# PREFACE

# FABRICATION OF COMPONENTS OF THE CREYS-MALVILLE PLANT

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The Creys-Malville plant construction is now almost complete. Functional testing is well under way; loading and criticality are scheduled for 1985. A stage has been reached where first conclusions can be drawn from the Superphénix design and construction experience. It is this vast reservoir of unique practical know-how that was the subject of the recent meeting in Paris, "Experience acquise pendant la fabrication des composants du surgénérateur de Creys-Malville," December 16, 1982, organized by the Société Française d'Energie Nucléaire, Kerntechnische Gesellschaft, and the Società Nucleare Italiana, where the papers that follow were presented in French.

Superphénix is the world's first commercial size breeder. The scale-up from its predecessor, Phénix, represents a considerable engineering achievement, accomplished within just ten years and encompassing an immense technological stride forward. Design studies were performed using computer calculations and experimental research methods unthought of ten years ago. Hitherto unexplored aspects were investigated, in particular, in the fields of fatigue-creep damage assessment, seismic analyses, and identification and prevention of sodium water reaction hazards. New methods and procedures were elaborated, and highly specialized engineering teams were gradually formed and are presently ready to inaugurate the next step in fast breeder development.

As regards component fabrication, the constructors benefited fully from the Phénix experience, although many problems arose that required entirely new solutions.

Certain equipment, like the fuel-handling machines, was directly derived from the Phénix devices. The scale-up, in this case, proved completely successful, and these components required only minor adjustments after testing in the Commissariat à l'Energie Atomique sodium loops at Cadarache in the south of France.

Similarly, the primary and secondary sodium pumps derive directly from their predecessors, but scale-up had a considerable influence on the design and manufacture of certain castings, such as impellers, diffusers, and suction chambers. Tests performed in water at the Electricité de France test center in Gennevilliers proved satisfactory, and the pumps will be tested in sodium after installation in the reactor, just before startup.

For the reactor block fabricated structures, compliance with stringent seismic requirements raised certain problems, which had to be solved by the addition of various corrective devices, such as antivibrational devices, stiffeners, etc., or by the redesign of certain elements. The scale-up to the very large vessels designed for Superphénix involved, however, no particular difficulties. It was, in fact, the heat exchangers that raised the most serious problems. The intermediate heat exchanger (IHX) support structures were redesigned for seismic resonance reasons. After analysis of the 1976 Phénix IHX incident, tube bundle flow rate and temperature profiles were redefined, which involved a vast amount of additional design work.

The Superphénix steam generator (SG) differs entirely from that adopted for Phénix, which was unsuitable for a commercial reactor. The SG units developed for Creys-Malville thus required not only extensive research and development, the development of new, sophisticated computer codes for design validation, but also laboratory verification of the properties of the metal used for the tubes and the elaboration of research programs to define suitable welding processes.

It is perhaps still too soon, two years before Superphénix comes on line, to assess all aspects of the achievement. The experience is obviously a considerable technical success, however, accomplished under difficult, multinational conditions in a pioneering engineering field.