COMPARISON OF CIVA SIMULATION DEFECT RESPONSES WITH PHASED ARRAY UT EXAMINATION RESULTS OF WWER 1000 STEAM LINE WELDS

Ladislav Horacek*, Jan Kolar**, Petr Vlček*, Pavel Mares*
*Nuclear Research Institute REZ plc, **CEZ plc Temelín NPP

As a part of safety measures to improve in-service inspection of steam and feed water line welds outside containment at Temelin NPP the mechanised and manual UT examinations have been qualified for pulse echo technique. During the qualification some potential difficulties with defect sizing have been identified especially in case of occurrence of lack of fusion type defect detection close to the outer pipe surface in the vicinity of whip restraints fixation plates where there are decreased scanning limits due to the limited access. The probability of occurrence of such a defect type is very low due the necessity of existence of several simultaneous events (failed fabrication UT/x-ray examination, existence of lack of fusion defect in unfavourable TWE position close to outer surface, existence of defect close to the fixation plate). At present there is a possibility to overcome defect sizing uncertainties and to meet even more stringent qualification criteria for defect sizing with application of phased array UT examination (in comparison to pulse echo technique). In the contribution we provide results of phased array UT examination of the steam line large scale 1:1 test assembly with intended artificial and realistic defects. Defects in the test assembly cover PISC type A crack simulations, lack of fusion defects and fatigue cracks. What concerns defect sizing a maximum underestimation of defect height is close to 1 mm including all 4 lack of fusion type defects. Defect height estimates for majority of crack like defects in the test assembly differ from real height of manufactured defects 0.2-0.6 mm. Very good results have been obtained also using CIVA simulation of test assembly defect responses for phased array UT examination. Within the CIVA simulation the same test assembly geometry with and without influence of weld root and the same test assembly defects have been analysed. A review of available NDT qualification results including application of phased array UT is presented together with lessons learnt.