

**MATERIAL DIAGNOSTIC OF THE PRESSURE EQUIPMENT
IN THE ASPECTS OF NEW PRESCRIPTIONS**



PL0002212

**Ewa Hajewska, Waldemar Bilous, Witold Szteke, Jan Wasiak, Martyna Przyborska,
Tadeusz Wagner**
Institute of Atomic Energy

The association agreement between Poland and the European Union was signed on 1st February 1994. It involved the necessity for novelisation of the Polish law according to the prescriptions valid in UE, in this, the introduction of new methods of equipment diagnostics supervised by the Office of Technical Inspection (OTI). The process of harmonisation of the technical prescription is carried out according to the Directives of New Approach requirements, in particular 87/404/EC and 97/23/EC.

Material Research Laboratory (MRL) has the Certificate of Testing Laboratory Accreditation and is holding 2-nd Degree Approval according to the specifications of the OTI. These facts obliged the laboratory to introduce the new prescription to the investigations practice [1].

In MRL the special attention was given to the material examination of pressure equipment or its elements, according to the Directive 97/23/EC. In 1999 the new procedure for safety assessment of components with cracks was introduced into practice. This procedure can be used both for the assessment of detected cracks or crack like defects and for the defect tolerance analysis. The method utilised in the procedure is based on the R6-method [2] developed at Nuclear Electric plc. MRL applies the SACC program (Safety Assessment of Components with Cracks) developed by Swedish Office of Technical Inspection for use in nuclear power industry [3].

SACC is a Windows based PC-program. It can be used on any type of component and steel material as long as the input required can be quantified. The procedure is used to determine maximum acceptable and critical defect size or load level. The term acceptable is referred to results with required safety margins taken into account and the term critical to results with no safety margins included in the analysis, i.e. with safety factors set equal to unity.

There are some procedures in the SACC-program, in this:

- A fracture assessment procedure for ferritic steel components according to ASME Section XI IWB-3610, Appendix A. The 1995 edition of ASME Boiler and Pressure Vessel Code has been followed. The procedure is restricted to acceptance criteria based on applied stress intensity factor.
- A fracture assessment procedure for austenitic piping according to ASME Section XI IWB-3640, Appendix C. The 1995 edition of

ASME Boiler and Pressure Vessel Code has been followed together with a coming addendum where the so-called Z-factors have been revised and the restriction in maximum allowable crack depth changed from 60 to 75% of the wall thickness for welds by SMAW and SAW. Only analytical solutions according to Appendix C are included in the program.

- A fracture assessment procedure for ferritic piping according to ASME Section XI IWB-3650, Appendix H. In 1995 edition of ASME Boiler and Pressure Vessel Code has been followed. Mainly analytical solutions according to Appendix H are included in the program. However, for axial cracks under EPFM conditions only tabular solutions are available.
- A procedure to calculate crack growth due to fatigue. Fatigue crack growth laws according to ASME Section XI, Appendices A and C have been built into the program. A user also has the possibility to input a crack growth law of their own.
- A procedure to calculate crack growth due to stress corrosion. Stress corrosion crack growth laws according to the Swedish regulation SKIFFS 1994:1 [4] have been built into the program. A user also has the possibility to input a crack growth law of their own.

REFERENCES

- [1] E. Hajewska, W. Bilous, W. Szteke, J. Wasiak, M. Przyborska, T. Wagner: *Material Diagnostic of the Pressure Equipment in the Aspects of New Prescriptions*, VI Seminar: Materials Investigation for Power Plant and Power Industry, Zakopane, 23-25 June 1999, Report IAE-54/A.
- [2] I. Milne, R. A. Ainsworth, A. R. Dowling, and A. T. Stewart: *Assessment of the Integrity of Structures Containing Defects*, The International Journal of Pressure Vessels and Piping, 32, 3-104, (1988).
- [3] P. Anderson, M. Bergman, B. Brickstad, L. Dahlberg, F. Nilsson, and I. Sattari-far: *A Procedure for Safety Assessment of Components with Cracks - Handbook*, SAQ/FoU-Report 96/08, SAQ Kontroll AB, Stockholm, Sweden, 1996.
- [4] *The Swedish Nuclear Inspectorates Regulations Concerning Structural Components in Nuclear Installations*, SKIFS 1994:1, Swedish Nuclear Inspectorate, Stockholm, Sweden, 1994.