

Developments in Fracture Mechanics and Non-Destructive Examination

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INTRODUCTION

The purpose of this chapter is to give a brief review of the major developments and trends that have occurred in some of the technical areas covered by Division G of SMIRT since the first conference was held in Berlin in 1971. As with any human activity, time and experience produce organic change so that the technical areas covered by Division G have changed somewhat over the 18 years of its existence. As first conceived by Tom Jaeger, Division G was one of two divisions devoted to Light Water Reactor Components other than fuel and cladding. Division F was conceived with Core Structures and Piping whilst Division G was devoted to the Steel Reactor Pressure Vessels.

The early Conferences devoted much time to Stress Analysis of particular pressure vessel regions, such as nozzles, cylinder/cylinder intersections, vessel heads and flanges. However, from the start there have always been several sessions on fracture mechanics and reactor vessel integrity analysis, a topic which has been one of growth of interest even up to the present Conference.

By 1979 (SMIRT 5), "Failure Assessment" made up all but one of the sessions, and the Division had become a recognized center for discussion of all aspects of fracture mechanics work, attracting papers and discussion from leading experts in the field.

Similar discussions did occur in other divisions, however, and particularly in Division F in relation to Reactor Circuit Primary Piping to which many of the same features applied. This was recognized at SMIRT 6 in 1981 by the first joint session between Divisions G and F under the title Fracture Mechanics of Piping, and by arranging the timetables so that delegates to other Divisions could attend those sessions of Division G that were devoted to the more general aspects of Fracture Mechanics such as methods of toughness measurement and the development of elasto-plastic fracture mechanics treatments.

In 1983 the Chicago SMIRT 7 had no less than 7 joint G and F sessions covering not only the fracture mechanics methods and their applications to both pressure vessels and pipings but also this similar joint interest in stress analysis, thermal loading and fatigue. This situation led to a reconsideration of the terms of reference of the Divisions such that in the later Conferences, Division G has concentrated on failure assessment aspects of all non-fuel steel reactor components, and by the time of the 8th Conference (Brussels, 1985) the title of Division G was changed from "The Structural Analysis of Steel Reactor Pressure Vessels" to "Fracture Mechanics and Inspection", a change maintained in the present Conference. It is to fit in with the present title and terms of reference therefore that this review is directed only to the aspects of Division G coverage, leaving developments in