MOX Fuel Talking Points/Q&A

1. What is mixed oxide (MOX) fuel?

    - MOX fuel is a mixture of plutonium and uranium.

    - MOX fuel is typically made using plutonium recycled from used nuclear fuel (i.e., reactor-grade (RG) MOX), but it can also be made using surplus plutonium from nuclear weapons (i.e., weapons-grade (WG) MOX).

    - Low-enriched uranium (LEU) fuel commonly used in commercial nuclear reactors initially has no plutonium. During irradiation in a reactor it builds up plutonium as a result of the nuclear reactions. Toward the end of its useful life LEU fuel contains about 1% plutonium and actually produces about half of its power from this plutonium rather than uranium. RG MOX is fabricated from this recycled plutonium.

    - WG MOX has a higher concentration of the Pu-239 isotope, which is more desirable for power generation than other plutonium isotopes.

LEU and MOX Fuel Makeup (Typical Values)

Components	LEU	WG MOX	RG MOX
Total Uranium	**100%**	**95.7%**	**91%**
U-238	95-96%	95%	91%
U-235	4-5%	trace	Trace
Total Plutonium	**0%**	**4.3%**	**9%**
Pu-238	-	0%	0.1%
Pu-239	-	4%	5.2%
Pu-240	-	0.2%	2.4%
Pu-241	-	0.1%	0.7%
Pu-242	-	trace	0.6%

2. How does reactor operation with MOX fuel differ from operation with LEU fuel?

    - Based on current practice and future plans, MOX and LEU fuels would be loaded into the core at the same time, with the fraction of the core using MOX typically in the range of 30-40%.

    - The MOX core would be designed and licensed to the same operating and safety criteria as an all LEU core (e.g. same operating temperature, electrical output, etc.). The MOX core may require enhanced reactivity controls (increased soluble boron in the reactor coolant and/or additional control rods) to meet the licensed operating conditions.

- Operations with a MOX core would be nearly identical to operations with an all LEU core.

3. Are the consequences of an accident worse using MOX fuel?

    - Both LEU fuel and MOX fuel meet conservative NRC safety criteria for design basis events.

    - Independent safety authorities in five different countries have reviewed the use of MOX fuel in commercial nuclear plants, including severe accident analysis, and found that it meets all licensing and safety requirements.

    - For beyond design basis events (i.e. significant fuel damage, loss of primary containment integrity and some atmospheric dispersal) the consequences from a 40% WG MOX fuel core would not be significantly worse than those with an all LEU fuel core.

4. What about storing irradiated MOX fuel? Is MOX fuel hotter?

    - Right after reactor shutdown, irradiated fuel produces heat due to the decay of radioactive isotopes contained within the fuel equal to about 7% of pre-shutdown operating power.

    - Irradiated MOX fuel initially produces about 4% less decay heat than equivalent LEU fuel. Decay heat production falls off very rapidly for both fuel types, to less than 1% of original operating power after 24 hours. However, decay heat production in MOX fuel declines at a slower rate than LEU fuel due to isotopic differences in the irradiated MOX fuel. Eventually irradiated MOX fuel produces slightly more decay heat than irradiated LEU fuel, about 16% more after 5 years.

    - After about 5 years, the decay heat load from both fuel types is about the same as one or two medium-sized hair dryers for each used fuel assembly. Used fuel with this decay heat rate is sufficiently cooled to allow loading into dry cask storage.