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17 February 1977

Mr. L.J. Evans
Chief, Requirements Analysis Branch
Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Evans:

The enclosed paper develops some underlying ideas of containment and its use in Basic Capability 4. It builds upon our papers of 4 February and 31 January, and presents a somewhat different approach from that submitted on 16 February.

Sincerely yours,

Harvey J. Spiro
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HJS:jn

Enclosure

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Although containment systems could be considered along with all other elements of the safeguards system, and their regulation included in the "conditions" part of Basic Capability 2, it is probably more useful to consider containment systems as a separate "Basic Capability." Justification for highlighting their role in the overall safeguard system is twofold:

- They "contain" or encapsule SNM, which is the raison d'etre of the safeguard system. Alternatively speaking, the containment system must be penetrated in order to access SNM - legally or illegally.
- If the containment system is unbreached, no SNM has been accessed.

WHAT SHOULD CONTAINMENT DO?

In order to prescribe regulations for containment, one must specify what functions the containment system is expected to serve. Excluding non-safeguard related functions (e.g., radiation shielding, convenience in handling), one can isolate five basic containment functions:

- ✓ • Delay or prevent theft or unauthorized access to SNM.
- ✓ • Unitize and identify quantities of SNM.
- ✓ • Provide early warning about attempted theft.
- alarm on door broken seals
- ✓ • Provide ex post facto information about theft.
- real time acct'g (diversion)
- physical info on acct'g.
- 7 • Remain closed unless transferring SNM from one containment to another.

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why if in flow stream?

A previous option paper (BC4) delineated some of the trade-offs between delay and information when considering whether containment should be the first "skin" around SNM or the first non-movable layer.

Since the extreme concepts ("first layer" or "all layers") for defining containment tend to be inadequate in fulfilling one or another of these functions, a compromise concept must be introduced if these functions are considered important.

DEFINITION OF CONTAINMENT

The containment system for a given batch of SNM (site specific, subject to the state and use of SNM) can be considered to be the closest n envelopes surrounding the SNM which are not to be breached except to transfer SNM (under authorization) from one containment system to another.

This type of definition allows the assignment of different types of containment to different batches of SNM, yet retains the "closed containment system" concept of function 5.

An example is helpful here. If the containment for some plutonium oxide pellets in storage is defined as "metal cannisters, concrete sheaths (with seals), and a closed vault," i.e., three "layers," these or equivalent layers must always be unbreached for containment to be unbreached. If the vault door must be opened from time to time, a guard or some device must be placed at the vault door (or inside the vault, or both) to replace the "closed vault" third layer which no longer exists when the vault door is open.

The concept emphasized here is that once the n^{th} containment layer is breached, the effective containment of that batch of SNM is reduced to $n-1$ layers. If the system has been overdesigned, this may still be acceptable containment; if not, the breached envelope must be replaced by an equally effective closed or unbreached layer.

WHAT CHARACTERIZES AUTHORIZED CONTAINMENT?

✓ In order for containment to have meaning, we must associate it with the SNM it is supposed to protect. The aspect of known quantity of SNM within a given containment system fulfills part of this requirement, by associating a specific amount (and type) of SNM with a given containment system. This aspect is the link with the material accounting system, which is mutually dependent on containment.

While it is necessary to know the quantity of SNM within a given containment system, it should certainly be the correct quantity for that particular containment. This concept of authorized quantity can be taken to mean "known and correct" quantity.

This still is not sufficient to characterize proper containment. One must know where to find any given containment system, and once again it should be in its correct place. The concept expressed here is that of authorized (and, hence, known) location for SNM containment.

Authorized containment, of course, must be unbreached.

The only other aspect of containment still not specified is that it must be able to show evidence of tampering. It should be obvious from examination of a container or containment system whether there has been a breach. This ability is also necessary to make containment meaningful: If the layers of containment can be opened and closed without evidence of this motion, then they cannot fulfill functions 3, 4, or 5, and are dubiously effective for functions 1 and 2.

SUMMARY

Using our five underlying functions of containment, we define containment as:

The closest n envelopes surrounding SNM which are not to be breached except to transfer SNM (under authorization) from one containment system to another.

To be authorized, the containment must also:

- Contain an authorized (and known) quantity of SNM;
- Be in an authorized (and known) location;
- Be able to show evidence of tampering; and
- Be unbreached.

A Basic Capability 4 which requires all SNM to be in authorized containment as described herein is an independent capability.