

A Presentation to the National Academy of Sciences

January 8, 2008

Area Completion Project

Soil & Groundwater Remediation and Facilities Deactivation and Decommissioning



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Commitment to Safety

- **Demonstrated commitment to safety**
 - **Have worked 10 million hours and 8.5 years without a lost time injury on soil and groundwater work**

SAFETY IS OUR TOP PRIORITY

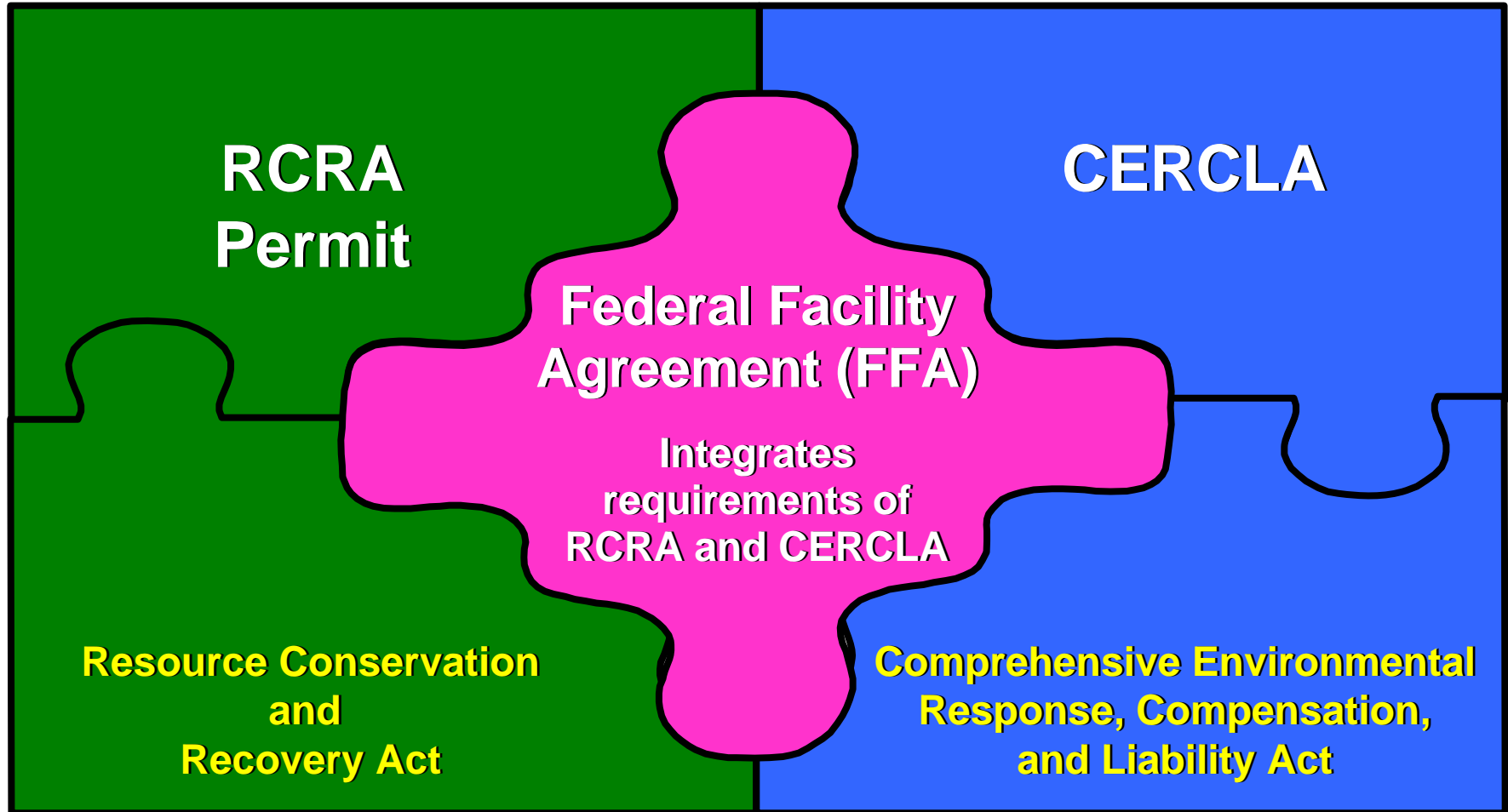


Program Scope

- **Area Completion Projects (ACP) is responsible for waste unit remediation (including soil, groundwater, and surface water) and facilities deactivation and decommissioning**
 - **515 total waste units**
 - **985 total excess facilities**



Regulatory Drivers



Project Performance

- **All FFA regulatory milestones met since 1993**
 - (1,990 of 1,990 milestones)
- **Maintaining a strong relationship with regulators**
- **Stakeholders providing meaningful opportunities for input to decision-making**
- **Project Status**
 - 14 groundwater remediation systems operating
 - 246 of 985 excess facilities decommissioned
 - 352 of 515 waste units completed
- **Area Completion Strategy (started FY 05) significantly reduced project cost and schedule**
- **Use of technologies is critical to project success**
 - Tailoring technologies for specific needs

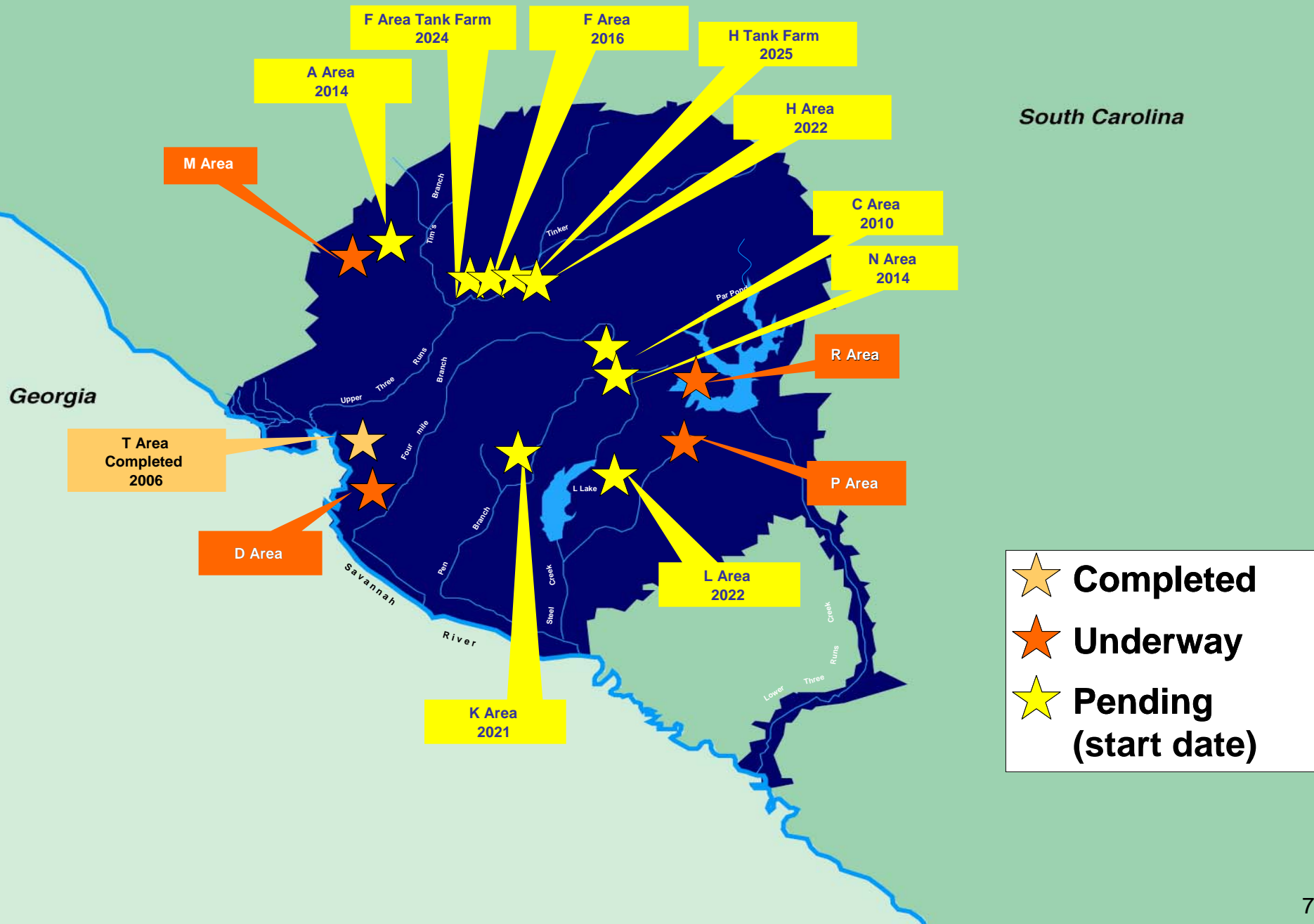


Area Completion Strategy

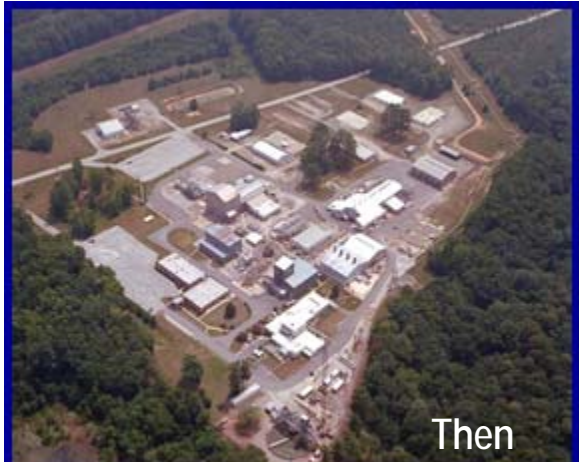
- **A systematic approach to completing cleanup work integrating D&D and SGP scope**
- **Historical process:**
 - Did not focus on any single area
 - Evaluated each waste unit individually with much paperwork
 - Did not address D&D facilities
- **Today's process:**
 - Addresses large groupings of waste units and facilities in a geographic area
 - Integrates D&D / SGP cleanup
 - Area end states can be determined
 - Economies of scale in sampling, remediation, and documentation



SRS Completion Areas



T-Area Completion



- **1st Area Completion - September 2006**
 - Remediated 8 waste units
 - Completed D&D of 28 facilities
 - Installed a 10-acre geosynthetic cover
- **Accelerated project 48 months ahead of original schedule**
- **Groundwater remediation underway with SRNL support**
 - Remediating volatile organic compounds (VOCs) in vadose zone using 5 microblowers
 - Edible oil study underway to enhance and microbially accelerate VOC remediation



M Area Operable Unit



- **2nd Area Completion scheduled for 2011**
- **D&D completed in 2006**
 - 22 facilities removed
 - Early cleanup actions implemented to accelerate schedule to 2010
 - In 2008 will remove selected contaminated media (radioactive and VOC contamination in soil and concrete)

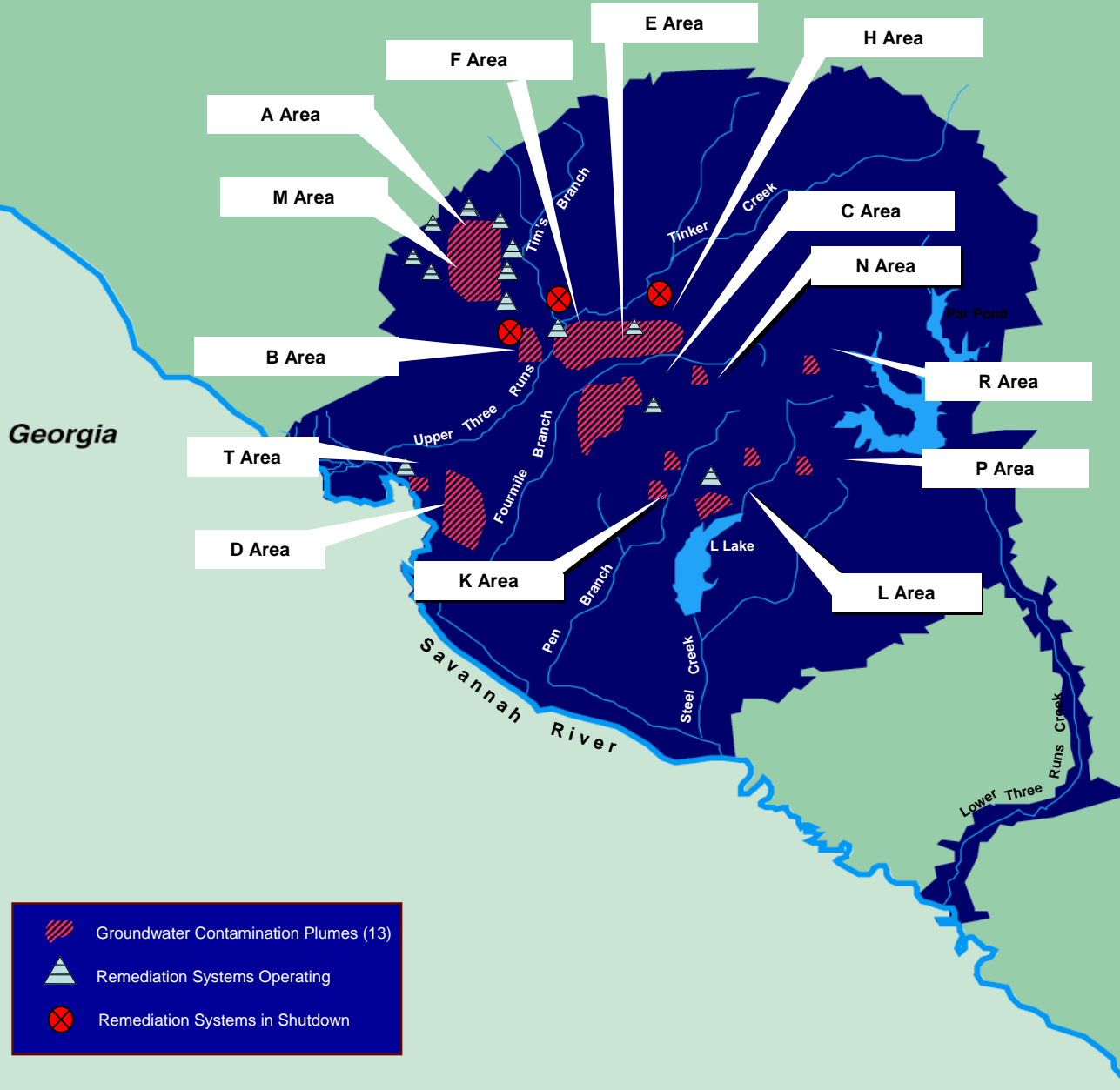


P Area Operable Unit

- **1st scheduled reactor Area Completion**
 - Encompasses 100 acres
 - Includes 5 waste units, and facility remnants from D&D
 - Record of Decision (ROD) is in Fiscal Year 2010
- **Early characterization complete (tritium, solvents, cesium)**
- **Taking early actions to address contamination sources**
- **Public Workshops in progress to solicit public input**



Groundwater Plumes



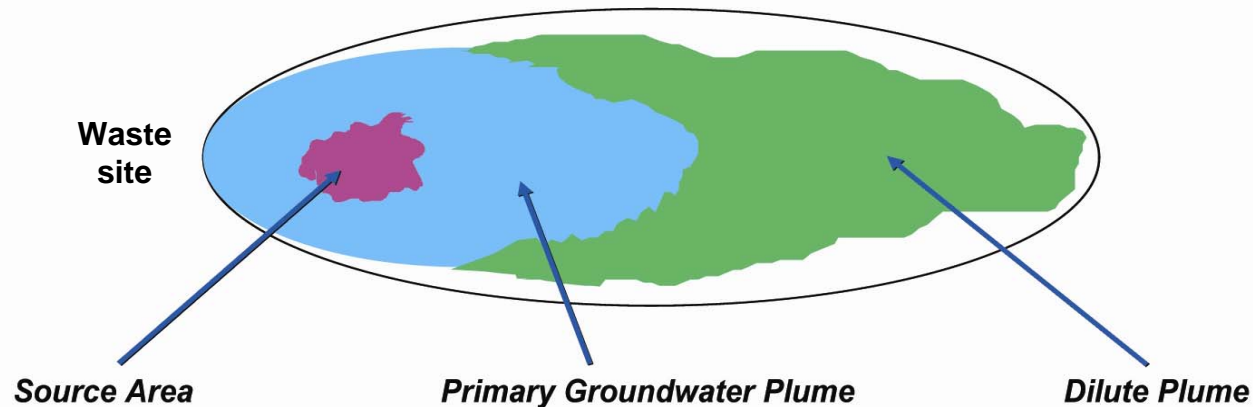
South Carolina

Georgia

- Groundwater Contamination Plumes (13)
- Remediation Systems Operating
- Remediation Systems in Shutdown

- 14 Groundwater Contamination Plumes**
A/M, F/H, B, TNX, E, P, L (2), K (2), C, N, R, and D Areas
- 14 Active Remediation Systems**
- 2 Airstrippers, 2 Recirculation, Dynamic Underground Stripping, 4 Soil Vapor Extraction Units (A/M Areas)
 - Airstripper (TNX)
 - Base Injection (F Waste Management Facility)
 - Electrical Resistance Heating (Chemical, Metals, & Pesticides Pits)
 - Phytoremediation (Mixed Waste Management Facility and H Waste Management Facility)
- 7 Enhanced Systems**
- Baroballs (A/M, Miscellaneous Chemical Basin, P Burning Rubble Pit)
 - Microblowers (A and C Burning Rubble Pits)
 - Barrier walls (F&H Waste Management Facility)
- 6 Passive Systems**
- Monitored Natural Attenuation (Chemical, Metals, & Pesticides Pits, D Oil Seepage Basin, R Reactor Seepage Basins, K and L Burning Rubble Pits, and Sanitary Landfill)
- 3 Systems In Shutdown**
- Biosparge (Sanitary Landfill)
 - Groundwater Waste Treatment Units (F&H)
- 11 Systems Pending**

Remediating a Contaminated Site



Hot Spot: Thorough characterization reduces cleanup volume

Highly Aggressive Technologies:

- Excavation
- Heating (Dynamic Underground Stripping or Electrical Resistance Heating)
- In situ chemical oxidation
- Active Soil Vapor Extraction

Zone of Capture: Characterization required and groundwater extraction is optimized to reduce treatment volume

Less Aggressive Active Technologies:

- Air stripping
- Recirculation wells
- Hydraulic barrier / Phyto-irrigation
- Base injection

Leading Edge: Characterization needed to predict mass transfer and flux

Low Energy Technologies:

- Phytoremediation
- Passive Soil Vapor Extraction (baroballs)
- Monitored Natural Attenuation

Enhanced Attenuation alternatives can apply to all zones to supplement Monitored Natural Attenuation (MNA):

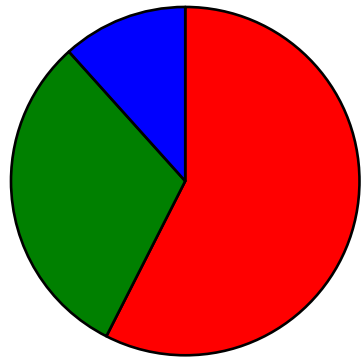
Capping, Oil Partitioning

Permeable Biotreatment Wall

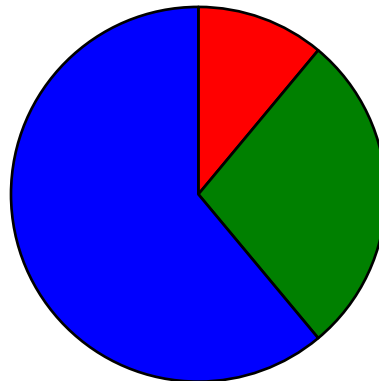
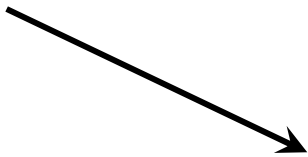
Constructed Wetland



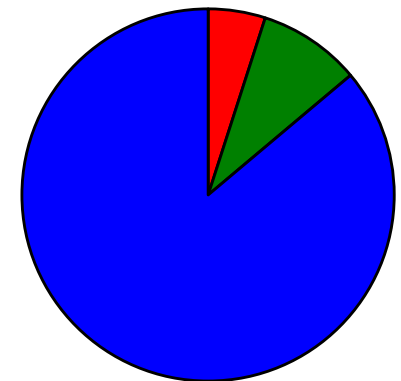
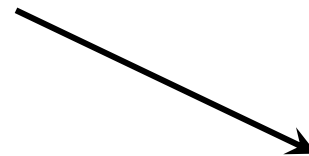
Groundwater Management Vision Active to Passive



FY08



FY20



FY40 **SRS**



SGP Significant Activities

Dynamic Underground Stripping (DUS)

- M-Area steam injection/contaminant removal system with SRNL support
 - Complete steam injection in 2008
 - Accelerates A/M Area groundwater cleanup (5 years vs. 200+ yrs. using conventional technologies)
 - Targets remediation at 3-acre contaminated area regarded as primary source of A/M Area subsurface contamination
- Largest application of an oil-field technology for environmental remediation
- Removed 380,000 lbs. of solvents to date
- Completed construction at a cost of \$17M with a project cost avoidance of \$20M.



Electrical Resistance Heating



- **Completed removal of 710 pounds of solvents at C Reactor in 2006**
 - 99 % efficiency based on soil samples
 - Achieved cleanup two years faster than Soil Vapor Extraction
- **Above-ground equipment relocated to Chemical, Metal and Pesticide Pits in 2007 to remediate solvents with SRNL support**



Phytoremediation



- **Controlling E-Area tritiated groundwater discharge to stream with sheet pile dam and irrigating pine forest for evapotranspiration**
- **70% reduction of tritium to stream**
- **2-acre pond and irrigating 22 acres of pine trees (under expansion)**



General Separations Area Consolidation Unit



- Consolidated waste from 3 basins into the Old Radioactive Waste Burial Ground (ORWBG)
- Constructed a geosynthetic cover over the 76-acre ORWBG
- Eliminated offsite disposal of 45,000 cubic yards of contaminated soil
- Completed D&D of three facilities
- In-situ closure resulted in significant cost avoidance and avoidance of high hazards associated with burial ground waste removal
- Completed project in November 2007

AGGRESSIVELY REDUCING RISK



D&D Significant Activities

- **Completed decommissioning of Naval Fuels Complex 6 months ahead of schedule**
 - 110,000 square feet manufacturing facility with 5 smaller auxiliary facilities
 - Manufactured reactor fuel
 - Operations halted in 1989



Technology Challenges

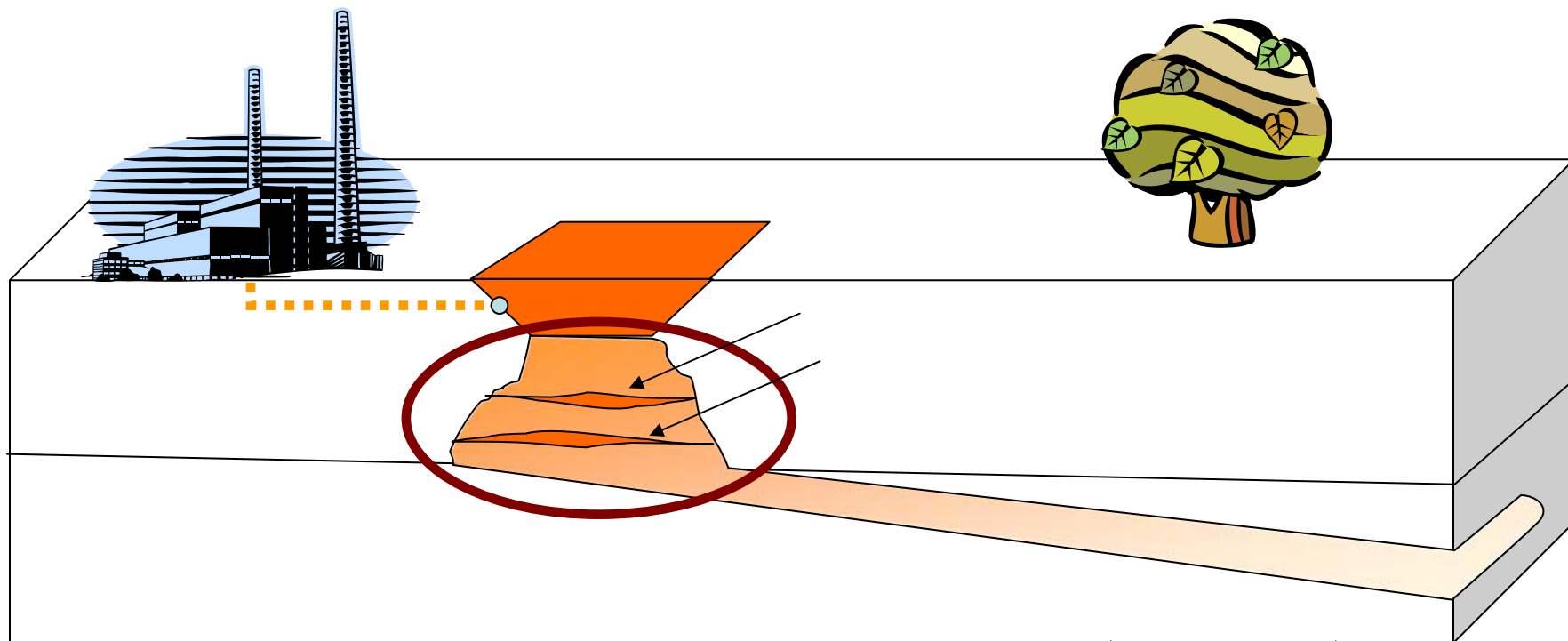
- **ACP technology challenges (with SRNL support) included in the EM Roadmap (listed in priority):**
 - “Tight Zones” and Mass Transfer Limitations
 - Abandoned sewer lines *
 - Monitored Natural Attenuation (MNA) and Enhanced Attenuation (EA) for chlorinated solvents *
 - Institutional Control technologies
 - MNA and EA for metals and radionuclides *
- **Continued development and deployment of new technologies are critical to project success**

* Selected by EM in 2007 for development



“Tight Zones” and Mass Transfer Limitations

Measuring and overcoming long and slow contaminant releases



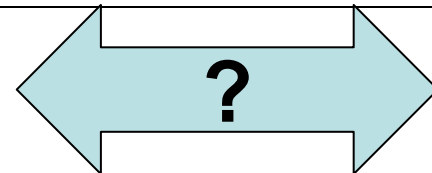
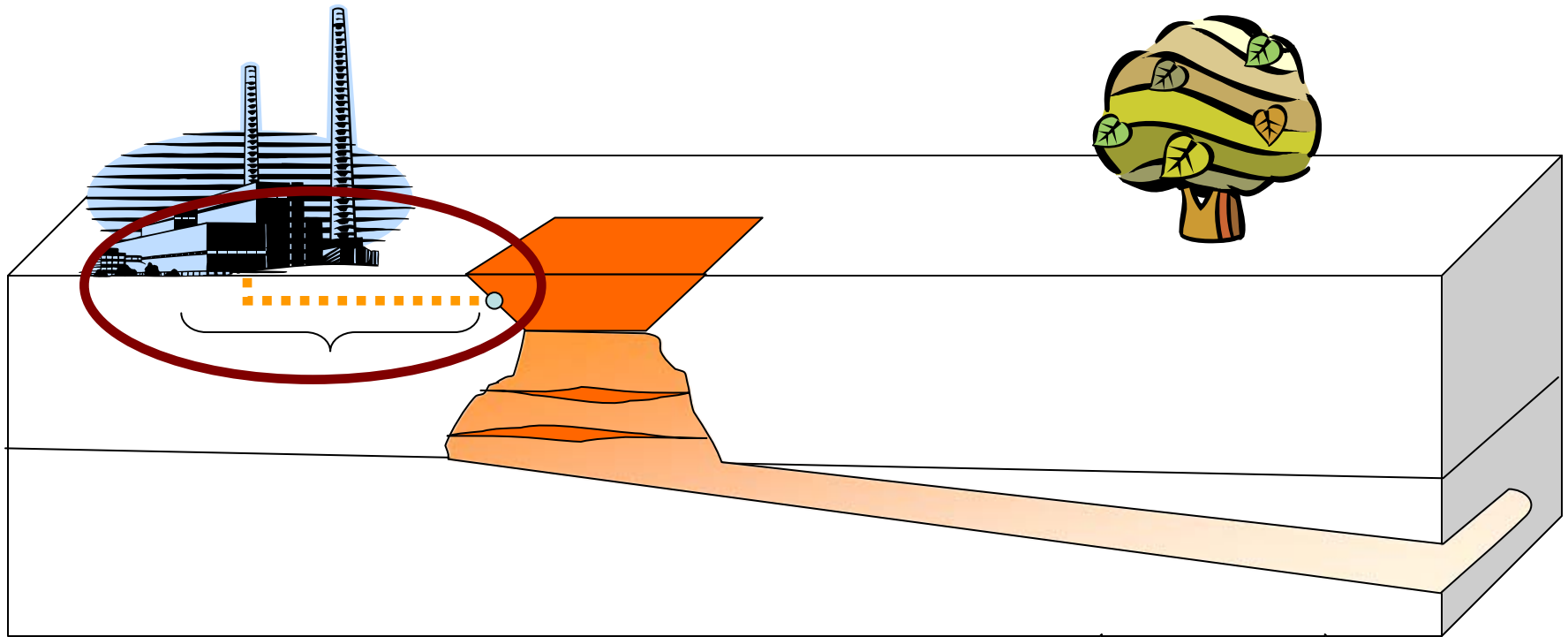
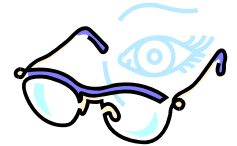
“Tight Zones” and Mass Transfer Limitations

- **Primary Objectives**
 - **Need** -- tools to measure and overcome the primary barrier to completing treatment in variably layered geology at SRS
- **Sites and Studies**
 - Target plumes include organics, metals, and radionuclides in groundwater and soil across the entire SRS
 - Example technologies include fracturing clay to create openings, vadose heating to increase mass transfer rates, long-term deployment of sustainable-passive barriers



Abandoned Sewer Lines

Responsible management of diffuse, non-point source contamination.



Abandoned Sewer Lines

- **Primary Objectives**

- Provide innovative or improved tools for characterization and remediation (up to 10 miles of underground lines associated with each industrial area)
- Without adequate characterization, is entire source considered contaminated and require equivalent remediation?

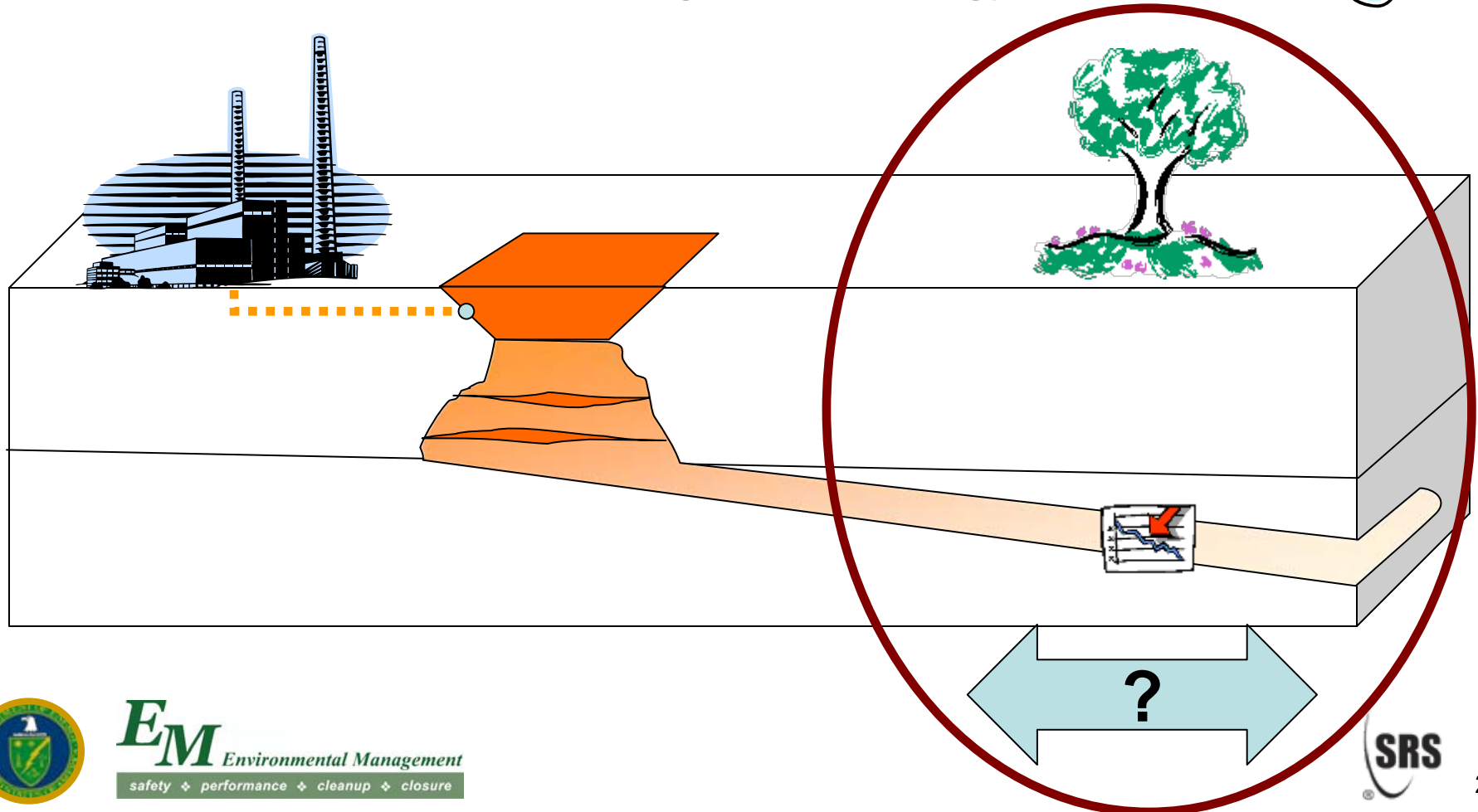
- **Sites and Studies**

- Target sites include all major SRS facilities
- Example technologies include geophysics, gas tracers, robotics, in situ removal and /or stabilization systems
- Project Team formed, Program Plan in development, and identifying waste units for application



MNA / EA for Chlorinated Solvents and for Metals and Radionuclides

Proving and ensuring plume stability → transitioning to passive environmental management strategy.



MNA / EA for Chlorinated Solvents

- **Primary Objectives**

- Prove Natural Attenuation (NA) is occurring or implement EA to avoid / eliminate active remediation
- Provide improved tools that ensure attenuation is occurring for transition of sites into long term stewardship
- Encourage “combined remedies” (e.g., active at source, passive at distal portion of plume)

- **Sites and Studies**

- Need to demonstrate EA – examples include barometric pumping, long-lived e-donor (e.g., vegetable oil) injection, and post-thermal treatments
- Target sites and plumes include groundwater and soil in C Area, P Area, L Area, D Area, and A Area
- Project Team formed, Program Plan in development, and identifying waste units for application



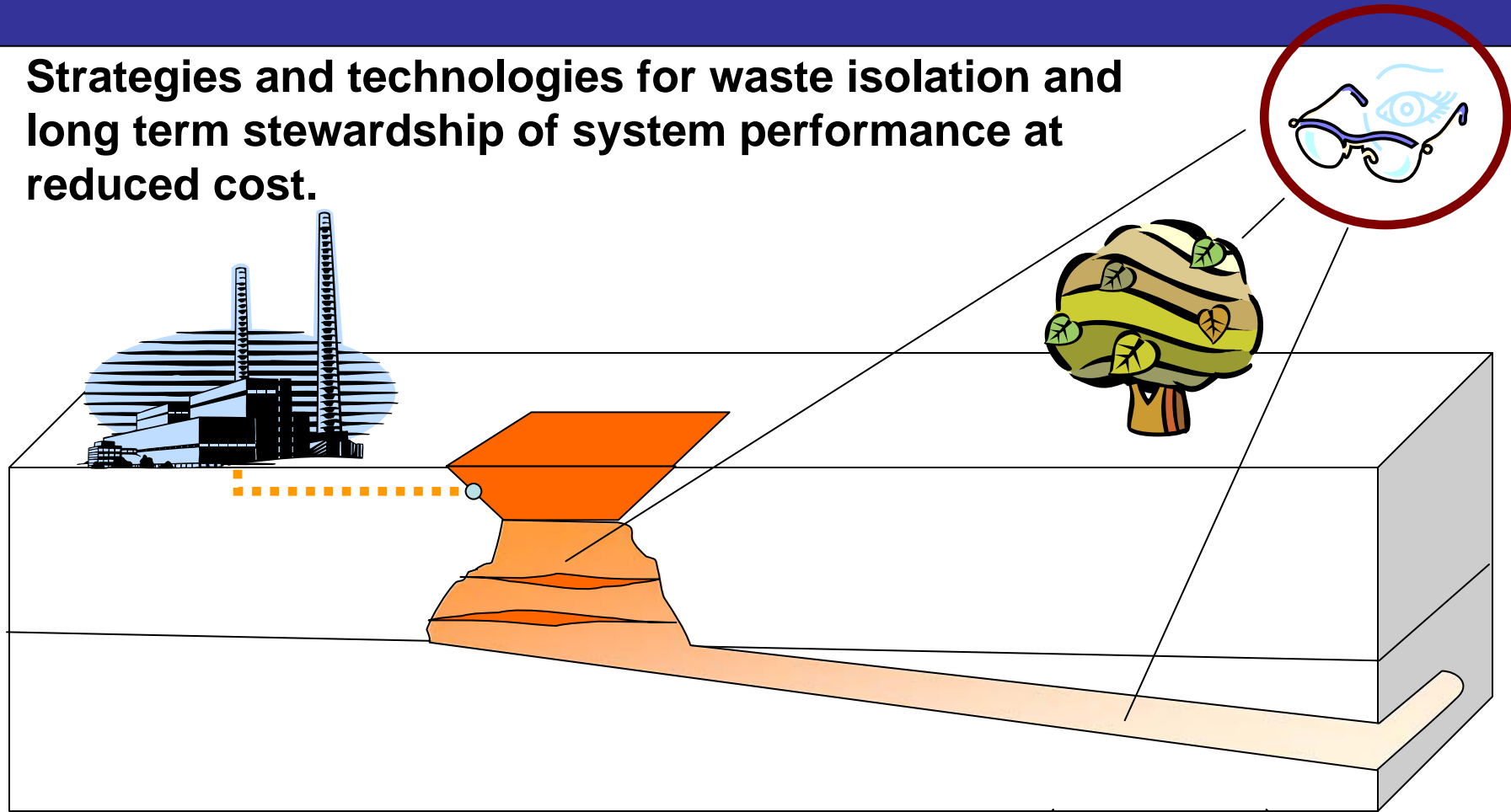
MNA / EA for Metals and Radionuclides

- **Primary Objectives**
 - Prove NA is occurring or implement EA to avoid / eliminate active remediation
 - Provide improved tools that ensure attenuation is occurring for transition of sites into long term stewardship
- **Sites and Studies**
 - F Area Field Demonstration Site
 - D Area, Coal Piles, and large-complex sites (such as burial grounds and reactor buildings) that will be transitioning in to closure and long term monitoring in the future
 - In situ geochemical stabilization rather than destruction to demonstrate plume stability and mass balance, use of plants, and sustainable infiltration control
 - Project Team formed, Program Plan in development, and identifying waste units for application



Institutional Control Technologies

Strategies and technologies for waste isolation and long term stewardship of system performance at reduced cost.





Institutional Control Technologies

- **Primary Objectives**
 - Develop improved tools and strategies (do we look at individual plumes or collectively at an entire watershed) for long term monitoring
 - Alternatives to current practice (frequent measurements in large numbers of monitoring wells)
 - Innovative systems for performance monitoring of capping and isolation remediations
 - Program to address major performance monitoring concerns documented in NAS / NRC reports
- **Sites and Studies**
 - All sites leaving waste in place
 - Long term remedial actions

