Chapter 4

THE NUCLEAR REGULATORY COMMISSION'S ROLE

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The Nuclear Regulatory Commission (NRC) licenses all commercial nuclear reactors and monitors them for safe operation. Thus, NRC is a natural agency both to promote standardization and to benefit from it. NRC recognizes the advantages of standardization: from its viewpoint, it would expedite the licensing process and save staff time and attention; it would enhance public health and safety; and it might benefit construction through the earlier availability of final design documents and construction experience.

A standardization program was first instituted in 1973 by the former Atomic Energy Commission. The program, with some changes, still operates under NRC today, as will be described further. Vendors, architect engineers (AEs), and utilities have participated in the standardization program, however, it has had only marginal success in reducing leadtimes or manpower efforts. At the present time, standardization is accorded low priority at NRC. In fact, all licensing at NRC is at a virtual standstill, not only because of decline of new plant orders but also because of the many uncertainties over the outcome of unresolved safety issues. These topics will form the content of this chapter.

NRC'S CURRENT STANDARDIZATION PROGRAM

All plants currently must be reviewed at both the preliminary safety analysis report (PSAR) stage and at the final safety analysis report (FSAR) stage. Thus, both custom and standard plant applications follow a two-stage review process.

For the custom plant, the utility applicant must submit a PSAR, including a general plan for the plant and many details about the particular site. If the PSAR is approved, the utility is granted a construction permit (C P). In the second stage, the utility applicant must file an FSAR that describes in greater design detail the reactor as it is actually being built. The FSAR has considerably more detail about the types and characteristics of the actual components of the balance of plant (BOP) than does the PSAR. Acceptance of the FSAR and inspection of the completed plant result in the issuance of an operating license (O L).

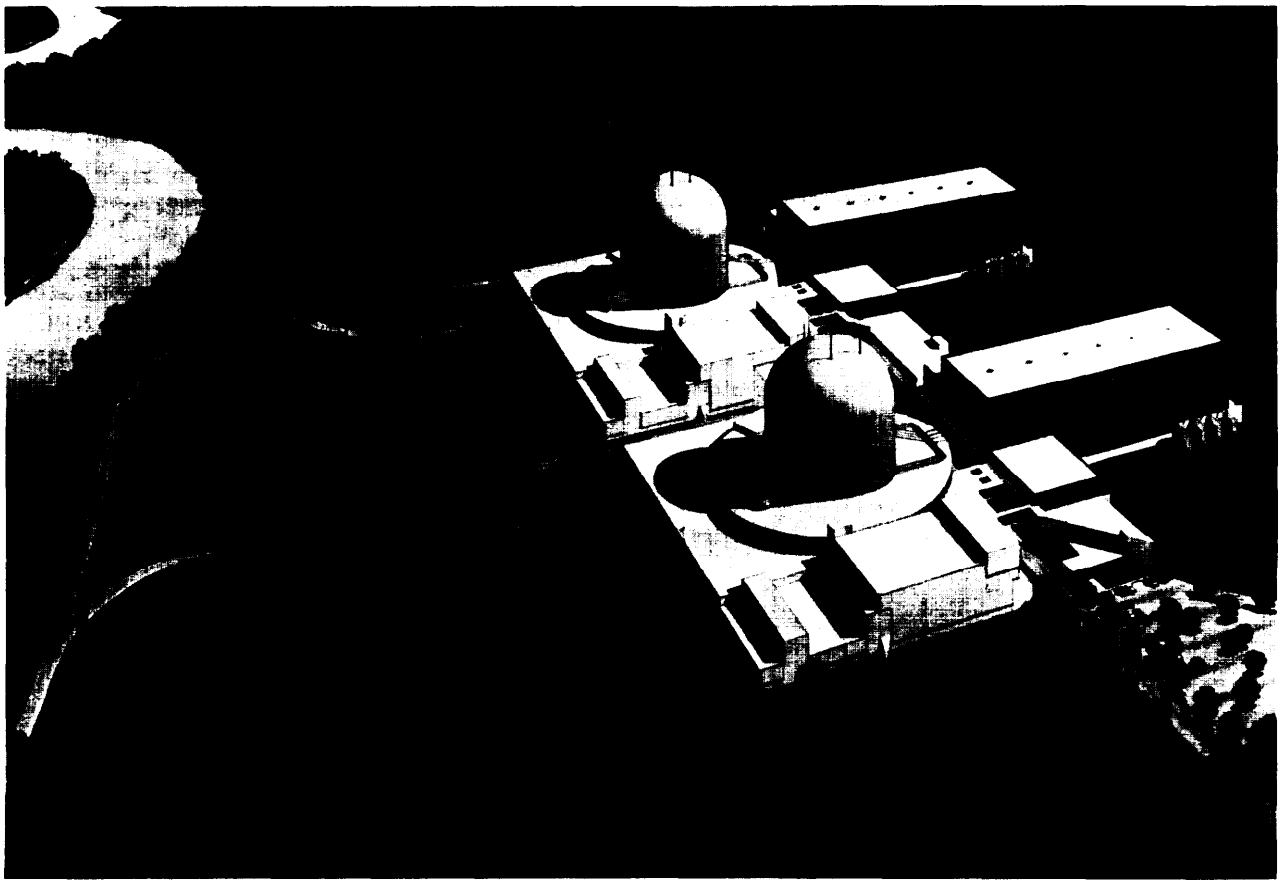
The licensing for a standard plant is also a two-stage process but may take a shortcut by one of the following four methods. [1]

Reference Plant Concept

Under this concept, a vendor or an AE firm may apply for approval of an entire facility, or a major portion of it, outside the context of a particular utility application. Once NRC reviews and accepts the reference system design, it issues a preliminary design approval (PDA). The PDA can then be referenced by a utility to build a specific plant at the CP stage.

A similiar procedure exists for the vendor or AE firm to obtain a final design approval (FDA), which can then be referenced in the FSAR submitted by the utility applicant at the OL stage. Once the FDA is issued for either a nuclear steam supply system (NSSS) andlor BOP, the PDA is no longer needed. The way licensing would then work is that the utility would reference the FDA for a CP. The utility's OL for the plant would, therefore, only require an audit of the constructed plant to assure compliance with the FDA. (The licensing of the Palo Verde plants in Arizona should give Combustion Engineering an FDA for its standard NSSS.)

'Nuclear Regulatory Commission, "Review of the Commission Program for Standardization of Nuclear **Power Plants and Recommendations to Improve Standardardizations Concepts, " NUREG 0427, February 1978**



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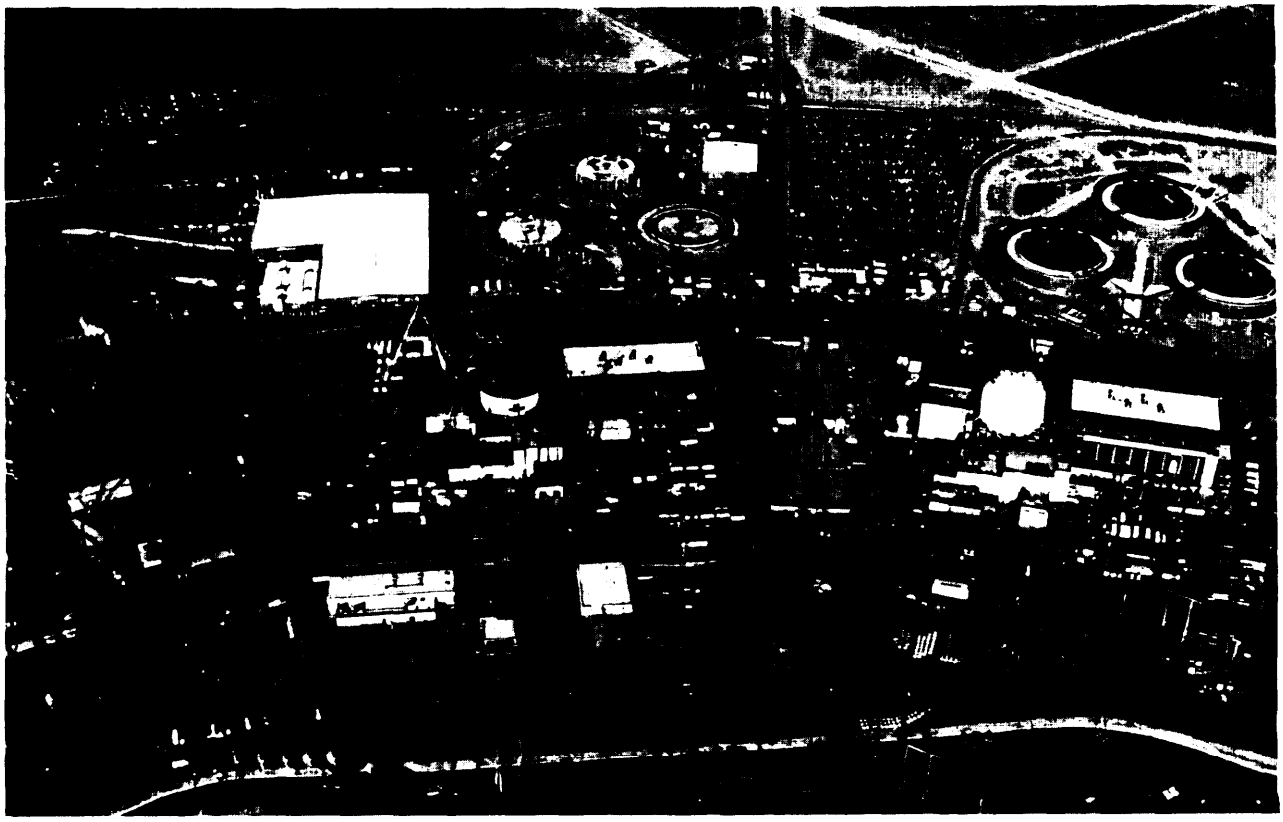
Duplicate Plant Concept

Under this concept, NRC receives a number of applications for construction and operation of nuclear powerplants of essentially the same design to be built at different sites by one or more utilities. Initially, the concept applied to applications received within a few months of one another. As modified, the concept allows NRC staff to issue a preliminary duplicate design approval (PDDA) for the first duplicate plant approved at the CP stage and a final duplicate design approval (FDDA) at the OL stage.

Manufacturing License Concept

The manufacturing license concept involves the submittal of an application for a number of identical nuclear powerpl ants which would be manufactured at one location and moved to a different location for operation. An application for a manufacturing license is submitted by a vendor and includes a report that is similar to a safety analysis report (SAR) except that it is designated a design report. The utility-applicant and site-specific information are reviewed on each application that references the manufacturing license application.



This concept is specifically applicable to the Offshore Power Systems (OPS) approach. The approach includes the NSSS and BOP, manufactured in Florida, towed to a permanent site for mooring and connection to the electrical grid.

Replicate Plant Concept

The replicate plant concept involves the submittal of an application by a utility applicant for a nuclear powerplant of essentially the same design as one in which the staff's review has resulted in the issuance of a safety evaluation report. The nuclear powerplant previously reviewed by the staff is referred to as the base plant, and the new plant is referred to as the replicate plant.

NRC has considered, but not yet implemented, a program by which a standard plant could be reviewed only once before it is licensed. This involves the concept of a standard design approval (SDA). NRC staff believes that single-stage licensing review is desirable from the standpoint of the public, industry, and NRC. The advantage of a single-stage licensing review from the NRC staff's viewpoint is that it is based on more complete information and a single set of regulatory requirements.

From the utility applicant's standpoint, construction can proceed on the basis of an NRC staff-approved design that will not be subjected to a second review. From the public's viewpoint, a more complete understanding of the facility is available at the beginning. Intervenors should be able to frame more specific contentions based on the more detailed design.

One problem in the formulation of any single-stage licensing procedure is that the AE firms would have difficulty in supplying, at an early stage, the level of detail typical of an final design. As one AE firm put it, they believe one-stage licensing:

> . . . can be an effective tool in increasing licensing predictability if executed at the proper level of detail so as not to tie up the AEs, the utilities, and the regulators in paperwork that would result from the inevitable changes necessary to complete the design and construction of a plant.

To make a single-stage review applicable to the entire plant design, NRC would issue an SDA in lieu of a combined PDA and FDA. The SDA concept involves the submittal of information that is significantly more developed than that now provided for a preliminary design but somewhat less than that for a final design. The SDA would of necessity be limited in some areas to complete functional specifications rather than to actual design drawings and specifications to avoid possible antitrust problems with equipment suppliers. A supplementary NRC staff-audit function would be required during plant construction to verify that the actual components—features installed or constructed —adequately meet the approved functional specifications. To date the SDA single-stage review concept has not been implemented.

The General Electric Co. (GE) has proposed the similar concept of a "power-worthiness certificate" (PWC), in analogy to the air-worthiness certificate granted to aircraft by the Federal Aviation Administration. The major difference between PWC and SDA concepts is the scope of hardware licensed. The minimum scope for the PWC is the NSSS plus the other radiologically significant systems and structures. This is contrasted to the NSSS *or* BOP minimum for the SDA.

EXPERIENCE WITH THE NRC STANDARDIZATION PROGRAM

Under the reference plant concept there has been quite a lot of activity for NSSSS, but this is of marginal value for standardizing reactors because the vendors' NSSS systems are already fixed in design. Five AE firms have submitted BOP designs under the reference system concept, but none of these have yet been used.

Under the duplicate plant concept, two major projects have been undertaken. With three plants being planned at each of three sites, Duke Power has more experience with this concept than other utilities. Duke is also unusual in that it serves as its own AE. A consortium of utilities (Standardized Nuclear Unit Power Plant System (SNUPPS)) is also making considerable use of the duplicate plant concept. Originally planned at six plants, the group has now cut its number of plants planned under the concept to three. Four other applications for pairs of plants under the concept have been made.

OPS is the only applicant that has requested a manufacturing license, which is an application for a license to manufacture eight identical plants. The licensing process has been completed except for the new requirements imposed by NRC as a result of the TM I accident. This post-TMI review has been held up by NRC as it has for other pending CP. OPS presently has no plants on order and probably must obtain a manufacturing license before it can accept orders.

Initially, five utilities applied for licenses under the replicate plant concept, but only one of these applications remains active. Single-stage licensing has not been implemented.

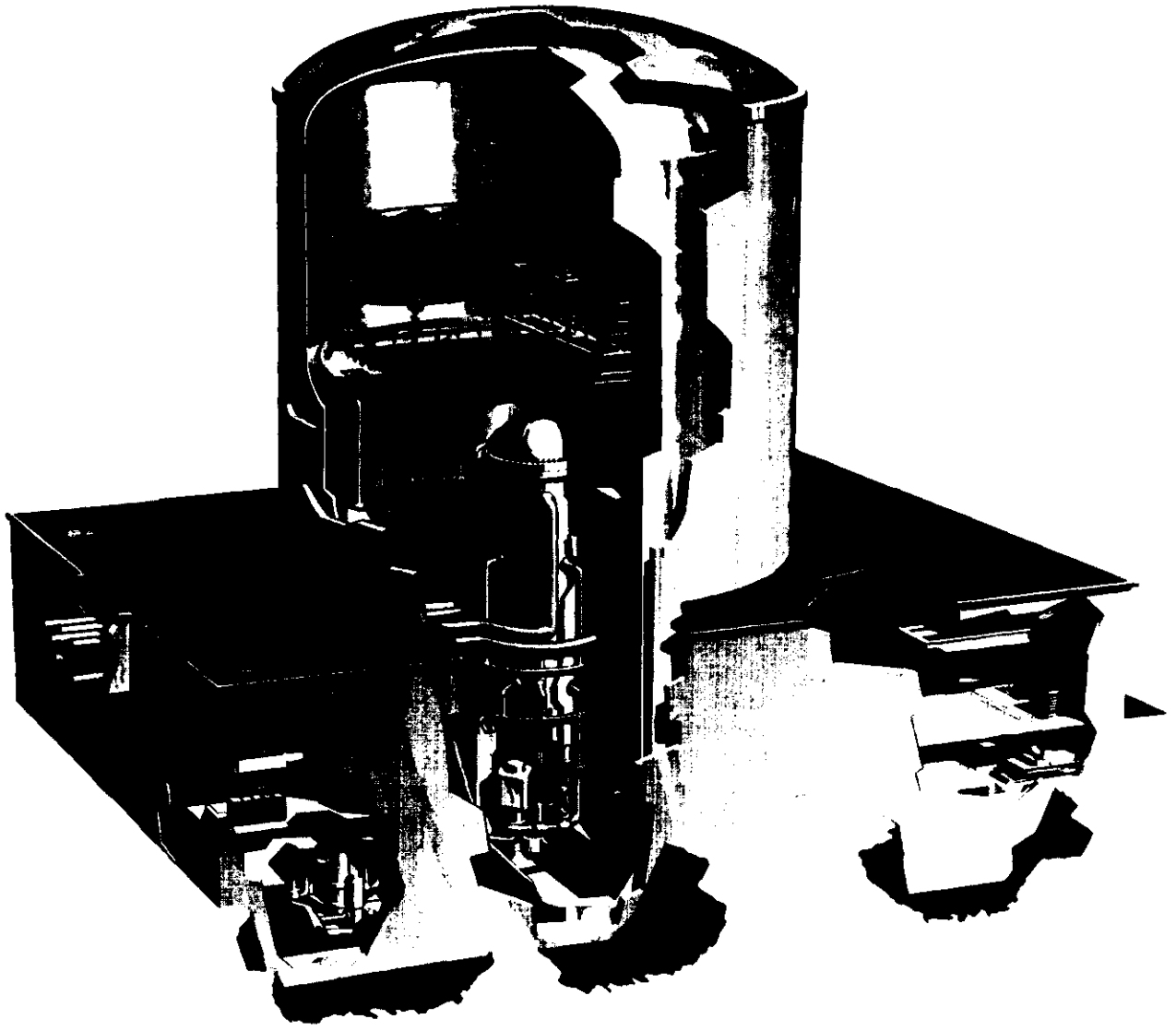


illustration credit General *Electric Co*

Cutaway view of the reactor building for the BWR nuclear island. The nuclear island contains those structures of radiological significance

In summary to date, there has been participation in NRC's standardization program by all four vendors, by five AE firms, and initially by 10 utilities (though some have since canceled). It should be noted that all BOP construction done under NRC standardization programs has been under the duplicate plant concept. No doubt most participants did so in the hope of reducing licensing times, increasing predictability that designs would be accepted for licensing, and lessening construction costs.

By and large, it is too early to judge whether many of these hopes will be realized. Duke Power has encountered some difficulties with its duplicate plant efforts (see ch. 3, pp. 23-24). However, SNUPPS does report it has cut construction costs about 10 percent by standardizing.

An NRC study of the standardization program revealed that savings in the effort needed to review applications, the primary objective of NRC's program, have been minimal so far.[2] The number of questions asked during a review is considered a key indicator of the difficulty of processing a nuclear plant application. The standard reviews over the period studied took as many as 12.6 man-years and as many as 1,060 questions, compared to 6.3 man-years and 700 questions for a custom design. Note however, that the standard design review included a review of the basic design; subsequent reviews of referencing applications should be expected to be much shorter. Data for duplicate plant reviews indicate a substantial reduction in staff and industry effort.

In an interview of the NRC staff, OTA learned that the staff strongly supports the current approach to standardization but hopes that fewer standard plant designs than the number submitted to date will eventually result from the efforts of NRC. The staff expressed little or no support for a single standard nuclear plant designed and supported by Federal Government agencies. They did express great interest in single-stage licensing as represented by SDA but recognized that it poses greater problems to implement for BOP designs than for the NSSSS , mainly because of the traditional engineering procedures followed by the AEs and their utility customers.

The NRC staff feel that the nuclear power industry would be improved by having both Government and industry maintain a firm commitment to l imit changes to an approved standard design to those clearly needed for public health and safety reasons.

The staff felt that nonstandard designs resulted in confusion in understanding accident conditions such as those experienced at TMI. If that plant had been a standard design, the accident could have been analyzed with far less confusion and with more certainty.

Finally, the NRC staff believes that the present hearing process is a large impediment to the full realization of the benefits of standardization. Under present procedures, a standardized design with safety features reviewed in public licensing hearings and accepted by the NRC staff can be reevaluated and perhaps changed in future hearings. This process of adversary cross-examination may cause the industry and regulators to perform better and more thorough safety evaluations of proposed nuclear powerplants than would be performed in the absence of public scrutiny. To reduce the opportunity for public rehearing would enhance efforts toward standardization at the expense of public input.

The alternative in the NRC current standardizations program is the submittal of a final design by any qualified applicant to the Commission for rulemaking. [3] This allows NRC to review and approve a plant design without having received an individual CP application. Once approved, utilities could reference this design and start construction after demonstrating the acceptability of the proposed site. A procedure similar to this is being used for the manufacturing license although a final NRC review and possible hearing will be required prior to the towing of the initial floating nuclear plant from the manufacturing facility. Each site for a floating nuclear plant must be licensed. Since a public hearing is mandatory during rulemaking on the design, later hearings at the CP and OL stages would be limited to issues unrelated to the approved design (e. g., environmental impact and utility competence). Presently, no applicant has requested rulemaking under the current standardization program, probably because of the expense involved and the possible public perception that rulemaking on a design was a means of bypassing the statutory requirements of the Atomic Energy Act for public hearings.

Nuclear Regulatory Commission, op c it

'Code of Federal Regulations, title 10, pt 50, app O (40 FR-2977), Jan 17,1975

CURRENT STATUS OF LICENSING

Since TMI, new plant orders have disappeared. Meanwhile, NRC has been under intense pressure to investigate or rule on many safety issues. These two factors have combined to force standardization programs into the background. Currently, such programs are under the Standardization and Special Projects Branch at NRC and are manned by a very small staff with virtually no budget. However, the work that must be done includes review of Combustion Engineering's application for an FDA, which is the first one to be requested under the reference system concept [the 3-unit Palo Verde application references the Combustion Engineering FDA). Another important action awaiting the standardization branch is the complete acceptance review of the application by GE in March 1980 for an FDA for its nuclear-island designs. Six plants now under construction reference this design.

Although other matters do require heavy demands on its staff, NRC should be aware that current steps must be taken, both to consolidate the gains begun under the standardization program and to plan for a possible future of renewed interest in nuclear power. In particular, NRC should be giving more attention to the implementation of some form of single-stage licensing.

NRC'S FUTURE ROLE

One criticism sometimes leveled at NRC is that it is not disciplined or consistent in its decisions regarding which safety concerns are sufficient to warrant design changes or even reactor retrofits. Industry observers, in particular, worry that unless NRC is more disciplined, reactors initially designed as similar plants may grow apart because of changing regulations. Adoption of a safety goal would certainly help NRC arrive at consistent and more predictable decisions regarding design changes. As generally used now, the concept of a safety goal — which might be either quantitative or qualitative— **is** the definition of an optimum level of safety as a focus for the licensing process. It would consider both individual and societal risk, and include some method of measuring the effectiveness of the safety standards prevailing at any particular time.

In the licensing for either custom or standard plants, NRC has currently introduced an atmosphere of uncertainty. Many safety issues await rulemaking by NRC. Until NRC rules on the issues or unless NRC adopts interim criteria, nuclear plant designers will be uncertain how to design a plant that can be licensed. One example of these current safety issues pertains to degraded cores. The objective of the degraded core rulemaking, to commence some-time during the second half of 1981, is to determine whether fundamental changes are required in reactor design to prevent or mitigate a melted core from penetrating the containment and entering the outside environment. NRC has not provided any interim guidelines for what designs are acceptable until the rulemaking is completed.

As another example, NRC has recently ruled that applicants analyze all accidents of a certain class (called "class 9" accidents). Unfortunately, NRC has not defined these accidents well enough or sufficiently narrowed that class of accidents for them to be reasonably analyzed.

These two examples are a few of many that indicate that NRC is not managing its activities effectively at this time. Uncertainties or ambiguities such as those mentioned will impede *all* licensing— standard or otherwise. The adoption of a safety goal might facilitate the many decisions NRC has to make.