4.3.5 Small Modular Reactors

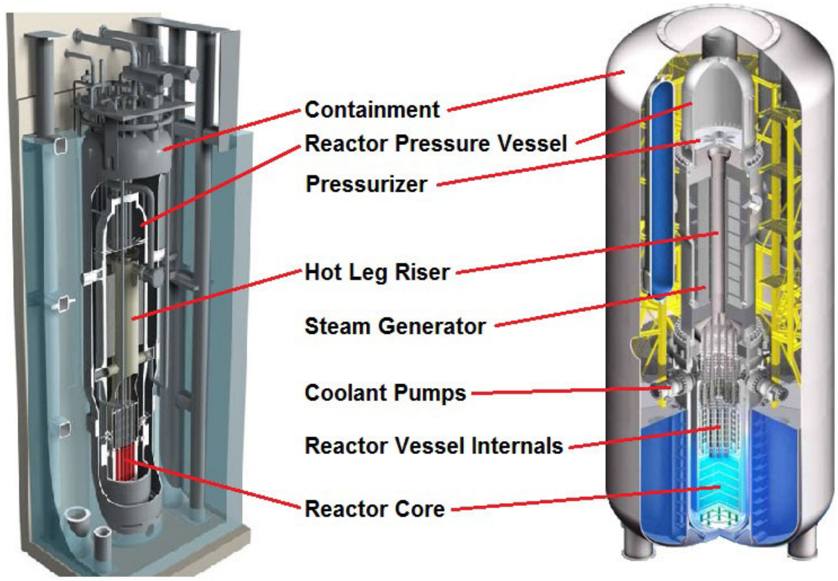

Figure 1: Sketches of the NuScale (left) and Westinghouse (right) SMRs (not to scale).

In recent years there has been an increase of interest in the development of small modular reactors (SMRs) about a quarter of the size of conventional large-scale commercial reactors. Most (though not all) of the SMR designs are traditional pressurized water reactors designed to be manufactured in a factory and transported as a whole to their operating location. This would allow faster construction and more flexibility in the deployment and ultimate disposal of the reactor. Examples shown in figure 1 include the proposed Westinghouse SMR that generates 225 MW of electricity; conceptually 25 of these reactor containment vessels units would fit within the containment of a full-scale Westinghouse AP1000 reactor plant. The 27 m tall containment vessel encloses a 24.7 m tall reactor vessel housing a core with 89 assemblies loaded with $< 5\%$ enriched U^{235}. The passive safety systems require no operator intervention for 7 days. Also shown is the smaller NuScale SMR designed to generate 45 MW of electricity; the 24.3 m tall containment enclosing a 19.8 m tall reactor vessel operates in a below-grade, water-filled pool of water. It is designed to safely shut down and self-cool indefinitely with no operator action, no electric power and no additional water. These SMRs are also designed to be combined in a multiple reactor array with a unified control and safety system. In a general sense they reflect an operational strategy similar to that of the small gas turbine generating units, designed for flexibility in deployment and usage as well as speed of construction. Thus some of the decrease in efficiency is offset by the reduced start-up and shut-down durations.

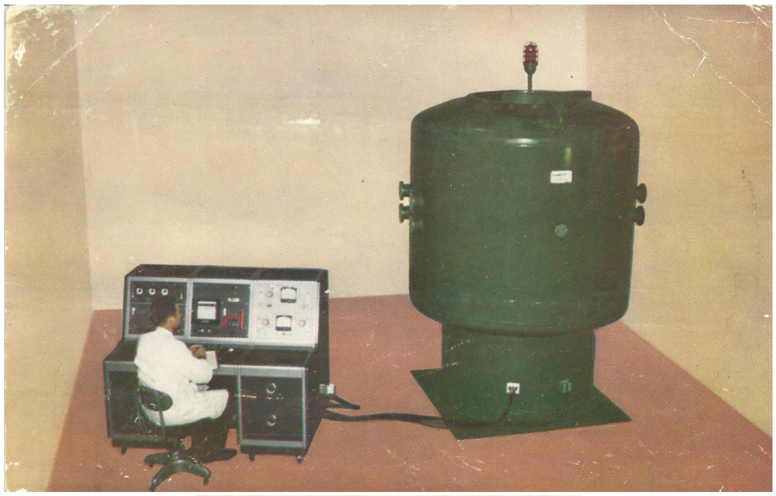

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Figure 2: Postcard advertising a personal reactor, circa 1950. Top: front; Bottom: obverse.

It is interesting to reflect that, in the early days of nuclear reactor development, Aerojet-General advertised a personal nuclear reactor, the $AGN201$, that is depicted in the advertising postcard shown in figure 2. The blurb on the back of the postcard is particularly disingenuous and illustrates how much public perceptions of reactor safety have changed.