

# A Systems Engineering Process for Safeguards Design

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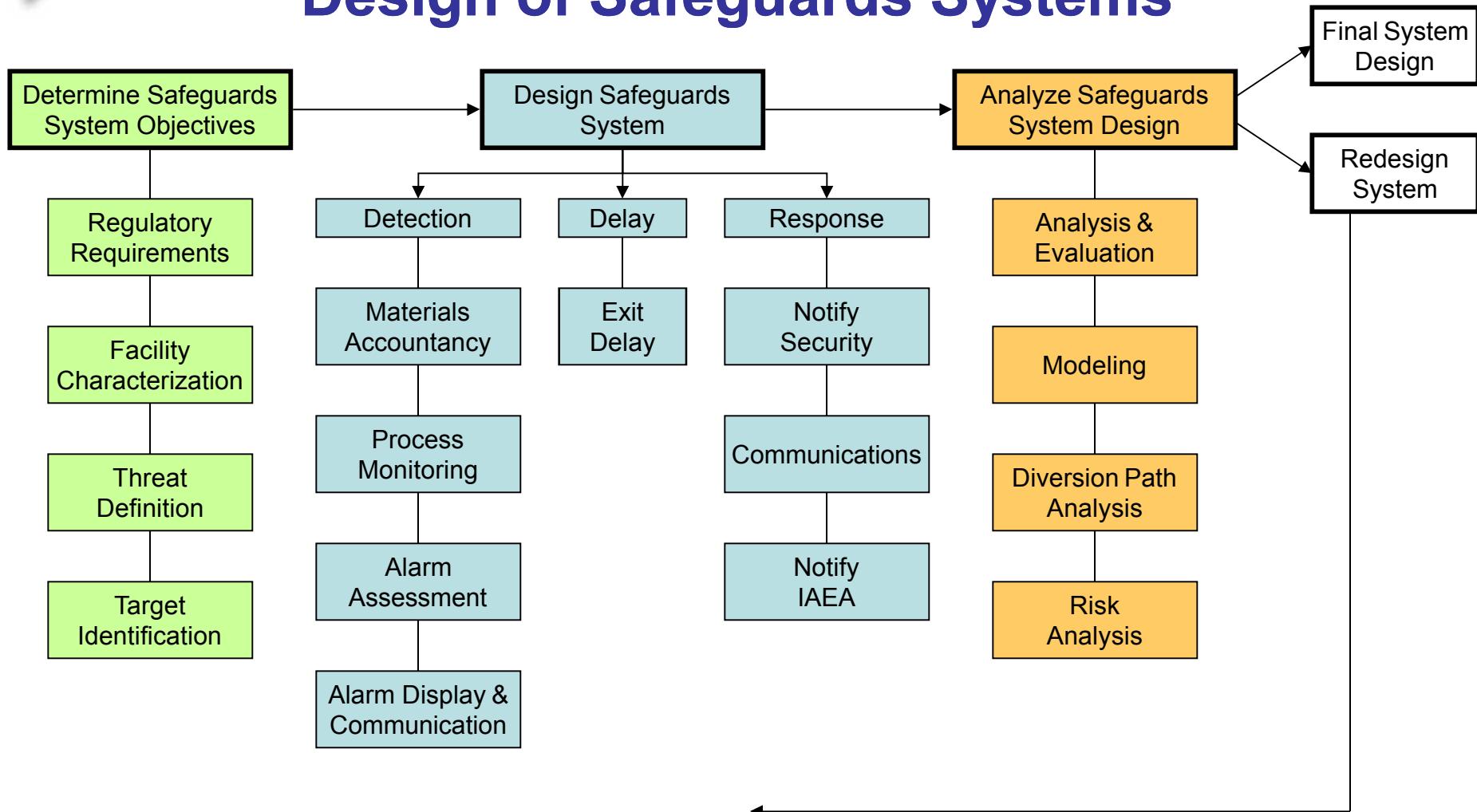


# Presentation Outline

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- **Describe an initial version of a systems engineering process for safeguards design and evaluation to support the development of new fuel cycle facilities**
  - Safe, secure, efficient, cost-effective
  - Support the demonstration that these facilities meet regulatory requirements
- **Focus on process to provide a framework**
  - Integrate safeguards technologies for material control and accountability (MC&A), including measurement equipment, process monitoring, and modeling and analysis tools
  - Apply for design and evaluation of different combinations of safeguards technologies for a range of facility types
  - Patterned after the Design Evaluation and Process Outline used for physical protection systems
- **Identify existing tools that can be applied at different steps**
  - Safeguards Software Inventory

# A Systems Engineering Approach to the Design of Safeguards Systems

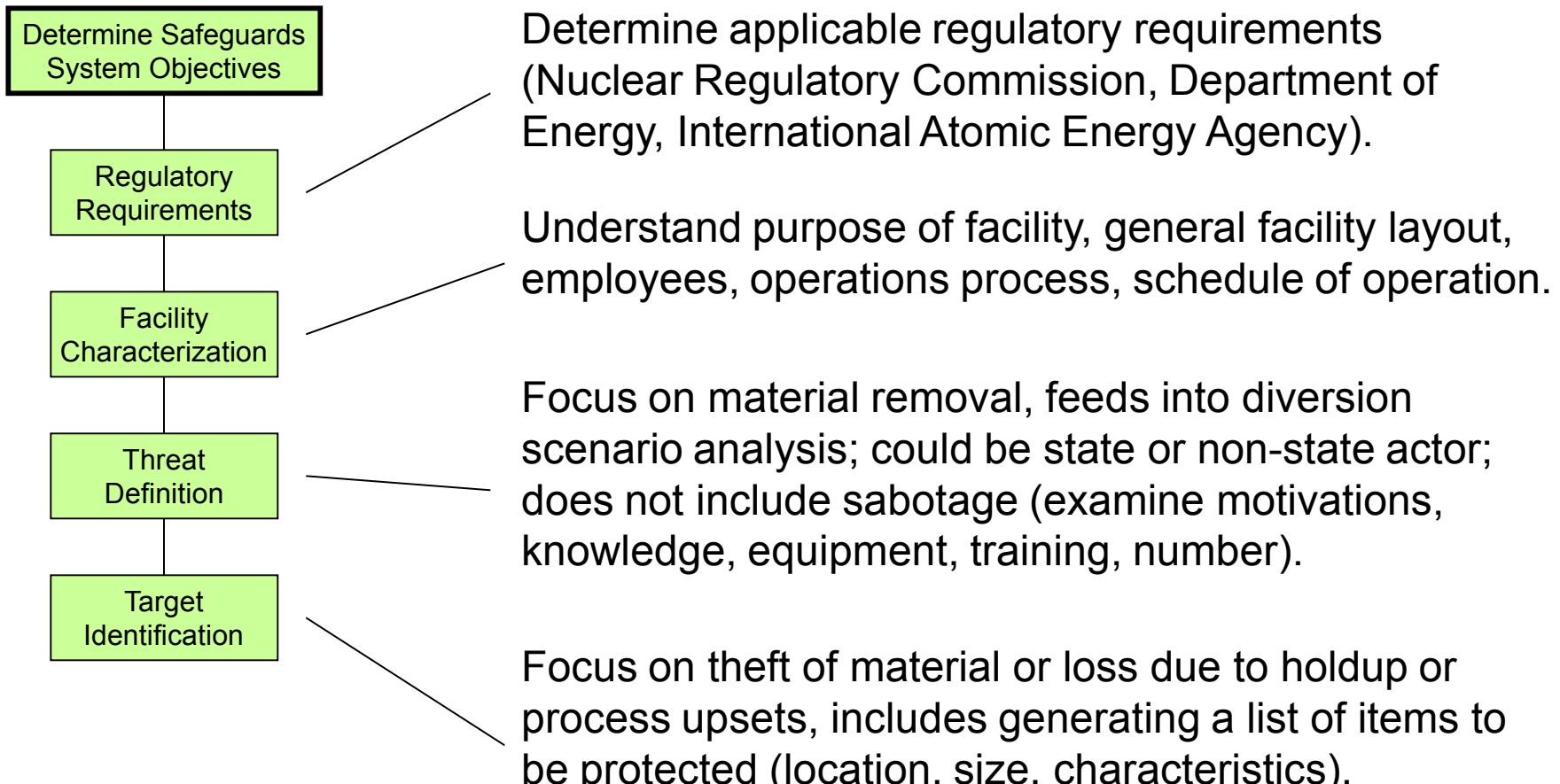


(similar to the Design and Evaluation Process Outline developed for physical security)



# Determine Safeguards System Objectives

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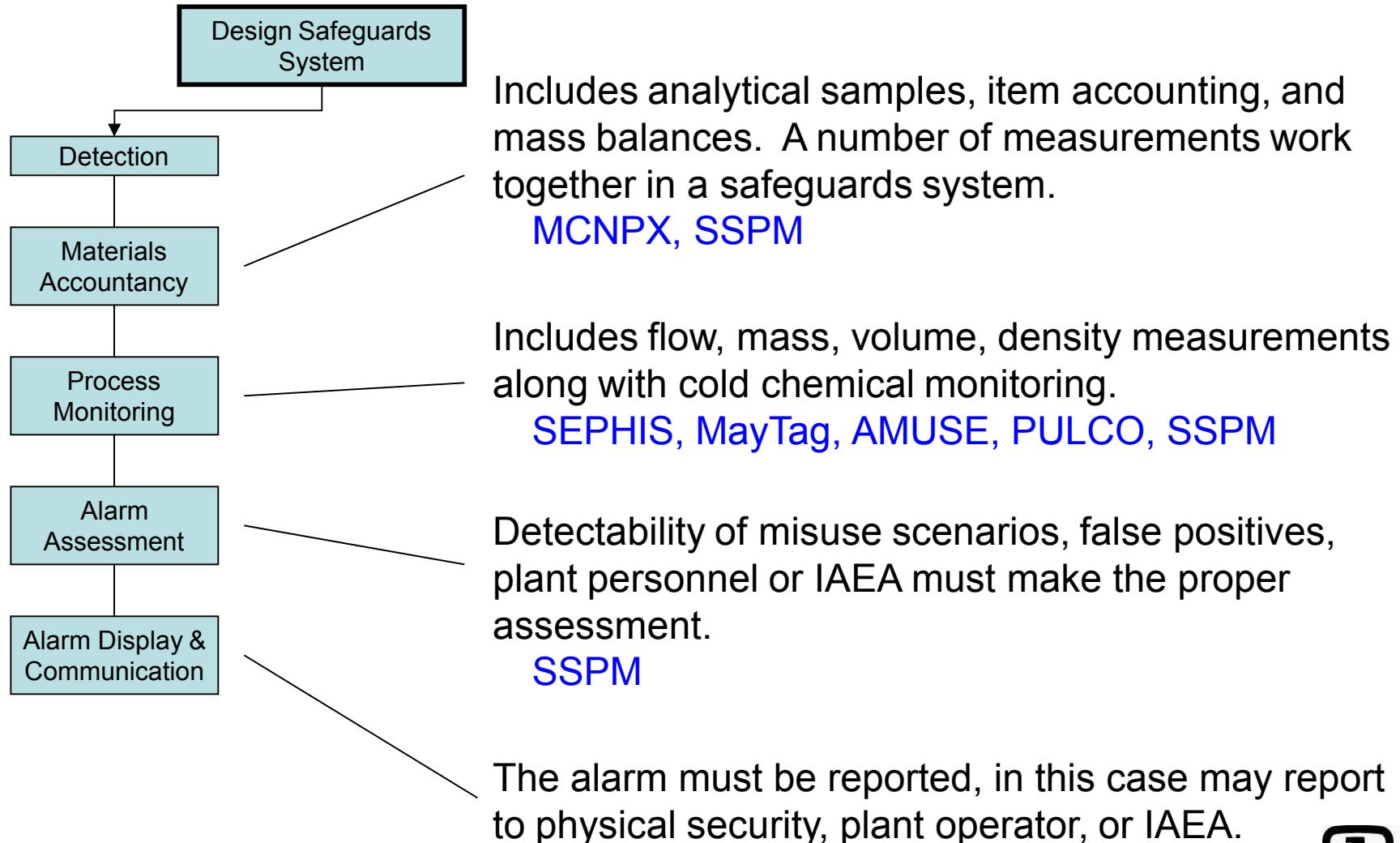


**ORIGEN, CINDER, MCNP, SYNTH, GEANT**



# Design Safeguards System

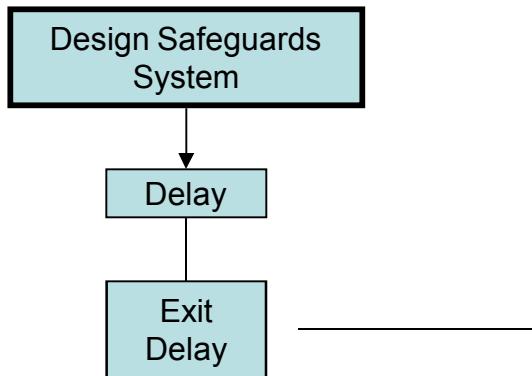
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# Design Safeguards System

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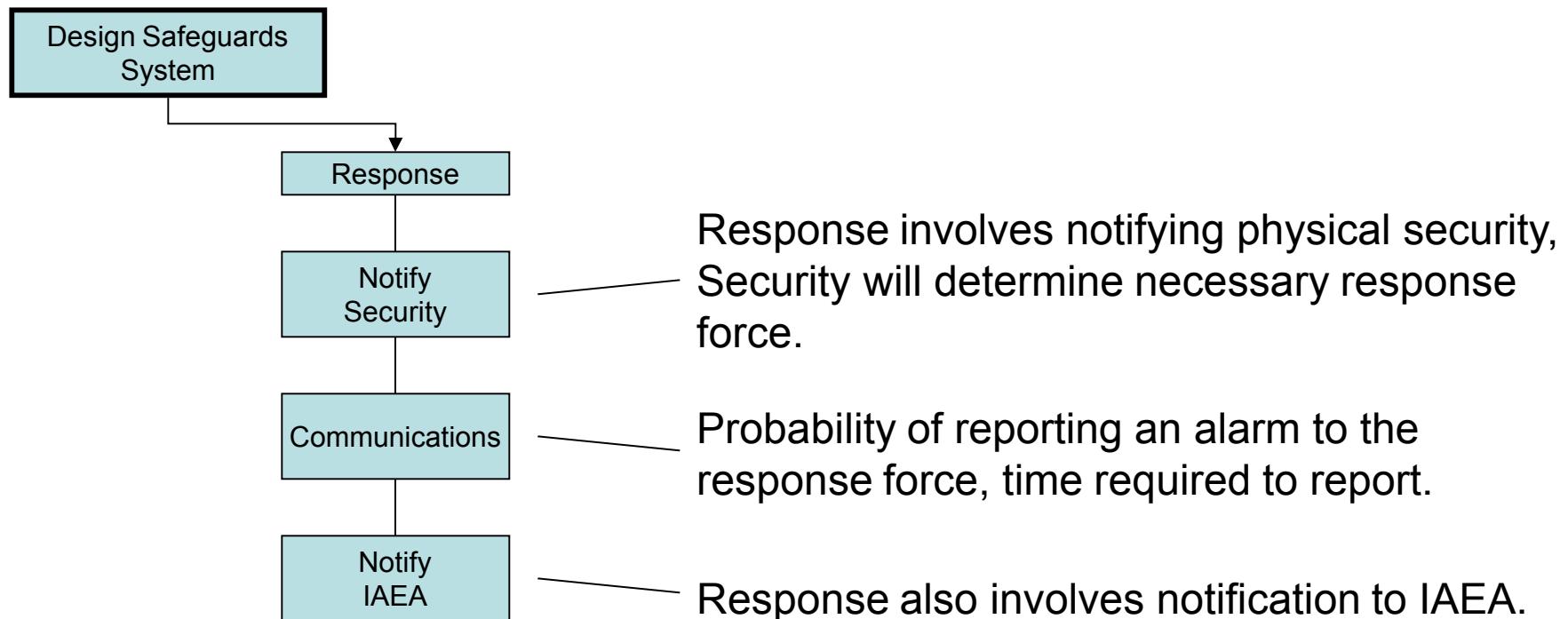
Exit delay is of most importance to safeguards, depends on detection time and time to accumulate one significant quantity of material.

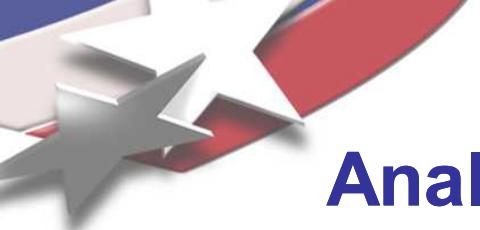
Other work integrating MC&A with physical protection has developed strategies for protracted theft timelines.



# Design Safeguards System

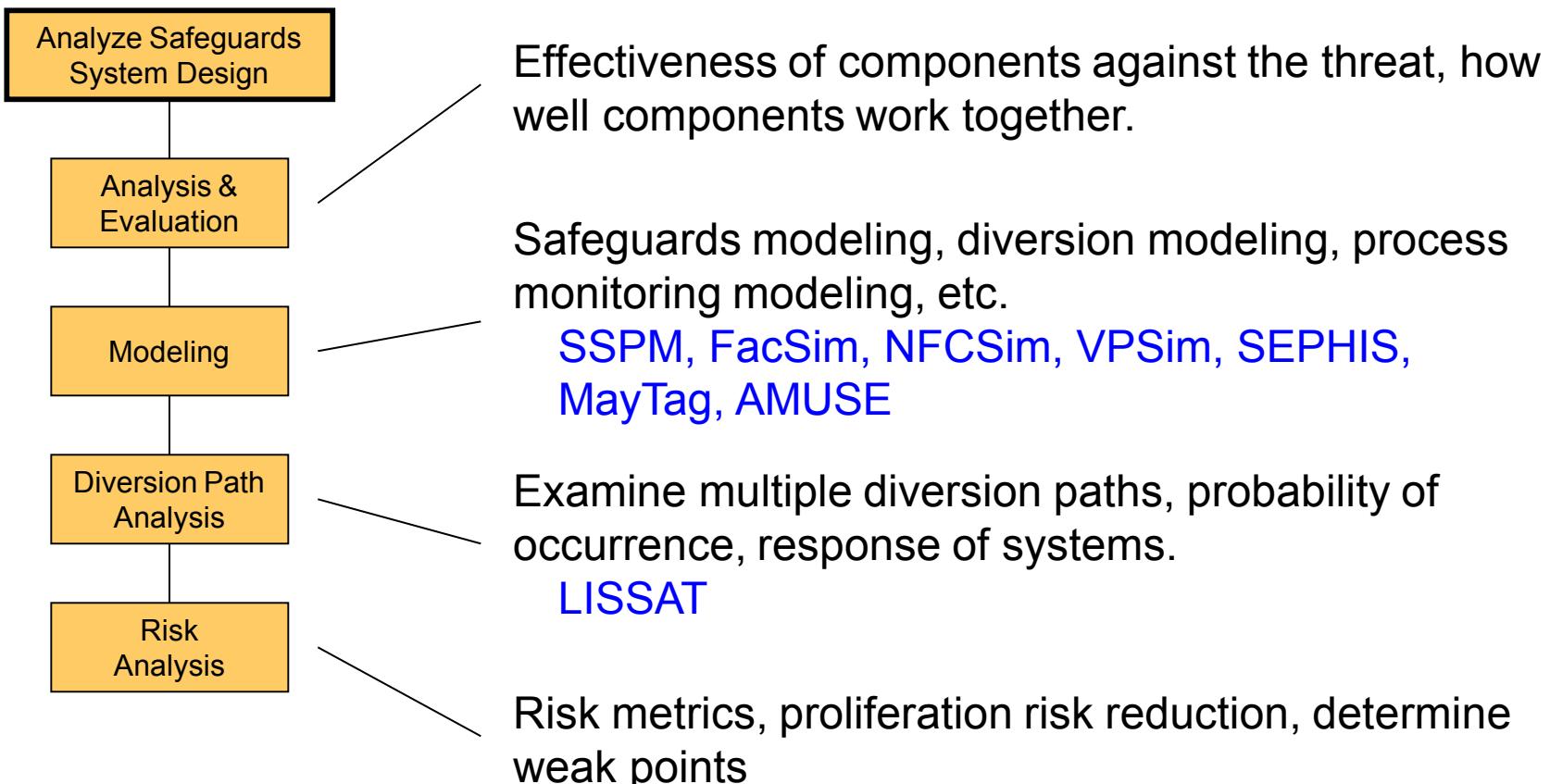
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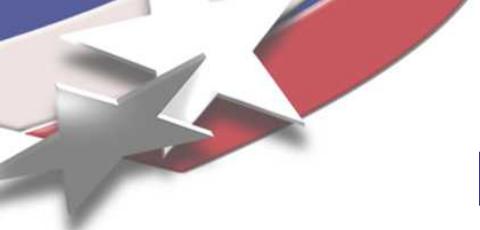




# Analyze Safeguards System Design

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# Demonstrating the Process

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- **Focus has been on demonstrating “Analyze Safeguards Design”**
  - Separations Safeguards Performance Model for reprocessing plant accountancy and process monitoring
  - Related work incorporating operational activities for MC&A with physical protection
- **Insights have been gained from integration analyses**
  - MC&A activities provide additional detection opportunities and can contribute significantly to cumulative detection
- **Integration work will continue**
  - Evaluate process monitoring measurements and high precision material measurements
  - Apply to conceptual reprocessing plant facility to integrate physical protection and safeguards systems