



Support for Nuclear Power Plant Licensing

Argonne National Laboratory's Environmental Science Division (EVS) applies its extensive expertise in environmental and safety studies to support licensing assessments for new and existing nuclear power plants.

Problem/Opportunity

In order to maintain the nuclear power option as a critical component of ensuring adequate future supplies of electrical energy, the operating licenses of many of the existing nuclear power plants are being renewed and new plants are applying for licenses. The policy of the Nuclear Regulatory Commission (NRC) in the licensing proceedings is to apply the best available technical expertise to conduct environmental and safety reviews. Environmental reviews generally result in the preparation of Environmental Impact Statements (EISs) and the safety reviews of the plant systems, structures, and components result in the preparation of Safety Evaluation Reports (SERs).

The NRC requires plant-specific reviews of the environmental impacts of license renewal and new reactor applications in accordance with the National Environmental Policy Act. Since the early 1970s, Argonne scientists and engineers have assisted NRC in preparing EISs and related safety studies for the Atomic Energy Commission, and later, the NRC. Argonne has been recognized as a preeminent authority in EIS preparation and has the requisite tools and approaches to perform technical analyses, manage information, and develop processes to support the licensing process.

Review of License Renewal Applications

There are 104 operating nuclear power plants in the United States that produce approximately 20 percent of the country's electricity supply. Most of these plants are approaching the end of their 40-year initial license life, and more than half have applied for license renewals for another 20 years for a total operating period of 60 years under NRC's License Renewal Rule.

Reviews of plant license applications can encompass the full range of potential environmental concerns, including impacts on human health, air quality, water and soil, ecology,

socioeconomics, waste management, land use, environmental justice, and cumulative impacts.



License Renewal for Nuclear Power Plants Requires Plant-Specific Environmental Reviews

The NRC has asked Argonne to provide expert technical services to support environmental assessments or reviews of license renewal applications for more than 25 nuclear power plants. Our participation includes the following tasks:

- Leading the environmental review processes for several power plant license renewals,
- Bringing together additional resources in key specialty areas for environmental reviews,
- Recommending appropriate actions for areas in which mitigation is required,
- Providing expert testimony at public hearings and assisting the NRC in resolving public concerns, and
- Providing training to NRC staff who have licensing review and approval responsibilities.

License renewal applicants are required to identify and update time-limited aging analyses. During the design phase for a nuclear power plant, certain assumptions about the length of time the plant will be operated are incorporated into design calculations for several of the plant's systems, structures, and components. If additional aging management activities are warranted for a structure or component that is covered by the rule, applicants have the flexibility to determine appropriate actions. These activities could include, for example, adding new monitoring programs or increasing inspections.

Plant Aging Research and Analysis

Argonne analyzes the status of research to confirm current understanding of nuclear power plant structural integrity. Research proposed by Argonne addresses issues that may arise if reactors are licensed beyond 60 years. Argonne is providing knowledge and expertise on fracture toughness testing and crack-growth-rate measurements under light water reactor conditions and may propose additional structural integrity testing that will contribute to the NRC objective of developing regulations to assure safe nuclear power plant operation beyond 60 years.

Expertise for New Reactor Licensing

EVS provides technical assistance to the NRC's Office of New Reactors (NRO) in applying the regulatory system for efficient licensing of new nuclear power reactors. The consultation services provided by Argonne include outlining managerial and administrative approaches for licensing reviews and designing an orientation process to ensure that prospective license review team members have the regulatory insights to effectively assist the NRC in conducting safety, environmental, and other reviews. The new reactor licensing process now includes preparation of EISs and SERs for qualification of specific sites, certification of standard reactor designs, preparation of EISs and SERs for Combined Construction and Operating License applications (COLAs), and qualification of reactor component vendors.

Argonne staff members assist with environmental reviews of new reactor applications, working with the NRC and its contractors and leading the effort to prepare EISs for two of the COLAs. Argonne has reviewed the parts of a Design Certification application related to the design and qualification basis for the reactor pressure vessel, core support structures, and internal structures. Other Design Certification and COLA reviews conducted by Argonne involve the design and qualification basis for the control-rod-drive system and parts of a Design Certification application and several COLAs related to the

following Category I structures: (1) concrete containment vessel shell structure; (2) concrete and steel internal structures of the steel containment vessel; (3) all seismic Category I structures and other safety-related structures, except for the containment structure and foundation mat; and (4) foundation mat.

The NRC's relationship with Argonne allows the Commission to consult individuals with the required technical expertise to provide vendor inspections that ensure safe system components in the following areas:

- Ferrous and nonferrous metallurgy involving welding and joining techniques;
- Nondestructive examination of nuclear components, such as piping, welds, cladding, and tubing;
- Hardware and software design, installation, and testing of digital instrumentation and control systems, including all areas of the product lifecycle — from specification, design, documentation, and procurement to manufacturing, assembly, testing, delivery, training, and installation support;
- Design and engineering of pumps, valves, and other nuclear power plant mechanical systems;
- Nuclear power plant structural engineering and design; and
- Design and implementation of electrical systems involving high and medium voltage power transmission and distribution systems and design and operation of on-site power sources.