



Foundry Sand Reuse in Oklahoma

Best Practices & Regulatory Compliance

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Table of Contents

1. Oklahoma - Foundry Sand Recycling and Reuse (Cover)
2. Table of Contents
3. Key Concepts and Definitions
4. Regulatory Guidelines
5. Reuse Applications and Oklahoma Examples
6. Environmental and Technical Considerations
7. Funding, Grants, and Incentives
8. Active Participants in Oklahoma
9. Success Story Highlights
10. Clear Business Case Summary
11. Risk Management Overview
12. Step-by-Step Workflow for Foundries
13. Real Cost Savings Example
15. General FAQ & Landfill-Specific FAQ
16. References

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 Oklahoma, 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, which are expensive and limited.
- 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 and public works projects more affordable.

4. Regulatory Guidelines

Oklahoma Department of Environmental Quality (DEQ) Regulations

The Oklahoma DEQ permits the beneficial reuse of certain industrial solid wastes, including spent foundry sand, through its Beneficial Reuse Request (BRR) process. Approval is granted on a case-by-case basis, provided the material:

- Is not mixed with incompatible or hazardous waste, and
- Does not pose a threat to human health or the environment.

Spent foundry sand, especially from iron and steel foundries, may be approved for reuse in applications such as:

- Construction materials – e.g., as a fine aggregate in concrete or asphalt
- Landfill engineering – e.g., daily cover, interim cover, drainage layers
- Structural fill and road subbase – e.g., for access roads, berms, or industrial site prep
- Emergency uses – e.g., as fill for erosion control or temporary flood barriers

Federal EPA Guidelines

At the national level, the U.S. EPA encourages the reuse of spent foundry sands from iron, steel, and aluminum foundries. EPA's major documents include:

- Risk Assessment for Spent Foundry Sands in Soil-Related Applications (2014)
- Sustainable Materials Management Program resources.

EPA concluded that silica-based sands from iron, steel, and aluminum foundries can be safely reused in soil blends, construction materials, and road bases.

EPA does not federally regulate beneficial reuse of non-hazardous foundry sands but defers regulatory authority to states like Oklahoma's DEQ.

Local Ordinances

Most cities and counties in Oklahoma defer to the Oklahoma Department of Environmental Quality (DEQ) framework regarding foundry sand reuse. However, local jurisdictions may impose additional requirements based on zoning, land use, or proximity to sensitive areas such as floodplains, wetlands, or residential developments.

For large-volume projects - especially those involving land application or fill near populated or environmentally sensitive zones - local authorities may require:

- Notification of intent
- Site development or grading permits
- Coordination with municipal public works or planning departments

That said, when a project complies with DEQ guidelines and has state-level authorization, additional local permitting or resistance is generally limited. Early engagement with county or city officials is recommended to avoid surprises and ensure alignment with local land use policies.

5. Reuse Applications and Oklahoma Examples

Beneficial reuse of foundry sand in Oklahoma varies based on the material’s properties, end-use goals, and oversight by the Oklahoma Department of Environmental Quality (DEQ). Field applications have been demonstrated or considered in construction, industrial operations, and municipal waste management. The following table outlines common reuse categories with examples or regulatory context for Oklahoma:

Common Beneficial Reuses

Reuse Application	Description	Oklahoma Examples or Status
Road Base & Fill	Substitute for sand or aggregate in subbase, embankments, or structural fill. Adds bulk and improves drainage.	Recognized under DEQ guidelines with appropriate waste characterization. Used in industrial park grading and rural roadway projects in the Tulsa and Muskogee areas.
Cement & Concrete Production	Feedstock in cement kilns or as a fine aggregate in precast concrete or masonry blends.	Evaluated by cement producers like LafargeHolcim and Ash Grove (OK & surrounding region). DEQ may request TCLP results and particle gradation data.
Landfill Uses	Employed as daily/interim cover or drainage layer in liner systems. Reduces reliance on native soils.	Used in county and regional landfills (e.g., near Oklahoma City and Lawton). DEQ requires documentation of suitability and approval under solid waste permits.
Soil Amendment	Mixed into topsoil for drainage and structure enhancement. Requires low contaminants and silica-rich content.	Limited use pending further review. DEQ considers site-specific pilot applications, particularly on brownfield rehabilitation or DOT roadside stabilization sites.
Sandblasting Abrasive	Used in abrasive blasting as a substitute for virgin sand, if non-toxic and dry.	Allowed under industrial hygiene standards if free of heavy metals and moisture. Foundries in eastern Oklahoma have trialed spent core sand for equipment cleaning.

Oklahoma Examples in Action

- **Cement Kiln Reuse:** Cement facilities in and around Oklahoma—including Ash Grove (Foreman, AR) and LafargeHolcim (Ada, OK)—have evaluated and, in some cases, accepted qualified spent foundry sands as alternative feedstock. This helps reduce reliance on virgin quarried materials and cuts down CO₂ emissions in clinker production.
- **Road Construction Fill:** Foundry sand has been used as subbase material for plant access roads, utility corridors, and pad fills in industrial zones around Tulsa and Oklahoma City. Local contractors often

collaborate with foundries to reduce hauling costs and source consistent fill material.

- **Landfill Daily Cover:** Several Oklahoma landfills, including facilities in Canadian and Comanche counties, have approved spent foundry sand as daily or interim cover. When properly characterized and approved, this reuse reduces demand for native soils and landfill operational costs.
- **Potential Soil Amendments:** Pilot projects in central and western Oklahoma have tested silica-rich spent sand as a component in erosion control and revegetation mixes. The DEQ requires clear evidence of non-hazardous status—especially for any use near agricultural land or water bodies.
- **Sandblasting and Niche Uses:** Select foundries in the Muskogee and Ardmore areas have repurposed consistent-grain core sand for abrasive blasting, particularly in fabrication shops and pipeline yards. Use is conditional on the absence of contaminants like lead or chromite.

6. Environmental and Technical Considerations

Beneficial reuse of foundry sand requires careful understanding of material composition, contaminant risks, and environmental testing protocols to ensure safe and responsible outcomes.

Types of Foundry Sands

Ferrous Foundry Sands (Iron and Steel Castings):

- Typically high-purity silica sand bonded with clay (green sand) or chemical resins.
- Low in contaminants.
- EPA and DEQ consider these the safest and most preferred for reuse.

Non-Ferrous Foundry Sands (Aluminum, Brass, Bronze Castings):

- Similar base sand but potential contamination from metal alloys.
- Brass/Bronze sands often contain elevated lead, requiring more stringent testing or stabilization before reuse.

Specialty Sands:

- Some foundries use olivine sands or other media; not covered under EPA's standard risk assessment for reuse.
- May alter soil pH or chemistry.

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, pigments	Usually low and stable in ferrous foundries; not a major issue.
Phenols / Cresols	Phenolic resins (binder breakdown)	Organic compounds typically present in very low concentrations.
PAHs	Burnt sea coal or resin residues	Detected at very low levels; below environmental risk thresholds.
Dust / Free Silica	Physical hazard from dry sand	Requires dust suppression measures during handling to protect workers.
pH / Salinity	Binders, chemical additives	Some foundry sands have slightly alkaline pH, generally not problematic unless used directly in soils.

Importance of TCLP Testing

The Toxicity Characteristic Leaching Procedure (TCLP) is the industry-standard EPA test to determine whether foundry sand poses a leaching hazard to groundwater.

- Simulates landfill leachate conditions using an acetic acid solution.
- Measures 8 key metals (Lead, Arsenic, Cadmium, Chromium, etc.).
- Passing TCLP = Sand is classified as non-hazardous.
- Ferrous foundry sands in Oklahoma typically pass TCLP easily.

If foundry sand fails TCLP (e.g., high lead from brass castings):

- It must be managed as hazardous waste, not reused without treatment.

Key for Oklahoma Reuse: All sands used in landfill cover, road base, concrete, etc., must pass TCLP and have supporting documentation.

Environmental Behavior of Foundry Sand

- Heavy metals in ferrous sands are generally immobilized in the sand matrix.
- Organics (e.g., phenols, PAHs) are below actionable risk levels according to EPA risk assessments.
- Field studies show low leachability and no significant uptake into plants when used in soil amendments.

Conclusion: For properly characterized ferrous foundry sands, environmental risks are minimal — supporting broad beneficial reuse.

7. Funding, Grants, and Incentives

State-Level Incentives

Oklahoma Environmental Quality Incentive Grants (EQIG):

- Supports projects aimed at reducing landfill input, including recycling and reuse infrastructure.
- Foundry sand reuse initiatives (e.g., sand screening, transport equipment, or containment silos) may qualify under waste minimization categories.
- Eligible applicants include municipalities, private businesses, and nonprofit organizations.
- Grant cycles vary; funding is competitive and often tied to specific DEQ strategic priorities.

Solid Waste Management and Environmental Fund (SWMEF):

- Provides support for landfill improvements, recycling programs, and diversion strategies.
- Projects that utilize foundry sand as daily/intermediate cover or structural landfill material may be eligible.
- Encourages collaboration between landfill operators and industrial byproduct generators like foundries.

Oklahoma Waste Tire Recycling Fund (model for reuse programs):

- While focused on tires, this fund demonstrates Oklahoma's approach to incentivizing the reuse of regulated waste streams through rebate systems and processor reimbursements.
- A similar structure could apply to foundry sand reuse with proper classification and stakeholder support.

Oklahoma Department of Commerce – Business Expansion Incentives:

- Programs such as the Quality Jobs Program and Investment/New Jobs Tax Credit Package may benefit foundries investing in sand reclamation or material recovery infrastructure.
- Sales tax exemptions may apply to equipment used in qualifying environmental or manufacturing processes.
- Must meet thresholds for investment, job creation, or environmental benefit.
- Application required through the Oklahoma Department of Commerce.

Local/Regional Economic Development Partnerships:

- Several Oklahoma counties and cities—especially those with active industrial parks—offer small business development grants, infrastructure assistance, or matching funds for environmental innovation.

- Foundries demonstrating local economic impact or sustainability outcomes (e.g., job creation + landfill diversion) may access these funds.
- Coordination with local economic development authorities (e.g., Tulsa's INCOG or OKC Partnership) is recommended.

Federal-Level Opportunities

EPA Sustainable Materials Management Grants:

- Periodically available grants supporting innovative reuse/recycling projects.
- Can fund pilot projects, outreach campaigns, or infrastructure improvements related to foundry sand.

Federal Infrastructure and Recycling Funding (Infrastructure Investment and Jobs Act):

- Some grant programs are open to states and municipalities improving recycling or circular economy initiatives.
- Foundry sand reuse aligns with goals of waste reduction and sustainable construction.

FHWA / DOT Support:

- Federal Highway Administration promotes the use of recycled materials (including foundry sand) in road construction.
- Some research grants and technical support available for projects demonstrating new uses of industrial byproducts in infrastructure.

Local Opportunities

Local Government Partnerships:

- Counties and cities sometimes offer mini-grants or project cost-sharing for green construction and waste diversion projects.
- Example: County public works departments may help subsidize trucking costs if foundry sand is used in local road construction.

Public-Private Collaborations:

- Landfills may waive tipping fees for sand.
- Construction contractors may provide free transport in exchange for discounted material.
- Informal partnerships often unlock major savings without formal grant applications.

Summary Table: Key Funding and Incentive Programs

Program/Incentive	Type	Key Details	Impact for Foundry Sand Reuse
Environmental Quality Incentive Grants (EQIG)	State Grants	Competitive grants managed by the Oklahoma DEQ. Open to municipalities, businesses, and nonprofits for recycling, reuse, and diversion projects.	Can fund screening equipment, silos, and transport systems for sand reuse and reclamation.
Solid Waste Management and Environmental Fund (SWMEF)	Cost Savings / Local Support	Supports landfill upgrades and diversion strategies; funded by tipping fees and DEQ allocations.	Encourages sand reuse as cover or structural fill in landfills, reducing native soil use and tipping costs.
Local Economic Development Grants	Regional / Matching Funds	City and county development boards (e.g., Tulsa INCOG, OKC Partnership) offer matching or startup grants for sustainability and infrastructure.	May provide seed capital or cost-share support for local sand reuse projects tied to job creation or site reuse.
Oklahoma Commerce Investment & Jobs Incentives	Tax Credits / Sales Tax	Includes Quality Jobs and Investment/New Jobs Tax Credit programs. Requires job creation or qualified capital expenditure.	Equipment for sand reuse or reclamation could qualify for sales tax exemption or tax credits with proper filing.
EPA/Federal Grants (e.g., SWIFR, USDA REAP, Brownfields)	Federal Research / Demo	Grants from EPA, USDA, or DOE for infrastructure, reuse innovation, or brownfield remediation.	Can co-fund Oklahoma projects that pilot sand reuse in construction, soil blending, or industrial redevelopment.

8. Active Participants in Oklahoma

End Users (Consumers of Foundry Sand) – Oklahoma

- City of Tulsa Waste-to-Energy and Landfill Operations Tulsa's solid waste system includes landfills that may accept industrial byproducts like foundry sand, pending chemical analysis and DEQ approval. Potential use includes daily/intermediate cover and structural fill.
- Construction Contractors and Road Builders Contractors across Oklahoma—including those in the OKC and Tulsa metros—have used foundry sand for embankment fill, industrial site prep, and rural roadway subgrades. Coordination with DOT standards and geotechnical consultants is often required.
- Oklahoma State University (OSU) Research initiatives at OSU have explored industrial byproduct reuse, soil amendment performance, and erosion control—potentially applicable to foundry sand. Findings from

OSU Extension and the Biosystems Engineering department support reuse in civil and environmental contexts.

- Municipal and County Landfills Facilities in Canadian, Cleveland, and Comanche counties have either trialed or expressed interest in using foundry sand as alternative cover or engineered fill, especially where native soil is scarce or costly.

Supporting Programs and Agencies

Oklahoma Department of Environmental Quality (DEQ) – Land Protection Division

- Oversees waste classification, solid waste permitting, and landfill operations statewide.
- Offers technical assistance and reviews for beneficial use projects involving industrial byproducts like foundry sand.
- Administers applicable recycling grants and supports case-by-case beneficial use determinations (BUDs).

Oklahoma Recycling Association (OKRA)

- Provides education, networking, and grant guidance for recycling and materials diversion.
- Facilitates connections between industrial material generators (such as foundries) and end users in construction, agriculture, or waste management.
- Promotes circular economy practices across Oklahoma's public and private sectors.

Oklahoma State University (OSU) – Biosystems and Civil Engineering Departments

- Conducts research on soil amendments, construction materials, and erosion control using reclaimed byproducts.
- Supports pilot projects and field testing relevant to foundry sand reuse in civil engineering and landfill operations.
- Extension services may assist with site evaluations and performance assessments.

Keep Oklahoma Beautiful / Local Keep America Beautiful Chapters

- Provide small grants and community engagement support for recycling, litter reduction, and sustainability efforts.
- Can assist with public outreach or educational signage related to foundry sand reuse projects.
- May collaborate on campaigns to build local support for reuse efforts involving industrial materials.

American Foundry Society (AFS) – South Central Chapter

- Offers technical resources, training, and environmental compliance support for foundries in Oklahoma and surrounding states.
- Members share insights and case studies on successful sand reclamation and reuse programs.

- Collaborates with universities and agencies to promote sustainable practices in the metal casting industry.

Key Collaboration Insights

- Foundries across Oklahoma produce steady volumes of spent sand—often silica-based and physically consistent—making them strong candidates for beneficial reuse.
- Landfills and Cement Plants represent high-volume reuse opportunities when supported by DEQ approval, analytical data, and viable transport logistics.
- Contractors and Municipalities create demand for affordable fill, subgrade material, and engineered alternatives, especially for road, industrial, and utility projects.
- DEQ, OKRA, OSU, and local development agencies provide the regulatory foundation, research support, and technical assistance to scale reuse programs responsibly.
- AFS South Central Chapter and regional recycling networks foster industry innovation, share successful case studies, and help normalize standards and quality benchmarks.

Oklahoma has the essential building blocks for a sustainable foundry sand reuse ecosystem. Proactive coordination between foundries, regulators, end-users, and researchers can unlock significant environmental gains and reduce material costs across multiple sectors.

9. Success Story Highlights

Success Story 1: Tulsa Metro Landfill Trial Program A regional landfill near Tulsa accepted trial loads of spent foundry sand for use as daily and intermediate cover.

- Material was approved following DEQ review and TCLP testing.
- Helped demonstrate a clear regulatory and operational pathway for safe reuse of foundry sand in municipal waste systems.
- Reduced native soil consumption and lowered operational costs for the landfill.

Success Story 2: Oklahoma State University (OSU) Research Collaboration Researchers at OSU's Biosystems and Civil Engineering departments partnered with local foundries to evaluate reuse potential.

- Conducted material characterization and pilot studies on sand as road fill and soil amendment.
- Identified significant benefits in terms of reduced virgin material use and cost efficiency.
- Helped validate safety and performance benchmarks needed for broader adoption.

Success Story 3: Regional Equipment Grant Leveraging Small foundries and materials processors in eastern Oklahoma received regional recycling assistance grants and economic development incentives.

- Funds were used to purchase sand screening and conveyor systems for reuse preparation.

- Demonstrated how state and local funding can support infrastructure that diverts industrial byproducts from landfills.
- Created a framework for scalable, cost-effective reuse programs across the state.

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 for customers and regulators.

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

Beneficial reuse of foundry sand carries significant economic and environmental benefits, but participants must manage risk carefully to ensure compliance and protect their businesses.

Best Practices

Beneficial reuse of foundry sand offers clear economic and environmental advantages, but participants must manage compliance, liability, and recordkeeping carefully to ensure long-term success and regulatory protection.

- **Testing:** All foundry sand intended for reuse should pass a current Toxicity Characteristic Leaching Procedure (TCLP) test. Testing is recommended annually or whenever the casting process or materials change.

- **Documentation: Maintain Certificates of Analysis (CoA), TCLP results, and shipping/disposal records for a minimum of five years, in line with DEQ audit expectations.**

- **Written Agreements:** Always execute written contracts with receiving parties—such as landfills, cement kilns, or contractors—clearly defining each party’s responsibilities, approved uses, and disposal/reuse limitations.
- **Site-Specific Approvals:** For new, large-scale, or nontraditional reuse scenarios, consult the Oklahoma DEQ prior to material movement. Oklahoma does not operate under a universal Beneficial Use Determination (BUD) program, so case-by-case reviews are common and recommended.
- **Insurance:** Ensure your liability insurance policy reflects your beneficial reuse operations. Notify your carrier of material movement and reuse activities to confirm coverage applicability in the event of environmental claims.

ARS Support: ARS can assist participants in setting up compliance systems, testing protocols, and document templates to minimize legal risk.

12. Step-by-Step Workflow for Foundries

Simple Process to Start Foundry Sand Reuse:

- **Test:**
 - Conduct TCLP testing on representative sand samples through an accredited laboratory.
 - Confirm results meet Oklahoma DEQ non-hazardous thresholds.
- **Document:**
 - Save all lab results, including full reports and summary sheets.
- **Partner:**
 - Contact ARS to match your material to a reuse project (landfill, cement, construction).
- **Agreement:**
 - Sign a beneficial reuse agreement or memo of understanding.
- **Ship:**
 - Begin shipping sand as needed.

- Label loads clearly and maintain load-out logs.
- Monitor:
- If your production process changes (e.g., alloy change, new binder), re-test your sand.
- Maintain communication with ARS and receiving partners.

Result: Compliance, savings, and sustainability without added operational headaches.

13. Real Cost Savings Example

Why Reuse Makes Financial Sense:

- Landfill Disposal Costs:
- Disposal fee: ~\$70-\$150/ton
- Landfill surcharge: +\$4.25/ton
- Total = ~\$74.25-\$154.25/ton to landfill
- Beneficial Reuse Costs:
- Transportation only: ~\$10-\$75/ton (varies by distance)

Savings Calculation:

If your foundry produces 1,000 tons/year:

Landfill cost: 1,000 tons x \$49.25 = \$49,250

Reuse transport cost (avg \$15/ton): 1,000 tons x \$15 = \$15,000

Total annual savings = ~\$34,250

Multiply this by 5–10 years and the impact becomes massive.

15. General FAQ & Landfill-Specific FAQ

Q: Is reused foundry sand safe for public use projects like roads or parks?

A: Yes, provided the sand passes environmental testing (like TCLP), silica-based foundry sand from iron, steel, and aluminum foundries has been proven safe for reuse in infrastructure projects. DEQ and U.S. EPA endorse reuse for approved applications like roads, landfill cover, and construction fill.

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

A: Sand must be tested initially to prove non-hazardous status. After that, testing frequency depends on process consistency. Most foundries re-test yearly or if they change raw materials or binder systems.

Q: Can reused foundry sand be used near homes, gardens, or drinking water supplies?

A: Applications like road base and landfill cover are common and safe. For use in soils near gardens or homes, additional case-by-case approvals and environmental assurances may be needed (especially for soil amendments).

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

A: If post-use monitoring detects hazards (extremely rare with properly approved sand), remediation or removal would be required. This is why initial proper testing and documentation are critical.

Q: Who is responsible for proving the sand is safe - the foundry or the user?

A: The foundry (generator) is responsible for testing and certifying that the sand meets regulatory requirements. The end user must ensure they use the sand only in approved ways.

Landfill-Specific FAQ

Q: Does foundry sand affect landfill leachate or groundwater?

A: No. Studies by EPA, USDA, and DEQ confirm that properly tested ferrous foundry sand does not contribute hazardous leachate or groundwater issues.

Q: Is foundry sand considered "cover material" for daily cover compliance?

A: Yes. DEQ regulations approve foundry sand as daily or intermediate cover.

Q: Do we need special equipment to handle foundry sand?

A: No. Standard landfill spreading equipment (dozers, loaders) can handle foundry sand easily.

Q: How do we document use to maintain surcharge exemption?

A: Maintain simple load logs and daily cover documentation. ARS can provide templates.

Q: What if sand chemistry changes?

A: Periodic re-testing is recommended, especially if the foundry changes alloy or binder systems.

16. References

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