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U.S. ATOMIC ENERGY COMM.
OFFICE OF THE SECRETARY
PUBLIC PROCEEDINGS BR.

IN REPLY
REFER TO: N-2

19 April 1963

Mr. Woodford B. McCool, Secretary
U. S. Atomic Energy Commission
Washington 25, D. C.

Dear Mr. McCool:

The enclosed remarks about 10 CFR Parts 70 and 71 as proposed in the FEDERAL REGISTER of March 5 are in response to the general invitation for comment.

Sincerely yours,

Hugh C. Paxton

Hugh C. Paxton

HCP:mjl

Encl: As noted above.

Distribution:

W. B. McCool w/3 cys. encl.
C. C. Campbell w/encl.
K. F. Hertford w/encl.
L. R. Rogers w/encl.
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thru R. E. Schreiber

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11 April 1963

CRITICALITY ASPECTS OF PROPOSED 10 CFR PARTS 70 AND 71, THE FEDERAL REGISTER, MARCH 5, 1963

GENERAL COMMENTS

The basic problems with 10 CFR Parts 70 and 71 as proposed in the Federal Register of March 5, 1963, are the complete inflexibility implied by the detail requested in a license application, and the inclusion of arbitrary nuclear safety rules under the guise of "standards" and "guides." Actually, the only pertinent standard that exists is ignored, the ASA-ANS "Standard for Operations with Fissile Materials Outside Reactors." This standard is qualitative because general numerical limits are not yet sufficiently firm for industry-wide acceptance. The quantitative rules in Parts 70 and 71 are based on the "Nuclear Safety Guide," TID-7016, Rev. 1, but restricted so as to reduce even the limited generality of the Guide.

Deficiencies of the Nuclear Safety Guide are recognized in the following statement from its Foreword: "The recommendations in the Guide are intentionally conservative, and they may, therefore, be applied directly and safely provided the appropriate restrictions are met. In this usage it is believed that the Guide will be of value to organizations whose activities with fissile materials are not extensive. The Guide is also expected to be a point

of departure for members of established nuclear safety teams, experienced in the field, who can judiciously extend the specifications to their particular problems." That TID-7016 Revision 1 is at least two years out of date is indicated by plans for Revision 2 which are at least that old. Developments in nuclear safety are such that an effective guide must grow continually.

Criteria from which rules may be obtained are not stated in either Part. This is a particularly serious omission in Part 71, for transportation conditions are so ill-defined that they do not lead directly to criticality limits. There should be included the somewhat idealized conditions that must be assumed for criticality evaluation, chosen by experts on transportation and packaging so as to best represent their experience and judgement. Then any competent nuclear safety team can establish criticality limits that will satisfy these criteria. Without general guidance, there is no basis for supplementing the rather arbitrary and incomplete rules of Part 71. (Though the criteria underlying Part 70 can almost be deduced from the rules, it would be better if they, too, were stated.)

As contrasted with basic criteria, specific rules for safe transportation require a staggering effort if

they are to be at all realistic and complete. The impressive investigations of critical arrays exemplified by ORNL experiments and UK-French Monte Carlo calculations apply to many specific situations of interest (that are not included in Part 71), and offer hope of some generalization. At the same time, they show that years of development can go into rules that cover such things as Class II shipments of low-enrichment uranium, and truly general Class I specifications. In the meantime, logical regulations should stress basic criteria so that individual problems can be covered as realistically as possible.

It is probable that the proposed regulations would establish a more than adequate level of safety, but at a cost including the stagnation of improvement in safety criteria as well as the sacrifice of significant economies in many processes of the US nuclear industry. Licensee operations of the type that we are considering are necessarily restricted under the existing system, and the proposals discourage any change in the system. No important technological development in the bulk chemical processing of fissile material is to be expected of Licensees as long as the primary responsibility for nuclear safety remains with the Commission. A time scale that makes process development worthwhile is denied the Licensee by splitting off a part of the development as inherent as nuclear safety. At present, Licensees

may be "--organizations whose activities with fissile materials are not extensive," and even the emasculated version of the Nuclear Safety Guide may be adequate for them. If, however, Licensees are to contribute to the growth of the industry and make use of advances in the level of knowledge in the field of criticality safety, it is vital that the Government plan toward a degree of flexibility in federal regulations which will encourage the expeditious application of such advances.

SPECIFIC COMMENTS

The following specific remarks are for the purpose of documenting the general comments about proposed Parts 70 and 71. There is no implication that changes of detail can solve the problems associated with these proposals.

Illustration of inflexibility

70.25(b)(1)-(4): The detail demanded here effectively rules out all flexibility. Broad ranges of conditions could be effective in criticality control, yet permit process improvements without time-consuming renegotiation.

Though the generalities of 70.25(b)(5) about alarm system and emergency procedures make sense, the arbitrary detail of 70.34 and the specific requirements of 70.35 can lead to unjustifiable situations. More than 300 grams, for example, as metallographic samples in quite normal environment, may require neither alarm nor emergency procedure. There is no allowance for processing irradiated fuel, where γ-activity and the shielding required for it should influence both instrument characteristics and emergency plans. It seems that the arbitrary requirement of a drill at least once every three months should depend upon local conditions.

Major examples of rules that must grow

70.42(b): Figures 5-8 apply to idealized solutions and mixtures of plutonium with limited Pu^{240} content. Much larger limits are anticipated for practical solutions of plutonium from high-burnup reactor fuel.

70.43(c)(2): Figure 15 is only a summary, and may be replaced by detailed curves of critical parameters vs H/U^{235} for uranium of various U^{235} enrichments.

70.43(d): The shape allowance factors of Figure 16 are minimum values and may be expanded to apply more realistically to various specific materials.

70.43(f): Figure 18 is an incomplete summary.

70.46, 71.52(c), 71.62(a): The tables are extremely incomplete. Expansion would include cylinder-diameter limits and a breakdown in terms of U^{235} enrichment.

70.53(b): As indicated by ORNL data, the spacings in the table for 5" containers are too restrictive.

70.54(a): ORNL experiments show that Figure 23 is much too restrictive for many classes of units.

70.55(c): The values in the table are too restrictive in view of individual unit limits of 70.46.

71.33(a), 71.41(a), 71.42: Except for the materials of 71.41(b), Class I is defined specifically in terms of the UK package. This container was designed without regard for uranium at enrichments in the power reactor

range, for which great simplification is possible.

Shielding up to 0.3 electron volts (71.41a) implies cadmium, which, according to E. R. Woodcock of the UKAEA, sometimes disappears during long contact with wood. Substitute poisons that are being tested in the UK may leave us high and dry with this inflexible Class I requirement.

How are leakage spectra to be compared, as required by 71.41(a)?

71.43(a)(4), (b)(1): Note that the U^{235} enrichment limit of 92.5% leaves no provision for most highly enriched uranium in the US.

71.66(b): Large quantities of D_2O, Be, or graphite can be tolerated.

Distortions of the "Nuclear Safety Guide"

70.42(a), (b), (c): Figures 1, 5, and 9 contain a "treaty" factor of safety to cover double-batching errors (which are by no means unique). Unlike the "Nuclear Safety Guide," these rules contain no relief for cases in which double-batching can be ruled out.

70.46, 71.52(c), 71.62(a): Again, the tables include allowance for double-batching, from which there is no relief. (Note that 71.22(ℓ)(2) requires confirmation that packages are loaded properly.)

70.54(a): Figure 23 was designed to apply to larger units than those of 70.46 (see TID-7016).

70.55(c): This table, also, applies to larger units than those of 70.46 (see TID-7016). As used, it is much too restrictive.

71.41(b)(1), (2), (3): The H/X limits contain a factor of safety of two or more, presumably to cover analytical errors. A factor of ten allowance would be more logical. Again, note the requirement of 71.22(ℓ)(2) that package contents be confirmed.

Unnecessary rules

70.33(f)(1), (2): The requirements of (f)(3) are sufficient.

70.43(b), 71.52(c): There appear to be no practical cases in which $\rho > \rho_0$.

71.52(a): This is unnecessary in view of (b).

71.52(b)(4): For Class II, there is no point to the minimum spacing of 4", as optimum moderation between packages cannot be ruled out.

71.65(a), (b): These are unnecessary in view of the test requirements of (c).

71.65(c): Limits can be provided for packages without birdcages.

More arbitrary rules

70.33(d): The 12-ft. spacing is excessive for many cases. It should be permissible to store uranium powder

or chips under liquids other than oil or water.

70.33(e): The performance requirement is unnecessary for (e)(2) and (e)(3).

70.43(e): The cutoff of curves in Figure 17 is arbitrary.

70.52(a): Limitations (1) and (2) are arbitrary and overrestrictive.

70.54(b), 70.55(b): The 8" minimum spacing is not necessary for many situations. For example, it has been shown experimentally that large numbers of storage units of Rover fuel are safe without spacing.

70.57: The isolation criteria are arbitrary and subject to refinement.

71.52(b)(1), (3), 71.65(c)(1), (3): The limit of 10% in spacing reduction is unnecessary, as limits can be adjusted to any final volume.

71.64: It is difficult to guess the reason for limiting this to insoluble compounds and metals.

71.65(c)(4): The 6" spacing is unnecessarily large, even for effective isolation when packages are flooded by water.

<u>A suggestion</u>

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

Maybe it is time to consider a more realistic

definition such as, "Nuclear safety means the protection of persons and property from the effects of a fission-chain reaction." The phrase, "generally by the avoidance of accidental criticality," might be added.

In shielded facilities, particularly for processing irradiated fuel, it may be economically desirable to relax nuclear safety restrictions provided there are inherent limitations to excursion yields (as by restricted flow rates into vessels). Such economic advantage cannot be realized until the stigma of "accidental criticality" is removed. In this vein, it is suggested that the "report of accidental criticality" (70.92) should be relieved where shielding protects personnel and there is no significant damage or material loss.

It may be noted that 70.41(g) does not mention soluble poisons, which may be acceptable for certain processes in shielded facilities.

Other comments

70.31: Even a release of less than 300 grams of plutonium should be avoided.

70.32: Only (c) is clear, and in it "wherever possible" is too strong. It is frequently impracticable, but not impossible, to eliminate procedural or administrative controls.

70.41(e): "Minimal" reflector serves only as a guideline (which does the Licensee no good as long as the Commission does all his thinking about safety).

70.42: C. E. Newlon (K-1550) has developed a numerical limit for particle size of material that will be effectively homogeneous when mixed with water.

70.45: The homogeneous approximation may not be conservative for uranium of U^{235} enrichments down to 5%.

71.42(a)(2): Some authorities consider the standard 1 hour fire unrealistic.

71.43: Woodcock of the UK states that wood-sampling for Class I containers has proven unsatisfactory, which should imply that the detail of Figures 1 and 2 is not justified.

71.52(c), 71.64(c): There is no allowance for containers that will not leak (as with independent, well-designed seals). This is inconsistent with 71.42(a), which makes such allowance for Class I packages.

71.65(d): For Class III shipment, proper tiedowns should be a satisfactory alternative to the tripod.

We are uncertain of some of the above interpretations, for the proposed regulations are so involved as to be difficult to follow in their detail.

RECOMMENDATIONS

We agree with the attached statement by the LASL Safety Director, notably, that the form of the proposed regulations associates an undeserved risk level with atomic energy.

We recommend that guides be separated from regulations, and we oppose the arbitrary modification of existing guides such as TID-7016 and TID-7019. If these documents fail in the purpose for which they are intended, the most constructive approach by the AEC would be to participate vigorously in revisions that make them acceptable. We recognize the desirability of making available to Licensees the specific rules of the Division of Licensing and Regulation, but urge a separate document such as that which provides guidance for reactor siting.

We recommend, further, that regulations stress criteria for establishing nuclear safety controls in terms of pertinent critical data. Sources of such criteria are the ASA-ANS "Standard for Operations with Fissile Materials Outside Reactors," generalized portions of the "Nuclear Safety Guide," and, for shipping, outputs of the Interagency Committee on Transportation of Radio-

active Materials. The often-voiced need for uniform transportation regulations is satisfied by a common set of basic nuclear safety criteria. The solution to any individual shipping problem, however, will depend upon container design details and the appropriateness of available critical data, and is not amenable to generalization.

The LASL Nuclear Criticality Safety Committee

R. J. Bard

B. L. Moore

H. C. Paxton

R. Reider

D. R. Smith

W. R. Stratton

4-11-63

COMMENT ON FEDERAL REGISTER 10 CFR 70 AND 71

I urge consideration for the withdrawal from the Federal Register of details dealing with nuclear criticality safety.

The Federal Government has historically demonstrated an enlightened concern with explosives safety; it has managed to fulfill its responsibilities in the field of explosives safety without recourse to establishing detailed rules with the force of law in the Federal Register. Executive agencies have provided direction and leadership in explosives safety with such examples as "Ordnance Safety Manual" Ordnance Corps, Department of the Army and "Ammunition Ashore," OP-5, of the U. S. Navy. The Atomic Energy Commission, for example, has endorsed the Ordnance Safety Manual as a standard to be employed by its contractors.

The chemical industry has done an outstanding safety job through the use of industry standards. The Manufacturing Chemists' Association, Inc., has through its Safety and Fire Protection Committee promulgated such standards as Chemical Safety Data Sheets and Safety Guides for Recommended Safe Practices and Procedures. Such standards have done a good job in controlling the impact of unique technical risk on the public.

I believe that 20 years of large scale nuclear technology has not demonstrated that the atomic energy industry of the United States is any more hazardous than the explosives or chemical industry. I believe that the Atomic Energy Commission in using the Federal Register as an instrument for establishing detailed safety rules is assigning an undeserved risk level to atomic energy and thus may inhibit development and growth of a vital industry without any clear reduction in potential risk.

Roy Reider

LASL Safety Director

4-12-63

Hugh C. Paxton

UNIVERSITY OF CALIFORNIA
LOS ALAMOS SCIENTIFIC LABORATORY
(Contract W-7405-Eng-36)
P. O. BOX 1663
LOS ALAMOS, NEW MEXICO

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Mr. Woodford B. McCool, Secretary

U. S. Atomic Energy Commission

Washington 25, D. C.