ATOMIC ENERGY COMMISSION

10 CFR PART 70

REVISION OF 10 CFR 70 "LICENSING OF SPECIAL NUCLEAR MATERIAL" TO ADD CRITICALITY CONSIDERATIONS AND OTHER LICENSING CRITERIA

NOTICE OF PROPOSED RULE MAKING

STATEMENT OF CONSIDERATIONS

Prior to approving an application to receive, possess, use and transfer special nuclear material, the Atomic Energy Commission must determine that the applicant's proposed procedures, facilities, and equipment are adequate to protect health and minimize danger to life or property. In making this determination the Commission evaluates the applicant's proposed procedures intended to avoid a condition of accidental criticality. In this evaluation the Commission utilizes a considerable amount of experimental and calculated technical information derived primarily from work performed under Commission contracts.

The use of this information over a period of years has resulted in the development of informal standards or guides which the Commission staff utilizes as licensing criteria in determining the adequacy of an applicant's proposed procedures, facilities and equipment to protect against accidental criticality during receipt, possession, use and transfer of special nuclear materials. These criteria have not yet been explicitly stated in the Commission's Regulations. The proposed revision of 10 CFR Part 70, set out below, would define these criteria explicitly insofar as they apply to receipt, possession, including storage, and processing of special nuclear material.

Concurrently with publication of this proposed revision of 10 CFR Part 70, a notice is being published of proposed amendments of 10 CFR Part 71 which would add criteria applicable to transport of special nuclear material.

The proposed revision of Part 70 deletes Sections 70.37 (Disclaimer of warranties) and 70.43 (Licensee's responsibility for special nuclear material), since provisions dealing with those matters are included in the standard special nuclear material lease agreements between the Commission and licensees, and the sections relate to licensees' business relationships with the Commission.

The proposed revision of Part 70 would amend Section 70.53 in a new Section 70.93 to provide that the Commission may require certain licensees to submit Form AEC-578a, "Material Activity Schedule", supporting Form AEC-578, "Material Status Report". The new Form AEC-578a is designed to provide a reconciliation mechanism with respect to special nuclear material physically possessed by one licensee but held by him for the account of another licensee to whom the material was leased by the Commission. Experience has shown the need for such a reconciliation schedule. The Commission has found on a number of occasions that information submitted by the licensee having physical possession of special nuclear material is inconsistent with information submitted by the licensee financially responsible to the Commission. Use of the new form will eliminate considerable correspondence in connection with the reconciliation of accounts. Advance notice will be furnished to licensees required to submit Forms AEC-578a. Form AEC-578a is to be signed by both licensees. Specimen copies of Form AEC-578a may be obtained from the Division of Licensing and Regulation, United States Atomic Energy Commission, Washington 25, D. C.

Except for the changes relating to Sections 70.37, 70.43 and 70.53 all proposed changes in the revision relate to considerations of health and safety, including avoidance of accidental criticality.

In the interest of simplification and clarification, the present Section 70.22, "Contents of Applications", is to be subdivided, two sections specify information which must be furnished in every application, and another describing information to be provided only by applicants wishing authorization to receive, possess or use special nuclear material containing in excess of 300 grams, computed by adding the weight of any U-233 and any plutonium to 0.6 times the weight of any U-235. Accidental criticality is not a problem with less than these quantities.

Sections 70.23 and 70.24, which now prescribe information which must be furnished by all applicants, have been expanded to provide more detailed information regarding the specific subjects which the AEC evaluates in reviewing an application (for example, handling and shielding devices, ventilating systems, glove boxes, fire detection and extinguishing systems, waste removal, security against theft, personnel monitoring, surveys and emergency procedures).

Section 70.25 provides similarly detailed information regarding contents of an application where there is a potential hazard of accidental criticality.

The revised regulation introduces a new requirement in Section 70.26 applicable to persons who possess or use special nuclear material which is not covered by Commission license, at the location where the licensed material will be located. If the total quantity of licensed and non-licensed material will exceed 300 grams, computed by adding the weight of any U-233 and of any

plutonium to 0.6 times the weight of any U-235, the applicant must either demonstrate that licensed material will not be combined with other special nuclear material and will be handled so that neutron interaction will be negligible, or must provide the detailed nuclear safety evaluation required by Section 70.25, taking into account all special nuclear material which may be present.

The revised regulation includes graphs, tables, and other non-textual material which embody the criteria used by the AEC in evaluating applications as to avoidance of accidental criticality. These criteria include mass and geometry limits for individual units and for arrays of units as well as criteria related to moderation control, allowance factors for varying U 235 enrichments, for cylinder shapes, reduced density for undiluted metal, and for U 235, U 233, and Pu 239 when diluted with other elements. The criteria have been derived primarily from TID-7016, Revision No. 1, "Nuclear Safety Guide", although in several cases the published data have been modified to conform with more recent data or provide a greater degree of safety. For example, Section 70.42 Figure 2, "Container Volume Limit for Isolated Unit, Homogeneous, Water-Moderated Fully-Enriched (93.5% U 235) Uranium", and Section 70.43 Figure 14, "Allowance Factor for U 235 Compounds and Aqueous Homogeneous Solutions (Thick Reflector)", have been clarified by providing that Figure 2 is to be used only for 93.5% enriched uranium, and that for lower enrichments the allowance factors of Figure 14 may be applied to obtain container volume limits only by multiplying 4.8 liters, the low point on the thick reflector curve for compounds or solutions of Figure 2, by the appropriate allowance factor obtained from Figure 14. This limitation is

required inasmuch as for lower enrichments the optimum condition occurs at a degree of moderation different from that for the 93.5% enriched material. Reference is made to the article by D. Callihan, "A Review of Criticality Data Obtained by Experimental Methods" appearing in "Criticality Control" published by the Organization for Economic Cooperation and Development, 1961. The author makes this point clear by demonstrating experimentally the shift of the optimum condition to higher H/X ratios as the enrichment is reduced. For example, at 93.5% the optimum occurs at an H/X of about 50 whereas at 4.9% enrichment the optimum occurs at an H/X close to 300.

If the applicant can demonstrate that his operations will be performed in accordance with the pertinent criteria in the regulation, his application will be approved. As an alternative, an applicant may develop other criteria for nuclear safety based on the specific operations and conditions existing in his plant. If he can demonstrate to the Commission the validity of these criteria, that they provide an equivalent margin of safety, and that they are to be used under a rigorous administrative enforcement system assuring that they will be observed, the Commission will approve the application.

The criteria for acceptance of procedures and controls to avoid accidental criticality are based on the principle that the applicant has taken positive action to prevent the occurrence of any single event which is likely to cause criticality.

In addition to the criteria related to avoiding accidental criticality, more detailed information is provided regarding criteria for approval of monitor alarm systems, emergency procedures and evacuation drills. For

example, requirements for fail-safe instrumentation, for testing of the monitor alarm system in order to assure that the detecting system is operable, and for quarterly evacuation drills, have been added.

The revised regulation requires that transfer of special nuclear material in any one package which contains in excess of 16 grams, computed by adding the weight of any U 233 and any U 235 to 1.77 times the weight of any plutonium, shall comply with the requirements of proposed revision of Part 71. Solid irradiated fuel elements containing in excess of 2000 curies in any one ship must comply with the requirements of the proposed 10 CFR Part 72.

The Commission recognizes that nuclear safety is of such a complex nature that all-inclusive technical criteria applicable to all operations cannot be specified in the regulation at this time. The rule, therefore, provides that alternative technical criteria may be proposed by an applicant with respect to his specific operations, and will be approved if he provides reasonable assurance that nuclear safety will be achieved. However, some detailed technical data on mass, volume, cylinder diameter, slab thickness and separation distances are included in the proposed regulation to provide applicants and licensees with specific criteria which have received Commission approval. By this means licensees and applicants would be assured that the Commission will approve the issuance of licenses which properly apply these criteria, and that activities conducted in compliance with the criteria will be acceptable to the Commission.

These criteria have received general acceptance from technical criticality experts, as they were published in TID 7016, Rev. 1. The proposed regulation provide opportunity for applicants to propose other criteria. The Commission would, however, be happy to consider any comments from interested persons who may believe that it would be preferable to set out the technical values in a separate guide.

Notice is hereby given that adoption of the following revision of 10 CFR Part 70 is contemplated. All interested persons who desire to submit written comments and suggestions in connection with the proposed revision should send them to the Secretary, United States Atomic Energy Commission, Washington 25, D. C., within 90 days after publication of this notice in the Federal Register. Comments received after that period will be considered if it is practicable to do so, but assurance of consideration cannot be given except as to comments filed within the period specified.

1. Part 70 is revised in its entirety to read as follows:

TABLE OF CONTENTS

Section

Authority: §§70.1 to 70.111 issued under sec. 161, 68 Stat. 948; 42 USC 2201. Interpret or apply secs. 51, 53, 57, 182, 183, 68 Stat. 929, 930, 932, 953, 954. 42 USC 2071, 2073, 2077, 2232, 2233.

GENERAL PROVISIONS

§70.1 Purpose.

(a) The regulations in this part establish procedures and criteria for the issuance of licenses to receive, possess, use and transfer special nuclear material and for the distribution by the Commission of special nuclear material to licensees; and establish and provide for the terms and conditions upon which the Commission will issue such licenses and distribute special nuclear material. Other requirements are prescribed by other parts of this chapter and by regulations of other agencies. The requirements of this part are in addition to and not in substitution for those other requirements. In particular, Part 71 of this chapter constitutes regulations to protect against accidental criticality in the shipment of special nuclear material and Part 72 governs protection against accidental criticality and radiation exposure in the shipment of irradiated fuel elements.

(b) The regulations in this part are issued pursuant to the Atomic Energy Act of 1954 (68 Stat. 919).

§70.2 Scope. Except as provided in §§70.11 to 70.13, inclusive, the regulations in this part apply to all persons in the United States.

§70.3 License requirements.

(a) No person subject to the regulations in this part may receive, possess, use or transfer special nuclear material except as authorized in a license issued by the Commission pursuant to the regulations in this part.

(b) No person subject to the regulations in this part may, except as authorized by a license issued pursuant to this part:

(1) transport or deliver to a carrier for transport a package containing more than 16 grams of special nuclear material, computed by adding the weight of any U-233 and of any U-235 to 1.77 times the weight of any plutonium;

(2) transport or deliver to a carrier for transport more than five times the quantity of special nuclear material specified in §70.3(b)(1) within any period of 24 hours.

§70.4 Definitions. As used in this part:

(a) "Act" means the Atomic Energy Act of 1954 (68 Stat. 919), as amended.

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

(c) "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.

(d) "Carrier" means a person who is exempted by §70.12 from the regulations in this part.

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

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

(g) "Criticality" means the state in which the effective neutron multiplication constant (k_{eff}) of a quantity of special nuclear material equals or exceeds unity, so that a nuclear chain reaction occurs.

(h) "Degree of moderation" means the ratio of the number of moderator atoms to the number of fissionable atoms, usually expressed for hydrogen as a moderator as H/X, H/U-233, H/U-235, or H/Pu.

(i) "Effective density" means the number of kilograms of U-235, U-233, or plutonium in each liter of a metal, compound, solution or mixture.

(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, officer, authority, administration, or other establishment in the executive branch of the government.

(k) "License," except where otherwise specified, means a license issued pursuant to the regulations in this part.

(l) "Moderator" means a substance which significantly slows neutrons.

(m) "Nuclear safety" means the avoidance of accidental criticality.

(n) "Neutron interaction" means the exchange of neutrons between masses of special nuclear material.

(o) "Neutron poison" means a substance which effectively absorbs neutrons and is not fissionable.

(p) "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.

(q) "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; or (3) to make or to produce new special nuclear material.

(r) "Reflector" means material which reflects neutrons. "Thick reflector" means material with a neutron reflecting capacity equivalent to more than 1 inch of water. "Nominal reflector" means material with a neutron reflecting capacity equivalent to not more than 1 inch of water. "Minimal reflector" means material with a neutron reflecting capacity equivalent to not more than 1/8 inch of stainless steel or other common metals.

(s) "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.

(t) "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.

(u) "Source material" means source material as defined in §40.4 of this chapter.

(v) "Special nuclear material"[1/] means (1) plutonium, uranium 233, uranium enriched in the isotope U-233 or in the isotope U-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 in any of the foregoing, but does not include source material.

(w) "Unit" means a discrete aggregation of special nuclear material.

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

(y) Terms defined in Part 30 have the same meanings when used in this part.

§70.5 Communications. All communications concerning the regulations in this part may be addressed to the Atomic Energy Commission, Washington 25, D. C., Attention: Director, Division of Licensing and Regulation or may be delivered in person at the Commission's offices at 1717 H Street, N. W., Washington 25, D. C., or its offices at Germantown, Maryland.

§70.6 Interpretations. Except as specifically authorized by the Commission in writing, no interpretation of the meaning of the regulations in this part by an

---

1/ Pu 239, Pu-241, U-233 and U-235 are sometimes referred to as "fissile material." See International Atomic Energy Agency, "Regulations for the Safe Transport of Radioactive Material," Safety Series No. 6.

officer or employee of the Commission other than a written interpretation by the General Counsel will be recognized to be binding upon the Commission.

§70.7 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.

§70.8 New application by holder of existing license.

Upon finding that because of the nature of the operations of the holder of an existing license, or because of other special circumstances, it is necessary or appropriate for the protection of the public health and safety, the Commission may issue an order requiring the licensee to file an application for a new license in accordance with the requirements of this part. On the failure of the licensee to request a hearing within 30 days or to file such an application within 90 days after receipt of the order, the license shall terminate.

EXEMPTIONS

§70.11 Persons using special nuclear material under contract with and for the account of the Commission. The regulations in this part do not apply to any person to the extent that he receives, possesses, uses or transfers special nuclear material under, and in accordance with, a contract with and for the account of the Commission.

§70.12 Carriers. Common and contract carriers, warehousemen and the United States Post Office Department are exempt from the regulations in this part to the extent

that they transport or store special nuclear material in the regular course of carriage for another or storage incident thereto.

§70.13 Department of Defense. The regulations in this part do not apply to the Department of Defense to the extent that it receives, possesses, or uses special nuclear material in accordance with the direction of the President pursuant to section 91 of the Act.

§70.14 Specific exemptions. The Commission may, on application of any interested person or on 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 endanger life or property or the common defense and security and are otherwise in the public interest.

§70.15 Production and utilization facilities. Nothing in this part shall be deemed to prohibit the operation of a nuclear reactor or other production or utilization facility in accordance with a license or authorization issued by the Commission.

LICENSE APPLICATIONS

§70.21 Filing. An application for a license shall be filed with the Commission in six copies as provided in §70.5. The Commission may require the filing of six additional copies.

§70.22 Contents of application.

(a) The application shall be organized and presented in accordance with the requirements of this section and shall include: (1) the general information required by §70.23; (2) the information concerning radiation safety required by §70.24; (3) the information concerning nuclear safety required by §70.25; and (4) the information concerning shipment required by Parts 71 and 72 of this chapter.

(b) An application for a license filed pursuant to this part may include application for authority to conduct other specified licensed activities.

(c) An application which contains Restricted Data shall be prepared in such manner that all Restricted Data is separated from the unclassified information.

(d) Applications and documents submitted to the Commission in connection with them will be made available for public inspection in accordance with Parts 2 and 9 of this chapter.

(e) An application and any statement submitted in connection with it shall be signed by the applicant or licensee or by a person authorized to act on his behalf.

(f) An application may incorporate by clear and specific reference any relevant information in previous applications, statements or reports filed with the Division of Licensing and Regulation of the Commission. The Commission may require that an application be re-submitted with incorporation by reference eliminated or limited.

§70.23 General information. Each application shall contain the following general information:

(a) If the applicant is a corporation or other legal entity, the State where it was incorporated or organized, the location of the principal office, the names, addresses and citizenship of its principal officers, and information known to the applicant concerning the control or ownership, if any, exercised over the applicant by an alien, foreign corporation or foreign government. If the applicant is an individual, the full name, address, age, and citizenship of the applicant and the names and addresses of three personal references.

(b) The address at which the activity is to be performed, indicating each specific location at which special nuclear material will be received, handled, used or stored, with a description and scale map of surrounding areas showing the nature of the occupancy and use.

(c) Identification and complete description of the special nuclear material which the applicant proposes to use or produce, including chemical and physical forms and isotopic content; maximum quantity by weight of special nuclear material of each kind which is to be possessed by the applicant at any time; and an estimate of the total amount by weight of special nuclear material of each kind which will be produced and received annually. Plutonium shall be considered to be 100% Pu-239 unless an assay has demonstrated otherwise.

(d) A summary description of any proposed activity in which special nuclear material will be produced, and of any proposed use of special nuclear material.

(e) The applicant's technical qualifications, including the training and the experience of the applicant and his technical and supervisory staff, which are related to the conduct of the proposed activity.

(f) A description of the supervisory, inspection and other procedures intended to insure that the proposed activities will be performed in accordance with the conditions of the license.

(g) The Commission will ordinarily require the applicant to submit information with respect to his financial qualifications (1) to undertake the proposed activity and conduct it for a reasonable period and (2) to pay Commission charges for use, consumption and loss of special nuclear material. Such information will not ordinarily be required in the case of an application limited to small quantities

of special nuclear material for use in research and development.

§70.24 Radiation safety. The application shall contain the following information concerning radiation safety:

(a) A description of equipment and facilities which will be used by the applicant to protect health and minimize danger to life or property, including, among other things: handling and shielding devices; separation of work areas; ventilating systems, glove boxes and hoods; fire detection and fire extinguishing equipment; radiation detection instruments; air sampling equipment; devices for the disposal of radioactive effluents and wastes; storage facilities; and equipment for security against unauthorized removal of material.

(b) An outline of the proposed procedures to protect health and minimize danger to life or property, including procedures for personnel monitoring; type and frequency of radiation surveys of the facility; equipment and environs; and methods of waste disposal.

(c) The applicant's evaluation of the effects of fire, explosion and other accidents and the probability of release of radiation or radioactive material as a result of accidents.

§ 70.25 Nuclear safety.

In an application for a license or for amendment of a license to receive, possess or use special nuclear material containing more than 300 grams, computed by adding the weight of any U-233 and of any plutonium to 0.6 times the weight of any U-235:

(a) the applicant shall:

(1) evaluate the possibility of criticality at each step of the process;

(2) identify the principle on which nuclear safety will depend at each step; and

(3) demonstrate that it is highly unlikely that criticality can occur.

(b) The application shall include:

(1) a description and evaluation of procedures for receiving special nuclear material into the facility and inspecting the shipment on receipt, including:

(i) analysis of the contents of each package for the degree of moderation, chemical composition and isotopic content;

(ii) confirmation of the net weight of special nuclear material in each package;

(iii) conformity of the placement of material in the receiving area and the storage facility with authorized procedures; and

(iv) handling of wet and damaged packages.

(2) A description and evaluation of procedures for the storage of special nuclear material, including:

(i) limitations on total quantity of material, quantity limit for each individual unit, dimensions of containers, and spacing between units;

(ii) a description of containers in which special nuclear materials are stored;

(iii) description of the storage facility, including dimensions and materials of construction of the enclosure and shelving, cubicles, cages and other equipment within the storage area designed to assure proper spacing between stored units;

(iv) precautions to avoid entry of water into the storage area where other than the most effective degree of moderation is assumed in the sizing and spacing of stored units; and

(v) administrative controls over the distribution of special nuclear material from storage and its return to storage, including means of verifying the weight, isotopic content, chemical composition and degree of moderation.

(8) A description and evaluation of procedures for handling and processing the special nuclear material, including: material flow diagrams; plan views of all facility areas in which special nuclear material is to be used, processed or stored, identifying each work area, item of equipment and storage area; and a description of each step in the manufacturing process, including:

(i) a description, using appropriate sketches or drawings of equipment and facilities in which the hazard of criticality exists and showing dimensions in sufficient detail to permit evaluation of the information required by subdivisions (iii), (iv), (v) and (vi) of this subparagraph;

(ii) chemical and physical form of special nuclear material in each step of the process, including isotopic content; the nature of any materials blended or mixed with the special nuclear material; and the

resulting concentrations, densities and degrees of moderation throughout the step of the process;

(iii) maximum quantities of all special nuclear material at any one time in each step of the process;

(iv) spacing of masses of special nuclear material within each process area, and separation from special nuclear material in adjoining areas;

(v) methods of collecting, handling and transporting products from each process area or individual operation, and evaluation of the nuclear safety of those methods;

(vi) description of procedures which are intended to prevent criticality resulting from accumulation of special nuclear material in scrap or waste, lathe turnings, crucible slag, pickling solutions, choppings, sumps, and filters.

(4) a description of the procedures which will be employed to analyze the material at various stages of operations in order to assure compliance with the provisions of the license, including degree of moderation, fissionable isotope enrichment and content, and assay of waste.

(5) a description of the proposed monitor alarm system and emergency procedures, including pre-set alarm levels, fail-safe features, response time of devices and frequency of evacuation drills. The description shall include a drawing showing the location of all sensing devices, their distances to possible sources of criticality, and intervening shielding, with calculations of radiation attenuation factors.

§70.26 Combined operations.

If both licensed and other special nuclear material will be possessed or used at one location, and the total quantity contains more than 300 grams, computed by adding the weight of any U-233 and of any plutonium to 0.6 times the weight of any U-235, the application shall include either:

(a) information which demonstrates that the quantity of special nuclear material in the possession of the licensee under the authority of the license will be isolated from other special nuclear material in accordance with §70.57; or

(b) the information concerning nuclear safety of the total quantity of special nuclear material required by §70.25.

§70.27 Additional information. The Commission may at any time require further information in order to enable it to determine whether a license should be granted, denied, modified, suspended or revoked.

STANDARDS FOR LICENSES

§70.31 General standards. An application for a license or an amendment to a license will be approved if the Commission determines that:

(a) the special nuclear material is to be used for:

(1) the conduct of research or development activities relating to:

(i) nuclear processes;

(ii) the theory and production of atomic energy, including processes, materials, and devices related to such production;

(iii) utilization of special nuclear material and radioactive material for medical, biological, agricultural, health or military purposes;

(iv) utilization of special nuclear material, atomic energy, and radioactive material and processes entailed in the utilization or production of atomic energy or such material for all other purposes, including industrial use, the generation of usable energy, and the demonstration of the practical value of utilization or production facilities for industrial or commercial purposes; or

(v) the protection of health and the promotion of safety during research and production activities;

(2) activities licensed by the Commission under section 103 or 104 of the Act; or

(3) such other uses as the Commission determines to be appropriate to carry out the purposes of the Act;

(b) the applicant is qualified by reason of training and experience to use the material for the specified purpose in accordance with the regulations in this chapter;

(c) the applicant's proposed facilities, equipment and procedures are adequate to protect health and to minimize danger to life or property;

(d) the applicant appears to be financially qualified:

(1) to undertake the proposed activity and conduct it for a reasonable period of time, and

(2) to pay Commission charges for use, consumption and loss of special nuclear material;

(e) the special nuclear material can be made available to the applicant as requested. In the event that applications for special nuclear material exceed the amount available for distribution, the Commission will give preference to those activities which are most likely in its opinion to contribute to basic research, to

the development of peaceful uses of atomic energy, or to the economic and military strength of the Nation. In the event that applications for special nuclear material for use in activities licensed by the Commission pursuant to section 104b of the Act exceed the amount of special nuclear material available for such use, the Commission will give preference to such applications as will in its opinion lead to major advances in the application of atomic energy for industrial or commercial purposes.

(f) If the application is for possession of special nuclear material containing in excess of 300 grams computed by adding the weight of any U-233 and of any plutonium to 0.6 times the weight of any U-235, the proposed activity will be so conducted that the occurrence of either criticality or a significant release of radioactive material is highly unlikely. In making such a determination, the Commission will be guided by the standards in §§70.41 to 70.47 inclusive and §§70.51 to 70.57 inclusive, and the considerations in §§70.32, 70.33, 70.34, and 70.35.

§70.32 Nuclear safety system.

(a) The system of nuclear safety, including equipment, facilities and procedures, shall assure that criticality is prevented at all times within the limits established by this part.

(b) The system shall also assure that positive action is taken to prevent any event which may cause criticality.

(c) Nuclear safety shall wherever possible depend on the characteristics of equipment and facilities rather than procedural or administrative controls.

(d) Special measures shall be provided for transition from one means of control to another.

§70.33 Facilities, equipment and procedures.

(a) Shelves, cubicles or containers for processing, handling and storing special nuclear material shall (1) provide spacing between units necessary to avoid criticality and (2) include design features which preclude spacing patterns other than those intended.

(b) Equipment and facilities, including construction materials, used for processing, handling and storing special nuclear material, shall be adequately designed and constructed for strength, stability and resistance to chemical attack.

(c) Facilities, equipment and procedures shall be such that a credible fire and the use of water in extinguishing a fire will not cause criticality or the release of special nuclear material to an unrestricted area in concentrations exceeding the limits prescribed by Part 20 of this chapter. For the purpose of this paragraph, a credible fire is one which can occur under foreseeable circumstances in view of the type and arrangement of combustible materials present, the measures provided for the control of fire and the assumption of a source of ignition.

(d) Powdered uranium, uranium machine turnings or other forms of special nuclear material capable of spontaneous combustion in air shall not be stored within 12 feet of other special nuclear material unless stored under oil, water or inert gas.

(e) A storage or transfer container for an individual unit based on (1) mass control at other than the most effective degree of moderation, (2) container volume, or (3) control of geometry shall be so designed and constructed that loss of contents will not occur if the container is dropped on an unyielding horizontal flat surface from a height of 4 feet or from the maximum height at which the material can be stored, whichever is higher.

(f) If the individual unit limits for storage are based on an assumption of other than the most effective degree of moderation,

(1) either each individual unit limit shall be chosen on the assumption that the material is saturated with water, or all special nuclear material shall be stored in containers which will not admit water if totally immersed in water for four hours;

(2) metallic masses of special nuclear material larger than 1/8 inch in diameter shall be stored without containers or in water-tight containers which meet the requirements of subparagraph 1 of this paragraph, or in perforated or open wire mesh containers; and

(3) any structure in which special nuclear material is stored shall be so designed and constructed that it will retain its structural integrity and will not admit water in the event of fire in an adjoining room or enclosure. Such a structure may not be equipped with a sprinkler system.

§70.34 Monitor alarm system.

A licensee who will possess at one location special nuclear material containing more than 300 grams, computed by adding the weight of any U-233 and of any plutonium to 0.6 times the weight of any U-235, shall maintain in each area in which special nuclear material is handled, used or stored, a monitoring system, including gamma or neutron sensing devices, which will energize an audible alarm in the event of criticality.

(a) The monitoring system shall:

(1) have a pre-set alarm level of not less than 5 millirems per hour nor more than 20 millirems per hour;

(2) have a response time no greater than 3 seconds at a radiation level of 20 milliroentgens per hour or 140 neutrons per square centimeter per second;

(3) be capable of operating the alarm when the radiation level at a distance of 1 foot from the location where special nuclear material is handled, used, or stored which is most distant from the sensing device does not exceed 300 roentgens per hour or 2.1×10^6 neutrons per square centimeter per second;

(4) be capable of operating the alarm at a radiation level to be anticipated from an incident causing 10^{18} fissions during a period of 0.1 seconds at the point where special nuclear material will be located nearest to any sensing device; and

(5) provide a sensing device within 120 feet of every location where special nuclear material is handled, used or stored or at such lesser distance as may be required to compensate for intervening shielding.

(b) Each monitor-alarm circuit shall:

(1) be equipped with an auxiliary power source which will automatically supply the system in the event of disruption of primary power;

(2) be tested by sounding the alarm at the time of each practice evacuation drill; and

(3) either give warning in case of any malfunction which renders the system inoperable, or be tested weekly. If the test program includes sounding the alarm at times other than a practice evacuation drill, personnal shall be given adequate notice prior to the test and instructed concerning response to real alarms.

(c) The alarm shall be clearly audible in all portions of areas in which special nuclear materials are handled, used or stored and in all adjacent areas where significant exposure to radiation may result from an incident.

(d) The alarm system shall be so designed and constructed that the alarm will continue to sound until re-set by a designated supervisor.

§70.35 Emergency procedures. A licensee shall establish a comprehensive emergency plan for each area in which special nuclear material is handled, used or stored for prompt and rapid evacuation of all personnel to a designated assembly area upon the sounding of the alarm. The plan shall permit re-entry only by permission of a designated supervisor. It shall include the placement of portable radiation survey instruments in accessible locations; designation of an individual in each area responsible for determining the cause of an alarm; and procedures for prompt selection of an alternate assembly area in case of a high radiation level in the designated assembly area. Procedures to familiarize personnel with the evacuation plan shall include drills to be conducted at least once every three months for each operating and maintenance shift.

CRITERIA FOR DETERMINING LIMITS FOR INDIVIDUAL UNITS

§70.41 General.

(a) Individual units. A unit of special nuclear material may be considered to be safe from criticality if it complies with the requirements of §§70.42 and 70.43 for homogeneous mixtures, of §70.44 for lattices of uranium rods of low enrichment, of §70.45 for other heterogeneous systems, of §70.46 for general mass and volume limits, or of §70.47 establishing special limits, and also complies with the pertinent requirements of those sections concerning density, degree of moderation and reflection.

(b) Arrays. An array of units of special nuclear material may be considered safe from criticality if it complies with the requirements of §§70.51 to 70,57 inclusive concerning the determination of safe limits of arrays of individual units.

(c) Limits. The Commission may require in appropriate cases a variety or combination of limits in the control of criticality of one or more such units.

(d) Moderation. In establishing limits, the most effective degree of moderation shall be assumed unless control of moderation can be assured through elimination, confinement or control of water and other moderators containing hydrogen.

(e) Reflection. Reflector conditions shall be assumed to be "thick" unless the licensee demonstrates that reflection cannot exceed "nominal" limits or shall be assumed to be "nominal" unless he demonstrates that reflection cannot exceed "minimal" limits.

(f) Additional factors. In establishing criticality limits, proper allowances shall be made for uncertainties in sampling and analysis, and for other sources of error.

(g) Neutron poisons. The effects of built-in neutron poisons may be considered if there is assurance of their continued presence and effectiveness.

(h) Special moderator and reflector.

(1) When beryllium, heavy water or graphite is present as a moderator or reflector, nuclear safety will be evaluated on the basis of experimental data or calculations, which take into account characteristics of the moderator or reflector.

(2) One and one-half inches of steel or graphite may be deemed to be a "nominal" reflector for special nuclear material in the form of metal, and 1 inch of steel may be deemed to be a "nominal" reflector for a solution containing special nuclear material.

§70.42 Basic Criteria. Solutions, suspensions or mixtures of liquids or fine particles or granules in any combination may be considered to be homogeneous mixtures, and shall be subject to the limits prescribed by this section.

(a) A homogeneous mixture of water moderated uranium containing 93.5% or more of U-235 may not exceed a mass limit determined in accordance with Figure 1, a volume limit determined in accordance with Figure 2, a cylinder diameter determined in accordance with Figure 3, or a slab thickness determined in accordance with Figure 4, when the degree of moderation and reflection are as specified in the pertinent Figure and the U-235 density is not in excess of that specified in Figure 13 for the degree of moderation.

(b) A homogeneous mixture of water moderated plutonium containing 3% or more of Pu-240 may not exceed a mass limit determined in accordance with Figure 5, a volume limit determined in accordance with Figure 6, a cylinder diameter determined in accordance with Figure 7, or a slab thickness determined in accordance with Figure 8, when the degree of moderation and reflection are as specified in the pertinent Figure and the plutonium density is not in excess of that specified in Figure 13 for the degree of moderation. In determining limits pursuant

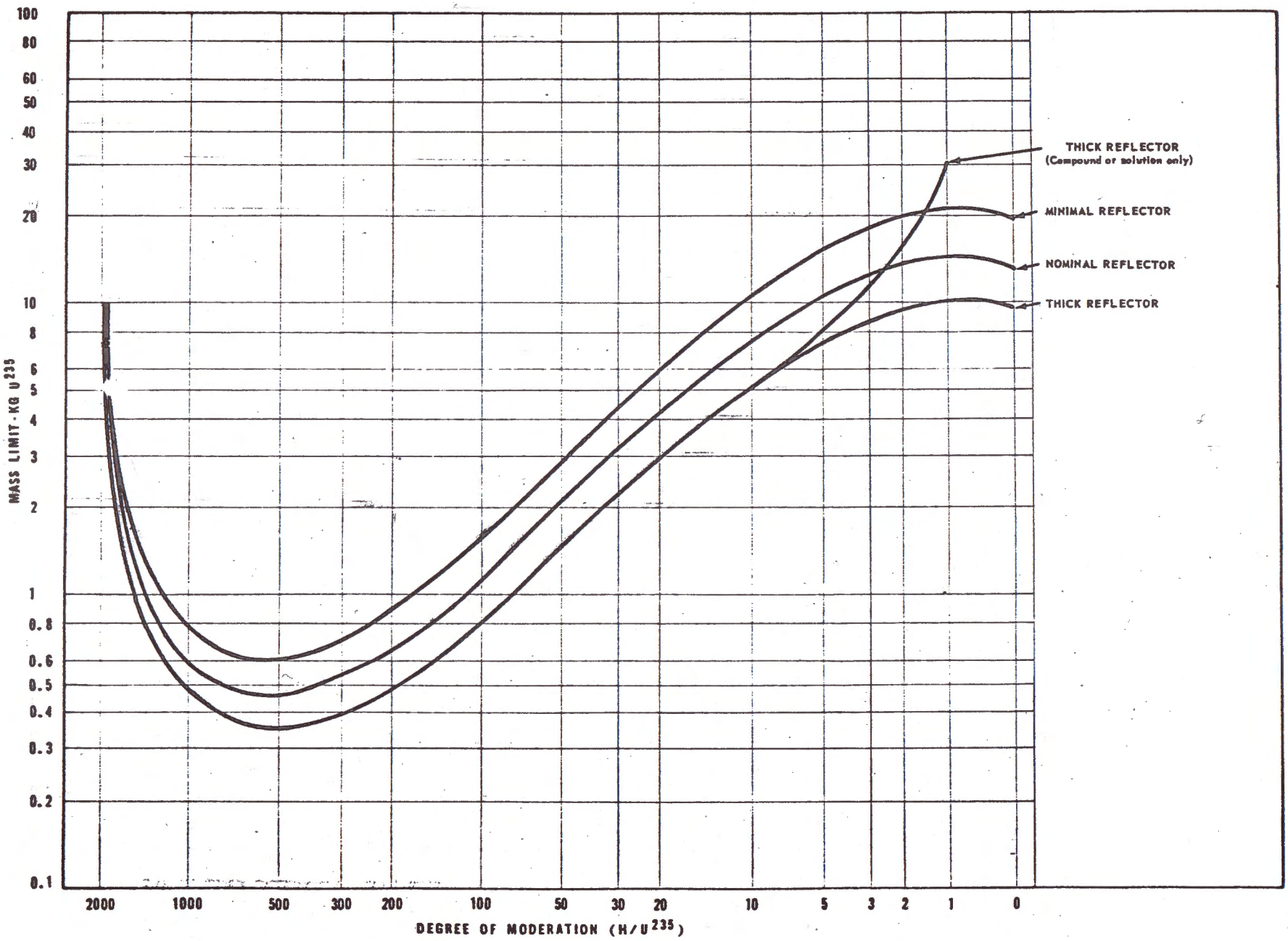


Fig. 1 MASS LIMIT FOR ISOLATED UNIT
HOMOGENEOUS, WATER-MODERATED FULLY-ENRICHED (93.5% U^{235}) URANIUM

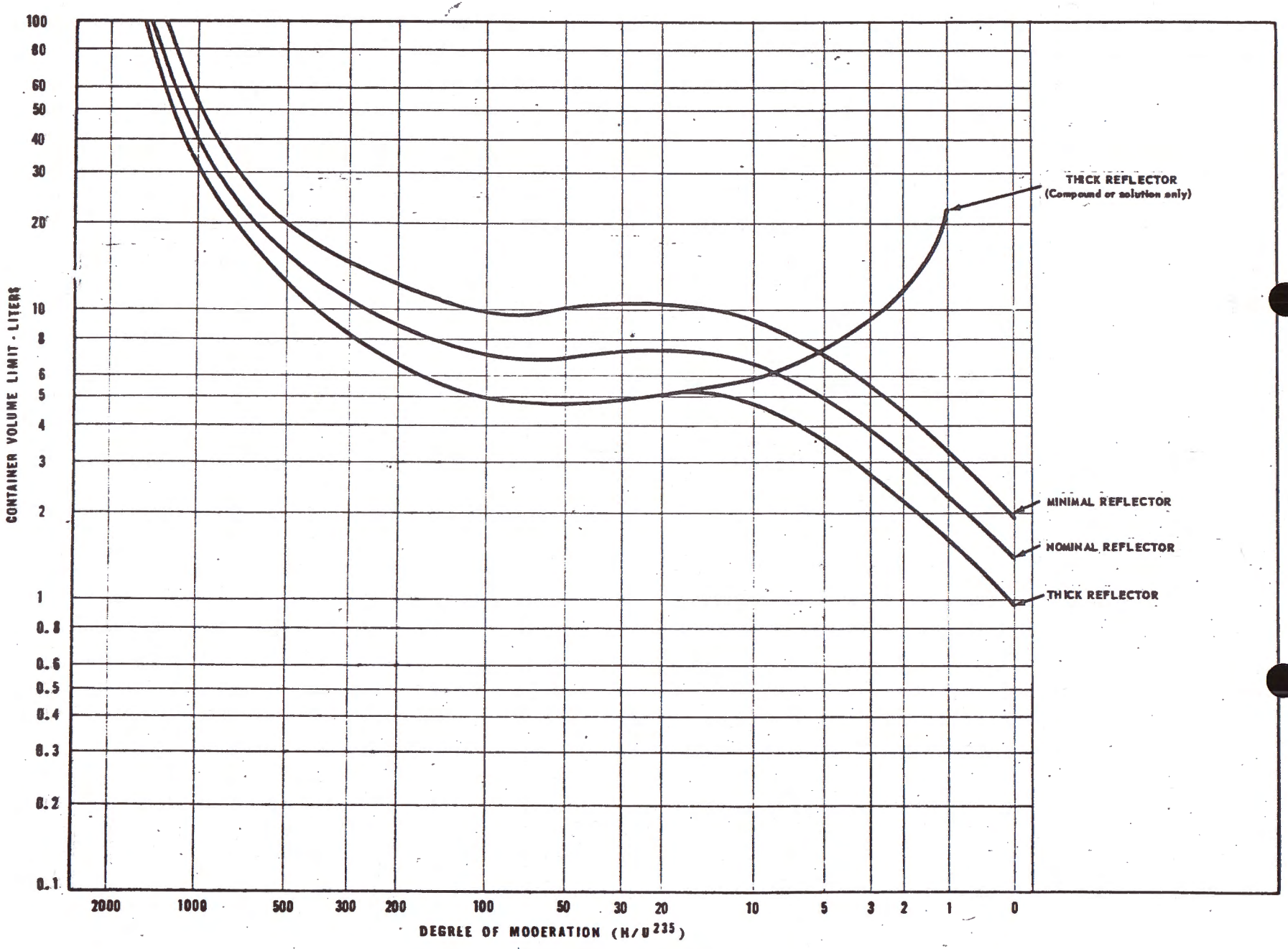


Fig. 2 CONTAINER VOLUME LIMIT FOR ISOLATED UNIT
HOMOGENEOUS, WATER-MODERATED FULLY-ENRICHED (93.5% U^{235}) URANIUM

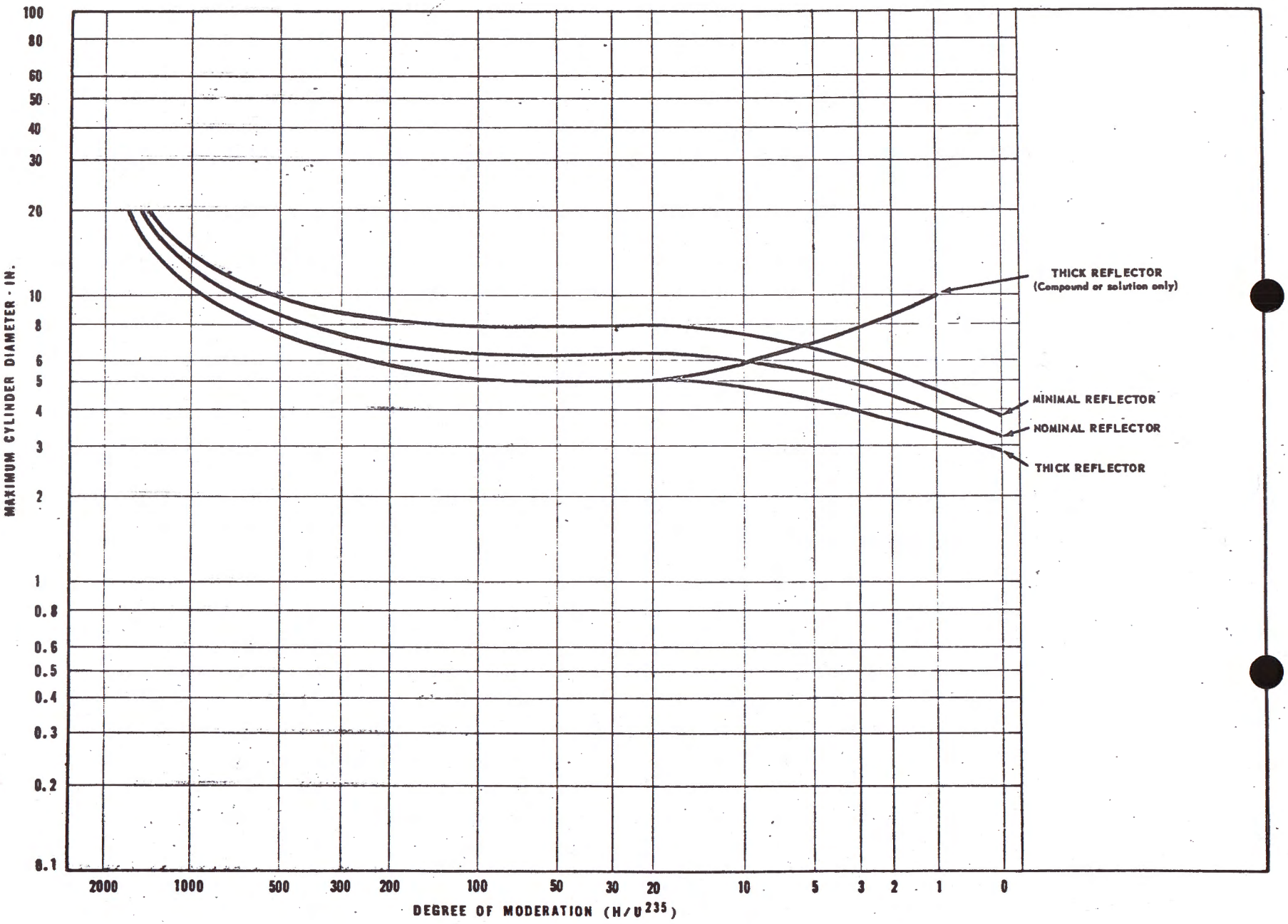


Fig. 3 MAXIMUM DIAMETER OF ISOLATED CYLINDER
HOMOGENEOUS, WATER-MODERATED FULLY-ENRICHED (93.5% U^{235}) URANIUM

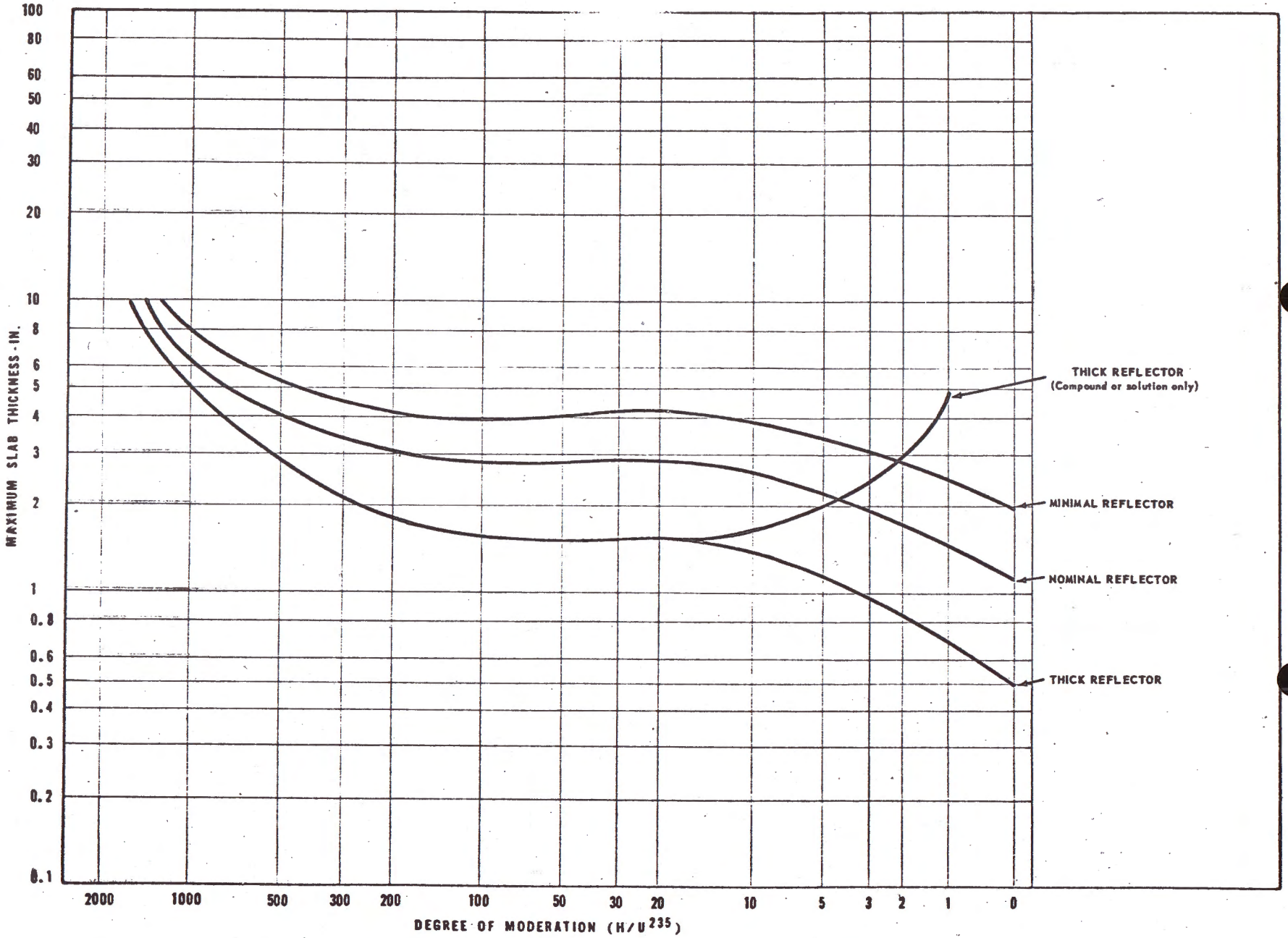


Fig. 4 MAXIMUM THICKNESS OF ISOLATED SLAB
HOMOGENEOUS, WATER-MODERATED FULLY ENRICHED (93.5% U^{235}) URANIUM

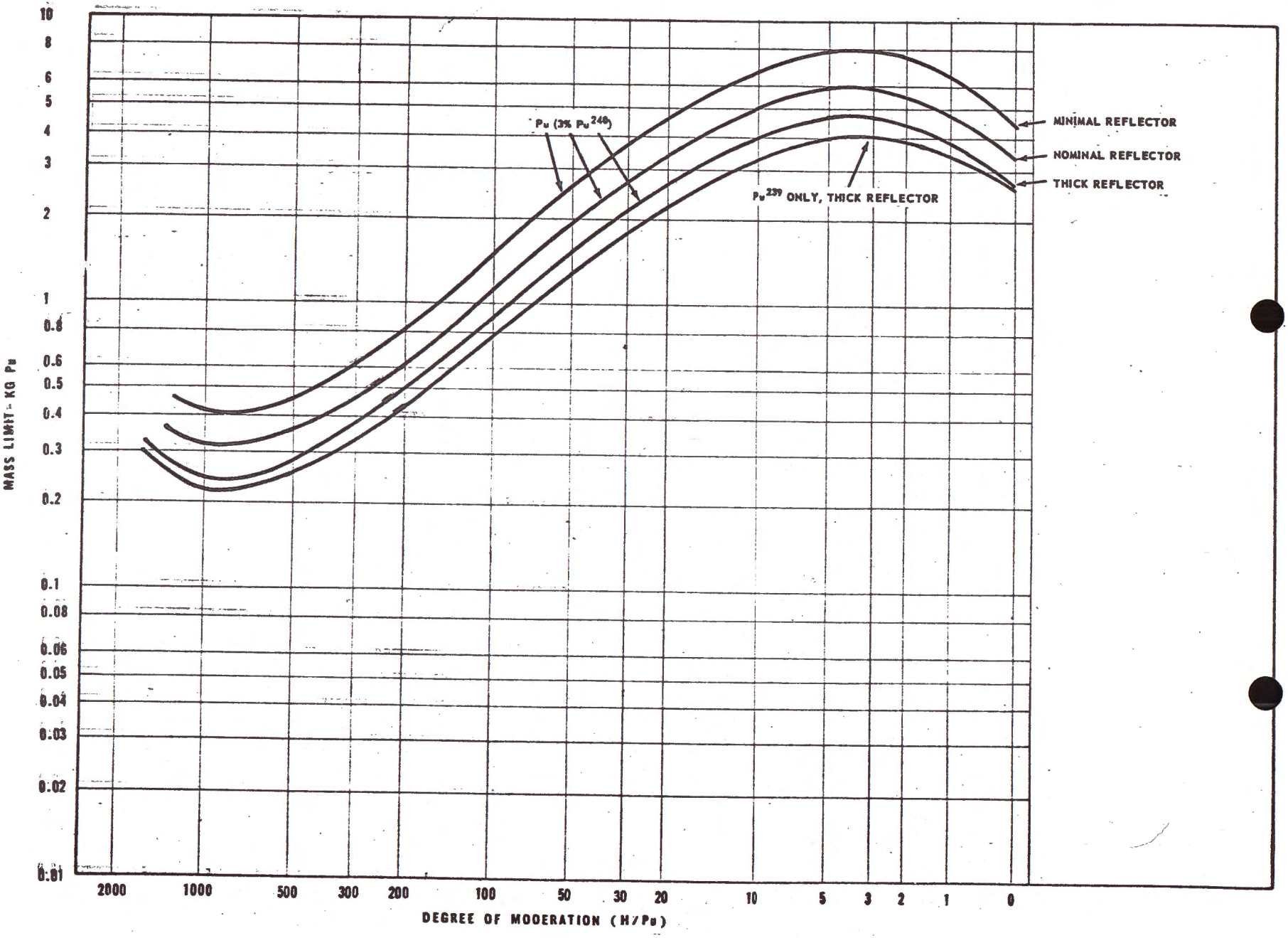


Fig. 5 MASS LIMIT FOR ISOLATED UNIT
HOMOGENEOUS, WATER-MODERATED Pu

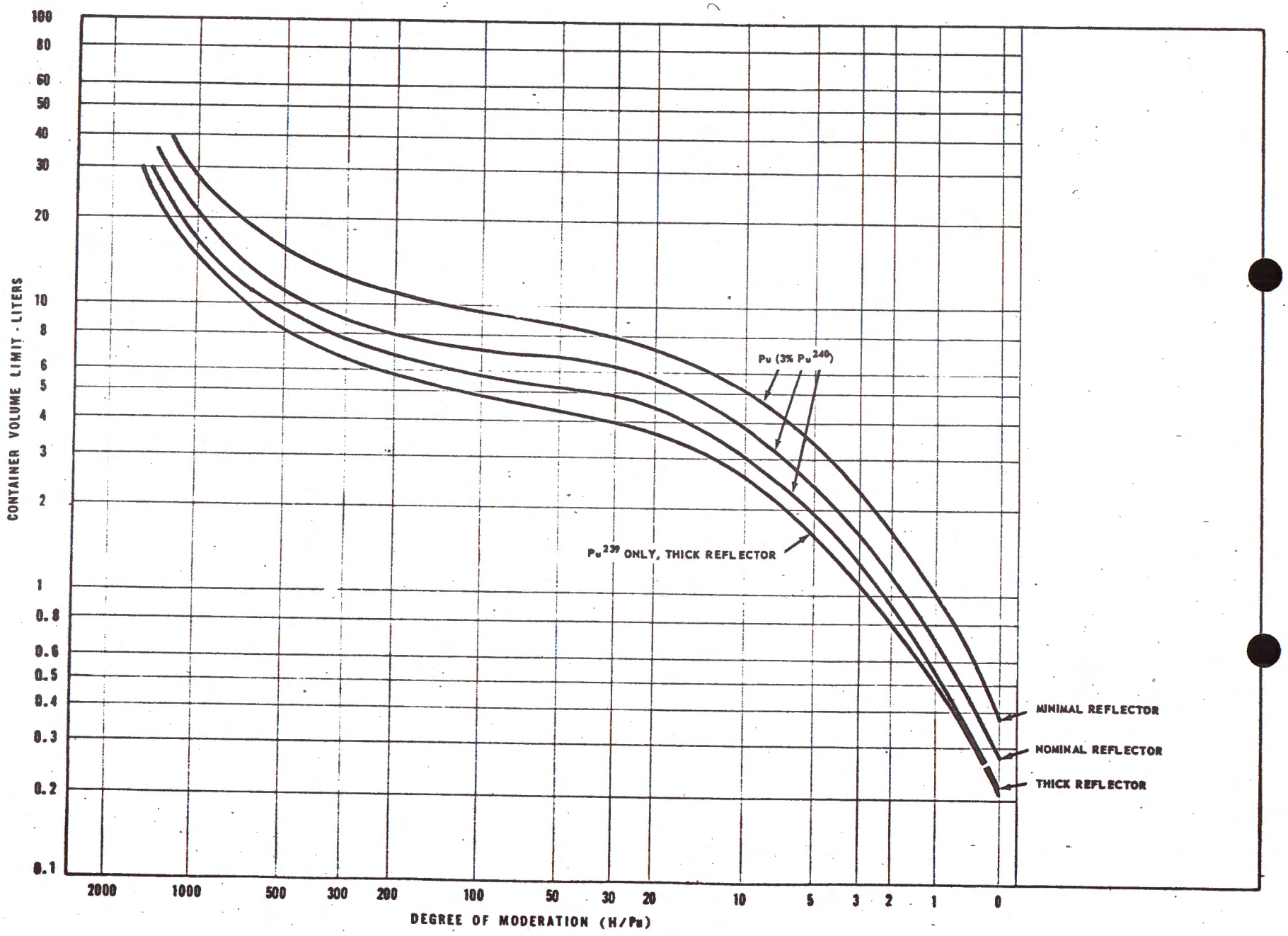


Fig. 6 CONTAINER VOLUME LIMIT FOR ISOLATED UNIT HOMOGENEOUS, WATER-MODERATED Pu

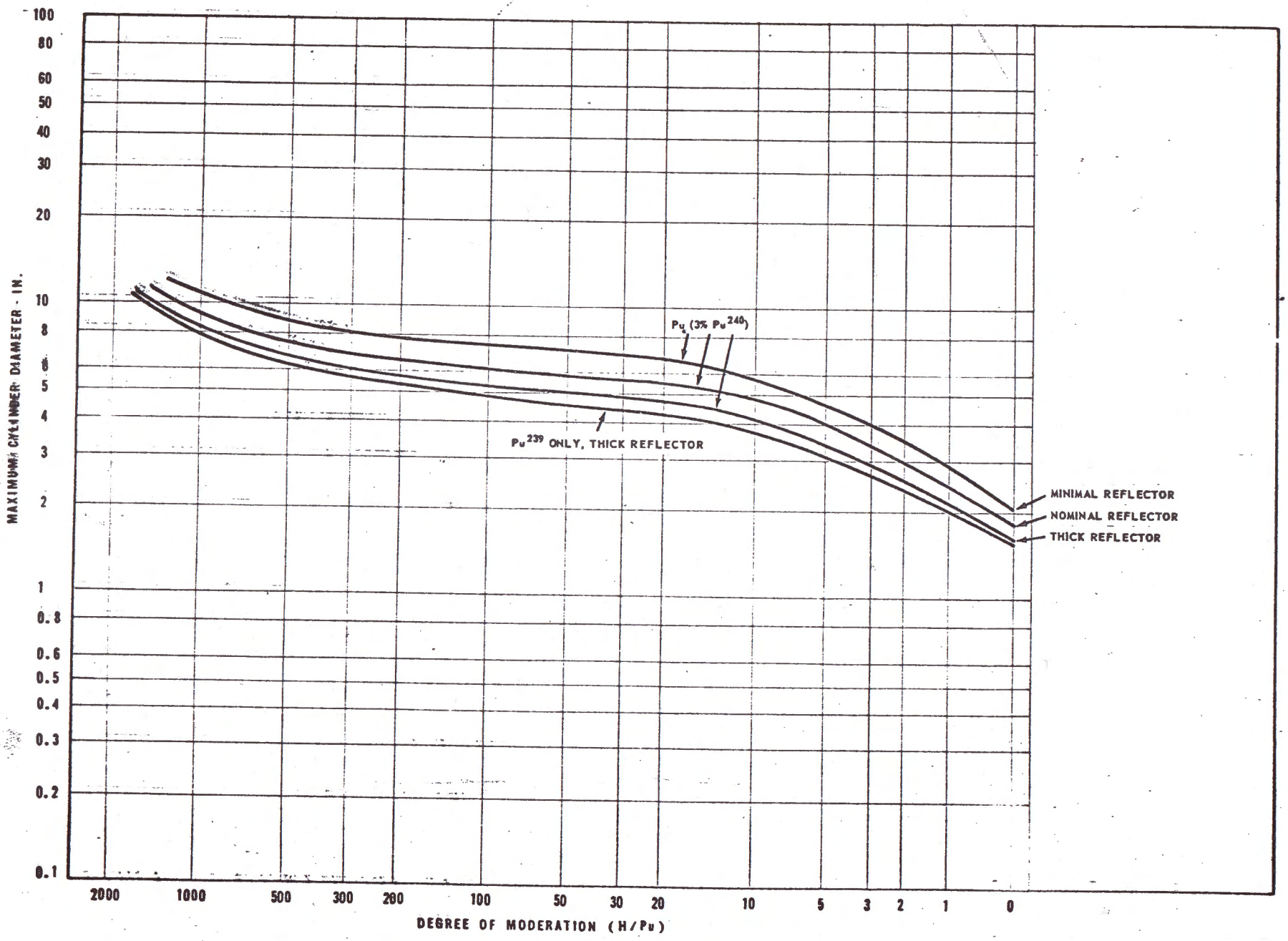


Fig. 7 MAXIMUM DIAMETER OF ISOLATED CYLINDER
HOMOGENEOUS, WATER-MODERATED Pu

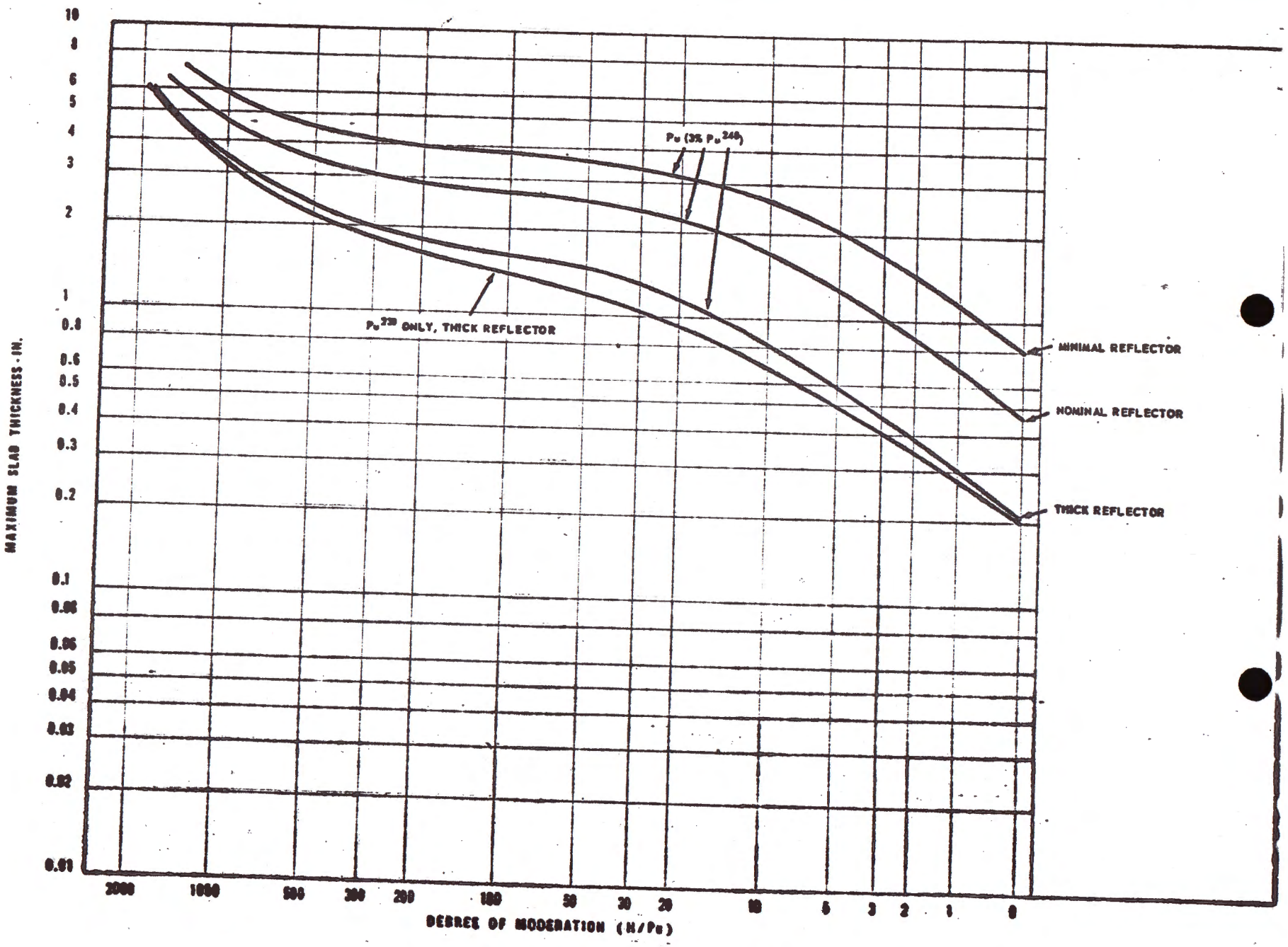


Fig. 8 MAXIMUM THICKNESS OF ISOLATED SLAB HOMOGENEOUS, WATER-MODERATED Pu

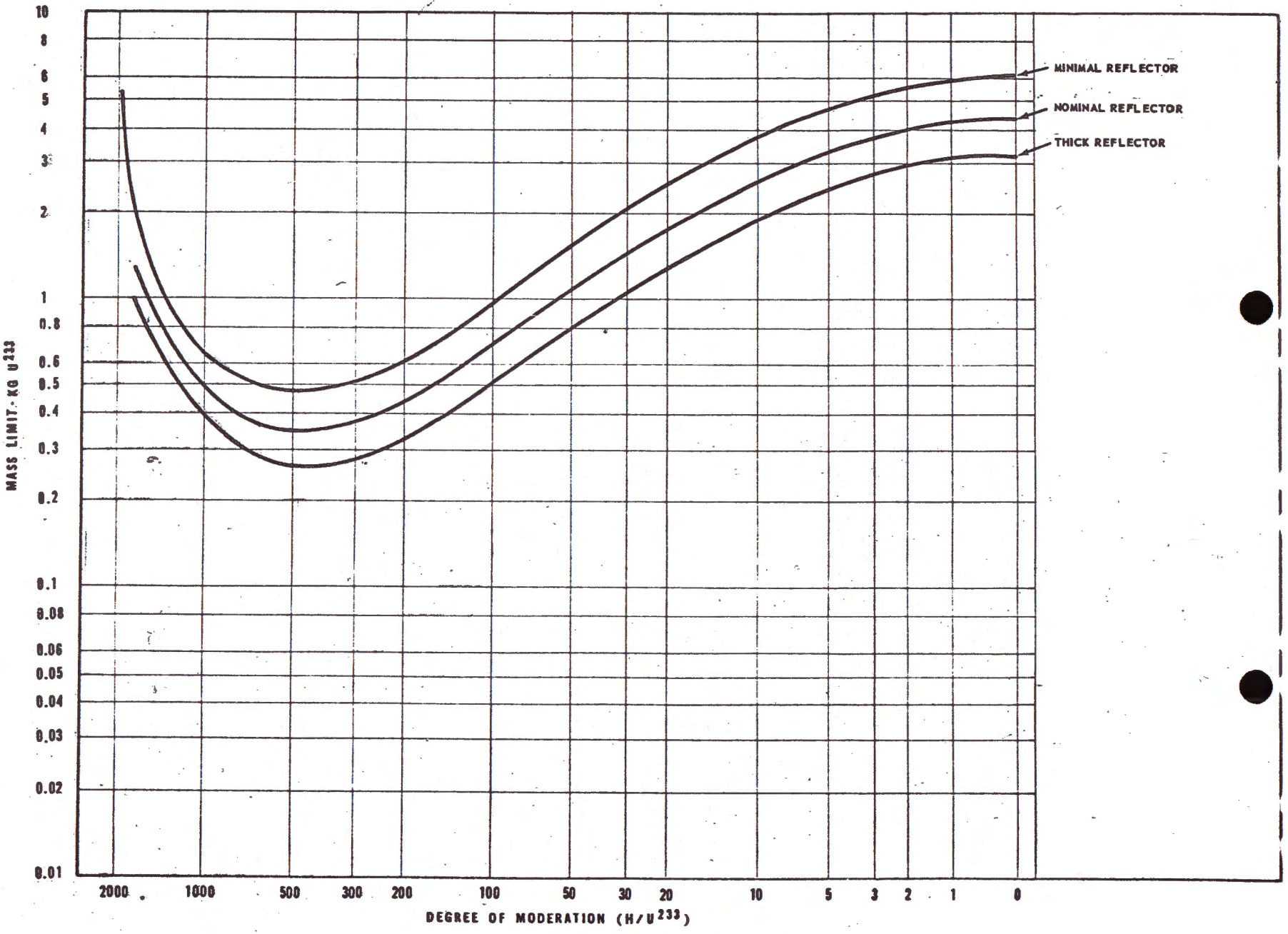


Fig. 9 MASS LIMIT FOR ISOLATED UNIT
HOMOGENEOUS, WATER-MODERATED U-233

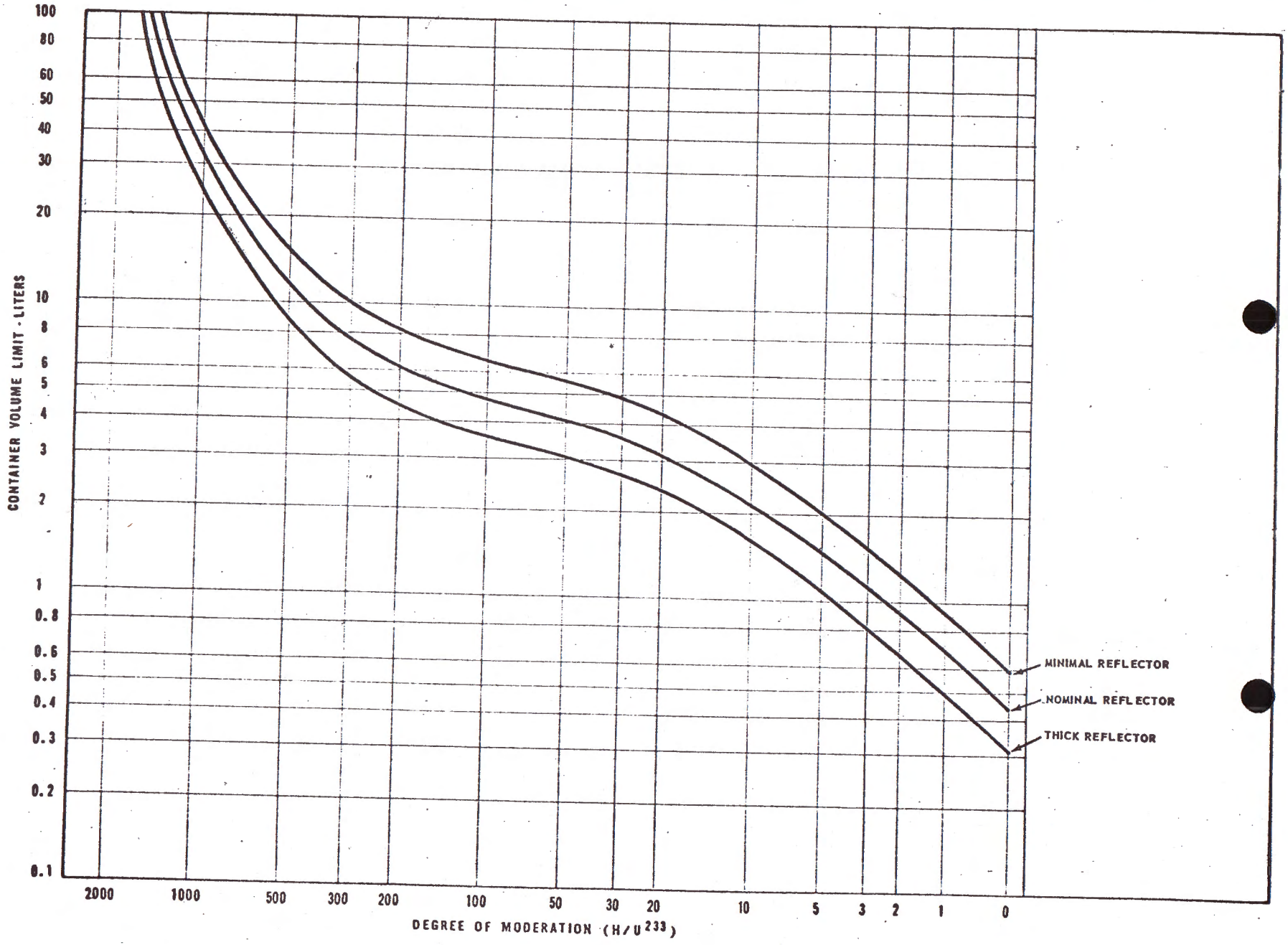


Fig. 10 CONTAINER VOLUME LIMIT FOR ISOLATED UNIT HOMOGENEOUS, WATER-MODERATED U-233

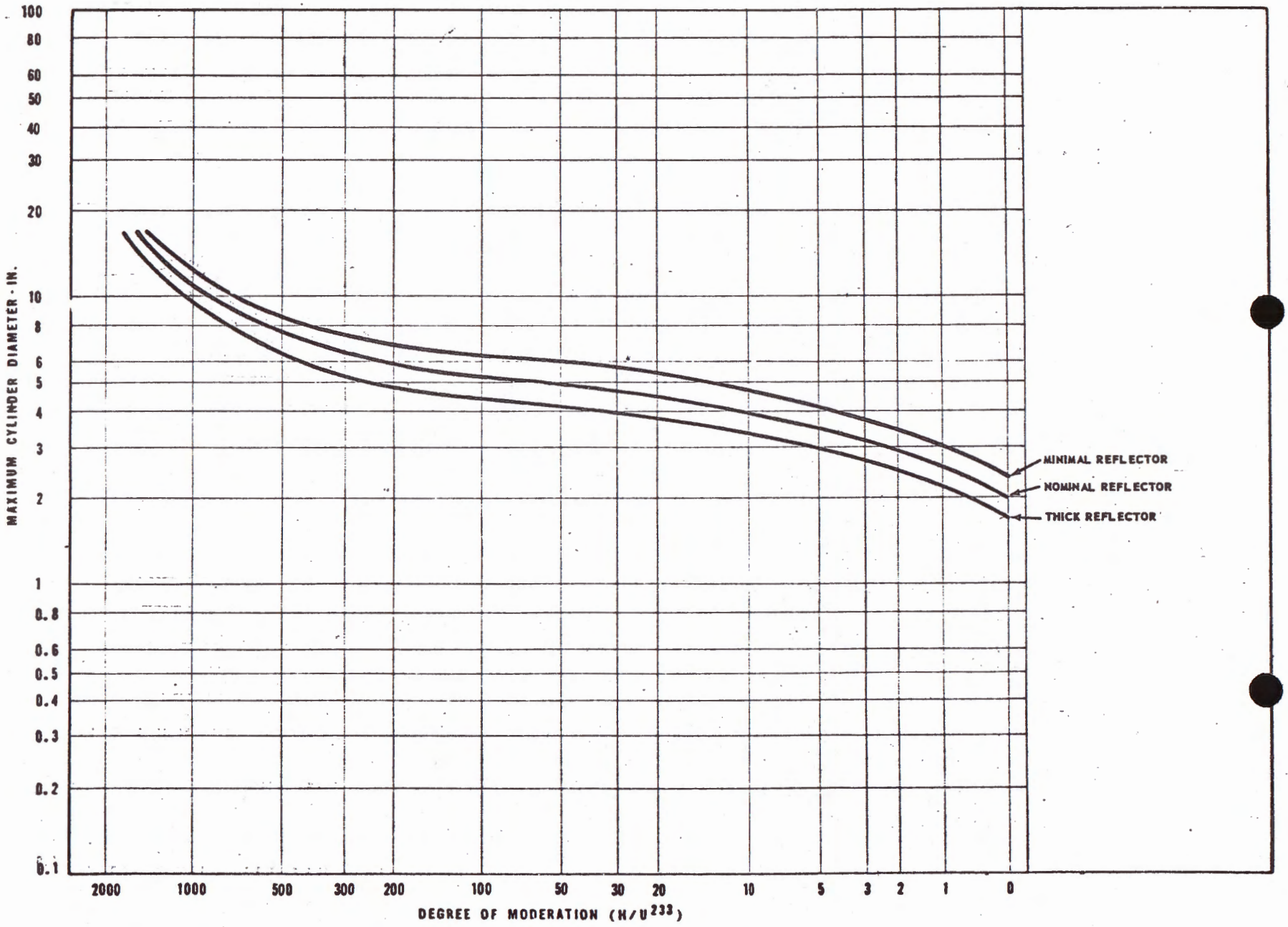


Fig. 11 MAXIMUM DIAMETER OF ISOLATED CYLINDER HOMOGENEOUS, WATER-MODERATED U-233

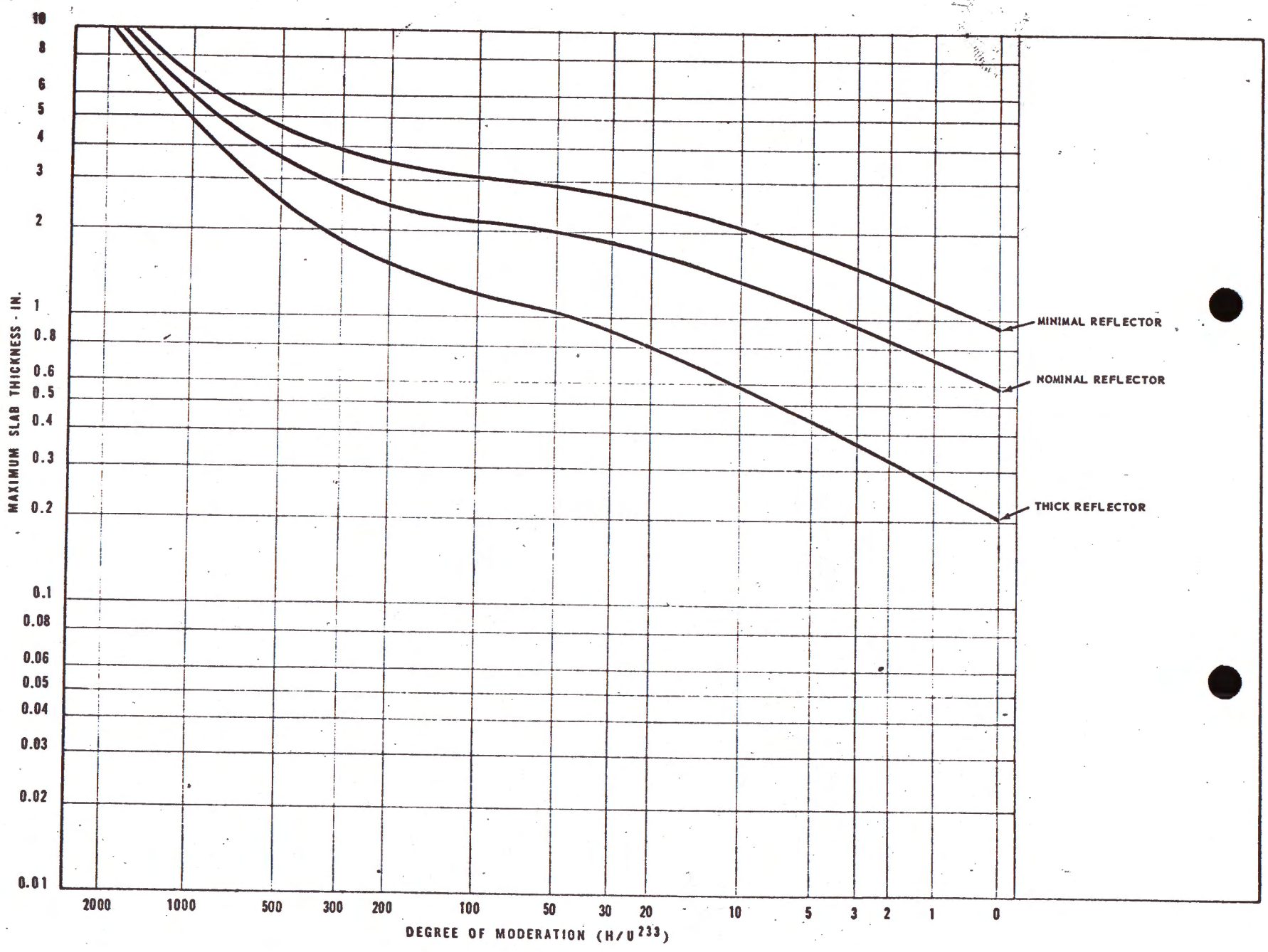


Fig. 12 MAXIMUM THICKNESS OF ISOLATED SLAB HOMOGENEOUS, WATER-MODERATED U-233

to this section and Figures 5, 6, 7 or 8, the total mass of plutonium may be considered to be Pu-239 and the curve designated "Pu-239 only, thick reflector" may be used in ascertaining the limit unless the proportion of Pu-240 is equal to or greater than 3% of the total plutonium, in which case the other appropriate curves in each of those Figures shall be used.

(c) A homogeneous mixture of water moderated uranium containing U-233 may not exceed a mass limit determined in accordance with Figure 9, a volume limit determined in accordance with Figure 10, a cylinder diameter determined in accordance with Figure 11, or a slab thickness determined in accordance with Figure 12, when the degree of moderation and reflection are as specified in the pertinent Figure and the U-233 density is not in excess of that specified in Figure 13 for the degree of moderation.

§70.43 Adjustment and allowance factors.

(a) The permissible mass, container volume, cylinder diameter or slab thickness determined in accordance with §70.42:

(1) shall be adjusted by multiplying it by the effective density adjustment factor determined in accordance with §70.43(b); and

(2) may be multiplied by:

(i) an enrichment allowance factor determined in accordance with §70.43(c),

(ii) a shape allowance factor determined in accordance with §70.43(d),

(iii) a density allowance factor determined in accordance with §70.43(e), and

(iv) a dilution allowance factor determined in accordance with §70.43(f).

(b) Effective density of metal, mixture, compound or solution. If the effective density (ρ) of metal or of a mixture, compound or solution which contains U-235, U-233 or plutonium is greater than the effective density (ρ_o) specified in Figure 13 of this section as corresponding to a specified degree of moderation then:

(1) a limit of cylinder diameter or slab thickness determined in accordance with §70.42 shall be multiplied by the ratio of the effective density specified in Figure 13 (ρ_o) to the actual effective density (ρ);

(2) a mass limit determined in accordance with §70.42 shall be multiplied by the square of that ratio; and

(3) a container volume limit determined in accordance with §70.42 shall be multiplied by the cube of that ratio.

If the effective density of metal or of a mixture, compound or solution is less than the effective density specified in Figure 13 of this section as corresponding to a specified degree of moderation, then a limit determined in accordance with §70.42 of this section shall not be increased by reason of that fact.

(c) U-235 Enrichment.

(1) In the case of uranium metal without interspersed hydrogeneous material and without any other moderator, the mass limit determined in accordance with Figure 1 of §70.42 may be multiplied by an allowance factor

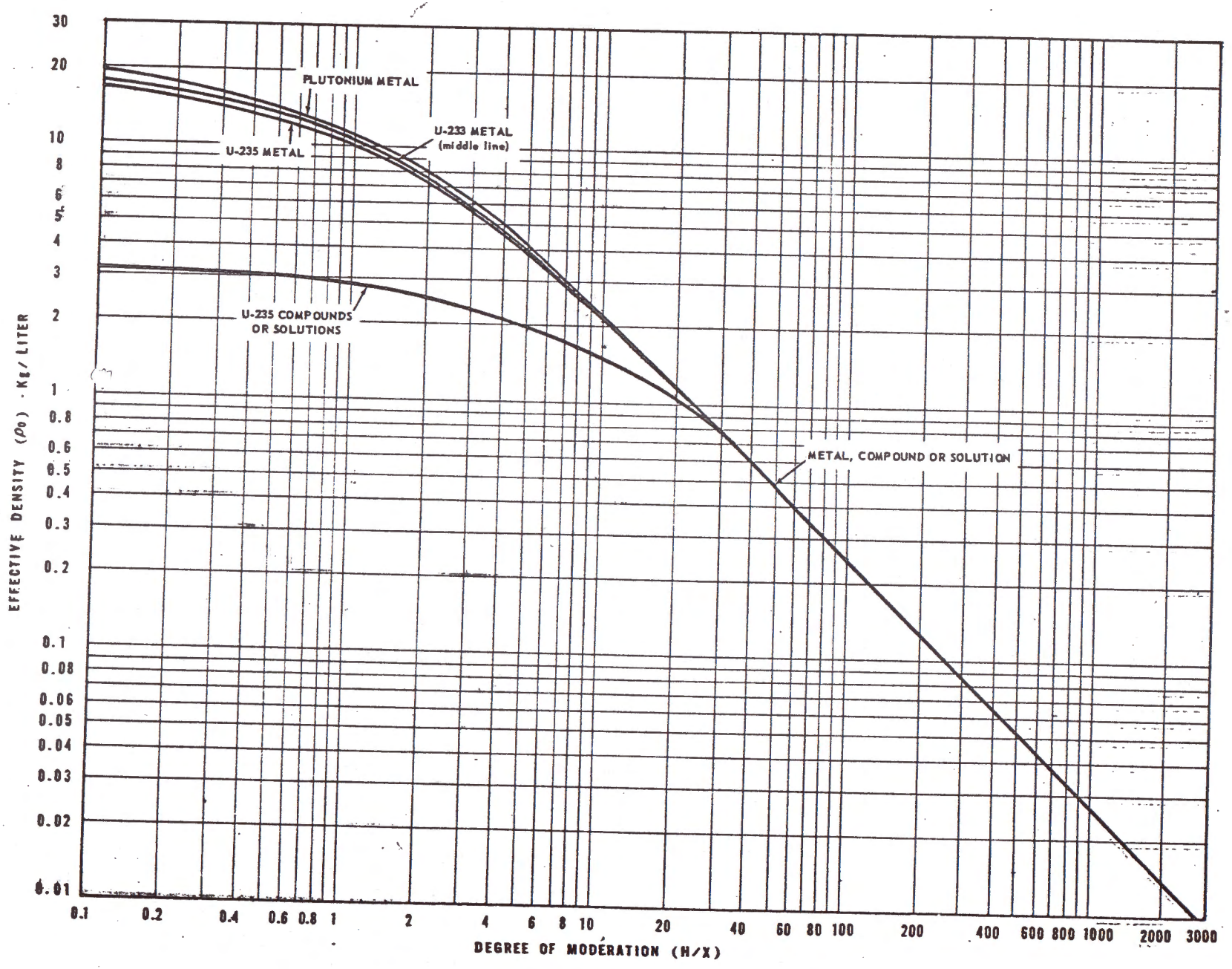


Fig. 13 EFFECTIVE DENSITY CORRESPONDING TO DEGREE OF MODERATION

in accordance with Figure 14 of this section, depending on the degree of enrichment of U-235.

(2) In the case of a uranium compound or an aqueous homogeneous solution of uranium under thick reflector conditions, the mass limit corresponding to any degree of moderation determined in accordance with Figure 1 of §70.42 may be multiplied by an allowance factor determined in accordance with Figure 15 of this section, depending on the degree of enrichment of U-235. If the enrichment of U-235 is less than 93.5% then the limit of container volume, cylinder diameter or slab thickness may be computed by multiplying a container volume of 4.8 liters, a cylinder diameter of 5.0 inches, or a slab thickness of 1.5 inches by an allowance factor determined in accordance with Figure 15, depending on the degree of enrichment of U-235.

(d) Shape. When special nuclear material is stored or handled in a cylindrical container the height of which is not the same as the diameter, a mass or volume limit may be increased by a shape allowance factor determined in accordance with Figure 16 of this section.

(e) Density. When the density of special nuclear material in the form of metal in the absence of diluents and of moderators is less than maximum, a mass limit determined in accordance with §70.42 may be multiplied by an allowance factor determined in accordance with Figure 17 of this section. For the purposes of this section, the maximum density of uranium containing U-235 shall be assumed to be 17.6 grams per cubic centimeter, the maximum density of plutonium shall be assumed to be 19.6 grams per cubic centimeter, and the maximum density of uranium containing U-233 shall be assumed to be 18.3 grams per cubic centimeter. The allowance factor for mass limits shall not in any event exceed 10.

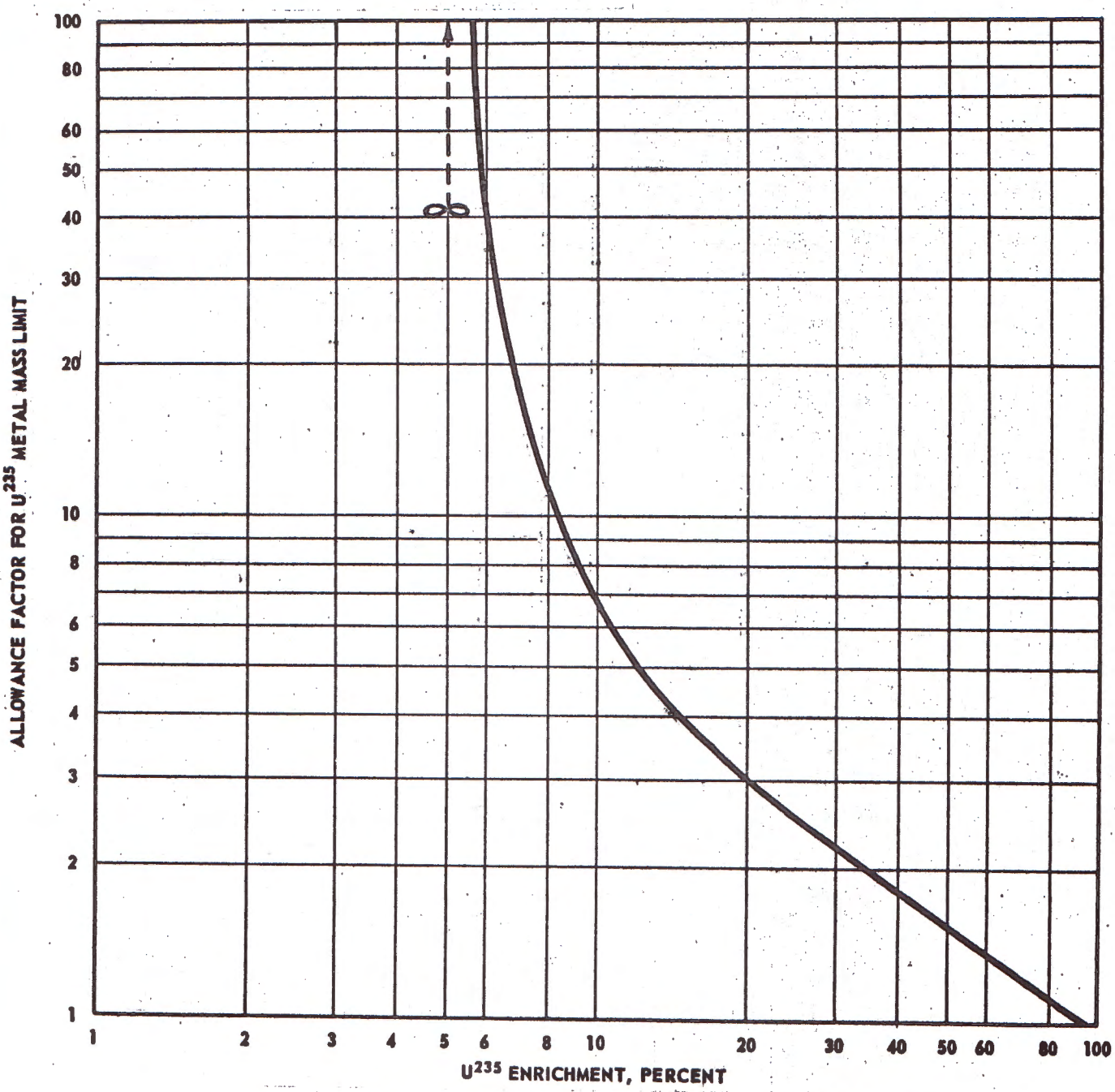


Fig. 14 ALLOWANCE FACTOR FOR U-235 MASS LIMITS FOR URANIUM METAL AT INTERMEDIATE U-235 ENRICHMENTS
(Not applicable if moderator is present)

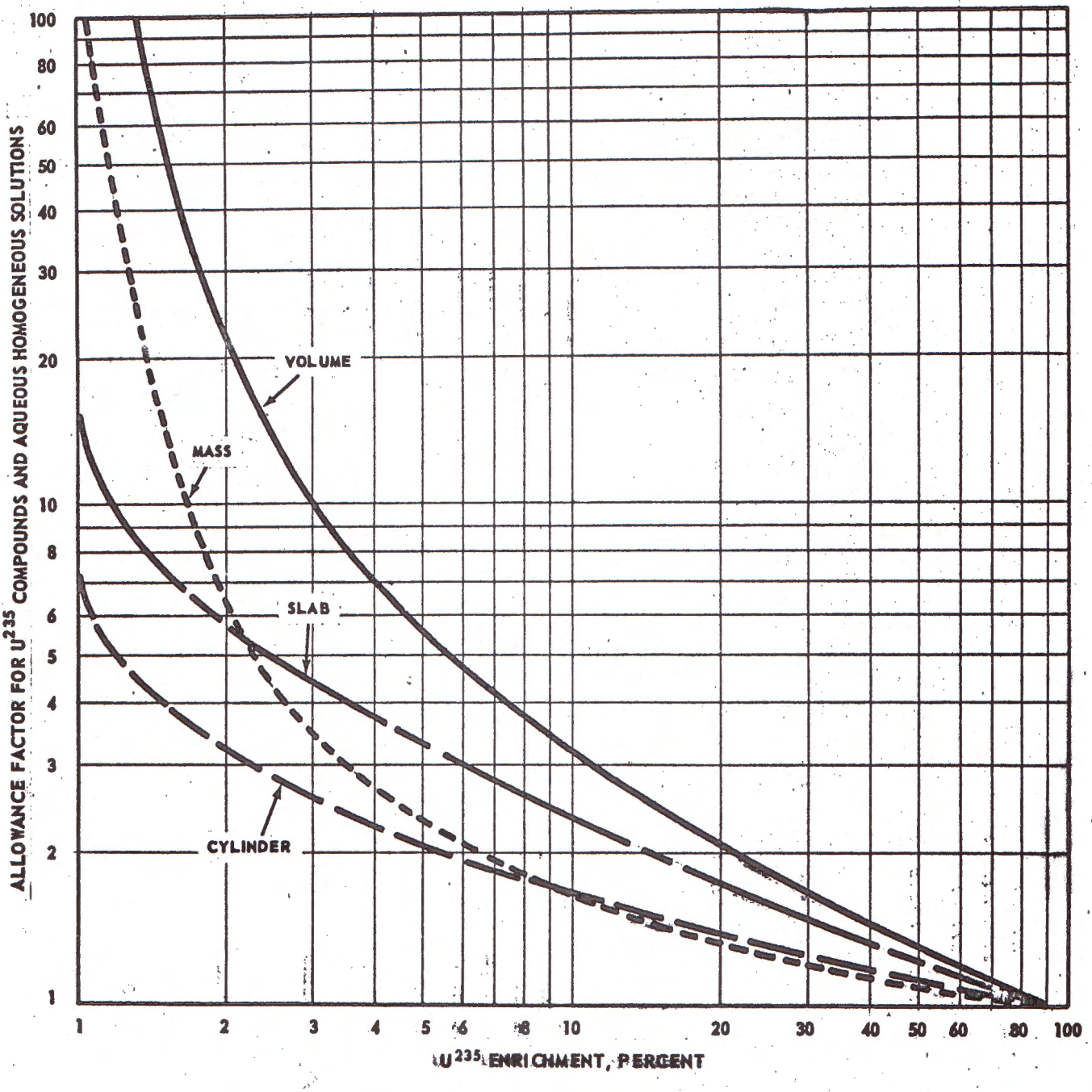


Fig. 15 ALLOWANCE FACTOR FOR U-235 COMPOUNDS AND AQUEOUS HOMOGENEOUS SOLUTIONS
(Thick Reflector)

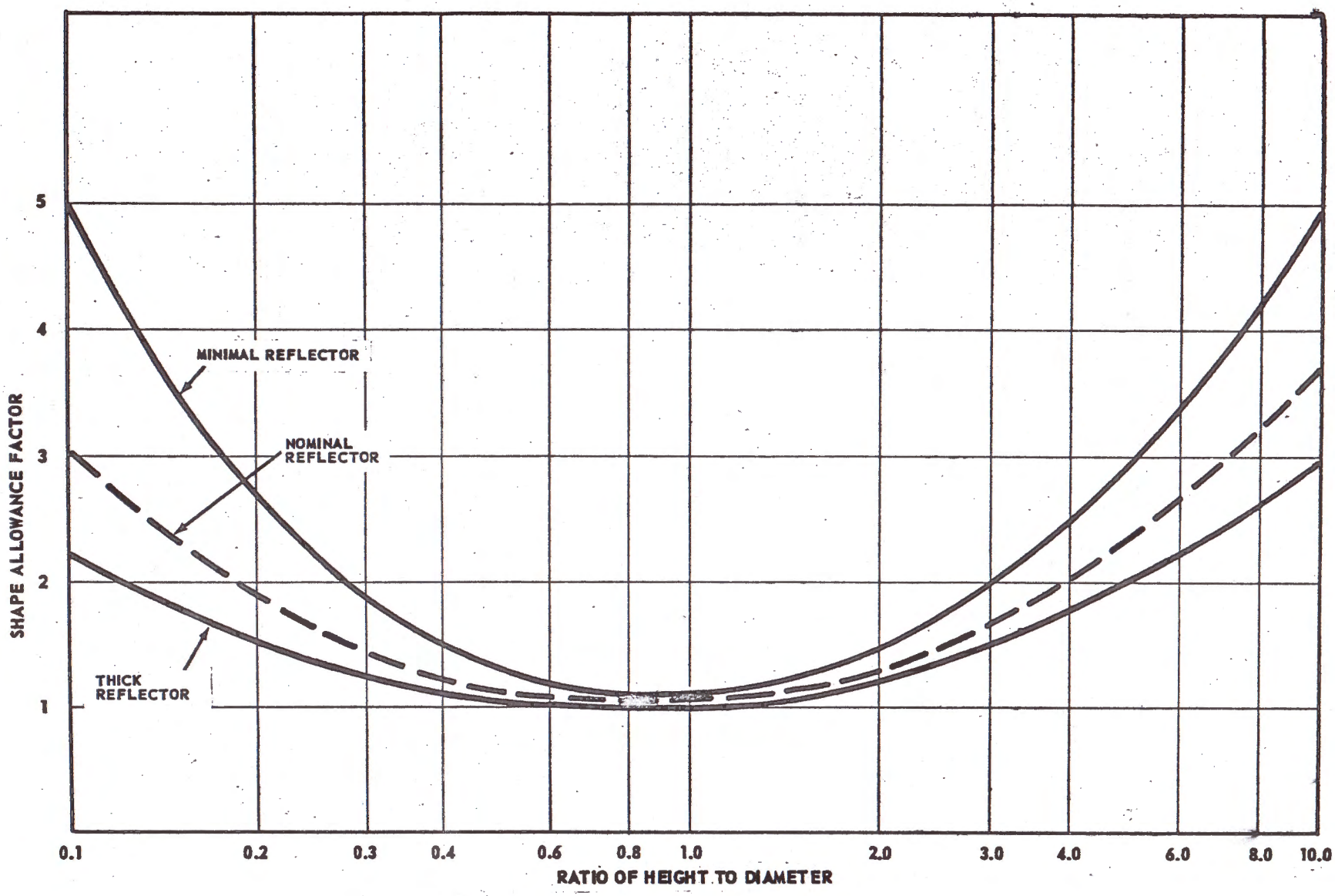


Fig. 16 SHAPE ALLOWANCE FACTOR FOR CYLINDER

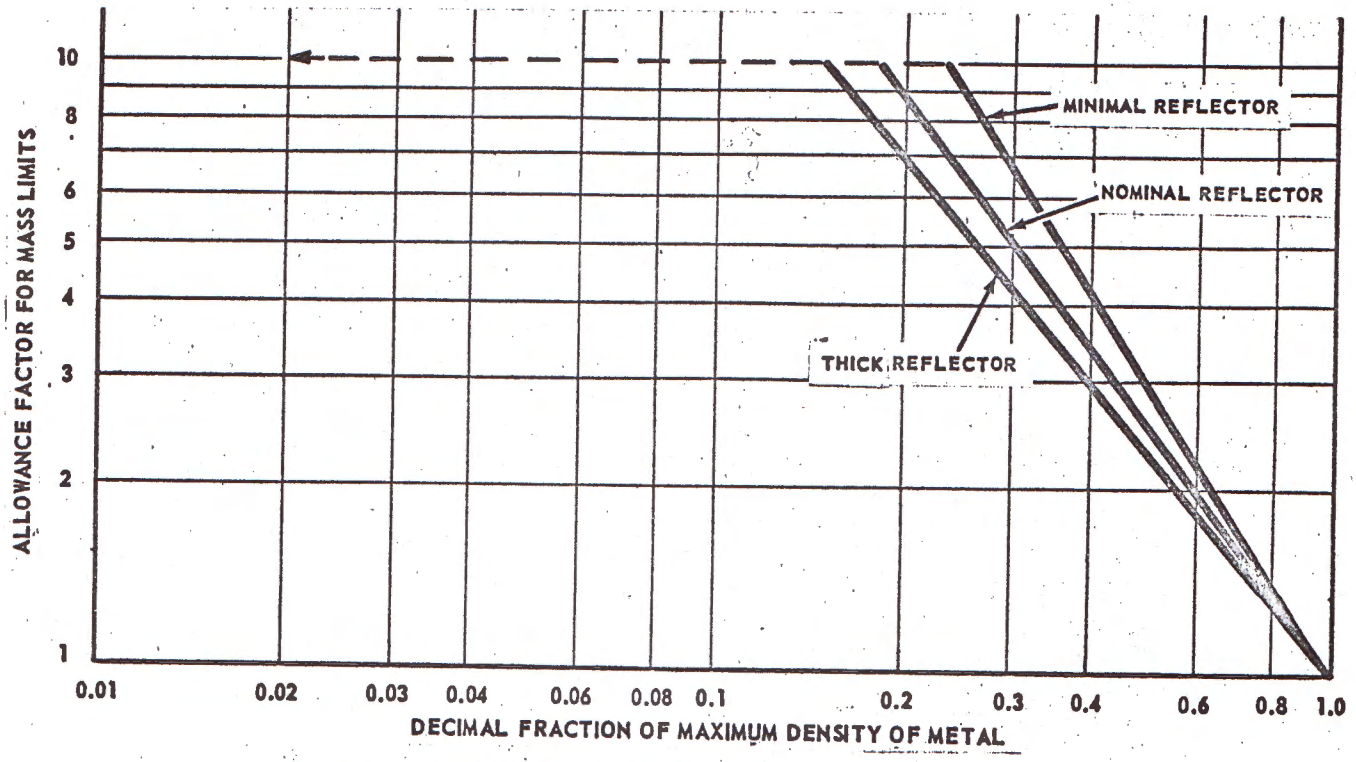


Fig. 17 ALLOWANCE FACTOR FOR REDUCED DENSITY OF U-235, Pu-239, AND U-233 AS METAL ONLY

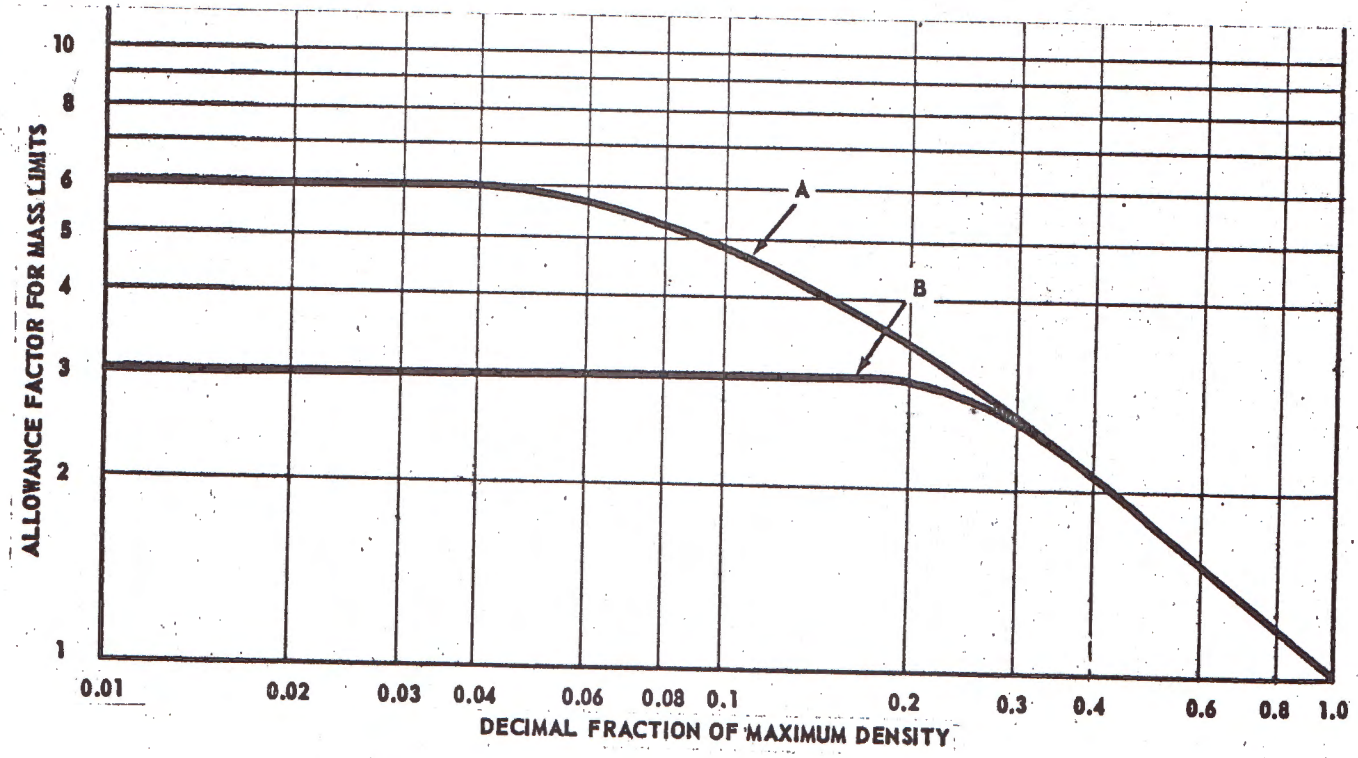


Fig. 18 ALLOWANCE FACTOR FOR U-235, Pu-239, AND U-233 MIXED HOMOGENEOUSLY WITH CERTAIN ELEMENTS

(f) Dilution.

(1) When U-235, Pu-239 or U-233 is mixed homogeneously with any element of atomic number 11 to 83 inclusive, in the absence of hydrogen, deuterium, beryllium or other moderator, the mass limit may be multiplied by an allowance factor determined in accordance with Curve A of Figure 18 of this section.

(2) When U-235, Pu-239 or U-233 is combined homogeneously in a mixture solution or compound with any element of atomic number 11 to 83 inclusive, or with carbon, nitrogen, oxygen or fluorine, in the absence of any other moderator or diluent, in the proportion of at least one atom of U-235, Pu-239 or U-233 for each 7 atoms of the mixture, the mass limit may be multiplied by an allowance factor determined in accordance with Curve B of Figure 18 of this section.

§70.44 Lattices of uranium rods of low enrichment.

(a) Limits of mass, container volume, cylinder diameter and slab thickness for a lattice consisting of rods of uranium metal, uranium alloy or uranium oxide in which no more than 5% of the uranium consists of U-235, moderated and reflected by light water only, shall be ascertained in accordance with Figures 19, 20, 21 and 22 respectively of this section.

(b) A shape allowance factor for a cylindrical container determined in accordance with Figure 17 of this section may be applied to a mass limit for such rods determined in accordance with Figure 19 or a volume limit determined in accordance with Figure 20 but not to a cylinder diameter limit determined in accordance with Figure 21 or a slab thickness limit determined in accordance with Figure 22.

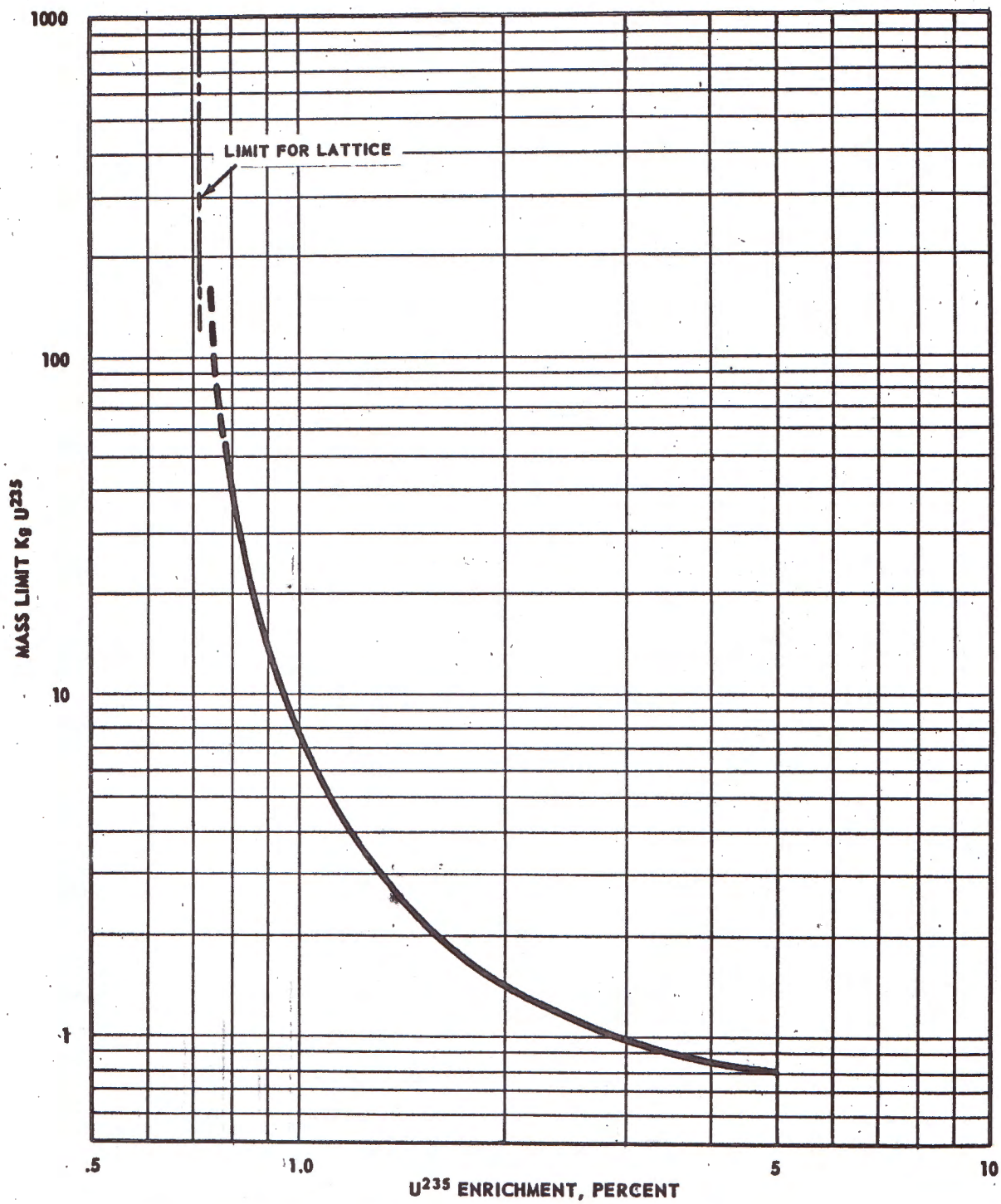


Fig. 19 MAXIMUM MASS LIMIT FOR URANIUM RODS IN LIGHT WATER, WATER REFLECTED

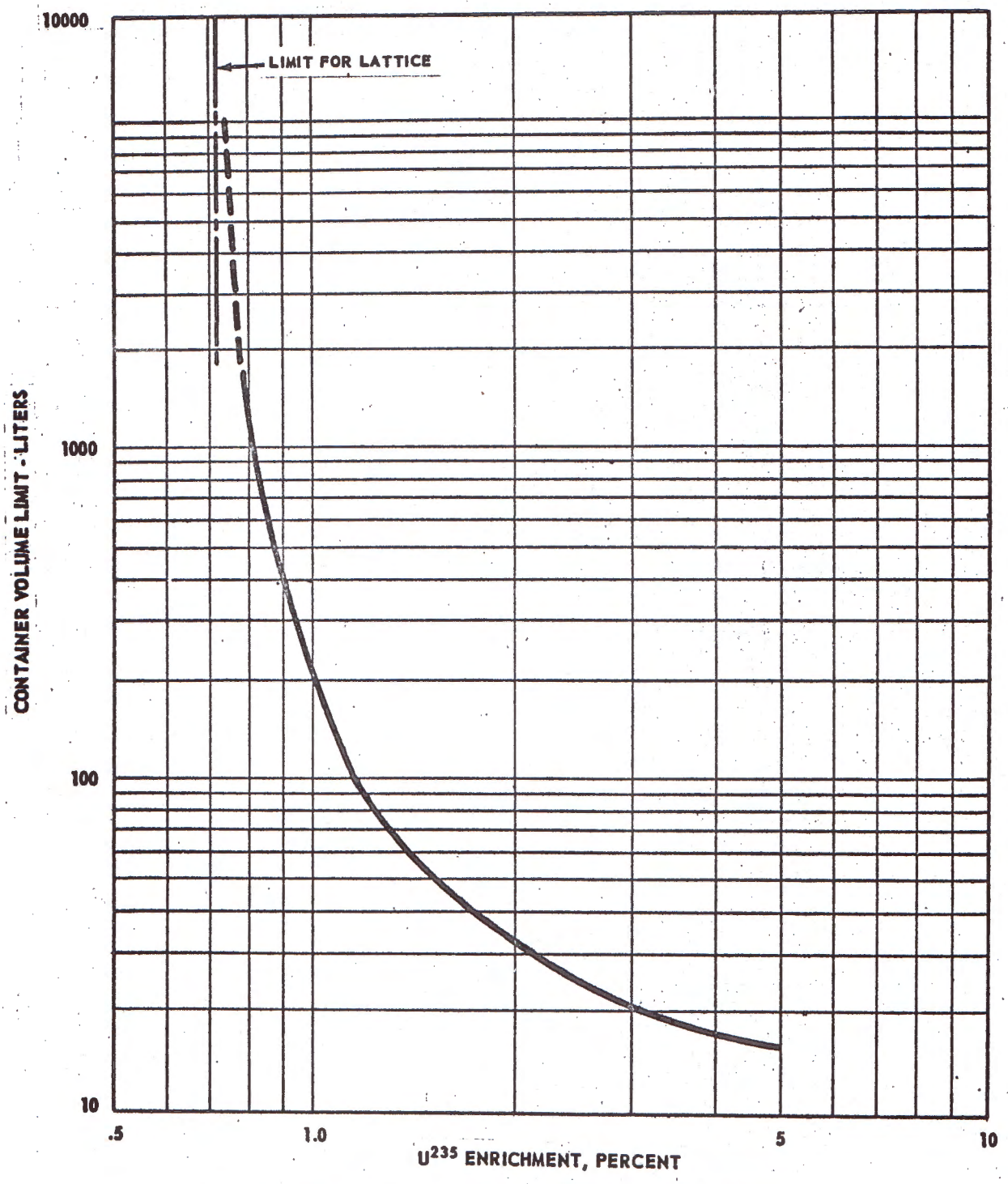


Fig. 20 CONTAINER VOLUME LIMIT FOR URANIUM RODS IN LIGHT WATER, WATER REFLECTED

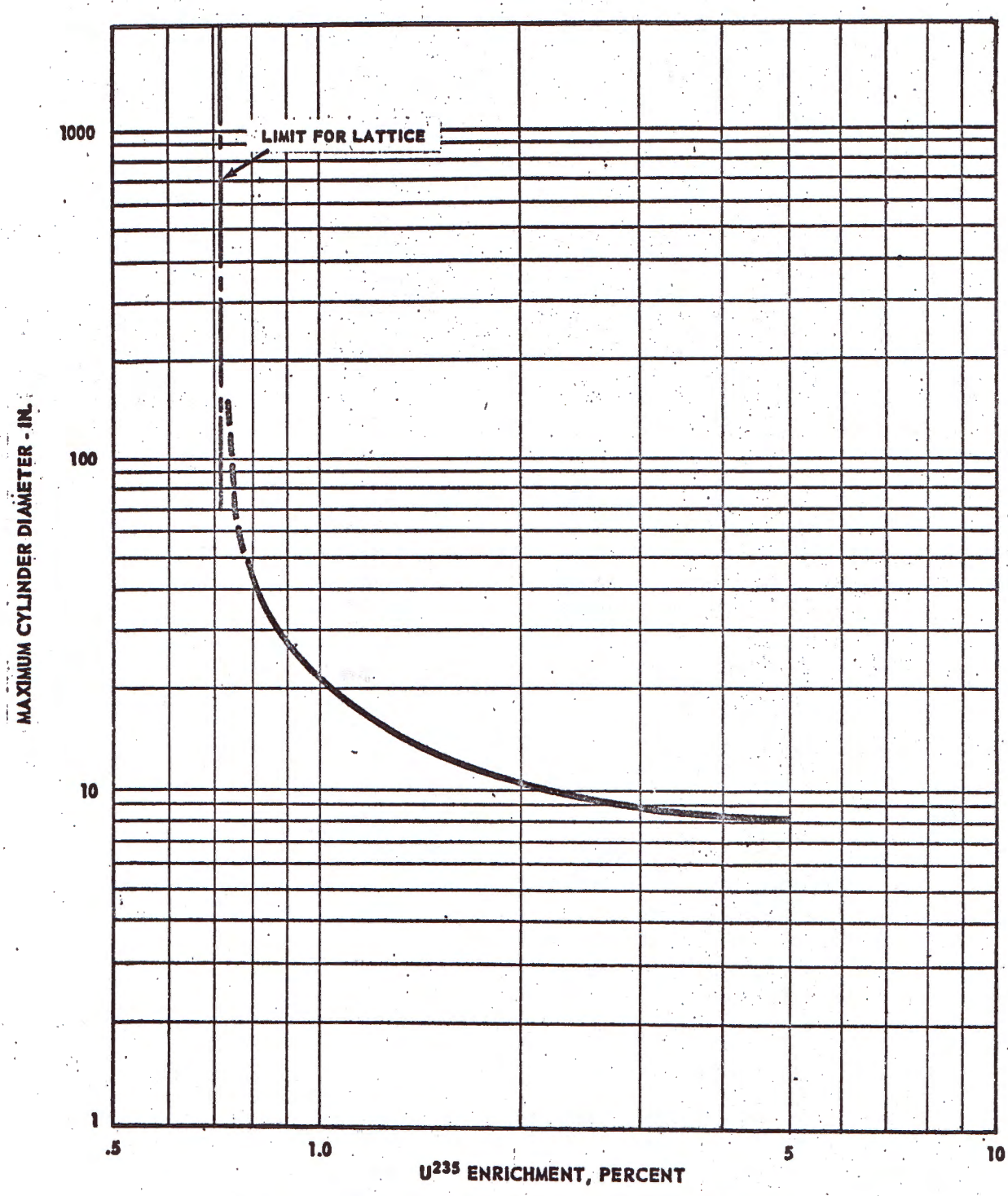


Fig. 21 MAXIMUM DIAMETER OF ISOLATED CYLINDER FOR URANIUM RODS IN LIGHT WATER, WATER REFLECTED

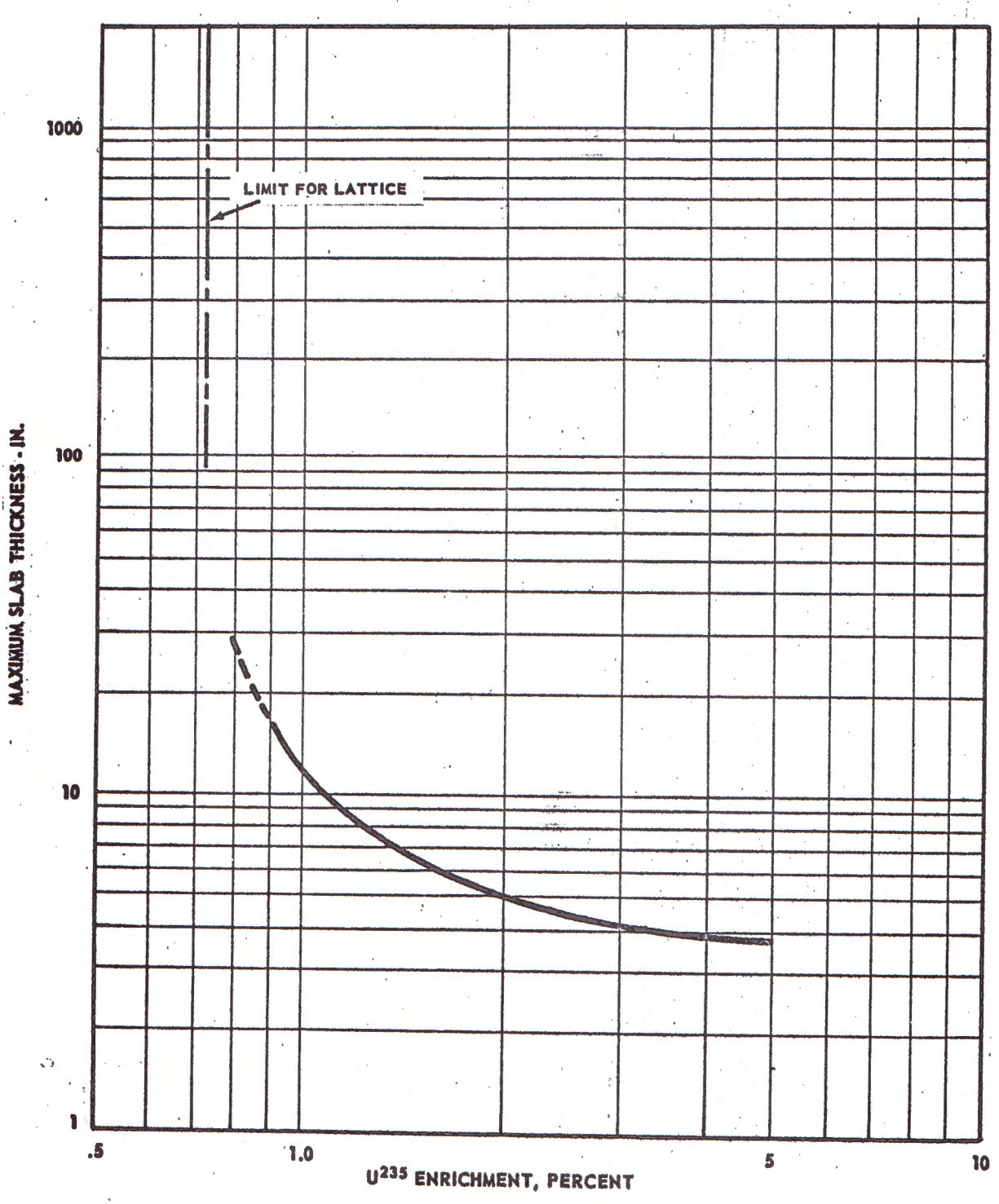


Fig. 22 MAXIMUM THICKNESS OF ISOLATED SLAB FOR LATTICES OF URANIUM RODS IN LIGHT WATER, WATER REFLECTED

§70.45 Other heterogeneous systems. Heterogeneous water moderated systems other than those described in §70.42, including systems which consist in whole or in part of uranium rods having an enrichment of greater than 5% of U-235, may be treated as homogeneous systems governed by §70.42 if the correction for effective density provided in §70.43(b) is applied.

§70.46 General mass and volume limits. The following mass and container volume limits for individual containers may be employed in any event, but allowance factors for variations in enrichment, density, dilution or shape of §70.43 may not be applied.

MASS AND CONTAINER VOLUME LIMITS FOR INDIVIDUAL UNITS

Degree of Moderation (H/X)		U^{235}	Pu	U^{233}
More than	Not more than	Mass Limits (in kilograms)		
-	2	10.0	2.5	2.8
2	3	9.0	2.5	2.5
3	5	7.3	2.5	2.2
5	10	5.2	2.5	1.8
10	20	3.6	2.4	1.3
		Volume Limits (in liters)		
20	-	3.6	2.4	1.3

§70.47 Special unit limits. The Commission may permit the establishment of limits other than those specified in §70.42 to 70.46, inclusive, when the sufficiency of the proposed limits is demonstrated by experimental data, calculations or plans for special controls. Adjustment factors for operating errors

and for uncertainties of measurement or calculation shall be included. The calculative method shall be verified by application to a system of known reactivity and of similar enrichment, composition, moderation and configuration.

CRITERIA FOR DETERMINING LIMITS FOR ARRAYS OF INDIVIDUAL UNITS

§70.51 General criteria of safety of arrays. Interaction among units of special nuclear material, determined in accordance with any of the criteria of §§70.41 to 70.47 inclusive, shall be so limited that criticality is precluded. An array of units of special nuclear material will be considered to be safe from criticality when the number of units in a single array is limited in accordance with §§70.52, 70.53, 70.54, 70.55 or 70.56, the spacing of individual units within the array complies with the requirements of the applicable one of those sections, and the array is isolated from other arrays in accordance with §70.57.

§70.52 Solid angle criteria

(a) The criteria in this section may be used to establish the minimum spacing requirements between units and the maximum number of individual units of special nuclear material within an array when,

(1) the array does not include any single mass of metal of 2 kilograms or more,

(2) each unit in the array is at least 12 inches from every other unit, and

(3) the value of the neutron multiplication factor (k) does not exceed 0.8 for any single unit.

(b) The maximum total solid angle subtended at any unit in an array by other units in the array is related to the neutron multiplication factor (k) of that unit in the following manner:

(1) if k is less than 0.3 the maximum total solid angle is six steradians;

(2) if k is not less than 0.3 but not greater than 0.8 the maximum total solid angle is a number of steradians equal to 9 minus 10 k.

(c) For purposes of this section the neutron multiplication factor (k) for a single unit shall be determined by assuming reflection provided by the container and any other immediately adjacent reflector other than a water reflector resulting from flooding, and assuming the most effective degree of moderation within the container which could result from accident, human error or leakage of water into the container. The neutron multiplication factor shall be determined by either of the following methods:

(1) calculation, verified by application to a system of known reactivity and of similar enrichment, composition, moderation and configuration, or

(2) assumption, in accordance with the following mass or geometry limits,

(i) when mass is the controlling limit of a unit, determined for a thick reflector by any of the methods in §§70.42 to 70.47 inclusive, k shall be 0.65;

(ii) when container volume, cylinder diameter or slab thickness is the controlling limit of a unit, determined for a thick reflector by any of the methods in §§70.42 to 70.47 inclusive, k shall be 0.8, except that k shall be 0.58 for a cylinder of inside diameter of 5 inches or less, containing a uranium compound or solution meeting the requirements of §§70.42(a) and 70.43(b).

(d) The solid angle (Ω) shall be determined as either,

(1) the solid angle subtended at the center of one unit by another unit, or

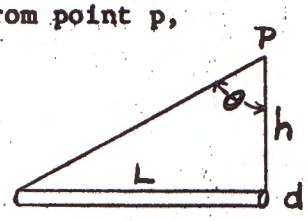
(2) an approximate solid angle determined in accordance with the following criteria:

(i) the cross-sectional area of a unit in a plane perpendicular to a line joining its center with the center of another unit divided by the square of the distance between its nearest surface and the center of the other unit,

$$\Omega = \frac{\text{CROSS SECTIONAL AREA}}{(\text{SEPARATION DISTANCE})^2}$$

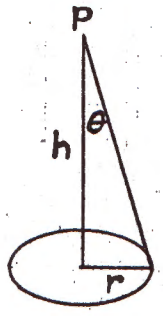
(ii) for a cylinder having a diameter d and subtending an angle (θ) at a point p at the center of the other unit, and having one end at the foot of a perpendicular of length h drawn from point p,

$$\Omega = \frac{d}{h} \sin\theta$$



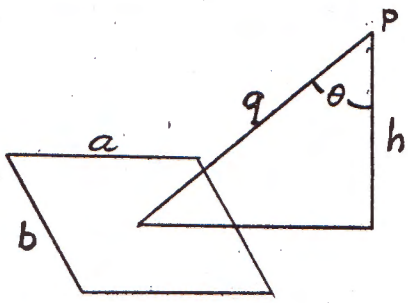
(iii) for a disc having a radius r which subtends an angle (2θ) at point p, and which lies in a plane perpendicular to a line h from point p to its center,

$$\Omega = 2\pi(1 - \cos\theta)$$



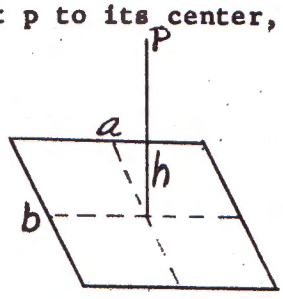
(iv) for a rectangle whose sides are a and b and the center of which is at a distance q from point p and at an angle (θ) from a perpendicular from p to its extended surface,

$$\Omega = \frac{ab\cos\theta}{q^2}$$



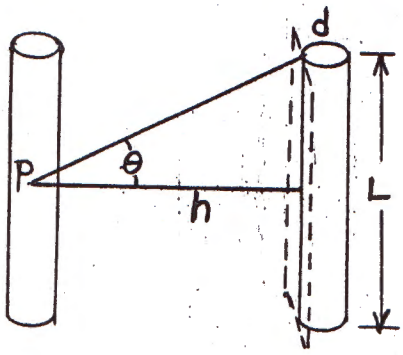
(v) for a rectangle whose sides are a and b, and which lies in a plane perpendicular to a line h from point p to its center,

$$\Omega = 4\sin^{-1}\frac{\left(\frac{a}{2}\right)\left(\frac{b}{2}\right)}{\sqrt{\left(\frac{a}{2}\right)^2+h^2}\sqrt{\left(\frac{b}{2}\right)^2+h^2}}$$



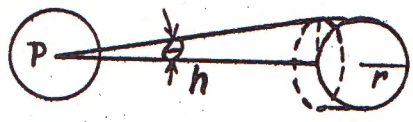
(vi) for a cylinder having a diameter d, whose axis is perpendicular to the line h from point p to its surface bisecting its length and whose length subtends an angle (2θ) at point p when the cylinder is represented by an orthographic projection on a plane tangent to the surface nearest point p,

$$\Omega = \frac{2d}{h}\sin\theta$$



(vii) for a sphere subtending an angle (2θ) at point p, when the sphere is represented by an orthographic projection of radius r on a plane tangent to the surface nearest point p,

$$\Omega = 2\pi(1-\cos\theta)$$



(e) In an array of three or more units the total solid angle subtended at any point by two or more units is the sum of the solid angles subtended by each of them except that a unit or portion of a unit which is shielded by another unit may be disregarded.

(f) In an array of identical units the solid angle shall be measured from the most nearly central unit.

(g) In an array of identical units where there is no identifiable most nearly central unit, or in an array made up of units which vary in multiplication factor, size or shape, the arrangement and spacing of the units shall be such that the total solid angle subtended at each unit by the other units shall not exceed the maximum allowable total solid angle corresponding to the neutron multiplication factor (k) of that unit.

§70.53 Spacing criteria for salts and solutions of uranium.

(a) an array of units of salts or solutions of uranium with the correspondence between effective density and degree of moderation specified in Figure 13, packaged in the containers specified in this section and not exceeding the specified maximum enrichment, may be spaced according to the following table except in the presence of graphite, beryllium or deuterium.

(b) A planar array may be spaced in accordance with this section only when containers are arranged on square pitch, with longitudinal axes of the containers parallel.

SPACING OF CONTAINERS OF SPECIFIED GEOMETRY
SALTS OR SOLUTIONS OF URANIUM

Common Containers		Maximum U-235 enrichment (%)	Minimum Edge-to-Edge Spacing, (ft.) Two Containers	Infinite Linear Array	Infinite Planar Array
4.8 liter volume		100	1	1	1
1.5" thick x 20' x20' slab		100	1	7	-
Cylindrical Containers					
Inside Diameter	Length				
5"	20'	100	1	2.5	4.5
5"	2.5'	100	-	1.25	1.5
5"	4'	100	-	1.5	2
8"	4'	12.5	-	3.5	4.5
10"	4'	5.9	-	4	5
12"	4'	3.75	-	4	5

§70.54 Spacing limits for storage in cubical array of individual units subject to General Mass and Volume Limits.

(a) Individual units which comply with the criteria of §70.46 may be stored in a cubical array, in numbers of units specified in Figure 23 of this section; depending on the minimum center-to-center spacing of units. Curve A of Figure 23 shall be employed when an array is fully reflected, and Curve B shall be employed where nominal reflection is assured.

(b) There shall in any event be a distance of at least 8 inches between adjacent surfaces of special nuclear material, regardless of the thickness of packaging.

§70.55 Spacing limits for certain arrays of individual units subject to general mass and volume limits.

(a) Individual units which comply with the criteria of §70.46 may be stored in an array, which is other than a cubical array as defined in §70.54, in accordance with the provisions of this section.

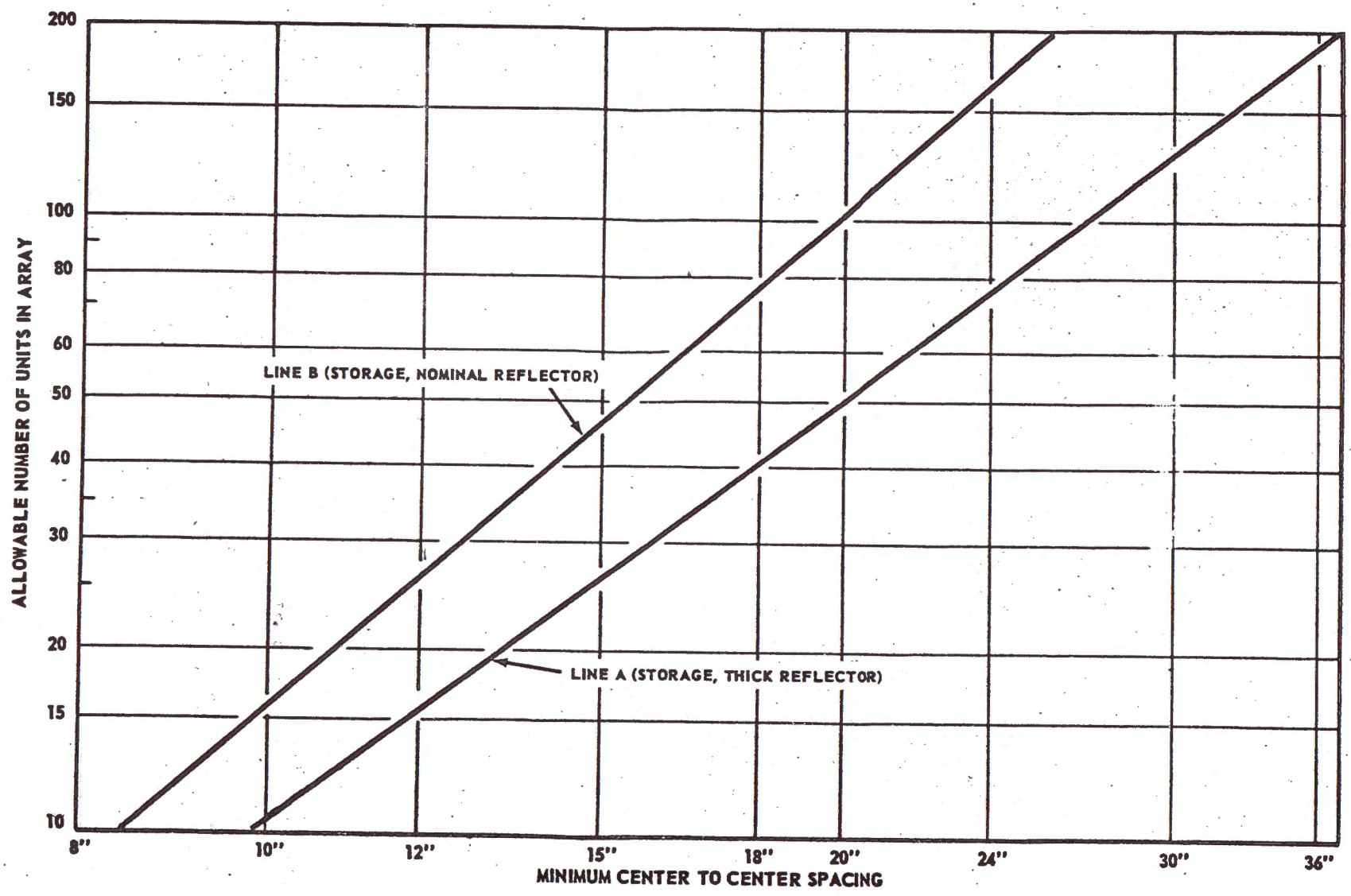


Fig. 23 ALLOWABLE NUMBER OF UNITS DEPENDING ON SPACING IN CUBIC ARRAYS

(b) There shall in any event be a distance of at least 8 inches between adjacent surfaces of special nuclear material, regardless of the thickness of the packaging.

(c) Two planar arrays shall be regarded as a single array if the distance between them is not greater than 7-1/2 feet.

Type of Array	Minimum center-to-center Spacing of Units (Inches)	Storage Limit Per Array, Number of Units
Isolated Linear or Planar Array	16	No limit
Two or more planar arrays separated by at least 7.5 feet	30	120 in each array 240 total
	24	90 in each array, 180 total
	20	50 in each array, 100 total

§70.56 Special array limits. The Commission may accept mathematical calculations demonstrating the nuclear safety of an array other than the limits prescribed in §§70.52 to 70.55 inclusive, if the calculative method is verified by application to a system of known reactivity and of similar enrichment, composition, moderation, reflection and configuration. The calculations shall include adjustment factors for operating errors and for uncertainties of measurement or calculation.

§70.57 Isolation Criteria

(a) An array of special nuclear material may be considered isolated from another array of special nuclear material if the separation is greater than the larger of the following distances:

(1) twelve feet, or

(2) the greatest distance across an orthographic projection of either array on a plane perpendicular to a line joining their centers.

(b) An array may be considered to be isolated if it is separated from all other special nuclear material by at least the equivalent of 8 inches of concrete of a density of 140 pounds per cubic foot.

(c) A linear array may be considered to be isolated from another linear array, regardless of length if the two arrays are separated by a distance of at least 12 feet.

LICENSES

§70.71 Issuance of licenses

(a) On determining that an application meets the requirements of the Act and of the regulations of the Commission, the Commission will issue a license in such form and with such conditions and limitations as it deems necessary or proper to effectuate the purposes of the Act.

(b) Allocation procedures.

(1) The Commission may include in licenses issued pursuant to Section 53 of the Act provisions as to availability to the licensee, as needed, of the quantities of special nuclear material required for conduct of the activities authorized. Such provisions usually will be in the form of a statement that the Commission has allocated to the licensee, for use in the conduct of such activities, a designated quantity or quantities of special nuclear material, and may include an estimated schedule for a reasonable period of time of special nuclear material to be transferred to the applicant and to be returned to the Commission.

(2) Provisions allocating special nuclear material will not be included in a license when the special nuclear material is to be charged to a quantity allocated to another licensee. Unless other arrangements are made with the Commission, special nuclear material transferred to a licensee to be fabricated or processed for another licensee will be charged to the quantity allocated in the latter's license.

(c) A license issued for use of special nuclear material in activities in which special nuclear material will be produced shall, subject to the provisions of §70.81(b), be deemed to authorize such persons to possess, use, and transfer the special nuclear material produced in the course of the authorized activities.

(d) No license will be issued

(1) for a use which is not under the jurisdiction of the United States; or

(2) if the Commission finds that the distribution of special nuclear material to the applicant would be inimical to the common defense and security.

§70.72 Conditions of licenses.

(a) A license shall expire at the time specified in the license and shall be deemed to contain and be subject to the following conditions;

(1) title to all special nuclear material shall at all times be in the United States;

(2) no right to the special nuclear material shall be conferred by the licensee except as defined by the license;

(3) neither the license nor any right under the license shall be assigned or otherwise transferred in violation of the provisions of the Act;

(4) all special nuclear material shall be subject to the right of recapture or control reserved by section 108 and to all other provisions of the Act;

(5) no special nuclear material may be used in any utilization or production facility except in accordance with the provisions of the Act;

(6) the licensee shall not use the special nuclear material to construct an atomic weapon or any components of an atomic weapon;

(7) except to the extent that the indemnification and limitation of liability provisions of section 170 of the Act apply, the licensee will hold the United States and the Commission harmless from any damages resulting from the use or possession of special nuclear material by the licensee.

(8) the licensee shall be subject to and shall observe all applicable rules, regulations and orders of the Commission.

(b) The Commission may incorporate in any license such additional conditions and requirements with respect to the licensee's receipt, possession, use and transfer of special nuclear material as it deems appropriate or necessary in order to:

(1) promote the common defense and security;

(2) protect health and minimize danger to life or property;

(3) protect restricted data;

(4) guard against the loss or diversion of special nuclear material;

(5) require such reports and the keeping of such records, and provide for such inspections, of activities under the license as may be necessary or appropriate to effectuate the purposes of the Act and regulations thereunder.

(c) if the special nuclear material license authorizes possession of special nuclear material containing more than 300 grams, computed by adding the weight of any U-233 and of any plutonium to 0.6 times the weight of any U-235, the license shall be deemed to contain and shall be subject to the following conditions:

(1) the licensee shall maintain current records which shall be kept available for inspection by the Commission at the address specified in the license, showing the location and quantity of special nuclear material at each licensed place of use;

(2) prior to the use of any special nuclear material in processing or storage, the licensee shall have clearly designated in writing and made known to all personnel concerned the responsibility for control of the material at each phase of the processing or storage;

(3) the licensee shall not permit any person to perform any operation involved in the processing or storage of the special nuclear material until he has received copies of, and instructions in, the licensee's operating and emergency procedures and shall have demonstrated understanding of them.

§70.73 Expiration. Except as provided in §70.74(b) and as may be provided in licenses issued for operation of production or utilization facilities pursuant to Part 50 of this chapter, a specific license shall expire no later than three years from the last day of the month in which it is issued.

§70.74 Renewal of license.

(a) An application for renewal of a license shall be filed in accordance with §§70.21 and 70.22.

(b) When a licensee, not less than thirty (30) days prior to expiration of an existing license, has filed an application in proper form for renewal of the license, the existing license shall not expire until the application for a renewal has been finally determined by the Commission.

§70.75 Amendment of license. An application for amendment of a license shall be filed in accordance with §§70.21 and 70.22 and shall specify the respects in which the licensee desires his license to be amended and the grounds for the amendment.

§70.76 Commission action on application to renew or amend. In considering an application by a licensee to renew or amend his license, the Commission will apply the standards and criteria prescribed by §§70.31 to 70.57, inclusive.

§70.77 Inalienability of licenses. No license granted under the regulations in this part, and no right to possess or utilize special nuclear material granted by any license issued pursuant to the regulations in this part, shall be transferred, assigned or in any manner disposed of, either voluntarily or involuntarily, directly or indirectly, through transfer of control of any 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 shall give its consent in writing.

§70.78 Reduction and termination of allocations.

(a) 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 licensee pursuant to §70.71, on the ground that the quantities allocated exceed those reasonably required, or estimated to be required, for conduct of the activities authorized by the license.

(b) The expiration, revocation or other termination of a license shall terminate all special nuclear material allocations incorporated in it, or issued in connection with it.

ACQUISITION, USE AND TRANSFER

§70.81 Authorized use.

(a) A licensee shall confine his possession and use of special nuclear material to the locations and purposes authorized in his license.

(b) The possession, use and transfer of any special nuclear material produced by a licensee, in connection with or as a result of use of special nuclear material received under his license, shall be subject to the provisions of the license and the regulations in this part.

(c) Nothing in the regulations in this part or in any license issued pursuant to the regulations in this part shall authorize or be deemed to authorize (1) the distribution of any special nuclear material to any person for a use which is not under the jurisdiction of the United States or (2) the export from or import into the United States of any special nuclear material.

§70.82 Transfer.

(a) No licensee shall transfer special nuclear material except as authorized by this section.

(b) A licensee may transfer special nuclear material:

(1) to the Commission;

(2) to a licensee whose license authorizes him to receive such special nuclear material; or

(3) as otherwise authorized by the Commission in writing.

(c) The transfer of amounts of special nuclear material in excess of those specified in §70.3(b) shall not be undertaken until the shipping procedures for the transfer have been approved by the Commission pursuant to the requirements of Parts 71 and 72 of this chapter.

RECORDS, REPORTS AND INSPECTIONS

§70.91 Records. A licensee shall keep records showing the receipt and transfer of special nuclear material.

§70.92 Reports of accidental criticality or loss of special nuclear material. In addition to the requirements for reporting incidents specified in §20.405 of this chapter, a licensee shall immediately notify the Director of the Atomic Energy Commission Regional Compliance Office designated in Appendix D of 10 CFR 20 of any occurrence of accidental criticality or any loss of special nuclear material other than normal operating loss.

§70.93 Material status reports.

(a) A licensee shall submit to the Commission on Form AEC-578 reports concerning special nuclear material distributed by the Commission pursuant to section 53 of the Act and received, transferred or possessed by the licensee or for which he is financially responsible. Reports shall be made as of December 31 and June 30 of each year, and shall be filed with the Commission within 30 days after the end of the period covered by the report, except that any licensee who during the six months preceding June 30 had

losses or burnup of less than ten grams of special nuclear material and did not receive or transfer any special nuclear material or financial responsibility for it need file only an annual report as of December 31. The Commission may permit a licensee to submit material status reports at other times when good cause is shown.

(b) The Commission may in addition require that a licensee submit Form AEC-578a, "Material Activity Schedule" as a reconcilation schedule for special nuclear material for which one licensee is financially responsible to the Commission but which is in the physical possession of another licensee. When Form AEC-578a is required, it shall be signed by both licensees.

§70.94 Material transfer reports. A licensee who transfers, and a licensee who receives, special nuclear material shall promptly submit to the Commission Form AEC-388 reports concerning each transfer of special nuclear material which has been distributed by the Commission pursuant to section 53 of the Act.

§70.95 Inspections.

(a) A licensee shall afford to the Commission at all reasonable times opportunity to inspect special nuclear material and the premises and facilities in which special nuclear material is received, possessed, used or transferred.

(b) A licensee shall make available to the Commission for inspection, on reasonable notice, records kept by him pertaining to his receipt, possession, use or transfer of special nuclear material.

§70.96 Tests. A licensee shall perform, or permit the Commission to perform, such tests as the Commission deems appropriate or necessary for the administration of the regulations in this part, including tests of (a) special nuclear material, (b) facilities in which special nuclear material is utilized, produced or stored, (c) radiation detection and monitoring instruments, and (d) other equipment and devices used in connection with the production, utilization or storage of special nuclear material.

MODIFICATION AND REVOCATION OF LICENSES

§70.101 Modification and revocation of licenses.

(a) The terms and conditions of all licenses shall be subject to amendment, revision, or modification by reason of amendments to the Atomic Energy Act of 1954, or by reason of rules, regulations or orders issued in accordance with the Act or any amendments thereto.

(b) Any license may be revoked, suspended or modified, in whole or in part, for any material false statement in the application or any statement of fact required under section 182 of the Act or because of conditions revealed by such application or statement of fact or any report, record, or inspection or other means which would warrant the Commission to refuse to grant a license on an original application or for violation of, or failure to observe any of the terms and conditions of the Act or the license or of any rule, regulation or order of the Commission.

(c) Upon revocation, suspension or modification of a license, the Commission may immediately retake possession of all special nuclear material held by the licensee. In cases found by the Commission to be of extreme importance to the national defense or security, or to the health and safety of the public, the Commission may recapture any special nuclear material held by the licensee prior to any of the procedures provided under the Administrative Procedure Act.

(d) Except in cases of willfulness or those in which the public health, interest or safety requires otherwise, no license shall be modified, suspended or revoked unless, prior to the institution of proceedings therefor, facts or conduct which may warrant such action shall have been called to the attention of the licensee in writing and the licensee shall have been accorded opportunity to demonstrate or achieve compliance with all lawful requirements.

§70.102 Suspension and operation in war or national emergency. 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,

(a) suspend any license it has issued;

(b) order the recapture of special nuclear material distributed;

(c) order the operation of any licensed facility;

(d) order entry into any plant or facility in order to recapture special nuclear material or to operate the facility. 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

§ 70.111 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.

FOR THE ATOMIC ENERGY COMMISSION

Woodford B. McCool
Secretary

Dated at Germantown, Maryland this

15th day of February, 1963.