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DESIGN APPROACHES FOR ENHANCING THE ENGINEERING FEASIBILITY OF TOKAMAK POWER REACTORS*

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In this paper, we review the design approach developed in the ORNL Fusion Power Demonstration Study.[1] In carrying out this study, we have emphasized the application of current and near-term technologies as the most logical path to demonstrate commercial feasibility in this century. In addition, we are pursuing simplified, practical concepts to present fusion as a more acceptable energy source for the utility industry.

The following design concepts are a summary of those having greatest impact on reactor feasibility by the application of current or near term technology.

1. Blanket Structural Material

It is our judgement that an alloy similar to type 316 stainless steel will be capable of achieving integral wall loading of 10-20 MW-yr/m^2. This is accomplished primarily by limiting the first wall temperature to 400°C to minimize radiation effects. Moreover, the unique helium production reactions associated with nickel-bearing alloys in thermal neutron fluxes allow an excellent simulation of fusion reactor neutron radiation effects in existing fission reactors.

2. Blanket Coolant

We are pursuing three alternatives for the primary blanket coolant with the major emphasis on design reliability. Sodium-potassium salts seem to offer the most promise due to their capability to transfer heat at low pressure. Helium and liquid lithium are also being pursued as attractive alternatives. The ultimate choice will necessarily be based on development and demonstration

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