GUIDANCE FOR BENEFICIALLY REUSING CONSTRUCTION & DEMOLITION DEBRIS FINES

CDRA Mission:

Provide positive support and representation to the industry and CDRA members in legislative and rule-making venues that impact the recycling business.

Act as an advocate to promote C&D recycling and the recycle business in every manner possible that benefits CDRA members.

Facilitate and sponsor CDRA member interaction between the membership companies and further facilitate interaction between the membership and the many specialized services that can potentially benefit the membership such as equipment, financing, insurance and other specialized third party resources.

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Construction and demolition debris (C&D) consists of the materials generated during the construction, renovation, and demolition of buildings, roads, bridges, and other structures. C&D may be recovered for direct reuse (e.g., use of recovered lumber in new construction projects), utilized in other beneficial ways (e.g., crushed concrete used for road base), or disposed of in landfills (and to a lesser extent in combustion facilities). In a 2017 CDRA study detailing the benefits of recycling C&D, the total generated C&D mass for the United States (US) in 2014 was 583 million tons, where 73% was recycled. In the same study, 15.1 million tons of C&D fines were generated, but only 44% was recycled.

Broadly, the C&D stream is comprised of concrete, wood, metal, asphalt, drywall, masonry products, land-clearing debris, and a variety of other constituents. C&D fines represent one of the major remaining constituents, generated during the processing of the incoming C&D stream at a recycling facility operation. One of the first steps of processing C&D is to screen incoming materials to remove materials with a small particle size, thus making the remaining materials more suitable for additional processing steps. These fines (referred to as recovered screened material in some locations) consist primarily of soil, but also includes small pieces of wood, concrete, drywall, rock, and other miscellaneous materials. The density and strength of C&D fines are largely dependent on the material composition, with materials such as concrete contributing to a higher density and strength.

In some locations C&D fines have not been widely recycled outside of landfill applications because of concerns of trace contaminants. The CDRA contracted with the University of Florida to develop a document titled: Guidance for Beneficially Reusing Construction and Demolition Debris Fines. The primary focus of the guidance document is a characterization study done using 14 samples from 12 C&D facilitates in the US measuring the chemical and physical properties of the fines. Risk assessment is also discussed with respect to direct exposure and leachability of C&D fines when beneficially reused. The main concern being direct exposure risk because C&D debris rarely leach chemicals above regulatory risk thresholds.

The samples were evaluated for particle size distribution, flammability, volatile solids (VS) content, asbestos content, total heavy metal concentrations, total PAH concentrations, PCB concentrations and total extractable petroleum hydrocarbon concentrations. Where appropriate, risk-based regulatory thresholds were compared to the results to provide context; since such thresholds vary from state to state, geographic-appropriate thresholds should be used when evaluating materials from a specific facility. In addition to statewide risk thresholds, EPA nationwide risk threshold (RSLs) were also referenced.

The results of the characterization study can be used to determine broader markets for recycling C&D fines. Although markets for C&D fines already exist, beneficial use of this material may at times be limited because some chemical concentrations exceed risk-based regulatory thresholds. The most common market for C&D fines is currently use as alternative daily cover, which conserves virgin soil. Fines dominated by soil can be used as clean structural fill, whereas fines with concrete, brick, and denser material can be used as structural fill. The gypsum and organic content of C&D fines can make it an appropriate soil or agricultural amendment.

The guidance document addresses strategies that can be used by recyclers to create better products using their C&D fines and market them for the appropriate beneficial reuse. The results of the study along with these strategies were applied to case studies that provide greater guidance for recycling C&D fines.
The concern of trace chemicals in C&D fines has led some state regulatory agencies to require routine testing and compliance with risk-based regulatory thresholds. These thresholds account for background concentrations and vary geographically, resulting in states adopting different policies regarding beneficial reuse.

The results of the study support that some problematic trace chemicals are more heavily concentrated in the smaller fraction of C&D fines, suggesting additional processing can aide in reducing the concentrations of these chemicals. A couple of the samples used in the characterization study were processed using screening and washing to evaluate the change in concentrations of lead, arsenic, and PAHs. When the selected C&D fines were screened to less than 0.19” (4.8 mm), more than half of them had a PAHs reduction of 50%. When compared with regulatory risk thresholds, more samples had PAHs concentrations below risk thresholds as the smaller materials were removed. Processing to remove particles less than 0.19” (4.8 mm) by either a washing process or a mechanical screening process significantly reduces concentrations of lead, sulfate and PAHs. An observable reduction in arsenic also occurs when removing the finer fraction to a lesser extent because arsenic is distributed throughout the size fractions. The results for each tested parameter are presented in Table 1.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Results</th>
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<tr>
<td>Total Concentration of Heavy Metals</td>
<td>Among the heavy metals analyzed in the study, the two warranting the most concern are arsenic and lead. Nine samples had concentrations above the RSLs commercial risk threshold for arsenic. Arsenic concentrations exist at levels above the lowest risk threshold in all samples, with only one sample exhibiting arsenic slightly above Florida’s commercial/industrial risk threshold (12 mg/kg). In the case of lead, 1 sample exceeded the commercial RSL (800 mg/kg) and three other samples exceeded the residential RSL (400 mg/kg).</td>
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<td>Total PAHs Concentrations (BaP-equivalent total PAHs)</td>
<td>Polycyclic aromatic hydrocarbons (PAHs) are one of the main chemicals of potential concern in C&amp;D fines. Concentrations among the different samples vary considerably, with half of the samples close to or above the commercial/industrial Florida’s risk threshold (0.7 mg/kg) and 4 samples exceeding New York’s residential risk threshold (1 mg/kg). Out of 14 samples, 12 were below the commercial/industrial RSL for BaP (2.1 mg/kg).</td>
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<td>Particle Size Distribution</td>
<td>The distribution results show 50% to 90% of the sample mass resides in the gravel and sandy CD fines fractions (0.19”-3/4” and 0.033”-3/4”) with the majority of C&amp;D fines within the range of 0.033” to 3/4”. Approximately 70 to 90% of the material was larger than 0.012” and the percentage of material greater than 1” ranged from 0 to 16%. Material larger than 3/4” was predominantly concrete with other significant portions of wood, gypsum, asphalt. Material greater than 0.98” had more glass and less gypsum.</td>
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<td>Flammability</td>
<td>The flash point of all samples was greater than 200 °F</td>
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<td>Volatile Solids Content</td>
<td>The overall average of the 14 samples was 18%. The majority of samples had a volatile solids content of 9%-25% with 3 samples having values greater than 45%. Samples with a higher VS content likely contain size reduced particles of wood and other flammable products.</td>
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<td>Asbestos Content</td>
<td>Only one sample of the 14 tested had traces of asbestos with the overall content reported to be less than 1%.</td>
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<td>Total PCBs</td>
<td>The majority of samples tested for PCBs were below detection limits, with the only two above the limit being below the most conservative risk threshold of 0.089 mg/kg for California. It can be concluded that PCBs are not a chemical of concern in C&amp;D fines.</td>
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<tr>
<td>Extractable Petroleum Hydrocarbons</td>
<td>Total petroleum hydrocarbons (TPH) concentrations in half of the 14 samples were close or exceeded Florida commercial/industrial risk thresholds. Most states do not have a risk threshold for TPH making this a site specific concern.</td>
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<td>Moisture Content and pH</td>
<td>The pH and moisture content of the samples ranged between 6.5 to and 15 to 30%, respectively.</td>
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In some cases, the fines from a particular C&D recycling operation may not meet the risk-based regulatory concentrations for unlimited beneficial reuse. This could be because the specific risk thresholds where the facility is located are low, requiring a demonstration project to show regulators there is not an increased risk by reusing fines. Another limiting factor is the trace components in C&D fines. Depending on the characteristics of the material, a beneficial reuse should be tailored to a specific product.

C&D facility operators can use the following strategies to explore opportunities for beneficial use of their fines. Facilities should consult the environmental regulatory agency in their state prior to reusing their C&D fines.

### Strategy 1: Controlling the Product

The results of the characterization study reveal the wide variance in C&D across the US, which subsequently affect the reuse opportunities for respective recyclers. Controlling the materials entering the waste stream will impact the characteristics of the final product. For example, removing wood and material less than 0.079” (2 mm) with screening or washing technology will produce a product with higher strength that can be used as structural fill. This final product will also contain less pollutants commonly concentrated in the smaller size fraction (e.g. PAHs).

### Strategy 2: Control the Risk

Materials being proposed for beneficial reuse are often compared to the most conservative risk-based thresholds to determine if a material has the potential to harm humans or surrounding environment. If chemical concentrations are above certain risk thresholds, C&D facility operators can limit the risk of exposure by mixing C&D fines with clean soil, placing clean soil over the material, or using products in less populated areas.

### Strategy 3: Site Specific Assessment

The risk based thresholds often used to evaluate potential risk are based on a chemical being 100% bioavailable, making these metrics overly conservative in some cases. For some reuse projects, a more specific assessment of background concentrations and bioaccessibility may be used to demonstrate a reduced risk. Background concentrations in soil and “clean” construction materials can be measured to evaluate the actual risk of beneficially reusing C&D fines.

The guidance document created by the CDRA provides recyclers with aide in determining the constituents of greatest concern in their C&D fines. The results of the characterization study can aide recyclers in seeking regulatory approval for beneficially reusing their fines in a wider range of scenarios. Facilities with chemicals exceeding their respective regulatory risk thresholds can use the provided strategies to reduce the associated risk and market their product to appropriate markets, reducing the amount of material entering a landfill as waste.

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