Foundry Sand Reuse in Pennsylvania

Best Practices & Regulatory Compliance

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3. Key Concepts and Definitions

What is Foundry Sand?

Foundry sand is a high-quality silica sand used by metal casting facilities to make molds for shaping molten metal into parts. After repeated use, the sand becomes "spent" and needs to be replaced — creating a large volume of by-product material.

What is Beneficial Reuse?

Beneficial reuse means finding safe, productive ways to repurpose industrial by-products (like foundry sand) instead of throwing them away. It protects the environment, saves natural resources, and cuts disposal costs. In Pennsylvania, beneficial reuse helps businesses lower expenses and communities build infrastructure more sustainably.

Examples of beneficial reuse for foundry sand include:

- Replacing mined sand in concrete or road base

- Using sand as daily cover at landfills
- Mixing into manufactured soils for landscaping

What is a TCLP Test?

TCLP stands for Toxicity Characteristic Leaching Procedure — a laboratory test required by the U.S. EPA to find out if a waste material might release harmful contaminants into groundwater.

How a TCLP test works:

- A sample of the material is soaked in a mild acidic solution that simulates rainwater or landfill conditions.
- Scientists measure what chemicals "leach out" of the sample into the fluid.
- If dangerous levels of metals (like lead) or chemicals are found, the material is classified as hazardous waste and must be managed under strict regulations.
- If the material passes the TCLP test (meaning contaminants are below federal limits), it can be reused safely under environmental rules.

Why Should Readers Care About Foundry Sand Reuse?

- Environmental Protection: Reuse reduces waste sent to landfills and conserves natural sand resources.
- Cost Savings: Foundries, cities, and contractors save money by reusing sand instead of buying new materials or paying high disposal fees.
- Public Safety: Proper testing (like TCLP) ensures that reused sand does not threaten drinking water, soil, or the environment.
- Economic Growth: Reuse projects create jobs, strengthen recycling industries, and make local construction projects more affordable.

4. Regulatory Guidelines

Pennsylvania DEP Regulations

The Pennsylvania Department of Environmental Protection (DEP) manages the beneficial reuse of foundry sand under its Residual Waste Beneficial Use program, which operates through General Permits WMGR019 and WMGR098. These permits allow the reuse of foundry sand as a residual waste when it complies with specific environmental and safety standards.

Approved uses for foundry sand in Pennsylvania include:

- Roadway construction material, meeting Department of Transportation (PennDOT) specifications
- Ingredient or component in manufacturing concrete or asphalt products

- Other specified uses under general permits that ensure no risk to public health or the environment

Key Regulatory Points:

- Foundry sand must meet established chemical and leachate thresholds to qualify for beneficial use.
- Usage is primarily limited to ferrous foundry sand.
- The sand cannot exceed contaminant levels set by DEP’s guidelines.
- Beneficial use requires adherence to proper handling, storage, and end-use conditions.
- Non-ferrous foundry sands or other novel uses require site-specific approvals.

Landfill Fee Exemption: A court decision ruled that the $4 per ton Growing Greener fee does not apply to foundry sand utilized as alternative daily cover at landfills, providing an economic incentive for beneficial use.

Federal EPA Guidelines

The U.S. EPA encourages the reuse of spent foundry sands from iron, steel, and aluminum foundries. EPA's risk assessments have concluded that these sands can be safely reused in soil blends, construction materials, and road bases. The EPA defers regulatory authority to states.

Local Ordinances

In Pennsylvania, most municipalities and counties defer to the DEP's framework. If a project complies with DEP's permits, additional local permitting is generally minimal.

5. Reuse Applications and Pennsylvania Examples

Common Beneficial Reuses

Reuse Application	Description	Examples or Status
Road Base & Fill	Substitute for sand/aggregate in road subbase and structural fill.	PennDOT-accepted use covered under DEP General Permits WMGR019 and WMGR098.
Cement & Concrete Production	Raw feedstock in Portland cement kilns or as fine aggregate in concrete.	Sand from PA foundries is used in cement and concrete with DEP approval.
Landfill Uses	Daily cover, interim cover, or drainage layer material.	Widely practiced at PA landfills, with fee exemptions.
Soil Amendment	Blended into manufactured soils to improve drainage.	Supported under WMGR098 for ferrous/aluminum sands.

Reuse Application	Description	Examples or Status
Sandblasting Abrasive	Dry, granular sand for surface cleaning.	Certain PA foundries supply core sands for industrial use.
Other Innovative Uses	Cattle bedding, snow/ice control sand.	Permitted on a case-by-case basis with testing.

Pennsylvania Examples in Action

- Sand Reclamation Advances: Boose Aluminum Foundry in Stevens, PA, uses advanced reclamation to reduce waste and costs.
- Construction Fill: PennDOT and municipal projects use certified foundry sand as structural fill.
- Landfill Cover: Multiple landfills use foundry sand mixes for daily cover.
- Concrete and Cement Use: Regional cement plants incorporate foundry sand into their raw materials.

6. Environmental and Technical Considerations

Types of Foundry Sands

- Ferrous Foundry Sands (Iron and Steel): High-purity silica sand, considered the safest for reuse.
- Non-Ferrous Foundry Sands (Aluminum, Brass, Bronze): May have metal contamination, requiring stricter testing.
- Specialty Sands: Olivine or other media may require special assessment.

Contaminants of Concern

Contaminant	Source	Notes
Lead (Pb)	Brass/bronze alloys	Key concern; must not exceed TCLP leaching limit (5.0 mg/L).
Chromium (Cr)	Stainless steel alloys	Usually low and stable in ferrous foundries.
Phenols / Cresols	Phenolic resins	Organic compounds typically present in very low concentrations.
PAHs	Burnt sea coal/resin	Detected at very low levels, below risk thresholds.
Dust / Free Silica	Physical hazard	Requires dust suppression measures during handling.
pH / Salinity	Binders, additives	Some sands have slightly alkaline pH, generally not problematic.

Importance of TCLP Testing

The Toxicity Characteristic Leaching Procedure (TCLP) is the standard EPA test to determine if sand poses a leaching hazard. All foundry sand for beneficial use in PA must pass TCLP and other chemical tests to comply with DEP limits.

Environmental Behavior of Foundry Sand

For properly characterized ferrous foundry sands, heavy metals are generally immobilized, organics are below risk levels, and field studies show low leachability, making environmental risks minimal.

7. Funding, Grants, and Incentives

State Level Incentives

- Industrial Sites Reuse Program (ISRP): Grants and loans for redevelopment of former industrial sites.
- Pennsylvania Growing Greener Program: Grants for projects that reduce waste.
- Residual Waste Beneficial Use General Permits: Streamlined regulatory approval reduces costs.
- Landfill Fee Exemption for Alternative Daily Cover: Exemption from landfill tipping fees and the $4 per ton Growing Greener surcharge.
- Property and Equipment Tax Incentives: Local jurisdictions may offer tax incentives for recycling infrastructure.
- Technical and Regulatory Assistance: The PA DEP provides guidance to encourage reuse projects.

Federal-Level Opportunities

- EPA Sustainable Materials Management Grants: Funding for innovative reuse projects.
- Infrastructure Investment and Jobs Act: Grants for recycling and circular economy initiatives.
- FHWA / DOT Support: Promotion and research grants for using recycled materials in road construction.

Local Opportunities

- Local Government Partnerships: Mini-grants or cost-sharing for green construction.
- Public-Private Collaborations: Landfills may waive tipping fees, and contractors may offer discounted transport.

8. Active Participants in Pennsylvania

Foundries (Generators of Spent Sand)

- Boose Aluminum Foundry (Stevens, PA): Invests in in-house sand reclamation.
- Donsco, Inc. (Mount Joy & Wrightsville, PA): Has a formal environmental management program for reuse and recycling.
- McConway & Torley, LLC (Pittsburgh, PA): A major steel foundry participating in recycling initiatives.
- Foundry in Hollidaysburg, PA: A case study of a facility with a successful sand reclaim system.

End Users (Consumers of Foundry Sand)

- Construction Contractors: Use sand as structural fill and subbase material.
- PennDOT and Municipal Projects: Use certified sand in infrastructure.
- Cement and Concrete Producers: Incorporate sand as a raw material feedstock.
- Landfills: Use sand as alternative daily cover.
- Mine Reclamation Sites: Use sand for fill and soil-blending.

Supporting Programs and Agencies

- Pennsylvania Department of Environmental Protection (DEP)
- Penn State University
- PA Department of Community and Economic Development (DCED)
- American Foundry Society (AFS)

Key Collaboration Insights

The success of foundry sand reuse in Pennsylvania depends on the synergy between foundries, end-users, the DEP, universities, and industry associations.

9. Success Story Highlights

- Coal Mine Reclamation in PA: A former coal mine was reclaimed using spent foundry sand to create manufactured soil.
- Construction and Road Base Material: A PA aluminum foundry provided sand for local construction projects as a subbase fill.

- In-House Reclamation and Cost Savings: A Hollidaysburg foundry implemented a reclaim system, leading to major operational savings.

10. Clear Business Case Summary

Why Foundries Should Reuse Sand:

- Save $30–$50 per ton vs. landfill disposal costs.
- Avoid environmental liability.
- Improve sustainability reporting.

Why Contractors Should Reuse Sand:

- Get free or discounted sand for construction fill.
- Improve project bids by lowering material costs.

Why Landfills Should Accept Foundry Sand:

- Secure free cover material.
- Reduce operating costs.
- Increase daily cover efficiency.

11. Risk Management Overview

Best Practices

- Testing: All sand must pass a current TCLP test.
- Documentation: Keep all test results and shipping records for at least five years.
- Written Agreements: Establish contracts with receiving facilities.
- Site-Specific Approvals: Seek DEP determination for new or unusual uses.
- Insurance: Verify liability coverage.
- ARS Support: ARS can assist with setting up compliance systems.

12. Step-by-Step Workflow for Foundries

- Test: Conduct TCLP testing on sand samples.
- Document: Save all lab results.
- Partner: Contact ARS to match your material to a project.
- Agreement: Sign a beneficial reuse agreement.
- Ship: Begin shipping sand with clear labeling.
- Monitor: Re-test sand if your process changes.

13. Real Cost Savings Example

Cost Type	Expense (Example)
Landfill Disposal	~$74.25 - $154.25 / ton
Beneficial Reuse	~$10 - $75 / ton (transport only)

Annual Savings (1,000 tons/year): ~$34,250

15. General FAQ & Landfill-Specific FAQ

Q: Is reused foundry sand safe for public use projects?

A: Yes, provided the sand passes environmental testing (like TCLP), it is safe for approved applications.

Q: How often does foundry sand need to be tested?

A: Initially, and then yearly or if raw materials or binder systems change.

Q: Can reused sand be used near homes or gardens?

A: Applications like road base are safe. Use in soils near sensitive areas may need case-by-case approvals.

Q: What happens if a sand load fails testing after reuse starts?

A: Remediation or removal would be required, which is why proper initial testing is critical.

Q: Who is responsible for proving the sand is safe?

A: The foundry (generator) is responsible for testing and certification.

Landfill-Specific FAQ

Q: Does foundry sand affect landfill leachate in Pennsylvania?

A: No. DEP-required testing ensures the material will not leach harmful contaminants.

Q: Is foundry sand approved for daily cover compliance in Pennsylvania?

A: Yes, the PA DEP approves qualified foundry sand as an alternative daily cover material.

Q: Is special equipment needed to handle foundry sand?

A: No, standard landfill equipment is sufficient.

Q: How do we document use for the surcharge exemption in Pennsylvania?

A: Maintain load logs, generator certifications, and internal records of its use as daily cover.

Q: What if the sand chemistry changes?

A: The DEP requires foundries to re-test sand periodically, especially if the production process changes.

16. References

- Pennsylvania DEP - Residual Waste Beneficial Use General Permits: https://www.pa.gov/agencies/dep/programs-and-services/business/residual-waste-permitting/list-of-residual-waste-beneficial-use-general-permits.html

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- PA General Permit WMGR098 (PDF): https://files.dep.state.pa.us/Waste/Bureau%20of%20Waste%20Management/WasteMgtPortalFiles/SolidWaste/Residual_Waste/GP/WMGR098%20SD.pdf
- U.S. EPA - Beneficial Uses of Spent Foundry Sands: https://www.epa.gov/smm/beneficial-uses-spent-foundry-sands
- American Foundry Society (AFS) - Case Studies: https://www.afsinc.org/case-studies