

# Renaissance Watch: Licensing is winding down

*One of the drivers of the Nuclear Regulatory Commission's ongoing force reduction effort is the fact that the reviews of the remaining active license applications are nearly finished.*

By E. Michael Blake

Critics of the Nuclear Regulatory Commission, in Congress and in the nuclear industry, may want to consider tempering some of their complaints about the agency's budget—especially if the construction of new power reactors in the United States is desired as a goal. Any substantial reduction in the work of the NRC would almost certainly not affect its core missions with regard to public health and safety. Among the work that is most likely to be diminished, or prolonged, are actions on requests by licensees for amendments (including license renewals and power uprates) and exemptions, reinterpretation of laws and regulations, and applications for new facilities. That said, as the NRC seeks to draw down its budget through its Project AIM 2020, pending applications for new reactor licenses may not be affected, because in most cases, the staff's work on the applications is nearing completion.

A decade ago, nuclear electricity providers pushed not just to test the power reactor licensing process in 10 CFR Part 52, but to actually use the process to seek real licenses. The outcome of this push is that combined operating licenses (COL) have been issued on four applications for seven reactors. The construction of four reactors at two sites is at an advanced stage, while the applicants for the other two licensed projects have tempered their enthusiasm



Photo: TVA  
**Watts Bar:** Unit 2 was fueled last December.

and don't plan to build the reactors in the near term.

This leaves four active applications, also for a total of seven COLs, and the environmental reviews are finished for all but one; the final environmental impact statement (EIS) for Florida Power & Light Company's Turkey Point-6 and -7 is scheduled for issuance in October. The safety reviews for Duke's Levy-1 and -2 and Lee-1 and -2 and Turkey Point-6 and -7, are expected to end in June, August, and November,

respectively, with the issuance of the final safety evaluation reports (SER). The lingering issues over design changes (such as the condensate return) and control room habitability and dose were closed out by the NRC in March. Dominion's North Anna-3 will take longer, with seismic issues arising from a 2011 earthquake near the site still to be resolved. The target date for issuance of the final SER is April 2017.

This leaves relatively little billable-hour staff work to be done in the near fu-

ture. With the withdrawal over the past 12 months of the COL applications for Bellefonte-3 and -4, Callaway-2, Calvert Cliffs-3, and Grand Gulf-3 (in addition to the withdrawal of the Nine Mile Point-3 application in 2014), the only remaining open COL dockets (apart from those mentioned above) are for Bell Bend, Comanche Peak-3 and -4, and Harris-2 and -3. For various reasons addressed below, it is unlikely that these proceedings will become active again during the reach of Project AIM 2020, although there has been enough activity concerning one of them to complete a major task: On April 21, the NRC issued the final EIS for Bell Bend, which is proposed for a site adjacent to the Susquehanna plant in Pennsylvania by an organization that is now under the ownership of a recently created firm called Talen Energy. Bell Bend cannot advance any further, however, without a resumption of activity on the design certification of the chosen reactor model.

Rounding out what could be thought of as the first wave of 10 CFR Part 52 licensing proceedings, on April 26, the Atomic Safety and Licensing Board that held the mandatory hearing on PSEG Nuclear's application for an early site permit authorized the staff to issue the permit (see page 23). PSEG has announced that it has no immediate plans to build new nuclear capacity at the site, which is adjacent to the company's Hope Creek/Salem power reactors in New Jersey.

So are we emerging from the era of new reactor licensing? Not necessarily. Although they may not amount to a "wave," some 10 CFR 52 initiatives have begun since 2010. One of them is generating quite a few billable hours right now, another may do so by early next year (and be followed by a COL application), and still another (not yet formally declared) may become the first COL application for large light-water reactors since 2009.

### Why certify?

NRC new-reactor activity may have eased off in general, but not on the application for certification of the design of the APR1400 reactor, which is backed by a South Korean consortium led by Korea Hydro & Nuclear Power Corporation (KHNP). The NRC staff had scheduled six face-to-face meetings with KHNP for the first three weeks of May, and three more are planned for June. More meetings could be scheduled in that time frame, since the end of one meeting can set the agenda and preparation time for another new meeting.

In February, the NRC declared the completion of Phase 1 of the six-phase technical review (issuance of the preliminary SER and requests for additional information [RAI]; experience with other certifications suggests that there could be many

more RAIs later on), and the target date for the completion of Phase 2, issuance by the NRC of the SER with open items, is November.

Moving past Phase 1 is something of an achievement in light of the fact that the consortium first applied to certify the design of the 1,400-MWe pressurized water reactor in 2013, with the submittal of the application having been delayed twice before then, but the NRC did not accept the application for docketing on the grounds that not enough information was provided. A revised application, submitted in December 2014, passed muster and was docketed.

Getting through Phase 2, however, has been extremely difficult for other applicants, as their responses to RAIs either did not lead to the closure of key NRC questions or forced the applicant to rethink the design's core principles. Areva's U.S. EPR got through Phase 3 (the Advisory Committee on Reactor Safeguards' review of the SER with open items), but mainly because the NRC had allowed some unresolved issues, originally to have been addressed in Phase 2, to be treated as open items. These items were still not resolved after Phase 3, so Phase 4 (the advanced SER with no open items) remained incomplete in February

2015, when Areva asked that the NRC stop work on the application. Mitsubishi Heavy Industries' US-APWR had not reached Phase 2 completion when the applicant asked in November 2013 that the NRC defer further work.

Despite substantial reductions in their commercial prospects, the U.S. EPR and the US-APWR are the reference designs in the COL applications for Bell Bend and Comanche Peak-3 and -4, respectively. The APR1400, with one unit finished in South Korea and seven more under construction (three in South Korea and four in the United Arab Emirates), has no license applicant in the United States. Certification in this country might make the APR1400 more marketable in other countries, given the "gold standard" reputation of the NRC worldwide, but this reactor model already seems to be doing very well at attracting customers who are ready to buy and build now—as opposed to those not-yet-nuclear countries that sign intergovernmental agreements and memorandums of understanding with vendor countries that may have to cover many of the eventual projects' costs.

The decision to seek APR1400 certification in the United States was made early in this decade, when the consortium was first seeking to export the APR1400. The scandal over insufficiently qualified ca-

bling in the APR1400s under construction in South Korea had not yet come to light. Thus, the consortium did not seek NRC approval just to improve the reactor model's image, but that approval may now be more helpful for APR1400 sales to emerging nuclear markets. Then again, those markets may be pulling back from building reactors (as some of them have done a few times in the past), or seeking to pay less for them. It has been reported that in some of the negotiations that haven't progressed, it was the consortium that decided to pull back.

The reason for certification is much clearer in the case of the NuScale Power Module. The designer, NuScale Power, intends that the 50-MWe (gross) integral PWR be built and operated first in this country and then exported to other interested countries. So far, this approach is made feasible by the declared intention of Utah Associated Municipal Power Systems to apply next year to license a NuScale Power Module-based plant (with multiple modules) in 2017. The target for the submittal of the design certification application is sometime in the second half of this year.

The NRC has had several pre-application meetings with NuScale Power personnel, and the pace is likely to pick up once the certification application is submitted. In

many ways, the module resembles a conventional LWR, but the differences are substantial (most notably, helical-coil steam generation within the reactor vessel). NuScale Power would also like to have the design credited with a far different source term than what the NRC uses for conventional LWRs (for example, to allow a plant's emergency planning zone to be the site boundary). NuScale Power and the NRC have also disagreed on how many control room personnel would be needed to operate a plant with as many as 12 modules. Last year, the NRC requested public comments on draft design-specific review standards, which the agency intends to use to make key decisions on how the NuScale Power Module is to be certified and regulated. At this writing, the final version of the draft standards had not been issued.

Utah Associated Municipal Power Systems has no nuclear experience, but the consortium set up to support Oregon-based NuScale Power includes Energy Northwest, owner and operator of the Columbia nuclear power plant, which houses the only licensed power reactor in the region. If the licensing effort goes ahead as planned, Energy Northwest will take on the role of plant operator.

Other hints about possible new ventures can come to light in responses to the

NRC's requests for advance information so that the agency can plan its budgets accordingly. The NRC asks for this information voluntarily, and even if someone responds, the information might be withheld from public disclosure. Even so, Southern Company has indicated (and not just to the NRC) that it might apply for COLs for another twin AP1000 plant, with the most recent statement (in this case, to the Georgia Public Service Commission, earlier this year) suggesting that the plant would be built on a greenfield site in Georgia. Also, in what may be the first effort in decades to gain regulatory endorsement for something other than a light-water reactor, the startup company X-energy, which seeks to develop a pebble bed high-temperature gas-cooled reactor, has stated that it may submit something for NRC consideration in fiscal year 2017, which begins in October.

### The summary

In what follows, **BOLD CAPITALS** are used for projects under (or approved for) construction; **bold** indicates a submitted application; *italics* means that an application is forthcoming. Acronyms: ACRS, Advisory Committee on Reactor Safeguards; ASLB, Atomic Safety and Licensing Board; COL, combined construction and operating license; COLA, COL application; CS, proposed date for the start of commercial operation; EPC, engineering, procurement, and construction; ESP, early site permit; FEIS (DEIS), final (draft) environmental impact statement; FSER (DSER), final (draft) safety evaluation report; ITAAC, inspections, tests, analyses, and acceptance criteria; MH, mandatory hearing and final decision; RAI, request for additional information; TBD, to be determined.

In many cases, detailed schedules for the NRC staff's technical reviews are in effect, and the following abbreviations are used for the phases of the design certification process: P1 (RAIs issued by the NRC); P2 (SER with open items); P3 (ACRS review of SER); P4 (advanced SER); P5 (ACRS review of advanced SER); and P6 (FSER). COLA reviews are based on the same six phases (referred to below as SP1 through SP6), but in some cases, the NRC is using a four-phase safety review with letters instead of numbers (SPA through SPD), essentially skipping SP2 and SP3. The COLA environmental review has four phases: EP1 (scoping); EP2 (DEIS); EP3 (comments on DEIS); EP4 (FEIS).

### Licensed, awaiting startup

**WATTS BAR-2**, 1,177-MWe Westinghouse PWR, Tennessee Valley Authority; Spring City, Tenn.; *the operating license was issued on October 22, 2015*. Fuel

loading was completed on December 8. CS: summer 2016.

At this writing, fuel has been in the Watts Bar-2 reactor vessel for five months, and apart from spontaneous fissions that would happen anyway, the uranium-235 has not started to release significant energy. TVA has gained NRC approval to complete a number of pre-startup tests after fuel loading. The end of the long wait was in sight, however. On May 2, TVA announced that Watts Bar-2 would be taken to initial criticality in May, with the target date for commercial operation moved from the first half of 2016 to this summer.

### Under construction

**VOGTLE-3, -4**, 1,100-MWe Westinghouse AP1000s, Southern Nuclear Operating Company; Waynesboro, Ga.; about 60 percent complete in EPC terms. CS: late 2019 and 2020. *The COLs were issued on February 10, 2012*. ITAAC status: 22 are closed and confirmed by the NRC for Unit 3; 21 are closed and confirmed for Unit 4.

Perhaps now, with Westinghouse having agreed to a settlement with both of its U.S. customers and taking over the nuclear business of CB&I, the rest of the work on the projects will go more smoothly than it did while component fabrication



was going through delays. On April 18, Southern took delivery of the first of the four reactor coolant pumps for Unit 3. The “canned” pump design for the AP1000 had been a concern, but the first pump for the Sanmen plant in China passed qualification testing last year.

**SUMMER-2, -3**, AP1000s, SCANA/Santee Cooper; Parr, S.C.; completion percentage not yet stated. CS: late 2019 and 2020. **The COLs were issued on March 30, 2012.** ITAAC status: for Unit 2, 25 are closed and 24 are confirmed by the NRC; for Unit 3, 22 are closed and 21 are confirmed.

The settlement with what was then called “the consortium” (with Westinghouse now in charge of every business unit that truly matters) has been accepted by state regulators in South Carolina, as it has in Georgia. This has not quieted assertions (from commenters not in an official capacity) that the deal will make the final cost of the plant, and the power it produces, too high.

### Licenses received

**FERMI-3**, ESBWR, DTE Energy; Monroe, Mich. CS: TBD. **The COL was issued on May 1, 2015.** The licensee has not signed an EPC contract, nor has it announced any commitment to build and operate the reactor.

**SOUTH TEXAS-3, -4**, Toshiba ABWRs, Nuclear Innovation North America; Palacios, Texas. CS: TBD. **The COL was issued on February 12, 2016.** An EPC contract was signed in February 2009.

To some extent, this project has always been conditioned on the receipt of a loan guarantee from the Department of Energy. In the years since the DOE gave the project a preliminary offer sheet, the DOE’s guarantee authority has been broadened to more potential projects, with no greater dollar amount, and the DOE has said nothing about whether it still considers South Texas-3 and -4 to be candidates for a loan guarantee.

### License applications

Both to save space and to keep the focus on the most active projects, the following list excludes Duke Energy’s Harris-2 and -3, Entergy’s River Bend-3, Luminant Power’s Comanche Peak-3 and -4, and Susquehanna Nuclear’s Bell Bend, which have been either slowed or suspended at the request of the applicants. It will be restated, however, for Bell Bend: **FEIS issued on April 26, 2016.** This list now includes no nuclear capacity of any kind, partly built or entirely new, at TVA’s Bellefonte site in Alabama; the agency recently took public comments on whether to sell the site.

**North Anna-3**, ESBWR, Dominion Generation; Mineral, Va. CS: TBD, perhaps 2029; FSER: April 2017; **FEIS issued**

**on March 17, 2010.** SP3 completed, November 2009; SP4 due, October 2016 (13 chapters completed). Dominion and GE Hitachi Nuclear Energy have stated that they have agreed on all contract terms, but Dominion has not committed to building the reactor and so has not signed an EPC contract. The hearing record is closed.

Fermi-3 was the first ESBWR to be licensed, but North Anna-3 may be the first to be built, although perhaps not right away. In a filing on April 29 with the Virginia State Corporation Commission (which, among other things, regulates utilities), Dominion stated that it considers North Anna-3 to be of great value, but the timing is uncertain because of the prospect of federal limits (or the lack thereof) on carbon dioxide emissions in the power generation sector. For this reason, Dominion estimates a startup date of 2029, although it has been working more closely with GE Hitachi on this not-yet-licensed project than DTE has on the licensed Fermi-3.

**Lee-1, -2**, AP1000s, Duke Energy; Gaffney, S.C. CS: 2024, 2026; FSER: August 2016; **FEIS issued on December 20, 2013;** MH: TBD. SPC completed, December 2015. There are no intervenor contentions.

Mandatory hearing dates had not been announced at this writing for this Duke project or for Levy-1 and -2, although with two sets of AP1000 licenses already issued, perhaps the only concern that could arise is whether the Fish and Wildlife Service could change the status of the northern long-eared bat from threatened to endangered. What may ultimately impede this project are the terms under which it would be acceptable to North Carolina regulators, because while the plant is in South Carolina, most of the customers are in the state to the north.

**Levy-1, -2**, AP1000s, Duke Energy; Levy County, Fla. CS: 2024, 2025–2026. FSER: June 2016; **FEIS issued on April 27, 2012.** SPC completed, January 2012. The contested hearing was resolved in Duke’s favor. The EPC contract was canceled on August 1, 2013. Open issues in the safety review were resolved as of March 1.

This project was started by Progress Energy, and the merger with Duke gave the company six potential AP1000s (counting the suspended Harris-2 and -3, also started by Progress). Perhaps more than any other applicant still pursuing COLs, Duke has moved from enthusiasm for new nuclear before the fracking boom to hesitation while fracking is in full swing.

**Turkey Point-6, -7**, AP1000s, FPL; Florida City, Fla. CS: 2022, 2023; FSER: November 2016; FEIS: October 2016; MH: TBD. SPA completed, June 2015; SPB due, July. EP2 completed, February 2015. One intervenor contention has been admitted into the hearing process.

More than 11,000 public comments on the draft EIS were submitted, prompting the NRC to push back the target date of the final EIS by eight months. Also, because of unresolved design issues, target dates have not been set for the rest of the safety review. At least FPL has made some headway in the contested hearing process, although not as much as it wanted; on April 21, the presiding ASLB granted part of FPL’s request for summary disposition of the intervenor contention on wastewater chemical discharge, but kept the part of the contention asserting possible migration of the chemicals to the Upper Floridan Aquifer.

**Eastern Idaho**, two or more NuScale Power Modules, Utah Associated Municipal Power Systems with Energy Northwest; on or near property of Idaho National Laboratory. Application submittal is planned for 2017.

### Early site permits

**PSEG site**, reactor TBD, PSEG; Salem, N.J. **FSER issued September 16, 2015; FEIS issued November 13, 2015.** MH: March 24. **The ESP was issued on May 5, 2016.**

**Clinch River**, reactor TBD, TVA; Clinch River, Tenn. TVA’s 2015 integrated resource plan does not include any nuclear capacity at this site but allows for further study of small modular reactors. TVA has held pre-application meetings with the NRC, but no target date has been announced for application submittal.

**Blue Castle Project**, two AP1000s, Blue Castle Holdings; Green River, Utah. The application is currently planned for submittal in late 2016.

### Design certification

**ABWR**, 1,350-MWe boiling water reactor, GE Hitachi or Toshiba. The original General Electric design was certified in 1997. **The final certification rule** for Toshiba’s version, for South Texas-3 and -4, **was published on December 16, 2011, and became effective on January 17, 2012.** GE Hitachi and Toshiba have both applied for the renewal of the ABWR certification, which expired in 2012. The NRC has docketed both applications, and reviews are being carried out without specific schedules.

**AP1000**, 1,100-MWe PWR, Westinghouse. This design was certified in 2006. In 2007, Westinghouse applied to amend the design. **The final certification rule was published on December 30, 2011, and became effective immediately.**

**ESBWR**, 1,520-MWe BWR, GE Hitachi. **The final certification rule was published on October 15, 2014, with an effective date of November 14.**

**U.S. EPR**, 1,600-MWe PWR, Areva. Technical reviews have been suspended at the applicant’s request. P3 completed, May

2012; P4 due, TBD (six chapters completed, and part of one other).

**US-APWR**, 1,700-MWe PWR, Mitsubishi Heavy Industries. At the applicant's request, technical reviews have been slowed but not halted completely. P1 completed, January 2009; P2 due, TBD (17 chapters completed).

**APRI400**, 1,400-MWe PWR, consortium led by Korea Electric Power Corporation. The certification target date is TBD, but a schedule was set for technical reviews in June, with P6 in September 2018. P1 completed, March 2016; P2 due, November 2016.

*Westinghouse SMR*, 225-MWe integral PWR, Westinghouse. The application submittal date is TBD, and Westinghouse has reduced work on the design.

*mPower*, 195-MWe integral PWR, Generation mPower (BWX Technologies/Bechtel). The application submittal date is TBD, and in March it was announced that Bechtel has taken charge of development, with the goal of arranging outside financing by March 2017. If enough money comes in to revive the project, BWXT will provide \$60 million in in-kind design services; if it does not, BWXT is to pay Bechtel \$30 million to resolve all claims, disputes, and issues. A draft set of design-specific review standards was issued in May 2013.

*NuScale Power Module*, 50-MWe (gross) integral PWR, NuScale Power. The application is expected in late 2016. A draft set of design-specific review standards was issued in June 2015.

*SMR-160*, 160-MWe integral PWR, Holtec International. The application submittal date is TBD.

There are no other declared certification candidates at this time, but many other designs have been proposed. In January, the DOE chose two projects for new funding support: X-energy's *Xe-100*, a pebble bed gas-cooled reactor, and the *Molten Chloride Fast Reactor* from a team that includes TerraPower and Southern Nuclear.

That mention of non-LWRs may take us ultimately to the next would-be renaissance (a term we have always used with a degree of levity). To the extent that there is excitement in reactor design, it is far outside the realm of the prismatic-fueled conventional steam-cycle LWR. The DOE and the NRC have conferred on how to develop a system for the deployment of non-LWRs. It is probably not enough for proponents of non-LWRs merely to insist that the NRC learn enough about the designs to regulate them as routinely as it does LWRs; proponents might want to look past their own idealism to see what the real world actually needs, and can use, in an energy production system. **NW**