

Applying the HVRC VRdose Planner in the design of a Pneumatic Transfer System

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The UK National Nuclear Laboratory (NNL) has developed simulations using the HVRC VRdose Planner, to assist in the design of a Pneumatic Transfer System (PTS) within an active facility. The PTS is at the concept stage, and rationale behind the installation is to facilitate the transfer of small radioactive packages more quickly and safely than is possible using current methods, which require significant input from operators and/or large and heavy equipment. VRdose Planner simulations have been used to determine the optimum pipe material and thickness in order to simulate the radiological effects of mal-operation.

Simulations were undertaken to represent three point sources with a Spent Nuclear Fuel (SNF) inventory moving through the PTS from one end of the plant to another. Dose graphs have been used to understand the radiological implications of the sources and results found the risk to operators to be minimal. The visual animation of the simulation has provided the NNL with a quick and effective way of describing the scenario and identifying areas of risk which would otherwise have been time consuming.

Applications

Design – The programme enables assessors from any discipline or background to interface with the virtual design, undertake operations and fully understand the environment proposed. Furthermore, where layouts are found wanting, they can be rectified in real time and fed back into the official design drawings and requirements.

Safety Case – The development of a safety case are undertaken against a suite of 2D technical drawings which can be hard to follow, particularly for disciplines that do not have regular interface with design. Supplementing the safety case with the availability of advanced simulation and walkthroughs could prove a step change in efficiency and speed up understanding in this process.

Decommissioning – The ability to map out radiation and simulate dose uptake is particularly beneficial during the decommissioning of existing facilities. The ability to create an accurate 3D model and visualise regions of high radiation, allows operators to plan and coordinate activities in advance of operations. The accurate prediction of dose uptake enables realistic operational timescales to be determined. This minimises the risk to operators, and avoids the overly restrictive timescales which are predicted using traditional dose assessment techniques, which are based on very pessimistic assumptions.

Operational Confidence – Having developed and built the model up through the design phase, the real-world plant has its own virtual twin. Within the virtual environment, routine operations can be simulated by a virtual operator with the dose uptake being recorded. Accident scenarios can be simulated and the consequences assessed with a high degree of confidence.

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