

# Starting & Sustaining The Foundry Byproduct Beneficial Reuse Program in Texas

Diana L Lundelius, CHMM  
Hensley Industries Inc



---

*North Texas Air & Waste Management Association  
June 11, 2008 - Dallas, TX*

# Foundry Byproducts

Screened Foundry Sand

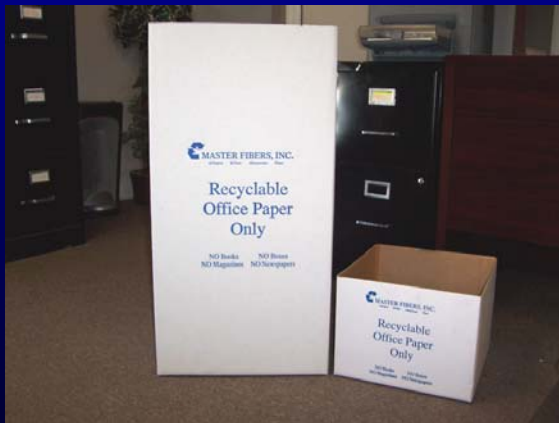


Carbide graphite electrodes

Furnace Slag



# Reclaimed Metal/Paper/ Cardboard/Wood Waste



*North Texas Air & Waste Management Association  
June 11, 2008 - Dallas, TX*

# Target Materials

- Spent foundry sand
- Spent furnace slag
- Carbide graphite electrodes
- Ladle and furnace refractory
- Office paper/cardboard/supersacks
- Secondary – wood waste, plastic, e-waste, printer/toner cartridges

# Advantages To Beneficial Reuse

- Disposal costs avoided
- Economic incentives to reduce overhead costs
- Cost effective material separation technologies available
- Secondary reclamation reduces raw material costs
- Reuse/recycle materials on site
- Improved operations efficiency
- Turn foundry sand into pay dirt – get \$\$\$

# Challenges, Obstacles, Pitfalls

- **Employee and management attitudes**
- Limited physical space available
- Limited capital funding
- Material separation/segregation/storage
- **Breaking into end user markets**
- **Meeting end user requirements**
- **Transportation**
- **Waste regulations**

# Assemble Data & Set Milestones

- Identify markets/uses for byproduct materials
- Identify partners within reasonable distance
- Quantify material generation rates
- Determine material segregation & storage needed
- Conduct environ & materials testing
- Evaluate materials within waste regulations
- Transportation cost analysis
- Scheduling & logistics
- Decide how you will negotiate contracts
- Set target dates for implementation & stick to them

# Successful Partnerships

## Who Do You Talk To & How?

- Identify markets/end uses for byproduct materials
- Identify partners *within reasonable distance*
- Potential partners
  - concrete/aggregate – screening, crushing, stockpiling
  - roadbase/flowable fill product blenders
  - asphalt blenders – fines additives
  - concrete/brick/asphalt recyclers - secondary suppliers
  - cement kilns – furnace slag
- Identify end user requirements
- Guarantee your supply within a reasonable margin

# Key Factors For Successful Logistic Planning

- **Establish transportation cost factors**
- **Be selective in equipment investments**
- **Manpower – in house, temps, part time**
- **Consider wide range of equipment and manpower options – rent, lease/purchase, outsource, on site contractor**
- **Look at upstream process generation points for improved material separation**
- **Implement in phases**

# Key Factors For Successful Implementation

- Keep changes simple
- Educate employees about new expectations
- Involve & engage all depts for ideas
- Engage vendors & suppliers in recycling efforts
- Housekeeping
- Establish tracking mechanisms & accountability
- Realistic expectations
- Keep looking for other applications & end users
- Keep improving material separation & handling

# Establish New Attitudes & Behaviors

- Gain consensus from **everyone**
- Look good on paper – show REAL savings
- Reinforce expectations about performance & accountability
- Show success with one program at a time
- Address learning curve issues immediately
- Be persistent
- **Ask for ideas & alternatives when faced with criticism**
- **Perfection is not required for success**
- **Report results and refine goals**

***Stop calling your spent reusable materials wastes.  
They are BYPRODUCTS.***

# **Elements of Beneficial Reuse Program Spent Foundry Sand Solids & Slag**

- Partnered w/ local concrete/aggregate company
- Turnkey on site screening/crushing, portable equipment
- Screen to < 1-1/2 inches (<1/2 inch for asphalt)
- Partnered with local rebase blender to make road base aggregate products
- Crush furnace slag, blend or use as crushed stone
- Strategically locate sand screening, stockpiling & transport
- Contract/temporary labor on as needed basis
- Improve upstream separation to remove metals, trash
- Protect stockpiles - consistent quality, prevent washout
- Aim for Class 3 status even if you can't meet criteria now

# Waste Characterization Testing to Meet TxDOT Prequalification (Texas)

- **Must meet Class 2 non-hazardous criteria at minimum**
- **Class 3 (inert) highly desirable but not critical**
- **Class 3 testing**
  - Total/TCLP metals, VOC, SVOC
  - Total petroleum hydrocarbon (TPH)
  - Total PCBs
  - Total pests/herbs – can eliminate based on process knowledge
  - 7-Day leachate for Table 3 constituents, metals, TDS
- **TDS limit of 500 mg/L is very difficult to meet**
- **Air set sand and core materials contribute organics**
- **Get the metal out!!**

# Materials Testing to Meet TxDOT Prequalification (Texas)

- **ASTM-D698A**
- **Solid Number/Max Dry Unit Weight pcf**
- **Optimum moisture content %**
- **Liquid limit**
- **Plastic limit**
- **Plasticity index**
- **% finer than No. 200 sieve**
- **Results expressed as moisture-density relationship nomograph**

# Acceptable/Unacceptable Applications For Spent Foundry Byproducts

## Acceptable

- Road base
- Industrial foundation underlayment
- Inert concrete/aggregate products
- Asphalt fines additive
- Cement fines additive
- No direct potential exposure to people or animals

## Not Acceptable

- Residential or commercial mulching
- Soil blending for landscape use
- Playgrounds
- Surface land application as clean fill
- Potential for direct exposure to people or animals

# Elements of Reclamation Program Carbide Graphite Electrodes

- Crush & reuse as carbon raiser
- Ask carbon suppliers about reclamation capabilities
- Crush & offer to concrete/aggregate users
- Identify reclaimers – where, how much, cost, transport
- Determine logistic requirements for collection, stockpiling, transport
- Conduct cost vs benefit evaluation for each option
- Select best recycling/reclamation option & implement

# Elements of Reclamation Program

## Furnace & Ladle Refractory

- Refractory manufacturers crush and reclaim for manufacturing new product
- Sand must be separated cleanly from refractory
- Absolutely no metal
- Refractories may be combined
- Truckload quantities required
- Logistic planning needed for collection, stockpiling, loading, transport
- Cost break for closed loop reclamation with refractory supplier is ideal partnership

# Elements of Recycling Program

## Office Paper/Cardboard

- Quantify generation amounts
- Identify recycler willing to work with small generators
- Trailer pull frequency & weight requirements
- Select recycling containers and trailer size
- Identify what can/can't be recycled
- Target locations for recycling containers – paper & cardboard must be kept dry
- Educate employees – NO TRASH
- Resourceful use of internal and contract manpower
- How about that confidential shredded paper?

# **Elements of Recycling Program**

## **Wood Waste**

- **Quantify generation amounts and sources**
- **Identify wood waste mulching facilities - locations, tipping fees, container requirements**
- **Storage and transport – rolloff, trailer, closed box**
- **Engage trash service & wood pallet vendors**
- **Coordinate with wood pallet repair**
- **Determine need to break down pallets, crates, boxes**
- **Keep unacceptable materials out of wood waste**
- **Staging & housekeeping to manage stockpile**
- **Wood waste generating depts implement & monitor**
- **Use janitorial service or contract labor**

# Tracking Costs & Savings

- Track internal/external labor & equipment costs
- Include cost avoided for disposal and raw materials
- Track reduced plant trash hauls, compactor pulls
- Break out % of plant trash contents before recycling
- Track actual recycling costs
- Track recovered materials – BONUS!!!  
Keep for raw materials value, track raw material shipments cancelled or postponed as cost avoided
- Keep tracking formulas realistic but simple – use a spreadsheet

# **Additional Recycling/Reclamation & Source Reduction Opportunities**

- **Construction debris reclamation**
- **Electronics and small battery recycling**
- **Printer/toner cartridge reclamation**
- **Reclaim spent core scrubber wastewater**
- **Replace drums w/ totes or portable tanks**
- **Recycle supersacks**
- **Pelletize EAF dust and sand baghouse dust**
- **Separate air set & green sand**
- **Separate aluminum & copper**

# Acknowledgements

- Texas Cast Metal Association (TCMA)  
<http://www.tcmainc.com/>
- Foundry Industry Recycling Starts Today (FIRST)  
<http://www.foundryrecycling.org/Home/tabid/36/Default.aspx>
- TxDOT Recycling Programs -[http://www.txdot.gov/services/general\\_services/recycling/default.htm](http://www.txdot.gov/services/general_services/recycling/default.htm)
- EPA – Beneficial Reuse of Foundry Sand  
Jeffrey Kohn ([kohn.jeffrey@epa.gov](mailto:kohn.jeffrey@epa.gov)), National Metal Casting Sector Point-of-Contact, (202) 566-1407  
<http://www.epa.gov/sectors/metalcasting/foundry.html>
- TCEQ - Foundries Compliance Resources  
<http://www.tceq.state.tx.us/assistance/sblga/foundry.html#tools>  
David Hudson, 325-698-6122