Nuclear Criticality Safety

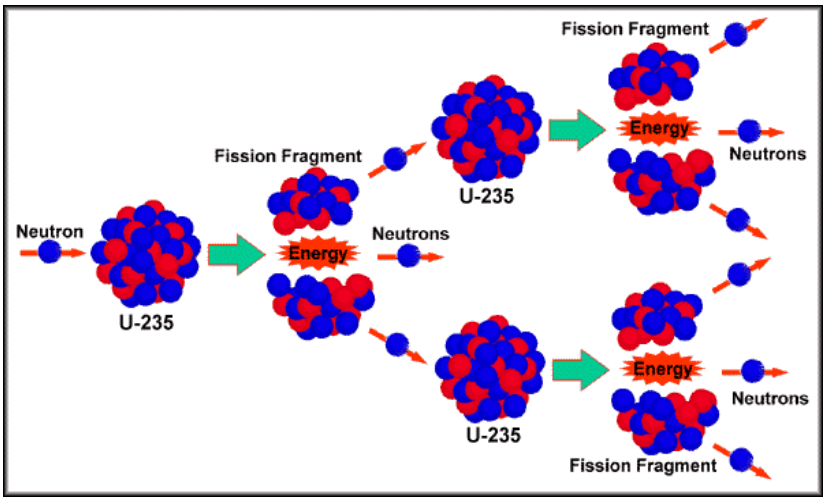
What is meant by Nuclear Criticality Safety?

Examples of general knowledge of NCS:

What is Nuclear Criticality Safety (NCS)?:

- Protection against an accidental criticality (i.e., uncontrolled nuclear fission chain reaction)

Illustration of a nuclear fission chain reaction with U-235:



Why is NCS important?:

- Potential for energy and radiation hazard to workers

How will NRC evaluate NCS for the MOX facility?:

- Same as for any other fuel cycle facility (i.e., licensing, oversight, enforcement)
- Addressing specific issues related to using plutonium

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What are important concepts in NCS?

Examples of important concepts in NCS for fuel cycle facilities:

What does the goal of zero accidental criticalities mean?:

- No nuclear fission chain reactions
- Facility operations must be subcritical during both normal and credible abnormal operations, thus effective neutron multiplication factor (*k-eff*) < 1.0
- *k-eff* = (neutron production rate) / (neutron loss rate)
- *k-eff* = 1.0 means critical

What factors are used to keep operations subcritical?:

- Material - Mass, Element, Enrichment, Heterogeneity
- Shape - Geometry, Volume, Concentration, Density
- Poison - Solid, Liquid
- Others - Reflection, Moderation, Unit Interaction

How are those factors used?:

- To make it difficult to create a problem
- To make it easy to do the right thing
- To make maloperation inconvenient
- To make proper operations convenient

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What are open CAR NCS items?

Examples

- **NCS personnel experience levels with plutonium and/or MOX fuel**
- **NCS margin of subcriticality for safety, when calculating *k-eff***
- **NCS use of the term 'highly unlikely'**

What are closed NCS CAR items?

Examples

- **NCS personnel education levels**
- **NCS commitment to the double contingency principle**

("Process designs should incorporate sufficient factors of safety to require at least two unlikely, independent, and concurrent changes in process conditions before a criticality accident is possible.")

- **NCS use of a criticality accident alarm system**
- **NCS use of a preferred design approach**