Enriched Uranium Storage Solution

Client Confidential

Introduction

In order to make up fuel rods for nuclear power stations, low concentrations of uranium hexafluoride (UF6) must first be enriched. Once enriched, the UF6 is typically stored horizontally in steel cylinders. MMI's client double-stacked their cylinders, however, in order to increase storage capacity, wondered whether this arrangement could be increased to a triple stack.

MMI was asked to assess the stability of such an arrangement - taking gravity and seismic load cases into account.

Figure 1: Typical UF6 storage cylinder

Stacked Arrangement

Initial analysis, which involved simply stacking the cylinders on top of each other, indicated unacceptably high stresses at the contact locations. In order to address this, a number of rubber blocks were incorporated into the design to distribute the loading over a larger surface area and reduce the stresses in the cylinders.

Detailed Stress Analysis

The stop blocks were made from a hyperelastic material, which could be affected by both temperature and strain rate effects. Therefore, these were included within the model, in order to predict the bounding stresses.

The maximum stresses within the blocks during the seismic load case were initially calculated using a simplified response spectra analysis, which gave an indication of the loads. Following this, detailed time history analyses were performed in order to calculate the actual stress distribution.

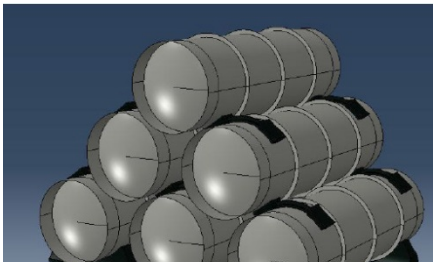

Figure 2:Rendered image of 3 tier stacked arrangement showing rubber blocks

Stability Analysis

In addition to the stresses within the key components, the assessment also considered the stability of the arrangement. This was achieved through a number of sensitivity studies by applying a range of imperfections to the arrangement and assessing the response.

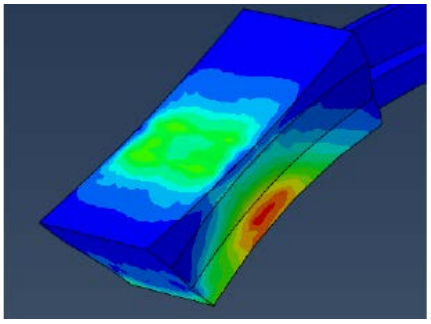

Figure 3: Internal stress distribution within hyperelastic support block

Outcome

The results of the analysis were used to improve the design of the support blocks and provide the site with increased capacity and hence the potential for increased productivity.

www.mmiengineering.com
info@mmiengineering.com