

Development of Chemical, Physical, & Toxicity Criteria for DoD Acquisition Programs



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Report Documentation Page

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What's the Challenge?

Acquisition, Technology and Logistics



- Increased performance & reliability of new weapon systems require new materials and chemicals.
- DoD lacks detailed guidance to determine what data are needed & when to assess & manage life-cycle risks

DoD Acquisition Policies

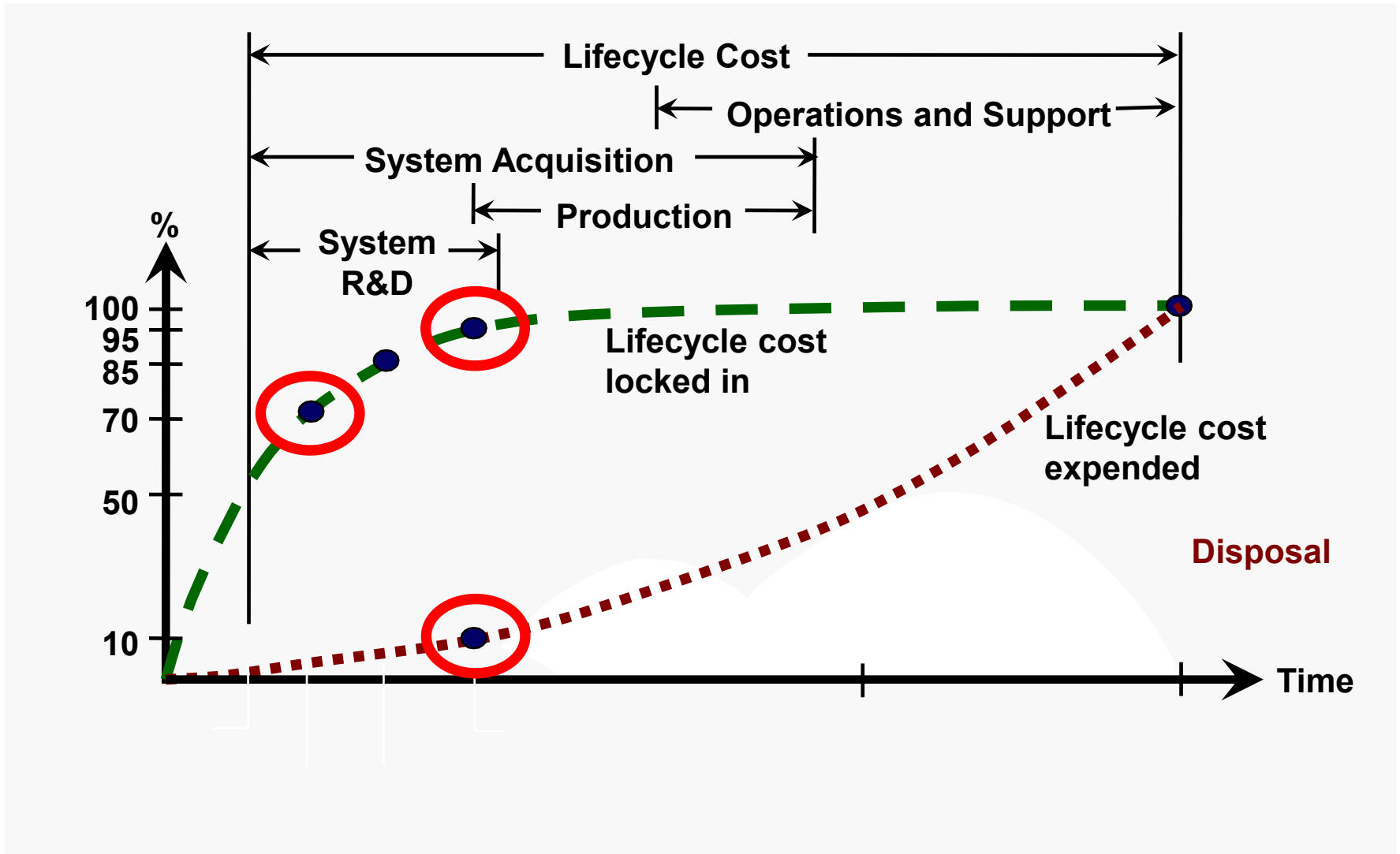
- **DoDD 5000.1 – The Defense Acquisition System (May 12, 2003)**
 - “Safety shall be addressed throughout the acquisition process. Safety considerations include human (includes human/system interfaces), toxic/hazardous materials and substances, ...”

- **DoDI 5000.2 – Operation of the Defense Acquisition System (May 12, 2003)**
 - Programmatic Environmental and Occupational Health Evaluation (PESHE) is required.....
 - As part of risk reduction, the PM shall prevent ESOH hazards where possible, and manage ESOH hazards where they cannot be avoided. ...
 - During system design, the PM shall document hazardous materials used in the system and plan for the system’s demilitarization and disposal.

But... what *specifically* do we need to know to assess & manage risks...
and when do we need to know it?

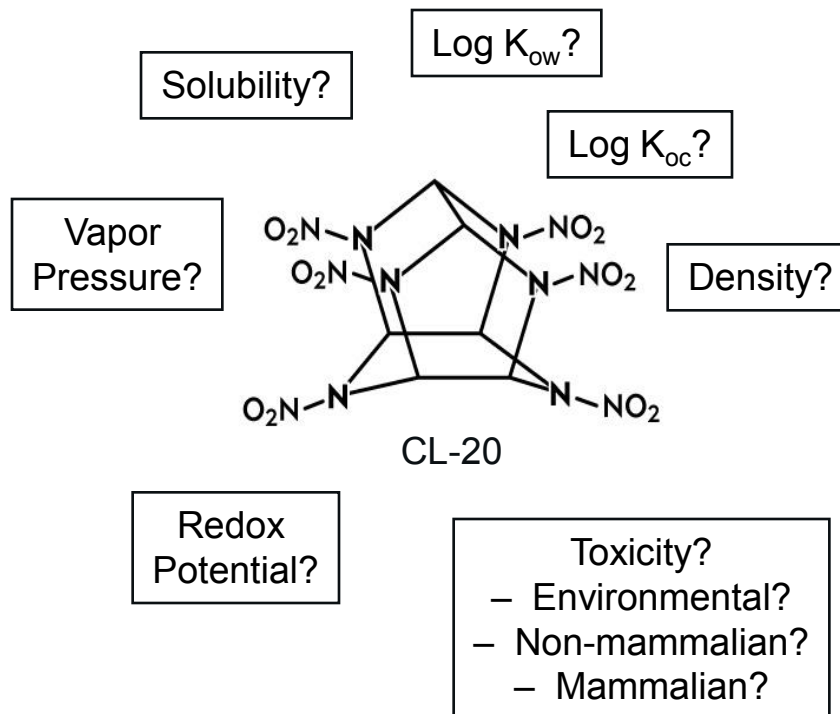
Percent Cost Locked-In By Design Phase

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What's the Solution?

- **Benchmark existing guidance, policy, and practices.**
- **Develop standard set of physical, chemical, and toxicological data needs – select needs for specific programs.**
- **Identify critical points in the DoD acquisition process requiring specific data.**
- **Develop guidance for DoD acquisition community**



Benchmarking Results

Acquisition, Technology

- Examined public & private practices world-wide, including DoD
- Each had limitations
 - limited to one group or category of chemicals
 - not designed to evaluate life-cycle risks
 - don't easily fit military acquisition process
- Selected best features from each



Standard Set of Data Needs

- Detailed data needs for chemicals/materials with consistent display format
- Data needs vary based on application and predicted exposures
 - 92 possible elements
- Data used to better identify, assess, & mitigate risks

General Chemical, Production, and Use Information						
Item #	Evaluation Item	Utility/Information Provided	Chemical Lifecycle Stage when Data Desirable	Caveats	More Information	Notes
1.01	Chemical name	- identity - communication	Conception		OECD, 2007b	A
1.02	Molecular formula & weight, computational	- chemical identification - exposure characterization	Conception	polymers frequently reported as number-average weight	ASTM, 2008 ^a Johnson et al., 2007 ^a USEPA, 1997 ^b OECD, 2007b ^a	
1.03						

Proposed Data Needs

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- **Elements (13) of the general chemical, production and use information**
 - Chemical identification information
 - Molecular and physical state information
 - Production volume
 - Production methods
 - Uses
 - Disposal methods

- **Elements (19) of physical-chemical information**
 - Melting and boiling point
 - Vapor pressure
 - Oxidation-reduction potential
 - Explosive properties

Proposed Data Needs

Acquisition, Technology and Logistics

- **Elements (30) of environmental fate and transport characteristics**
 - Solubility
 - Partitioning among environmental media
 - Degradation/stability
 - Breakdown product identification

- **Elements (28) of environmental and non-mammalian toxicity**
 - Toxicity to aquatic organisms
 - Toxicity to terrestrial organisms
 - Biotransformation and kinetics in species for which long-term tests are conducted

Proposed Data Needs

Acquisition, Technology and Logistics

- **Elements (29) mammalian toxicity/carcinogenicity**
 - Toxicity to mammalian test species
 - Toxicokinetics, metabolism and distribution in test species
 - Mode of action for toxic effects
 - Extrapolation of dose-response curve to humans

Proposed DoD New Chemical Human and Environmental Health Evaluation Process

Acquisition, Technology and Logistics

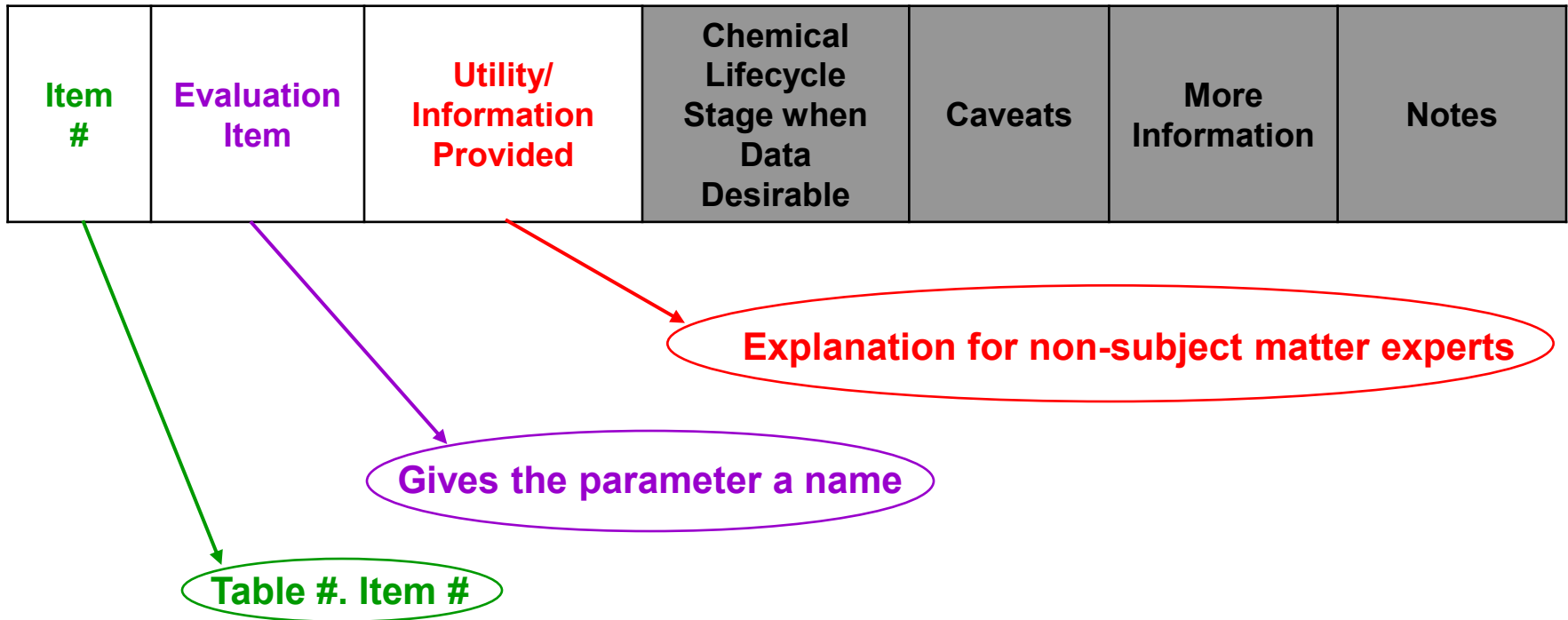
Organization of the Information Tables

Item #	Evaluation Item	Utility/ Information Provided	Chemical Lifecycle Stage when Data Desirable	Caveats	More Information	Notes
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Proposed DoD New Chemical Human and Environmental Health Evaluation Process

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Organization of the Information Tables (cont.)



Proposed DoD New Chemical Human and Environmental Health Evaluation Process

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Organization of the Information Tables (cont.)

Item #	Evaluation Item	Utility/ Information Provided	Chemical Lifecycle Stage when Data Desirable	Caveats	More Information	Notes
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- **Conception:** Molecular relationships and characteristics are evaluated to gain an understanding of the chemicals properties
- **Synthesis:** Production of chemical or material is demonstrated and perhaps optimized
- **Testing:** Chemical or material tried in the specific application or system configuration for which it was developed
- **Production:** Specific formulations established and mass production is planned

Proposed DoD New Chemical Human and Environmental Health Evaluation Process

Acquisition, Technology and Logistics

Organization of the Information Tables (conc.)

Item #	Evaluation Item	Utility/ Information Provided	Chemical Lifecycle Stage when Data Desirable	Caveats	More Information	Notes
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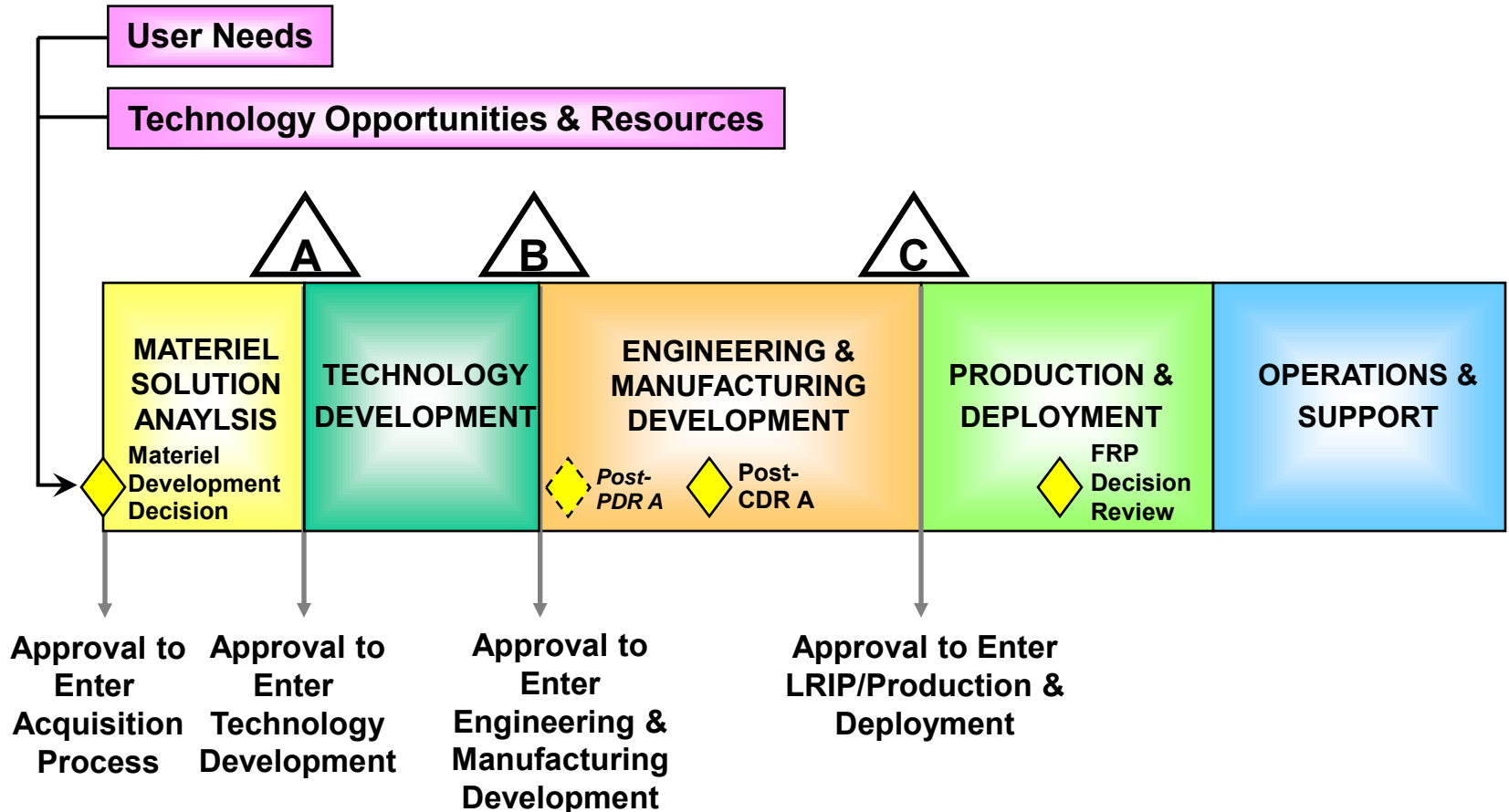
Priorities, limits and experimental design considerations

References

Organization-specific requirements (footnotes)

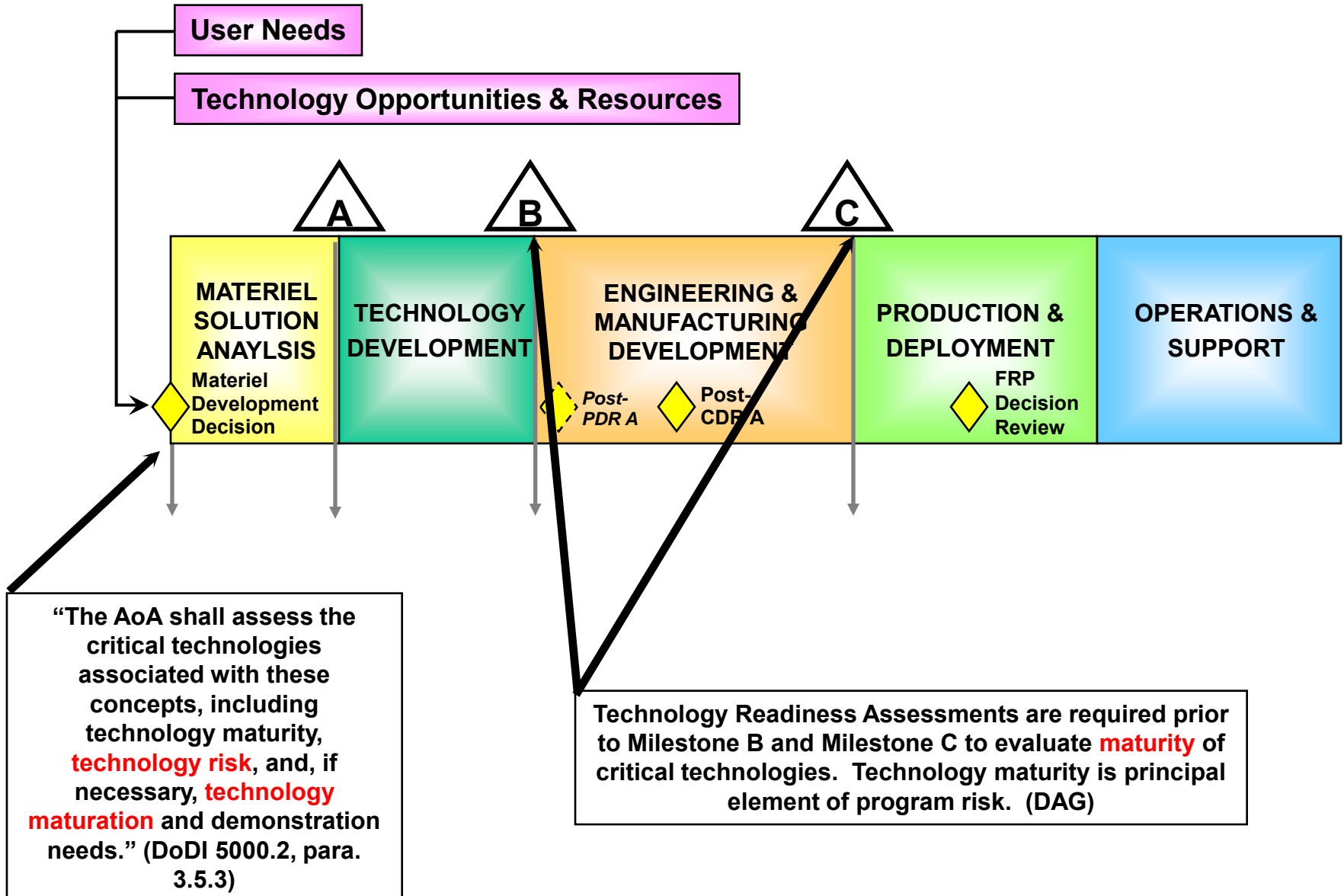
**How do we incorporate this into the
DoD acquisition process??**

Match to DoD Acquisition Decision Points



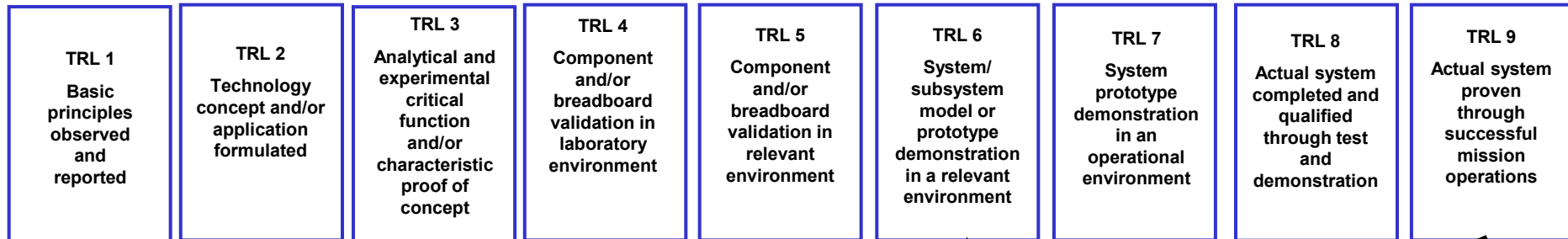
- Materiel Development Decision precedes entry into any phase of the acquisition process
- PDR = Preliminary Design Review CDR = Critical Design Review
- FRP = Full Rate Production

DoD Acquisition Decision Points



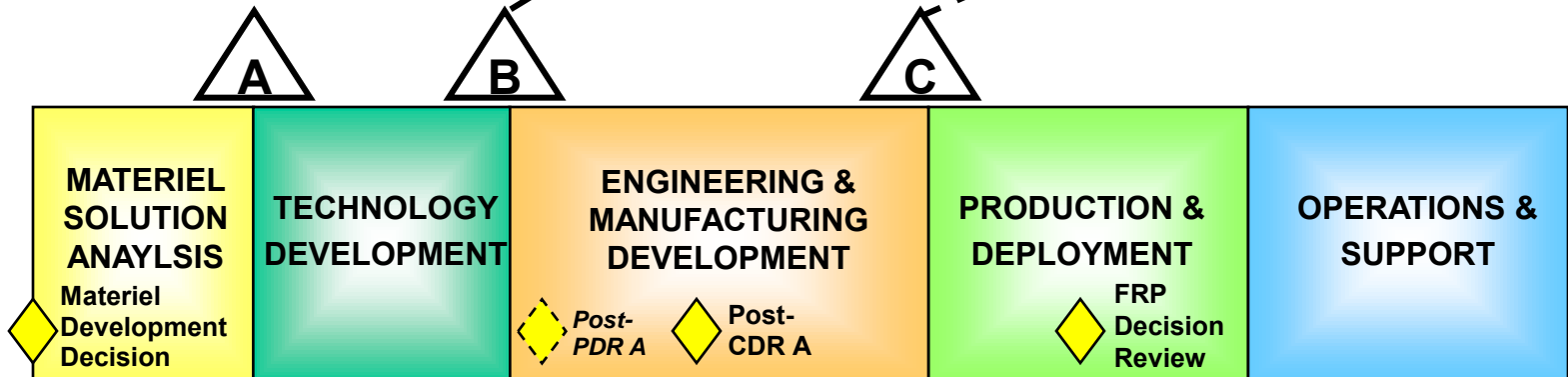
Technology Readiness Levels (TRLs)

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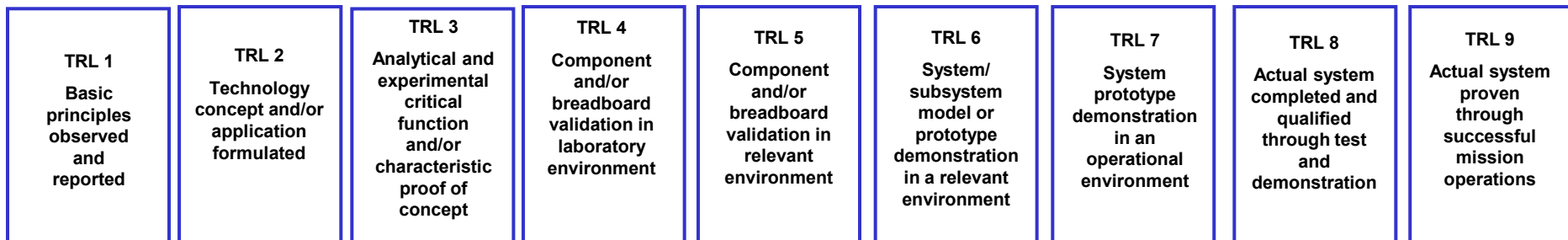
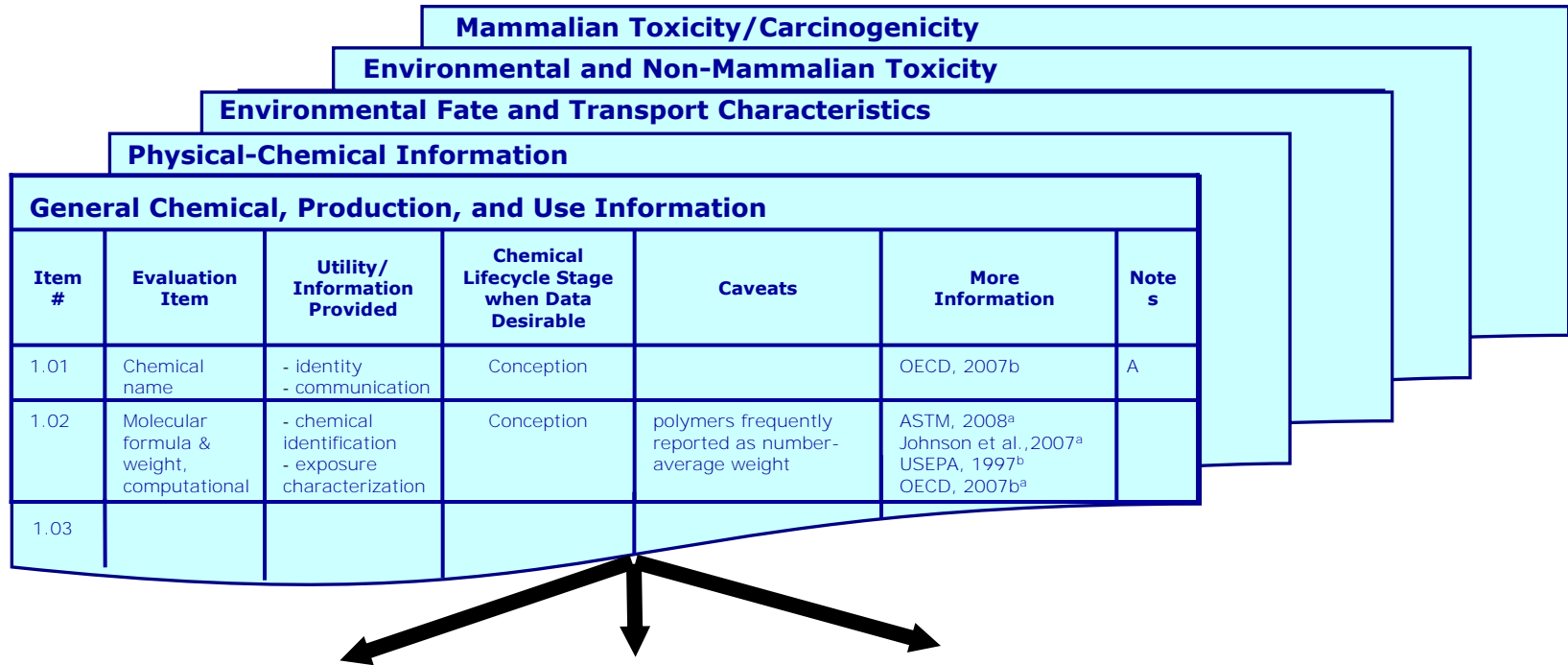


Best Practices

- MS B: \geq TRL 6
- MS C: \geq TRL 8



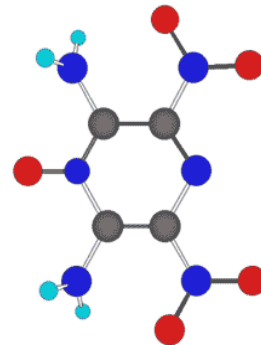
Tie TRLs to ESOH Data Needs



Next Steps

- **Develop users manual for developers and program managers**
 - **What information/data about a chemical/material should be in hand at various acquisition stages (or TRLs)?**
 - **Requirement or guidance?**
- **Incorporate requirement or guidance under acquisition series policies and procedures**
- **Develop training module**
 - **Defense Acquisition University**
 - **Self-directed learning**

Questions & Discussion



Backup Slides

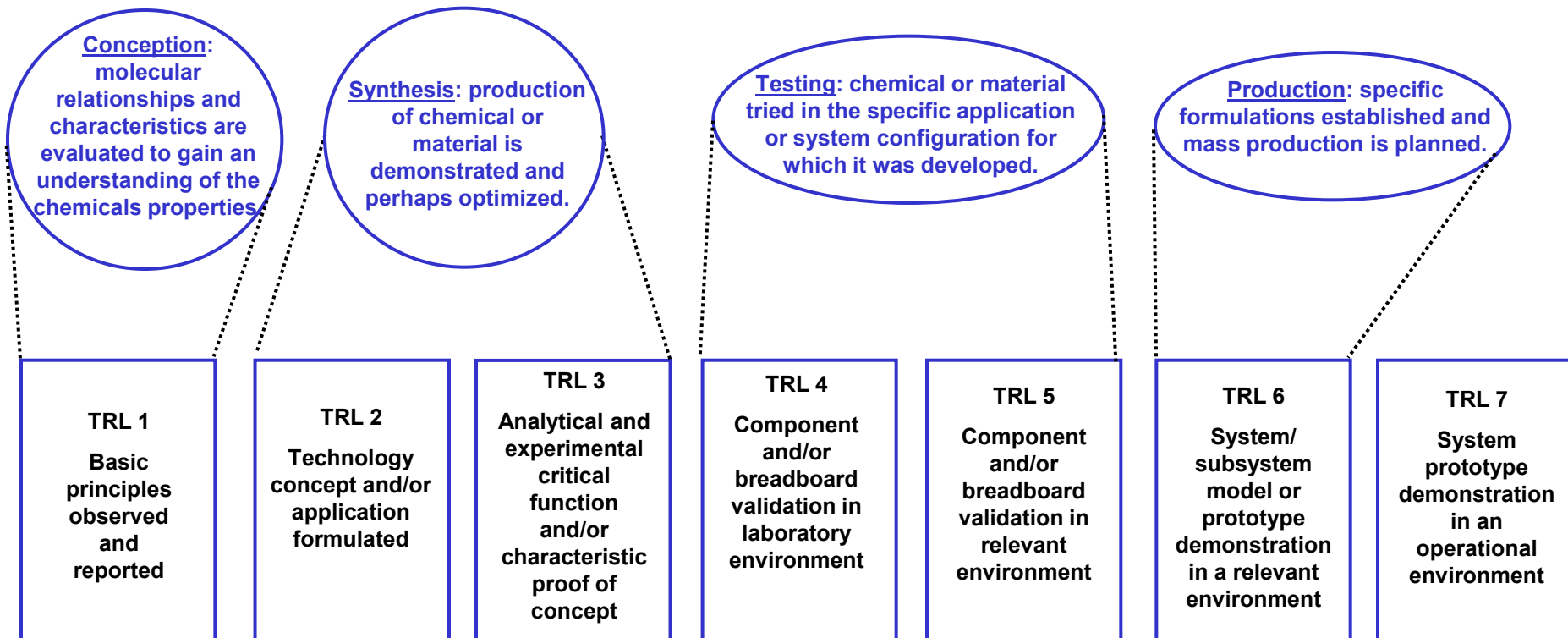
DoD Acquisition Hazard Evaluation Requirements

- **MIL-STD-882D – DoD Standard Practice for System Safety**
 - Defines Hazard as “Any real or potential condition that can cause injury, illness, or death to personnel; ...; or damage to the environment.”
 - Defines Safety as “Freedom from those conditions that can cause death, injury, occupational illness, ... or damage to the environment.”

- **Defense Acquisition Guidebook (DAG): Provides minimum requirements for the PESHE**
 - Requires identification of hazardous materials used in the system and approach for incorporating hazardous material considerations into system demilitarization and disposal planning.
 - Hazardous materials risk information should include:
 - The locations and quantities of HAZMAT on the system, where applicable;
 - Energetic qualification information for each energetic material used in the system;
 - Reasonably anticipated hazardous byproducts/discharges and expected quantities of hazardous waste generated during normal use/maintenance, in addition to those anticipated in emergency situations (e.g., exhaust, fibers from composite materials released during accidents, etc.); and
 - Special HAZMAT training and handling

DoD Acquisition Hazard Evaluation Requirements

Acquisition, Technology and Logistics

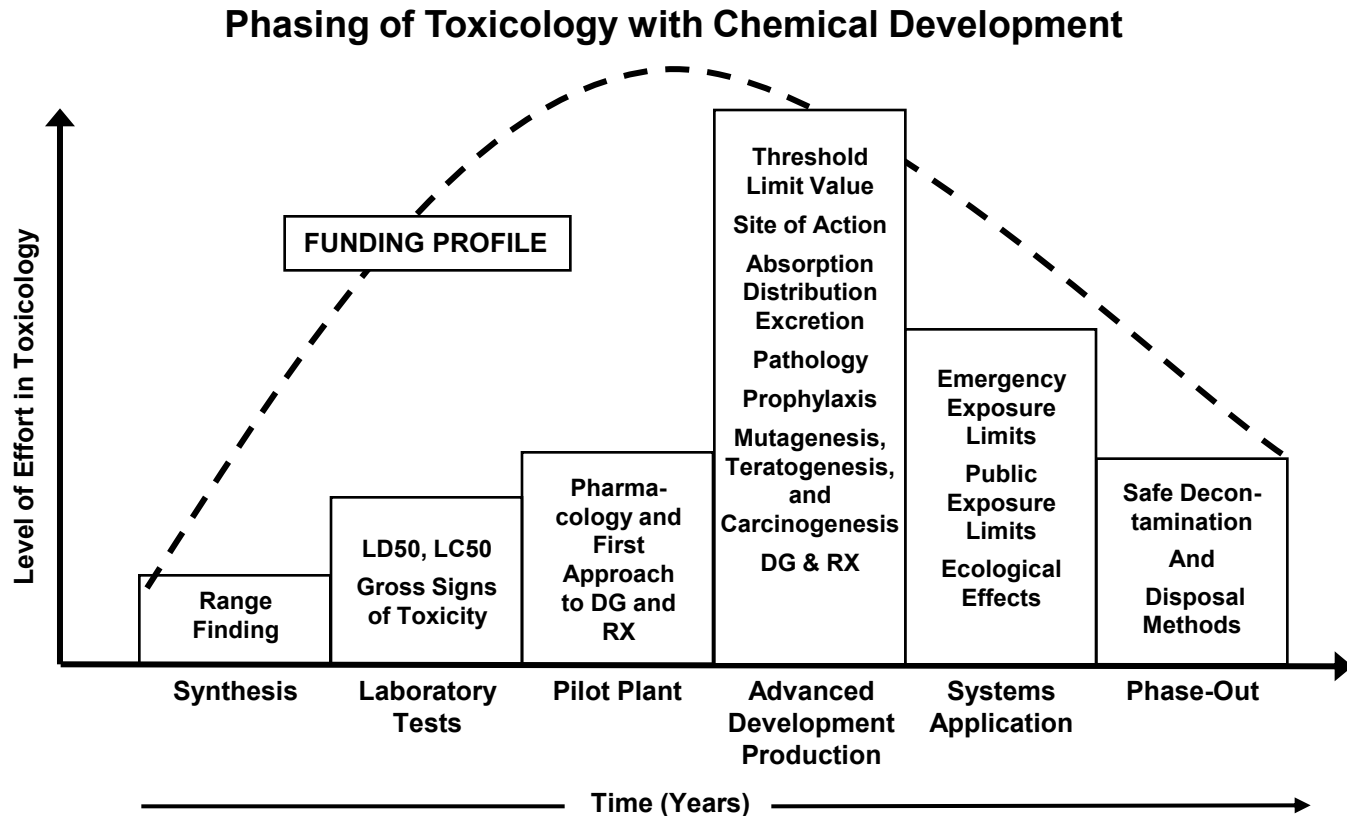


Technology Readiness Levels (DAG, 10.5.2)

Pioneering DoD Work

Acquisition, Technology and Logistics

The Impact on DoD of the Toxic Substances Control Act (AF-AMRL*, 1980)

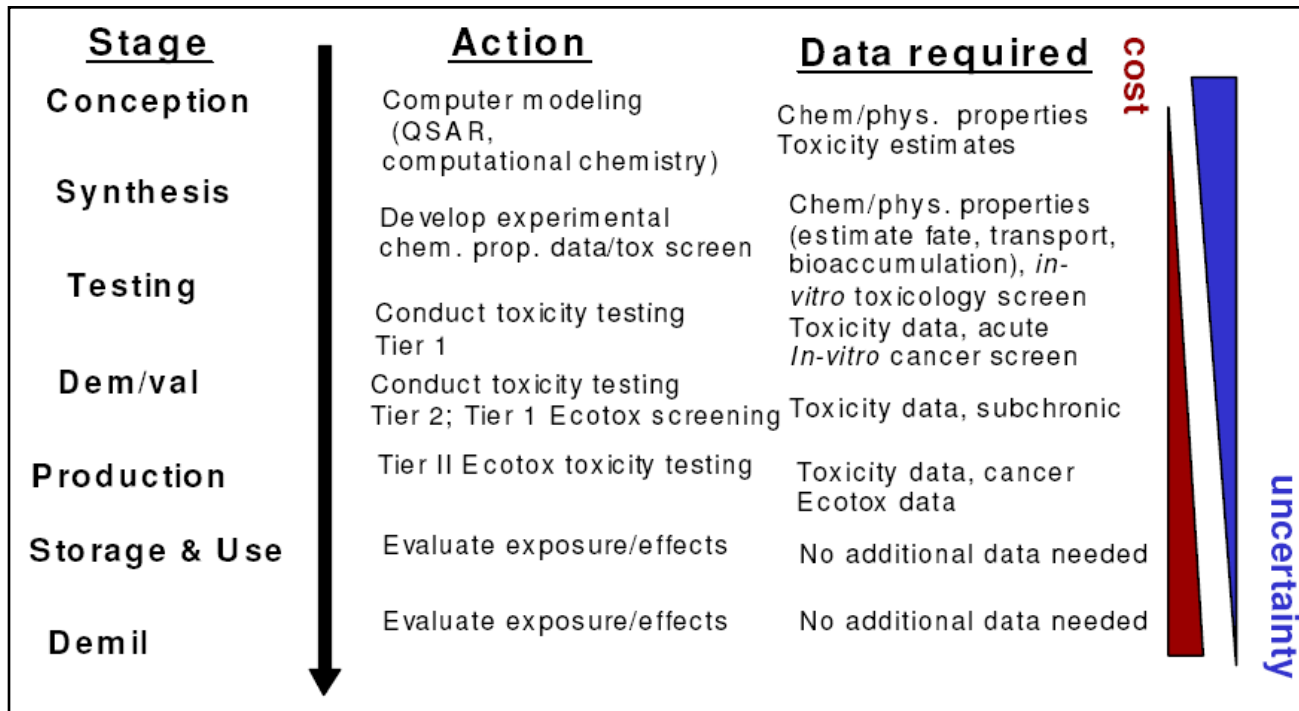


* Air Force Aerospace Medical Research Laboratory

Pioneering DoD Work

Acquisition, Technology and Logistics

Assessing the Potential Environmental Consequences of a New Energetic Material: A Phased Approach (USA-CHPPM 2007)



General hierarchical approach to the development of environmental data (Johnson et al., 2007)