FACT SHEET NOVEMBER 22, 2013

INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

Foundry Sand as Structural Fill

Office of Land Quality, Solid Waste Program

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Description:

Indiana is a national leader in many of its regulations and attitudes toward foundry sand reuse. Foundry sand use is addressed in the Indiana Code, under IC 13-19-3-7, which allows for specific use of type III foundry sand without the need for a permit from the Indiana Department of Environmental Management (IDEM). Additionally, Indiana's Solid Waste Rule, in the Indiana Administrative Code under 329 IAC 10-3-1, allows for other uses of waste foundry sand (and other solid waste) when the use is determined to be "legitimate". One common use of these solid wastes is for structural fill. Regardless of whether the use is under the statute or rule, demonstrating the use of foundry sand as structural fill depends on several factors. The proper planning and application of the material at the construction site separates the use as legitimate structural fill from waste disposal and open dumping.

Factors for Demonstrating Legitimate Use:

The following factors should be addressed to demonstrate a project is legitimate structural fill use:

- Structural fill is defined in 329 IAC 10-2-183 as soil material that is placed in lifts and compacted to a specified density as determined by a construction quality assurance/construction quality control (CQA/CQC) plan or by the design specifications.
- The material will be used to support a specific structure. Several categories such as roads, parking lots, floor slabs, etc., are listed in IC 13-19-3-7. The design specifications should include the foundation requirements for the specific structure.
- The area where the structural fill will be placed must be a stable foundation. Factors such as the geological formation and hydrology of the site must be evaluated.
- Structural fill material specifications such as grain size analysis, Atterberg limits, moisture/density curve, moisture content, and friction angle must be evaluated.
- Design calculations such as slope stability analysis, erosion calculations, storm water drainage ditches sizing and pipe crushing calculations must be completed.
- Standard construction procedures should be adjusted to account for using foundry sand.
- The site should be prepared for foundry sand placement in the same way it is prepared for similar soil fill materials. It should be cleared and grubbed, and the topsoil should be retained for final cover where foundry sand will remain exposed.
- The normal precautions for draining the site to prevent seeps, pools or springs from contacting the foundry sand should be followed.
- The water content of the foundry sand is adjusted to prevent dusting and to enhance compaction.
- Foundry sand is spread using appropriate construction equipment, such as dozers. Lifts are usually 6 to 12 inches thick.
- The lift thickness, the weight and speed of the compaction equipment, and the number of passes should be determined for optimal compaction. Many contractors run test pads to determine the best construction methods to accomplish the required foundry sand's compaction rate.
- As with any fill material, controlling its moisture is an important consideration in compaction. Be sure to compare placed and compacted foundry sand moisture content and density to the desired water content and maximum dry density specified by the design.
- Prevent wind and water erosion of the surface of the foundry sand by using the same sediment and erosion control techniques commonly used for other earthwork operations.
- The completed project, not including the structure being constructed (e.g. asphalt parking lot, building, etc.), should be covered with 18 to 24 inches of clay type soil and vegetation. No foundry sand should remain exposed.

The Structural Fill Construction Standards Checklist is included as an attachment to this fact sheet to assist you in addressing the factors above.

Environmental Impacts:

- Following the above basic engineering and construction practices will help ensure that the use of foundry sand, or other legitimate use of solid waste, qualifies as structural fill.
- For structural fill using type III foundry sand under the statutory exclusion found in IC 13-19-3-7, an IDEM approval or permit will not be required for individual project as long as the foundry has a current Type III waste classification.
- Impacts to the environment such as run-off of waste material can be avoided by following the basic engineering and construction practices outlined in the Structural Fill Construction Standards Checklist that accompanies this fact sheet.
- These structural fill guidelines outlined here are not intended to impact existing guidelines for spent foundry sand uses such as daily cover, protective landfill leachate cover, capped embankments, land application, soil amendment, and raw material incorporated into another product.

IDEM's Role:

- IDEM is responsible for protecting human health and the environment while providing for safe industrial, agricultural, commercial, and governmental operations vital to a prosperous economy.
- IDEM's Office of Land Quality will evaluate legitimate use requests for solid waste.
- Structural fill projects may also be subject to regulations regarding storm water, construction in a floodway, wetlands, or fugitive dust.
- IDEM is responsible for issuing Waste Classifications under 329 IAC 10-9-4.

Additional Information:

- For more information on the use of foundry sand as structural fill and a link to IC 13-19-3-7, please visit IDEM's website at www.idem.IN.gov/4996.htm.
- For questions and concerns, feel free to call IDEM's Office of Land Quality at (317) 234-6923 or (800) 451-6027, ext. 4-6923.
- Refer to the "Structural Fill Construction Standards Checklist," attached to this fact sheet, for items that must be considered and/or performed in demonstrating a legitimate structural fill use project.

Structural Fill Construction Standards Checklist

(attachment to IDEM's Foundry Sand as Structural Fill fact sheet)

Definition (329 IAC 10-183) "Structural Fill" means soil material that is placed in lifts and compacted to a specified density as determined by the CQA/CQC document or by the design specifications.

A. Items you need to consider before placing structural fill:

☐ 1. Stable foundation – sub-base that is not susceptible to natural or human-induced events such as caving, sudden subsidence, liquefaction. Examples of poor sub-base are: karst terrain (sinkholes), mine spoils, underground mines, saturated soil, poorly drain soils, manmade fills.

☐ 2. Geological formation and hydrology of the site. You should look for high water table, water bearing zones, rock outcropping, ravines, springs, natural streams and drainage ways, surface water runoff pattern. Placing fill over such features is generally not recommended unless site specific investigation and design is made.

B. Items you need to include when designing your structural fill project:

☐ 1. Foundation requirements for the structural fill.

☐ 2. Structural fill material specifications such as grain size analysis, Atterberg limits, moisture/density curve and moisture content, friction angle, and any design calculation such as: slope stability analysis, erosion calculations, storm water drainage ditches sizing and pipe crushing calculations.

☐ 3. Construction quality assurance/construction quality control plan including methods of placement of the structural fill and testing frequencies to assure the fill was properly placed. This plan should include:

___ a. Delineation of the responsibilities for CQA/CQC management.
___ b. Description of the required level of experience and training for the contractor, crew and CQA/CQC inspector.
___ c. A description of field observation, calibration procedures for field testing equipment.
___ d. Description of sampling, protocols, sample size and methods for determining sample locations and frequency of sampling
___ e. Handling/blending of material used for structural fill.
___ f. Required density and moisture content to achieve design compaction; Typically 90% modified Proctor or 95% standard Proctor density is recommended unless design specifications or material properties require site specific densities.
___ g. Lift thickness; 6" to 12" loose lifts are recommended.

___ h. Confirmatory tests before placement of fill material to assure that fill material meets the design specification. Typical recommended testing and frequencies:
Moistures content: 1 test for every 5,000 cubic yards and minimum 3 tests per project.
Grain size: every 1 test for 5,000 cubic yards and minimum 3 tests per project.
Atterberg Limits (liquid limit and plasticity index): 1 test for every 5,000 cubic yards and minimum 3 tests per project.
Moisture-density curve: 1 test for every 5,000 cubic yards and minimum 3 tests per project.

___ i. Compaction equipment specification.

___ j. In-situ tests on each lift during the fill placement to assure that the fill has been properly placed and compacted.
Nuclear density test: 5 tests per acre per lift.
Moisture content: 5 tests per acre per lift.
Moisture-density curve: every 5,000 cubic yards.

___ k. Identification of problems during construction of fill and corrective measures.

___ l. Inspection records of construction.

C. Tasks you should perform when planning your structural fill project:

☐ 1. Review of design and specification for the structural fill with the construction representative.

☐ 2. Inspection of the sub-base before fill placement.

☐ 3. Construction of the test pad (if applicable) to assure proper compaction of the fill is achieved.

☐ 4. Oversight of construction/fill activity.

☐ 5. Conformance testing that the fill material meets specifications.
Lift thickness.

☐ 6. Equipment, compaction effort and expected number of passes to achieve proper compaction.

☐ 7. Inclement weather conditions.

☐ 8. Daily inspection of construction site, corrective measures taken.

Exceptions/Comments: _____