



Identification and Review of Standards for Beneficial Use of Industrial By-Products

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Background

- NCASI / USEPA Region 5 joint effort
- Midwest Industrial By-Products Beneficial Use Summit – Chicago, IL
- NCASI recommended project
- Identify and summarize material specifications, performance standards, and technical guidance for the beneficial use of industrial by-products

Project Scope

- Conduct literature search to identify both existing and proposed “standards”
- Industries included:
 - Cement
 - Foundry
 - Pulp and Paper
 - Utility
- Prepare a report summarizing each standard
 - By-Product
 - Beneficial Use
 - Sponsoring Organization
 - Availability



Cement Industry

- By-Products
 - Cement Kiln Dust
- Beneficial Uses
 - Waste solidification/soil stabilization
 - Replacement for Portland cement
 - Hydraulic barrier in landfill construction
 - Agricultural soil amendment
 - Flowable fill
 - Mineral filler in asphalt
 - Sorbant to remove SO₂ from cement kiln flue gas
 - Mine reclamation



Cement Industry

■ Identified Standards

- FHWA guideline for use of CKD as an activator in pozzolanic-stabilized base mixtures
- FAA specification for use of CKD as a sub grade stabilizer
- PCA guideline for use of CKD to stabilize clay soil
- PCA specification for use of CKD to solidify or stabilize waste
- PCA guideline for compaction and resulting permeability of CKD
- FHWA guideline for use of CKD as mineral filler in hot mix asphalt
- ASTM standard for use of CKD in stabilization, fixation, solidification, pH control, flocculation, and agricultural applications



Foundry Industry

■ By-Products

- Sand
- Slag
- Baghouse Dust
- Furnace and Ladle Refractory

■ Beneficial Uses

- Structural fill
- Road base / sub base
- Fine / coarse aggregate in asphalt paving
- Aggregate for flowable fill



Foundry Industry

- **Beneficial Uses (continued)**
 - Fine aggregate for concrete
 - Raw material for cement manufacturing
 - Soil blending/manufactured topsoil/potting soil/compost
 - Fine aggregate in concrete block
 - Alternate landfill daily cover
 - Hydraulic barrier in landfill final cover
 - Rock wool
 - Coarse aggregate for highway sub base
 - Filler for plastic extrusion



Foundry Industry

- **Standards**
 - Ohio DOT specification for use of sand in structural backfill and pipe bedding
 - FHWA guideline for use of sand in asphalt concrete
 - FHWA guideline for use of sand in flowable fill
 - ACI technical document for use of sand in flowable fill
 - Indiana DOT specification for use of sand as fine aggregate in Portland cement concrete
 - ASTM guideline for assessment of alternate daily cover using foundry sand
 - Texas DOT specification for use of slag in cold processed recycled paving material



Pulp & Paper Industry

■ By-Products

- Wastewater treatment plant residuals
- Coal-fired boiler ash
- Wood-fired boiler ash
- Mixed fuel source boiler ash
- Causticizing materials

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Pulp & Paper Industry

■ Beneficial Uses

- Soil amendment
- Compost
- Alternate landfill daily cover
- Hydraulic barriers
- Absorbent / Animal bedding
- Lightweight glass aggregate
- Admixture in Portland cement concrete
- Raw material in cement manufacturing
- Building board
- Soil stabilization
- Fine aggregate in asphalt paving

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Pulp & Paper Industry

■ Standards

- NCASI guideline for use of P&P wastewater treatment residuals (wwtr) and causticizing materials as soil amendments
- AASHTO specification for use of wwtr in surface mulch for erosion/sedimentation control
- ASTM standard for evaluation of wwtr as alternative landfill daily cover
- NCASI & EPA guidelines for use of wwtr in hydraulic barrier layers
- ASTM standard for use of wwtr in absorbents

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Pulp & Paper Industry

■ Standards (continued)

- ASTM specification for use of wwtr as lightweight aggregate in concrete masonry units
- ASTM standard for use of wwtr as lightweight aggregates for structural concrete
- Canadian standards for use of wood ash as a liming material for agricultural soils
- NCASI guideline for use of wwtr and boiler ash as forest soil amendments
- Canadian standard for use of causticizing materials as agricultural soil amendments

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Utility Industry

■ By-Products

- Fly ash
- Bottom ash/boiler slag
- Flue gas desulfurization (FGD) material

■ Beneficial Uses

- Mineral admixture in Portland cement concrete
- Grout
- Mineral filler in asphalt paving
- Flowable fill
- Structural fill



Utility Industry

■ Beneficial Uses (continued)

- Waste solidification/soil stabilization
- Soil amendment
- Fine aggregate in asphalt paving
- Granular base
- Snow and ice control
- Wallboard
- Mine reclamation



Utility Industry

■ Standards

- ASTM standard for sampling and testing fly ash for use in Portland cement concrete
- ASTM standard and ACI guideline for use of fly ash as a pozzolanic material in concrete
- AASHTO standard and FHWA guideline for use of fly ash as a mineral admixture Portland cement concrete
- ACPA guideline for use of fly ash in fast track concrete pavements
- ASTM specification for use of fly ash with lime in mortar
- FHWA & ACPA guidelines for use of fly ash as a grout for sealing voids beneath pavement slabs



Utility Industry

■ Standards (continued)

- AASHTO specification & FHWA guideline for use of fly ash as a mineral filler in asphalt paving mixtures
- ASTM specification, ACI & FHWA guidelines for use of fly ash in flowable fill
- ASTM specification & FHWA guidelines for use of fly ash in structural fill
- ASTM guideline for use of fly ash in waste stabilization
- ASTM standard and FHWA guideline for use of fly ash in soil stabilization
- ACAA guideline for use of fly ash in flexible pavement



Utility Industry

- Standards (continued)
 - AASHTO specification for use of fly in compost and for erosion/sediment control on sloped areas
 - ASTM standard for use of fly ash in surface mine reclamation
 - ASTM standard for characterization and evaluation of fly ash
 - Etc., etc., etc.



What's Next?

- Working copy of the document will be available from NCASI (www.ncasi.org/summit.html)
- Work-in-progress
- More by-products, more industries, more standards
- Provide input to NCASI for potential future versions of this document

