

Qualification of LS-DYNA[®] for the Transport and Storage of Radioactive Materials

Gilles Marchaud, Valérie Saint-Jean, Stéphane Nallet
AREVA TN, Montigny-le-Bretonneux, France

Abstract

For 50 years, AREVA TN has been supplying customer-focused, innovative transportation and storage solutions for radioactive material with the highest levels of safety and security.

Transportation and storage casks are designed to comply with stringent regulations. For instance, a cask designed to transport radioactive material may be required to withstand a 9m drop onto a flat unyielding target.

AREVA TN performs LS-DYNA analyses to evaluate the crashworthiness of casks and to reduce the need for costly real tests. Such a methodology relies on the capability of the computer code to model the main physical phenomena that occur in a cask and its content when they are subject to a transient mechanical event.

The validity of LS-DYNA is confirmed by comparing its results with reference results, for a variety of test cases covering these phenomena. The reference results are obtained either analytically or from real tests. AREVA TN defined specific test cases to validate:

- *The main constitutive laws suitable for woods and metals,*
- *The time integration scheme, with a view to the conservation of total energy,*
- *The implementation of geometric nonlinearities (large displacements and rotations),*
- *The correct representation of mass/stiffness distribution (vibrations, rigid-body displacements),*
- *Shockwave propagation,*
- *Energy dissipation in a complex structure composed with components in contact with each other.*

Such a qualification is performed every time AREVA TN chooses to use a more recent version of LS-DYNA.

The present paper will focus on a selection of these test cases and present their features as well as their results.