Overview of Recycling Industry and Key Recycling Issues Affecting Materials Sustainability

David L. Wagger, Ph.D., Director of Environmental Management, ISRI

Institute for Recovery, Recycling, Reuse, and Remanufacturing (R4-I) Planning Meeting
Denver, Colorado

September 25, 2013

ISRI
Voice of the Recycling Industry
Institute of Scrap Recycling Industries, Inc.

Overview

Institute of Scrap Recycling Industries, Inc.
Voice of the Recycling Industry

- ISRI
- Recycling Industry
- Recycling Characteristics and Challenges
- Summary

Institute of Scrap Recycling Industries, Inc.

Institute of Scrap Recycling Industries, Inc.
Voice of the Recycling Industry

- *Voice of the Recycling Industry*
- Developer of Internationally Recognized Specifications

Ferrous & non-ferrous metals

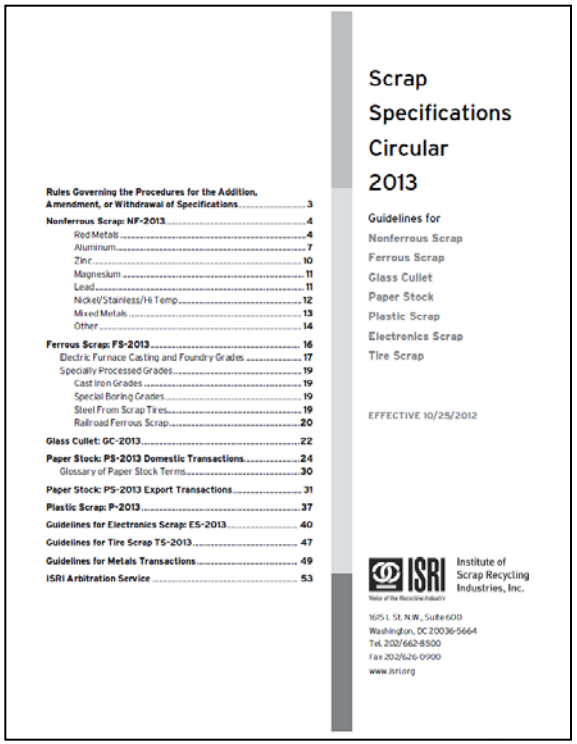
Plastics

Glass

Electronics

Paper

Rubber



Scrap Specifications Circular 2013

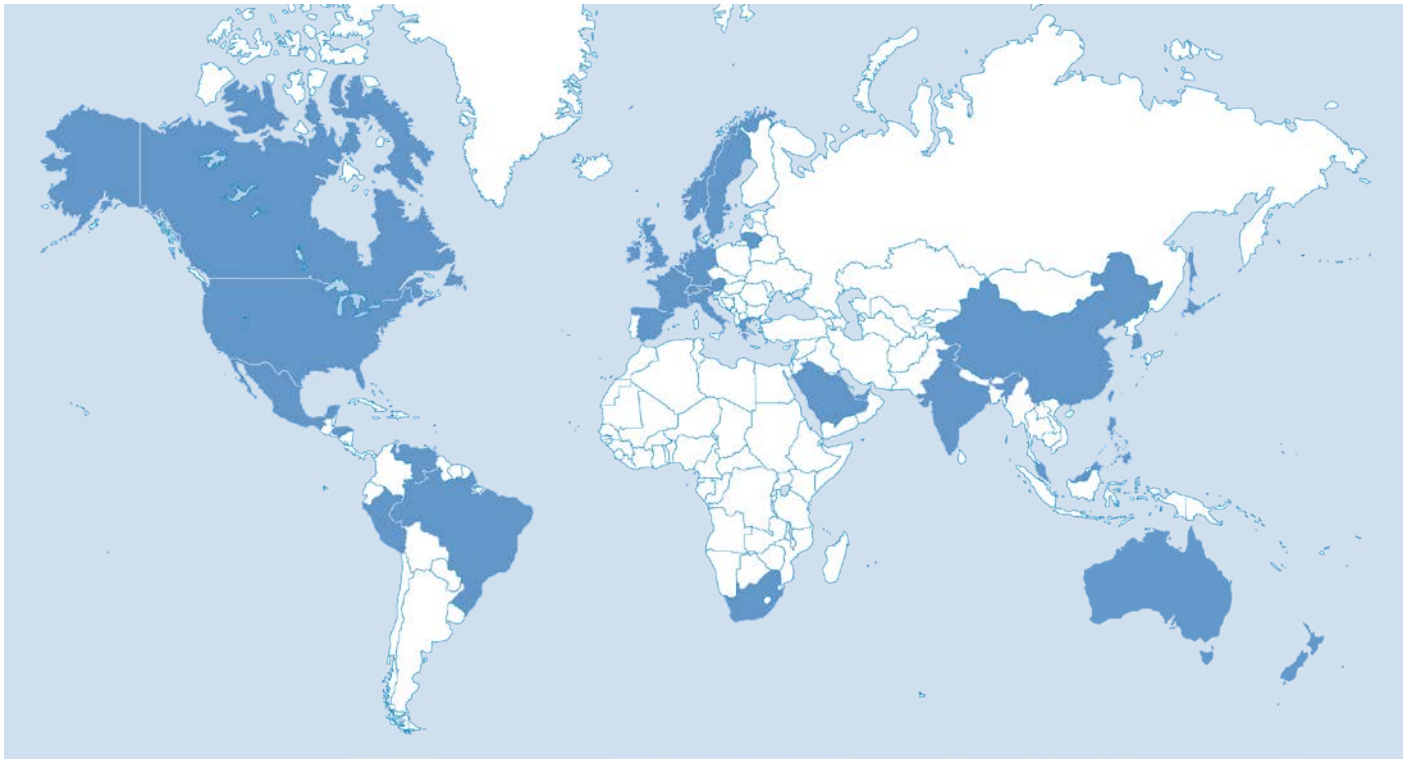
Guidelines for
Nonferrous Scrap
Ferrous Scrap
Glass Cullet
Paper Stock
Plastic Scrap
Electronics Scrap
Tire Scrap

EFFECTIVE 10/25/2012

ISRI Institute of Scrap Recycling Industries, Inc.
Voice of the Recycling Industry
1615 L St. N.W., Suite 600
Washington, DC 20036-5664
Tel. 202/662-8500
Fax 202/626-0900
www.isri.org

Institute of Scrap Recycling Industries, Inc.

Institute of Scrap Recycling Industries, Inc.
Voice of the Recycling Industry



1,600+
Member companies

6,000+
Recycling facilities worldwide

30
Countries

Sustainable Recycling

Institute of Scrap Recycling Industries, Inc.
Voice of the Recycling Industry

- U.S. scrap industry committed to not just delivering plentiful volumes of scrap, but delivering high quality scrap for both our domestic & international customers in an environmentally responsible manner

- Technological advances have resulted in significant gains in scrap quality over the last several years.

- Design plays an important role.
  - Design for Recycling® -- Developed by ISRI in early 1980s
  - Designed to encourage manufacturers to consider end-of-life issues of their products at the design stage
  - Welcome discussions with manufacturers on DfR

Sustainable Recycling

Institute of Scrap Recycling Industries, Inc.
Voice of the Recycling Industry

Voluntary 3rd Party certification plays a critical role towards ensuring sustainable recycling

Recycling Industry Operating Standard™ (RIOS™)

- Developed by ISRI
- Voluntary, comprehensive quality, environmental, and health & safety management system that integrates the key elements of ISO 14001, ISO 9001, and OHSAS 18001
- Accredited certification program supported by the ANSI-ASQ National Accreditation Board (ANAB)

RIOS™ CERTIFIED RECYCLER

R2/RIOS™

- Combines the Responsible Recycling Practices ("R2"), developed by stakeholders and U.S. EPA, with RIOS™

RIOS™ R2 CERTIFIED ELECTRONICS RECYCLER

Recyclers Are Manufacturers.

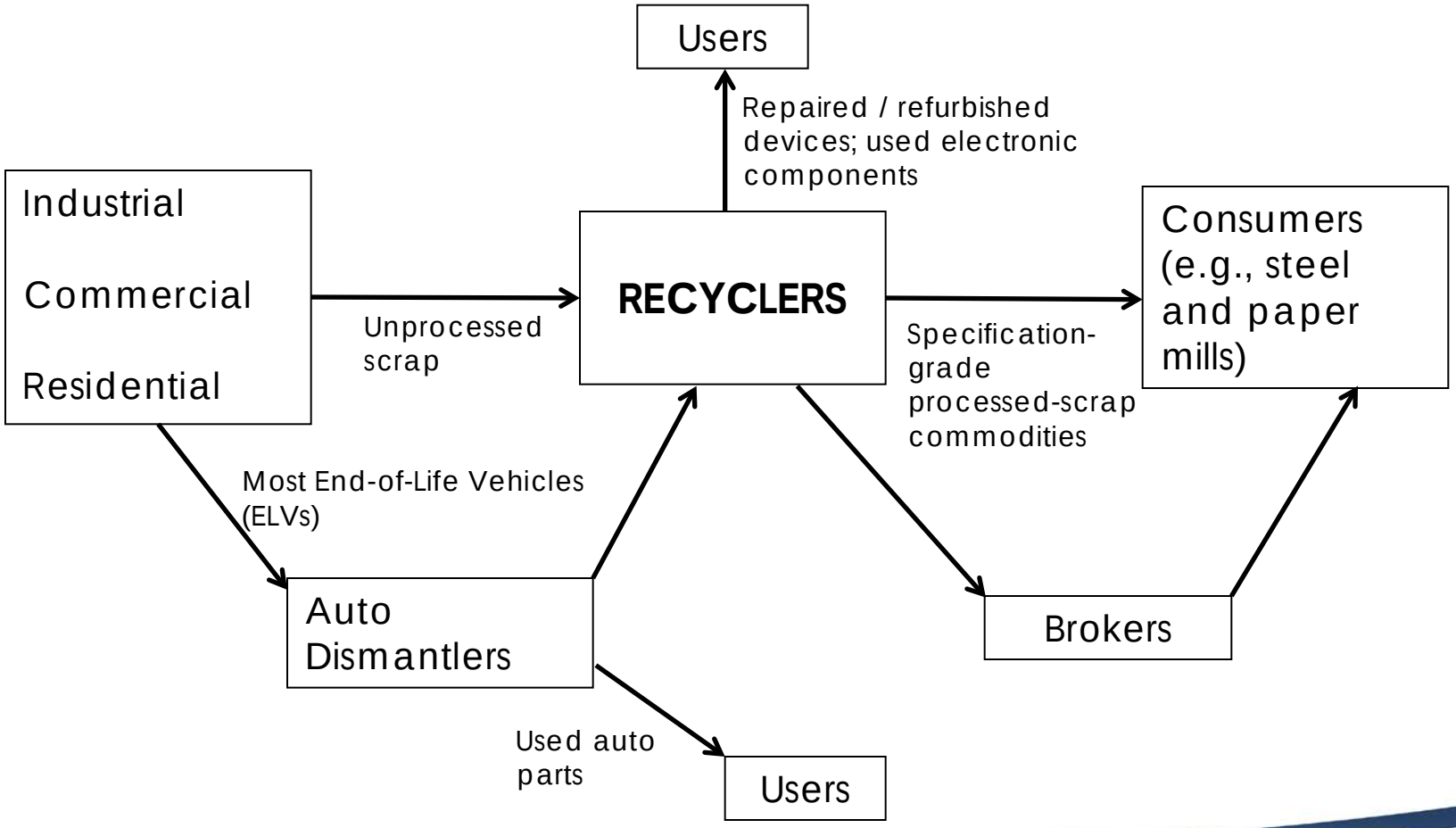
ISRI Institute of Scrap Recycling Industries, Inc.
Voice of the Recycling Industry

- Inputs (Secondary Material)
  - Industrial, commercial, residential scrap
  - Obsolete / end-of-life scrap
  - Obsolete / end-of-life consumer products
- Processing — Almost exclusively mechanical
  - Shearing, baling, chopping, shredding, sorting, etc.
- Outputs (Products)
  - Specification-grade processed-scrap commodities
- Regulated as any other manufacturers, except potentially for Inputs and Outputs

Recyclers are Key to Material Sustainability.

Institute of Scrap Recycling Industries, Inc.
Voice of the Recycling Industry

Simplified Material Flow Chart



Processing Equipment – Shredder

Institute of Scrap Recycling Industries, Inc.
Voice of the Recycling Industry

Processing Equipment – Baler

Processing Equipment – Mobile Shear

Institute of Scrap Recycling Industries, Inc.
Voice of the Recycling Industry

E-Recycling Equipment – Refurbishment and Repair

ISRI Institute of Scrap Recycling Industries, Inc.
Voice of the Recycling Industry

E-Recycling Equipment – Shredding Technology

Institute of Scrap Recycling Industries, Inc.
Voice of the Recycling Industry

E-Recycling Equipment – Vibrating Feeder & Screen

Institute of Scrap Recycling Industries, Inc.
Voice of the Recycling Industry

E-Recycling Equipment – Sorting and IR Technology

Institute of Scrap Recycling Industries, Inc.
Voice of the Recycling Industry

U.S. Recycling Industry

Institute of Scrap Recycling Industries, Inc.
Voice of the Recycling Industry

2012 Statistics			
Total Processed (million metric tons)			135
Value of Materials Processed (Billion US$)			90
Commodities (million metric tons)			
Iron and Steel	75.2	Paper	46.4
Aluminum	5.4	Plastics (bottles only, 2011)	0.73
Copper	2.0	Electronics (2011)	4.4
Lead	1.2	Tires (est., 2011)	1.0
Zinc	0.24		

Worldwide Demand for Scrap Commodities

Institute of Scrap Recycling Industries, Inc.
Voice of the Recycling Industry

- Scrap is the 1st link in the global manufacturing supply chain, meeting more than 40% of industrial consumers' raw material needs annually worldwide.

- Scrap moves to where demand directs it, regardless of its original location.
  - LME started trading Cu in 1876, building on an already existing global market
  - Today: US exports scrap commodities to 160 countries (65% OECD/35% Non-OECD in 2011)

Worldwide Demand for Scrap Commodities

ISRI Institute of Scrap Recycling Industries, Inc.
Voice of the Recycling Industry

2012 Export Statistics			
Total Exported (million metric tons)			47.3
Value of Materials Exported (Billion US$)			27.8
Number of countries exported to			160
Exported Commodities (million metric tons)			
Iron and Steel	20.0	Copper	1.2
Aluminum	2.0	Paper	20.2
Nickel, SS, Alloy	1.5	Plastics	2.0

Conditions Favorable to Recycling

ISRI Institute of Scrap Recycling Industries, Inc.
Voice of the Recycling Industry

- Higher value of secondary materials
- Economically efficient material separation
  - Consumer products designed for recycling or reuse
- Regulation of (unprocessed) materials and (processed) commodities as valuable raw material and products
  - "Scrap is not waste."
- Regulation of recyclers as manufacturers
  - "Recycling is Not Disposal."
- Economically accessible and viable markets for processed commodities

<u>These factors help to move materials without specific collection.</u>

Recycling Impediments: External Issues

Institute of Scrap Recycling Industries, Inc.
Voice of the Recycling Industry

- Regulation of secondary materials as "waste"
  - Reduces availability, value, mobility, and marketability
- "Patchwork" regulation across states
  - Impedes flow of materials to recyclers and commodities to markets
- Lack of information about materials delivered for recycling
  - Difficult to evaluate
  - No knowledge of any potential hazards
  - Potentially no process designed to recycle them
  - Potentially no recycling markets available
- Lack of available or accessible markets

Recycling Impediments: Material Issues

Institute of Scrap Recycling Industries, Inc.
Voice of the Recycling Industry

- Constituents of concern (e.g., Cd, Pb, Hg)
  - Special handling/management
  - Potential environmental and health & safety (EH&S) impacts
  - Special regulatory requirements
- "Inseparable" materials, especially if "incompatible" (e.g., plastics/metal laminate and joined metals)
  - Difficult to process/separate and perhaps to identify
  - Reduced quality, value, marketability
- "Unidentifiable" materials (e.g., new/exotic alloys and composites)
  - Difficult to categorize/process/sort properly
  - Reduced quality, value, marketability
- Greater numbers of materials at lower concentrations
  - Less efficient separation

<u>These reduce efficiency and increase costs.</u>

Design for Recycling®

Institute of Scrap Recycling Industries, Inc.
Voice of the Recycling Industry

DfR policy to increase recyclability of consumer durables:

1. Making consumer products recyclable
2. Reducing environmental risks from consumer products
3. Controlling special environmental problems
4. Assistance to manufacturers of consumer durables

Vehicle Recycling Process

Institute of Scrap Recycling Industries, Inc.
Voice of the Recycling Industry

- Feedstock: ELVs, small appliances, metal scrap
  - Preparation needed to minimize potential problems (e.g., batteries).
  - Average ELV > 10 years old
  - Most ELVs arrive from auto dismantlers already prepared
- Shredders / Hammermills for size reduction to fist-sized pieces
- Magnets to separate ferrous metal as commodity
- Eddy current machines (or heavy media) to separate nonferrous metals as commodities
- Remaining non-metallic material currently to landfill, but potentially recyclable
  - Recycling of certain plastics on the horizon

Challenges for Vehicle Recycling

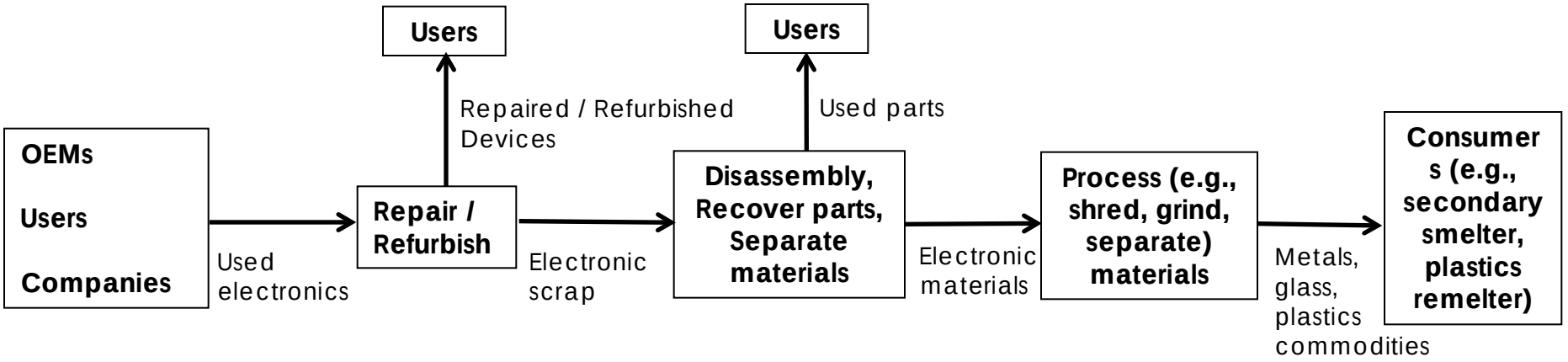
Institute of Scrap Recycling Industries, Inc.
Voice of the Recycling Industry

- New and emerging vehicle types (to be recycled in the coming years)
  - Hybrid vehicles (e.g., hybrid batteries)
  - Electric vehicles (e.g., electric motors and batteries)
- Composition / Design of new vehicles
  - Continuation of current design issues (e.g., undeployed airbags)
  - New alloys
  - New composites
  - New components
  - New constituents of concern
- Adapting / evolving recycling technologies and infrastructure
  - Currently designed for older vehicles

Generalized Electronics Recycling Process

Institute of Scrap Recycling Industries, Inc.
Voice of the Recycling Industry

Simplified Material Flow



Challenges for Electronics Recycling

ISRI Institute of Scrap Recycling Industries, Inc.
Voice of the Recycling Industry

- Design of new electronics devices
  - Designed for repair?
  - Designed for disassembly?
- Composition of new devices
  - More elements/materials in low concentrations?
  - New composites
  - New constituents of concern
- Markets for used devices and components
  - Short product lifecycles
  - Short market lifecycles
  - Availability and accessibility

In Summary

Institute of Scrap Recycling Industries, Inc.
Voice of the Recycling Industry

ISRI recognizes the need to help its members with upcoming recycling challenges and looks forward to working with other stakeholders in achieving sustainable recycling and sustainable materials.

Thank You

Institute of Scrap Recycling Industries, Inc.
Voice of the Recycling Industry

David L. Wagger, Ph.D.
Director of Environmental Management
Institute of Scrap Recycling Industries, Inc.
DavidWagger@ISRI.org 202-662-8533