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Best Practices for Risk-Informed Remedy Selection, Closure, and Post-Closure Control of Contaminated Sites: A National Academies Workshop

Holistic Approaches to Remediation: Alternate End States

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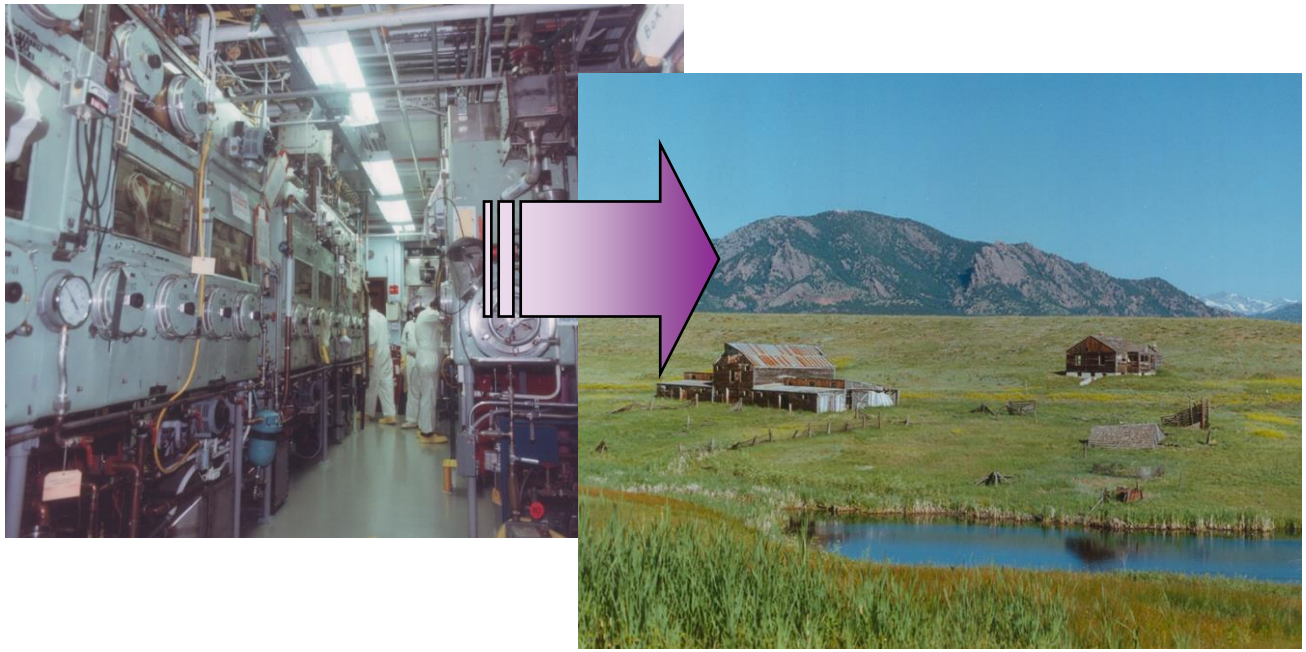
Discussion Outline

- Risk-based Methodology
  - Decisionmaking practice at Rocky Flats and other sites
- Role of End State/Post Closure
  - Fixed
  - Variable
  - Sustainable Economic Development
- Post-Closure Development Factors and Implications for Remediation Management

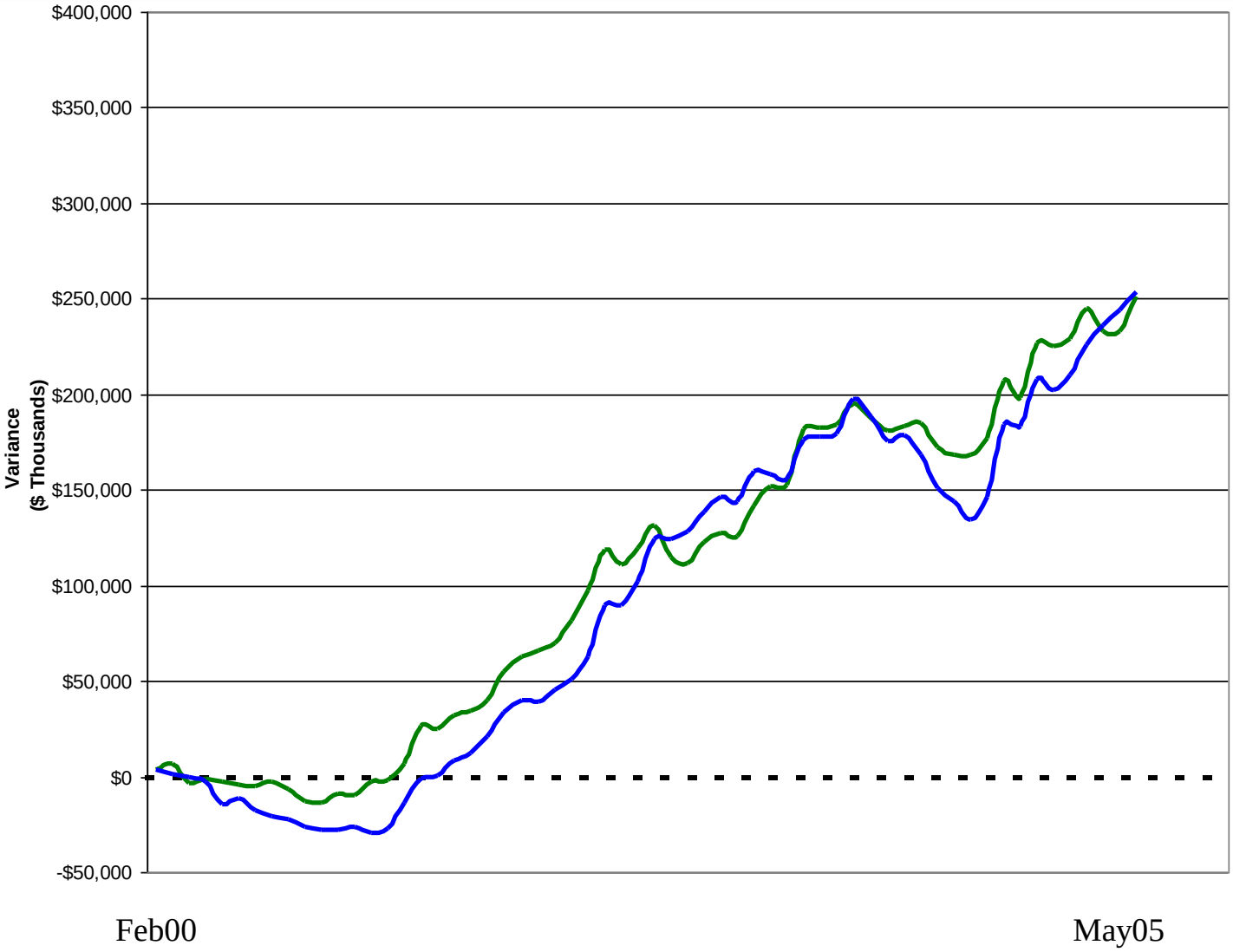
Progressive Contract

"Reengineering" + Technology = Δ Cost + Δ Schedule

$37B/2060 → $7B/2010 → $6B/2006



Project Performance (Baseline)
Cost and Schedule Variances



Cost Variance +$251M (+7.1%)

Schedule Variance +$254M (+7.8%)

Systems Approach

- Project Integration
  - Technology
  - Contract
  - Regulations, Codes, Standards
- Technology Intragration
  - Tool-box components
  - Complete flow sheet
  - Detailed activity level
- Key is risk-based planning

Elements of Risk

- Technology
- Cost
- Schedule
- Externalities
- Safety, Public Health, Environment
- End State Definition

- Issue - Predictability for Project Managers
  - Reliability, timing of funds needed for parallel scheduling (baseline and off-baseline)

The risk/reward fulcrum:
Contracting Factors that Promote Technology Impact

- Multi-year target cost/schedule through completion
- Pre-baselined technology innovation
  - Continuous tech improvement implicit in target cost/schedule
- Performance measure elimination
  - Enables long-term bets and hedging
- Transfer of technology responsibility and risk
- Transfer of schedule control
  - Enables rearranging of activities and resources

Contracting Factors that Promote Technology Impact
(the risk/reward fulcrum continued)

- Programmatic risk-based management required
  - PRA must be continuous throughout the project
- Risk mitigation requires pro-active planning and funding of off-baseline technology alternatives
- Rolling Wave Method - pros and cons
  - Get started, but don't lock down; build on-ramps for new tech
  - Multiple pathways, real-time problem solving
  - Note: Initial state uncertainties, end state options impact the risk profile
- But … with transfer of risk-reward…
  - Technology risk hurdle is raised

Balancing Contract Pros and Cons

- DOE/contractor cost sharing can be a critical factor
- DOE to accept some of the performance risk and share rewards
- Expect DOE Operations and Contractors to partner on technology
- Contract can enable EM S&T program participation and other technology-promoting factors (PRA, …)

Beyond Contract Incentives

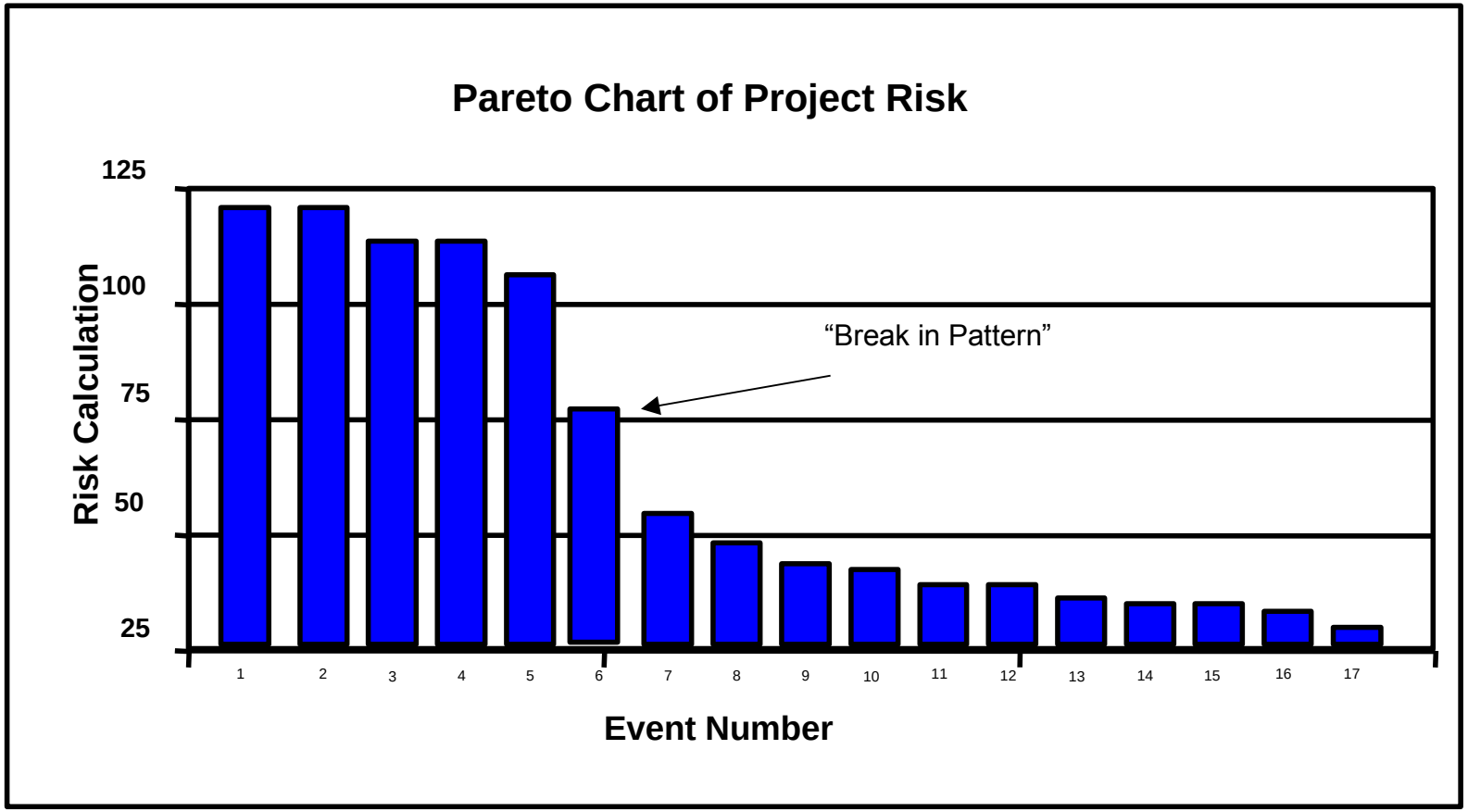
- Regulations, orders, standards, WACs, . . . should be performance-based
- Technology-based requirements can be disincentives to innovation
- Shared savings concept extended to DOE at project activity level
- Inter-site incentives to include Field Offices
- National labs as “contractors”

Risk Informed Management System in Practice

- Critical Path is statistical/probabilistic
  - on-baseline is not deterministic; must also pursue…
  - … off-baseline/near-baseline activities that may become critical
- Technology risk, Schedule risk, External risk assigned for each activity
  - range and distribution for each risk are estimated
- Detailed activity level baseline and BOE are essential

At-Risk Activities

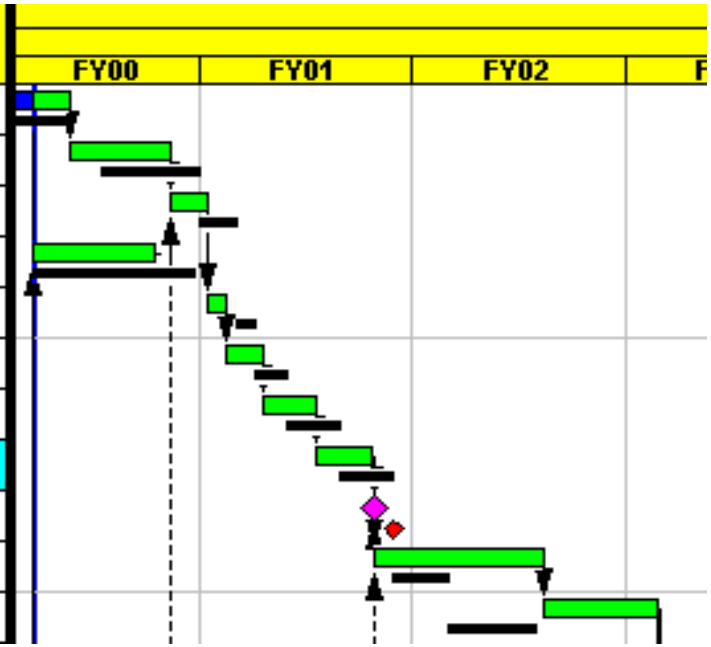
Ranking of activities per risk



Put in the Fix

Scheduling risk mitigation

Activity ID	Activity Description	Rem Dur	Early Start	Early Finish
C0D37111P1	B707 Dry Oper. IDC301 Graphite Shapes	37	04OCT99A	20FEB00
C0D70700P4	B707 Dry Opr IDC480 Lght Mtls	106	21FEB00*	12AUG00
C0D37101P5	B707 Dry Oper. IDC197 Tant. Targ.	38	13AUG00*	14OCT00
C0D70700P8	B707 Dry Oper IDC370 LECO's K-Mod	172	20DEC99	12JUL00
C0D37111P4	B707 Dry Oper. IDC442 Leached	20	14OCT00	16NOV00
C0D37100P3	B707 Dry Oper. IDC371 Firebrick	36	16NOV00	18JAN01
C0D7760014	IDC300,300,312,377 Graphite Shapes	57	18JAN01	18APR01
C0D7070013	B707 TRU IDC301 Graphite Shapes	58	19APR01	22JUL01
C0D70700P6	B707 Dry Repack Operations Complete	0		26JUL01
D2RSNM0201	SNM Holdup Removal/Deact - MOD D	56	26JUL01*	14MAY02
D2RSNM0203	SNM Holdup Removal/Deact - Module D	95	14MAY02	23NOV02



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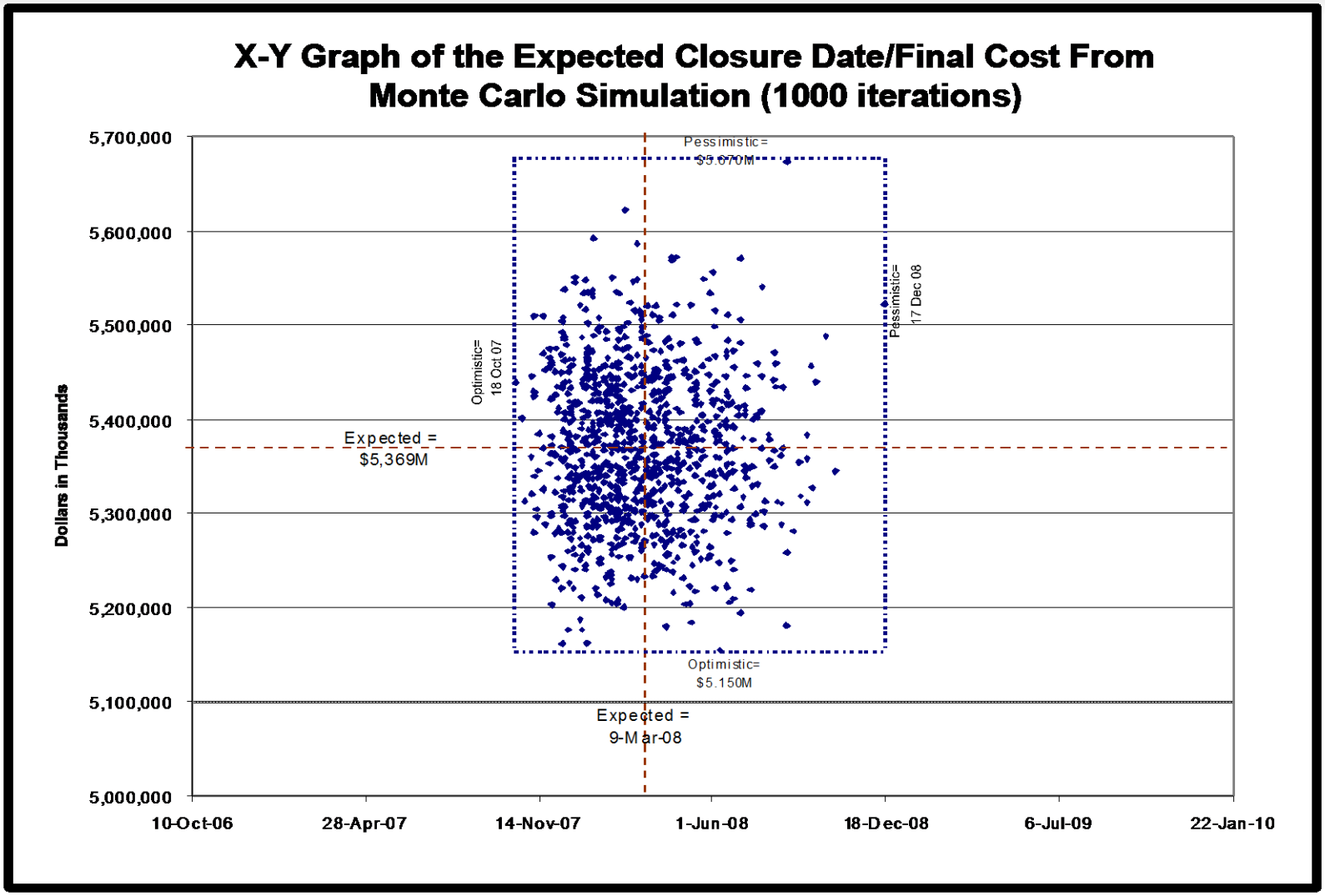
Monitor Performance Indicators



Technology Planning Implications

- Rigorous and detailed risk evaluations up front
  - "what could go wrong?" vs. "what now?"
  - slow down to speed up … or, "fast = half fast"
- Identify and focus resources on the weak links in the intrasystem
  - without detailed baseline/CP, the weak links are missed in the PRA
- Pursue both improved and alternative tech in parallel
- Anticipate the train wrecks and concentrate resources on the identified risks before they become problems
- Game the technology bet … play to win

Technology Roulette…
"Hedging the Technology Bet"

- Pursue multiple pathways until the risk is under control
- Place bets both on- and off-baseline
- Place bets on competing approaches, not just competing technologies
- One-thing-at-a-time achieves some breakthroughs but results in an odds-on overrun of the total project
  - Technical complexity multiplies the risk, reduces the odds of success, increases the need for risk-informed management

Integration of Technology and Regulatory Programs

- Just ask … just say yes
  - technical basis and equivalent performance cases promoted by EM-50/20 and RFETS with several successes
- Regulations, orders, standards, WACs . . . should be performance-based
  - technology-based standards work against potential break-through technologies

End State Mission

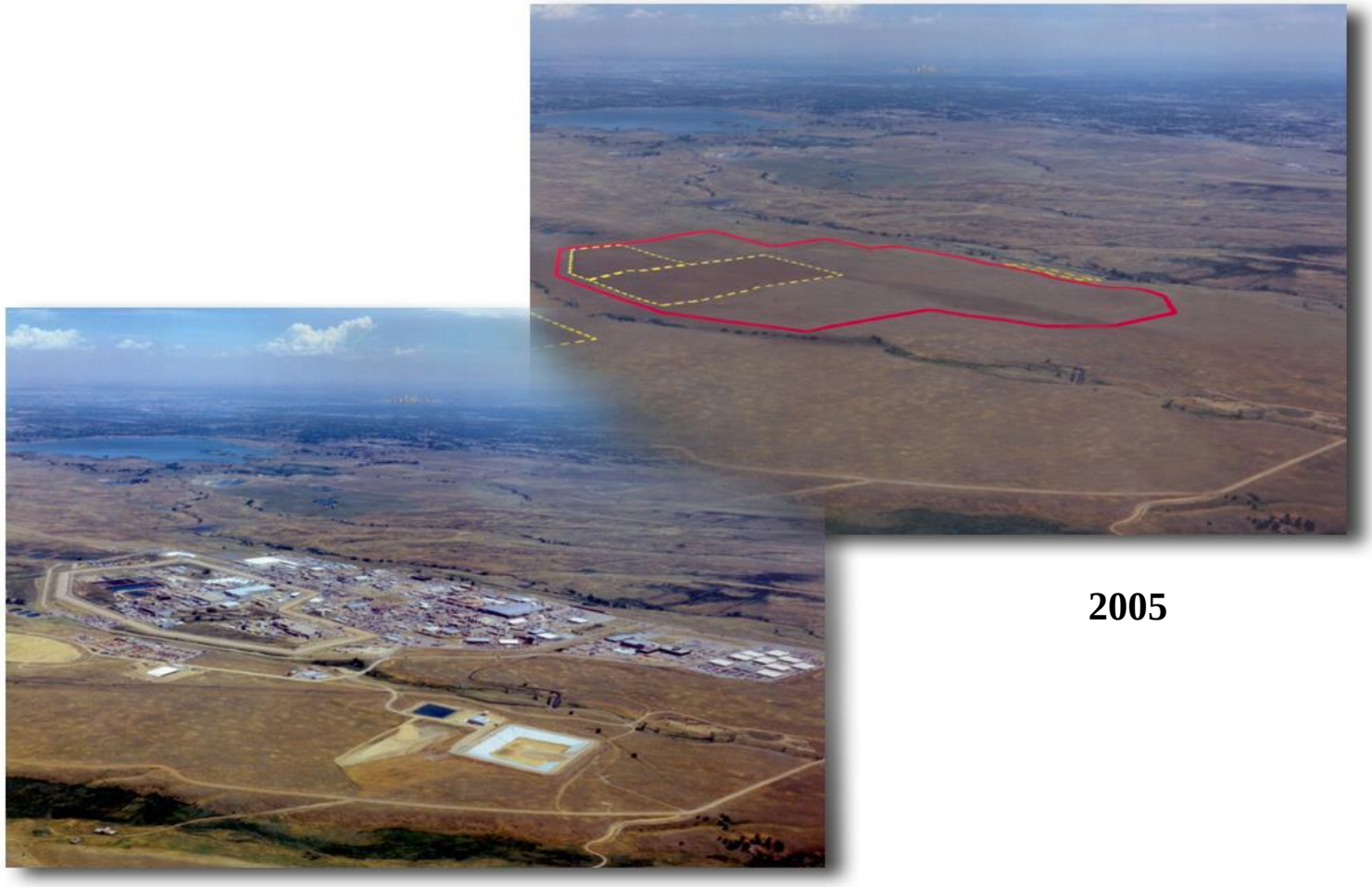
- Fixed Mission
  - Closure site/part of site
  - Standards fixed per location reuse
- Variable End Use
  - Cost vs. clean up levels
  - Environmental and health risk assessments
  - Informed agreements with stakeholders essential
- Sustainable economic development
  - Private investor/owner driven
  - DOE provides infrastructure assets
  - Flexible remedy management system responsive to investor needs
    - Schedule risk is enhanced
    - ***Premium on schedule predictability and asset availability***

DOE Site Infrastructure Assets

- Land
- Water
- Connected grid
- Security
- Transportation
- Skilled work force
- Enlightened regulators
- Educated communities
- National Labs and strong university alliances

bottom line: investment resources

Thank you!

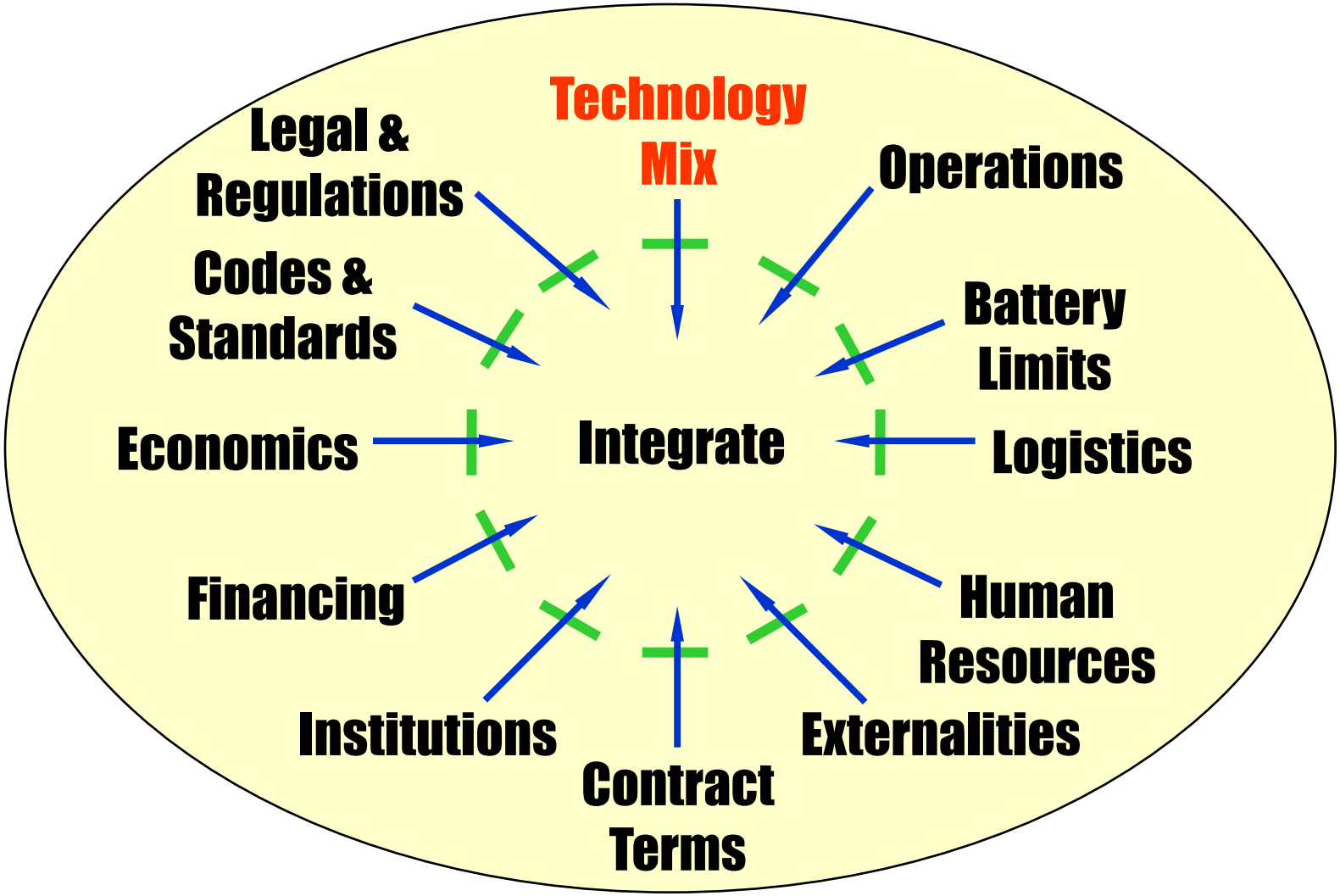


2005

2000

backup slides for potential questions

Project Definition



Project Dynamics
Technology Funding Implications

- Issue: Predictability for project managers
  - reliability, timing of funds are essential for Rolling Wave
- Sol'n: Local Banking model
  - known availability; local control; quick response
    - no extensive proposal cycle
  - grants or cost-sharing accounts (according to risk)
  - local can be DOE or contractor (" " ")
  - partnership is key
  - revolving?
- Sol'n: Fenced Bank
  - technology only, but not over-specified
  - retained earnings?

Contracting Approaches

- M&O Concept
  - CPFF/Award Fee
  - Risk largely retained by DOE
  - Risk - reward opportunities limited

- M&I Concept
  - Performance measures/activity milestones/fees
  - Risk - reward transferred to contractor
  - Period of performance for activities and contract narrowly defined

M&O → M&I → CR Impact on Innovation

- Productivity incentivized as risk-reward transferred
- Fee curve through completion alleviates problem of short-term milestones
- Efficiencies baselined up front; technical innovation implicit in target cost/schedule
- Risk mitigation requires pro-active planning and funding of off-baseline alternatives
- Innovation risk hurdle is raised

Decision Tools

- WISE model
- Project Planning and Integration
- Programmatic Risk Assessment

Outcomes

- Prioritize technology -- 80/20 rule
- Schedule technology -- windows of opportunity
- Support WISE -- bottom line impact
- Productivities
  - D&D, WM, ER
  - Processes, Instrumentation, IS
  - Management, consolidation

Sustainable Remediation: Drivers, Issues, and Tools

- EO 13514
  - Baseline data, standards, and practice improvements are required on defined sustainability parameters
  - EM implementation initiative
- Seeking win-win-wins between closure acceleration, jobs, and long term stewardship
- Life Cycle Analysis – both Programmatic AND Triple Bottom Line (ISO14040)
- EPI/Asset Revitalization: site conversion for sustainable economic development
- Tools and skills for EO compliance
  - Baselining and tracking the req'd parameters
  - Sustainability decision model
- Negotiate and optimize together with DOE Field Offices
  - Framework Planning tools can help

Mine

Level 2: Transport

Gravel to site

Operators to Site

Operators to Site

Spent Carbon Regeneration

PVC pipe to Site

Carbon to and from Site

Level 1: On Site

Groundwater Treatment

Drill Cuttings Off Site

Well Construction

Treated Water to Sewage

BioInjections

Operators and Equipment to Site

Groundwater Extraction

Electricity to Site

Cheese Whey to Site

Molasses to Site

Water to Site

Operators to Site

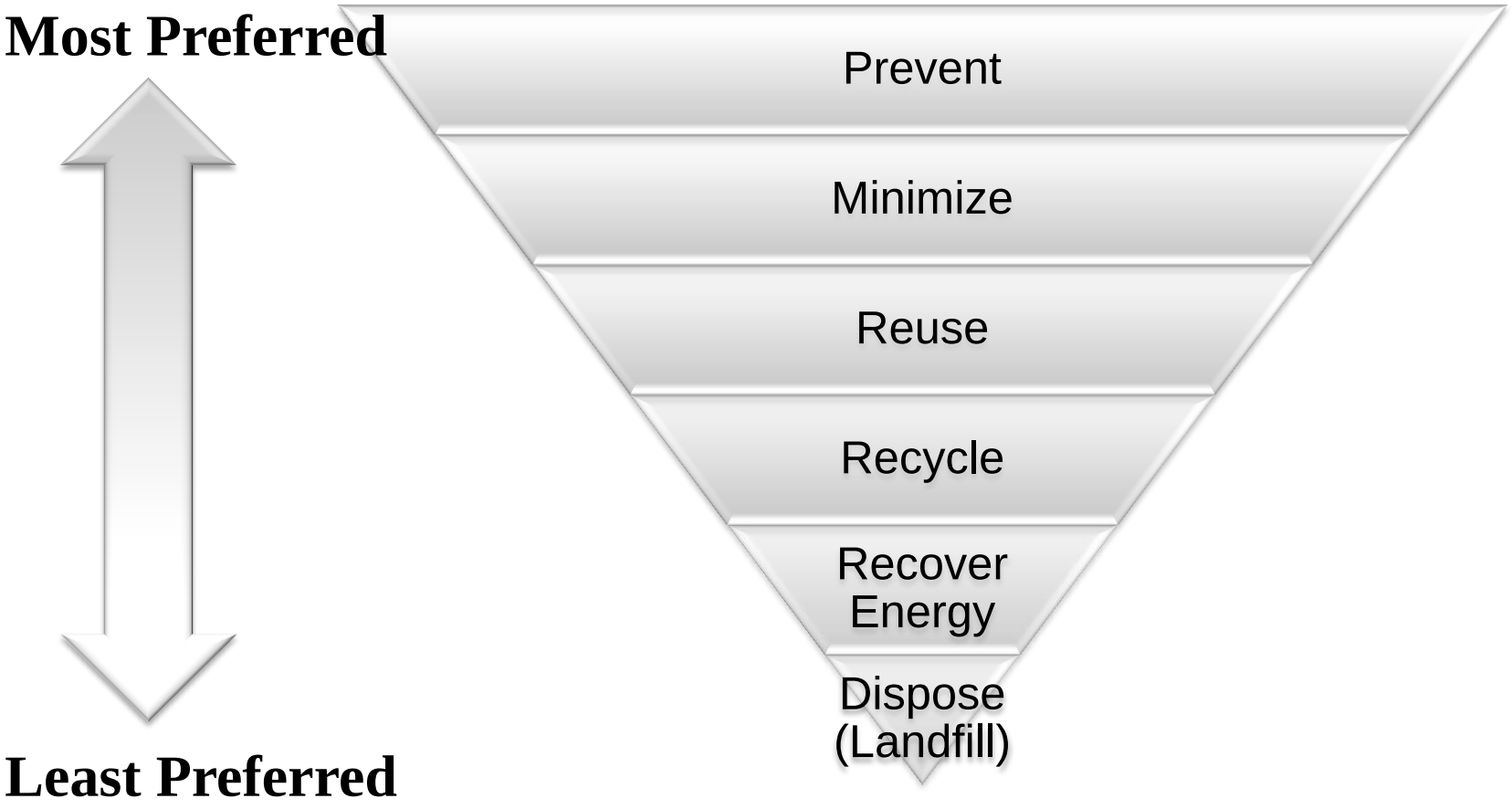
Molasses Manufacture

Level 3: Manufacture

Cleanup Project Practices

- Green remediation – “net benefit from cleanup actions” (EPA)
  - well underway at DOD sites
- Waste mgmt (legacy, D&D, ER) – targets: waste/disposal min
- Water mgmt – targets: conservation and zero discharge
- Energy mgmt (fac utilities, vehicles, cats, power, …) – targets: carbon, GHG min
- Materials selection & use – targets: degradable, reusable
- Deconstruction methods employ all of the above
- Procurement – sustainable supply chain (w/ life cycle assessment

Solid Waste Hierarchy

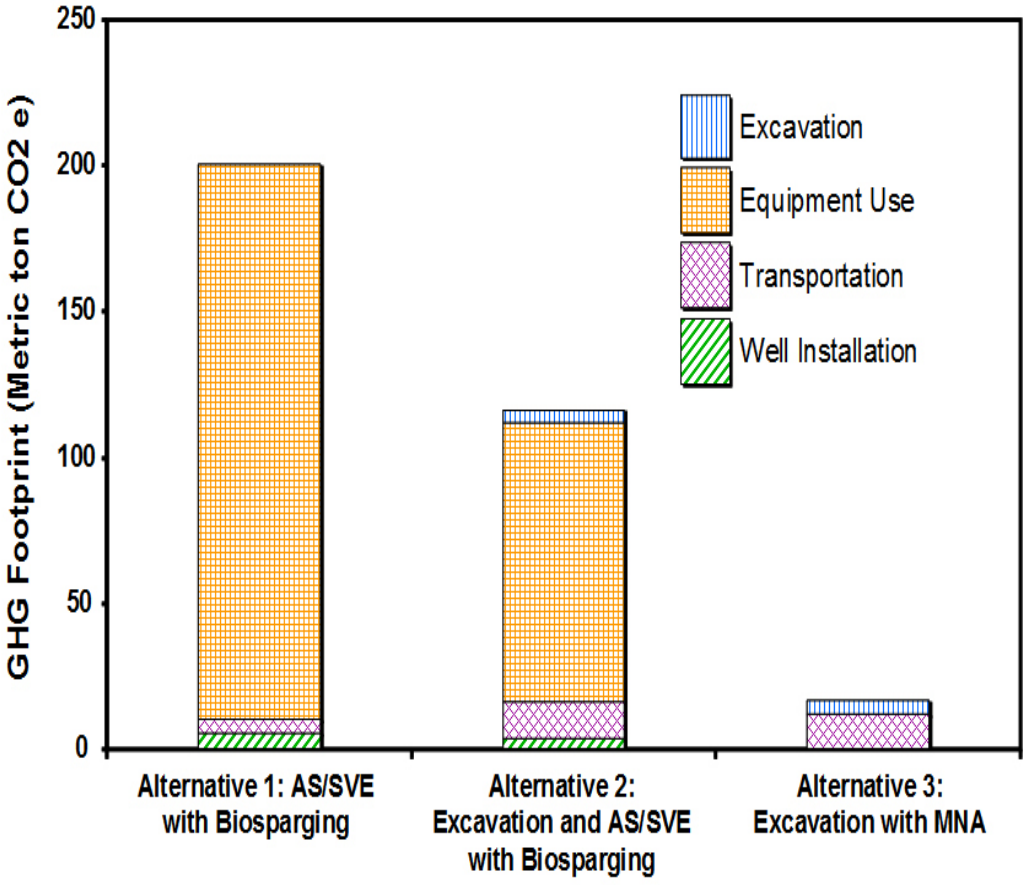


Example Green Deconstruction Methods

- Reuse recovered trees and compost green waste for fertilizer
- Crush concrete for onsite reuse
- Recover metals and slag
- Salvage decontaminated pipe
- Recycle petroleum, oils, and lubricants
- Use for- and non-profit partners for resource recovery
- Use other industry-specific materials, such as wood waste, wall board, etc.

Naval Facilities Command (NAVFAC) Sustainable Environmental Remediation (SER)

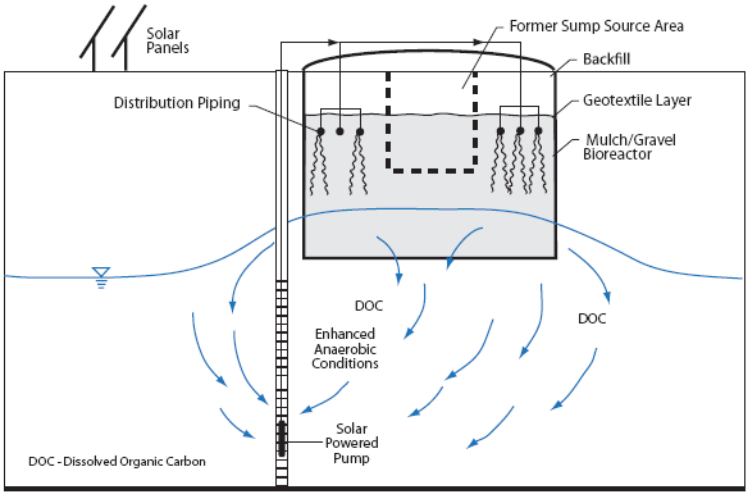
- Metrics include:
  - GHG Emissions
  - Energy Usage
  - Criteria Air Pollutants
  - Ecological Impacts
  - Water Usage
  - Resource Consumption
  - Worker Safety
  - Community Impacts



Some Cleanup Practice Examples

- Bio, phyto, in-situ, passive, natural processes vs. pump and treat or IX
- Jacking vs. drilling
- Reuse of rubble vs. haul and landfill; on-site borrow
- Decon agents and aerosol vs. liquid methods
- Misters vs. hose down
- Rail vs. road
- Solar for pumps, monitoring stations
- Equipment energy efficiency – bio diesel, variable frequency pumps
- Landfill solar
- VOC's: fume controls, net VOC's removed vs. emitted
- Revitalize the land and ecology

Example: Solar Powered Subgrade Bioreactor



Mulch filled, passive cell. Could be used for nitrate, uranium, Tc99, Cr(VI), chlorinated solvents

Energy-Technology Parks

- Energy Park Initiative/Asset Revitalization -- EM programs
- Site assets converted for economic development
  - Focus on green energy and technology-based economic development (TBED)
- DOE site assets: land, water, connected grid capacity, transportation infrastructure, educated workforce, enlightened communities and regulators
- DOE has designated a local economic development organization lead for major sites
- Opportunity to provide well-conceived plans to optimize use of assets and private industry sustainability

Hanford potential – early proposals

- On-site solar, biofuel and modular nuke plants
- Storage; integrate with off-site wind and hydro
- Smart grid demo to integrate above items
- Fleet conversion to eV
- Renewables supply electric and steam for WTP
- PNNL/Battelle is the tech lead for TRIDEC (Tri-Cities designated developer)
- Issue: TRIDEC requested DOE funding; private sector needs to drive these proposals

Another site potential - based on assets

- Mix of commercial business and tech demonstration centers
- Intra-Park and regional enterprise integration
- Biomass
  - Commercial power; liquid and solid fuels demos
- Solar
  - Commercial power; testing & demo center; PV manufacturing
- Storage
  - Commercial RE-grid load management bet. Mid-West and N-East S-East interties; technology development center
- Electric Vehicle
  - Testing and demo center for battery charging-changing systems; battery manufacturing
- IGCC w/ CO2 sequestration
  - Commercial scale demo
- Nuclear new build