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Experimental investigation on hot water seal over an analogous U-shaped device

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Abstract

A scale ration of 1:1 test loop was constructed to investigate the water seal formation phenomenon in front of pressurizer safety valve in nuclear plant. The water seal features were investigated under the condition of pressure ranging from 0.15 to 0.55 MPa. The test was placed in a room with air conditioner to make sure the temperature in the room is keep relative stability thermal conditions, the temperature in the room may fluctuation between 20 degree to 25 degree. Water level oscillates in the process of water seal stabilization, the experimental data fit very well with the proposed model in the paper. The water seal formation time reduced significantly with pressure increasing and air concentration decreasing. Refilling of the pipe is much more rapid than the initial one due to a lower content of non-condensable gases remaining in the steam. Finally, the water seal starting point judgment method has been put forward in this paper.

Keywords

Hot water seal; Non-condensable gases; Water seal oscillate; inclined annular tube; condensation.

1. Introduction

As an advanced third generation nuclear power technology, "Hualong One" equipped with a new design in water seal device in front of pressurizer safety valve. In the previous nuclear power plant, a U-shaped tube filled with water was the water seal structure, installed in the pressurizer discharge line connected the safety valve and the pressurizer. The U-shaped tube water seal structure played a role of preventing non-condensable gas leaking through from the relief and safety valve. to reduce the thermal/hydraulic pipe loads in downstream pipe system when open the safety valve and to maintain the safety valve temperature stability, the designer moved the water seal structure from the outside of the pressurizer to inside of the pressurizer, this research is to verify the availability of the new structure. Compared with the existing works, this paper combined with condensation with water seal oscillation, put forward a judgment method to decide the hot water seal starting point.

It has been found that when the safety valve opened, the activation of safety valve causes the loop seal water slug to move through the safety valve and into the downstream pipe, the movement of this water slug in

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