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AVAILABILITY OF NUCLEAR STANDARDS INFORMATION

Wm. B. Cottrell

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AVAILABILITY OF NUCLEAR STANDARDS INFORMATION

(Talk Prepared for Presentation at the American Nuclear Society — Executive Conference on Nuclear Standards, April 30 — May 2, 1972)

by
Wm. B. Cottrell

JULY 1972

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AVAILABILITY OF NUCLEAR STANDARDS INFORMATION

Introduction

For the past ten years those in the forefront of the nuclear standards business have been primarily concerned with the necessity of selling the standards concept and with the implementation of standards developing processes. Although these two concerns still persist, both have received considerable attention and emphasis so that enlightened technical management in the nuclear industry today should have little trouble justifying support for such endeavors. At the same time, however, the number of organizations and technical societies whose standards are involved, and indeed the numbers of standards themselves, are such that it is not an easy task to find out what standards are available for a particular project. This then is the purpose of this paper.

In discussing the availability of nuclear standards, I choose not to make a distinction between code or standard, regulation or guide, criterion or specification. In specific applications, each of these terms may have a specific meaning which is generally associated with the application. We are concerned here with the availability of the documentation whatever its designation and regardless of the application. Thus unless otherwise specified the term "standard" in the paper will include all of the aforementioned types of documents.

As noted nuclear standards exist in many guises (as codes, guides, etc.) and may or may not be published in an approved form when needed. For the purpose of this discussion a nuclear standard is any standard which is relevant to nuclear technology in some uniquely nuclear manner (e.g., concerned with nuclear facilities, nuclear materials, radiation, etc.). It has been variously estimated that from 2000[1] to 5000[2] standards are required for a typical reactor power plant, whereas at the present time only some 560 existing nuclear standards can be identified. Those required and existing standards are tabulated in Table 1 for various technical areas. Considerable uncertainty appears to exist as to the number of the required standards. However, these numbers may be

Table 1. Number of Standards Existing and Estimated Total Required for a Typical Reactor Power Plant

Area	Estimated Number Required[2]	Existing[3]
Materials and testing	600 – 1200	297
Design	200 – 400	101
Electrical and instrumentation	600 – 1000	55
Equipment and processes	1400 – 2400	107
	Total 2800 – 5000	560

reconcilable if one accepts that they are only estimates and that the scopes of standards yet to be written may be broad or narrow.

If our interest in the availability of nuclear standards is limited to "existing" standards our task assumes one dimension; if our interest extends to proposed standards still under development or perhaps only under consideration our task assumes another dimension. In instances where no consideration has yet been given to the "standard" in question the availability of relevant information would presumeably be of interest and that poses a different problem. "Relevant" in the context used here, connotes not only a technical relevance, but some basis for evaluation. I shall attempt to address this paper to the availability of information at all three levels of development ie.,1) existing standards, 2) standards under development, and 3) areas not yet subject to standards development.

In order to develop an adequate background for the problem of locating standards information, this paper will discuss briefly the following topics in the order listed – Organizations Producing Nuclear Standards; Standards Compilations, Catalogs and Indexes; and Information Centers. This will be followed by a discussion of some of the practical aspects of obtaining standards information and the conclusions of this paper.

Organizations Producing Nuclear Standards

The number of organizations producing nuclear standards is of course a function of the definition of nuclear standards. While there are over 400 nongovernment standards-producing organizations in the United States[4] less than 25 have produced all the nuclear standards released to date. In general, these are technical societies or industrial research groups. The nongovernmental organizations which are active in nuclear standards work are shown in Table 2 together with the total of existing standards, and the standards under development by each organization.

One can get some idea of the extent of the nuclear interests of the various organizations by the number of standards each has prepared. However, this is certainly not a completely valid "involvement index." In the case of ASME, for example, the "Boiler and Pressure Vessel Code; Section III - Nuclear Vessels" is listed as a single standard, whereas in term of scope, size, and effort, it is an order of magnitude greater than the average standard.

Another measure of organizational involvement with nuclear standards is readily apparent from examination of the number of approved standards as a function of time. Such information for several nongovernmental organizations is presented in Figure 1. Similar information for the three governmental organizations principally concerned with nuclear standards is presented in Figure 2. The three governmental organizations are the National Bureau of Standards, the Environmental Protection Agency (which now includes the Federal Radiation Council) and the United States Atomic Energy Commission.

There are several other difficulties with any standards total, as reported above, such as, the duplication that may exist between a criterion which supplements a regulation, and a specification which further defines criterion. Yet other difficulties are in deciding whether or not a given standard is "nuclear" and in determining whether or not some work is in progress. With the above reservations in mind, it is of interest to note that a recent compilation[3] identifies approximately 370 existing nuclear standards with another 250 under development — exclusive of standards work sponsored by the US Government. On the other hand

Table 2.[a] Nongovernmental Organizations Active in Nuclear Standards

Organizations	No. of Existing Standards[b]	No. of Standards under Development
1. Air Pollution Control Assoc.	0	0
2. Am. Assoc. for Contamination Control	3	1
3. Am. Bureau of Shipping	1	0
4. Am. Conf. of Government Ind. Hygiene	4	0
5. Am. Concrete Institute	0	1
6. Am. Industrial Hygiene Assoc.	1	0
7. Am. National Standards Institute	40	172
8. Am. Nuclear Society	10	38
9. Am. Petroleum Institute	3	0
10. Am. Society of Civil Engr.	1	4
11. Am. Society of Mechanical Engr.	8	2
12. Am. Society of Testing and Materials	164	7
13. Am. Welding Society	5	0
14. Assoc. of Nuclear Instrument Mfg., Inc.	0	0
15. Inst. of Electrical and Electronics Engr.	9	22
16. Inst. of Nuclear Materials Management	0	0
17. Inst. Society of America	5	0
18. Mfgs. Standardization Soc. of the Valve and Fitting Industry	25	0
19. National Academy of Sciences	11	0
20. Nat. Council on Radiation Protection and Measurement	24	1
21. National Elect. Mfg. Assoc.	0	0
22. National Fire Protection Assoc.	2	0
23. National Sanitation Foundation	1	0
24. Society of Naval Architects and Marine Engr.	1	0
25. Underwriters Lab., Inc.	3	0

[a]Data in this table were taken from reference #3.

[b]The standards considered as "existing" include those listed as, "Tentative" and "Under Revision" as well as "Approved."

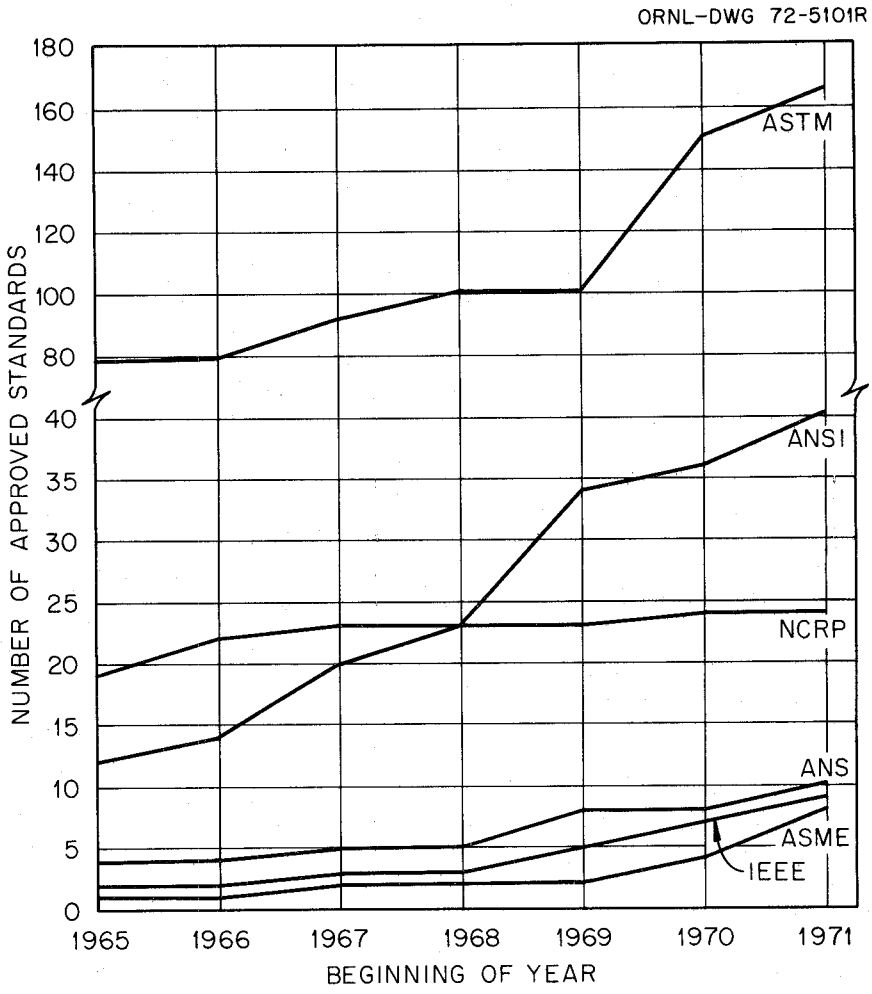

Fig. 1. Cumulative Listing of Approved Nuclear Standards by Non-government Organizations.

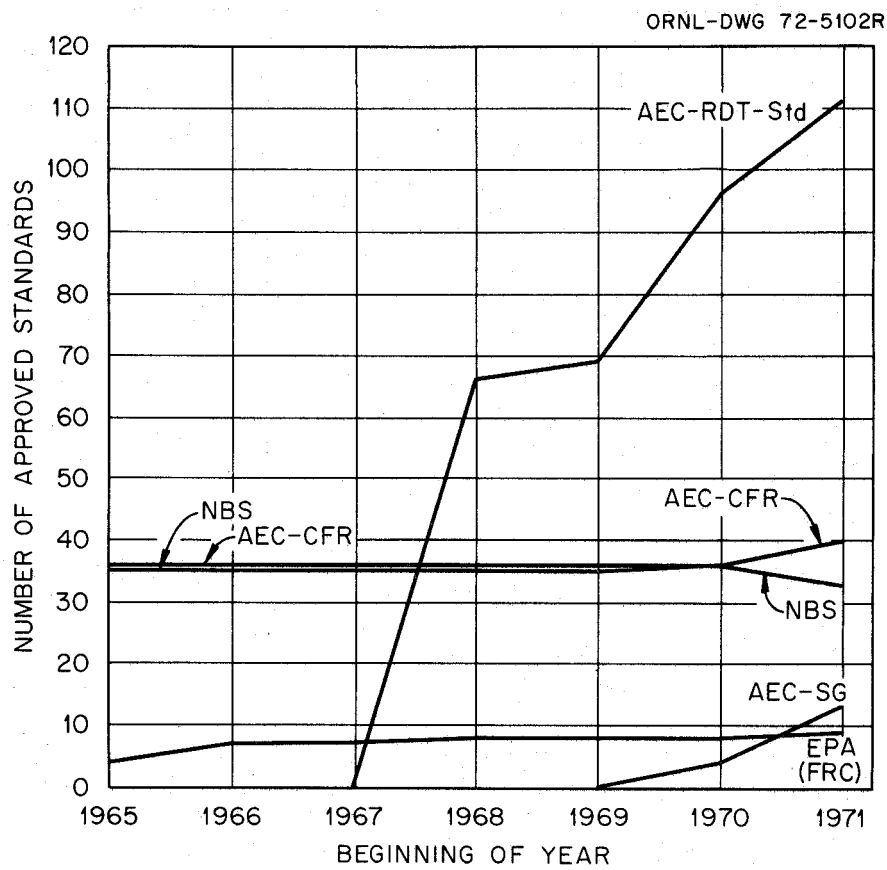

Fig. 2. Cumulative Listing of Approved Nuclear Standards by Government Agencies.

the "government sponsored" activities include approximately 190 existing standards and an additional 190 under development. Combining the numbers from these two sources gives a total of 560 existing standards and 440 under development.

As far as the governmental activities in nuclear standards are concerned it is not surprising that the US Atomic Energy Commission is responsible for the vast majority of the standards prepared. The AEC nuclear standard activities are reflected in three types of documents 1) regulations (which are processed into the Code of Federal Regulations), 2) guides (which are recommendations to be followed unless one has an acceptable alternative, and 3) standards (which are specifications, criteria, and procedures for in-house use). There are approximately 37, 18 and 147 approved documents in each of these categories as of the end of FY-1971.

Standards Compilations, Catalogs and Indexes

Every organization which has a significant standards producing — effort will have a catalog of the standards which it has prepared. Of equal or greater interest are standards listings which attempt to cover the entire spectrum. There are three such published documents which approach this goal to varying degrees, 1) ANSI Annual Catalog[5], 2) NBS Index of US Voluntary Engineering Standards,[6] and 3) ORNL-NSIC Annual Compilation of Nuclear Standards.[3]

The American National Standards Institute Catalog contains all standards which have been promulgated by that organization on all matters. Since the American National Standards Institute is supported by hundreds of national trade associations and technical, professional and scientific societies in the US, it is a logical place to look for any standard. However, the ANSI Catalog is limited to approved standards only, and there are only 51 such ANSI Nuclear Standards listed in their 1972 catalog.

The NBS Special Publication #329 is an index of over 19,000 voluntary engineering and related standards (as of 12-31-69) published by the more than 350 technical societies, industrial institutes, etc. in the United States and it represents a rather prodigious undertaking. However,

in this case it's not obvious what standards are nuclearly oriented and, as with the ANSI Catalog, it is limited to approved published standards.

The Annual Compilation of US Nuclear Standards,[3] prepared by the Oak Ridge National Laboratory's Nuclear Safety Information Center with the cooperation of the ANSI Nuclear Technical Advisory Board, is specifically directed toward the matter at hand, and hence represents the most useful compilation of nuclear standards information. The 1971 edition of this compilation list 560 existing standards and 440 additional standards under development including both government and nongovernment sources. The data are tabulated by organizations, but all standards, both existing and under development, are listed in a KWIC Index.

In addition to the three aforementioned documents each society of note publishes its own standards index. Some of the more relevant indexes (including the three mentioned above) are listed in Table 3.

Table 3. List of Catalogs and Indexes Containing Nuclear Standards

1.	American National Standards Institute Catalog[5]
2.	An Index of US Voluntary Engineering Standards[6]
3.	Compilation of Nuclear Standards — Part 1 US Activities[3]
4.	Index to ASTM Standards[7]
5.	Annual Report of the ANS Standards Committee[8]
6.	ASME Publications Catalog[9]

Information Centers

There are numerous information centers in the United States which are concerned with some aspect of nuclear energy which may be identified from various compilations.[10,11,12,13,16] Inevitably the scope, available services, level of expertise, modus operandi, accessibility, response time, etc., will vary significantly from one center to the next. Conceptually at least, each information center collects, stores, analyzes, and disseminates relevant information within its subject scope. By concept then, such centers provide an obvious source for information

regarding the existence of standards on matters within their scope or — in lieu of standards — of technical information on the subject in question. While there are literally hundreds of technical information centers in the US, Table 4 identifies some of those centers whose scope is specifically relevant to nuclear energy. Most, but not all, of these are sponsored by the US Atomic Energy Commission. Furthermore, most, but not all of the centers listed, offer services at no cost, but recent US Government policy suggests that user cost recovery practices will become more common.

Undoubtedly, the groups which would be of greatest value to the average engineer most of the time are the AEC's Technical Information Center (21), ORNL's Nuclear Safety Information Center (15), and ANS's Information Center on Nuclear Standards (10). That being the case, they only will be discussed further here, although for specific information within their scope any of the other listed centers could be a better source in a given instance.

Of the three centers singled out above, the Technical Information Center (TIC) has the broadest scope and information base, but its principle function is related to the indexing and abstracting of the world's nuclear literature for Nuclear Science Abstracts and the dissemination of technical reports prepared by the Atomic Energy Commission and its contractors. The standards which would be identifiable in this system are those which exist as approved documents which have been processed by NSA. Until recently the NSA System did not routinely collect and process all nuclear standards; it did not routinely identify standards under development (except that information may be included in documents processed, e.g., specifically the ORNL-NSIC Compilation of Nuclear Standards); nor is TIC so constituted to provide special consultations on the subject, although some of their personnel are knowledgeable in this regard. However, through a recent arrangement, TIC is indexing and abstracting nuclear standards collected by the ANS — Information Center on Nuclear Standards (see below).

The Nuclear Safety Information Center (14), on the other hand, selectively collects all information on nuclear safety including nuclear standards. This center also prepares and publishes the compilation of

Table 4. Information Centers with Nuclear Interests

Center Title	Center Location
1. Accelerator Information Center	Oak Ridge National Laboratory
2. Argonne Code Center	Argonne National Laboratory
3. Berkeley Particle Data Group	Lawrence Radiation Laboratory
4. Charged-Particle Cross-Section Data Center	Oak Ridge National Laboratory
5. Controlled Fusion Atomic Data Center	Oak Ridge National Laboratory
6. Criticality Data Center	Nuclear Division, Union Carbide
7. Ecological Sciences Information Center	Oak Ridge National Laboratory
8. Environmental Mutagens Information Center	Oak Ridge National Laboratory
9. Information Center for Internal Exposure	Oak Ridge National Laboratory
10. Information Center on Nuclear Standards	American Nuclear Society
11. Liquid Metal Information Center	Atomics International
12. LMFBR Fuel and Cladding Information Center	Richland, Washington
13. National Neutron Cross Section Center	Brookhaven National Laboratory
14. Nuclear Data Project	Oak Ridge National Laboratory
15. Nuclear Safety Information Center	Oak Ridge National Laboratory
16. Physical Data Group	Lawrence Radiation Laboratory
17. Radiation Chemistry Data Center	University of Notre Dame
18. Radiation Shielding Information Center	Oak Ridge National Laboratory
19. Research Materials Information Center	Oak Ridge National Laboratory
20. Shock Wave Data Center	Lawrence Radiation Laboratory
21. Technical Information Center	USAEC, Oak Ridge
22. Thermodynamic Properties of Metals and Alloys	Lawrence Radiation Laboratory

nuclear standards previously mentioned and has a staff of some 30 technical experts who may provide counsel with regard to any technical matter within the scope of nuclear safety. As previously noted, the Compilation of Nuclear Standards[3] not only lists all existing nuclear standards, but also all those standards which the sponsoring organizations will admit as to being "under development." The services provided by the Nuclear Safety Information Center include:

1. Extensive state-of-the-art reports in each of its subject areas.
2. The bimonthly technical progress review, Nuclear Safety.
3. Scope and progress information on current nuclear-safety research contracts via the Program and Project Information File (PPIF).
4. Special bibliographies upon request.
5. Selective Dissemination of Information (SDI) to selected individuals.
6. The Center's staff is available to answer technical inquiries as time permits.
7. Visitors may come to the Center to use the files and consult with the staff specialists.

At the present time these services are available to all qualified users at no cost, but a cost recovery charge is expected to be applied early next fiscal year.

The most recent information source on nuclear standards is the Information Center on Nuclear Standards (ICONS)[15] established by the American Nuclear Society. ICONS is organized as an information analysis center to carry out selective acquisition storage, retrieval and analysis of information on nuclear standards. This center also has available to it technical consultants, who are acknowledged leaders in their area of specialization. These consultants may be called upon to sort out redundant and out-of-date information, answer technical inquiries, prepare state-of-the-art reports, conduct studies on the effects of nuclear standards, etc. Information from ICONS is available only to subscribers who pay $500 per year for the service which includes:

1. A one year subscription to Nuclear Standards News — Value $350/yr.
2. A one year subscription to Nuclear News — Value $18/yr.

3. Reduced rates on all "state-of-the-art" reports monographs, data compilations and reports on the results of standard studies — Value approx. $50/yr.
4. Coupons worth 10 hours of research time — Value $200/yr.
5. All ANS Standards and Drafts free-of-charge — Value $100/yr.
6. Abstracts of all nuclear standards — Value approx. $300/yr.
7. Access to nuclear standard experts.

How to Find a Nuclear Standard

In the previous sections of this paper, I have attempted to identify the number of all-nuclear standards (both approved and under development), the identity of the sponsoring organizations, compilations of such standards and information centers which could provide assistance in searching for a particular standard. In the following discussion I will consider by specific examples a logical procedure for the search for a given standard. At the onset of such a search one must recognize the possibility that the desired standard may or may not exist, and that in the latter event the standard may be under development or could conceivable be placed under development. In view of these possibilities we will recognize four different cases and consider each separately. The four are:

Case 1. The desired standard exists.

Case 2. The desired standard is under development.

Case 3. The desired standard neither exists nor is under development, but in the time frame of interest may be developed by the recognized standards groups.

Case 4. The desired standard neither exists nor is under development and in the time frame of interest cannot be developed by the recognized group.

Case 1: If the standard exists, the only problem is that of locating it. Thru the exercise of modest engineering judgment, the scope of the desired standard can be related to the area of interest of one of the standards producing organizations and the existance of the standard may be accertained directly from the organization in question. A more comprehensive search may be undertaken by using the compilations and/or indexes mentioned

in Section 3 above, or by soliciting the services of the appropriate information center (see preceding Section).

Case 2: If the standard does not exist, but is under development the search strategy is similar to that above. However, in this instance it should be noted that not all organizations publicize their standards development activities. This such work under development may or may not be identifiable from the information in compilations, although the cognizant information centers should be better informed on the matter. In general, however, the standards developing group would be the best source of information for activities in their area. However, the fact that a standard is under development does not necessarily mean that it is available even in draft form, as that decision is generally left to the discretion of the each standards committee. If such a draft standard is not available upon request the situation reverts to Case 3 or 4.

Case 3: If the standard neither exists nor is under development at any given time, there is the possibility that the responsible standards producing group may be in a position to develop the desired standard. The responsible group would be identified by one of the aforementioned techniques. However, there are several problems, if one is forced to go this route, not the least of which is the time involved, even assuming that the responsible standards producing group has an interest in developing the standard in question. Traditionally the time for the development of a standard — from inception to approval — has been around 5($\pm$ a factor of 2) years. However, recent emphasis on development on standards has caused many groups to reexamine and streamline their generation, review, and approval process. In other instances certain standards groups have existing procedures for developing needed standards information — where the desired information is an interpretation or extension of existing standards. The activities of the ASME Boiler and Pressure Vessel Code Committee is outstanding in this regard. The required interpretation or new material is assigned to a working subgroup which develops the required material that is then submitted for the designated review and approvals.

Depending upon the scope and depth of the new material, the process may take only a few months.

Case 4: If the subject area in question is not "covered" by a standard or standard draft, as can be obtained through any of the preceding cases, the potential user has no remaining option but to proceed on the basis of the best information available to him, consistent with the application at hand. Should that application require that the technology relative to the desired standard be further examined, this may be done in a variety of ways, as determined by circumstances:

1. The user may proceed without further attempting to ascertain "standard" practice.
2. The user, if qualified, may undertake his own evaluation of the technology.
3. The user may have his own engineering staff to evaluate existing technology.
4. The user may solicit another group to evaluate technology including individual consultants, appropriate information centers, research or engineering firms.
5. The user may undertake R&D to develop the information for his needs.

All of these procedures are common in engineering practice. It is unfortunate that, frequently, information developed in this manner is a long time in reaching the form of a standard.

Conclusion

In this paper I have identified the principal organizations involved in the production of nuclear standards in the U.S. today, as well as various means for ascertaining whether or not a given standard exists and in the latter case whether or not the standard is under development, and how to obtain available information. From this review it is apparent that a lot of standards materials is available but that much more standards material is needed to approach a condition of thorough coverage. In a somewhat simplistic summary — where hundred of standards have been identified, thousands are needed. Further, a sizeable fraction of existing hundreds may not be directly applicable to a detailed engineering

application since many apply to basic physical processes or are general criteria which need further development for a specific application. Fortunately, with the growth of the nuclear industry, work on the development of nuclear standards has been accelerated almost across the board. While the major impact of this increased effort remain to be felt, both the number of standards under development and the resolve with which this work is being persued has increased dramatically in the past few years. Most of this recent emphasis is concentrated on the nuclear standards work under the American Nuclear Society, the Nuclear Technical Advisory Board of ANSI and the U.S. Atomic Energy Commission. Only time can tell how rapidly the fruits of these labors will be realized.

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