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ROSE CONSULTING ENGINEERS LTD

Nuclear – Capability Statement

1 EXPERIENCE

Rose Consulting Engineers Ltd (RCEL) is an SME company providing specialist engineering analysis services to the process industries. Over forty man years experience have been gained in the successful application of advanced technologies such as Computational Fluid Dynamics (CFD) in process development and safety support.

2 SKILLS

With a successful history of problem solving in the nuclear industry RCEL offer a range of practical skills in support of design and continued safe operation of nuclear related plant, such as;

- technical assessments for COMAH support
- transport analyses for DETR submissions
- fire and ventilation analysis for safety support
- gas dispersion analysis for environmental impact assessments in support of EA submissions
- INSA peer reviews

3 QUALITY ASSURANCE

RCEL internal procedures ensure that suitably qualified and experienced personnel (SQEP) are appointed to carry out the required analysis and that another SQEPed engineer is chosen to check the analysis assumptions, methodology and supporting material.

RCEL procedures have been accepted by all our clients and an independent assessment for ISO9000:2000 is scheduled for the end of 2003.

4 EXAMPLE PROJECTS

4.1 NUCLEAR FUEL TRANSPORT [1]

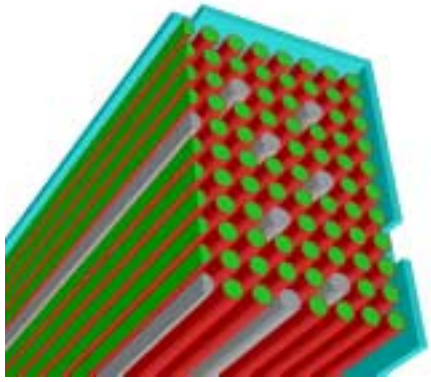

Figure 1 Spent fuel tube bundle, CFD model.

Figure 1 shows the geometry of a spent fuel tube bundle inside a wet transport flask. This was analysed in order to assess fuel cladding temperatures during a standard IAEA fire event. The heat transfer mechanisms considered in this particular analysis included conduction, convection, radiation, evaporation and condensation. Studies were performed with both the CFX and Fluent codes for verification purposes

By considering all of the heat transfer modes, it was shown that the fuel pin cladding did not exceed its design maximum temperature during a fire and that the flask internal pressure remained well within acceptable levels.

4.2 HYDROGEN DISPERSION

In nuclear processes world wide, the generation of hydrogen and the subsequent management of the hazard is key to the safe operation of the plant. The behaviour of hydrogen-air mixtures is complex due to high buoyancy forces imparted by the evolving hydrogen. For safety case submissions the key sensitivities in the engineering models must be assessed. RCEL procedures ensure that important physical phenomena are understood.

[1] Burt, D.J., Cory, A.R., Graham, S.J and Myszko, M. *Ullage Temperatures in Wet Spent Fuel Transport Flasks*, Proc Inst Nuc Eng, Vol 13, No 3-4, 2002.

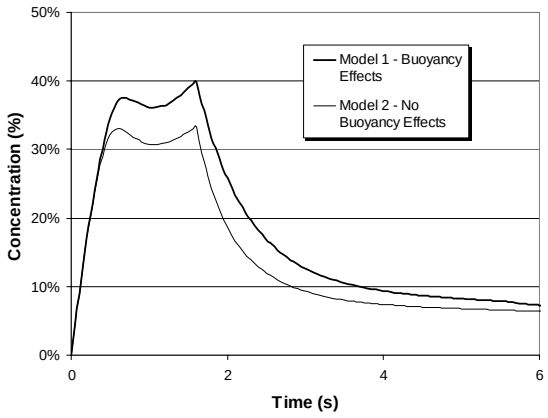

Figure 2 Maximum hydrogen concentrations in an air-vented silo

To illustrate this approach; two simulations were carried out with the Fluent CFD code to investigate the transient dispersion of a fixed volume of hydrogen released over several seconds into a moderately vented silo. Figure 2 shows the difference in the simulations for predicted peak hydrogen concentrations. In one case the effect of turbulent diffusion is over-predicted by not activating the buoyancy term, leading to higher predicted hydrogen concentrations. These higher concentrations would have a significant impact on any subsequent analysis investigating over-pressures due to possible ignition.

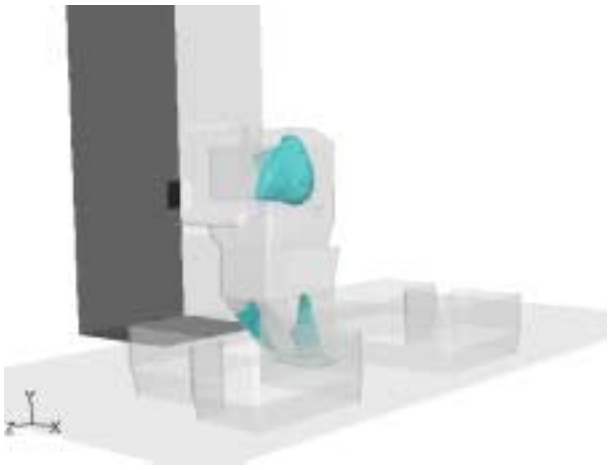

Figure 3 Volume of hydrogen-air mixture at >1% hydrogen concentration

Having gained an understanding of the key physical processes an appropriate methodology can then be implemented on plant. Figure 3 shows the volume of hydrogen-air mixture for a particular release event investigated in radioactive waste packaging building.

4.3 PROCESS ASSESSMENT

Engineering analysis contributes greatly to the further understanding of the processes employed in the nuclear industry, CFD is of particular value because of the highly active nature of the materials involved. In order to increase confidence in the performance of a Sentencing Tank agitator system, prior to active operation, it was planned to undertake both water and simulant testing. However, due to difficulties with experimental simulants, CFD was used in combination with on-site testing using water.

The sentencing tank sat upstream of waste handling plant that had particular specifications for incoming streams. An area of concern was the amount of solids, in the form of grit, and how well these were homogenised. Figure 4 gives a view of the tank agitator system and the predicted velocity field at a particular operating point.

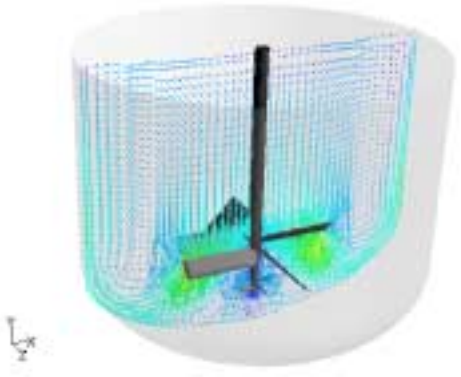

Figure 4 Velocity vectors in a sentencing tank

5 WORKING RELATIONSHIPS

With flexibility being key, RCEL work with clients in several ways. Staff can work on site in order to interact with other client project team members or work packages can be outsourced to RCEL premises. A combination of the two approaches may also be employed where regular interim meetings are scheduled at the client premises. The work may be carried out on a fixed price or charged by the hours undertaken. Please contact Dr. Alan Rose if you have any queries.