HOW DESIGN FEATURES DIFFER FROM IROFS

(The view from AREVA's Horn Rapids Road Facility)

A "design feature" is distinguished from a passive engineered items relied on for safety (IROFS) in this way: If the *only identified failure mechanism* for a specific passive engineered feature is loss of configuration control, then the item or attribute is a "design feature" and *it is not necessary to declare it an IROFS.*

In other words, failure characteristics are used to distinguish between "design features" and IROFS. *Inherent* failure modes relate to passive engineered IROFS, but never to "design features".

Plant examples follow to illustrate how the AREVA Horn Rapids Road (HRR) integrated safety analysis (ISA) Team has implemented this concept.

First, we compare two vessel diameters, one an IROFS, the other not:

The example vessel is a favorable geometry calciner tube (when crediting the inside diameter and wall thickness). This diameter is properly documented and the dimension is controlled for criticality safety. The subject accident sequence involves the favorable diameter increasing to an unfavorable diameter. Because this diameter can change through erosion or corrosion and accidental criticality might become possible, this diameter would be listed as a passive engineered IROFS with management measures to assure that the diameter remains in an acceptable range.

Another calciner in use has a favorable geometry tube to the **outside** diameter of the calciner tube. This diameter is also properly documented and the dimension is controlled for criticality safety. In this case no mechanism other than unauthorized replacement (involving loss of configuration control) was identified to increase the tube size to an unfavorable diameter. Therefore, this diameter is **not** an IROFS. If it is credible for the calciner tube to crack or develop a hole, thereby resulting in a loss of containment event, the loss of containment event would have to be evaluated and IROFS provided if needed.

In a similar fashion, the diameter of a small diameter pipe that transfers fissile solution is not considered an IROFS. It is noted that the pipe may leak and the resulting loss of containment accident sequence will need to be evaluated, and appropriate IROSF established if needed. In this case although a loss of containment has occurred, the pipe diameter has not been lost.

For another example we compare the spacing dimension between two favorable geometry process vessels that contain special nuclear material (SNM). The specified minimum spacing between the vessels is required to maintain an acceptable K_{eff}. The vessels are rigidly mounted to a building structure in a seismically-qualified system. The only credible mechanism to reduce the spacing is unauthorized removal of the tanks and modification of the mounting system which alters the fixed spacing (involving loss of configuration control). The spacing dimension therefore **is not** an IROFS.

<u>On the other hand</u>, consider the transfer of multiple portable vessels into an array where we must control spacing by administratively requiring that they be stored in locked grids designed to maintain spacing. In this situation, assuming the grids was robust and permanently secured to the building structure, the grid spacing is **not** itself an IROFS, because no failure mechanism is

identified to decrease it. However, the administrative requirements governing placement of the containers on the grids would be an IROFS, because many inherent failure mechanisms such as operator error exist, and the grids might themselves be identified as a necessary component of the administrative IROFS.

Thirdly, we consider two different devices installed on a tank of uranyl nitrate solution, both intended to prevent backflow from the tank into an unfavorable geometry. A funnel break might be installed to prevent backflow. This device **need not** be called an IROFS because physical laws prevent reverse flow through it, and the only identified method of failure is unauthorized removal and replacement by a solid-piped connection (involving loss of configuration control). <u>On the other hand</u>, another type of passive engineered device, an overflow drain, used to prevent backflow must be called an IROFS because *inherent* failure methods – i.e., methods of plugging the drain – are identified.

Finally, we look at two aspects of a building structure. The controlling dimensions and design of building walls and floors, if solely considered as support structures for SNM-containing vessels, are not IROFS, because they are covered by baseline design criteria, e.g., seismic qualification, and no *inherent* failure method was identified. <u>On the other hand</u>, in the HRR Facility we have designated various components of a duplex roof as moderation-control IROFS, because *inherent* roof failure mechanisms – ways that leaks *inherently* develop in roofs – have been identified.