THE USAEC HEAVY-SECTION STEEL TECHNOLOGY PROGRAM : OBJECTIVES AND STATUS

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The number of civilian reactor power stations in operation, under construction and on order now exceeds one hundred. The vast majority of the reactor systems employed in these power stations are the water moderated variety, being either boiling water reactors (BWR) or pressurized water reactors (PWR). The evolution of the concepts has resulted in vessels with walls up to at least 12-in. thick and diameters up to 16 ft for PWR plants and 6 to 8-in. thick with diameters over 20 ft for BWR plants.

The U.S. Atomic Energy Commission (USAEC) has the responsibility for public safety in assuring safe operation of these nuclear stations. The Heavy Section Steel Technology (HSST) program which was initiated in 1966 is one of the larger engineering programs undertaken by the USAEC in meeting its safety responsibilities.

The HSST program is concerned with the primary vessels for water reactors with the main emphasis being placed on the effects of flaws, material inhomogeneities and discontinuities on the behavior of the vessels under normal operating and accident conditions. Emphasis is placed on developing a technology that can be used to establish the margin of safety against failure of the vessels, particularly catastrophic vessel failure that could invalidate critical plant safety features.

Fracture phenomena under the environmental conditions of interest and the effects of section thickness on the fracture behavior of the large reactor vessels are being examined through a systematic progression of specimen size up to the equivalent of a full section thickness of 12 in. The program will culminate in a series of simulated service tests in which deliberately flawed vessels of substantial thickness will be tested to fracture.

The broad spectrum of investigations of the HSST program covers metallurgy, chemistry, material properties, inspection, analytical and experimental stress and strain analysis, environmental effects (with emphasis on irradiation), fracture mechanics, and the general area of fracture behavior.

In this paper the status of the various investigations will be presented and the significant accomplishments in each of the areas of investigation will be summarized.