SUMMARY OF DOE-EM CMM R&D GOALS

These pages provide a concise listing of the **Near-Term** and **Far-Term Goals** identified in **APPENDIX A**, along with an indication of which CAAs will be the primary beneficiaries of that Goal. A more detailed evaluation of these **Goals** and their relationships with needs groups may be found in *FY 2001 Office of Science and Technology Investments in Characterization, Monitoring, and Sensor Technology: A Cross-cutting Analysis* (CMST-CP, June 2001). That document also links each of the **Goals** to one or more DOE-EM OST programs.

Critical Application Areas (CAAs) are identified as follows:

SCR	Subsurface Characterization and Remediation
FDD	Facility Deactivation and Decommissioning
LTM	Long-Term Monitoring
WNMC	Waste and Nuclear Material Characterization
WTC	Waste Tank Closure
WTI	Waste Tank Integrity
TWP	Tank Waste Processing
MWP	Mixed Waste Processing

Many of these goals are shared among CAAs. These crosscutting aspects make it possible in many cases to leverage technology development accomplished previously for one CAA to meet needs of another. The document cited in the previous paragraph examines these crosscutting relationships in detail.

WASTE, SOURCE, AND NUCLEAR MATERIALS CHARACTERIZATION

Near-Term Goals

- Expand direct push capabilities to minimize the need for drilling during subsurface characterization (**SCR**).
- Improve methods for determining the subsurface distribution of dense non-aqueous phase liquids (DNAPLs), radionuclides, heavy metals, high explosives, and pyrophoric compounds (**SCR**, **FDD**).
- Expand capabilities for characterization beneath structures (**FDD**).
- Improve sampling technology for characterizing deep plumes (**SCR**, **LTM**).
- Improve methods for hydrogeological characterization of flow and transport (**LTM**, **SCR**).
- Improve and validate geophysical methods for determining the spatial distribution of contaminants in the subsurface (**SCR**, **LTM**).
- Improve tomographic nondestructive assay and nondestructive evaluation (NDA/NDE) and other characterization systems for containerized wastes (**WNMC**).
- Develop *in situ* methods for detecting contamination on surfaces and in inaccessible areas (**FDD**, **WTC**).
- Develop robotic platforms for characterization sensors (**FDD**, **WTC**).
- Supplant slow, costly, inaccurate laboratory methods; develop *in situ* characterization techniques for high-level waste (HLW) applications; obtain regulatory approval for innovative technologies (**all**).
- Develop better methods for evaluating and monitoring HLW tank integrity (**WTI**).

- Develop better methods for evaluating final and/or immobilized waste form content, durability, and degradation (**WNMC**).

- Develop *in situ*, real-time sensors for lead, low energy gamma-emitters, polychlorinated biphenyls (PCBs), and other constituents of concern in facilities slated for deactivation and decommissioning (**FDD**, **LTM**).

Far-Term Goals

- Improve methods for characterizing the subsurface, particularly in deep, complex, and heterogeneous settings, using direct observation as well as indirect geophysical techniques (**SCR**, **LTM**).

- Develop more flexible data integration methods (**SCR**, **LTM**).

- In general, develop the capability to characterize and quantify any residual waste which remains in any DOE facility after cleanup activities have been completed (**FDD**, **WTC**, **LTM**).

PROCESS AND PRODUCT MONITORING

Near-Term Goals

- Improve tank waste slurry monitoring capability (**TWP**).

- Improve capability to monitor tank waste liquid/solid separation processes (**TWP**).

- Develop on-line process control monitors for tank wastes as well as mixed waste, mixed transuranic (TRU) waste, and nuclear materials immobilization and stabilization (**TWP**, **MWP**, **WNMC**).

- Develop improved methods for HLW and low-level waste (LLW) process monitoring at the basic science level (**TWP**, **MWP**).

- Complete the development of continuous emissions monitors for constituents including mercury and dioxins/furans (**TWP**, **MWP**).

- Identify and address issues arising in emissions monitoring for mixed waste alternative oxidation treatments (**MWP**).

- Develop an improved understanding of dioxin and furan formation and control (**MWP**).

- Improve capabilities for real-time monitoring of subsurface remediation (**SCR**).

- Develop real-time portable beryllium monitors for surface and airborne contamination (**FDD**).

Far-Term Goals

- Develop monitors for tank waste slurrying and pretreatment processes yet to be developed (**TWP**).

- Nurture promising *in situ* HLW and LLW immobilization monitoring technologies (**TWP**, **MWP**).

- Develop acceptable methods for verifying waste tank closure risk analyses (**WNMC**, **LTM**).

- Develop/negotiate more flexible regulatory paradigms allowing the use of less expensive measurements (**several**).

- Develop effluent monitoring and control methods that can facilitate continuously documented regulatory compliance (**several**).

- Develop monitoring techniques for bioremediation processes to track process functioning as well as contaminant concentration (**LTM**).

- In general, develop waste remediation process monitoring, control, and automation to the level of reliability and acceptability expected of normal industrial production processes (**several**).

LONG-TERM MONITORING

Near-Term Goals

- Develop better, carefully validated geophysical monitors and data integration methods for subsurface DNAPLs (**SCR**, **LTM**).

- Identify well-characterized test areas for modeling methods (**LTM**).

- Adapt available monitoring systems for long-term, unattended, self-calibrating and testing operation with minimal maintenance and automated, remote data reporting (**SCR**, **LTM**).

- Develop remote systems for monitoring large areas such as landfill covers (**LTM**).

- Develop automated systems for remote monitoring of long-term *ex situ* treatment processes (**LTM**).

Far-Term Goals

- Develop systems for unattended long-term monitoring of closed structures, waste repositories, and stabilized waste tank farms (**LTM**).

- Capitalize on government and academic research on micro electro-mechanical sensors (MEMS) and other innovative scientific development, and direct that development toward areas of importance to DOE-EM (**several**).

- Develop techniques for monitoring bioremediation. (**SCR**, **FDD**, **LTM**)

- Participate in collaborative efforts among DOE, Department of Defense (DoD), U.S. Environmental Protection Agency (EPA), and other stakeholder groups to enhance regulatory and public acceptance of innovative monitoring strategies, equipment, and practices (**several**).

NONDESTRUCTIVE METHODS

Near-Term Goals

- Continue development of NDA technologies for the assay of Resource Conservation and Recovery Act (RCRA) metals (**WNMC**, **TWP**, **MWP**).

- Continue development of NDE and NDA methods for complex contact handled drum wastes (**WNMC**).

- Develop technologies for non-intrusive tomographic NDA and NDE of boxed wastes (**WNMC**).

- Develop multi-detector NDA technologies for characterization of remote handled wastes (**WNMC**).

- Advance the NDE of HLW tank wall, knuckle, bottom, and piping integrity (**WTI**).

- Develop NDA techniques for inventory verification of containerized SNF (**WNMC**, **LTM**).
- Develop remote technologies for monitoring containerized SNF in extended dry interim storage (**LTM**, **WNMC**).
- Develop sensors for determining moisture in spent nuclear fuel prior to encapsulation (**WNMC**).

Far-Term Goals

- Continue development of NDE methods for monitoring safety of aging HLW tanks (**WTI**).

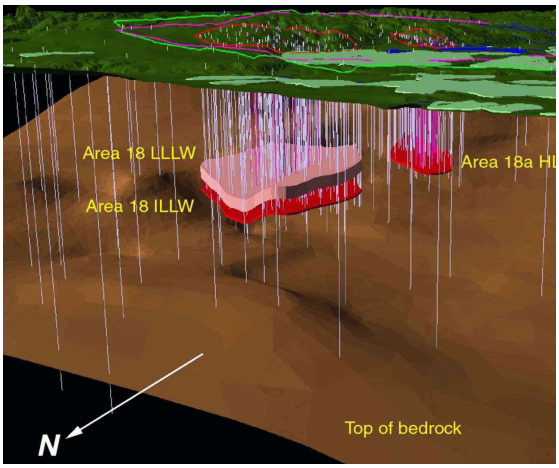
IMPROVED SCIENTIFIC UNDERSTANDINGS

Near-Term Goals

- Improve basic understandings of subsurface structures and their relationship with contaminant fate and transport (**SCR**, **LTM**).
- Improve basic understandings of contaminant fate and transport processes and their relationships with geology, hydrogeology, and geochemistry (**LTM**).
- Develop acceptable remote data acquisition, screening, and reporting models (**LTM**).

Far-Term Goals

- Develop better fundamental understanding of subsurface processes and characteristics critical for determining contaminant fate and transport (**LTM**, **SCR**).
- Improve capability to evaluate critical subsurface processes, particularly at large sites with heterogeneous geological and hydrogeological conditions (**SCR**, **LTM**).
- Develop automated, self-testing, self-reporting, self-calibrating sensors for long-term monitoring (**LTM**).
- Develop secure, redundant, automated data collection, storage, retrieval, evaluation, and reporting systems for long-term monitoring data (**LTM**).



TechID 775: Modeling the Subsurface in the Tomsk Region

TechID 70: BetaScint™