Experimental test of heat transfer from transport casks with axial fins

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In order to achieve higher heat dissipation, the outer surface area of the transport and storage cask for radioactive material is increased by the use of cooling fins. The GNB CASTOR® casks are fitted with cooling fins, machined into the cask body, which run circumferentially around the cask outer surface. The first generation GNB CONSTOR® casks have a smooth outer surface without fins which is made from a steel plate. This is possible because the heat capacity of their contents is relatively low. For higher heat capacities of the CONSTOR® cask, it is necessary to develop a special solution to allow heat to be dissipated from the cask´s outer surface. For the CASTOR® cask series, it is also desirable to achieve higher heat dissipation rates. From an economic point of view, a solution whereby separate cooling fins are attached to a smooth outer surface would be preferable to the currently machined fins. Several concept solutions are available to achieve this. One of the concepts has been investigated in detail. This concept comprises a series of aluminium profiles which are strapped to the smooth outer cask surface. This in effect provides a cask with axial fins. This solution also allows for the inclusion of moderator material within certain areas of the aluminium profiles.
Several experiments to investigate this concept have been performed. A test specimen was investigated, consisting of a 2m by 0.4m segment of the finned profile attached to a heating plate. In order to simulate various cask orientations during transport and storage, measurements were taken for different test-piece orientations. CFD simulations of the various tests were also performed.
In this presentation, the experiments, test results and results from the CFD simulations are discussed in detail. The nature of the air flow along the axial fins and its overall effect upon the heat dissipation from a cask is shown. By comparing the experimental results with the results of the CFD simulation, the influence of the different parameters on the modelling of the heat transfer process were evaluated.