METHODOLOGY FOR THERMAL TESTS USING TRS

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Theoretical studies on the behavior of equipment items or components exposed to the thermal effects of nuclear weapons are not easy because materials such as print, plastics or composites cannot be accurately modeled due to the structural change of the material during thermal irradiation.
Moreover, results of experiments performed on small samples of materials are not, in most cases, in agreement with the behavior of larger items. A number of experiments have shown the influence of both size and environment on the behavior of equipment items.

Consequently, it is necessary to use the radiation simulation methods appropriate for tests on full scale targets. The large simulators available today are radiation sources using aluminum and liquid oxygen (TRS), but their performance is limited by current technology. The characteristics of the radiation produced by such simulators are different from those of a nuclear explosion, in particular regarding the flux profile versus time and the spectral distribution of energy.

In order to achieve representative simulation, a test methodology was developed, taking into account both the characteristics of the material to be assessed and the performance of the simulator. This methodology is based on the principle of damage equivalence.

This paper presents the measured characteristics of the radiation generated by TRS; the characteristics and behavior of materials which were classified according to their sensitivity to certain simulation parameters; and the methods recommended to guarantee damage equivalence for each class of materials. It also provides a number of experimental results highlighting the interest of full-scale thermal experiments.