SAFETY EVALUATION

ESSENTIAL SPRAY POND PIPING
PALO VERDE NUCLEAR GENERATION STATION

Engineering Branch
Division of PWR Licensing-B

## Introduction

The spray pond trunk lines and spray nozzle piping have revealed, under radiographic examination, a combination of intermittent pipe wall thickness deteriorations and through wall pitting due to microbiologically induced corrosion. The licensee analyzed the structural integrity of these piping systems for the highest total piping loads including those for a seismic event. ASME Code Section III equations were used to work backwards from the allowable stresses to obtain the required pipe weld wall thickness.

## Evaluation

The licensee considered two conditions in the analysis of the piping systems. One was uniform degradation (thinning) of the pipe weld to establish what uniform circumferential weld wall thickness is required. The other was total penetration of the pipe weld by throughwall pits. For this, a conservative model of four equally spaced pipe weld segments of minimum fabricated pipe wall thickness was assumed to determine the circumferential length of integral weld required. For both cases, the highest total piping loads (including those for a seismic event) were taken from the original system design calculation for each size of pipe and were applied to the reduced pipe weld cross section.

The results of the calculation showed that the most critical case was for the 14 inch diameter pipe where a uniform weld wall thickness of 0.206 inch is required, or an intermittent weld length (total of four segments) of 35.12 inches was required. This represented a 34% reduction from nominal wall thickness or a 20% reduction of total circumferential weld length, respectively. Subsequently, radiographic weld examinations revealed 108 indications for a 14 inch diameter pipe weld. For evaluation purposes, it was conservatively assumed that all indications became 1/8 inch diameter throughwall pits. This 30% loss of circumferential weld length was greater than that allowed from the initial conservative analysis and was therefore found to be unacceptable. The licensee was asked to reassess the margins in their simplifying assumptions and refine their analysis. The pipe was reevaluated for the assumed reduced section and the resulting stress was determined for the highest combined loads from the original design analysis as earlier. This time, however, the stress concentration factors around the holes were excluded because (1) the conservative assumptions used for establishing the reduced sections were considered compensating, (2) the evaluation already included component stress intensification factors, and (3) the material in the assumed section was symmetrically distributed around the circumference. The resulting stress was found to be less than that allowed by ASME Code. The 24 inch diameter pipe was similarly evaluated for its maximum number of radiographic indications and was found to be less critical. The remaining pipe sizes were judged acceptable by comparison.

## Conclusion

The existing pipe condition is a combination of intermittent pipe wall thickness deteriorations and throughwall pitting. The majority of the radiographic indications showed negligible deterioration of the pipe wall. The limited number of throughwall pits were mostly pinhole type (1/32 inch or smaller). The pipe is not expected to ever achieve a condition equal to any of the conditions evaluated above. it is concluded, therefore, that the essential spray pond piping is structurally capable of performing its intended function.