

#### 4. LICENSE RENEWAL

In the recently published report of the President's Committee of Advisors on Science and Technology (PCAST), nuclear energy was identified as one of the prominent energy technologies that could contribute to alleviate global climate change and also help in other energy challenges including reducing dependence on imported oil, diversifying the U.S. domestic electricity supply system, expanding U.S. exports of energy technologies and reducing air and water pollution. The Department concurs with this perspective and believes that in order to realize the benefits of nuclear energy for the Nation, it is important to maintain the operation of the current fleet of nuclear power plants throughout their safe and economic lifetimes.

Although these plants have been an important component of the Nation's energy supply, currently contributing close to 20% in electricity generation, this source is at risk. The average age of all U.S. nuclear power plants is approximately 20 years and the average age of the oldest 50 units is approximately 25 years. These 50 units represent roughly eight percent of the current U.S. electricity generation capacity. Their operating licenses, initially issued by the NRC for 40 years, begin to expire in large numbers in 2010 with 13 plants representing some 11,700 MWe going off-line in 2014 alone. However, it appears unlikely that many of these plants will operate much beyond 30 years, since the ability to make and recover investments in the plant and remain competitive in a deregulated electricity market, diminishes rapidly in the last ten years of licensed life. Making the decision to renew the operating license earlier in life not only improves the economics of remaining capital cost recovery, but also lengthens the time available to accumulate decommissioning funds. Without a proven, viable, demonstrated process for license renewal in the very near future, allowing additional time to recover investments, many of the currently operating nuclear power plants are or will soon be, in jeopardy of closure.

A trend has already been established where utilities facing social, regulatory and economic uncertainties, have exercised their option for early closure of their nuclear facilities, well before the current license expiration date. This has resulted in a loss of approximately 6,000 MWe of emissions-free generating capacity in the past eight years. Unless reversed by positive near-term action, this trend is expected to continue and could potentially accelerate as the uncertainties of deregulation come into play.

U.S. nuclear power plants are initially licensed to operate for 40 years. This term was specified by Congress in the Atomic Energy Act of 1954. The Act was fashioned after the Communications Act of 1934, in which radio stations were licensed to operate for several years and allowed to renew their licenses as long as the stations continued to meet their charters. The Atomic Energy Act also allowed for nuclear power plants to renew their licenses. Congress selected a 40-year term for nuclear power plants because 40 years was a typical amortization period for an electric power plant. The 40-year license term was not based on safety, technical or environmental factors.

In 1995, the NRC finalized its requirements for renewal of the operating license of a nuclear power plant and published the License Renewal Rule, 10CFR54. These requirements are in addition to existing safety requirements defined primarily by 10CFR50, and are intended to provide additional assurance that the effects of aging will be adequately managed throughout the

operating life of the plant. The nuclear utility industry has been actively engaged with the NRC over the last several years implementing the requirements of 10CFR54.

Currently, the total time required to develop a license renewal application, to respond to NRC requests for additional information, and to prepare for and respond to issues which may arise in a public hearing is estimated to be 10 years. The cost to prepare a license renewal application is estimated by industry to be approximately \$10 million, and the total cost of a license renewal campaign (application preparation and NRC reviews, public hearings, and state and local regulatory reviews) is estimated by industry to be in excess of \$30 million. This estimate does not include additional operations and maintenance costs associated with license renewal requirements during the renewed license term.

Industry efforts have been on-going relative to implementing the technical requirements on specific systems, structures and components for which the results have been documented in reports submitted to the NRC for review and approval. As a result of these industry efforts to implement the requirements of the license renewal rule, several generic technical issues have emerged. Fatigue of metal components and equipment qualification of electrical components are NRC Generic Safety Issues. ASME inspection requirements for small bore, Class 1 piping, currently in use today are not being accepted by the NRC License Renewal Staff as adequate aging management programs for license renewal. Inspection requirements for concrete containment structures and metal liners, accepted for current operating plants, may not be accepted by the NRC as adequate for license renewal. To date, a total of 17 generic technical issues associated with license renewal implementation have been identified and it is likely that additional generic technical issues will be identified as plants of different designs begin to implement license renewal requirements. These technical issues and other process related issues can significantly affect the cost of license renewal and represent a considerable source of uncertainty for utilities contemplating license renewal. Several of these generic technical issues have the potential for significantly impacting current plant operation, irrespective of license renewal, and warrant an aggressive program to address the R&D needs on aging effects outlined in Chapter 3 of this document.

At present, only a few utilities have active license renewal programs in place; no utility has submitted an application nor has any utility announced its intention to submit a license renewal application. For most of the plants eligible for license renewal (i.e. older than 20 years), preparations have not yet begun because of uncertainties associated with the technical requirements of the rule and future costs associated with implementation of additional requirements imposed as a condition of the renewed license. The fragility of current nuclear plant economics coupled with the uncertainties of deregulation and the license renewal process preclude significant utility movement toward license renewal. The utilities with license renewal programs in place have multiple unit sites (approx. 800 MWe/unit), for which one application is being prepared for all units. The end result will be a lower cost/MWe expenditure for preparing the license renewal application. Utilities with single units will incur the same costs as multiple unit sites, therefore making license renewal a much less attractive option. By reducing the uncertainties and improving the efficiency of the licensing process, the costs associated with license renewal will become more manageable for a larger number of nuclear plant owners.

The handful of plants involved in preparation of applications believe their plants as they currently exist, coupled with the regulatory requirements in place (including both Part 50 and Part 54) should provide an economical source of electricity generation during the renewal term. Confidence exists with regard to the physical capabilities of the plants. However, confidence in the licensing process, and demonstrating compliance with Part 54 as interpreted by NRC License Renewal Staff, does not fare as well. Experience with the initial plant licensing process (review and approval of an application for operation), which essentially halted the growth of the nuclear industry by adding excessive costs to plant construction, coupled with the uncertainty in the license renewal process, deters utilities from pursuing the renewal of their operating licenses. The unwarranted costs incurred during the initial licensing of the plants cannot occur during license renewal if nuclear power plants are to be competitive in a deregulated environment. The licensing process needs to be efficient, predictable and stable. If the manner in which the regulation is implemented, not the regulation itself, does not change, there will be little incentive to pursue license renewal for the majority of plants.

In order to continue to realize the benefits from operation of the current fleet of nuclear power plants, a viable, demonstrated process for license renewal is required within the next few years. Unnecessary costs and uncertainties associated with license renewal need to be eliminated, and practical, economic solutions to generic technical issues have to be developed today and confirmed through longer term R&D activities.

To ensure a license renewal process which is efficient, stable, and predictable several applicants are needed. The applications should be representative of each of the NSSS designs and should be submitted in close succession, no more than one year apart. Currently three utilities, representative of three NSSS designs are performing license renewal evaluations and preparing applications. Should these utilities decide to submit applications, it is expected that the time between submittals could lag one to three years with each application taking a minimum of five years to complete the review process.

#### 4.1 Current License Renewal Activities

Baltimore Gas and Electric Company (BG&E) has developed an approach for a license renewal application for its Calvert Cliffs plant. BG&E submitted its integrated plant assessment methodology in August 1995, detailing how BG&E intends to address the requirements in Part 54. The NRC subsequently issued a safety evaluation report approving this methodology and has also approved BG&E's template for developing license renewal technical reports. BG&E has submitted over 20 detailed license renewal technical reports for selected plant systems, structures and components for staff review in 1997. BG&E has received letters from the NRC



Figure 4-1 Calvert Cliffs Plant

stating that these reports contain sufficient information to begin their technical review. BG&E has not yet made a decision whether to submit the license renewal application for Calvert Cliffs, which should be completed in early 1998.

Duke Energy has established a license renewal project for the Oconee units. Technical information needed to support a renewal application is being developed in a composite "License Renewal Technical Information Topical Report," designated OLRP-1001. The first section on the reactor building was submitted in March, 1997 and is under NRC review. Samples of the other areas, referred to as "vertical slices," have been submitted to the NRC staff for comment to provide feedback for completing the Oconee License Renewal Application and to support a decision on whether to submit a formal license renewal application later in 1998.

Southern Company has informed the NRC of its intent to prepare an application for license renewal for Plant Hatch and expects to submit for staff comment, its approach to completing the technical requirements of Part 54 in early 1998. A decision on whether to submit a formal application will be made following completion of a license renewal application document, based on the then current plant economics and NRC requirements regarding implementation of Part 54 (stability, predictability of implementing the rule).

The Nuclear Energy Institute (NEI) License Renewal Working Group has designated the EPRI Life Cycle Management (LCM) Subcommittee, and the associated EPRI LCM Program, as the mechanism for addressing the open technical issues that have been identified as the result of NRC staff review of, and comment on, generic and plant-specific technical report submittals. An original set of open technical issues, including fatigue of metal components and environmental qualification of cables, was identified during the review of the ten License Renewal Industry Reports (IRs) prepared by the Department and EPRI through contractors and national laboratories. The NRC staff provided some 844 comments (873 separate questions or parts of questions) on the ten IRs, about 90 % of which were eventually closed satisfactorily by the industry through the submittal of additional information and further justification. Closure of this large number of comments has been confirmed, in part, through the publication by the NRC of the Working Draft of the Standard Review Plan for the Review of License Renewal Applications for Nuclear Power Plants (SRP-LR) in September 1997. The 85 remaining (open) technical comments on the IRs were then grouped according to subject matter (e.g., 29 of the 85 open comments concerned fatigue of metal components), leading to 15 open technical license renewal issues. Two additional technical issues have been identified through other means: one as a result of NRC review of a generic topical report on reactor coolant system piping (BAW-2243) by the Babcock and Wilcox Owners Group (B&WOG), and one as a result of NRC contractor review of Industry Report Agreements (NUREG 1557).

The EPRI LCM Subcommittee has developed industry technical positions on these issues, using EPRI research and development projects and related industry information as a resource. Industry technical positions have been developed on fatigue of metal components, thermal aging embrittlement of cast austenitic stainless steel (CASS) components, primary water stress corrosion cracking (PWSCC) of reactor vessel and pressurizer Alloy 600 penetrations, stress corrosion cracking (SCC) of low-alloy steel components in reactor water environments, environmental qualification of low-voltage in-containment cable, neutron irradiation embrittlement of reactor

pressure vessels, degradation of small-bore piping, adequacy of ASME Section XI visual inservice inspections, incorporation of mandatory Appendices VII and VIII of ASME Section XI on plant inservice inspection programs, freeze-thaw damage of concrete structures, reinforcement corrosion in concrete structures, alkali-aggregate reactions in reinforced concrete structures, differential settlement of steel and concrete structures, one-time inspections of concrete and steel structures, irradiated-assisted stress corrosion cracking (IASCC) of internals; void swelling of internals, and stress relaxation of internals (bolts, pins, and fasteners).

The next step in the process is to obtain closure of the technical issues, and incorporate resolution in the Working Draft of the SRP-LR, through dialogue with the NRC staff, through the ASME Code consensus process, and through plant-specific submittals. While many of these issues may require R&D to confirm the most appropriate aging management strategy, a mechanism must be found to obtain agreement with the NRC on reasonable solutions which are appropriate today for license renewal.

## 4.2 License Renewal Needs

Nuclear utilities have three primary needs with respect to license renewal:

1. Generic license renewal technical issues need to be satisfactorily resolved now so that the costs of license renewal will be known with more certainty;
2. The entire license renewal process has to be successfully demonstrated, removing the economic uncertainties associated with preparation, approval and operation under a renewed license for plant designs that are representative of current operating plants; and
3. The utilities need a license renewal process that is efficient and relies largely on existing programs so that the cost of a renewed license does not make license renewal uneconomic for smaller, single unit nuclear power plants.

The Department, utilizing the resources of the National Laboratories, Universities, EPRI, participating utilities, and other industry organizations, will undertake the following tasks to establish license renewal as a viable, predictable option for current operating plants.

### Resolution of Generic License Renewal Technical Issues

Generic license renewal technical issues identified to date and others that are identified as a result of license renewal demonstration activities will be resolved in a manner acceptable to industry and the NRC. This task will be performed with the guidance of the NEI License Renewal Working Group, build on work completed by EPRI, and result in successful near-term closure of generic license renewal technical issues.

A consensus technical body will be established on an as needed basis to develop, review, and support the resolution of technical issues identified by licensees as they prepare applications. Use of a consensus technical body will accelerate the development of an application by making

resources available to assess the adequacy of existing activities for managing aging effects during the renewal term and/or identifying modifications which will have been scrutinized and found to be technically sound and cost effective. This activity will play a stronger role in the applications developed for the BWR and the Westinghouse PWR, which represent the large majority of current operating plants. A similar approach will be used to resolve issues which have been previously identified by BG&E and Duke Energy as a result of work completed on their applications. Issues which arise as a result of review of the applications by the NRC will be treated in a similar manner with emphasis on generic resolutions applicable to each of the four NSSS designs.

By resolving issues generically the implementation of Part 54 should result in a more stable and predictable licensing process and reduce the time and resources needed for review by the NRC.

#### License Renewal Demonstrations

The demonstration projects will explore various approaches to satisfying the requirements of the License Renewal Rule and will lead to optimization of the license renewal process. The demonstrations will ensure that each design type is taken into account as solutions to technical issues are developed, and that the solutions are practical and cost effective for each design. Utility ownership will drive the closure of the technical issues for these demonstrations as a result of the NRC approving the license renewal applications. For that reason, it is important that each reactor type is represented in the process.

This effort will build on work completed to date by Baltimore Gas and Electric, Duke Energy, and Southern Nuclear and accelerate the development and resolution of outstanding issues as the NRC reviews and approves the applications. In addition, a Westinghouse PWR plant will be selected for development and submittal of a license renewal application, providing a model for the largest group of U.S. designs. Resources will be placed on closing the gap between each of the license renewal demonstration plants relative to completion of their applications.

The projects under this task would include: (1) demonstration for near-term license renewal applicants, (2) demonstration for a BWR design, and (3) demonstration for a Westinghouse PWR design.

The License Renewal Demonstration Program contains the necessary elements to ensure that license renewal becomes an economically viable option, in a timely manner which will allow all nuclear plants the choice of exercising this option.

The high priority projects identified for commencement in FY 1999 are listed below, along with the principal objectives of each project. See Volume II for detailed descriptions of these high priority projects.

Project ID: 4-1 (Corresponding Project in Vol III: 4.1.2.1)  
Project Title: Resolution of Generic Technical Issues Impeding the Success of License Renewal  
Principle Objective: Accelerate the development of solutions to generic license renewal technical issues resulting from implementation of 10 CFR Part 54 "Requirements for Renewal of Operating Licenses For Nuclear Power Plants

Project ID: 4-2 (Corresponding Project in Vol III: 4.1.2.2)  
Project Title: License Renewal Demonstrations  
Principle Objective: Simplify and accelerate the process for development, review and approval of a license renewal application by resolving technical and process issues by means of a demonstration program.