C., or its offices at Germantown, Md.

§ 20.101 Exposure of individuals to radiation in restricted areas.

(a) Except as provided in paragraph (b) of this section, no licensee shall possess, use, or transfer licensed material in such a manner as to cause any individual in a restricted area to receive in any period of one calendar quarter from radioactive material and other sources of radiation in the licensee's possession a dose in excess of the limits specified in the following table:

Rems per calendar quarter

1. Whole body; head and trunk; active blood-forming organs; lens of eyes; or gonads	1¼
2. Hands and forearms; feet and ankles	18¾
3. Skin of whole body	7½

(b) A licensee may permit an individual in a restricted area to receive a dose to the whole body greater than that permitted under paragraph (a) of this section, provided:

(1) During any calendar quarter the dose to the whole body from radioactive material and other sources of radiation in the licensee's possession shall not exceed 3 rems; and

(2) The dose to the whole body, when added to the accumulated occupational dose to the whole body, shall not exceed 5 (N–18) rems where "N" equals the individual's age in years at his last birthday; and

(3) The licensee has determined the individual's accumulated occupational dose to the whole body on Form AEC–4,

or on a clear and legible record containing all the information required in that form; and has otherwise complied with the requirements of § 20.102. As used in paragraph (b), "Dose to the whole body" shall be deemed to include any dose to the whole body, gonads, active blood-forming organs, head and trunk, or lens of eye.

§ 20.102 Determination of accumulated dose.

(a) This section contains requirements which must be satisfied by licensees who propose, pursuant to paragraph (b) of § 20.101, to permit individuals in a restricted area to receive exposure to radiation in excess of the limits specified in paragraph (a) of § 20.101.

(b) Before permitting any individual in a restricted area to receive exposure to radiation in excess of the limits specified in paragraph (a) of § 20.101, each licensee shall:

(1) Obtain a certificate on Form AEC–4, or on a clear and legible record containing all the information required in that form, signed by the individual showing each period of time after the individual attained the age of 18 in which the individual received an occupational dose of radiation; and

(2) Calculate on Form AEC–4 in accordance with the instructions appearing therein, or on a clear and legible record containing all the information required in that form, the previously accumulated occupational dose received by the individual and the additional dose allowed for that individual under § 20.101(b).

(c)(1) In the preparation of Form AEC–4, or a clear and legible record containing all the information required in that form, the licensee shall make a reasonable effort to obtain reports of the individual's previously accumulated occupational dose. For each period for which the licensee obtains such reports, the licensee shall use the dose shown in the report in preparing the form. In any case where a licensee is unable to obtain reports of the individual's occupational dose for a previous complete calendar quarter, it shall be assumed that the individual has received the occupational dose specified in whichever of the following columns apply:

Part of body	Column 1 Assumed exposure in rems for calendar quarters prior to Jan. 1, 1961	Column 2 Assumed exposure in rems for calendar quarters beginning on or after Jan. 1, 1961
Whole body, gonads, active blood-forming organs, head and trunk, lens of eye.	3¾	1¼

(2) The licensee shall retain and preserve records used in preparing Form AEC–4.

If calculation of the individual's accumulated occupational dose for all periods prior to January 1, 1961 yields a result higher than the applicable accumulated dose value for the individual as of that date, as specified in paragraph (b) of § 20.101, the excess may be disregarded.

§ 20.103 Exposure of individuals to concentrations of radioactive material in restricted areas.

(a) No licensee shall possess, use or transfer licensed material in such a manner as to cause any individual in a restricted area to be exposed to airborne radioactive material possessed by the licensee in an average concentration in excess of the limits specified in Appendix B, Table I, of this part. "Expose" as used in this section means that the individual is present in an airborne concentration. No allowance shall be made for the use of protective clothing or equipment, or particle size, except as authorized by the Commission pursuant to paragraph (c) of this section.

(b) The limits given in Appendix B, Table I, of this part are based upon exposure to the concentrations specified for forty hours in any period of seven consecutive days. In any such period where the number of hours of exposure is less than forty, the limits specified in the table may be increased proportionately. In any such period where the number of hours of exposure is greater than forty, the limits specified in the table shall be decreased proportionately.

(c)(1) Except as authorized by the Commission pursuant to this paragraph, no allowance shall be made for particle size or the use of protective clothing or equipment in determining whether an individual is exposed to an airborne concentration in excess of the limits specified in Appendix B, Table I.

(2) The Commission may authorize a licensee to expose an individual in a restricted area to airborne concentrations in excess of the limits specified in Appendix B, Table I, upon receipt of an application demonstrating that the concentration is composed in whole or in part of particles of such size that such particles are not respirable; and that the individual will not inhale the concentrations in excess of the limits established in Appendix B, Table I. Each application under this subparagraph shall include an analysis of particle sizes in the concentrations; and a description of the methods used in determining the particle sizes.

(3) The Commission may authorize a licensee to expose an individual in a restricted area to airborne concentrations in excess of the limits specified in Appendix B, Table I, upon receipt of an application demonstrating that the individual will wear appropriate protective equipment and that the individual will not inhale, ingest or absorb quantities of radioactive material in excess of those which might otherwise be permitted under this part for employees in restricted areas during a 40-hour week. Each application under this subparagraph shall contain the following information:

(i) A description of the protective equipment to be employed, including the efficiency of the equipment for the material involved;

(ii) Procedures for the fitting, maintenance and cleaning of the protective equipment; and

(iii) Procedures governing the use of the protective equipment, including supervisory procedures and length of time the equipment will be used by the individuals in each work week. The proposed periods for use of the equipment by any individual should not be of such duration as would discourage observance by the individual of the proposed procedures; and

(iv) The average concentrations present in the areas occupied by employees.

§ 20.104 Exposure of minors.

(a) No licensee shall possess, use or transfer licensed material in such a manner as to cause any individual within a restricted area who is under 18 years of age, to receive in any period of one calendar quarter from radioactive material and other sources of radiation in the licensee's possession a dose in excess of 10 percent of the limits specified in the table in paragraph (a) of § 20.101.

(b) No licensee shall possess, use or transfer licensed material in such a manner as to cause any individual within a restricted area, who is under 18 years of age to be exposed to airborne radioactive material possessed by the licensee in an average concentration in excess of the limits specified in Appendix B, Table II of this part. For purposes of this paragraph, concentrations may be averaged over periods not greater than a week.

(c) The provisions of paragraph (c) of § 20.103, shall apply to exposures subject to paragraph (b) of this section.

§ 20.105 Permissible levels of radiation in unrestricted areas.

(a) There may be included in any application for a license or for amendment of a license proposed limits upon levels of radiation in unrestricted areas resulting from the applicant's possession or use of radioactive material and other sources of radiation. Such applications should include information as to anticipated average radiation levels and anticipated occupancy times for each unrestricted area involved. The Commission will approve the proposed limits if the applicant demonstrates that the proposed limits are not likely to cause any individual to receive a dose to the whole body in any period of one calendar year in excess of 0.5 rem.

(b) Except as authorized by the Commission pursuant to paragraph (a) of this section, no licensee shall possess, use or transfer licensed material in such a manner as to create in any unrestricted area from radioactive material and other sources of radiation in his possession:

(1) Radiation levels which, if an individual were continuously present in the area, could result in his receiving a dose in excess of two millirems in any one hour, or

(2) Radiation levels which, if an individual were continuously present in the area, could result in his receiving a dose in excess of 100 millirems in any seven consecutive days.

§ 20.106 Concentrations in effluents to unrestricted areas.

(a) There may be included in any application for a license or for amendment of a license proposed limits upon concentrations of licensed and other radioactive material released into air or water in unrestricted areas as a result

of the applicant's proposed activities. Such applications should include information as to anticipated average concentrations and anticipated occupancy times for each unrestricted area involved. The Commission will approve the proposed limits if the applicant demonstrates that it is not likely that any individual will be exposed to concentrations in excess of the limits specified in Appendix B, Table II, of this part. For purposes of this paragraph concentrations may be averaged over periods not greater than one year.

(b) Except as authorized by the Commission pursuant to § 20.302 or paragraph (a) of this section, no licensee shall possess, use or transfer licensed material in such a manner as to release into air or water in any unrestricted area any concentration of radioactive material in excess of the limits specified in Appendix B, Table II, of this part. For purposes of this paragraph, concentrations may be averaged over periods not greater than one year.

(c) For purposes of this section, determinations as to the concentration of radioactive material shall be made with respect to the point where such material leaves the restricted area. Where the radioactive material is discharged through a stack, tube, pipe, or similar conduit, the determination may be made with respect to the point where the material leaves such conduit.

(d) The provisions of this section do not apply to disposal of radioactive material into sanitary sewerage systems (see § 20.303).

§ 20.107 Medical diagnosis and therapy.

Nothing in the regulations in this part shall be interpreted as limiting the intentional exposure of patients to radiation for the purpose of medical diagnosis or medical therapy.

§ 20.108 Orders requiring furnishing of bio-assay services.

Where necessary or desirable in order to aid in determining the extent of an individual's exposure to concentrations of radioactive material, the Commission may incorporate appropriate provisions in any license, directing the licensee to make available to the individual appropriate bio-assay services and to furnish a copy of the reports of such services to the Commission.

PRECAUTIONARY PROCEDURES

§ 20.201 Surveys.

(a) As used in the regulations in this part, "survey" means an evaluation of the radiation hazards incident to the production, use, release, disposal, or presence of radioactive materials or other sources of radiation under a specific set of conditions. When appropriate, such evaluation includes a physical survey of the location of materials and equipment, and measurements of levels of radiation or concentrations of radioactive material present.

(b) Each licensee shall make or cause to be made such surveys as may be necessary for him to comply with the regulations in this part.

§ 20.202 Personnel monitoring.

(a) Each licensee shall supply appropriate personnel monitoring equipment to, and shall require the use of such equipment by:

(1) Each individual who enters a restricted area under such circumstances that he receives, or is likely to receive, a dose in any calendar quarter in excess of 25 percent of the applicable value specified in paragraph (a) of § 20.101.

(2) Each individual under 18 years of age who enters a restricted area under such circumstances that he receives, or is likely to receive, a dose in any calendar quarter in excess of 5 percent of the applicable value specified in paragraph (a) of § 20.101.

(3) Each individual who enters a high radiation area.

(b) As used in this part,

(1) "Personnel monitoring equipment" means devices designed to be worn or carried by an individual for the purpose of measuring the dose received (e. g., film badges, pocket chambers, pocket dosimeters, film rings, etc.);

(2) "Radiation area" means any area, accessible to personnel, in which there exists radiation, originating in whole or in part within licensed material, at such levels that a major portion of the body could receive in any one hour a dose in excess of 5 millirem, or in any 5 consecutive days a dose in excess of 100 millirems;

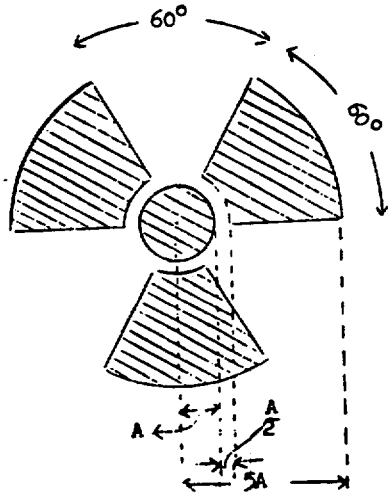
(3) "High radiation area" means any area, accessible to personnel, in which there exists radiation originating in whole or in part within licensed material at such levels that a major portion of the body could receive in any one hour a dose in excess of 100 millirem.

§ 20.203 Caution signs, labels, and signals.

(a) *General.* (1) Except as otherwise authorized by the Commission, symbols prescribed by this section shall use the conventional radiation caution colors (magenta or purple on yellow background). The symbol prescribed by this section is the conventional three-bladed design:

RADIATION SYMBOL

1. Cross-hatched area is to be magenta or purple.
2. Background is to be yellow.



(2) In addition to the contents of signs and labels prescribed in this section, licensees may provide on or near such signs and labels any additional information which may be appropriate in aiding individuals to minimize exposure to radiation or to radioactive material.

(b) *Radiation areas.* Each radiation area shall be conspicuously posted with a sign or signs bearing the radiation caution symbol and the words:

CAUTION [1]
RADIATION AREA

(c) *High radiation areas.* (1) Each high radiation area shall be conspicuously posted with a sign or signs bearing the radiation caution symbol and the words:

CAUTION [1]
HIGH RADIATION AREA

(2) Each high radiation area shall be equipped with a control device which shall either cause the level of radiation to be reduced below that at which an individual might receive a dose of 100 millirem in one hour upon entry into the area or shall energize a conspicuous visible or audible alarm signal in such a manner that the individual entering and the licensee or a supervisor of the activity are made aware of the entry. In the case of a high radiation area established for a period of 30 days or less, such control device is not required.

(d) *Airborne radioactivity areas.* (1) As used in the regulations in this part, "airborne radioactivity area" means (i) any room, enclosure, or operating area in which airborne radioactive materials, composed wholly or partly of licensed material, exist in concentrations in excess of the amounts specified in Appendix B, Table I, Column 1 of this part; or (ii) any room, enclosure, or operating area in which airborne radioactive material composed wholly or partly of licensed material exists in concentrations which, averaged over the number of hours in any week during which individuals are in the area, exceed 25 percent of the amounts specified in Appendix B, Table I, Column 1 of this part.

(2) Each airborne radioactivity area shall be conspicuously posted with a sign or signs bearing the radiation caution symbol and the words:

CAUTION [1]
AIRBORNE RADIOACTIVITY AREA

(e) *Additional requirements.* (1) Each area or room in which licensed material is used or stored and which contains any radioactive material (other than natural uranium or thorium) in an amount exceeding 10 times the quantity of such material specified in Appendix C of this part shall be conspicuously posted with a sign or signs bearing the radiation caution symbol and the words:

CAUTION [1]
RADIOACTIVE MATERIAL(S)

(2) Each area or room in which natural uranium or thorium is used or stored in an amount exceeding one-hundred times the quantity specified in Appendix C of this part shall be conspicuously posted with a sign or signs

[1] Or "Danger".

bearing the radiation caution symbol and the words:

CAUTION[1]
RADIOACTIVE MATERIAL(S)

(f) *Containers.* (1) Each container in which is transported, stored, or used a quantity of any licensed material (other than natural uranium or thorium) greater than the quantity of such material specified in Appendix C of this part shall bear a durable, clearly visible label bearing the radiation caution symbol and the words:

CAUTION[1]
RADIOACTIVE MATERIAL

(2) Each container in which natural uranium or thorium is transported, stored, or used in a quantity greater than ten times the quantity specified in Appendix C of this part shall bear a durable, clearly visible label bearing the radiation caution symbol and the words:

CAUTION[1]
RADIOACTIVE MATERIAL

(3) Notwithstanding the provisions of subparagraphs (1) and (2) a label shall not be required:

(i) If the concentration of the material in the container does not exceed that specified in Appendix B, Table I, Column 2 of this part, or

(ii) For laboratory containers, such as beakers, flasks, and test tubes, used transiently in laboratory procedures, when the user is present.

(4) Where containers are used for storage, the labels required in this paragraph shall state also the quantities and kinds of radioactive materials in the containers and the date of measurement of the quantities.

§ 20.204 Exceptions from posting requirements.

Notwithstanding the provisions of § 20.203,

(a) A room or area is not required to be posted with a caution sign because of the presence of a sealed source provided the radiation level twelve inches from the surface of the source container or housing does not exceed five millirem per hour.

(b) Rooms or other areas in hospitals are not required to be posted with caution signs because of the presence of patients containing byproduct material provided that there are personnel in attendance who shall take the precautions necessary to prevent the exposure of any individual to radiation or radioactive material in excess of the limits established in the regulations in this part.

(c) Caution signs are not required to be posted at areas or rooms containing radioactive materials for periods of less than eight hours provided that (1) the materials are constantly attended during such periods by an individual who shall take the precautions necessary to prevent the exposure of any individual to radiation or radioactive materials in excess of the limits established in the regulations in this part and; (2) such area or room is subject to the licensee's control.

§ 20.205 Exemptions for radioactive materials packaged for shipment.

Radioactive materials packaged and labeled in accordance with regulations of the Interstate Commerce Commission shall be exempt from the labeling and posting requirements of § 20.203 during shipment, provided that the inside containers are labeled in accordance with the provisions of § 20.203(f).

§ 20.206 Instruction of personnel; posting of notices to employees.

(a) All individuals working in or frequenting any portion of a restricted area shall be informed of the occurrence of radioactive materials or of radiation in such portions of the restricted area; shall be instructed in the safety problems associated with exposure to such materials or radiation and in precautions or procedures to minimize exposure; shall be instructed in the applicable provisions of Commission regulations and licenses for the protection of personnel from exposures to radiation or radioactive materials; and shall be advised of reports of radiation exposure which employees may request pursuant to these regulations.

(b) Each licensee shall post a current copy of the regulations in this part, a copy of the license, and a copy of operating procedures applicable to work under the license conspicuously in a sufficient number of places in every establishment where employees are employed in activities licensed by the Commission to permit them to observe such documents on the way to or from their place of employment or shall keep such documents available for employees' examination upon request.

(c) Form AEC-3 "Notice to Employees", shall be conspicuously posted in a sufficient number of places in every establishment where employees are employed in activities licensed by the Commission to permit them to observe a copy on the way to or from their place of employment.

NOTE: Copies of Form AEC-3 "Notice to Employees", may be obtained by writing to the Manager, appropriate AEC Operations Office or the Director, Division of Licensing and Regulation, Washington 25, D.C.

§ 20.207 Storage of licensed materials.

Licensed materials stored in an unrestricted area shall be secured against unauthorized removal from the place of storage.

WASTE DISPOSAL

§ 20.301 General requirement.

No licensee shall dispose of licensed material except:

(a) By transfer to an authorized recipient as provided in the regulations in Part 30, 40, or 70 of this chapter, whichever may be applicable; or

(b) As authorized pursuant to § 20.302; or

(c) As provided in § 20.303 or § 20.304, applicable respectively to the disposal of licensed material by release into sanitary sewerage systems or burial in soil, or in § 20.106 (Concentrations in Effluents to Unrestricted Areas).

§ 20.302 Method for obtaining approval of proposed disposal procedures.

Any licensee or applicant for a license may apply to the Commission for approval of proposed procedures to dispose of licensed material in a manner not otherwise authorized in the regulations in this chapter. Each application should include a description of the licensed material and any other radioactive material involved, including the quantities and kinds of such material and the levels of radioactivity involved, and the proposed manner and conditions of disposal. The application should also include an analysis and evaluation of pertinent information as to the nature of the environment, including topographical, geological, meteorological, and hydrological characteristics; usage of ground and surface waters in the general area; the nature and location of other potentially affected facilities; and procedures to be observed to minimize the risk of unexpected or hazardous exposures.

§ 20.303 Disposal by release into sanitary sewerage systems.

No licensee shall discharge licensed material into a sanitary sewerage system unless:

(a) It is readily soluble or dispersible in water; and

(b) The quantity of any licensed or other radioactive material released into the system by the licensee in any one day does not exceed the larger of subparagraphs (1) or (2) of this paragraph:

(1) The quantity which, if diluted by the average daily quantity of sewage released into the sewer by the licensee, will result in an average concentration equal to the limits specified in Appendix B, Table I, Column 2 of this part; or

(2) Ten times the quantity of such material specified in Appendix C of this part; and

(c) The quantity of any licensed or other radioactive material released in any one month, if diluted by the average monthly quantity of water released by the licensee, will not result in an average concentration exceeding the limits specified in Appendix B, Table I, Column 2 of this part; and

(d) The gross quantity of licensed and other radioactive material released into the sewerage system by the licensee does not exceed one curie per year.

Excreta from individuals undergoing medical diagnosis or therapy with radioactive material shall be exempt from any limitations contained in this section.

§ 20.304 Disposal by burial in soil.

No licensee shall dispose of licensed material by burial in soil unless:

(a) The total quantity of licensed and other radioactive materials buried at any one location and time does not exceed, at the time of burial, 1,000 times the amount specified in Appendix C of this part; and

(b) Burial is at a minimum depth of four feet; and

(c) Successive burials are separated by distances of at least six feet and not more than 12 burials are made in any year.

§ 20.305 Treatment or disposal by incineration.

No licensee shall treat or dispose of licensed material by incineration except as specifically approved by the Commission, pursuant to §§ 20.106(a) and 20.302.

[1] Or "Danger."

RECORDS, REPORTS, AND NOTIFICATION

§ 20.401 Records of surveys, radiation monitoring, and disposal.

(a) Each licensee shall maintain records showing the radiation exposures of all individuals for whom personnel monitoring is required under § 20.202 of the regulations in this part. Such records shall be kept on Form AEC–5, in accordance with the instructions contained in that form or on clear and legible records containing all the information required by Form AEC–5. The doses entered on the forms or records shall be for periods of time not exceeding one calendar quarter.

(b) Each licensee shall maintain records in the same units used in the appendices to this part, showing the results of surveys required by § 20.201 (b), and disposals made under §§ 20.302, 20.303, and 20.304.

(c) Records of individual radiation exposure which must be maintained pursuant to the provisions of this subsection shall be preserved until December 31, 1965 or until a date five years after termination of the individual's employment, whichever is later. Records which must be maintained pursuant to this part may be maintained in the form of microfilms.

NOTE: Prior to December 31, 1965 the Commission may amend this paragraph to assure the further preservation of records which it determines should not be destroyed.

§ 20.402 Reports of theft or loss of licensed material.

Each licensee shall report by telephone and telegraph to the Manager of the nearest Atomic Energy Commission Operations Office listed in Appendix D, immediately after its occurrence becomes known to the licensee, any loss or theft of licensed material in such quantities and under such circumstances that it appears to the licensee that a substantial hazard may result to persons in unrestricted areas.

§ 20.403 Notifications of incidents.

(a) *Immediate notification.* Each licensee shall immediately notify the Manager of the appropriate Atomic Energy Commission Operations Office shown in Appendix D by telephone and telegraph of any incident involving byproduct, source or special nuclear material possessed by him and which may have caused or threatens to cause:

(1) Exposure of the whole body of any individual to 25 rems or more of radiation; exposure of the skin of the whole body of any individual of 150 rems or more of radiation; or exposure of the feet, ankles, hands or forearms of any individual to 375 rems or more of radiation; or

(2) The release of radioactive material in concentrations which, if averaged over a period of 24 hours, would exceed 5,000 times the limits specified for such materials in Appendix B, Table II; or

(3) A loss of one working week or more of the operation of any facilities affected; or

(4) Damage to property in ex ss of $100,000.

(b) *Twenty-four hour notification.* Each licensee shall within 24 hours notify the Manager of the appropriate Atomic Energy Commission Operations Office listed in Appendix D by telephone and telegraph of any incident involving licensed material possessed by him and which may have caused or threatens to cause:

(1) Exposure of the whole body of any individual to 5 rems or more of radiation; exposure of the skin of the whole body of any individual to 30 rems or more of radiation; or exposure of the feet, ankles, hands, or forearms to 75 rems or more of radiation; or

(2) The release of radioactive material in concentrations which, if averaged over a period of 24 hours, would exceed 500 times the limits specified for such materials in Appendix B, Table II; or

(3) A loss of one day or more of the operation of any facilities affected; or

(4) Damage to property in excess of $1,000.

§ 20.404 Report to former employees of exposure to radiation.

At the request of a former employee each licensee shall furnish to the former employee a report of the former employee's exposure to radiation as shown in records maintained by the licensee pursuant to § 20.401(a). Such report shall be furnished within 30 days from the time the request is made; shall cover each calendar quarter of the individual's employment involving exposure to radiation, or such lesser period as may be requested by the employee. The report shall also include the results of any calculations and analyses of radioactive material deposited in the body of the employee and made pursuant to the provisions of § 20.108. The report shall be in writing and contain the following statement:

This report is furnished to you under the provisions of the Atomic Energy Commission regulations entitled "Standards for Protection Against Radiation" (10 CFR Part 20). You should preserve this report for future reference.

(b) The former employee's request should include appropriate identifying data, such as social security number and dates and locations of employment.

§ 20.405 Reports of overexposures and excessive levels and concentrations.

(a) In addition to any notification required by § 20.403, each licensee shall make a report in writing within 30 days to the Director, Division of Licensing and Regulation, U.S. Atomic Energy Commission, Washington 25, D.C., of (1) each exposure of an individual to radiation or concentrations of radioactive material in excess of any applicable limit in this part or in the licensee's license; (2) any incident for which notification is required by § 20.403; and (3) levels of radiation or concentrations of radioactive material (not involving excessive exposure of any individual) in an unrestricted area in excess of ten times any applicable limit set forth in this part or in the licensee's license. Each report required under this paragraph shall describe the extent of exposure of persons to radiation or to radioactive material; levels of radiation and concentrations of radioactive material involved; the cause of the exposure, levels or concentrations; and corrective steps taken or planned to assure against a recurrence. The licensee shall transmit a copy of each report to the Manager of the appropriate Atomic Energy Commission Operations Office listed in Appendix D.

(b) In any case where a licensee is required pursuant to the provisions of this section to report to the Commission any exposure of an individual to radiation or to concentrations of radioactive material, the licensee shall also notify such individual of the nature and extent of exposure. Such notice shall be in writing and shall contain the following statement:

This report is furnished to you under the provisions of the Atomic Energy Commission regulations entitled "Standards for Protection Against Radiation" (10 CFR Part 20). You should preserve this report for future reference.

§ 20.406 Notice to employees of exposure to radiation.

At the request of any employee, each licensee shall advise such employee annually of the employee's exposure to radiation as shown in records maintained by the licensee pursuant to § 20.401(a).

EXCEPTIONS AND ADDITIONAL REQUIREMENTS

§ 20.501 Applications for exemptions.

The Commission may, upon application by any licensee or upon its own initiative, grant such exemptions from the requirements of the regulations in this part as it determines are authorized by law and will not result in undue hazard to life or property.

§ 20.502 Additional requirements.

The Commission may, by rule, regulation, or order, impose upon any licensee such requirements, in addition to those established in the regulations in this part, as it deems appropriate or necessary to protect health or to minimize danger to life or property.

ENFORCEMENT

§ 20.601 Violations.

An injunction or other court order may be obtained prohibiting any violation of any provision of the act or any regulation or order issued thereunder. Any person who willfully violates any provision of the act or any regulation or order issued thereunder may be guilty of a crime, and upon conviction, may be punished by fine or imprisonment or both, as provided by law.

APPENDIX A [Reserved]

APPENDIX B

CONCENTRATIONS IN AIR AND WATER ABOVE NATURAL BACKGROUND

[See notes at end of appendix]

Element (atomic number)	Isotope [1]		Table I Column 1 Air (μc/ml)	Table I Column 2 Water (μc/ml)	Table II Column 1 Air (μc/ml)	Table II Column 2 Water (μc/ml)
Actinium (89)	Ac 227	S	2×10^{-12}	6×10^{-6}	8×10^{-14}	2×10^{-6}
		I	3×10^{-11}	9×10^{-5}	9×10^{-13}	3×10^{-4}
	Ac 228	S	8×10^{-8}	3×10^{-3}	3×10^{-9}	9×10^{-5}
		I	2×10^{-6}	3×10^{-3}	6×10^{-10}	9×10^{-5}
Americium (95)	Am 241	S	6×10^{-13}	1×10^{-4}	2×10^{-13}	4×10^{-6}
		I	1×10^{-10}	8×10^{-4}	4×10^{-12}	2×10^{-5}
	Am 243	S	6×10^{-13}	1×10^{-4}	2×10^{-13}	4×10^{-6}
		I	1×10^{-10}	8×10^{-4}	4×10^{-12}	3×10^{-5}
Antimony (51)	Sb 122	S	2×10^{-7}	8×10^{-4}	6×10^{-9}	3×10^{-5}
		I	1×10^{-7}	8×10^{-4}	5×10^{-9}	3×10^{-5}
	Sb 124	S	2×10^{-7}	7×10^{-4}	5×10^{-9}	2×10^{-5}
		I	2×10^{-8}	7×10^{-4}	7×10^{-10}	2×10^{-5}
	Sb 125	S	5×10^{-7}	3×10^{-3}	2×10^{-8}	1×10^{-4}
		I	3×10^{-8}	3×10^{-3}	9×10^{-10}	1×10^{-4}
Argon (18)	A 37	Sub [2]	6×10^{-3}		1×10^{-4}	
	A 41	Sub	2×10^{-8}		4×10^{-9}	
Arsenic (33)	As 73	S	2×10^{-6}	1×10^{-3}	7×10^{-9}	5×10^{-4}
		I	4×10^{-7}	1×10^{-3}	1×10^{-8}	5×10^{-4}
	As 74	S	3×10^{-7}	2×10^{-3}	1×10^{-8}	5×10^{-4}
		I	1×10^{-7}	2×10^{-3}	4×10^{-9}	5×10^{-4}
	As 76	S	1×10^{-7}	6×10^{-4}	4×10^{-9}	2×10^{-4}
		I	1×10^{-7}	6×10^{-4}	3×10^{-9}	2×10^{-4}
	As 77	S	5×10^{-7}	2×10^{-3}	2×10^{-8}	8×10^{-4}
		I	4×10^{-7}	2×10^{-3}	1×10^{-8}	8×10^{-4}
Astatine (85)	At 211	S	7×10^{-9}	5×10^{-5}	2×10^{-10}	2×10^{-6}
		I	3×10^{-8}	2×10^{-3}	1×10^{-9}	7×10^{-5}
Barium (56)	Ba 131	S	1×10^{-6}	5×10^{-3}	4×10^{-8}	2×10^{-4}
		I	4×10^{-7}	5×10^{-3}	1×10^{-8}	2×10^{-4}
	Ba 140	S	1×10^{-7}	8×10^{-4}	4×10^{-9}	3×10^{-5}
		I	4×10^{-8}	7×10^{-4}	1×10^{-9}	2×10^{-5}
Berkellium (97)	Bk 249	S	9×10^{-10}	2×10^{-3}	3×10^{-11}	6×10^{-4}
		I	1×10^{-7}	2×10^{-3}	4×10^{-9}	6×10^{-4}
Beryllium (4)	Be 7	S	6×10^{-6}	5×10^{-3}	2×10^{-7}	2×10^{-3}
		I	1×10^{-6}	5×10^{-3}	4×10^{-8}	2×10^{-3}
Bismuth (83)	Bi 206	S	2×10^{-7}	1×10^{-3}	6×10^{-9}	4×10^{-5}
		I	1×10^{-7}	1×10^{-3}	5×10^{-9}	4×10^{-5}
	Bi 207	S	2×10^{-7}	2×10^{-3}	6×10^{-9}	6×10^{-5}
		I	1×10^{-7}	2×10^{-3}	5×10^{-10}	6×10^{-5}
	Bi 210	S	6×10^{-9}	1×10^{-3}	2×10^{-10}	4×10^{-5}
		I	6×10^{-9}	1×10^{-3}	2×10^{-10}	4×10^{-5}
	Bi 212	S	1×10^{-7}	1×10^{-3}	3×10^{-9}	4×10^{-4}
		I	2×10^{-7}	1×10^{-3}	7×10^{-9}	4×10^{-4}
Bromine (35)	Br 82	S	1×10^{-6}	8×10^{-3}	4×10^{-8}	3×10^{-4}
		I	2×10^{-7}	1×10^{-3}	6×10^{-9}	4×10^{-5}
Cadmium (48)	Cd 109	S	5×10^{-8}	5×10^{-3}	2×10^{-9}	2×10^{-4}
		I	7×10^{-8}	5×10^{-3}	3×10^{-9}	2×10^{-4}
	Cd 115m	S	4×10^{-8}	7×10^{-4}	1×10^{-9}	3×10^{-5}
		I	4×10^{-8}	7×10^{-4}	1×10^{-9}	3×10^{-5}
	Cd 115	S	2×10^{-7}	1×10^{-3}	8×10^{-9}	3×10^{-5}
		I	2×10^{-7}	1×10^{-3}	6×10^{-9}	4×10^{-5}
Calcium (20)	Ca 45	S	3×10^{-9}	3×10^{-4}	1×10^{-9}	9×10^{-6}
		I	1×10^{-7}	5×10^{-3}	4×10^{-9}	2×10^{-4}
	Ca 47	S	2×10^{-7}	1×10^{-3}	6×10^{-9}	5×10^{-5}
		I	2×10^{-7}	1×10^{-3}	6×10^{-9}	3×10^{-5}
Californium (98)	Cf 249	S	2×10^{-13}	$<10^{-4}$	5×10^{-14}	4×10^{-6}
		I	1×10^{-10}	7×10^{-4}	3×10^{-12}	2×10^{-5}
	Cf 250	S	5×10^{-13}	4×10^{-4}	2×10^{-13}	1×10^{-5}
		I	1×10^{-10}	7×10^{-4}	3×10^{-12}	3×10^{-5}
	Cf 252	S	2×10^{-11}	7×10^{-4}	7×10^{-13}	2×10^{-5}
		I	1×10^{-10}	7×10^{-4}	4×10^{-12}	2×10^{-5}
Carbon (6)	C 14	S	4×10^{-6}	2×10^{-3}	1×10^{-7}	8×10^{-4}
	(CO_2)	Sub	5×10^{-5}		1×10^{-6}	
Cerium (58)	Ce 141	S	4×10^{-7}	3×10^{-3}	2×10^{-8}	9×10^{-5}
		I	2×10^{-7}	3×10^{-3}	5×10^{-9}	9×10^{-5}
	Ce 143	S	3×10^{-7}	1×10^{-3}	9×10^{-9}	4×10^{-5}
		I	2×10^{-7}	1×10^{-3}	7×10^{-9}	4×10^{-5}
	Ce 144	S	1×10^{-8}	3×10^{-4}	3×10^{-10}	1×10^{-5}
		I	6×10^{-9}	3×10^{-4}	2×10^{-10}	1×10^{-5}

See footnotes at end of table.

CONCENTRATIONS IN AIR AND WATER ABOVE NATURAL BACKGROUND—continued

[See notes at end of appendix]

Element (atomic number)	Isotope [1]		Table I Column 1 Air (μc/ml)	Table I Column 2 Water (μc/ml)	Table II Column 1 Air (μc/ml)	Table II Column 2 Water (μc/ml)
Cesium (55)	Cs 131	S	1×10^{-6}	7×10^{-3}	4×10^{-7}	2×10^{-4}
		I	3×10^{-6}	3×10^{-3}	1×10^{-7}	9×10^{-5}
	Cs 134m	S	4×10^{-6}	2×10^{-1}	1×10^{-6}	6×10^{-3}
		I	6×10^{-6}	3×10^{-3}	2×10^{-7}	1×10^{-4}
	Cs 134	S	4×10^{-8}	3×10^{-4}	1×10^{-9}	9×10^{-6}
		I	1×10^{-8}	1×10^{-3}	4×10^{-10}	4×10^{-5}
	Cs 135	S	5×10^{-7}	3×10^{-3}	2×10^{-8}	1×10^{-4}
		I	9×10^{-8}	7×10^{-3}	3×10^{-9}	2×10^{-4}
	Cs 136	S	4×10^{-7}	2×10^{-3}	1×10^{-8}	9×10^{-5}
		I	2×10^{-7}	2×10^{-3}	6×10^{-9}	6×10^{-5}
	Cs 137	S	6×10^{-8}	4×10^{-4}	2×10^{-9}	2×10^{-5}
		I	1×10^{-8}	1×10^{-3}	5×10^{-10}	4×10^{-5}
Chlorine (17)	Cl 36	S	4×10^{-7}	2×10^{-3}	1×10^{-8}	8×10^{-5}
		I	2×10^{-8}	2×10^{-3}	8×10^{-10}	6×10^{-5}
	Cl 38	S	3×10^{-6}	1×10^{-3}	9×10^{-8}	4×10^{-4}
		I	2×10^{-6}	1×10^{-3}	7×10^{-8}	4×10^{-4}
Chromium (24)	Cr 51	S	1×10^{-3}	5×10^{-2}	4×10^{-7}	2×10^{-3}
		I	2×10^{-6}	5×10^{-2}	8×10^{-8}	2×10^{-3}
Cobalt (27)	Co 57	S	3×10^{-6}	2×10^{-2}	1×10^{-7}	5×10^{-4}
		I	2×10^{-7}	1×10^{-2}	6×10^{-9}	4×10^{-4}
	Co 58m	S	2×10^{-6}	8×10^{-3}	6×10^{-7}	3×10^{-3}
		I	9×10^{-6}	6×10^{-3}	3×10^{-7}	2×10^{-3}
	Co 58	S	8×10^{-7}	4×10^{-3}	3×10^{-8}	1×10^{-4}
		I	5×10^{-8}	3×10^{-3}	2×10^{-9}	9×10^{-5}
	Co 60	S	3×10^{-7}	1×10^{-3}	1×10^{-8}	5×10^{-5}
		I	9×10^{-9}	1×10^{-3}	3×10^{-10}	3×10^{-5}
Copper (29)	Cu 64	S	2×10^{-6}	1×10^{-2}	7×10^{-8}	3×10^{-4}
		I	1×10^{-6}	6×10^{-3}	4×10^{-8}	2×10^{-4}
Curium (96)	Cm 242	S	1×10^{-10}	7×10^{-4}	4×10^{-12}	2×10^{-5}
		I	2×10^{-10}	7×10^{-4}	6×10^{-12}	3×10^{-5}
	Cm 243	S	6×10^{-12}	1×10^{-4}	2×10^{-13}	5×10^{-6}
		I	1×10^{-10}	7×10^{-4}	3×10^{-12}	2×10^{-5}
	Cm 244α	S	9×10^{-13}	2×10^{-4}	3×10^{-13}	7×10^{-6}
		I	1×10^{-10}	8×10^{-4}	3×10^{-12}	3×10^{-5}
	Cm 245	S	5×10^{-12}	1×10^{-4}	2×10^{-13}	4×10^{-6}
		I	1×10^{-10}	8×10^{-4}	4×10^{-12}	3×10^{-5}
	Cm 246	S	5×10^{-12}	1×10^{-4}	2×10^{-13}	4×10^{-6}
		I	1×10^{-10}	8×10^{-4}	4×10^{-12}	3×10^{-5}
Dysprosium (66)	Dy 165	S	3×10^{-6}	1×10^{-2}	9×10^{-8}	4×10^{-4}
		I	2×10^{-6}	1×10^{-2}	7×10^{-8}	4×10^{-4}
	Dy 166	S	2×10^{-7}	1×10^{-3}	8×10^{-9}	4×10^{-5}
		I	2×10^{-7}	1×10^{-3}	7×10^{-9}	4×10^{-5}
Erbium (68)	Er 169	S	6×10^{-7}	3×10^{-3}	2×10^{-8}	9×10^{-5}
		I	4×10^{-7}	3×10^{-3}	1×10^{-8}	9×10^{-5}
	Er 171	S	7×10^{-7}	3×10^{-3}	2×10^{-8}	1×10^{-4}
		I	6×10^{-7}	3×10^{-3}	2×10^{-8}	1×10^{-4}
Europium (63)	Eu 152 (T/2=9.2 hrs)	S	4×10^{-7}	2×10^{-3}	1×10^{-8}	6×10^{-5}
		I	3×10^{-7}	2×10^{-3}	1×10^{-8}	6×10^{-5}
	Eu 152 (T/2=13 yrs)	S	1×10^{-8}	2×10^{-3}	4×10^{-10}	8×10^{-5}
		I	2×10^{-8}	2×10^{-3}	6×10^{-10}	8×10^{-5}
	Eu 154	S	4×10^{-9}	6×10^{-4}	1×10^{-10}	2×10^{-5}
		I	7×10^{-9}	6×10^{-4}	2×10^{-10}	2×10^{-5}
	Eu 155	S	9×10^{-8}	6×10^{-3}	3×10^{-9}	2×10^{-4}
		I	7×10^{-8}	6×10^{-3}	3×10^{-9}	2×10^{-4}
Fluorine (9)	F 18	S	5×10^{-6}	2×10^{-2}	2×10^{-7}	8×10^{-4}
		I	3×10^{-6}	1×10^{-2}	9×10^{-8}	5×10^{-4}
Gadolinium (64)	Gd 153	S	2×10^{-7}	6×10^{-3}	8×10^{-9}	2×10^{-4}
		I	9×10^{-8}	6×10^{-3}	3×10^{-9}	2×10^{-4}
	Gd 159	S	5×10^{-7}	2×10^{-3}	2×10^{-8}	8×10^{-5}
		I	4×10^{-7}	2×10^{-3}	1×10^{-8}	8×10^{-5}
Gallium (31)	Ga 72	S	2×10^{-7}	1×10^{-3}	8×10^{-9}	4×10^{-5}
		I	2×10^{-7}	1×10^{-3}	6×10^{-9}	4×10^{-5}
Germanium (32)	Ge 71	S	1×10^{-6}	5×10^{-3}	4×10^{-7}	2×10^{-3}
		I	6×10^{-6}	5×10^{-3}	2×10^{-7}	2×10^{-3}
Gold (79)	Au 196	S	1×10^{-6}	5×10^{-3}	4×10^{-8}	2×10^{-4}
		I	6×10^{-7}	4×10^{-3}	2×10^{-8}	1×10^{-4}
	Au 198	S	3×10^{-7}	2×10^{-3}	1×10^{-8}	5×10^{-5}
		I	2×10^{-7}	1×10^{-3}	8×10^{-9}	5×10^{-5}

CONCENTRATIONS IN AIR AND WATER ABOVE NATURAL BACKGROUND—continued

[See notes at end of appendix]

Element (atomic number)	Isotope [1]		Table I		Table II	
			Column 1 Air (μc/ml)	Column 2 Water (μc/ml)	Column 1 Air (μc/ml)	Column 2 Water (μc/ml)
Gold (79)	Au 199	S	1×10^{-6}	5×10^{-5}	4×10^{-6}	2×10^{-4}
		I	8×10^{-7}	4×10^{-5}	3×10^{-6}	2×10^{-4}
Hafnium (72)	Hf 181	S	4×10^{-6}	2×10^{-5}	1×10^{-6}	7×10^{-5}
		I	7×10^{-6}	2×10^{-5}	3×10^{-6}	7×10^{-5}
Holmium (67)	Ho 166	S	2×10^{-7}	9×10^{-4}	7×10^{-8}	3×10^{-3}
		I	2×10^{-7}	9×10^{-4}	6×10^{-8}	3×10^{-3}
Hydrogen (1)	H3	S	5×10^{-6}	1×10^{-1}	2×10^{-7}	3×10^{-5}
		Sub	2×10^{-3}		4×10^{-5}	
Indium (49)	In 113m	S	8×10^{-6}	4×10^{-3}	3×10^{-7}	1×10^{-3}
		I	7×10^{-6}	4×10^{-3}	2×10^{-7}	1×10^{-3}
	In 114m	S	1×10^{-7}	5×10^{-4}	4×10^{-9}	2×10^{-4}
		I	2×10^{-6}	5×10^{-4}	7×10^{-10}	2×10^{-4}
	In 115m	S	2×10^{-6}	1×10^{-3}	8×10^{-8}	4×10^{-4}
		I	2×10^{-6}	1×10^{-3}	6×10^{-8}	4×10^{-4}
	In 115	S	2×10^{-7}	3×10^{-3}	9×10^{-9}	9×10^{-4}
		I	3×10^{-9}	3×10^{-3}	1×10^{-9}	9×10^{-4}
Iodine (53)	I 126	S	8×10^{-9}	5×10^{-4}	3×10^{-10}	2×10^{-4}
		I	3×10^{-7}	3×10^{-3}	1×10^{-8}	9×10^{-4}
	I 129	S	2×10^{-9}	1×10^{-4}	6×10^{-11}	4×10^{-5}
		I	7×10^{-9}	6×10^{-3}	2×10^{-9}	2×10^{-4}
	I 131	S	9×10^{-9}	6×10^{-4}	3×10^{-10}	2×10^{-4}
		I	3×10^{-7}	2×10^{-3}	1×10^{-8}	6×10^{-4}
	I 132	S	2×10^{-7}	2×10^{-3}	8×10^{-9}	6×10^{-4}
		I	9×10^{-7}	5×10^{-3}	3×10^{-8}	2×10^{-3}
	I 133	S	3×10^{-8}	2×10^{-4}	1×10^{-9}	7×10^{-5}
		I	2×10^{-7}	1×10^{-3}	7×10^{-9}	4×10^{-4}
	I 134	S	5×10^{-7}	4×10^{-3}	2×10^{-8}	1×10^{-3}
		I	3×10^{-6}	2×10^{-3}	1×10^{-7}	6×10^{-4}
	I 135	S	1×10^{-7}	7×10^{-4}	4×10^{-9}	2×10^{-4}
		I	4×10^{-7}	2×10^{-3}	1×10^{-8}	7×10^{-4}
Iridium (77)	Ir 190	S	1×10^{-6}	6×10^{-3}	4×10^{-8}	2×10^{-3}
		I	4×10^{-7}	5×10^{-3}	1×10^{-8}	2×10^{-3}
	Ir 192	S	1×10^{-7}	1×10^{-3}	4×10^{-9}	4×10^{-4}
		I	3×10^{-8}	1×10^{-3}	9×10^{-10}	4×10^{-4}
	Ir 194	S	2×10^{-7}	1×10^{-3}	8×10^{-9}	3×10^{-4}
		I	2×10^{-7}	9×10^{-4}	5×10^{-9}	3×10^{-4}
Iron (26)	Fe 55	S	9×10^{-7}	2×10^{-3}	3×10^{-8}	8×10^{-4}
		I	1×10^{-6}	7×10^{-3}	3×10^{-8}	2×10^{-3}
	Fe 59	S	1×10^{-7}	2×10^{-3}	5×10^{-9}	6×10^{-4}
		I	5×10^{-8}	2×10^{-3}	2×10^{-9}	5×10^{-4}
Krypton [2] (36)	Kr 85m	Sub	6×10^{-6}		1×10^{-7}	
	Kr 85	Sub	1×10^{-5}		3×10^{-7}	
	Kr 87	Sub	1×10^{-6}		2×10^{-8}	
Lanthanum (57)	La 140	S	2×10^{-7}	7×10^{-4}	5×10^{-9}	2×10^{-3}
		I	1×10^{-7}	7×10^{-4}	4×10^{-9}	2×10^{-3}
Lead (82)	Pb 203	S	3×10^{-6}	1×10^{-3}	9×10^{-8}	4×10^{-4}
		I	2×10^{-6}	1×10^{-3}	6×10^{-8}	4×10^{-4}
	Pb 210	S	1×10^{-10}	4×10^{-6}	4×10^{-10}	1×10^{-7}
		I	2×10^{-10}	5×10^{-6}	8×10^{-10}	2×10^{-4}
	Pb 212	S	2×10^{-8}	6×10^{-4}	6×10^{-10}	2×10^{-4}
		I	2×10^{-8}	5×10^{-4}	7×10^{-10}	2×10^{-4}
Lutetium (71)	Lu 177	S	6×10^{-7}	3×10^{-3}	2×10^{-8}	1×10^{-3}
		I	5×10^{-7}	3×10^{-3}	2×10^{-8}	1×10^{-3}
Manganese (25)	Mn 52	S	2×10^{-7}	1×10^{-3}	7×10^{-9}	3×10^{-4}
		I	1×10^{-7}	9×10^{-4}	5×10^{-9}	3×10^{-4}
	Mn 54	S	4×10^{-7}	4×10^{-3}	1×10^{-8}	1×10^{-3}
		I	4×10^{-7}	3×10^{-3}	1×10^{-8}	1×10^{-3}
	Mn 56	S	8×10^{-7}	4×10^{-3}	3×10^{-8}	1×10^{-3}
		I	5×10^{-7}	3×10^{-3}	2×10^{-8}	1×10^{-3}
Mercury (80)	Hg 197m	S	7×10^{-7}	6×10^{-3}	3×10^{-8}	2×10^{-3}
		I	8×10^{-7}	5×10^{-3}	3×10^{-8}	2×10^{-3}
	Hg 197	S	1×10^{-6}	9×10^{-3}	4×10^{-8}	3×10^{-3}
		I	3×10^{-6}	1×10^{-2}	9×10^{-8}	5×10^{-3}
	Hg 203	S	7×10^{-8}	5×10^{-4}	2×10^{-9}	2×10^{-4}
		I	1×10^{-7}	3×10^{-3}	4×10^{-9}	1×10^{-3}
Molybdenum (42)	Mo 99	S	7×10^{-7}	5×10^{-3}	3×10^{-8}	2×10^{-3}
		I	2×10^{-7}	1×10^{-3}	7×10^{-9}	4×10^{-4}
Neodymium (60)	Nd 144	S	8×10^{-11}	2×10^{-3}	3×10^{-13}	7×10^{-4}
		I	3×10^{-10}	2×10^{-3}	1×10^{-11}	8×10^{-4}

See footnotes at end of table.

CONCENTRATIONS IN AIR AND WATER ABOVE NATURAL BACKGROUND—continued

[See notes at end of appendix]

Element (atomic number)	Isotope [1]		Table I		Table II	
			Column 1 Air (μc/ml)	Column 2 Water (μc/ml)	Column 1 Air (μc/ml)	Column 2 Water (μc/ml)
Neodymium (60)	Nd 147	S	4×10^{-7}	2×10^{-3}	1×10^{-8}	6×10^{-4}
		I	2×10^{-7}	2×10^{-3}	8×10^{-9}	6×10^{-4}
	Nd 149	S	2×10^{-6}	8×10^{-3}	6×10^{-8}	3×10^{-3}
		I	1×10^{-6}	8×10^{-3}	5×10^{-8}	3×10^{-3}
Neptunium (93)	Np 237	S	4×10^{-10}	9×10^{-4}	1×10^{-12}	3×10^{-3}
		I	1×10^{-10}	9×10^{-4}	4×10^{-12}	3×10^{-3}
	Np 239	S	8×10^{-7}	4×10^{-3}	3×10^{-8}	1×10^{-3}
		I	7×10^{-7}	4×10^{-3}	2×10^{-8}	1×10^{-3}
Nickel (28)	Ni 59	S	5×10^{-7}	6×10^{-3}	2×10^{-8}	2×10^{-3}
		I	8×10^{-7}	6×10^{-3}	3×10^{-8}	2×10^{-3}
	Ni 63	S	6×10^{-6}	8×10^{-4}	2×10^{-8}	3×10^{-4}
		I	3×10^{-7}	2×10^{-3}	1×10^{-8}	7×10^{-4}
	Ni 65	S	9×10^{-7}	4×10^{-3}	3×10^{-8}	1×10^{-3}
		I	5×10^{-7}	3×10^{-3}	2×10^{-8}	1×10^{-3}
Niobium (Columbium) (41)	Nb 93m	S	1×10^{-7}	1×10^{-3}	4×10^{-9}	4×10^{-4}
		I	2×10^{-7}	1×10^{-3}	5×10^{-9}	4×10^{-4}
	Nb 95	S	5×10^{-7}	3×10^{-3}	2×10^{-8}	1×10^{-3}
		I	1×10^{-7}	3×10^{-3}	3×10^{-9}	1×10^{-3}
	Nb 97	S	6×10^{-6}	3×10^{-3}	2×10^{-7}	9×10^{-4}
		I	5×10^{-6}	3×10^{-3}	2×10^{-7}	9×10^{-4}
Osmium (76)	Os 185	S	5×10^{-7}	2×10^{-3}	2×10^{-8}	7×10^{-4}
		I	5×10^{-8}	2×10^{-3}	2×10^{-9}	7×10^{-4}
	Os 191m	S	2×10^{-6}	7×10^{-3}	6×10^{-7}	3×10^{-3}
		I	9×10^{-6}	7×10^{-3}	3×10^{-7}	2×10^{-3}
	Os 191	S	1×10^{-6}	5×10^{-3}	4×10^{-8}	2×10^{-3}
		I	4×10^{-7}	5×10^{-3}	1×10^{-8}	2×10^{-3}
	Os 193	S	4×10^{-7}	2×10^{-3}	1×10^{-8}	6×10^{-4}
		I	3×10^{-7}	2×10^{-3}	9×10^{-9}	5×10^{-4}
Palladium (46)	Pd 103	S	1×10^{-6}	1×10^{-3}	5×10^{-8}	3×10^{-3}
		I	7×10^{-7}	8×10^{-3}	3×10^{-8}	3×10^{-3}
	Pd 109	S	6×10^{-7}	3×10^{-3}	2×10^{-8}	9×10^{-4}
		I	4×10^{-7}	2×10^{-3}	1×10^{-8}	7×10^{-4}
Phosphorus (15)	P 32	S	7×10^{-8}	5×10^{-4}	2×10^{-9}	2×10^{-4}
		I	8×10^{-8}	7×10^{-4}	3×10^{-9}	2×10^{-4}
Platinum (78)	Pt 191	S	8×10^{-7}	4×10^{-3}	3×10^{-8}	1×10^{-3}
		I	6×10^{-7}	3×10^{-3}	2×10^{-8}	1×10^{-3}
	Pt 193m	S	7×10^{-6}	3×10^{-3}	2×10^{-7}	1×10^{-3}
		I	5×10^{-6}	3×10^{-3}	2×10^{-7}	1×10^{-3}
	Pt 197m	S	6×10^{-6}	3×10^{-3}	2×10^{-7}	1×10^{-3}
		I	5×10^{-6}	3×10^{-3}	2×10^{-7}	9×10^{-4}
	Pt 197	S	8×10^{-7}	4×10^{-3}	3×10^{-8}	1×10^{-3}
		I	6×10^{-7}	3×10^{-3}	2×10^{-8}	1×10^{-3}
Plutonium (94)	Pu 238	S	2×10^{-13}	1×10^{-4}	7×10^{-14}	5×10^{-4}
		I	3×10^{-11}	8×10^{-4}	1×10^{-12}	3×10^{-3}
	Pu 239	S	2×10^{-13}	1×10^{-4}	6×10^{-14}	5×10^{-4}
		I	4×10^{-11}	8×10^{-4}	1×10^{-12}	3×10^{-3}
	Pu 240	S	2×10^{-13}	1×10^{-4}	6×10^{-14}	5×10^{-4}
		I	4×10^{-11}	8×10^{-4}	1×10^{-12}	3×10^{-3}
	Pu 241	S	9×10^{-11}	7×10^{-3}	3×10^{-12}	2×10^{-3}
		I	4×10^{-9}	4×10^{-2}	1×10^{-9}	1×10^{-2}
	Pu 242	S	2×10^{-13}	1×10^{-4}	6×10^{-14}	5×10^{-4}
		I	4×10^{-11}	9×10^{-4}	1×10^{-12}	3×10^{-3}
Polonium (84)	Po 210	S	5×10^{-10}	2×10^{-3}	2×10^{-11}	7×10^{-3}
		I	2×10^{-10}	8×10^{-4}	7×10^{-12}	3×10^{-3}
Potassium (19)	K42	S	2×10^{-6}	9×10^{-3}	7×10^{-8}	3×10^{-3}
		I	1×10^{-7}	6×10^{-4}	4×10^{-9}	2×10^{-3}
Praseodymium (59)	Pr 142	S	2×10^{-7}	9×10^{-4}	7×10^{-9}	3×10^{-4}
		I	2×10^{-7}	9×10^{-4}	6×10^{-9}	3×10^{-4}
	Pr 143	S	3×10^{-7}	1×10^{-3}	1×10^{-8}	5×10^{-4}
		I	2×10^{-7}	1×10^{-3}	6×10^{-9}	5×10^{-4}
Promethium (61)	Pm 147	S	6×10^{-7}	6×10^{-3}	2×10^{-8}	2×10^{-3}
		I	1×10^{-7}	6×10^{-3}	3×10^{-9}	2×10^{-3}
	Pm 149	S	3×10^{-7}	1×10^{-3}	1×10^{-8}	4×10^{-4}
		I	2×10^{-7}	1×10^{-3}	8×10^{-9}	4×10^{-4}
Protactinium (91)	Pa 230	S	2×10^{-9}	7×10^{-3}	6×10^{-11}	2×10^{-3}
		I	6×10^{-10}	7×10^{-3}	3×10^{-11}	2×10^{-3}
	Pa 231	S	1×10^{-13}	3×10^{-4}	4×10^{-14}	9×10^{-7}
		I	1×10^{-10}	8×10^{-4}	4×10^{-12}	2×10^{-3}

CONCENTRATIONS IN AIR AND WATER ABOVE NATURAL BACKGROUND—continued

[See notes at end of appendix]

Element (atomic number)	Isotope [1]		Table I		Table II	
			Column 1 Air (μc/ml)	Column 2 Water (μc/ml)	Column 1 Air (μc/ml)	Column 2 Water (μc/ml)
Protoactinium (91)	Pa 233	S	6×10^{-7}	4×10^{-3}	2×10^{-6}	1×10^{-4}
		I	2×10^{-7}	3×10^{-3}	6×10^{-9}	1×10^{-4}
Radium (88)	Ra 223	S	2×10^{-8}	2×10^{-5}	6×10^{-11}	7×10^{-7}
		I	2×10^{-10}	1×10^{-4}	8×10^{-13}	4×10^{-6}
	Ra 224	S	5×10^{-8}	7×10^{-5}	2×10^{-10}	2×10^{-6}
		I	7×10^{-10}	2×10^{-4}	2×10^{-11}	5×10^{-6}
	Ra 226	S	3×10^{-11}	4×10^{-7}	1×10^{-13}	1×10^{-8}
		I	5×10^{-11}	9×10^{-6}	2×10^{-13}	3×10^{-8}
	Ra 228	S	7×10^{-11}	8×10^{-7}	2×10^{-13}	3×10^{-8}
		I	4×10^{-11}	7×10^{-6}	1×10^{-13}	3×10^{-8}
Radon (86)	Rn 220	S	3×10^{-7}	.....	1×10^{-9}	.....
		I	.....	.....	.....	.....
	Rn 222	S	1×10^{-7}	.....	3×10^{-9}	.....
		I	.....	.....	.....	.....
Rhenium (75)	Re 183	S	3×10^{-6}	2×10^{-3}	9×10^{-8}	6×10^{-5}
		I	2×10^{-7}	8×10^{-3}	5×10^{-9}	3×10^{-4}
	Re 186	S	6×10^{-7}	3×10^{-3}	2×10^{-8}	9×10^{-5}
		I	2×10^{-7}	1×10^{-3}	8×10^{-9}	5×10^{-5}
	Re 187	S	9×10^{-6}	7×10^{-3}	3×10^{-7}	3×10^{-3}
		I	5×10^{-7}	4×10^{-3}	2×10^{-8}	2×10^{-3}
	Re 188	S	4×10^{-7}	2×10^{-3}	1×10^{-8}	6×10^{-5}
		I	2×10^{-7}	9×10^{-4}	6×10^{-9}	3×10^{-5}
Rhodium (45)	Rh 103m	S	8×10^{-5}	4×10^{-1}	3×10^{-6}	1×10^{-2}
		I	6×10^{-6}	3×10^{-1}	2×10^{-7}	1×10^{-2}
	Rh 105	S	8×10^{-7}	4×10^{-3}	3×10^{-8}	1×10^{-4}
		I	5×10^{-7}	3×10^{-3}	2×10^{-8}	1×10^{-4}
Rubidium (37)	Rb 86	S	3×10^{-7}	2×10^{-3}	1×10^{-8}	7×10^{-5}
		I	7×10^{-8}	7×10^{-4}	2×10^{-9}	2×10^{-5}
	Rb 87	S	5×10^{-7}	3×10^{-3}	2×10^{-8}	1×10^{-4}
		I	7×10^{-8}	5×10^{-3}	2×10^{-9}	2×10^{-4}
Ruthenium (44)	Ru 97	S	2×10^{-6}	1×10^{-2}	8×10^{-8}	4×10^{-4}
		I	2×10^{-6}	1×10^{-2}	6×10^{-8}	3×10^{-4}
	Ru 103	S	5×10^{-7}	2×10^{-3}	2×10^{-8}	8×10^{-5}
		I	8×10^{-8}	2×10^{-3}	3×10^{-9}	8×10^{-5}
	Ru 105	S	7×10^{-7}	3×10^{-3}	2×10^{-8}	1×10^{-4}
		I	5×10^{-7}	3×10^{-3}	2×10^{-8}	1×10^{-4}
	Ru 106	S	8×10^{-8}	4×10^{-4}	3×10^{-9}	1×10^{-5}
		I	6×10^{-9}	3×10^{-4}	2×10^{-10}	1×10^{-5}
Samarium (62)	Sm 147	S	7×10^{-11}	2×10^{-3}	2×10^{-12}	6×10^{-5}
		I	3×10^{-10}	2×10^{-3}	9×10^{-12}	7×10^{-5}
	Sm 151	S	6×10^{-6}	1×10^{-2}	2×10^{-7}	4×10^{-4}
		I	1×10^{-7}	1×10^{-2}	5×10^{-9}	4×10^{-4}
	Sm 153	S	5×10^{-7}	2×10^{-3}	2×10^{-8}	8×10^{-5}
		I	4×10^{-7}	2×10^{-3}	1×10^{-8}	8×10^{-5}
Scandium (21)	Sc 46	S	2×10^{-7}	1×10^{-3}	8×10^{-9}	4×10^{-5}
		I	2×10^{-8}	1×10^{-3}	8×10^{-10}	4×10^{-5}
	Sc 47	S	6×10^{-7}	3×10^{-3}	2×10^{-8}	9×10^{-5}
		I	5×10^{-7}	3×10^{-3}	2×10^{-8}	9×10^{-5}
	Sc 48	S	2×10^{-7}	8×10^{-4}	6×10^{-9}	3×10^{-5}
		I	1×10^{-7}	8×10^{-4}	5×10^{-9}	3×10^{-5}
Selenium (34)	Se 75	S	1×10^{-6}	9×10^{-3}	4×10^{-8}	3×10^{-4}
		I	1×10^{-7}	8×10^{-3}	4×10^{-9}	3×10^{-4}
Silicon (14)	Si 31	S	6×10^{-6}	3×10^{-2}	2×10^{-7}	9×10^{-4}
		I	1×10^{-6}	6×10^{-3}	3×10^{-8}	2×10^{-4}
Silver (47)	Ag 105	S	6×10^{-7}	3×10^{-3}	2×10^{-8}	1×10^{-4}
		I	8×10^{-8}	3×10^{-3}	3×10^{-9}	1×10^{-4}
	Ag 110m	S	2×10^{-7}	9×10^{-4}	7×10^{-9}	3×10^{-5}
		I	1×10^{-8}	9×10^{-4}	3×10^{-10}	3×10^{-5}
	Ag 111	S	3×10^{-7}	1×10^{-3}	1×10^{-8}	4×10^{-5}
		I	2×10^{-7}	1×10^{-3}	8×10^{-9}	4×10^{-5}
Sodium (11)	Na 22	S	2×10^{-7}	1×10^{-3}	6×10^{-9}	4×10^{-5}
		I	9×10^{-8}	9×10^{-4}	3×10^{-10}	3×10^{-5}
	Na 24	S	1×10^{-6}	6×10^{-3}	4×10^{-8}	2×10^{-4}
		I	1×10^{-7}	8×10^{-4}	5×10^{-9}	3×10^{-5}
Strontium (38)	Sr 85m	S	4×10^{-5}	2×10^{-1}	1×10^{-6}	7×10^{-3}
		I	3×10^{-5}	2×10^{-1}	1×10^{-6}	7×10^{-3}
	Sr 85	S	2×10^{-7}	3×10^{-3}	8×10^{-9}	1×10^{-4}
		I	1×10^{-7}	5×10^{-3}	4×10^{-9}	2×10^{-4}
	Sr 89	S	3×10^{-8}	3×10^{-4}	1×10^{-9}	1×10^{-5}
		I	4×10^{-8}	8×10^{-4}	1×10^{-9}	3×10^{-5}

See footnotes at end of table.

CONCENTRATIONS IN AIR AND WATER ABOVE NATURAL BACKGROUND—continued

[See notes at end of appendix]

Element (atomic number)	Isotope [1]		Table I		Table II	
			Column 1 Air (μc/ml)	Column 2 Water (μc/ml)	Column 1 Air (μc/ml)	Column 2 Water (μc/ml)
Strontium (38)	Sr 90	S	3×10^{-10}	4×10^{-4}	1×10^{-11}	1×10^{-7}
		I	5×10^{-9}	1×10^{-3}	2×10^{-10}	4×10^{-6}
	Sr 91	S	4×10^{-7}	2×10^{-3}	2×10^{-8}	7×10^{-5}
		I	3×10^{-7}	1×10^{-3}	9×10^{-9}	5×10^{-5}
	Sr 92	S	4×10^{-7}	2×10^{-3}	2×10^{-8}	7×10^{-5}
		I	2×10^{-7}	2×10^{-3}	1×10^{-8}	6×10^{-5}
Sulfur (16)	S 35	S	3×10^{-7}	2×10^{-3}	9×10^{-9}	6×10^{-5}
		I	3×10^{-7}	8×10^{-3}	9×10^{-9}	3×10^{-4}
Tantalum (73)	Ta 182	S	4×10^{-8}	1×10^{-3}	1×10^{-9}	4×10^{-5}
		I	2×10^{-8}	1×10^{-3}	7×10^{-10}	4×10^{-5}
Technetium (43)	Tc 96m	S	8×10^{-5}	4×10^{-1}	3×10^{-6}	1×10^{-2}
		I	3×10^{-5}	3×10^{-1}	1×10^{-6}	1×10^{-2}
	Tc 96	S	6×10^{-7}	3×10^{-3}	2×10^{-8}	1×10^{-4}
		I	2×10^{-7}	1×10^{-3}	8×10^{-9}	5×10^{-5}
	Tc 97m	S	2×10^{-6}	1×10^{-2}	8×10^{-8}	4×10^{-4}
		I	2×10^{-7}	5×10^{-3}	5×10^{-9}	2×10^{-4}
	Tc 97	S	1×10^{-5}	5×10^{-3}	4×10^{-7}	2×10^{-4}
		I	3×10^{-7}	2×10^{-3}	1×10^{-8}	8×10^{-5}
	Tc 99m	S	4×10^{-5}	2×10^{-1}	1×10^{-6}	6×10^{-3}
		I	1×10^{-5}	8×10^{-2}	5×10^{-7}	3×10^{-3}
	Tc 99	S	2×10^{-6}	1×10^{-2}	7×10^{-8}	3×10^{-4}
		I	6×10^{-8}	5×10^{-3}	2×10^{-9}	2×10^{-4}
Tellurium (52)	Te 125m	S	4×10^{-7}	5×10^{-3}	1×10^{-8}	2×10^{-4}
		I	1×10^{-7}	3×10^{-3}	4×10^{-9}	1×10^{-4}
	Te 127m	S	1×10^{-7}	2×10^{-3}	5×10^{-9}	6×10^{-5}
		I	4×10^{-8}	2×10^{-3}	1×10^{-9}	5×10^{-5}
	Te 127	S	2×10^{-6}	8×10^{-3}	6×10^{-8}	3×10^{-4}
		I	9×10^{-7}	5×10^{-3}	3×10^{-8}	2×10^{-4}
	Te 129m	S	8×10^{-8}	1×10^{-3}	3×10^{-9}	3×10^{-5}
		I	3×10^{-8}	6×10^{-4}	1×10^{-9}	2×10^{-5}
	Te 129	S	5×10^{-8}	2×10^{-3}	2×10^{-9}	8×10^{-5}
		I	4×10^{-8}	2×10^{-3}	1×10^{-9}	8×10^{-5}
	Te 131m	S	4×10^{-7}	2×10^{-3}	1×10^{-8}	6×10^{-5}
		I	2×10^{-7}	1×10^{-3}	6×10^{-9}	4×10^{-5}
	Te 132	S	2×10^{-7}	9×10^{-4}	7×10^{-9}	3×10^{-5}
		I	1×10^{-7}	6×10^{-4}	4×10^{-9}	2×10^{-5}
Terbium (65)	Tb 160	S	1×10^{-7}	1×10^{-3}	3×10^{-9}	4×10^{-5}
		I	3×10^{-8}	1×10^{-3}	1×10^{-9}	4×10^{-5}
Thallium (81)	Tl 200	S	3×10^{-6}	1×10^{-2}	9×10^{-8}	4×10^{-4}
		I	1×10^{-6}	7×10^{-3}	4×10^{-8}	2×10^{-4}
	Tl 201	S	2×10^{-6}	9×10^{-3}	7×10^{-8}	3×10^{-4}
		I	9×10^{-7}	5×10^{-3}	3×10^{-8}	2×10^{-4}
	Tl 202	S	8×10^{-7}	4×10^{-3}	3×10^{-8}	1×10^{-4}
		I	2×10^{-7}	2×10^{-3}	8×10^{-9}	7×10^{-5}
	Tl 204	S	6×10^{-7}	3×10^{-3}	2×10^{-8}	1×10^{-4}
		I	3×10^{-8}	2×10^{-3}	9×10^{-10}	6×10^{-5}
Thorium (90)	Th 228	S	9×10^{-12}	2×10^{-4}	3×10^{-13}	7×10^{-6}
		I	6×10^{-12}	4×10^{-4}	2×10^{-13}	10^{-5}
	Th 230	S	2×10^{-12}	5×10^{-5}	8×10^{-14}	2×10^{-6}
		I	10^{-11}	9×10^{-4}	3×10^{-13}	3×10^{-5}
	Th 232	S	3×10^{-11}	5×10^{-5}	10^{-12}	2×10^{-6}
		I	3×10^{-11}	10^{-4}	10^{-12}	4×10^{-6}
	Th natural	S	3×10^{-11}	3×10^{-5}	10^{-12}	10^{-6}
		I	3×10^{-11}	3×10^{-4}	10^{-12}	10^{-6}
	Th 234	S	6×10^{-8}	5×10^{-4}	2×10^{-9}	2×10^{-5}
		I	3×10^{-5}	5×10^{-4}	10^{-9}	2×10^{-5}
Thulium (69)	Tm 170	S	4×10^{-8}	1×10^{-3}	1×10^{-9}	5×10^{-5}
		I	3×10^{-8}	1×10^{-3}	1×10^{-9}	5×10^{-5}
	Tm 171	S	1×10^{-7}	1×10^{-3}	4×10^{-9}	5×10^{-5}
		I	2×10^{-7}	1×10^{-3}	8×10^{-9}	5×10^{-5}
Tin (50)	Sn 113	S	4×10^{-7}	2×10^{-3}	1×10^{-8}	9×10^{-5}
		I	5×10^{-8}	2×10^{-3}	2×10^{-9}	8×10^{-5}
	Sn 125	S	1×10^{-7}	5×10^{-4}	4×10^{-9}	2×10^{-5}
		I	8×10^{-8}	5×10^{-4}	3×10^{-9}	2×10^{-5}
Tungsten (Wolfram) (74)	W 181	S	2×10^{-6}	1×10^{-2}	8×10^{-8}	4×10^{-4}
		I	1×10^{-7}	1×10^{-2}	4×10^{-9}	3×10^{-4}
	W 185	S	8×10^{-7}	4×10^{-3}	3×10^{-8}	1×10^{-4}
		I	1×10^{-7}	3×10^{-2}	4×10^{-9}	1×10^{-4}

CONCENTRATIONS IN AIR AND WATER ABOVE NATURAL BACKGROUND—continued

[See notes at end of appendix]

Element (atomic number)	Isotope [1]		Table I Column 1 Air (μc/ml)	Table I Column 2 Water (μc/ml)	Table II Column 1 Air (μc/ml)	Table II Column 2 Water (μc/ml)
Tungsten (Wolfram) (74)	W 187	S	4×10^{-7}	2×10^{-3}	2×10^{-8}	7×10^{-5}
		I	3×10^{-7}	2×10^{-3}	1×10^{-8}	6×10^{-5}
Uranium (92)	U 230	S	3×10^{-10}	1×10^{-6}	1×10^{-11}	5×10^{-8}
		I	1×10^{-10}	1×10^{-6}	4×10^{-12}	5×10^{-8}
	U 232	S	1×10^{-10}	8×10^{-7}	3×10^{-12}	3×10^{-5}
		I	3×10^{-11}	8×10^{-7}	9×10^{-13}	3×10^{-5}
	U 233	S	5×10^{-10}	9×10^{-6}	2×10^{-11}	3×10^{-5}
		I	1×10^{-10}	9×10^{-6}	4×10^{-12}	3×10^{-5}
	U 234	S	6×10^{-10}	9×10^{-6}	2×10^{-11}	3×10^{-5}
		I	1×10^{-10}	9×10^{-6}	4×10^{-12}	3×10^{-5}
	U 235	S	5×10^{-10}	8×10^{-6}	2×10^{-11}	3×10^{-5}
		I	1×10^{-10}	8×10^{-6}	4×10^{-12}	3×10^{-5}
	U 236	S	6×10^{-10}	1×10^{-5}	2×10^{-11}	3×10^{-5}
		I	1×10^{-10}	1×10^{-5}	4×10^{-12}	3×10^{-5}
	U 238	S	7×10^{-11}	1×10^{-5}	3×10^{-12}	4×10^{-5}
		I	1×10^{-10}	1×10^{-5}	5×10^{-12}	4×10^{-5}
	U-natural	S	7×10^{-11}	5×10^{-6}	3×10^{-12}	2×10^{-5}
		I	6×10^{-11}	5×10^{-6}	2×10^{-12}	2×10^{-5}
Vanadium (23)	V 48	S	2×10^{-7}	9×10^{-6}	6×10^{-9}	3×10^{-5}
		I	6×10^{-8}	8×10^{-6}	2×10^{-9}	3×10^{-5}
Xenon (54)	Xe 131m	Sub	2×10^{-5}		4×10^{-7}	
	Xe 133	Sub	1×10^{-5}		3×10^{-7}	
	Xe 135	Sub	4×10^{-6}		1×10^{-7}	
Ytterbium (70)	Yb 175	S	7×10^{-7}	3×10^{-5}	2×10^{-8}	1×10^{-6}
		I	6×10^{-7}	3×10^{-5}	2×10^{-8}	1×10^{-6}
Yttrium (39)	Y 90	S	1×10^{-7}	6×10^{-6}	4×10^{-9}	2×10^{-7}
		I	1×10^{-7}	6×10^{-6}	3×10^{-9}	2×10^{-7}
	Y 91m	S	2×10^{-5}	1×10^{-4}	8×10^{-7}	3×10^{-3}
		I	2×10^{-5}	1×10^{-4}	6×10^{-7}	3×10^{-3}
	Y 91	S	4×10^{-8}	8×10^{-7}	1×10^{-9}	3×10^{-8}
		I	3×10^{-8}	8×10^{-7}	1×10^{-9}	3×10^{-8}
	Y 92	S	4×10^{-7}	2×10^{-5}	1×10^{-8}	6×10^{-7}
		I	3×10^{-7}	2×10^{-5}	1×10^{-8}	6×10^{-7}
	Y 93	S	2×10^{-7}	8×10^{-6}	6×10^{-9}	3×10^{-7}
		I	1×10^{-7}	8×10^{-6}	5×10^{-9}	3×10^{-7}
Zinc (30)	Zn 65	S	1×10^{-7}	3×10^{-5}	4×10^{-9}	1×10^{-6}
		I	6×10^{-8}	5×10^{-5}	2×10^{-9}	2×10^{-6}
	Zn 69m	S	4×10^{-7}	2×10^{-5}	1×10^{-8}	7×10^{-7}
		I	3×10^{-7}	2×10^{-5}	1×10^{-8}	6×10^{-7}
	Zn 69	S	7×10^{-6}	5×10^{-5}	2×10^{-7}	2×10^{-6}
		I	9×10^{-6}	5×10^{-5}	3×10^{-7}	2×10^{-6}
Zirconium (40)	Zr 93	S	1×10^{-7}	2×10^{-5}	4×10^{-9}	8×10^{-7}
		I	3×10^{-7}	2×10^{-5}	1×10^{-8}	8×10^{-7}
	Zr 95	S	1×10^{-7}	2×10^{-5}	4×10^{-9}	6×10^{-8}
		I	3×10^{-8}	2×10^{-5}	1×10^{-9}	6×10^{-8}
	Zr 97	S	1×10^{-7}	5×10^{-6}	4×10^{-9}	2×10^{-6}
		I	9×10^{-8}	5×10^{-6}	3×10^{-9}	2×10^{-6}

[1] Soluble (S); Insoluble (I).

[2] "Sub" means that values given are for submersion in an infinite cloud of gaseous material.

NOTE: In any case where there is a mixture in air or water of more than one radionuclide, the limiting values for purposes of this Appendix should be determined as follows:

1. If the identity and concentration of each radionuclide in the mixture are known, the limiting values should be derived as follows: Determine, for each radionuclide in the mixture, the ratio between the quantity present in the mixture and the limit otherwise established in Appendix B for the specific radionuclide when not in a mixture. The sum of such ratios for all the radionuclides in the mixture may not exceed "1" (i.e., "unity").

EXAMPLE: If radionuclides A, B, and C are present in concentrations C_A, C_B, and C_C, and if the applicable MPC's, are MPC_A, and MPC_B, and MPC_C respectively, then the concentrations shall be limited so that the following relationship exists:

$$\frac{C_A}{MPC_A}+\frac{C_B}{MPC_B}+\frac{C_C}{MPC_C}\leq 1$$

2. If either the identity or the concentration of any radionuclide in the mixture is not known, the limiting values for purposes of Appendix B shall be:

a. For purposes of Table I, Col. 1—1×10^{-12}
b. For purposes of Table I, Col. 2—3×10^{-7}
c. For purposes of Table II, Col. 1—4×10^{-14}
d. For purposes of Table II, Col. 2—1×10^{-8}

3. If the conditions specified below are met, the corresponding values specified below may be used in lieu of those specified in paragraph 2 above.

Element (atomic number) and isotope	Table I Column 1 Air (μc/ml)	Table I Column 2 Water (μc/ml)	Table II Column 1 Air (μc/ml)	Table II Column 2 Water (μc/ml)
If it is known that Sr 90, I 129, Pb 210, Po 210, At 211, Ra 223, Ra 224, Ra 226, Ac 227, Ra 228, Th 230, Pa 231, Th 232, and Th-nat are not present		9×10^{-3}		3×10^{-6}
If it is known that Sr 90, I 129, Pb 210, Po 210, Ra 223, Ra 226, Ra 228, Pa 231, and Th-nat are not present		6×10^{-3}		2×10^{-6}
If it is known that Sr 90, Pb 210, Ra 226 and Ra 228 are not present		2×10^{-3}		6×10^{-7}
If it is known that Ra 226 and Ra 228 are not present		3×10^{-6}		1×10^{-7}
If it is known that alpha-emitters and Sr 90, I 129, Pb 210, Ac 227, Ra 228, Pa 230, Pu 241 and Bk 249 are not present	3×10^{-8}		1×10^{-10}	
If it is known that alpha-emitters and Pb 210, Ac 227, Ra 228, and Pu 241 are not present	3×10^{-10}		1×10^{-11}	
If it is known that alpha-emitters and Ac 227 are not present	3×10^{-11}		1×10^{-12}	
If it is known that Ac 227, Th 230, Pa 231, Pu 238, Pu 239, Pu 240, Pu 242, and Cf 249 are not present	3×10^{-12}		1×10^{-13}	
If Pa 231, Pu 239, Pu 240, Pu 242 and Cf 249 are not present	2×10^{-12}		7×10^{-14}	

APPENDIX C

Material	Microcuries
Ag^{105}	1
Ag^{111}	10
As^{76}, As^{77}	10
Au^{198}	10
Au^{199}	10
$Ba^{140}+La^{140}$	1
Be^{7}	50
C^{14}	50
Ca^{45}	10
$Cd^{109}+Ag^{109}$	10
$Ce^{144}+Pr^{144}$	1
Cl^{36}	1
Co^{60}	1
Cr^{51}	50
$Cs^{137}+Ba^{137}$	1
Cu^{64}	50
Eu^{154}	1
F^{18}	50
Fe^{55}	50
Fe^{59}	1
Ga^{72}	10
Ge^{71}	50
H^{3}(HTO or H_2O)	250
I^{131}	10
In^{114}	1
Ir^{190}	10
K^{42}	10
La^{140}	10
Mn^{52}	1
Mn^{54}	50
Mo^{99}	10
Na^{22}	10
Na^{24}	10
Nb^{95}	10
Ni^{59}	1
Ni^{65}	1
P^{32}	10
$Pd^{103}+Rh^{103}$	50
Pd^{109}	10
Pm^{147}	10
Po^{210}	0.1
Pr^{143}	10
Pu^{239}	1
Ra^{226}	0.1
Rb^{86}	10
Re^{186}	10
Rh^{103}	10
$Ru^{106}+Rh^{106}$	1
S^{35}	50
Sb^{124}	1
Sc^{46}	1
Sm^{153}	10
Sn^{113}	10
Sr^{89}	1
$Sr^{90}+Y^{90}$	0.1
Ta^{182}	10
Tc^{96}	1
Tc^{96}	1
Te^{127}	10
Te^{129}	1
Th (natural)	50
Tl^{204}	50
Tritium. See H^3	250
U (natural)	50
U^{233}	1
U^{234}-U^{238}	50
V^{48}	1
W^{185}	10
Y^{90}	1
Y^{91}	1
Zn^{65}	10
Unidentified radioactive materials or any of the above in unknown mixtures	0.1

NOTE: For purposes of §§ 20.203 and 20.304, where there is involved a combination of isotopes in known amounts the limit for the combination should be derived as follows: Determine, for each isotope in the combination, the ratio between the quantity present in the combination and the limit otherwise established for the specific isotope when not in combination. The sum of such ratios for all the isotopes in the combination may not exceed "1" (i.e., "unity").

EXAMPLE: For purposes of § 20.304, if a particular batch contains 2,000 μc of Au^{198} and 25,000 μc of C^{14}, it may also include not more than 3,000 μc of I^{131}. This limit was determined as follows:

$$\frac{2{,}000\ \mu c\ Au^{198}}{10{,}000\ \mu c}+\frac{25{,}000\ \mu c\ C^{14}}{50{,}000\ \mu c}+\frac{3{,}000\ \mu c\ I^{131}}{10{,}000\ \mu c}=1$$

The denominator in each of the above ratios was obtained by multiplying the figure in the table by 1,000 as provided in § 20.304.

APPENDIX D

UNITED STATES ATOMIC ENERGY COMMISSION OPERATION OFFICES

Operations office	Operations office address	Telephone
1. New York Operations Office	376 Hudson Street, New York 14, N.Y.	Yukon 9-1000.
2. Oak Ridge Operations Office	P.O. Box E, Oak Ridge, Tenn	Oak Ridge 5-7486 or 5-8611 Ext. 7607.
3. Savannah River Operations Office	P.O. Box A, Aiken, S.C.	Aiken, S.C., Midway 9-6211 or Augusta, Ga., Park 4-6311, Ext. 3333.
4. Albuquerque Operations Office	P.O. Box 5400, Albuquerque, N. Mex.	Alpine 6-4411, Ext. 38267.
5. Chicago Operations Office	9800 South Cass Avenue, Argonne, Ill.	Clearwater 7-7711, Ext. 2111 or 541.
6. Idaho Operations Office	P.O. Box 2108, Idaho Falls, Idaho	Jackson 2-6640.
7. San Francisco Operations Office	2111 Bancroft Way, Berkeley 4, Calif.	Thornwall 1-5620.
8. Hanford Operations Office	P.O. Box 550, Richland, Wash	Whitehall 2-1111, Ext. 6-5441.

NOTE: The record keeping and reporting requirements contained in this part have been approved by the Bureau of the Budget in accordance with the Federal Reports Act of 1942.

Dated at Germantown, Md., this 8th day of November 1960.

For the Atomic Energy Commission,

W. B. McCOOL,
Secretary.

[F.R. Doc. 60-10676; Filed, Nov. 16, 1960; 8:45 a.m.]

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Title 10—ATOMIC ENERGY

Chapter I—Atomic Energy Commission

PART 20—STANDARDS FOR PROTECTION AGAINST RADIATION

Statement of Considerations

On September 7, 1960 the Commission published in the FEDERAL REGISTER amendments to 10 CFR Part 20 to become effective January 1, 1961. The amendments were designed to bring the Commission's radiation protection standards into accord with the most recent recommendations of the Federal Radiation Council and the National Committee on Radiation Protection and Measurements. Subsequent to publication of the amendments on September 7, 1960, the Commission has received several comments from interested parties requesting clarification and corrections of certain sections of the regulation. The following amendments are designed to clarify and correct the regulation in the following respects:

1. Section 20.3(a)(4) of the regulation permits licensees to determine calendar quarters either (1) as successive 3-month calendar periods starting on January 1 of a year or (2) as successive periods of 13 complete consecutive weeks starting with the first complete calendar week of the year. Film badge processors have indicated that method (1) of determining calendar quarters would present problems to the industry in that every user of film badges on a monthly basis would be required to start his use on the first day of each month, thereby resulting a large influx of badges to be processed at that time of the month with only a few badges during the balance of the month. They have indicated that method (2) of determining calendar quarters is also unsatisfactory in that users of film badges on a two-week calendar basis could not keep records for a 13-week calendar quarter. Since the purpose of the regulation in defining a calendar quarter is limited to assuring that the exposure of individuals during a period of approximately 3 months is restricted to specified amounts, § 20.3(a)(4)(i) is amended to permit 3-month "calendar quarters" to start on any date within January, April, July or October rather than only on the first of the month; and to permit "calendar quarters" determined on a weekly basis to consist of alternating 14-week and 12-week periods, rather than only 13-week periods.

2. Section 20.206(c) requires Form AEC–3, (Notice to Employees), to be posted in every establishment where licensed activities are carried on regardless of whether any restricted areas which require radiation protection control measures exist in such establishment. Some licensees have pointed out that this requirement is unduly burdensome since posting of a Notice in unrestricted areas will result in many employees not working in restricted areas, nor even engaged in work with licensed material, becoming needlessly concerned as to the applicability of the poster to their activities. Since the purpose of the Notice is soley to assure that an employee working in or frequenting a restricted areas would be made aware of the information contained in the poster, § 20.206(c) is amended to require posting in such locations as to assure that employees working in or frequenting restricted areas will observe the Notice on the way to or from work.

3. Section 20.3(a)(14) of the regulation defines "Restricted area" in part as any area access to which is controlled by the licensee. Some licensees have requested clarification of the definition since access is controlled to many areas which have no relation to radioactive material. The definition has been changed by adding the phrase "for purposes of protection of individuals from exposure to radiation and radioactive materials". A corresponding change has been made in the definition of an unrestricted area in § 20.3(a)(17).

4. The Appendix "B" note in the regulation specifies methods of general applicability for determining limits for concentrations where there is a mixture in air or water of more than one radionuclide. It was not contemplated that these methods would necessarily apply in determining concentration limits for unique complex mixtures such as uranium ore dust. The concentration limit for the mixture of radionuclides in uranium ore dust calculated in accordance with these methods is lower by a factor of about 4 than previous concentration limits used for uranium ore dust. The uranium mill licensees have questioned the applicability of the Appendix "B" note methods for deriving a limit for uranium ore dust. The reduction in the limit for uranium ore dust is due to the fractional contribution of the unusually low limit for the radionuclide Thorium-230. The limit for Thorium-230 is based on a retention half-time in the lung of 4 years for pure thorium compounds. However, Thorium-230 does not appear in uranium ore dust as pure thorium compounds. The radionuclides in uranium ore dust of major health concern consist primarily of particles of insoluble uranium, which account for about 99.99 percent of the radionuclides with respect to mass, in secular equilibrium with the daughter products Thorium-230 and Radium-226 which are probably interspersed in a matrix within the uranium particle. Because of the unique physical and chemical state of the mixture of radionuclides in uranium ore dust, it does not appear appropriate to use the retention time for pure Thorium-230 as the basis for establishing a limit for ore dust. Rather, it appears desirable to use a single retention time for the mixture based upon the characteristics of the dust particle in which the radionuclides are fixed in insoluble form.

According, Appendix "B" note has been modified by adding paragraph 4 to establish concentration limits which are specifically applicable to uranium ore dust in air. It is assumed in deriving the new limits that the retention half-life of the individual radionuclides are governed not by their individual characteristics in the pure chemical state but by the characteristics of the dust particles in which the radionuclides are contained. For this purpose, a half-life of 120 days is used. This follows the practice of the International Commission on Radiological Protection and the National Committee on Radiation Protection in using a 120 day half-life for all insoluble materials in the lung except thorium and plutonium. This problem is under study by the Commission and by the Federal Radiation Council and the

limits specified should be considered interim values pending the result of such studies. Appropriate revisions will be made in the limits if the studies indicate a need therefor.

Inasmuch as these amendments are intended to relieve from rather than to impose restrictions under regulations currently in effect and will not adversely affect the public health and safety, the Commission has found that general notice of proposed rule-making and public procedure thereon are unnecessary and good cause exists why these amendments should be made effective as of January 1, 1961, the effective date of previously published amendments to Part 20.

Notice is hereby given that effective January 1, 1961, Part 20, Title 10, Code of Federal Regulations, "Standards for Protection Against Radiation," as amended on September 7, 1960 (25 F.R. 8595) is further amended in the following respects:

1. Amend § 20.3(a)(4)(i) to read as follows:

(i) The first period of any year may begin on any date in January; provided that the second, third and fourth periods accordingly begin on the same date in April, July, and October, respectively, and that the fourth period extend into January of the succeeding year, if necessary to complete a three-month quarter. During the first year of use of this method of determination by a licensee, the first period for that year shall also include any additional days in January preceding the starting date for the first period.

2. After the first sentence in § 20.3(a)(4)(ii) add the following sentence: "Alternatively, the four periods may consist of the first 14 complete, consecutive calendar weeks; the next 12 complete, consecutive calendar weeks; the next 14 complete, consecutive calendar weeks; and the last 12 complete, consecutive calendar weeks."

3. Amend § 20.3(a)(14) to read as follows:

(14) "Restricted area" means any area access to which is controlled by the licensee for purposes of protection of individuals from exposure to radiation and radioactive materials. "Restricted area" shall not include any areas used as residential quarters, although a separate room or rooms in a residential building may be set apart as a restricted area;

4. Amend § 20.3(a)(17) to read as follows:

(17) "Unrestricted area" means any area access to which is not controlled by the licensee for purposes of protection of individuals from exposure to radiation and radioactive materials, and any area used for residential quarters.

5. Amend § 20.206(c) to read as follows:

(c) Form AEC-3, "Notice to Employees", shall be conspicuously posted in a sufficient number of places in every establishment where employees are employed in activities licensed by the Commission to permit employees working in or frequenting any portion of a restricted area to observe a copy on the way to or from their place of employment.

6. Add the following paragraph 4 to the note in Appendix "B":

4. If the mixture of radionuclides consists of uranium and its daughter products in ore dust prior to chemical processing of the uranium ore, the values specified below may be used in lieu of those determined in accordance with paragraph 1 above or those specified in paragraphs 2 and 3 above.

a. For purposes of Table I, Col. 1—1×10^{-10} μc/ml gross alpha activity; or 2.5×10^{-11} μc/ml natural uranium; or 75 micrograms per cubic meter of air natural uranium.

b. For purposes of Table II, Col. 1—3×10^{-11} μc/ml gross alpha activity; or 8×10^{-12} μc/ml natural uranium; or 3 micrograms per cubic meter of air natural uranium.

Dated at Germantown, Md., this 22d day of December 1960.

For the Atomic Energy Commission.

WOODFORD B. MCCOOL,
Secretary.

[F.R. Doc. 60-12107; Filed, Dec. 29, 1960; 8:46 a.m.]

(Reprinted from 26 F. R., 352, January 18, 1961)

Title 10—ATOMIC ENERGY

Chapter I—Atomic Energy Commission

PART 20—STANDARDS FOR PROTECTION AGAINST RADIATION

Disposal of Radioactive Waste Material

On February 4, 1960, the Commission issued for public comment a proposed amendment to 10 CFR Part 20 designed to prohibit issuance of licenses which would authorize the disposal of radioactive waste material on privately owned sites by persons engaged in commercial radioactive waste disposal activities. The comments received by the Commission with respect to the proposed amendment have been considered by the Commission and are on file in the Commission's Public Document Room. The only changes which have been made in the proposed amendment as published in the FEDERAL REGISTER are that the amended section has been changed from 20.304 to 20.302, and that the words "Federal or State governments" have been changed to read "Federal government or by a State government."

Pursuant to the Administrative Procedure Act, notice is hereby given that the following amendment to Title 10, Chapter I, Part 20, "Standards for Protection Against Radiation," is adopted to be effective 30 days after publication in the FEDERAL REGISTER.

Section 20.302 is amended by the addition of the following statement at the end of the section:

The Commission will not approve any application for a license to receive licensed material from other persons for disposal on land not owned by the Federal government or by a State government.

Dated at Germantown, Md., this 6th day of January 1961.

For the Atomic Energy Commission.

WOODFORD B. McCOOL,
Secretary.

F.R. Doc. 61-364; Filed, Jan. 17, 1961; 8:45 a.m.]

(Published in 26 Federal Register, 11046, November 25, 1961)

Title 10—ATOMIC ENERGY

Chapter I—Atomic Energy Commission

PART 20—STANDARDS FOR PROTECTION AGAINST RADIATION

Concentration Limits in Radionuclide Mixtures

On pages 7142 and 7143 of the FEDERAL REGISTER of August 9, 1961 there was published a notice of proposed rule making to amend 10 CFR 20, "Standards for Protection Against Radiation", which would amend the Note to Appendix "B" of Part 20 to provide an additional standard for deriving a concentration limit for any mixture of radionuclides (1) where the identity of each radionuclide in the mixture is known but the concentration of each radionuclide in the mixture is not known, or (2) where the identity of each radionuclide in the mixture is not known but where it can be demonstrated by assay or by the process of elimination that radionuclides other than those presently specified in the Note are not present.

The amendment also specifies criteria for determining conditions under which radionuclides may be considered as not present in a mixture.

Interested persons were given 60 days in which to submit written comments in conection with the proposed amendments. No objections or suggested changes to the proposed amendment have been received by the Commission.

Pursuant to the Atomic Energy Act of 1954, as amended, and the Administrative Procedure Act of 1946, the proposed amendments of 10 CFR Part 20 are adopted, without change, as a document subject to codification.

Effective date. These amendments shall become effective 30 days after publication in the FEDERAL REGISTER.

Dated at Germantown, Maryland, this 15th day of November 1961.

For the Atomic Energy Commission.

WOODFORD B. McCOOL,
Secretary.

Part 20 is amended as follows:

1. Revise paragraph 3 of the Appendix "B" Note to read:

c. Element (atomic number) and isotope	Table I		Table II	
	Column 1 Air (μc/ml)	Column 2 Water (μc/ml)	Column 1 Air (μc/ml)	Column 2 Water (μc/ml)
If it is known that Sr 90, I 129, Pb 210, Po 210, At 211, Ra 223, Ra 224, Ra 226, Ac 227, Ra 228, Th 230, Pa 231, Th 232, and Th-nat are not present	----------	9×10^{-9}	----------	3×10^{-6}
If it is known that Sr 90, I 129, Pb 210, Po 210, Ra 223, Ra 226, Ra 228, Pa 231, and Th-nat are not present	----------	6×10^{-8}	----------	2×10^{-6}
If it is known that Sr 90, Pb 210, Ra 226 and Ra 228 are not present	----------	2×10^{-8}	----------	6×10^{-7}
If it is known that Ra 226 and Ra 228 are not present	----------	3×10^{-8}	----------	1×10^{-7}
If it is known that alpha-emitters and Sr 90, I 129, Pb 210, Ac 227, Ra 228, Pa 230, Pu 241 and Bk 249 are not present	3×10^{-9}	----------	1×10^{-10}	----------
If it is known that alpha-emitters and Pb 210, Ac 227, Ra 228, and Pu 241 are not present	3×10^{-10}	----------	1×10^{-11}	----------
If it is known that alpha-emitters and Ac 227 are not present	3×10^{-11}	----------	1×10^{-12}	----------
If it is known that Ac 227, Th 230, Pa 231, Pu 238, Pu 239, Pu 240, Pu 242, and Cf 249 are not present	3×10^{-12}	----------	1×10^{-12}	----------
If Pa 231, Pu 239, Pu 240, Pu 242 and Cf 249 are not present	2×10^{-12}	----------	7×10^{-14}	----------

2. Add the following paragraph 5 to the Appendix "B" Note:

5. For purposes of this note, a radionuclide may be considered as not present in a mixture if (a) the ratio of the concentration of that radionuclide in the mixture (C_A) to the concentration limit for that radionuclide specified in Table II of Appendix "B" (MPC_A) does not exceed 1/10, (i.e. $\frac{C_A}{MPC_A} \leqq \frac{1}{10}$) and (b) the sum of such ratios for all the radionuclides considered as not present in the mixture does not exceed ¼ i.e.

$$\frac{C_A}{MPC_A} + \frac{C_B}{MPC_B} + \ldots\ldots \leqq \tfrac{1}{4}).$$

3. If any of the conditions specified below are met, the corresponding values specified below may be used in lieu of those specified in paragraph 2 above.

a. If the identity of each radionuclide in the mixture is known but the concentration of one or more of the radionuclides in the mixture is not known, the concentration limit for the mixture is the limit specified in Appendix "B" for the radionuclide in the mixture having the lowest concentration limit; or

b. If the identity of each radionuclide in the mixture is not known, but it is known that certain radionuclides specified in Appendix "B" are not present in the mixture, the concentration limit for the mixture is the lowest concentration limit specified in Appendix "B" for any radionuclide which is not known to be absent from the mixture; or

[F.R. Doc. 61-11157; Filed, Nov. 24, 1961; 8:45 a.m.]

(Published in 26 Federal Register, 10770, November 17, 1961)

Title 10—ATOMIC ENERGY

Chapter I—Atomic Energy Commission

PART 2—RULES OF PRACTICE

Notice to Local Officials

On June 7, 1961, the Atomic Energy Commission published in 26 F.R. 5077 for public comment certain proposed amendments to 10 CFR Part 2 to provide for (1) formal notice to local officials of the filing of applications for certain facility and waste disposal licenses and amendments to such licenses; and (2) notices of hearings to be given by the Commission to the Governor, or other appropriate official of the State and the chief executive in the locality in which the facility is to be located or the activity to be conducted. Comments filed by interested persons have been given consideration. Certain modifications have been made for purposes of clarification.

Pursuant to the Administrative Procedure Act and the Atomic Energy Act of 1954, as amended, the following rules are published as a document subject to codification to be effective thirty days after publication in the FEDERAL REGISTER.

1. Section 2.101 is amended by redesignating the present text of that section as paragraph (b), revising the heading of that section, and adding a new paragraph (a) to read as follows:

§ 2.101 Notice of application, administrative examination of applications, informal conferences.

(a) A copy of an application or amendment to an application for a facility construction permit or license or an authorization subject to Part 115, or for a license to receive waste material from other persons for the purpose of packaging, storage or disposal, shall be served by the applicant on (1) the chief executive of the municipality in which the facility is to be located or the activity is to be conducted, or (2) if the facility is not to be located or the activity conducted within a municipality, then on the chief executive of the county. The AEC will send a copy of each such application or amendment to the Governor or other appropriate official of the State in which the facility is to be located or the activity is to be conducted.

§ 2.735 [Amendment]

2. Paragraph (a) of § 2.735 is amended to read as follows:

(a) Whenever a hearing is granted, AEC will give timely notice of the hearing to all parties and to other persons, if any, entitled by law to notice. Notice of hearing on an application or amendment to an application for a facility construction permit or license or an authorization subject to Part 115, or for a license to receive waste material from other persons for the purpose of packaging, storage or disposal, will be given (1) to the Governor or other appropirate official of the State and the chief executive of the municipality in which the facility is to be located or the activity is to be conducted, or (2), if the facility is not to be located or the activity conducted within a municipality, then to the chief executive of the county. Every notice of hearing will state the time, place, and nature of the hearing; the legal authority and jurisdiction under which the hearing is to be held; the matters of fact and law asserted or to be considered, which will be identified as the "Specification of Issues"; and a request for an answer. The time and place for hearing will be fixed with due regard for the convenience and necessity of the parties or their representatives.

Dated at Germantown, Md., this 9th day of November 1961.

For the Atomic Energy Commission.

WOODFORD B. MCCOOL,
Secretary.

[F.R. Doc. 61-10937; Filed, Nov. 16, 1961; 8:45 a.m.]

(Published in 27 Federal Register, 5905, June 22, 1962)

Title 10—ATOMIC ENERGY

Chapter I—Atomic Energy Commission

PART 1—STATEMENT OF ORGANIZATION, DELEGATIONS, AND GENERAL INFORMATION

PART 20—STANDARDS FOR PROTECTION AGAINST RADIATION

PART 31—RADIATION SAFETY REQUIREMENTS FOR RADIOGRAPHIC OPERATIONS

Miscellaneous Amendments

These amendments to Parts 1, 20 and 31 of the Commission's regulations are designed to reflect recent changes in the organization of the Division of Compliance, establishing five Regional Compliance Offices. In view of these organizational changes, the Compliance Field Offices listed in 10 CFR 1.6(c) and the location of field compliance staffs listed in 10 CFR 1.101(c) are no longer correct. These amendments would correct 10 CFR 1.6(c) and 10 CFR 1.101(c) to show the current location of the Regional Compliance Offices.

Appendix "D" of 10 CFR 20 presently lists the locations of the United States Atomic Energy Commission Operations Offices, and a number of sections of Part 20 and Part 31 require that certain reports be submitted to the nearest Operations Office. These amendments change Appendix "D" by listing addresses of the Regional Compliance Offices rather than the Operations Offices. Appropriate changes are made also in other sections of Parts 31 and 20 which refer to Appendix "D". Concurrently with publication of these amendments, appropriate revisions of Form AEC–3, "Notice to Employees," are being made to list the addresses of the Regional Compliance Offices.

The definition of "source material" in Part 20 is amended to bring it into conformity with the definition of "source material" in Part 40.

Because these amendments relate solely to agency organization and correction, the Commission has found that notice of proposed rule making and public procedure thereon are unnecessary and that good cause exists to make the amendments effective upon publication in the FEDERAL REGISTER.

Accordingly, pursuant to the Atomic Energy Act of 1954, as amended, and the Administrative Procedure Act of 1946, the following amendments of Parts 1, 20, and 31 of Commission regulations are published as documents subject to codification, effective upon publication in the FEDERAL REGISTER.

§ 1.6 [Amendment]

1. Paragraph (c) of § 1.6 is revised to read as follows:

(c) The Compliance Regional Offices are located as follows:

(1) Region I, Division of Compliance, USAEC, 376 Hudson Street, New York 14, N.Y.

(2) Region II, Division of Compliance, USAEC, 50 Seventh Street, Northeast, Atlanta 23, Ga.

(3) Region III, Division of Compliance, USAEC, 9800 South Cass Avenue, Argonne, Ill.

(4) Region IV, Division of Compliance, USAEC, P.O. Box 15266, Denver 15, Colo.

(5) Region V, Division of Compliance, USAEC, 2111 Bancroft Way, Berkeley 4, Calif.

§ 1.10 [Amendment]

2. Paragraph (c) of § 1.101 is revised to read as follows:

(c) Personnel engaged in compliance inspections and investigations are under the direction of the Director, Division of Compliance. Regional compliance staffs are located in New York City; Atlanta, Georgia; Argonne, Illinois; Denver, Colorado; and Berkeley, California.

§ 20.3 [Amendment]

3. Subparagraph 15 of § 20.3(a) is revised to read as follows:

(15) "Source material" means (i) uranium or thorium, or any combination thereof, in any physical or chemical form; or (ii) ores which contain by weight one-twentieth of one percent (0.05%) or more of *a.* uranium, *b.* thorium or *c.* any combination thereof. Source material does not include special nuclear material.

§ 20.206 [Amendment]

4. The note following § 20.206(c) is revised to read as follows:

NOTE: Copies of Form AEC–3, "Notice to Employees," may be obtained by writing to the Director of the appropriate Atomic Energy Commission Regional Compliance Office listed in Appendix "D" or the Director, Division of Licensing and Regulation, USAEC, Washington 25, D.C.

5. Section 20.402 is amended by changing the words "Manager of the nearest Atomic Energy Commission Office" to read "Director of the appropriate Atomic Energy Commission Regional Compliance Office". As amended § 20.402 reads:

§ 20.402 Reports of theft or loss of licensed material.

Each licensee shall report by telephone and telegraph to the Director of the appropriate Atomic Energy Commission Regional Compliance Office listed in Appendix D, immediately after its occurrence becomes known to the licensee, any loss or theft of licensed material in such quantities and under such circumstances that it appears to the licensee that a substantial hazard may result to persons in unrestricted areas.

6. Paragraphs (a) and (b) of § 20.403 are amended by changing the words "Manager of the appropriate Atomic Energy Commission Operations Office" to read "Director of the appropriate Atomic Energy Commission Regional Compliance Office" as amended § 20.403 (a) and (b) reads as follows:

§ 20.403 Notifications of incidents.

(a) *Immediate notification.* Each licensee shall immediately notify the Director of the appropriate Atomic Energy Commission Regional Compliance Office shown in Appendix D by telephone and telegraph of any incident involving byproduct, source or special nuclear material possessed by him and which may have caused or threatens to cause:

(1) Exposure of the whole body of any individual to 25 rems or more of radiation; exposure of the skin of the whole body of any individual of 150 rems or more of radiation; or exposure of the feet, ankles, hands or forearms of any individual to 375 rems or more of radiation; or

(2) The release of radioactive material in concentrations which, if averaged over a period of 24 hours, would exceed 5,000 times the limits specified for such materials in Appendix B, Table II; or

(3) A loss of one working week or more of the operation of any facilities affected; or

(4) Damage to property in excess of $100,000.

(b) *Twenty-four hour notification.* Each licensee shall within 24 hours notify the Director of the appropriate Atomic Energy Commission Regional Compliance Office listed in Appendix D by telephone and telegraph of any incident involving licensed material possessed by him and which may have caused or threatens to cause:

(1) Exposure of the whole body of any individual to 5 rems or more of radiation; exposure of the skin of the whole body of any individual to 30 rems or more of radiation; or exposure of the

feet, ankles, hands, or forearms to 75 rems or more of radiation; or

(2) The release of radioactive material in concentrations which, if averaged over a period of 24 hours, would exceed 500 times the limits specified for such materials in Appendix B, Table II; or

(3) A loss of one day or more of the operation of any facilities affected; or

(4) Damage to property in excess of $1,000.

7. Paragraph (a) of § 20.405 is amended by deleting the last sentence in paragraph (a), and inserting in the first sentence of paragraph (a) immediately after the words "Washington 25, D.C.," the following words "with a copy to the Director of the appropriate Atomic Energy Commission Regional Compliance Office listed in Appendix 'D' ". As amended § 20.405(a) reads as follows:

§ 20.405 Reports of overexposures and excessive levels and concentrations.

(a) In addition to any notification required by § 20.403, each licensee shall make a report in writing within 30 days to the Director, Division of Licensing and Regulation, U.S. Atomic Energy Commission, Washington 25, D.C., with a copy to the Director of the appropriate Atomic Energy Commission Regional Compliance Office listed in Appendix D, of (1) each exposure of an individual to radiation or concentrations of radioactive material in excess of any applicable limit in this part or in the licensee's license; (2) any incident for which notification is required by § 20.403; and (3) levels of radiation or concentrations of radioactive material (not involving excessive exposure of any individual) in an unrestricted area in excess of ten times any applicable limit set forth in this part or in the licensee's license. Each report required under this paragraph shall describe the extent of exposure of persons to radiation or to radioactive material; levels of radiation and concentrations of radioactive material involved; the cause of the exposure, levels or concentrations; and corrective steps taken or planned to assure against a recurrence.

8. Appendix "D" is revised to read as follows:

APPENDIX D

UNITED STATES ATOMIC ENERGY COMMISSION

COMPLIANCE OFFICES

Region	Address	Telephone
I		
Connecticut, Delaware, District of Columbia, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont.	Region I, Division of Compliance, USAEC 376 Hudson Street New York 14, N.Y.	YUkon 9 1000, Ext. 281.
II		
Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, Panama Canal Zone, Puerto Rico, South Carolina, Tennessee, Virginia, Virgin Islands, and West Virginia.	Region II, Division of Compliance, USAEC 50 Seventh Street NE. Atlanta 23, Ga.	873-6146.
III		
Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, Ohio, and Wisconsin.	Region III, Division of Compliance, USAEC 9800 South Cass Avenue Argonne, Ill.	CLearwater 7 7711, Ext. 2113 or Ext. 641.
IV		
Colorado, Idaho, Kansas, Montana, Nebraska, New Mexico, North Dakota, Oklahoma, South Dakota, Texas, Utah, and Wyoming.	Region IV, Division of Compliance, USAEC P.O. Box 15266 Denver 15, Colo.	237-5095.
V		
Alaska, Arizona, California, Hawaii, Nevada, Oregon, Washington and U.S. territories and possessions in the Pacific.	Region V, Division of Compliance, USAEC 2111 Bancroft Way Berkeley 4, Calif.	THornwall 1 5620.

§ 31.105 [Amendment]

9. The last sentence of paragraph (d) of § 31.105 is amended. As amended § 31.105(d) reads:

(d) Any test conducted pursuant to paragraphs (b) and (c) of this section which reveals the presence of 0.005 microcuries or more of removable radioactive material shall be considered evidence that the sealed source is leaking. The licensee shall immediately withdraw the equipment involved from use and shall cause it to be decontaminated and repaired or to be disposed of, in accordance with Commission regulations. A report shall be filed, within 5 days of the test, with the Director, Division of Licensing and Regulation, U.S. Atomic Energy Commission, Washington 25, D.C., describing the equipment involved, the test results, and the corrective action taken. A copy of such report shall be sent to the Director of the appropriate Atomic Energy Commission Regional Compliance Office listed in Appendix D of Part 20 of this chapter "Standards For Protection Against Radiation."

(Sec. 161, 68 Stat. 948; 42 U.S.C. 2201)

Dated at Germantown, Md., this 13th day of June 1962.

For the Atomic Energy Commission.

WOODFORD B. MCCOOL,
Secretary.

[F.R. Doc. 62-6081; Filed, June 21, 1962; 8:45 a.m.]

GPO 934335