Project Title:	Waste Water Treatment with Magnetic Separation
Organization(s):	**Los Alamos National Laboratory**
Presenters:	Joe Waynert (LANL), Jon Bernard (DuPont/LANL)
FY 2004 Funding:	$60 K (DOE to LANL); $150k (DuPont to LANL; funds-in); $100 K (DuPont matching funds)

Project Purpose and FY 2004 Objectives: Project Purpose and FY 2003 Objectives: DuPont is leading the SPI development of a 500 mm HTS reciprocating magnetic separator. An HTS magnetic separator offers significant operational energy savings compared to conventional copper coil separators. The DuPont business plan calls for the development of new applications of magnetic separation that can benefit from the energy efficiency. DuPont and LANL established a CRADA in FY03 that capitalizes on LANL's experience in magnetic separation. DuPont has stationed a full-time employee, Jon Bernard, at the Los Alamos Research Park. After jointly assessing several potential market opportunities, DuPont and LANL agreed to focus on the removal of heavy metals in wastewater using high gradient magnetic separation (HGMS). LANL will work with DuPont to develop an in-situ ferrite formation process that incorporates the heavy metals in a ferrite crystal lattice. The ferrites, having a high magnetic susceptibility, are then readily removed as they pass near a magnetized matrix material.

The objectives for FY 2004 were to determine the controlling parameters and their associated ranges for the ferrite process; optimize the ferrite and HGMS processes for the pilot plant application (Leadville, CO); determine the scaling issues in transitioning from the laboratory to the pilot plant operations; and establish a pilot plant location that allows for testing and demonstration.

FY 2004 Performance/FY 2005 Plans: In FY 2004 LANL and DuPont performed over 100 separate experiments investigating the effects of magnetic field strength, superficial velocity, matrix fiber diameter, reaction time, bubbling air impact on reaction, varying seed to iron (II) ratio, matrix packing density, and matrix column length. Reasonable ranges of operation to maximize the amount of material captured before breakthrough have been determined. An agreement has been established to locate a 10 gallon per minute pilot plant at the Leadville Mine Drainage Treatment facility in Colorado. Scaling issues in transitioning from the laboratory to the 10 gpm plant have been identified. Conceptual designs are being developed.

LANL plans for FY 2005

1) Either extend the CRADA with DuPont or find another company to support the development of the HTS HGMS.
2) Design, fabricate, assemble, and verify operational capability of the HGMS pilot plant system at LANL before transporting the system to Leadville.

FY 2004 Results: Significant progress has been made at LANL during the year. In the past fiscal year, we demonstrated by benchtop chemistry that a magnetic product of suitable quality and magnetic response can be formed at 6^{o}C, the water temperature at Leadville. We have confirmed the magnetic product is stable enough for long term storage and will pass standard EPA heavy metal leaching tests. Using HGMS test facility at Los Alamos Research Park, we have optimized magnetic separation conditions, such as flow rates, matrix material, breakthrough volume, … and developed a detailed process for magnetic separation considering issues related to scale-up of the process. We have established a location that allows testing of a pilot plant magnetic separator.

Research Integration: LANL and DuPont have regular teleconferences to ensure that R&D objectives, efforts, and results are in accord with project objectives. The results are reviewed by DuPont staff. Information and techniques are regularly exchanged between DuPont and LANL. As a full time DuPont employee, Jon Bernard participates in weekly LANL magnetic separation team meetings. A partnership between LANL, Leadville Institute of Science and Technology and the Bureau of Reclamation has been established to promote and evaluate the HGMS system in the Leadville Mine Drainage Treatment plant.