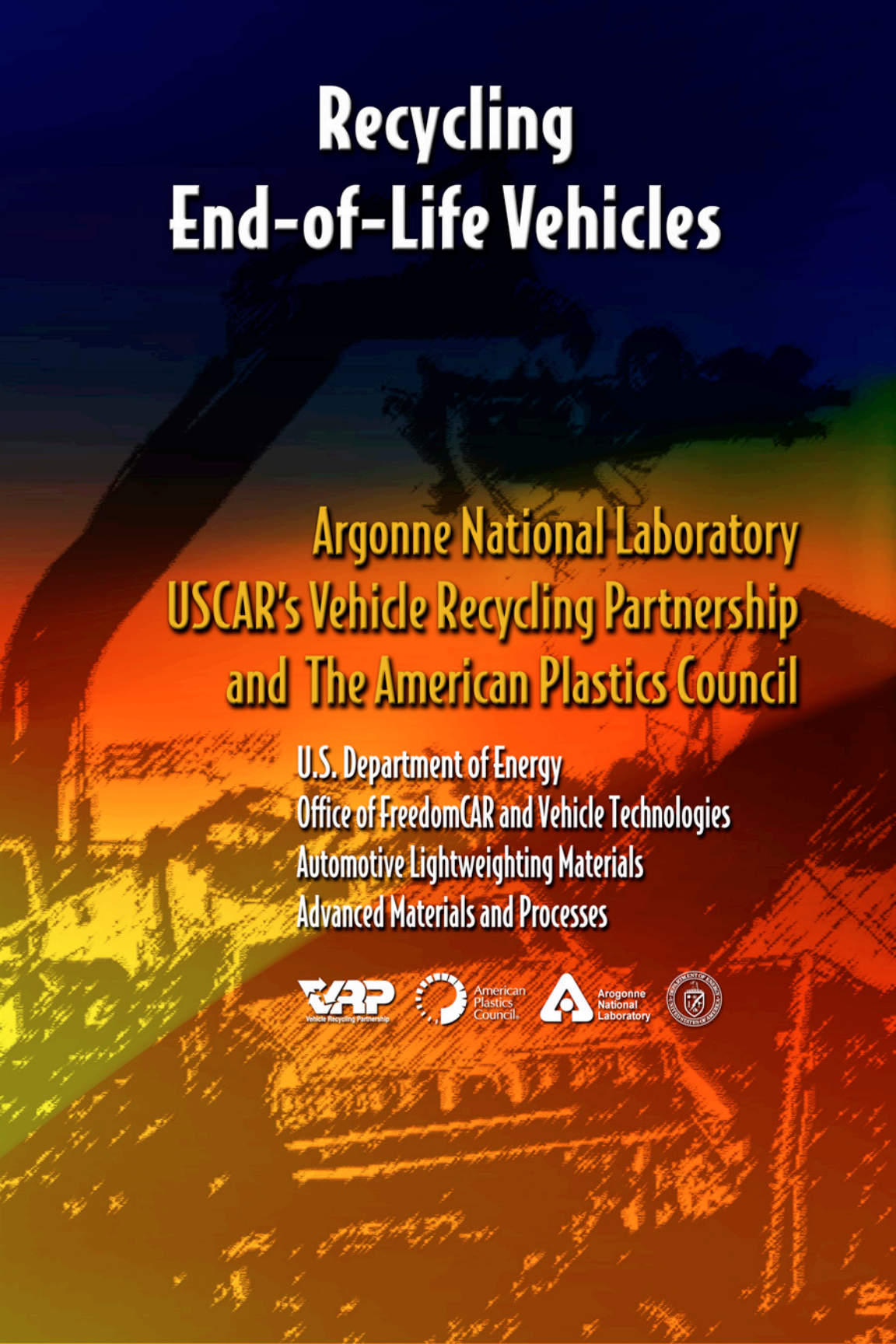
Recycling End-of-Life Vehicles



Argonne National Laboratory
USCAR's Vehicle Recycling Partnership
and The American Plastics Council

U.S. Department of Energy
Office of FreedomCAR and Vehicle Technologies
Automotive Lightweighting Materials
Advanced Materials and Processes

VRP Vehicle Recycling Partnership
American Plastics Council
Argonne National Laboratory

Research Objectives

LONG-TERM GOALS

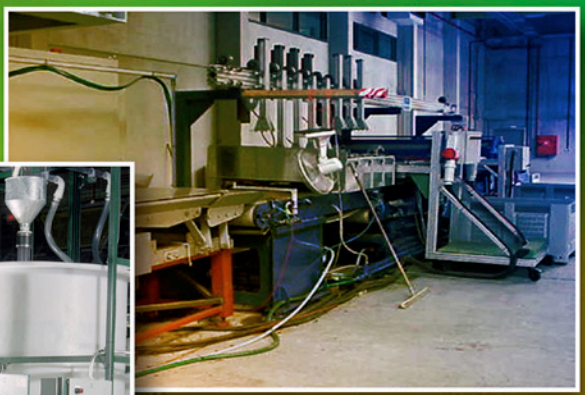
- Enable optimum recycling of all automotive materials
- Ensure that materials are not de-selected
- Obviate regulatory recycle mandates

INTERMEDIATE GOALS

- Establish the business case for automotive materials recycling
- Develop and demonstrate recycle process for advanced materials and systems
- Demonstrate feasibility of materials recovery from shredder residues
- Transfer technology to commercial practice
- Benchmark recycle technology and disseminate information to stakeholders

Path Forward: Fiscal Year 2003 Action Items

- Review with EU, Japan, and others to identify a "common platform" – establish basis for collaboration
- Demonstrate materials recovery technology
- Salyp thermoplastics sorting technology
- Argonne froth-flotation technology



Salyp TPS "Dorado"

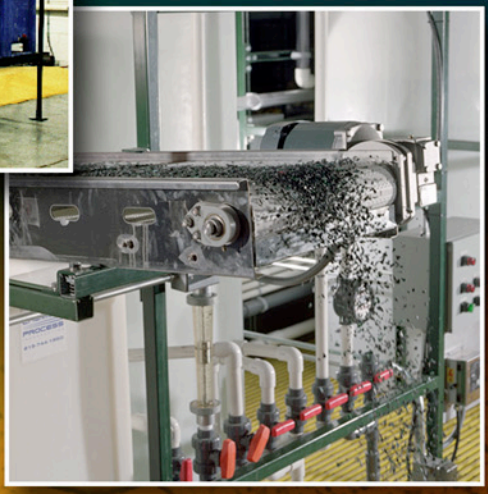
Argonne Froth Technology

- Initiate Baseline Assessment of existing and emerging ELV technologies – establish WEB-based information system
- Evaluate technology for removal/control of substances such as PCBs

Argonne Plastics Recycle Technology (Froth Flotation)

Status: Pilot Demonstration

1000 lb/hr Froth Separation Unit



Injection mold tests confirm recycle feasibility of 100% post-consumer ABS

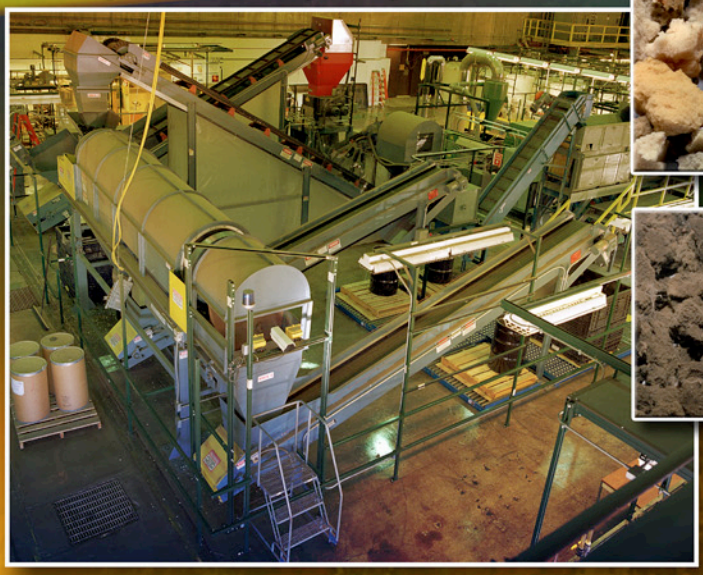
THE TECHNOLOGY CAN RECOVER HIGH-PURITY PLASTICS FROM:

- Consumer electronics
- Process scrap
- Shredder residues
- Obsolete appliances

Argonne Foam Recycling Technology

Status: Commercial Demonstration

Bulk Separation Facility at Argonne



Clean Foam

Dirty Foam

Full-scale 250 kg/h Aquarius at Salyp ELV Center – 2002

Salyp ELV Center

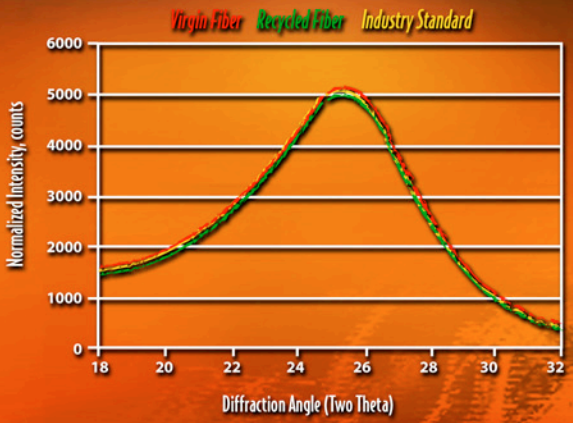
Innovative Material, New Recycling Technology

Polymer Matrix Composites

Carbon-fiber-reinforced polymer matrix composite (PMC) materials offer high strength and low weight, which can help improve fuel economy in automobiles. Argonne National Laboratory has developed a cost-effective process for recovering polymer matrix composites that results in a reusable end product that is virtually indistinguishable from its virgin counterpart.

The recycled material has been tested by Hexcel Carbon Fibers, Inc., and Oak Ridge National Laboratory. *"The surprising results were the high shear strength of the recycled materials. Suggested applications of recycled carbon fiber are SMC (sheet molding compound), Batteries, and Concrete Reinforcement."*

Dr. Mohamed Abdallah, Hexcel Carbon Fibers, Inc.



The 002 reflection from the IM7 control samples and the recycled samples.

"The 002 reflection and their azimuthal scans showing the orientation of the graphene planes for the virgin samples and for the recovered fibers were nearly identical. These data prove that the thermal process does not degrade the morphology in the interior constituent material."

Dr. Felix Paulauskas, Oak Ridge National Laboratory

Process of Recovering Polymer Matrix Composites