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Title: Reflector Worth of Dry Chemical and Powder Fire Extinguishing Agents

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Reflector Worth of Dry Chemical and Powder Fire Extinguishing Agents

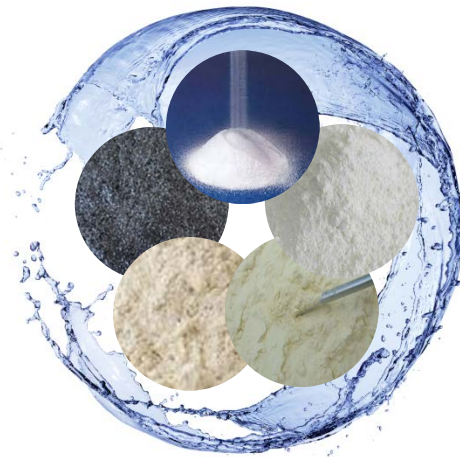
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November 9, 2015

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Motivation

- Simplifying Analyses
 - Develop reference demonstrating the reactivity worth of common fire fighting agents can be bounded by that of water.



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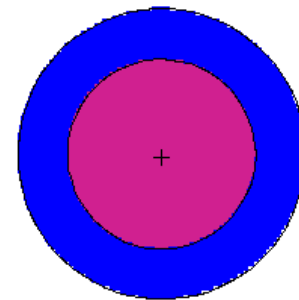
Introduction

- Reflector Worth
 - Fire Extinguishing Agents
 - Comparison to Water
 - Varied Densities
 - Differences in worth

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Description

- Reflected Plutonium Sphere
 - 4500 g
 - 100% Pu-239
 - Fire Extinguishing Agents
 - Close Fitting
 - Concentric Shell
 - 1 – 30 cm Thick
 - MCNP6 Version 1.0
 - ENDF/B-VII.1



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Fire Extinguishing Agents

- Graphite
- SiO₂
- Water
- MgO
- FORAY®
 - Ammonium Sulfate
 - Ammonium Phosphate
 - Magnesium Aluminum Sulfate (Fuller's Earth)
- MET-L-X®
 - Magnesium Distearate
 - Sodium Chloride



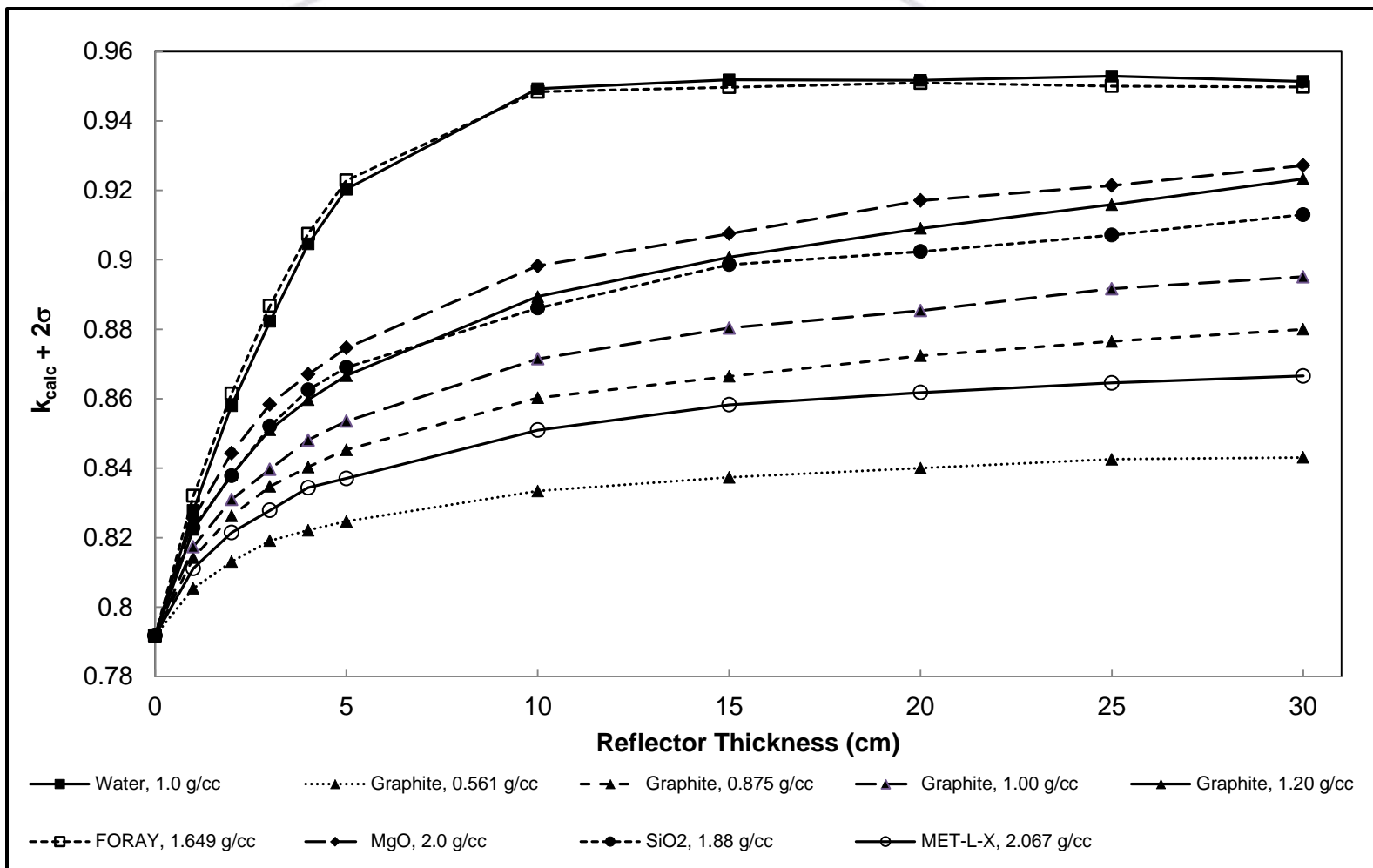
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Fire Extinguishing Agents

Material	Density(g/cc)
Graphite	0.561
	0.875
	1.000
	1.200
SiO ₂	1.889
FORAY [®]	1.649
Water	1.000
MgO	1.900
MET-L-X [®]	2.067

Material	Composition	Weight Fraction
FORAY [®]	Hydrogen	0.053
	Nitrogen	0.134
	Oxygen	0.546
	Magnesium	0.002
	Aluminum	0.003
	Silicon	0.006
	Phosphorus	0.221
	Sulfur	0.039
MET-L-X [®]	Hydrogen	0.003
	Carbon	0.032
	Nitrogen	0.008
	Oxygen	0.022
	Sodium	0.346
	Magnesium	0.004
	Aluminum	0.005
	Silicon	0.010
	Chlorine	0.572

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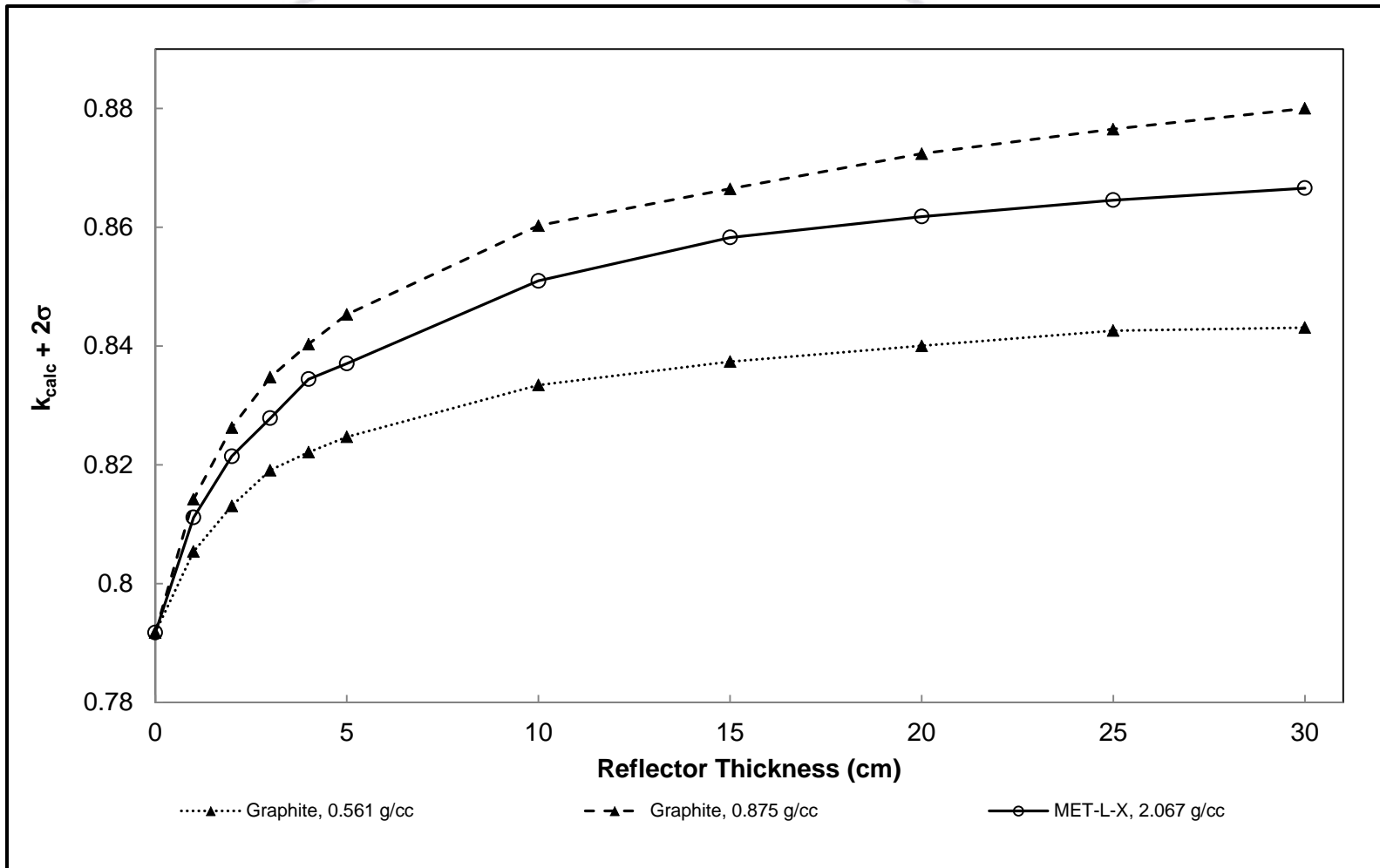


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Results

- Density ↑ Reactivity ↑
 - Exceptions
 - MET-L-X[®]
 - FORAY[®]
- Bounding Agent
 - Water vs FORAY[®]

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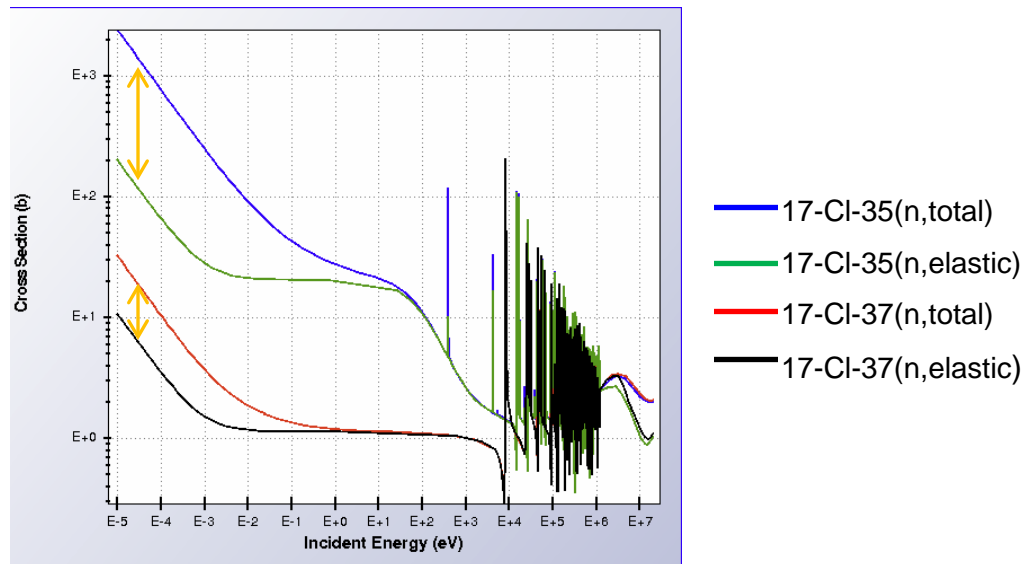


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Composition

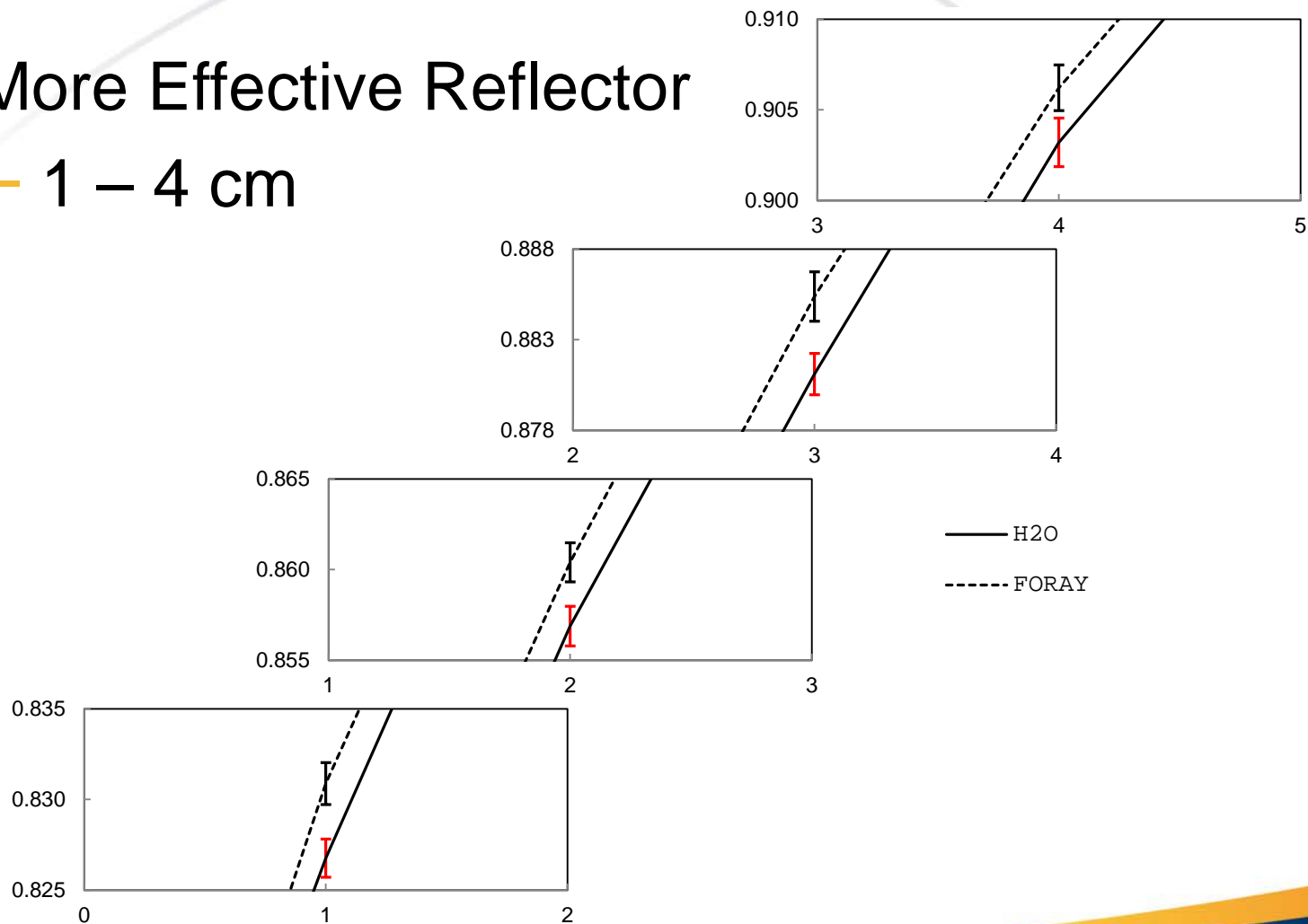
- Higher Density
- Higher Absorption
 - Chlorine
 - Sodium

Material	Composition	Weight Fraction
MET-L-X® $\rho = 2.067 \text{ g/cc}$	Hydrogen	0.003
	Carbon	0.032
	Nitrogen	0.008
	Oxygen	0.022
	Sodium	0.346
	Magnesium	0.004
	Aluminum	0.005
	Silicon	0.010
	Chlorine	0.572



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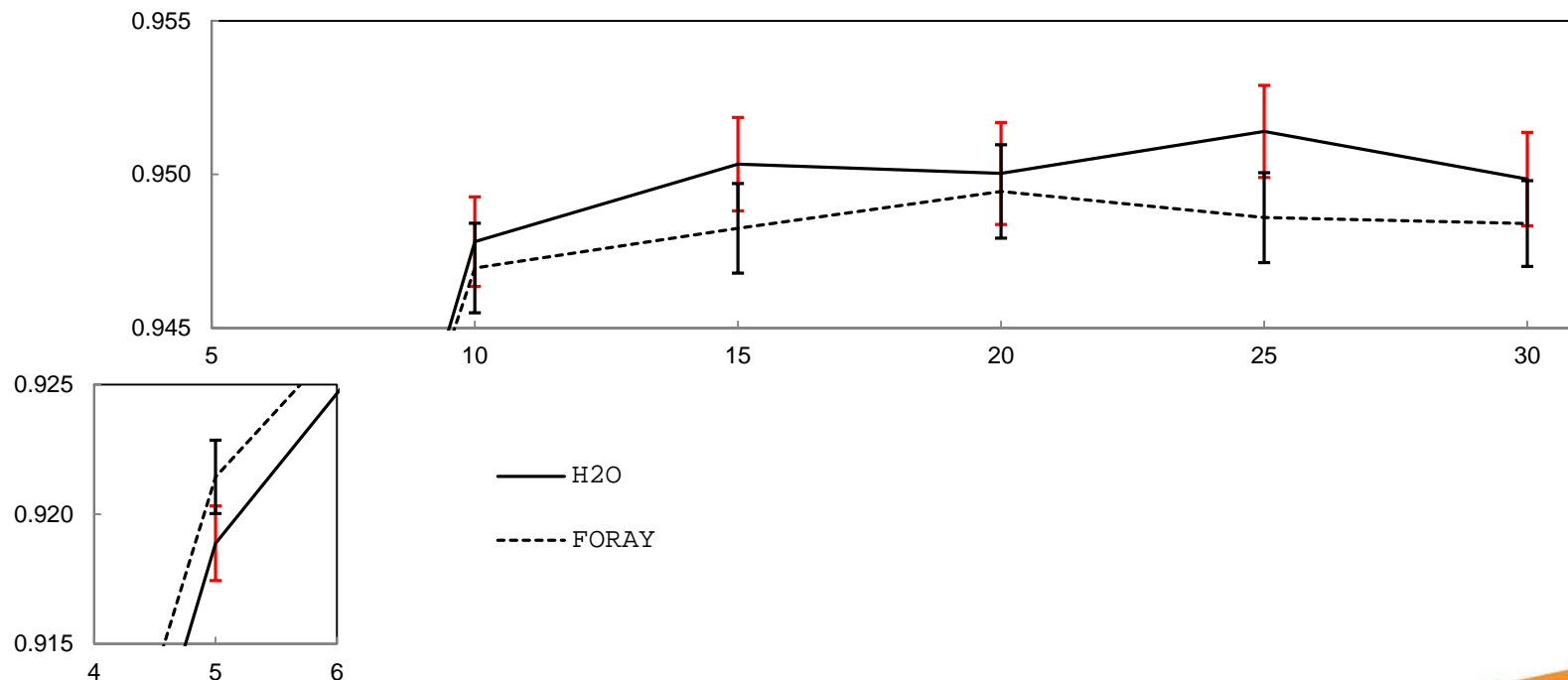
- More Effective Reflector
 - 1 – 4 cm



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- Equivalent to Water

- 5 – 30 cm

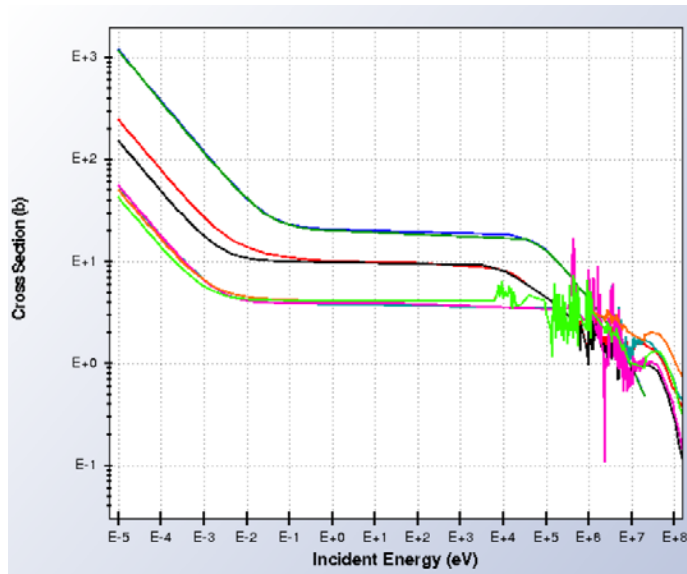


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Composition

- Higher Density
- Hydrogen Content
- Lower Absorption

Material	Composition	Weight Fraction
FORAY® $\rho = 1.649 \text{ g/cc}$	Hydrogen	0.053
	Nitrogen	0.134
	Oxygen	0.546
	Magnesium	0.002
	Aluminum	0.003
	Silicon	0.006
	Phosphorus	0.221
	Sulfur	0.039



- 1-H-1(n,total)
- 1-H-1(n,elastic)
- 7-N-14(n,total)
- 7-N-14(n,elastic)
- 8-O-16(n,total)
- 8-O-16(n,elastic)
- 15-P-31(n,total)
- 15-P-31(n,elastic)

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Considerations

- Moderation Effects
 - Hydrogen Content
- Neutron Absorption
- Complex Shapes
- Complex Geometries
 - Interstitial
- Multiple Fissile Units
 - Interaction

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