



## **Analytical Challenges in the Design of Anchorages for Pressure Retaining Components in Canadian Nuclear Power Plants**

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In Canadian Nuclear Power Plants, pressure retaining mechanical components such as piping systems, pressure vessels etc., are designed to the requirements of applicable standards (ASME Section III, Division 1 and CSA N285). Such components are generally supported by steel or concrete structures, referred in here as civil structures, designed to satisfy applicable civil engineering standards (e.g., CSA S-16, CSA A 23.3, CSA N287.3 etc.). Mechanical components transfer mechanical loads to the supporting civil structure by means of anchors, guides or hangers. However, the combinations of mechanical loads recommended by pressure retaining standards are quite different from those required by the standards applicable to civil structures. The difference in load combinations of the two standards may result in either over conservative or unconservative design, especially in the case of concrete anchors. The application of the right load combination becomes more complicated when a pressure retaining component also serves the purpose of containment, covering a sizeable opening through a massive concrete containment structure. Canadian standard CSA N287.3 imposes additional requirements on concrete containment structures, such as essentially elastic behaviour, on top of those required by CSA A 23.3, the governing standard for concrete structures. This paper investigates the analytical challenges with regard to the interface between the pressure retaining and the civil standards and presents solutions for the design of concrete anchorages subject to the mechanical loads transferred by pressure retaining components. It is concluded that amendments in Canadian standards are warranted.