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RESEARCH OF SECONDARY CIRCUIT WATER CHEMISTRY REGIMES (WCRs) IN GENERATION IV REACTORS

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Modern approaches to Generation IV nuclear energy development include the design of a pilot and demonstration power complex (PDEC) featuring the advanced lead-cooled reactor operating within a closed nuclear fuel cycle. A critical operational aspect of such systems is ensuring reliable secondary circuit water chemistry regime (WCR) to minimize corrosion and deposition.

Current nuclear power plants employ various water chemistry regimes (WCRs) including zero-solid treatment, hydrazine-based, ammonia-based, hydrazine-ammonia combined. However, none completely prevent iron-oxide and calcium-magnesium deposits. For the advanced power unit, a comprehensive technical solution has been developed based on:

1. Corrosion mechanism studies
2. Iron corrosion product transport analysis
3. Monitoring of salt impurities and oxygen content.

Key implemented solutions include:

– zero-solid WCR using corrosion-resistant steels for feedwater system components exposed to secondary circuit media;
– ultra-high purity water for circuit filling;
– stainless steel or titanium condenser tubing.

The system additionally incorporates 100% condensate polishing using precoat ion-exchange filters (PIEFs) with a mixed-bed powdered cation/anion resin.

These measures are designed significantly to reduce corrosion rate; to extend equipment lifespan; to enhance safety margins for advanced nuclear power complexes.

A comprehensive analysis of the implemented technical solutions and their system performance impacts will be discussed in detail in future.