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# Beneficial Use of Waste Materials: State of the Practice 2012

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Prepared by

Innovative Waste Consulting Services, LLC
Gainesville, FL

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# Notice

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# Foreword

The U.S. Environmental Protection Agency (EPA) is charged by Congress with protecting the Nation's land, air, and water resources. Under a mandate of national environmental laws, the EPA strives to formulate and implement actions leading to a compatible balance between human activities and the ability of natural systems to support and nurture life. To meet this mandate, the EPA's research program is providing data and technical support for solving environmental problems today and building a science knowledge base necessary to manage our ecological resources wisely, understand how pollutants affect human health, and prevent or reduce environmental risks in the future.

The National Risk Management Research Laboratory (NRMRL) is the Agency's center for investigation of technological and management approaches for preventing and reducing risks from pollution that threaten human health and the environment. The focus of the NRMRL's research program is on methods and their cost-effectiveness for prevention and control of pollution to air, land, water, and subsurface resources; protection of water quality in public water systems; remediation of contaminated sites, sediments, and ground water; prevention and control of indoor air pollution; and restoration of ecosystems. The NRMRL collaborates with both public and private sector partners to foster technologies that reduce the cost of compliance and to anticipate emerging problems. The NRMRL's research provides solutions to environmental problems by developing and promoting technologies that protect and improve the environment; advancing scientific and engineering information to support regulatory and policy decisions; and providing the technical support and information transfer to ensure implementation of environmental regulations and strategies at the national, state, and community levels.

This publication has been produced as part of the NRMRL's strategic long-term research plan. It is published and made available by the EPA's Office of Research and Development to assist the user community and to link researchers with their clients.

Cynthia Sonich-Mullin, Director
National Risk Management Research Laboratory

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## Abbreviations, Acronyms, and Initialisms

| | |
|---|---|
| ASTM | American Society for Testing and Materials |
| ASTSWMO | Association of State and Territorial Solid Waste Management Officials |
| BUD | Beneficial Use Determination |
| C&D | Construction and Demolition |
| CAO | Certificate of Authorization to Operate |
| CCC | Critical Contaminant of Concern |
| CFR | Code of Federal Regulations |
| CKD | Cement Kiln Dust |
| COC | Constituent of Concern |
| DI | Deionized Water |
| FGD | Flue Gas Desulfurization |
| FR | Federal Register |
| g | Gram |
| GCTL | Groundwater Cleanup Target Level |
| GHG | Greenhouse Gas |
| kg | Kilogram |
| L | Liter |
| LDEQ | Louisiana Department of Environmental Quality |
| L/S | Liquid to Solid Ratio |
| MDEP | Massachusetts Department of Environmental Protection |
| MEP | Multiple Extraction Procedure |
| mg | Milligram |
| Misc. | Miscellaneous |
| MPCA | Minnesota Pollution Control Agency |
| MSW | Municipal Solid Waste |
| NEWMOA | Northeast Waste Management Officials' Association |
| NJDEP | New Jersey Department of Environmental Protection |
| NRMRL | National Risk Management Research Laboratory |
| NYSDEC | New York State Department of Environmental Conservation |
| ODEQ | Oregon Department of Environmental Quality |
| Ppb | Parts Per Billion |
| Ppt | Parts Per Trillion |
| RBC | Risk Based Concentration |
| RCRA | Resource Conservations and Recovery Act |
| SCC | Soil Cleanup Criteria |
| SHC | Sustainable Healthy Communities |
| SPLP | Synthetic Precipitation Leaching Procedure |
| SW-846 | Test Methods for Evaluating Solid Waste, Physical/Chemical Methods |
| TARP | Technology Assistance and Reciprocity Partnership |
| TCDD | Tetrachlorodibenzodioxin |
| TCLP | Toxicity Characteristic Leaching Procedure |
| TEQ | TCDD Toxicity Equivalents |
| UCL | Upper Concentration Limit |
| U.S. | United States |
| EPA | United States Environmental Protection Agency |
| VRP | Voluntary Remediation Program |
| WARM | Waste Reduction Model |
| WBJ | Waste Business Journal |
| WET | Waste Extraction Test |

| | |
|---|---|
| WTE | Waste-to-Energy |

# Executive Summary

Solid wastes produced in today's society originate from a myriad of sources, including households, government, businesses, and industry. Current U.S. federal regulations for solid waste management have been developed to promote sound management of these wastes in a manner protective of human health and the environment. Most of these regulations, however, are directed toward handling and disposal of hazardous waste or municipal solid waste (MSW; household and commercial refuse). Also requiring sound management are the large volumes of non-hazardous residues, sludges, by-products, and spent materials produced as a result of industrial, mining, agricultural, commercial, and municipal activities. These solid wastes include but are not limited to combustion ash from power production; sludge from water treatment; residues generated from industrial processes and air pollution control equipment; and debris resulting from the maintenance and demolition of roads and bridges.

The management of non-hazardous residuals, debris, and by-products represent a challenge because of their volume and necessity for safe management, and an opportunity as a result of the tremendous materials recovery potential. In 2003, the U.S. Environmental Protection Agency (EPA) estimated that approximately 7.6 billion tons of industrial waste is generated each year. If used correctly, many of these materials can act as a substitute for virgin resources, including in the manufacture of new products, as fuel for energy recovery, or utilization as a construction product. The term commonly used to describe the practice of utilizing these wastes in a productive fashion is "beneficial use." The beneficial use of waste materials represents a shift to materials management as opposed to waste management and focuses on decreasing the amount of materials that are disposed, which may have numerous benefits, including decreasing the use of virgin materials in products or processes and potentially reduced lifetime greenhouse gas (GHG) emissions.

This beneficial-use state of the practice report is intended to provide waste generators, potential material end-users, and the regulatory community a thorough summary of beneficial-use approaches, current practices, and relevant issues. The specific aim of this effort was to identify state and regional procedures, practices, tools, and guidance for decision making with respect to beneficial use of waste materials and to examine the various mechanisms used by states to allow for the beneficial use of waste materials. An additional objective of this work was to assess specific types of dynamic data and elements of a tool that could facilitate procedures used by states as part of analyzing beneficial-use requests.

Decision making for beneficial use of waste materials must balance objectives of promoting waste-materials use with the need to protect human health and the environment. Examination of a potential beneficial-use application should consider what benefit the material plays in the proposed use, how it compares to the material it is replacing, and the long-term performance of the final product or application. When the waste material contains chemicals that would otherwise not be present in the intended product or application, the potential for these chemicals to pose risk to human health and the environment must be assessed. The potential for risk depends both on chemical concentration and form (e.g., can it migrate from the material over time), as well as the potential exposure that might result from the intended use. Exposure from a waste material beneficially used as an encapsulated ingredient in the manufacturer of a product would be expected to differ from an application where, for example, the waste is directly applied to soil in a residential setting.

A variety of factors are considered in the development of beneficial use options. The current regulatory status of the waste material must be assessed, and materials that meet the definition of hazardous waste must be managed following appropriate regulatory protocols identified in the regulations. While the beneficial use of some waste materials is addressed at the federal level, beneficial use of most waste materials falls to state regulatory agencies. State agencies handle beneficial use with a variety of mechanisms. States commonly provide regulatory or statutory exclusions of certain wastes and waste-use combinations. In other cases, states conduct an evaluation and subsequently develop a listing of allowable beneficial uses where a determination (sometimes referred to as a beneficial use determination [BUD]) has been made by the Agency, which allows any generator/user that meets the requirements of the BUD to use the waste within the constraints provided. This approval, sometimes referred to as a "standing use determination" or "preapproved beneficial use," may require that chemical testing first be completed to meet minimum thresholds. Wastes and uses that involved the use of a waste material such as an ingredient in a product were typically found to have an exclusion or a standing use (e.g., coal fly ash use as an ingredient in cement).

All state programs were found to have some mechanism (formal or informal) that allowed a generator to submit a request to beneficially use a waste material, which would be subsequently reviewed by the Agency. The makeup of the case-by-case programs differed among the states in terms of structure—in some states, the structure for case-by-case determinations was clearly defined and tools (such as application forms and detailed guidance) were available. In other states, regulatory language was written broadly and the specific data collection and demonstration requirements were not specified; thus, these considerations were truly developed on a case-by-case basis.

A review of current state programs related to beneficial use showed that these programs often differed in several respects. Key examples where variability was found include

- **Types of waste enumerated for beneficial use.** Some states provided extensive lists of waste materials that, provided certain criteria were met, were allowed to be beneficially used. Other states had very limited information in rules, statutes, and guidance related to the types of waste that could be beneficially used.
- **Analytical testing requirements.** Written regulation and policy in the states indicated a wide range of analytical testing, ranging from only determining whether or not a waste was hazardous to conducting a full, detailed, site-specific risk assessment. Analytical testing procedures for similar beneficial uses were found to differ as well, as some states require analysis of total concentration of constituents, while in other cases, states require the evaluation of the leachability of certain chemicals. Leachability testing requirements varied also, with some states requiring tests that simulate a landfill leaching environment (i.e., the toxicity characteristic leaching procedure) while other states require the use of another leaching test, such as the synthetic precipitation leaching procedure (SPLP) or the American Society for Testing Materials (ASTM) water leach test.
- **Chemicals of concern and concentration limits.** The regulatory review found that the chemicals that need to be evaluated for certain beneficial uses varied among states, and the associated numeric target levels varied substantially as well. These differences were observed to be a function of several factors, including the assumed exposure route, underlying assumptions regarding factors such as increased cancer risk, consideration of background concentrations, and assumed dilution effects.

Ultimately, while the goals of the regulatory programs in the United States related to beneficial use are essentially the same (regardless of the level of formality in the program), the approaches to meet these goals can differ, sometimes substantially. Some of the differences are reflected in terms of the level of information required to be collected and reviewed by the regulatory agency— practical limitations in several states identified included availability of staff to review beneficial use–related information, priority placed in beneficial-use activities at state agencies, and access to applicable and reliable information on particular wastes and uses. In other cases, differences between programs related to the level and nature of risk assessment conducted when evaluating beneficial uses.

Several data gaps were identified whose further assessment would help better understand key differences in regulatory programs and provide a building block for a dynamic tool to facilitate beneficial use. The gaps identified included further examining appropriate approaches to risk assessment for different types of beneficial-use applications; identifying a mechanism to better track beneficial-use activities at the state level; further assessment of appropriate techniques to apply analytical data in a risk framework; and examination of long-term performance of beneficially used waste materials with consideration towards environmental, economic, and public health considerations.

Several elements of a tool that could facilitate the beneficial-use evaluation process for states were identified. A public, open-source, and validated Web-based tool was identified as having a high potential to reach interested parties, such as state environmental regulatory officials. The tool would include an extensive database of information, including summaries of BUD applications and approvals (including source data) in different states; a mechanism to quickly compare applicable state rules in terms of appropriate target levels and other risk elements; and functionality to allow a user to quickly search and cross-reference information so that lessons learned from one state could be quickly applied in the context of another state. These elements would be necessary to give practical information to state regulatory agencies in a fairly rapid manner while accounting for the often widely differing regulatory framework in place related to beneficial use.

# 1. Introduction

## *1.1 Background*

The waste stream produced by commercial and industrial activities contributes substantially to the overall amount of waste generated in the United States—although accurate figures are not tracked on an annual basis such as is done with municipal solid waste (MSW). In 2003, the U.S. Environmental Protection Agency (EPA) estimated that approximately 7.6 billion tons of industrial waste are generated each year (EPA, 2003). Considerations following the generation of these wastes include identifying appropriate means of managing the wastes, including reuse, recycling, and disposal. The beneficial use of waste materials reflects a shift to materials management as opposed to waste management and focusing on decreasing the amount of materials that are disposed, which may have numerous benefits, including decreasing the use of virgin materials in products or processes and potentially reduced lifetime greenhouse gas (GHG) emissions.

A means to enhance beneficial use of industrial materials includes developing dynamic data and tools to assist communities in framing sustainability goals and decisions, as well as to identify technologies and approaches to enhance energy and materials recovery from existing waste streams. An additional need is to improve the effectiveness and efficiency of methods and guidance to address land and groundwater contamination sources and to encourage the use of innovative approaches to reduce new sources of contamination. The focus on the beneficial use of non-hazardous, non-MSW materials presents an opportunity to address both of these SHC objectives.

## *1.2 Report Objectives, Scope, and Organization*

This report was developed to present and analyze the state of the practice with respect to beneficial use of waste materials in the United States. The specific scope of work that was developed to meet this objective included the following tasks:

- Review state and regional procedures, practices, tools, and guidance for decision making with respect to beneficial use of waste materials.
- Identify the various mechanisms used by states to allow for the beneficial use of waste materials.
- Develop a listing of waste materials typically considered for beneficial use.
- Assess specific types of dynamic data and elements of a tool that would facilitate procedures used by states as part of analyzing beneficial-use requests. This step includes identifying current gaps in knowledge in terms of details of procedures used for beneficial use in the states.

This report is organized into six sections. **Section 1** presents the project background, report objectives, and organization. **Section 2** presents a discussion of fundamentals related to beneficial use of waste materials. **Section 3** provides an examination of federal rulemaking related to beneficial use and a review of state regulatory mechanisms for beneficial use, including risk assessment procedures. **Section 4** presents a series of specific case studies that compare the approaches of eight states to address eight different waste and beneficial use combinations. **Section 5** discusses data gaps that were identified in the analysis and potential elements of a tool that could be developed to facilitate the beneficial-use process by state agencies. **Section 6** presents the references used in the development of this report. Supplemental information is provided in a series of appendices. **Appendix A** provides a presentation of waste types that are commonly the subject of beneficial use, including a description and discussion of relevant research. **Appendix B** provides a summary of beneficial use–related statutes, rules, and guidance pertaining to beneficial use for the 50 states in the United States. **Appendix C** presents a comparison of risk-based target levels used by different states for several chemical parameters. **Appendix D** provides details of the eight state and waste-use combination case studies that were summarized in **Section 4** of the report.

## 1.3 Analytical Approach Used in the Report

As described in **Section 1.2**, one of the objectives of this report was to examine the state of the practice of beneficial use in the states. The fundamentals (**Section 2**), regulatory approaches (**Section 3**), and case studies (**Section 4**) primarily draw upon information gleaned from the examination of statutes and rules regarding solid waste management and beneficial use in each state, as well as associated guidance documents, beneficial-use application forms, and related supporting information. Additionally, where applicable, the technical literature and available beneficial-use databases were reviewed and cited in text, as appropriate. However, extended passages in **Sections 2, 3, and 4** draw upon the information learned through the examination of state statutes, rules, guidance, and conference with state solid waste representatives. For clarity, the information gathered through these means was consolidated and generalized (with some exceptions) to create a flow of information. A bibliography of the sources examined in this evaluation, many of which are directly cited, is provided in **Section 6**.

# 2. Beneficial Use Fundamentals

## 2.1 Definitions

The challenges of managing solid waste in the United States are well recognized at the federal, state, and local levels. Garbage from households and businesses must be efficiently removed from their source of generation and transported to facilities that provide opportunities for resource recovery (both materials and energy) and final disposal in a manner protective of human health and the environment. Similarly, residues, sludges, and spent materials from industries must be appropriately contained and managed in a safe, efficient, and economic fashion. These needs have led government agencies at all levels to develop regulations, from those that identify and control industrial wastes that merit special management as hazardous waste, to combustion and landfill requirements for household and commercial garbage (MSW) managed by local governments.

In addition to MSW, a large amount of non-hazardous solid waste is produced as a result of industrial, mining, agricultural, commercial, and municipal activities. These wastes include (but are not limited to) combustion ash from power production, sludge from water treatment, residues generated from industrial processes and air pollution control equipment and debris resulting from the maintenance and demolition of roads and bridges. These materials represent a challenge because of their volume and resulting necessity for economically viable and environmental safe management, but they also present a tremendous materials recovery opportunity. If used correctly, many of these materials can act as a substitute for virgin resources, be included in the manufacture of new products, serve as a fuel for energy recovery, serve as amendments for agricultural applications, or be utilized as a construction product.

The term commonly used to describe the practice of utilizing these wastes in a productive fashion is *beneficial use*. Although EPA provides some regulations regarding the beneficial use of some solid wastes (e.g., the 40 CFR 503 rules for biosolids from wastewater treatment, as described further in **Section 3**), there is no encompassing federal program for all of the beneficial-use activities described above; thus, individual states have developed their own regulatory programs to varying degrees.

While the specific nature of the wastes and use activities covered differs among the states, they have common objectives and share similar program features. For example, Massachusetts defines beneficial use as “the use of a material as an effective substitute for a commercial product or commodity.” Mississippi defines the practice as “the legitimate use of a solid waste in the manufacture of a product or as a product, for construction, soil amendment or other purposes, where the solid waste replaces a natural or other resource material by its utilization.” Similarly, Oregon defines beneficial use as “a sustainability practice that may involve using an industrial waste in a manufacturing process to make a product or using a waste as a substitute for construction materials.” In several cases, the term “beneficial use” is not defined at the state level, but regulations nevertheless are in place dictating procedures to obtain approval or otherwise use wastes in a manner consistent with regulations. In other cases, regulations and statutes are largely silent on the topic of beneficial use, including a lack of a definition, as well as limited direct or indirect acknowledgment of practices that are normally considered beneficial use.

## 2.2 Candidate Waste Materials

There are many unique waste materials that have been subject to beneficial-use requests and determinations at different states. Although several investigators have presented information regarding wastes that may be beneficially used, several recent efforts compiled information that included fairly extensive lists of wastes that have been subject to beneficial-use approvals or are beneficial use-related. For example, the Association of State and Tribal Solid Waste Management Officials (ASTSWMO) published two reports that summarized surveys that were conducted to identify beneficial use procedures in different U.S. states and territories, which included a listing of many wastes that have been the subject of a beneficial use requests (ASTSWMO, 2000; ASTSWMO, 2007). The US EPA (1994) published guidance regarding recycling and reuse of materials found at Superfund sites, which included a compendium of waste materials and technologies that are also commonly used as part of state beneficial use programs. Another example is an online database managed by the Northeast Waste Management Officials' Association (NEWMOA) that includes details regarding beneficial use requests and approvals from many states in the US (NEWMOA, 2012). The types of wastes included in a beneficial use program vary among states based on the generators located in or near a given state, as well as the regulatory scheme used in the state.

Given that the universe of wastes that are subject to beneficial use determinations is fairly vast, the types of waste materials examined in this report were selected based on those that are most commonly analyzed or included in state beneficial use programs. ***Figure 2-1*** presents a diagram showing a list of wastes commonly subject to beneficial use determinations, while **Appendix A** presents an expanded discussion of waste types, including a description of the waste and relevant research related to beneficial use or physical/chemical properties. The waste materials examined in this report are not intended to represent all wastes that could be beneficially used, but the selected materials that were examined are expected to provide a fairly complete picture of the major considerations normally used pertaining to evaluating a waste material for beneficial use.

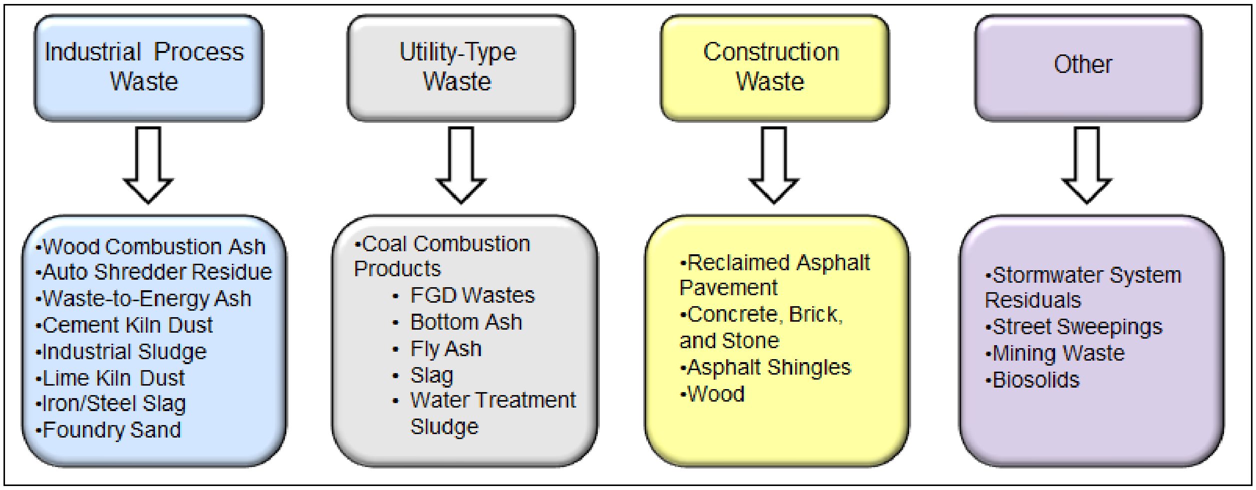

**Figure 2-1. Examples of Broad Categories and Specific Examples of Waste Materials Subject to Beneficial-Use Determinations**

## 2.3 Potential Benefits of Beneficial Use

The beneficial use of waste materials may have several positive results for waste material generators, end users, and others. A summary of potential benefits is provided in ***Table 2-1***.

**Table 2-1. Potential Benefits of Beneficially Using Waste Materials**

| Potential Benefit | Discussion |
|---|---|
| Reduced Waste Materials Management Costs | For a waste materials generator, identification of beneficial uses may help to decrease the generator's materials management costs. The magnitude of savings depends on the generator's disposal cost, proximity and availability of end users, and overall management costs such as permitting and recordkeeping. The tipping fee for disposal varies somewhat across the United States based on a variety of factors. As an example, ***Figure 2-2*** presents a representation of average tipping fees reported at MSW landfills in the United States based on data reported by van Haaren et al. (2010). Large industrial facilities may have on-site disposal facilities and, depending on the type of facility, extensive permitting and operations costs may be associated with the on-site disposal area, so limiting the use of such a facility would be expected to offset some of these costs. |
| Increased Recycling Rates | The beneficial use of waste materials would increase a generator's recycling rates compared to the case where all waste materials were disposed. |
| Decreased Carbon Footprint | In many cases, recycling and recovery of waste materials may decrease a generator's carbon footprint. For example EPA's Waste Reduction Model (WARM) tool for assessing greenhouse gas (GHG) and energy benefits associated with different waste management strategies finds that 0.24 tons of carbon dioxide equivalents are offset for every ton of coal fly ash beneficially used as a cement replacement in concrete, which is based on an estimate reported by the U.S. EPA (2006). |
| More Sustainable Materials Management | Beneficially using waste materials represents a more sustainable practice for both generators and end users. For generators, the amount of materials sent for disposal is decreased, while for end users, the extraction and use of virgin materials in many cases is decreased. |
| Reduced Manufacturing or Production Costs | End users that accept waste materials that can provide a benefit to a production or manufacturing process may realize cost savings compared to using virgin materials. |

As shown in ***Table 2-1***, there are several drivers—economic, environmental, and social—related to the beneficial use of waste materials. The presence and degree of each benefit depends on a multitude of factors, including the type, quantity, and nature of the waste material and the proposed end use.

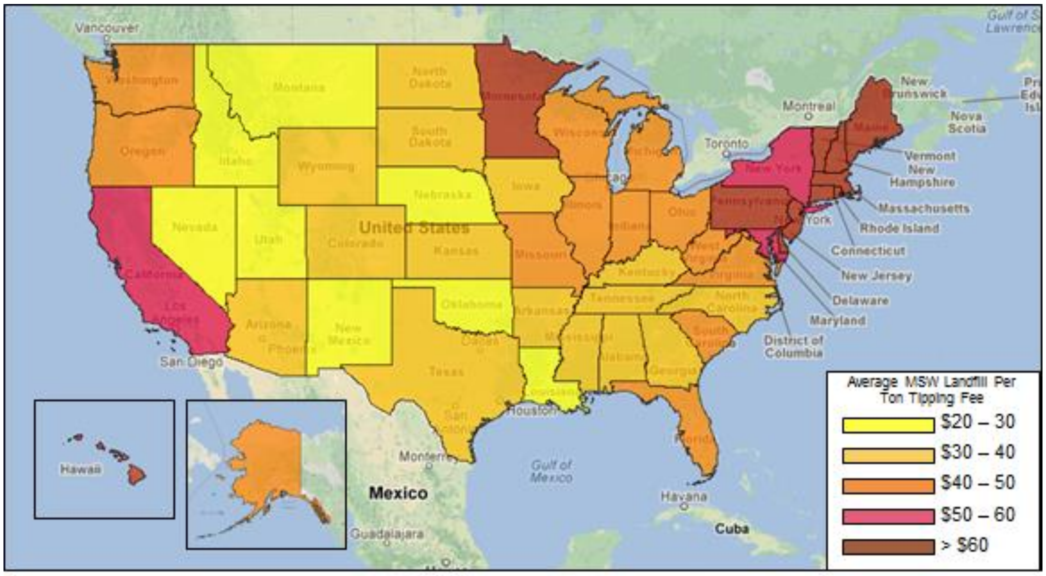

**Figure 2-2. Presentation of MSW Landfill Tipping Fees in the United States as of 2011**

**(adapted from WBJ [2012])**

## *2.4 Potential Limitations or Drawbacks of Beneficial Use*

While there are clearly benefits that may be offered by the use of waste materials as substitutes for ingredients or products, the reality is that several potential drawbacks associated with beneficial use may exist. ***Table 2-2*** summarizes the potential drawbacks related to beneficial use.

**Table 2-2. Potential Drawbacks of Beneficially Using Waste Materials**

| Potential Drawback | Discussion |
|---|---|
| Risk to human health and the environment | Many waste materials are created in a way that can concentrate chemicals to levels that are greater than were present in virgin resources (e.g., the combustion of coal or wood for energy production), although this is not always the case. Additionally, many waste materials are created through a treatment process designed to remove unwanted materials or chemicals (e.g., water treatment residuals, air pollution control residuals), so pollutant chemicals may be in the final byproduct that were not present in the original material. Thus, the materials may pose a risk to human health and the environment. The question of evaluating risk is also somewhat complex—a wide variety of risk standards are used and a variety of test procedures are employed as part of risk determination in each state. This is discussed in greater detail in **Section 3** of this report. |
| Whether a true benefit is being provided | An important consideration for beneficial use is ensuring that the use is providing a benefit to the user or the process, and avoiding a scenario where “sham recycling” occurs. Several states with beneficial use programs (as described in **Section 3**) have explicit provisions requiring generators to demonstrate that a beneficial use activity is truly providing a benefit. |
| Process changes and quality control | Some industrial processes may undergo slight to major changes during routine operations (e.g., the type of coal burned at a power plant may be changed, reducing the amount of flue gas scrubbing required, which can change the properties of air pollution control residuals). Thus, beneficial uses that are predicated on the residual achieving a certain chemical quality would be impacted. |
| Long-term performance of products made with waste materials and related life-cycle impacts | Long-term performance of a product made with a waste material is an important consideration and often represents an unknown. The major or trace chemical constituents present in a waste material likely differ somewhat from virgin resources that are used, so while some aspects of a waste material may meet a limited set of specifications for a product (e.g., the mix design used at a hot mix asphalt plant), unknowns may exist regarding how the waste material will impact the product long-term. There are several examples (e.g., using post-consumer asphalt shingles in hot mix asphalt) where extensive research and field demonstrations have been conducted, but this is not the case with many waste materials. Additionally, the life-cycle impacts – specifically the changes in the materials and associated potential risk to human health and the environment – of beneficially using waste materials could potentially result in negative impacts as the material degrades or deteriorates. |
| Accumulation of materials resulting from end use market forces | End use outlets for materials to be beneficially used are subject to market forces such as demand. Thus, economic conditions can lead to diminished quantities of beneficially used materials, which can result in the accumulation of the waste materials. This can lead to issues for waste material generators or processors because of time limits that are commonly imposed on waste material handlers to prevent speculative accumulation. |

As ***Table 2-2*** shows, several important considerations related to beneficial use could result in a beneficial use activity creating issues that, just as with the benefits of recycling waste materials, can have economic, environmental, and societal impacts.

## 2.5 Regulatory Considerations

### 2.5.1 Types of Beneficial Uses

Wastes have been beneficially used in a diverse number of applications, industries, and products. The nature of the reuse often plays a large role in the structure of a regulatory program, so a general discussion of the potential major reuse application scenarios is useful. In this section, beneficial use applications are described within one of the following four categories:

- Encapsulated use as an ingredient
- Encapsulated use as an aggregate
- Unencapsulated use as a fill material
- Unencapsulated use as an amendment.

While these four uses are described in concept below, specific examples and comparisons of how different regulatory programs manage beneficial use under these scenarios are presented in **Section 4**. The information presented in this section is intended to provide an overview of major types of beneficial uses. More specific discussion and descriptions of waste types and uses is presented in **Section 4** and **Appendix A**.

Note that for some regulatory beneficial use programs—especially those encompassing a wide breadth of waste recycling activities—some uses extend beyond those that fit in the four scenarios described in the following sections. Examples include paper and cardboard used as animal bedding and insulation, and automobile tires used for drainage media or as a fuel source. Additional beneficial uses involve alternate landfill cover material.

#### *Encapsulated Use as an Ingredient*

In many forms of beneficial use, the recycled material serves as an integral ingredient in the manufacture of a product, often substituting for a virgin material of similar quality and characteristics. In this case, the chemical composition of the beneficially used material plays an integral role in the production of a new product (conceptually illustrated in ***Figure 2-3***). A common example of this use category is the substitution of coal fly ash for a fraction of the Portland cement used in the manufacture of Portland cement concrete. This use and several other examples are described in ***Table 2-3***. Many of these wastes will also be presented in other use-scenario tables illustrating that, for some materials, multiple beneficial use options exist.

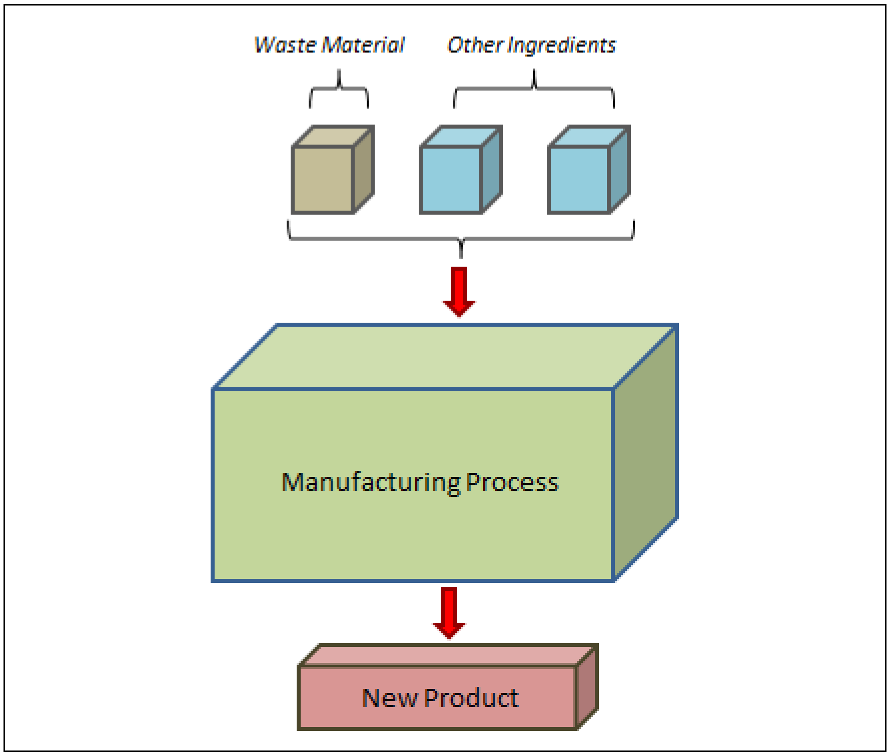

**Figure 2-3. Conceptual Illustration of "Encapsulated Use as an Ingredient" Beneficial-Use Scenario**

**Table 2-3. Examples of Waste Materials and Beneficial Use as an Encapsulated Ingredient in a Product**

| Waste Material | Example Beneficial Use as an Encapsulated Ingredient |
|---|---|
| Coal Fly Ash | Coal fly ash is used as an admixture as a replacement for (or an addition to) Portland cement and can be processed with cement clinker or blended with Portland cement to make blended cements. Class F fly ash (typically from burning anthracite or bituminous coal) is pozzolanic, with little or no cementing value alone, while Class C fly ash has self-cementing properties and pozzolanic properties. Depending on the class of fly ash used, the replacement rate can be up to 40% (by weight) or more. |
| FGD Byproduct | FGD byproduct from some coal combustion facilities consists predominantly of gypsum; thus, FGD byproduct is commonly used to replace virgin gypsum in the manufacture of gypsum drywall. |
| Foundry Sands,<br>Coal Bottom Ash,<br>Mill Scale | Many waste products are used as raw ingredients in the manufacture of Portland cement. They provide raw elements in the thermal manufacturing processing, including silica, iron, aluminum, and calcium. |
| Asphalt Shingles | When used in the manufacture of new hot mix asphalt pavement, the bituminous cement (asphalt) in the shingles substitutes for some new asphalt cement in the manufacture of new pavement. Note: the mineral content of the shingles also serves as a partial aggregate replacement. |
| Lime Softening Drinking Water Sludge | Sludge from softening water treatment facilities can be recalcined to make new lime for other lime applications, such as water treatment. Lime softening sludge has been used as a replacement for virgin lime in scrubbers in air pollution control facilities. |

Substitution of a waste for a virgin material in the manufacture of a product represents a high-value use for a waste product. Given that in many of these applications, the waste is chemically transformed during the process or has the desirable chemical properties to substitute for virgin material, beneficial use in this category may, in some programs, be allowed without the need for regulatory approval or testing. Such allowance is conditioned on the presumption that the waste plays a legitimate role as an ingredient in the process and that the chemical content of the waste is not substantially different from the material it is replacing.

### Encapsulated Use as an Aggregate

Another common request for beneficial use is as a substitute for aggregate (fine and coarse stone) in concrete (both Portland cement concrete and asphalt concrete). While the final product is encapsulated, this use scenario differs from the previous one in that the waste does not act as an ingredient needed because of its chemical properties, but instead serves to provide structural support to the product, replacing chemically inert stone (conceptually illustrated in ***Figure 2-4***). Many wastes have been utilized or proposed for use as an aggregate in Portland cement or asphalt concrete, as illustrated in ***Table 2-4***.

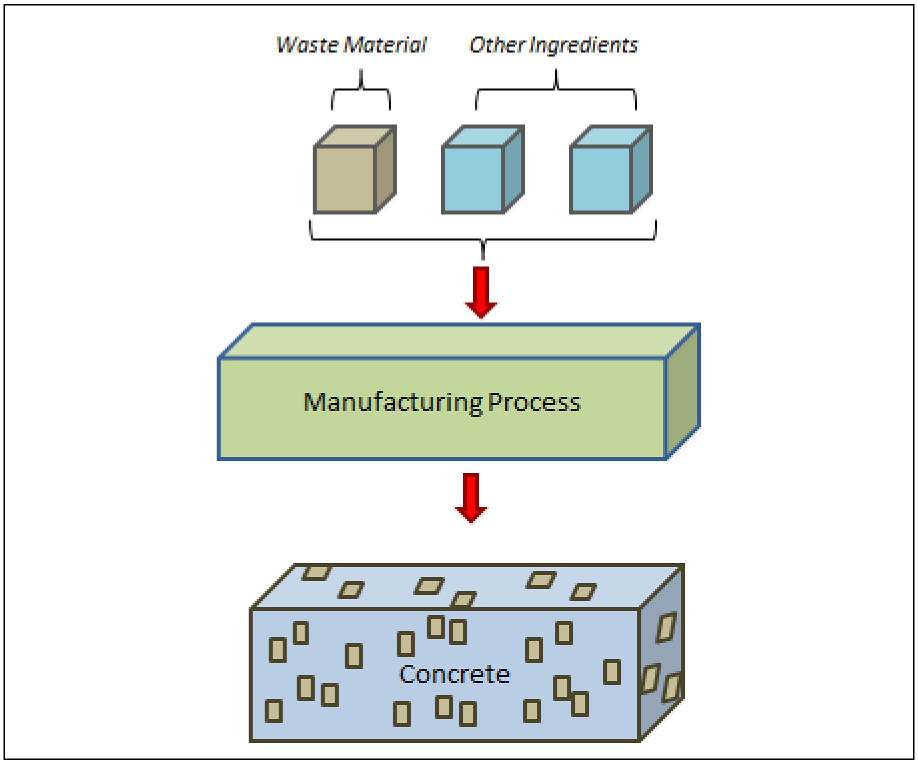

**Figure 2-4. Conceptual Illustration of "Encapsulated Use as an Aggregate" Beneficial-Use Scenario**

**Table 2-4. Examples of Waste Materials Used or Proposed for Use as an Aggregate in Concrete or Pavement**

| Example Waste Materials | |
|---|---|
| Foundry sand | Steel slag |
| Wood combustion ash | Chipped tires |
| Contaminated soil | Glass |
| Waste-to-energy ash | Reclaimed concrete, brick, and stone |
| Milled asphalt pavement | Coal combustion ash and slag |

Unlike use an ingredient, the use as an aggregate does not require that the chemical content of the waste be similar to the virgin material that it is replacing (rock or stone), though certainly the physical, chemical, and mechanical properties should be demonstrated to justify that the waste material provides a comparable benefit to the material it is replacing. Thus, regulatory programs consider the chemical content of the waste and/or final product, and the potential risk posed to human health and the environment as a result of chemical migration from the encapsulated product.

### Un-encapsulated Use as Fill Material or Manufactured Soil

Many candidate wastes have physical properties similar to stone or soil, and thus, another very commonly proposed beneficial use of such materials is as fill materials in construction projects or as a manufactured soil product. Applications include road base (as a substitute for crushed stone); fill for foundations, embankments, and site grading (as a substitute for soil); and use as a soil substitute (see ***Figure 2-5*** for a conceptual illustration). Many of the materials proposed for use as aggregate in the previous section are also commonly proposed fill candidates, as the specification for use as an aggregate may be too rigorous and because the demand for fill material in construction projects is large. Many wastes have been utilized or proposed for use as fill material in construction products, as illustrated in ***Table 2-5***.

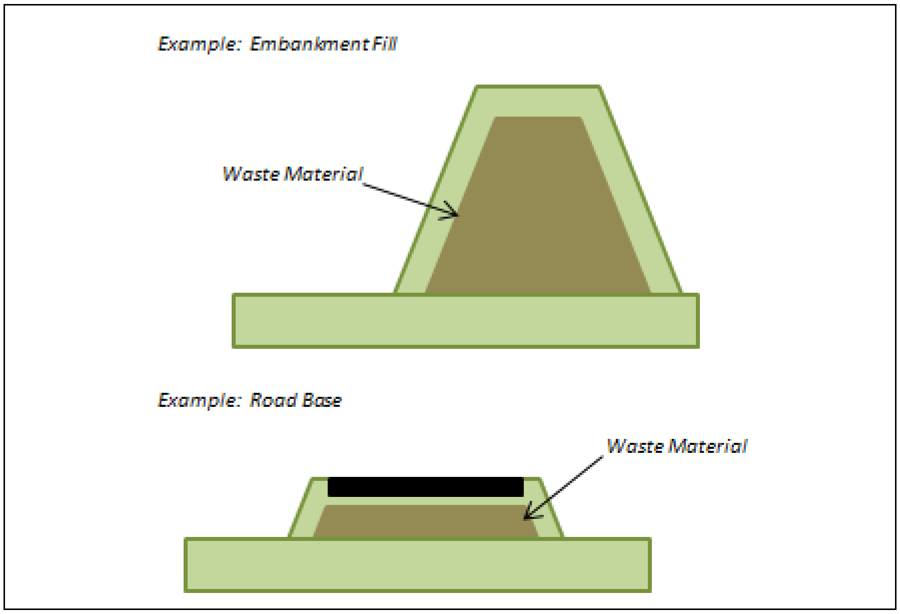

**Figure 2-5. Conceptual Illustration of "Un-encapsulated Use as a Fill Material or Manufactured Soil" Beneficial-Use Scenario**

**Table 2-5. Examples of Waste Materials Used or Proposed for Use as a Fill Material or Manufactured Soil**

| **Example Waste Materials** | |
|---|---|
| Foundry sand | Wood combustion ash |
| Pulp and paper mill sludge | Street sweepings |
| Chipped tires | Contaminated soil |
| Fines from C&D debris recycling | Dredged sediment |
| Glass | Waste-to-energy ash |
| Agricultural residues | Milled asphalt pavement |
| Stormwater cleaning system residuals | Coal combustion products |

Similar to the aggregate use, this fill and manufactured soil scenario does not require that waste have a particular chemical composition, though both the physical (e.g., density, strength) and chemical (e.g., pH, organic matter) makeup of the waste will affect use options for the material. Unlike the aggregate application, however, use as a fill material is not encapsulated and is much less limited in terms of the numbers and types of projects where such wastes might be utilized. The potential for unintended risks to human health and the environment from an improper application is magnified, and thus necessitates an increased degree of evaluation and scrutiny prior to permitting such use. The potential for direct human contact is much greater when waste materials are used as a substitute for soil, and regulatory programs must address multiple potential sites of application, including those near residences.

### *Unencapsulated Use as an Amendment*

In a different fashion from the bulk fill and manufactured soil, waste materials may still be applied to the land in an un-encapsulated fashion, but at a much lower rate than bulk fill. In these cases, the materials are added to the land to provide some agronomic benefit, either specifically targeting a need for a crop, or to improve the overall quality of the soil system in general. Benefits that land application of these waste materials bring to the crops include pH adjustment, increasing organic matter content, and addition of nutrients. Examples of un-encapsulated application of waste materials as an amendment to the land are described in ***Table 2-6***.

**Table 2-6. Examples of Waste Materials Used or Proposed for Use as a Land Application Amendment**

| Example Waste Material | Benefit Provided in Land Application Setting |
|---|---|
| Wastewater treatment plant biosolids | Nutrients; organic matter |
| Cement kiln dust | Liming agent |
| Lime softening drinking water sludge | Liming agent |
| Wood combustion ash | Liming agent |
| Iron coagulant drinking water sludge | Iron |
| FGD sludge | Calcium and sulfur |
| Recovered drywall | Calcium and sulfur |
| Phosphogypsum waste | Calcium and sulfur |
| Agricultural residues | Nutrients; organic matter |

Similar to beneficial use as a fill material, land application of a waste as a soil amendment faces the concerns of a potentially greater exposure to humans and ecosystems, with a possible added concern related to exposure from agricultural food products and exposure to grazing animals. Differently, however, this application does rely on the chemical nature of the applied material, and in many cases, the beneficially used wastes are being directly substituted for similar virgin materials (e.g., cement kiln dust replacing agricultural lime). Thus, the chemical comparison to the substituted virgin material, similar to beneficial use as a raw ingredient in product manufacturer, is an important consideration. When assessing the risk, the nature of the final form of the waste—mixed with soil as opposed to a replacement for soil—is a consideration of potential importance, as the constituent concentrations in the waste material and degree of blending with other soil that occurs may impact the type of setting (e.g., residential or commercial/industrial) where the material can be applied because of potential exposure scenarios such as wind-borne dust or surface water or groundwater impacts.

### 2.5.2 Regulatory Program Approaches

Specific examples of regulatory approaches for beneficial use at the federal (for a small group of specific wastes) and the state level (well-defined programs for many states) will be described in **Section 3**. Prior to this discussion, basic components of a regulatory program for beneficial use are outlined. For some wastes, specific regulations may already exist that address the management of a waste in one of the manners described previously without any specific mention of the term beneficial use. These regulations may have been developed with many of the same considerations described here for specific beneficial programs. The remainder of this discussion, unless otherwise noted, focuses on approaches and considerations for a specific beneficial use program.

A state's beneficial use program will normally be managed though the waste management section of the appropriate regulatory agency, though in some cases, other programs (e.g., waste cleanup programs to evaluate potential risk or water or agricultural programs to evaluate land application proposals) may be involved as well. As will be described in the following section, some states possess very clear regulatory language and well-developed policies or guidelines for beneficial use; others do not. ***Figure 2-6*** presents several questions that are typically considered by regulatory agencies when examining the potential beneficial use of a waste material.

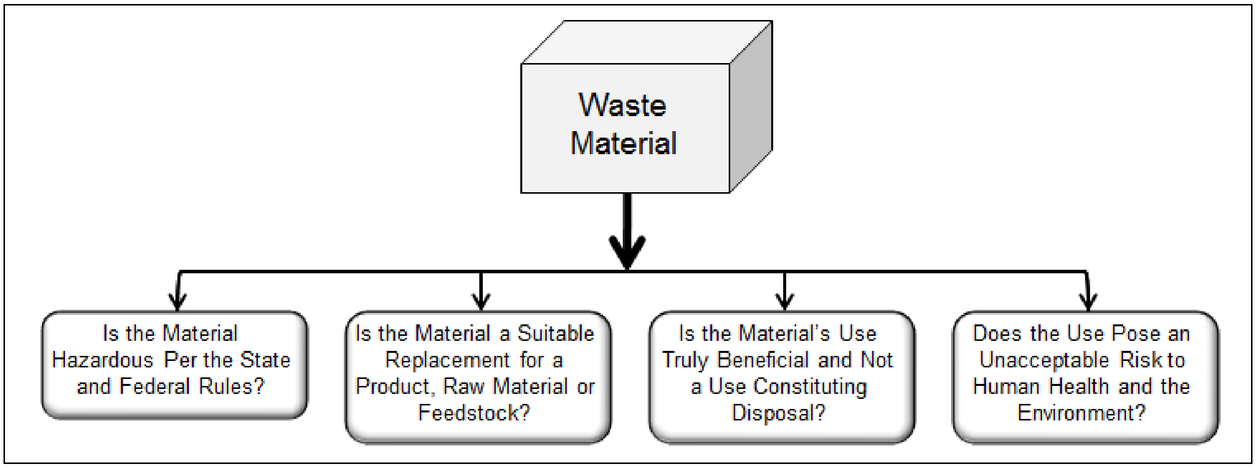

**Figure 2-6. Illustration of Typical Factors that Are Considered by Regulatory Agencies When Examining Beneficial Use for a Waste Material**

The challenge for the regulatory agency is to provide a permitting or authorization structure that meets the objectives of protecting human health and the environment, but at the same time, does not create major impediments that discourage beneficial use activities. The risk assessment process used during beneficial use determinations is one of several factors considered during decision-making; other factors include economic aspects as well as social aspects, though in terms of regulatory language, the major focus is often on technical, human health, and environmental considerations.

State regulatory programs make the determination of whether a particular beneficial use of a specific waste meets the requirements and objectives of the state's regulations and policies. This process is typically referred to as a beneficial use determination (BUD). A common approach used in state beneficial use programs is to publish (a) BUDs for specific wastes that have been determined appropriate such that any generator/user that meets the requirements of the BUD can use the waste and (b) a procedure for waste generators to apply for a case-specific BUD.

BUDs that a state has already made a decision that applies to a waste stream in general (not a specific generator)—sometimes referred to as a standing use determination or preapproved beneficial use—may or may not require some degree of additional testing. Is some cases, approval is granted as long as the identified waste stream and management option are met. In other cases, approval is contingent upon the waste meeting specific testing requirements for the chemical content of the waste. When analytical testing is required, states may require the results be submitted and, in other cases, the generator is simply required to maintain testing records and make them available upon request. ***Figure 2-7*** conceptually illustrates the impact that the level of waste material characterization and evaluation has on regulatory agency resources and involvement. Some states (e.g., Oregon) levy BUD processing fees based on the level of staff resources required for a given BUD type.

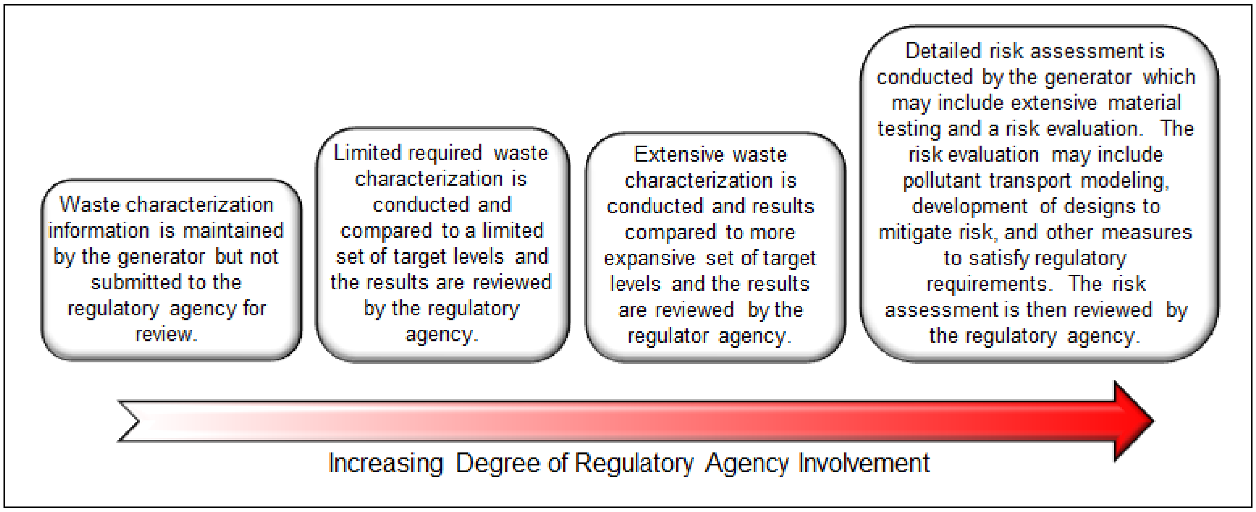

**Figure 2-7. Examples of Options Illustrating Potential Level of Regulatory Agency Review for Beneficial Use of Waste Materials**

While ***Figure 2-6*** presents the major categorical questions regulatory agencies evaluate when considering beneficial use, the process for making a BUD on a case-by-case basis is typically more detailed. For case-by-case determinations, the regulatory program provides application forms and specific data that must be included as part of the application form. Application requirements from several states (e.g., Arkansas, Illinois, Iowa, Minnesota, and Montana) were analyzed, and the common elements of the application requirements were generalized and summarized, as shown in ***Table 2-7***.

**Table 2-7. Summary of Typical Beneficial Use Application Requirements Based on a Review of Provisions in Several States**

| Example Beneficial Use Application Submittal Requirement | |
|---|---|
| Identifying information about the generator (e.g., name, contact information, location where the waste is generated). | A description of the waste, how it is generated, and the amount generated. |
| A description of the intended amount to be used and the intended use. | Information substantiating that the waste has the properties and characteristics that make it suitable as a replacement in the proposed use |
| Results of chemical testing | An assessment of potential impact on human health and the environment |
| A description of routine sampling or other steps that that will be conducted to ensure that the waste remains similar in characteristic to the tests presented with the application. | Evidence that a market for the waste exists, and a description of where the waste will be used and how it will be distributed. |
| A description of how the waste will be stored and appropriately managed to meet other applicable solid waste regulations. | Documentation that interested and affected parties (e.g., land owners for land application-related uses) have been provided appropriate notification. |
| A description of what mechanisms are in place to ensure that waste being used in the application remains in the intended environment. | Demonstration that the proposed use is providing an actual benefit and is not a use constituting disposal. |

The degree of detail required varies among programs, but the intent of requiring the information such as that provided in ***Table 2-7*** is to provide state program officials with sufficient detail about the proposed use to make a determination as to whether the use is appropriate under state program regulations. In some cases, very specific testing requirements and risk assessment techniques will be outlined in the program. In other cases, the applicant must conduct their own risk assessment using established techniques, or the regulator must assess the potential risk based on the chemical data provided. The following section describes the typical approaches used for assessing risk to human health and the environment.

### 2.5.3 Assessing Environmental Risk

At some point in the BUD process, a determination of whether the human health and environmental risk posed by a proposed use is acceptable or not is often made. Based on a review of chemical analysis data and related characterization information required by states (individual state summaries are provided in **Appendix B**), multiple considerations play a role in the environmental risk assessment process, as summarized in ***Figure 2-8***.

For some states, the factors listed in ***Figure 2-8*** are specifically addressed in the statutes or regulations. For example, some states are required to address ecological risk as part of a BUD. In some states, the appropriate level of cancer risk is dictated by statute. The various approaches used to incorporate these considerations into a beneficial use program are described and discussed in the remainder of this report. The rest of this chapter focuses on the common methods for using analytical data for chemical concentrations from a waste and making decisions regarding risk.

#### *Risk Pathways*

An approach to examine risk could be to conduct a site- and waste-specific risk assessment, the process of which is well-developed as a result of efforts that regulatory agencies have placed on determining appropriate clean up criteria for hazardous waste and contaminated sites. The difficulty with applying a detailed site-specific risk assessment, however, is that the application of a beneficially used waste, or products containing these wastes, will normally occur at multiple locations of final disposition (and at potentially varying application or loading rates), not one specific location where conditions are constrained. Thus, an alternative approach that many regulatory agencies rely upon is to provide a generic set of risk-based target thresholds that are not specific to any particular waste or reuse application, and in many cases, were developed as criteria to be met for remediating contaminated sites.

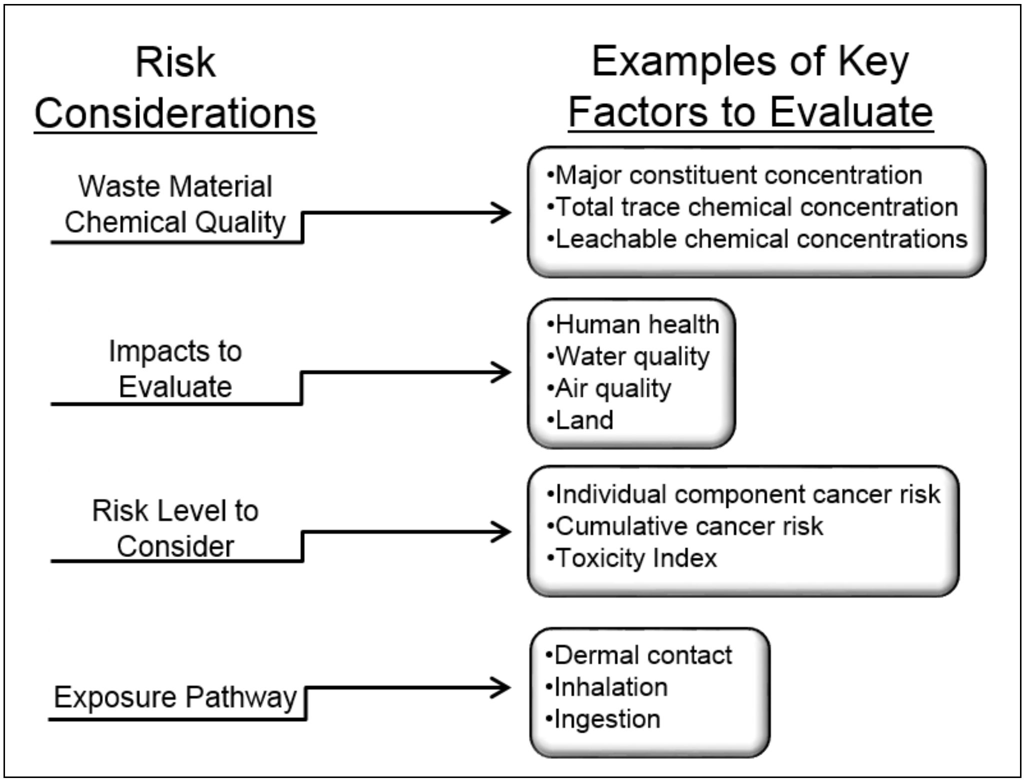

**Figure 2-8. Illustration of Typical Factors that Are Considered by Regulatory Agencies When Examining Beneficial Use for a Waste Material**

The potential or likely risk pathways are normally established early in the process, followed by more detailed analysis of the selected risk pathways. In most programs that use risk-based thresholds, the risk pathways considered normally include direct human exposure, groundwater impacts, and surface water impacts.  Additional risk pathways may include air impacts (e.g., dust), impacts to soil, and ecological impacts. Routes of potential direct exposure include ingestion, inhalation, and dermal contact. Risk evaluation of groundwater and surface water impacts involves assessing how much of a chemical will migrate from the waste into water, such as when rainfall, groundwater, or surface water comes into contact with the beneficially used material – a common approach to conduct this analysis involves the use of contaminant transport model. The concern of this risk pathway is contamination of a water supply (and eventual contact or consumption by humans, animals, or plants).

To address these pathways, thresholds are provided for two different measurements. The total concentration of a constituent of concern (COC) in a waste (units = mg/kg on dry weight basis) is most often used to assess the potential risk to humans (and possible target organisms into an ecosystem) that are directly exposed to the waste. Scientists have developed protocols for assessing the added risk to a human that have contact with the waste. A measurement or estimate of the fraction that leaches is necessary because, for some wastes and COCs, the bulk of the COC is bound on and encapsulated in the material, and thus will be expected to migrate into water at a slow rate. When assessing risk from leaching, common practice is to measure or estimate (from the total content) a water-phase concentration (mg/L) for the COC.

The development of generic, risk-based thresholds (e.g., in units of mg/kg-dry) follows standard approaches used for waste site risk assessment but rely on exposure conditions (e.g., amount of material ingested, body weight of individual), COC toxicity (e.g., slope factor for carcinogens, reference dose of non-carcinogens), and target risk. Generic risk-based thresholds for water concentration (e.g., units of mg/L) follow a similar approach as for direct exposure, but are based on COC risk posed by water consumption. In many states, the federal drinking water standards (which were developed using some of the approaches described previously) are adopted as the risk-based thresholds when examining risk to groundwater.

In a BUD application, the waste generator will collect an appropriate number of samples and have these samples analyzed for both total (mg/kg) and leachable (mg/L) concentrations of concern. In several cases, the waste generator can apply generator knowledge during the BUD process, which allows the generator to present known information about the product to refine the list of constituents of concern. If direct exposure is an appropriate risk pathway for the proposed beneficial use, the total concentration will be compared to the direct exposure risk-based thresholds, and concentrations above the threshold suggest a potential concern. If leaching to groundwater is an appropriate risk pathway, some programs may allow the total concentration to be compared to a leaching-derived total concentration risk threshold, but the more common approach compares the concentrations measured in the extract of leaching test and to compare these results to the risk-based water concentration threshold. Similarly, if measured leaching concentrations are above the risk-based threshold, a potential concern is indicated.

### Approaches to Assessing Leaching Risk

To examine the potential for groundwater contamination (or potential other water sources) in a BUD application, the mobility of a COC when the waste is exposed to water must be assessed (as opposed to the total concentration of a COC). The mobility of a COC from a waste will depend on many factors, including:

- The total concentration of COC in the waste or waste-amended product.
- The chemical form of the COC in the waste or product and its solubility in the aqueous environment in contact with the waste. Solubility will depend on factors such as pH, oxidation reduction potential, and other chemical species present.
- The relative ratio between the waste and the contacting solution (typically referred to as the Liquid to Solid Ratio [L/S]).
- The form and size of the waste and its contact with the leaching solution.

Numerous types of leaching tests have been utilized to characterize wastes, and they can generally be categorized into three major categories: laboratory batch extraction tests, column tests, and the field-scale tests. Batch tests are the ones most commonly utilized as part of environmental regulatory programs, and a number of commonly used tests (as well as some newly developed tests) are presented in ***Table 2-8***.

A limitation to using existing batch tests such as the Toxicity Characteristic Leaching Procedure (TCLP) or Synthetic Precipitation Leaching Procedure (SPLP) is that it only captures one set of conditions, when in reality many other factors may control COC leaching in the environment where a waste is beneficially used. Researchers have long looked at alternative leaching experiments to evaluate controlling factors such as pH, liquid to solid ratio, and leaching kinetics, and EPA is the process of adding a suite of new leaching procedures to its compendium of test methods (two of the four tests that are part of the leaching environmental assessment framework recently were approved as SW-846 methods), with one of the goals being able to utilize these tests for characterization of beneficial use applications. These methods are described in ***Table 2-8***.

### Table 2-8. Summary of Waste Material Leaching Procedures and Possible Use of Leaching Procedure in the BUD Process

| Leaching Procedure | Description and Possible Use in BUD Process |
|---|---|
| Toxicity Characteristic Leaching Procedure (TCLP, EPA Method 1311) | Method used to determine whether a solid waste is toxicity characteristic hazardous waste under RCRA; also used in hazardous waste treatment rules. Batch procedure where 100 g of waste is leached with 2 L of a buffered acetic acid solution for 18 hours. Some states allow TCLP to assess chemical leachability in BUD, but the acetic acid leaching is not normally thought to be representative of beneficial use scenarios. |
| Synthetic Precipitation Leaching Procedure (SPLP, EPA Method 1312) | Similar method to TCLP, but uses a synthetic rainwater instead of acetic acid solution. Commonly used by states to evaluate beneficial use. |
| California Waste Extraction Test (WET) | A batch test used in California for hazardous waste determination. Uses a citric acid solution and a 10:1 liquid to solid ratio. |
| ASTM Shake Extraction of Solid Waste with Water or Neutral Leaching Procedure (ASTM D 3987-85) | A batch test that provides for the shaking of an extractant (e.g., water) and a known weight of waste of specified composition to obtain an aqueous phase for analysis after separation. The final pH of the procedure is intended to reflect the interaction of the liquid extractant with the buffering capacity of the tested solid waste. A 20:1 liquid to solid ratio (by weight) is used. The extraction procedure is intended to simulate conditions where the solid waste is the primary factor impacting pH of the extract. The test is not applicable to organic constituents. |
| Multiple Extraction Procedure (MEP, EPA Method 1320). | The test was designed to simulate the leaching that a solid waste will undergo from repetitive precipitation of acidic rain on a landfill to assess the highest concentration of each constituent that is likely to leach in a real-world environment. The MEP is used in EPA’s hazardous waste delisting program. A 16:1 liquid to solid ratio is used. The procedure includes an extraction procedure similar to TCLP and re-extracted using a solution similar to SPLP. |
| Liquid-Solid Partitioning as a Function of Extract pH for Constituents in Solid Materials using a Parallel Batch Extraction Procedure (EPA Method 1313) | A method that was recently added to SW-846 in 2012. Allows leachability to be evaluated at a series of different pH environments. This has potential applicability to beneficial scenarios where chemical mobility of a desired pH or ranges of pH values requires examination. |
| Liquid-Solid Partitioning as a Function of Liquid-Solid Ratio for Constituents in Solid Materials using an Up-flow Percolation Column Procedure (EPA Method 1314) | A recently developed test that will soon be added to SW-846. Allows leachability to be evaluated as a function of liquid to solid ratio. This has potential applicability to beneficial scenarios where chemical mobility of a waste applied in a bulk fill fashion where water will infiltrate through over time. |
| Mass Transfer Rates of Constituents in Monolithic or Compacted Granular Materials using a Semi-dynamic Tank Leaching Procedure (EPA Method 1315) | A recently developed test that will soon be added to SW-846. Allows leachability to be evaluated for wastes that are encapsulated or compacted. This has potential applicability to beneficial scenarios where wastes are ingredients or encapsulated in products, or where wastes are compacted in place. |
| Liquid-Solid Partitioning as a Function of Liquid-Solid Ratio for Constituents in Solid Materials using a Parallel Batch Extraction Procedure (EPA Method 1316) | A method that was recently added to SW-846 in 2012. Similar to Method 1314, this test allows leachability to be evaluated as a function of liquid to solid ratio, but in a more rapid fashion than a column test. This has potential applicability to beneficial scenarios where chemical mobility of a waste applied in a bulk fill fashion where water will infiltrate through over time. |

While one decision that must be made in the BUD application process is the appropriate leaching procedure to be performed, an equally challenging question is how best to interpret the leaching results. The objective of the groundwater risk assessment in the BUD process is to determine whether a waste will result in an exceedance of an applicable standard or threshold, but determining what the leaching test concentration represents has been interpreted differently. For example, some states have interpreted SPLP results to represent a diluted concentration and thus require that SPLP results be compared directly to water quality thresholds. Other states allow the SPLP concentration to be modified by an expected dilution factor to account for the predicted impact on the environment. This issue has been discussed elsewhere (Townsend et al., 2006), who found that generic risk screening levels for leachable limits based on total concentrations were not appropriate, and comparison of SPLP results directly to water quality limits was found to be conservative. ***Figure 2-9*** represents a hypothetical beneficial use scenario and relevant points where a test result (such as a leaching test) could be applied and thus compared to a target level.

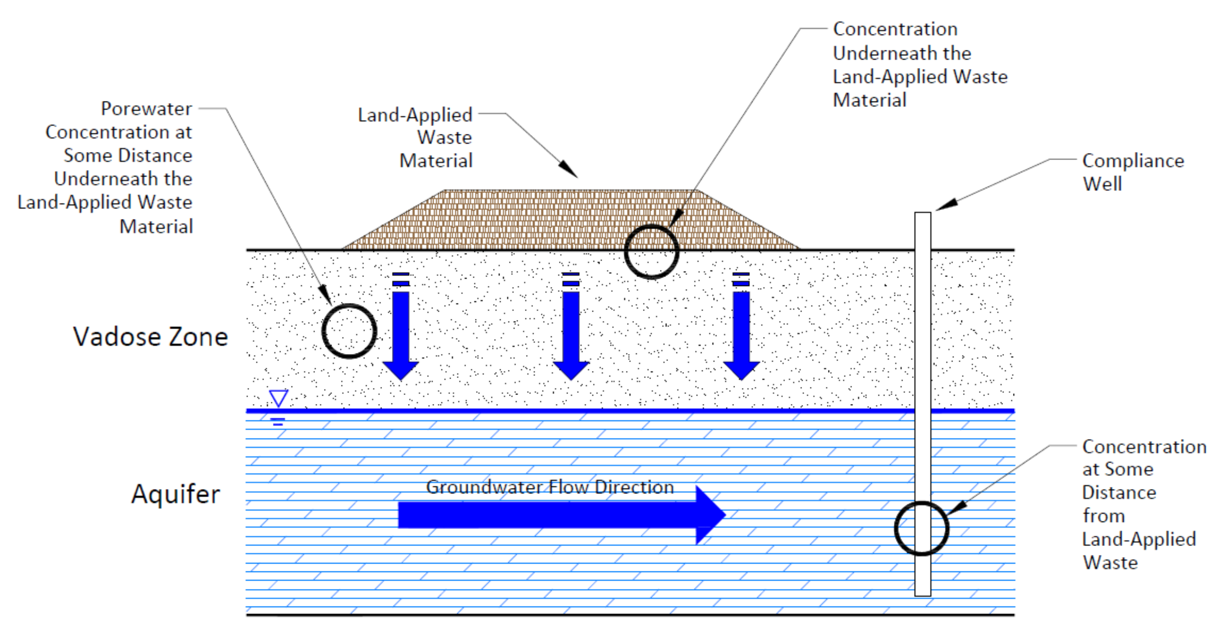

**Figure 2-9. Conceptual Illustration of Areas of Consideration with Respect to Evaluating Risk from a Land Application Scenario**

### 2.5.4 Examples of Tools Related to Beneficial Use of Waste Materials

During the BUD process, several tools may be used to assist regulatory agencies in understanding the technical merit of a given proposed beneficial use as well as potential risk factors. The list below presents a description of some of the more commonly-used pieces of information based on discussions with state agencies.

- Published information and data, including but not limited to technical journal articles, policy memoranda developed by state regulatory agencies, industry white papers.
- Publicly-available databases (e.g., the Beneficial Use Portal)
- Internet resources, including but not limited to the EPA industrial waste material websites
- Coordinated, multi-state efforts to share information. Two notable examples include:
  - The beneficial use database developed by NEWMOA. The database is available to state and regulatory agencies that provide data or information contributions to the database.
  - Technology Assistance and Reciprocity Partnership (TARP) was formed by several states (California, Illinois, Maryland, Massachusetts, New Jersey, New York, Pennsylvania, and

Virginia). The TARP program represents an effort to, among other objectives, facilitate information exchange between the member states regarding beneficial use of non-hazardous waste materials. A guidance document was developed that presents a series of uniform evaluation criteria to consider when making a BUD, though the guidance does not supersede state-specific regulatory requirements.

# 3. Current Regulatory Approaches

## *3.1 Federal Rules Pertaining to Beneficial Use*

The U.S. federal regulations provide detailed rules regarding the definition and management of hazardous waste and rules for landfills and incinerators managing household and commercial waste. However, a much broader universe of waste materials is produced every year that fall outside specific federal requirements. Federal regulations mostly do not specifically address the beneficial use of waste materials, but there are a few instances where beneficial use is acknowledged and cases where federal rules are used in guidance in many states related to beneficial use of waste materials. In the remainder of **Section 3.1**, examples where federal rules relate to beneficial use or where federal rulemaking that utilized risk assessment procedures similar to that used at the state level as part of beneficial use determinations are provided.

### 3.1.1 RCRA and Superfund

An example where federal rules have addressed beneficial use is found in RCRA, 40 CFR Part 261, which presents the definition of a solid waste. In the definition, several exclusions to the definition of solid waste and hazardous waste specifically address certain materials that are recycled, reclaimed, or reused in some fashion. For example, certain coke by-product wastes, which are created during the iron production process, were provided an exclusion from the definition of solid waste when they are recycled into new products (U.S. EPA, 2011). Another example is recovered oil from petroleum refining operations, which are often reused in the refining process and are afforded an exclusion from the definition of solid waste when the material is returned to the refinery.

U.S. EPA (1989) notes an example where a F006 electroplating sludge hazardous waste proposed for use as an ingredient in aggregate would be exempted from regulation as a solid waste if the aggregate was not placed on the land. Additionally, U.S. EPA (1989) provided a listing of criteria for evaluating whether a waste is being recycled, which were developed based on three Federal Register notices (53 FR at 522 (January 8, 1988), 52 FR at 17013 (May 6, 1987), and 50 FR at 638 (January 4, 1987))—these criteria are summarized below and are generalized so as not to be specific to hazardous wastes.

1. Is the material similar to an analogous raw material or product?
   a. Does it contain 40 CFR Part 261 Appendix VIII constituents not found in the analogous raw material/product (or at higher levels)?
   b. Does it exhibit hazardous characteristics that the analogous raw material/product would not?
   c. Does it contain levels of recoverable material similar to the analogous raw material/product?
   d. Is much more of the secondary material used as compared with the analogous raw material/product it replaces? Is only a nominal amount of it used?
   e. Is the secondary material as effective as the raw material or product it replaces?
2. What degree of processing is required to produce a finished product?
   a. Can the secondary material be fed directly into the process (i.e., direct use) or is reclamation (or pretreatment) required?
   b. How much value does final reclamation add?
3. What is the value of the secondary material?
   a. Is it listed in industry newsletters, trade journals, etc.?

   b. Does the secondary material have economic value comparable to the raw material that normally enters the process?
4. Is there a guaranteed market for the end product?
   a. Is there a contract in place to purchase the "product" ostensibly produced from the hazardous secondary materials?
   b. If the type of recycling is reclamation, is the product used by the reclaimer? The generator?
   c. Is the reclaimed product a recognized commodity?
   d. Are there industry-recognized quality specifications for the product?
5. Is the secondary material handled in a manner consistent with the raw materials/product it replaces?
   a. Is the secondary material stored on the land?
   b. Is the secondary material stored in a similar manner as the analogous raw material (i.e., to prevent loss)?
   c. Are adequate records regarding the recycling transactions kept?
   d. Do the companies involved have a history of mismanagement of hazardous wastes?
6. Other relevant factors.
   a. What are the economics of the recycling process?
   b. Does most of the revenue come from charging generators for managing their wastes or from the sale of the byproduct?
   c. Are the toxic constituents actually necessary (or of sufficient use) to the product or are they just "along for the ride"?

Another significant federal program that relates to beneficial use is the Superfund program. While the scope of Superfund is focused on addressing abandoned hazardous waste sites through assessment and remediation, a similarity to state beneficial use programs is the development and use of constituent contaminant limits (which are tied to risk-based thresholds) to determine when a contaminated medium meets remediation goals. In addition to Superfund, the beneficial use of waste materials that have been delisted as a hazardous waste has been addressed. For example, US EPA (2008d) technical support document related to the RCRA delisting process states that when a facility wants to reuse or recycle a hazardous waste, the facility must prepare and submit appropriate information to EPA (e.g., contaminant transport model results) for evaluation before the waste material can be delisted and used in the proposed manner.

### 3.1.2 Use and Disposal of Biosolids, 40 CFR Part 503

Biosolids are the solid waste resulting from the biological treatment of municipal wastewater in a domestic wastewater treatment plant. They are primarily organic in nature, but do contain nutrients, and thus offer benefits when beneficially used in a land application program. Biosolids do, however, contain trace pollutants that warrant testing and possible use limits to protect human health and the environment. EPA's biosolids rules (40 CFR Part 503) provide regulations governing the land application of biosolids, which includes criteria for heavy metal content, pathogen destruction, and vector attraction reduction. The heavy metal pollutant criteria were developed from a comprehensive risk assessment of multiple exposure pathways and ***Table 3-1*** provides a summary of risk pathways analyzed with respect to land application of biosolids as part of the 503 rulemaking.

In the risk assessment conducted by EPA as part of the 40 CFR 503 rulemaking for biosolids, the acceptable level of cancer risk from carcinogenic organic pollutants of $1 \times 10^{-4}$ (i.e., 1 case of cancer in a population of 10,000) was used for land application and surface disposal as well as the incineration scenarios. Note that pollutant limits for organics (13 total) were not included in the final Part 503 rule for various reasons (e.g., the chemical had been banned or restricted in use or manufacture in the United States, the chemical was not frequently detected in biosolids, or the limit for the pollutant identified in the risk assessment was not expected to be exceeded in biosolids that are used or disposed).

For risk target levels for inorganics such as metals, threshold limits such as risk reference doses were used, which represent the amount of daily intake of a substance that is not expected to cause adverse effects, which is considered to be an upper level of acceptable intake. The risk reference dose was then combined with pollutant intake or uptake information (e.g., the amount of a chemical constituent in biosolids taken up by plants that are then ingested by humans) to calculate a chemical constituent limit value.

**Table 3-1. Summary of Exposure Pathways Used in Risk Analysis for Land Application of Biosolids by the EPA as Part of 40 CFR 503 Rulemaking**

| Pathway | Description of Highly Exposed Individual |
|---|---|
| **1. Biosolids → Soil → Plant → Human** | Human (except home gardener) lifetime ingestion of plants grown in biosolids-amended soil |
| **2. Biosolids → Soil → Plant → Human** | Human (home gardener) lifetime ingestion of plants grown in biosolids-amended soil |
| **3. Biosolids → Human** | Human (child) ingesting biosolids |
| **4. Biosolids → Soil → Plant → Animal → Human** | Human lifetime ingestion of animal products (animals raised on forage grown on biosolids-amended soil |
| **5. Biosolids → Soil → Animal → Human** | Human lifetime ingestion of animal products (animals ingest biosolids directly) |
| **6. Biosolids → Soil → Plant → Animal** | Animal lifetime ingestion of plants grown on biosolids-amended soil |
| **7. Biosolids → Soil → Animal** | Animal lifetime ingestion of biosolids |
| **8. Biosolids → Soil → Plant** | Plant toxicity due to taking up biosolids pollutants when grown in biosolids-amended soils |
| **9. Biosolids → Soil → Soil Organism** | Soil organism ingesting biosolids/soil mixture |
| **10. Biosolids → Soil → Soil Organism → Soil Organism → Predator** | Predator of soil organisms that have been exposed to biosolids-amended soils |
| **11. Biosolids → Soil → Airborne Dust → Human** | Adult human lifetime inhalation of particles (dust) (e.g., tractor driver tilling a field) |
| **12. Biosolids → Soil → Surface Water → Human** | Human lifetime drinking surface water and ingesting fish containing pollutants in biosolids |
| **13. Biosolids → Soil → Air → Human** | Human lifetime inhalation of pollutants in biosolids that volatilized to air |
| **14. Biosolids → Soil → Ground Water → Human** | Human lifetime drinking well water containing pollutants from biosolids that leached from soil to ground water |

When establishing the use of a $1\text{x}10^{-4}$ risk level for carcinogens, the EPA noted that the aggregate risk from biosolids use in the United States is low; thus, a less restrictive risk limit (e.g., compared to a $1\text{x}10^{-6}$ risk level) was seen as appropriate to provide adequate protection (U.S. EPA, 1995). EPA (U.S. EPA, 1995) demonstrated that environmental protection was balanced with other considerations such as economic impacts by pointing out that, though not a determining factor in the development of the Part 503 rule limits, the use of a more stringent risk level would require thousands of facilities to achieve such limits, which would have placed an undue economic burden with limited difference in risk compared to the $1\text{x}10^{-4}$ risk level used in the final rule.

The final Part 503 rule recognized two categories for land application of biosolids: those applied in bulk to the land, and biosolids sold or given away in a bag or other container for land application. For bulk application, one of two pollutant limits must be met—pollutant concentration limits or the amount of a pollutant that is land applied must not exceed a cumulative pollutant loading rate. Pathogen and vector attraction reduction requirements must also be met in addition to the pollutant limits, as well as general requirements and management practices depending on the quality of the bulk biosolids.

For biosolids that are sold or given away in bags or containers, pollutant concentration limits must be met—these limits are the same as required for bulk biosolids land application—or the amount of pollutant land applied must not exceed an annual pollutant loading rate, which is used to calculate an application rate that is placed on a label on the bag or other container in which the sewage sludge is sold or given away. Bagged or containerized biosolids must meet the highest quality pathogen requirements and vector attraction reduction requirements. Like bulk biosolids, bagged or containerized biosolids is also subject to general requirements and a management practice depending on the quality of the biosolids.

Ultimately, the extent of the risk assessment conducted by the EPA was far-reaching, which is reflective of the number of facilities that would be affected by the rule-making. The exposure pathways evaluated go beyond that typically conducted for risk assessments for beneficial use conducted at the state level. The approaches used and the justifications made during the biosolids risk assessment (e.g., pollutant parameters of concern, the carcinogen risk level) are commonly used as a basis for beneficial use decision-making at the state level, as will be discussed in subsequent sections.

### 3.1.3 Land Application Under the Proposed Cement Kiln Dust Rule

In 1999, EPA published the Standards for the Management of Cement Kiln Dust (CKD) in the Federal Register (FR 1999), which proposed to allow CKD to be classified as a non-hazardous solid waste provided that specific management standards were met—the standards included those related to disposal facilities for CKD, dust control standards for those managing CKD, and pollutant concentration limits for cases where CKD is beneficially used as an agricultural amendment for soil pH adjustment. The specifics regarding the beneficial use standards and the methodology behind the development of pollutant limits is discussed below. Beneficial use of CKD under the proposed rule in 1999 afforded a generator exemption from management of the waste as a listed hazardous waste under the tailored Subtitle C management standards.

Analysis of trace constituent data for CKD by EPA indicated that four metals (arsenic, thallium, lead, and cadmium) may be present in CKD at levels that pose an unacceptable human health risk, which was defined as an excess of a $1 \times 10^{-5}$ individual lifetime cancer risk or a non-cancer hazard quotient of 1 in certain instances. EPA used this approach to define concentration limits for cadmium (22 mg/kg), lead (1,500 mg/kg), and thallium (15 mg/kg). However, EPA used an approach (alternative to using the $1 \times 10^{-5}$ individual lifetime cancer risk) for arsenic that considered typical arsenic concentrations of commercially-available agricultural lime. Based on data reviewed by the EPA, total arsenic concentrations in agricultural lime range from <1 mg/kg to 13 mg/kg, and based on that information, a limiting arsenic concentration of 13 mg/kg was proposed. EPA's rationale was that the specification of arsenic limits that were less than concentrations normally found in agricultural lime was impractical because the use of CKD at these concentrations would not constitute an increase in risk faced by anyone that used CKD as a substitute for agricultural lime.

In addition to the four metals described above, EPA proposed limiting concentrations for chlorinated dioxins and furans (collectively referred to herein as *dioxins*) using the same risk-based approach that was employed to establish limits for cadmium, lead, and thallium. The risk-based level was established based on a $1 \times 10^{-5}$ lifetime cancer risk and an assumed background soil concentration (8 parts per trillion [ppt] 2,3,7,8-TCDD toxicity equivalents [TEQ]) was established. Based on the background level established, the EPA calculated the maximum TEQ concentration of dioxins in CKD that would result in soil concentrations at or below 8 ppt TEQ—the concentration calculated in this scenario was 0.04 ppb, which was set as the proposed limiting concentration. Therefore, based on the proposed rules, CKD that exceeds the proposed concentration limit for dioxins cannot be used as a liming agent on agricultural soils.

The proposed rule specified a CKD application rate of 5 tons per acre of agricultural land every 2 years—the rate was set based on an assessment of technical literature, agricultural expert consultation, and physical and chemical properties of soil-CKD mixtures. The proposed rule indicated that application rates greater than 5 tons per acre every 2 years constituted disposal (i.e., not a legitimate beneficial use) and thus subject to RCRA regulation.

Following the proposed rules in the 1999 FR notice, the EPA published a notice of data availability (NODA) in the FR (FR 2002). This NODA notified the public of additional data and discussed a new approach to CKD management. The proposed standards would be finalized as a RCRA Subtitle D rule and temporarily suspend the proposed RCRA Subtitle C (hazardous waste) portion of the proposed rules for 3 to 5 years to assess how CKD management practices and regulatory programs evolve at the state level. No additional reported activity related to CKD rulemaking was identified (U.S. EPA, 2012).

## *3.2 State-by-State Review of Beneficial Use Programs*

### 3.2.1 Approach

The details of beneficial use programs in each state were examined using several resources. First, relevant solid waste and beneficial use–related statutes and regulations were identified and collected, mostly through state environmental agency websites. Related documents such as guidance reports and policy memoranda were also collected. Direct contact with specific state environmental regulatory personnel most directly involved with beneficial use was made to gather additional targeted information regarding procedures normally followed during the beneficial use process. Last, remaining data gaps were filled by examining relevant research or literature gathered in the past that related to beneficial use at the state level (e.g., the ASTSWMO surveys conducted in 2000 and 2007).

The statutes, regulations, and related guidance documents were reviewed to better understand the state of the practice regarding beneficial use of waste materials for each state and to identify relevant similarities and differences in program structure and implementation. Key topics examined included:

- Evaluating whether regulations or definitions specific to beneficial use existed.
- Identifying cases where, in the absence of beneficial use–specific rules, other mechanisms existed such as exclusions from the definition of solid waste.
- Evaluating the program structure to assess how beneficial use activities are approved or permitted (e.g., whether or not standing or pre-approved uses existed) in states with beneficial use programs.
- Understanding techniques used to evaluate risk to human health and the environment.
- Reviewing other factors besides risk that were evaluated as part of beneficial use determinations.
- Evaluating the examples of wastes that are specifically included in beneficial use programs.

The information gathered during the state evaluation was organized and analyzed – the compiled documentation from the state evaluation is presented in **Appendix B**. Major observations regarding state regulatory program structure and a broad discussion with specific examples related to standing BUDs and case-by-case BUDs is provided in **Sections 3.2.2**, **3.2.3**, and **3.2.4**.

### 3.2.2 State Regulatory Program Structure

The structure of a regulatory program related to beneficial use can vary, as the drivers of a beneficial use program may include the amount of industrial activity in a given state (which may impact the amount of waste produced and the number of available industrial end-users of waste materials), availability and type of land (which would relate to land application-related beneficial uses), and the location and size of environmentally sensitive areas, among other factors. The development of state regulatory programs for beneficial use can be impacted by other issues, including the regulatory agency's funding as well as other priority areas identified by the regulatory agency. For example, survey results reported by ASTSWMO (2007) indicated out of 40 responding states, only five states had staff dedicated to handling beneficial use–related issues at the agency, and of these five there were three instances where the agency dedicated at least one person full-time to beneficial use.

State rules, statutes, and guidance ultimately provide the framework that a given state executes a beneficial use program, and while instances of sometimes substantial variability were identified in the state review, generally programs can be classified as consisting of standing or pre-approved BUDs, case-by-case BUDs, or some combination. Strict classification of a state into these categories is complicated by the fact that some states include, for example, exclusions of certain recycling activities from regulation as a solid waste, where other states may classify the same recycling activity as falling under that state's beneficial use program. Despite these limitations, the data gathered from the states grouped each state into one of two categories: states with standing or pre-approved BUDs (which could include states that also allow case-by-case determinations) and states that only evaluate BUDs on a case-by-case basis.

### 3.2.3 Standing or Pre-Approved BUDs and Regulatory Exemptions

Many states allow beneficial use of designated materials for specific use applications under their rule program. The terminology for this distinction varies from state to state. In New York, for example, a list of beneficially used materials that are not considered solid waste (and thus not subject to solid waste regulation) are provided. Other states provide a list of wastes that are categorically approved for beneficial use (New Jersey), pre-approved for beneficial use (Colorado), and have standing beneficial use determinations (Minnesota, Oregon). Examples of these wastes are provided for New York (***Table 3-2***), New Jersey (***Table 3-3***), Colorado (***Table 3-4***) and Minnesota (***Table 3-5***).

Noticeable similarities among the different preapproved BUDs are applications such as coal fly ash used in concrete production, tire chips used in construction and drainage applications, concrete and asphalt used as aggregate in new concrete and pavement construction, and paper used as livestock animal bedding. Differences are noted for scenarios where bulk fill and agricultural applications are concerned. New York, for example, allows the use of coal fly ash and bottom ash as "structural fill within building foundations when placed above the seasonal high groundwater table" while New Jersey allows these products to be used "sub-base in roadway construction." Meanwhile, Minnesota provides a standing determination for coal fly and bottom ash to be used as an ingredient in concrete production and cement manufacture, but does not include a standing determination for fill applications.

Some states include analytical testing requirements as part of standing BUD provisions. For example, in Pennsylvania under General Permit WMGR046, a variety of solid wastes, including drinking water sludge, coal ash, foundry sand and dredged material can be used as manufactured soil as long as the conditions of the general permit are met. These include specific chemical testing requirements for both total and leachable concentrations of specified elements; the results do not have to be submitted to the state regulatory agency, but must be maintained on file.

**Table 3-2. Materials Not Considered Solid Waste Under New York's Beneficial Use Program Per Chapter IV, Subchapter B, Subpart 360 Regulations**

| |
|---|
| Compost and other waste derived soil conditioning products from facilities that are exempt or registered under this Part, and products that satisfy the applicable requirements of the rule. |
| Unadulterated wood, wood chips, or bark from land clearing, logging operations, utility line clearing and maintenance operations, pulp and paper production, and wood products manufacturing, when these materials are placed in commerce for service as mulch, landscaping, animal bedding, erosion control, wood fuel production, and bulking agent at a compost facility operated in compliance with the rule. |
| Uncontaminated newspaper or newsprint when used as animal bedding. |
| Uncontaminated glass when used as a substitute for conventional aggregate in asphalt or subgrade applications; |
| Tire chips when used as an aggregate for road base materials or asphalt pavements in accordance with New York State Department of Transportation standard specifications, or whole tires or tire chips when used for energy recovery. |
| Uncontaminated soil that has been excavated as part of a construction project, and that is being used as a fill material, in place of soil native to the site of disposition. |
| Nonhazardous, contaminated soil that has been excavated as part of a construction project, other than a department-approved or undertaken inactive hazardous waste disposal site remediation program, and that is used as backfill for the same excavation or excavations containing similar contaminants at the same site. Excess materials on these projects are subject to the requirements of this and related rules. |
| Nonhazardous petroleum contaminated soil that has been decontaminated to the satisfaction of the department and is being used in a manner acceptable to the department. |
| Solid wastes that are approved in advance, in writing, by the department for use as daily cover material or other landfill liner or final cover system components pursuant to the provisions of appropriate rules when these materials are received at the landfill; |
| Recognizable, uncontaminated concrete and concrete products, asphalt pavement, brick, glass, soil and rock placed in commerce for service as a substitute for conventional aggregate. |
| Nonhazardous petroleum contaminated soil when incorporated into asphalt pavement products by a producer authorized by the department. |
| Unadulterated wood combustion bottom ash, fly ash, or combined ash when used as a soil amendment or fertilizer, provided the application rate of the wood ash is limited to the nutrient need of the crop grown on the land on which the wood ash will be applied and does not exceed 16 dry tons per acre per year. |
| Coal combustion bottom ash placed in commerce to serve as a component in the manufacture of roofing shingles or asphalt products; or as a traction agent on roadways, parking lots and other driving surfaces. |
| Coal combustion fly ash or gas scrubbing by-products placed in commerce to serve as an ingredient to produce light weight block, light weight aggregate, low strength backfill material, manufactured gypsum or manufactured calcium chloride. |
| Coal combustion fly ash or coal combustion bottom ash placed in commerce to serve as a cement or aggregate substitute in concrete or concrete products; as raw feed in the manufacture of cement; or placed in commerce to serve as structural fill within building foundations when placed above the seasonal high groundwater table. |

### Table 3-3. Materials Categorically Approved for Beneficial Use Per the August 2009 New Jersey BUD Approval Process Guidance Document

| |
|---|
| Aggregate in asphalt or concrete applications; |
| Tire chips that are used as aggregate for road base materials or asphalt pavements in accordance with New Jersey Department of Transportation standard specifications, or whole tires or tire chips when they are used for energy recovery; |
| Soils for on-site reuse that contain contaminants at levels below the most stringent site clean-up levels established by the Department for that specific site, except for sites located in the Pinelands Area. |
| Contaminated soil that has been decontaminated to the satisfaction of the Department and is used or reused in a manner acceptable to the Department. |
| Non-hazardous solid waste, paper mill fiber (fiber from either virgin pulp or recycled paper mills) or paper fiber combustion ash (ash produced by incineration of paper mill fiber and paper de-inking sludge by-products) approved in advance by the Department for use or reuse as cover material, landfill liner, cap material, or other landfill design and management components. |
| Coal combustion bottom ash or paper fiber combustion ash (ash produced by incineration of paper mill fiber and paper de-inking sludge by-products) that is used or reused as a component in the manufacture of roofing shingles or bituminous asphalt products. |
| Coal combustion fly ash, gas scrubbing by-products or paper fiber combustion ash (ash produced by incineration of paper mill fiber and paper de-inking sludge by-products) that is used as an ingredient to produce light-weight block, light-weight aggregate, manufactured gypsum or manufactured calcium chloride. |
| Coal combustion fly ash, coal combustion bottom ash or paper fiber combustion ash (ash produced by incineration of paper mill fiber and paper de-inking sludge by-products) that is used as a cement or aggregate substitute in structural concrete, structural concrete products, as a raw feedstock in the manufacture of cement or as a cement substitute for structural grade products, or sub-base in roadway construction. |
| Coal combustion fly ash, coal combustion bottom ash or paper fiber combustion ash (ash produced by incineration of paper mill fiber and paper de-inking sludge by-products) that is used as an aggregate substitute in structural asphalt product. |

### Table 3-4. List of Pre-Approved Beneficial Uses under the Colorado Code of Regulations, 6 CCR 1007-2 Part 1, Section 8 – Recycling & Beneficial Use

| Waste Material | Pre-Approved Beneficial Use(s) |
|---|---|
| Waste Tire Sidewalls | ▪ Silage Covers<br>▪ Construction Barrel Weights |
| Shredded Waste Tires | ▪ Drainage Media Substitute<br>▪ Fuel Source (with appropriate air permitting)<br>▪ Landfill alternative cover (when approved in facility operations plan)<br>▪ Lightweight aggregate (with an engineered plan) |
| Waste Mining Tires | ▪ Livestock/equestrian Feeders |
| Waste Mining Tire Sidewalls | ▪ Windbreaks |
| Reclaimed Asphalt | ▪ Road Base<br>▪ Component of Hot or Cold Mix Asphalt<br>▪ Recompacted Asphalt<br>▪ Roadside Dressing<br>▪ Chip Seal Material<br>▪ Culvert Cover<br>▪ Base Stabilization |

| Waste Material | Pre-Approved Beneficial Use(s) |
|---|---|
| Reclaimed Concrete, Brick, and Stone (non-asbestos bearing materials) | ▪ Road Base<br>▪ Concrete Aggregate<br>▪ Component of Engineered Structural Backfill<br>▪ Aggregate Substitute<br>▪ Engineered Rip Rap<br>▪ Road Side Dressing |
| Non-Chemically Treated Wood | ▪ Mulch<br>▪ Bio-Filter |
| Glass (lead-free) | ▪ Concrete Aggregate<br>▪ Pavement Aggregate<br>▪ Aggregate Substitute<br>▪ Filter Pavement |
| Clean Reclaimed Porcelain | ▪ Aggregate Substitute |
| Steel Slag | ▪ Aggregate Substitute |
| Auto Fluff | ▪ Alternate Daily Cover when approved in facility operation plan |
| Shredded Paper/Cardboard | ▪ Animal Bedding<br>▪ Insulation |

**Table 3-5. List of Standing Beneficial Use Determinations per Minnesota Rules, Part 7035.2860, Subpart 4**

| Waste Material(s) | Standing Beneficial Use(s) |
|---|---|
| Unadulterated wood, wood chips, bark, or sawdust | Mulch, landscaping, animal bedding, erosion control, wood fuel production, a bulking agent at a compost facility operated in compliance with appropriate state rules, or as a substitute for wood |
| Unadulterated newspaper and newsprint | Animal bedding, insulation, or as a substitute for paper products |
| Uncontaminated glass | Sandblast agent |
| Unusable latex paints, characterized as high solid content, off-specification colors, sour, frozen, or poor quality | Processed latex pigment for use as an additive for the production of ASTM-specified specialty cement |
| Reclaimed glass and porcelain fixtures | Substitute for conventional aggregate or subgrade applications in accordance with appropriate Minnesota Department of Transportation Standard Specifications |
| Crumb rubber | Asphalt paving or applications where it is used as a substitute for rubber or similar elastic material |
| Tire shreds | Lightweight fill in the construction of public roads |
| Tire chips | Substitute for conventional aggregate in construction applications when the ratio of this substitution is no greater than one to one by volume. This does not include use of tire chips as general construction fill or clean fill. |
| Uncontaminated recognizable concrete, recycled concrete and concrete products, and brick | Substitute for conventional aggregate |
| Salvaged bituminous | Substitute for conventional aggregate in accordance with Minnesota Department of Transportation Standard Specifications |

| Waste Material(s) | Standing Beneficial Use(s) |
|---|---|
| Coal combustion slag | Component in manufactured products such as roofing shingles, ceiling tiles, or asphalt products |
| | Sand blast abrasive |
| Coal combustion fly ash (as defined by ASTM C 618) | Pozzolan or cement replacement in the formation of high-strength concrete |
| Coal combustion fly ash or coal combustion gas scrubbing by-products | Ingredient for production of aggregate that will be used in concrete or concrete products; does not include use in flowable fill |
| Foundry sand | Feed material for the manufacture of Portland cement |
| Uncontaminated by-product limes | Agricultural liming materials and distributed in accordance with chapter 1508 and Minnesota Statutes, sections 18C.531 to 18C.575. Application rates for by-product limes must be based on the lime recommendations of the University of Minnesota Extension Service and cannot cause the soil pH to exceed 7.1 after application. Site-specific application rates for by-product lime must be determined by an individual that has a background and understanding of crop nutrient management such as a crop consultant or University of Minnesota Extension Specialist. Recommended rates for lime can be obtained from the University of Minnesota Extension Service publication "Fertilizer Recommendations for Agronomic Crops in Minnesota " BU-06240-S, and the Minnesota Department of Agriculture publication "Ag-Lime Recommendations in Pounds ENP per acre" available on their Web site. |
| Manufactured shingle scrap and ground tear-off shingle scrap | Asphalt pavement or road subbases |

As another example, New Hampshire maintains a list (by rule) of wastes that are certified waste-derived products that are not regulated as a solid waste. The state also has a mechanism by which waste-derived products can be certified, at which point the materials are no longer regulated as solid wastes until the material itself is discarded—***Figure 3-1*** summarizes the uses that have been approved through its process for certifying waste-derived products through the provisions found in New Hampshire rule Env-Sw 1500. As ***Figure 3-1*** shows, the most commonly certified waste-derived product uses involves alternative daily cover at landfills.

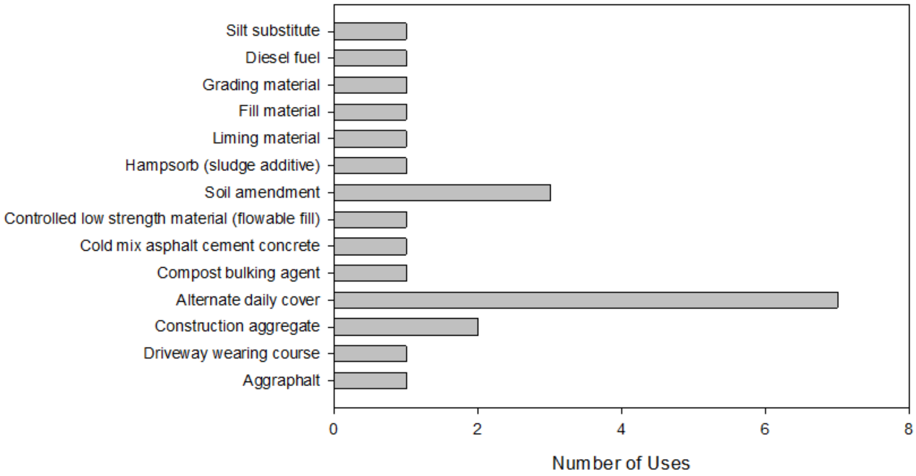

**Figure 3-1. Listing of Certified Waste Derived Product Uses that Have Been Granted Certification in New Hampshire**

### 3.2.4 Case-By-Case BUDs

Many states have case-by-case procedures that may allow for beneficial use of waste materials. The case-by-case structure and specific procedures regarding required demonstrations may be clearly defined. Case-by-case determinations may be specifically mentioned in rules or guidance, but specific procedures to evaluate wastes are determined in consultation with the regulatory agency. Or a state's rules may be silent on the topic of case-by-case evaluations, but this is the practice that is carried out in the state anyway. A case-by-case structure can provide the regulatory agency with a degree of latitude to evaluate a proposed waste and use (or, in some cases, multiple uses) based on the nature of the material and the proposed use setting(s). This structure is also used as a mechanism to allow closer evaluation of certain wastes and/or waste-use combinations that do not qualify under a standing or pre-approved use in states that have these mechanisms in place. To demonstrate and discuss the details of case-by-case program structures for beneficial use, programs from three states (Louisiana, Massachusetts, and Wyoming) were analyzed as provided below.

#### *Louisiana*

The state of Louisiana's beneficial use program is administered under Title 33 Part VII Subpart I Chapter 11: Solid Waste Beneficial Use and Soil Reuse. Beneficial use is considered "the use of waste material for some profitable purpose." Section 1105 of Chapter 11 identifies the procedures a generator needs to follow for a BUD. The Louisiana Department of Environmental Quality (LDEQ) reviews each application individually, considering characteristics depending on the nature of the waste and use intended.

A description of the process by which the waste is generated, a demonstration that the generator has minimized the produced quantity, and toxicity of the waste being considered to the extent practicable are required by LDEQ. Risk assessment is generally not required outside of demonstrating that the waste material is non-hazardous through TCLP testing. A demonstration for a known and/or reasonably probable market for the material is also necessary in the BUD application, as well as a description of the handling, storage, and utilization of the material and steps to be taken to ensure that it will not adversely affect public health or safety.

No application form is provided for submitting a BUD. Currently, 27 BUDs in the state are active for wastes, including blasting media; boiler and WWTP ash; spent carbon; petroleum contaminated soils; asphalt shingles; fluorogypsum; fats, oils, and greases; biosolids; and construction-related soils.

#### *Massachusetts*

The Massachusetts Department of Environmental Protection (MDEP) regulates the beneficial use of solid waste through the Beneficial Use Regulations 310 CMR 19.060. To be considered for beneficial use, a solid waste must first be identified as a "secondary material," which is a waste material that has characteristics that make it an effective substitute for an ingredient in an existing or new product or commodity. Once identified as a secondary material, the solid waste is classified under one of four categories dependent on the intended use of the material: (1) Commercial Products, (2) Regulated Systems, (3) Restricted Applications, and (4) Unrestricted Applications. There may be occasions when the Department may issue general beneficial use determinations as general permits that apply to a specific beneficial use of a secondary material, and there may also be circumstances when a secondary material is processed; at that point, the Department will determine the type and amount of processing allowable.

The Draft Interim Guidance Document for Beneficial Use Determination Regulations (March 2004) is an MDEP document that provides information to assist beneficial use applicants with the application process and the testing and risk assessment methods and options available, which depend on the determined beneficial use category. The Department developed a quantitative risk assessment approach for waste intended for use in restricted and unrestricted applications. Before application is possible, a request for determination of applicability (pre-application package) must first be submitted to MDEP.

The following information is required as part of the pre-application when applicable: a facility or operation description; a list of products currently and historically manufactured by the facility; a description of the secondary material, such as a physical and chemical characterization of the material, including results of analytical testing for hazardous materials that may be thought to be present; a representative sampling plan in accordance with SW-846, including Critical Contaminants of Concern (CCCs); specifications for use of the secondary material; and a list of licenses, permits, or other prior approvals issued for the use of the secondary material.

In the BUD application process, if the beneficial use pre-application is approved, each of the four material use categories has a different application (forms BWP SW 39 for Category 1 materials through BWP SW 42 for Category 4 materials), all of which require the same general project information, but with additional category-specific information requested. The MDEP provides supporting material and an application checklist. An application must be filed with the department, as well as a copy with the board of health of jurisdiction when the proposed use is limited to a specific location. A fee, dependent on the application category, applies.

The following general information is required (as determined during the pre-application process):

- All information required in the pre-application package
- If hazardous materials, including CCCs, are identified during the pre-application or application process, the project proponent will prepare and submit a Toxics Reduction Plan that
    - Details options to minimize the concentration of hazardous material that could be released to the environment
    - Documents steps that will be taken to implement economically and technologically feasible options
    - Includes all appropriate data derived from the sampling plan required in accordance with 310 CMR 19.060(4)(c)3.
- A statistically valid analysis of the concentration and distribution of all hazardous materials that may be contained in the proposed secondary material.

Each category has a list of additional requested information, which is summarized in ***Table 3-6***.

**Table 3-6. Example of Specifically Requested Information for Case-Specific BUD in Massachusetts**

| Category | Additional Requested Items (non-exhaustive) |
|---|---|
| 1 | ▪ Physical characterization of the commercial product<br>▪ Constituents (including hazardous materials) contained in the product manufactured using traditional materials or products<br>▪ Comparative analysis of the product manufactured using the secondary materials versus the traditionally used material it is replacing |
| 2 | ▪ Operative MDEP permit, order, or approval for the facility/site<br>▪ General description of the facility/site activities<br>▪ Appropriate numerical standards, risk management criteria, and other applicable requirement as identified by MDEP<br>▪ Identification, evaluation, and control of potential significant risks from the storage, transfer, processing, treatment activities, and use of the secondary material |
| 3 | ▪ Concentrations of hazardous materials of concern in the material proposed for use<br>▪ Upper concentration limits (UCLs) for those hazardous materials<br>▪ Background concentrations of those hazardous materials<br>▪ Release and exposure pathways<br>▪ Risk management techniques used to prevent adverse impact or significant risks to public health, safety, and the environment, including nuisance conditions<br>▪ Hazardous material concentration above UCLs<br>▪ Hazardous materials concentration not below background<br>▪ Evaluation and control of significant risks to public health and safety<br>▪ Evaluation and control of significant risks to the environment<br>▪ End of use management<br>▪ Deed notification |
| 4 | ▪ Description of proposed use<br>▪ Conservative, unrestricted general exposure assumptions<br>▪ Completed Category 3 section fields |

### Wyoming

Wyoming approves beneficial use applications on a case-specific basis through an exemption to the Solid Waste Rules (Chapter 1, General Provisions, (l)(xxi)), which allow the WDEQ to issue an exemption from solid waste permitting for “the reuse of wastes in a manner which is both beneficial and protective of human health and the environment, as approved by the administrator”.

A risk evaluation conducted for a BUD consists of total metals analysis and subsequent comparison to the limits in the state’s Voluntary Remediation Program (VRP) soil cleanup levels (Combined Cleanup Level Table, developed as described in Fact Sheet #12). The VRP tables contain constituent thresholds based on direct contact with soil and the potential for constituents to migrate to groundwater, which assume the groundwater will be used as a source of drinking water (also that no dilution-attenuation of the constituent will occur in the groundwater); migration to groundwater standards are used for all beneficial use applications. If naturally occurring background levels at a site prohibit reaching a VRP standard, WDEQ can establish a site-specific natural background, which may or may not affect beneficial use determinations. VRP tables were developed based on the U.S. EPA Region 9 Regional Screening Levels and EPA Soil Screening Guidance. A table of selected VRP migration to groundwater constituent concentration is detailed in ***Table 3-7***.

**Table 3-7. Selected Metal Constituent Concentration Thresholds from Wyoming VRP Soil Cleanup Tables**

| Constituent | Migration to Groundwater Threshold (mg/kg) |
|---|---|
| Aluminum | 55,000 |
| Antimony | 0.66 |
| Arsenic | 0.0013 |
| Barium | 300 |
| Cadmium | 1.4 |
| Chromium (III/VI) | 99,000,000/2.1 |
| Copper | 51 |
| Iron | 640 |
| Lead (tetraethyl) | 0.000014 |
| Manganese | 57 |
| Mercury (elemental) | 0.033 |
| Molybdenum | 3.7 |
| Selenium | 0.95 |
| Silver | 1.6 |
| Zinc | 680 |

No application form exists for a BUD. To obtain approval, the WDEQ must be contacted and the Integrated Solid Waste Management and State Recycling Coordinator will provide guidelines to follow for the beneficial use application process. If the beneficial use is approved, WDEQ will issue a letter of approval to the applicant.

Based on discussions with WDEQ, the stringency of the VRP migration to groundwater has limited the ability to issue many BUDs. Some agency discretion has been used in the past where VRP migration to groundwater limits were exceeded, but the beneficial use was approved because the use involved encapsulation (e.g., in cement). Conditions placed on approval can include, but are not limited to, periodic resampling and analysis for metals, notification to other regulatory authorities (e.g., the air quality division of WDEQ to address potential dust emissions), and resampling and laboratory analysis when any generation process changes occur.

The WDEQ is currently contemplating changes to its beneficial use program, where considerations such as using leaching test results (e.g., SPLP) and the development of a guidance document that identifies standing beneficial uses may be implemented.

### 3.2.5 Use of Risk-Based Thresholds

As discussed in **Section 2**, the characterization of risk for a beneficial use project is an important consideration for regulatory agencies. States that specified target limits were examined to compare and contrast the specified limits to assess the variability between states. Overall, the examination indicated that the methods used to evaluate risk, as well as the built-in assumptions in risk evaluations conducted by states, varied in many cases. A summary of major observations is provided below.

- The level of risk evaluation required by states depends on the type of waste, the proposed use, and the regulatory framework for beneficial use. A comparison of several specific case studies for the same waste and use combination in eight states is provided in **Section 4**.

- A common practice was for states to reference risk-based target levels for several constituents that were developed uniquely for the state. Many of these risk-based target levels were standards originally developed for contaminated site evaluation and remediation goals, but for simplicity, were applied to beneficial use applications. In other cases, the EPA regional screening levels were used as the target analyte list and concentration limit.
- Variability in evaluating leaching behavior was identified. The variability included the type of leaching test used (options identified included TCLP only, SPLP only, TCLP or SPLP, DI extraction, or some choice of the three). The limits that were used for comparison of leaching results were variable as well, which was likely a reflection of underlying risk assumptions (e.g., the lifetime increased cancer risk for carcinogenic compounds). Further discussion regarding the comparison of target limits and tests is provided below.
- In some cases (e.g., land application settings), comparison of background soil concentrations rather than comparisons to risk-based target levels was the mechanism used for evaluating risk.
- Several states had procedures that specified if a listed beneficial use chemical constituent target level was exceeded, beneficial use was not necessarily precluded. In these cases, a more detailed risk assessment specific to the proposed waste and use would be required to obtain permission to beneficially use the waste material.
- States may have imposed constituent target levels based on total concentration for some types of beneficial uses, but require target levels based on leachable concentration for other uses (e.g., Category 1 and Category 2 wastes in Colorado).

***Figure 3-2*** presents a summary of analytical testing required in each state in the United States based on a review of regulations, guidance, and discussion with state regulatory representatives. Although the nature of beneficial use evaluations may require more extensive testing than that explicitly defined in a regulation or guidance, the data in ***Figure 3-2*** were developed by only considering testing that was either explicitly mentioned in a regulation or guidance or was specifically mentioned by a regulatory agency staff member of the given state about the protocol normally followed. The data show a fairly even distribution of analytical testing requirements between states.

In addition to the type of analytical testing required, differences in the applicable chemical constituent limits were observed as well. ***Figures 3-3 and 3-4*** present an example of the variability in chemical constituent target levels among different states, specifically total concentration and leaching target limits for arsenic. A few key observations can be made about these figures based on a review of each state's relevant regulations, guidance, and typical practices. First, the applicable target limits varied, somewhat substantially (orders of magnitude). Second, the leaching procedures used varied: the leaching procedure threshold for Mississippi is based on leaching results using the TCLP; the analyte mobility limit for Colorado is based on a leaching test found in SW-846, but is not specific about which test; category 1, 2, and 3 leaching test limits for Wisconsin are based on the ASTM Water Leach Test; and the GCTL for Florida is used to compare SPLP results to in most cases, though as described in **Appendix B**, no specific regulatory or statutory guidance for testing related to beneficial use exists in the Florida rules. **Appendix C** provides additional figures showing comparisons of the total concentration and leachable concentration target limits for several additional inorganic parameters.

In addition to differences in specific leaching tests required, the results also reflect a trend of adjusting target levels as the intended or approved beneficial use changes. For example, Category 1 industrial byproducts in Wisconsin have the most stringent target levels to meet (of the five categories of industrial byproducts), but this category enjoys the most flexibility in terms of specifically identified uses that are exempted from regulation. As discussed previously, the differences in chemical concentration limits likely results from a variety of factors – some of these differences are discussed further in later sections –

but the presence of a difference from one state to another is not necessarily reflective of one limit or another being more appropriate or accurate than another.

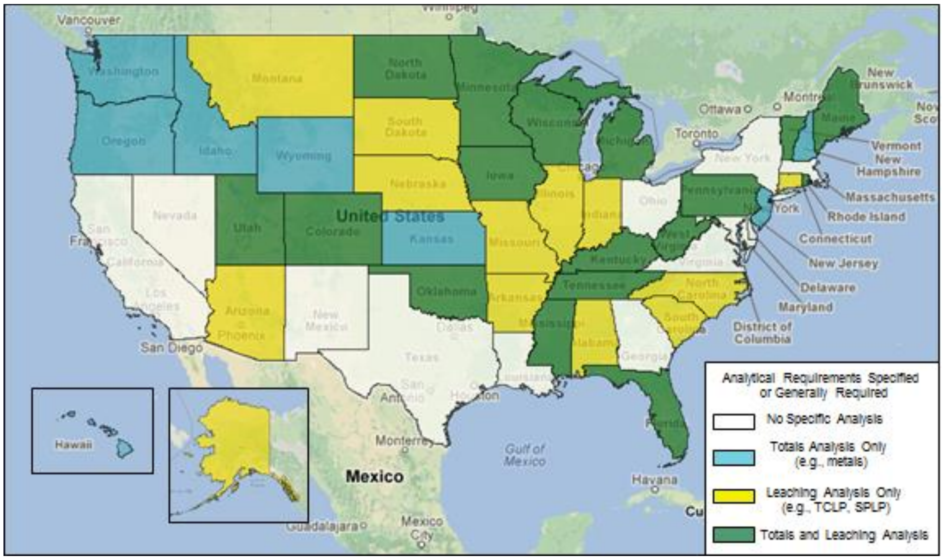

**Figure 3-2. Comparison of Commonly Required Analytical Testing In Support of a BUD in the United States Based on Evaluation of State Rules, Guidance, and Regulatory Agency Feedback**

It is noteworthy that the new SW-846 leaching methods 1313 and 1316 were not specified in any formal regulatory program's requirements. These leaching methods, as described in more detail in **Section 2**, involve more rigorous laboratory evaluation of leachate through the use of leaching over a wide range of pH values (Method 1313) and liquid-to-solid ratios (Method 1316), which represents a wider set of leaching conditions a waste material may be subject to relative to other leaching protocols.

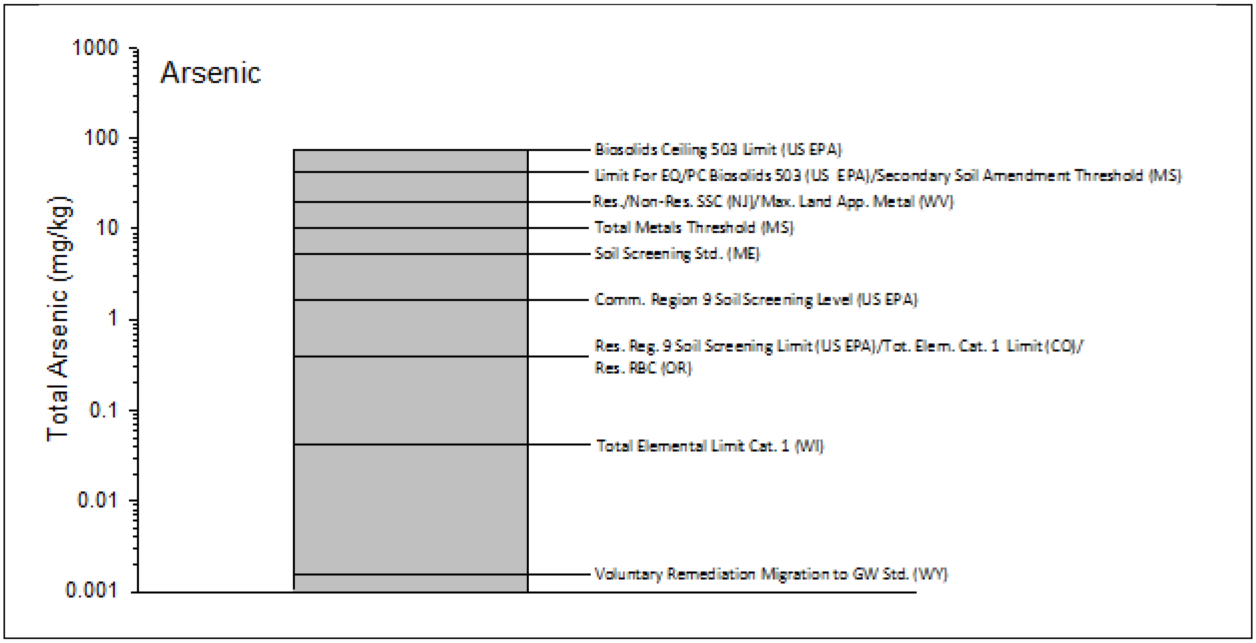

**Figure 3-3. Comparison of Total Concentration Limits for Arsenic Based on Federal Limits and State-Specified Limits for Beneficially Used Waste Materials**

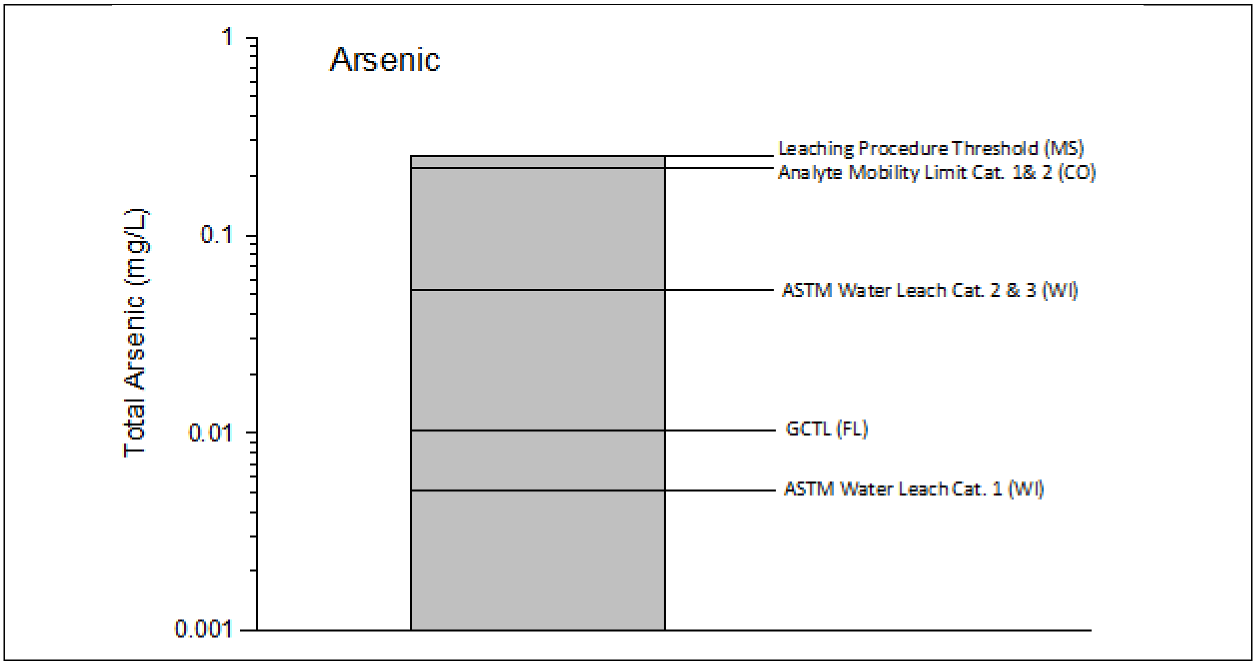

**Figure 3-4. Comparison of Leaching Target Concentration Limits for Arsenic in Mississippi, Colorado, Wisconsin, and Florida**

The results of the risk evaluation procedures at the state level reveal that some potentially substantial differences in the way that states identify and assess risk from the beneficial use of waste materials exist. These differences are evident in terms of the type of testing required, the list of chemical constituents that must be tested, and the numeric target levels that are established. The next section further examines state regulatory structure by presenting several case studies for multiple waste material and beneficial use combinations.

# 4. Examination of Current BUD Practices and Tools through Case Studies

## 4.1 Case Study Approach

As outlined in **Section 3**, federal and state beneficial use regulations, policy memos, BUD application instructions, and existing BUDs were reviewed. This information was coupled with conversations with regulatory and industry professionals, information from the literature, and the project team's existing experience, to provide a wide-ranging review of the current state of beneficial use practice in the United States. This work complements other reviews that have tabulated program status with respect to uses and wastes, but also provides an in-depth discussion of differences in program types and implementation. The case study review is intended to highlight similar (and contrasting) approaches to beneficial use by using a common waste-use combination. This review does not represent advocacy for one approach compared to another, and does not suggest that one approach or another is necessarily more appropriate. The exercise of discussing these case studies was conducted in part to inform some of the key research questions that are presented in **Section 5**.

In this section, a series of case studies are presented to provide direct comparisons of how different states address specific examples of beneficial use, with a common denominator of waste type and use type. ***Table 4-1*** presents the states selected for comparison, which was based on a combination of factors including geographic distribution in the United States and availability of specificity in the regulations. While the state programs and waste-use combinations selected do not necessarily represent the entire spectrum of ways that regulatory programs dictate beneficial use requirements, the data in the following sections highlight the similarities and variability among several state programs and therefore provides a useful baseline set of information upon which data gaps can be identified.

**Table 4-1. States and Waste-Use Combinations Selected for Case Study Evaluation**

| States Analyzed | Waste-Use Combinations Evaluated for Each State |
|---|---|
| Florida, Minnesota, Mississippi, New Jersey, New York, Oregon, Pennsylvania, Wisconsin | Coal Fly Ash as a Pozzolan in Concrete Production |
| | Foundry Sand as a Feed Material in the Manufacture of Portland Cement |
| | Coal Bottom Ash in Structural Concrete |
| | Steel Slag in Asphalt Pavement |
| | Waste-to-Energy Bottom Ash as Road Base |
| | Street Sweeping Use in a Soil Berm |
| | Bark Ash as an Agricultural Amendment |
| | Drinking Water Treatment Sludge as a Soil Amendment |

In this section, a short narrative and analysis is provided regarding each of the eight waste-use combinations. A detailed comparison of each state and the beneficial use–related procedures is provided in a series of annotated tables in **Appendix C**.

## 4.2 BUD Case Study Evaluation 1 – Coal Fly Ash for Use as a Pozzolan in Concrete Production

Fly ash collected in the air pollution control system of coal fired power plants (e.g., electrostatic precipitators, bag houses) have long been understood to exhibit pozzolanic (cementitious) properties when mixed with water and calcium hydroxide. Coal fly ash is thus commonly used as a partial substitute for Portland cement in the manufacture of Portland cement concrete at concrete batch plants (or similar facilities). While other beneficial use options are used or have been proposed for coal fly ash, this beneficial use normally represents the highest value beneficial use for this material. A comparison of eight state approaches to the beneficial use of fly ash in this manner is presented in **Appendix C**, ***Table C-1***.

Of the eight states considered in the case study evaluation, all allow for the use of coal combustion fly ash as a substitute for Portland cement, but the mechanism differed somewhat. For example, the beneficial use of fly ash in this manner is commonly practiced in Florida, but no specific rule or guidance exists. In six of the other states, exemptions from the definition of fly ash as a solid waste or a standing BUD were the mechanism to allow this activity. In Oregon, only one coal-fired power plant exists, but the state's recently promulgated rules do not address the beneficial use of coal ash. A review of data from the Energy Information Administration (EIA, 2012) indicated that fly ash produced at the one plant in Oregon is in fact beneficially used, though the specific beneficial use was not identified.

## 4.3 BUD Case Study Evaluation 2 – Foundry Sand as a Feed Material in the Manufacture of Portland Cement

The manufacture of Portland cement involves the thermal processing of several different raw materials, specifically those that provide a source of silica, calcium, iron, and aluminum. Cement kilns require large volumes of feed ingredients, typically rock and soil, but in many cases, raw materials can consist of waste materials that provide the aforementioned ingredients. Foundry sand has the potential to serve as a source of silica in the manufacture of Portland cement. In this beneficial use, the foundry sand serves as a substitute for virgin material. Eight state approaches to the beneficial use of foundry sand in the manufacture of Portland cement are presented in **Appendix C**, ***Table C-2***.

Six of the eight states reviewed allow for this beneficial use through a standing BUD or pre-approved use. One of the states (New York) required a case-specific determination for this use. One other state (Florida) does not have specific rules or guidance regarding beneficial use in this manner, but statutory discussion of industrial byproduct use provides basic restrictions such as time limits for storage of the material prior to use and indicating the material cannot be a hazardous waste.

## 4.4 BUD Case Study Evaluation 3 – Coal Bottom Ash in Structural Concrete

Bottom ash collected from coal combustion boilers do not exhibit the same pozzolanic properties as coal fly ash, but they can represent mineral sources for some applications, such as the manufacture of Portland cement. One use for coal bottom ash is as an aggregate in structural Portland cement concrete, either for concrete structures or for road paving. In this beneficial use, coal bottom ash serves as a substitute for virgin mineral aggregate. ***Table C-3*** in **Appendix C** presents a comparison of state approaches to coal bottom ash use in structural concrete.

When used as an aggregate, the ash is typically not considered an encapsulated ingredient, but is considered an encapsulated use. Five of the eight states reviewed allow the use of bottom ash in structural concrete as a standing BUD. Florida does not have a specific rule regarding this beneficial use, but typical practice for an encapsulated use involves material characterization, including leaching tests for comparison to state GCTLs. In Minnesota, a beneficial use proposal form would be submitted to MPCA with characteristic information on the waste material. Leaching data may be requested to assist with the state's determination. As is the case with fly ash, Oregon does not have a determination for the use of coal ash (there is only one coal plant in the state), but U.S. EIA (2011) indicates that some bottom ash was sold for beneficial use in the past, though the specific use was not known.

## 4.5 BUD Case Study Evaluation 4 – Steel Slag in Asphalt Pavement

In the manufacture of steel in blast furnaces, basic oxygen furnaces, or electric arc furnaces, molten iron and scrap steel are combined with fluxing agents such as lime, and during the process, the molten material separates into two different layers. The top layer, comprised of molten slag, is removed from the surface of the molten steel and allowed to cool to form solidified slag. Steel slag is primarily composed of oxidized minerals of calcium, iron, and aluminum in complexes of primarily silicate materials. In the beneficial use evaluated here, steel slag serves as a substitute for virgin mineral aggregate in the manufacture of asphalt (bituminous) pavement. ***Table C-4*** in **Appendix C** summarizes state approaches to the beneficial use of steel slag in asphalt pavement.

The beneficial use of steel slag as an aggregate in asphalt pavement is another example of an encapsulated use (similar to the beneficial use of bottom ash in structural concrete). Four of the eight states have a standing BUD or pre-approval, while the other four (Florida, Minnesota, New Jersey, and New York) require a case-specific BUD. Pennsylvania allows the use of steel slag for beneficial use as an ingredient in bituminous concrete (asphalt pavement) as long as measured total chemical and leaching concentrations are below specific risk-based thresholds (totals and leachable levels). For Florida and Minnesota, a similar evaluation process as with a BUD for bottom ash in structural concrete would be followed. In Florida, leaching data would be compared to GCTLs as part of the determination protocol, and Minnesota may require leaching data as part of the beneficial use proposal to be submitted to MPCA.

Based on the state agency rules and case studies for New Jersey, it is expected that a Certification of Authorization to Operate (CAO) would be submitted to NJDEP to beneficially use steel slag in asphalt pavement. The application for the CAO should include the results of chemical analysis for contaminants on the state’s soil cleanup criteria (SCC) list for direct exposure and impacts to groundwater (organic chemicals). Additional site-specific data may be requested to evaluate potential impacts to groundwater from inorganic constituents. In New York, a petition for a BUD must be submitted to NYSDEC with all the required information provided (e.g., waste description, market, justification, and chemical and physical characteristics).

## 4.6 BUD Case Study Evaluation 5 – Waste to Energy Bottom Ash as Road Base

When MSW is combusted in an incinerator to both reduce the mass and volume of garbage and to produce electricity, the facility conducting this process is generally described as a waste-to-energy (WTE) facility. One of the solid wastes produced at WTE facilities is bottom ash, a primarily mineral material that falls from the combustion grate into a water quench. At many facilities, the ferrous and non-ferrous metals are recovered from the bottom. In the United States, WTE bottom ash is typically mixed with WTE fly ash, and this combined ash is disposed in non-hazardous waste landfills. In many countries, the bottom ash is collected separately and recycled. One of the more common methods for recycling WTE ash in these locations is for road base. In the beneficial use evaluated here, WTE bottom ash serves as a substitute for crushed stone in the construction of road based underlying a paved road. A comparison of state approaches to beneficial use of WTE ash as a road base is presented in **Appendix C**, ***Table C-5***.

All eight of the states evaluated require a case-specific BUD for the use of WTE ash as a road base. This use may also require input from respective state Departments of Transportation. Florida has a specific guidance document for municipal WTE ash BUD, which outlines state objectives and goals for acceptable risk, procedures for characterization ash, and products made from ash for BUD assessment, both as part of an initial baseline study and for routine monitoring.

Minnesota, as with other BUDs, may require leaching data as part of the beneficial use proposal to be submitted to MPCA. A BUD application would need to be submitted for Mississippi. This beneficial use would be considered a Category II use (utilization in engineered construction or other civil engineering uses), and total metals must be analyzed and compared to threshold values, which, if exceeded, would require a TCLP test to be conducted, and the results compared to leaching thresholds. For New Jersey, a CAO would need to be submitted to NJDEP, which would include the results of chemical analysis for contaminants on the state's SCC list for direct exposure and impacts to groundwater (organic chemicals). Additional site-specific data may be requested to evaluate potential impacts to groundwater from inorganic constituents.

In New York, a petition for determination of the waste for beneficial use must be submitted to NYSDEC, which provides the required information (i.e., waste description, market justification, and chemical and physical characteristics). In Oregon, an application to ODEQ for approval would need to be submitted. If the waste does not contain hazardous substance significantly exceeding the concentration in a comparable raw product or commercial product, a Tier One application can be filed; this would not require comparison to RBC levels. Otherwise, a risk screening and comparison to concentrations to ODEQ-approved RBC levels is needed.

In Pennsylvania, the generator interested in pursuing this beneficial use must apply for a Pennsylvania DEP general permit. The evaluation process generally includes chemical characterization using TCLP or SPLP and establishing constituent target limits. To be used beneficially within Wisconsin, a BUD applicant would likely have to demonstrate that the characteristics of the WTE ash are similar to the state's definition of industrial by-products. The ash would therefore be classified as a Category 4 by-product, subject to chemical leaching requirements. Use as a road base in Wisconsin would constitute "confined geotechnical fill."

## 4.7 BUD Case Study Evaluation 6 – Street Sweepings for Soil Berms

Municipalities maintain roads using mechanical sweepers that collect a solid waste referred to as street sweepings. These materials are primarily soil, but do contain smaller amounts of pavement and waste materials (e.g., cigarette butts, leaves). Upon waste screening, the resulting material is similar to soil, and thus has been proposed for beneficial use in applications where soil fill material is needed. In the beneficial use evaluated here, screened street sweepings serve as a substitute for soil that would be used to construct a visual or noise berm as part of a construction project. ***Table C-6*** in **Appendix C** presents an assessment of eight state approaches to beneficial use of street sweepings in soil berms.

Four of the eight states evaluated require a case-specific BUD. Wisconsin recognizes street sweepings as an industrial by-product and restrictions and specifications for use in a soil berm (unconfined, geotechnical fill) are detailed in regulation (NR 538), and include construction stipulations as well as leaching chemical constituent limits. Although Florida, Minnesota, and New Jersey do not have regulations pertaining to street sweepings, all have published guidance documents addressing their reuse in a fill scenario, setting forth restrictions such as screening requirements and separation distances from sensitive environmental features (e.g., groundwater, potable water wells), as well as prescribing erosion control measures, such as seeding and covering. If requirements specified in the guidance document for specific uses are met, the street sweeping can be used without prior approval of their respective regulatory agencies.

Leaching analysis would typically be prescribed for this waste/use combination during the case-specific evaluations (e.g., in Mississippi or Pennsylvania) and compared to applicable standards or case-specific limits; inorganic and/or organic totals analysis may be utilized and compared to direct exposure (Oregon), or "impact to groundwater" standards and/or case-specific limits (e.g., New York, New Jersey). Due to the use of petroleum-based materials in road construction (e.g., coal-tar cements), states may be interested in levels of petroleum hydrocarbons (often measured in benzo(a)pyrene equivalents) present in the street sweepings for this unencapsulated use scenario (which was described in the Florida and New Jersey guidance documents).

## 4.8 BUD Case Study Evaluation 7 – Bark Ash as an Agricultural Amendment

Pulp and paper mills produce large amounts of tree bark as part of the paper-making process. This bark is often burned as a fuel source at the mill, with an ash produced in the process. Bark ash, similar to other types of wood ash, has been used as a soil amendment through land application. In addition to trace minerals of potential value such as potassium, wood ash provides the benefit of being a liming agent to raise the pH of the soil, desirable in many regions with naturally acidic soils. In the beneficial use evaluated here, ash from a bark boiler serves as a substitute for lime applied to agricultural land. A comparison of state approaches to this beneficial use is provided in **Appendix C**, ***Table C-7***.

The use of wood ash as an agricultural amendment is categorized as an unencapsulated use. Because of the nature of the use, case-specific applications are required in four of the eight states evaluated. Oregon was included as case-specific based on guidance published by ODEQ (2011), which indicates that ODEQ has to be contacted to assess whether an agricultural exclusion or a beneficial use determination needs to be made. Of states evaluated with case-specific determinations for bark ash used as an agricultural amendment, chemical characterization is typically required, and comparison to established constituent target levels (e.g., Mississippi's secondary soil amendment thresholds) is required. In the states with standing BUDs, Pennsylvania and Wisconsin place limits on the use of the material (e.g., location, chemical concentrations), whereas New York requires adherence to an agronomic application rate. Florida published a guidance document (FDEP, 2002) that implies bark ash could be beneficially used as a soil amendment without approval from the FDEP provided the bark ash did not include any ash from the combustion of painted or treated wood.

## 4.9 BUD Case Study Evaluation 8 – Drinking Water Treatment Sludge as a Soil Amendment

Drinking water treatment facilities utilize various chemical processes to convert raw surface or groundwater into potable water, and in the process, solid byproducts (water treatment sludge) are produced. Surface water treatment facilities utilize coagulants such as ferric chloride, ferric sulfate, or alum to remove chemicals from the water (e.g., organic matter that causes color). Groundwater treatment facilities often remove calcium hardness through a lime softening process. Sludge produced at these treatment facilities has a high mineral content, and thus possesses a potential value for beneficial use. In the beneficial use evaluated here, drinking water sludge serves as a substitute for lime or mineral nutrients applied to agricultural land. ***Table C-8*** in **Appendix C** presents the comparison of state approaches for beneficial use of drinking water treatment sludge as a soil amendment.

The use of drinking water sludge as a soil amendment is another unencapsulated use. Minnesota has a standing BUD for "by-product limes," which would be expected to include lime-based WTP sludge but not alum or ferric sludges. Wisconsin also has provisions specific to lime sludges. Florida does not have rules related to land application of WTP sludge, but a guidance document (FDEP, 2006) says that lime sludge can be land applied without FDEP approval, and other WTP sludges require case-specific determinations. Pennsylvania has a general permit for drinking water sludges.

## 4.10 Summary and Discussion of Case Studies

Based on an examination of the eight case studies, several observations can be made:

- Multiple differences were identified among states. In some cases (e.g., coal fly ash use in Portland cement), the eight states evaluated had consistent mechanisms to allow a beneficial use activity. In other cases (e.g., WTE ash), the evaluation mechanisms used by states varied.

- Encapsulated uses were found to have exemptions or standing use BUDs more frequently compared to unencapsulated uses, as shown in ***Figure 4-1***.
- For the same waste and use combinations, several states had contrasting numerical total and leachable concentration risk thresholds. For example, the residential soil cleanup target level for barium is 120 mg/kg in Florida, but is 700 mg/kg in New Jersey.
- The variability of approval sometimes included subdividing a given waste type. For instance, Pennsylvania provides a standing use general permit for drinking water treatment residuals, whereas, Florida has guidance that provides a standing approval for lime-based drinking water sludges but not alum or ferric-based sludges.

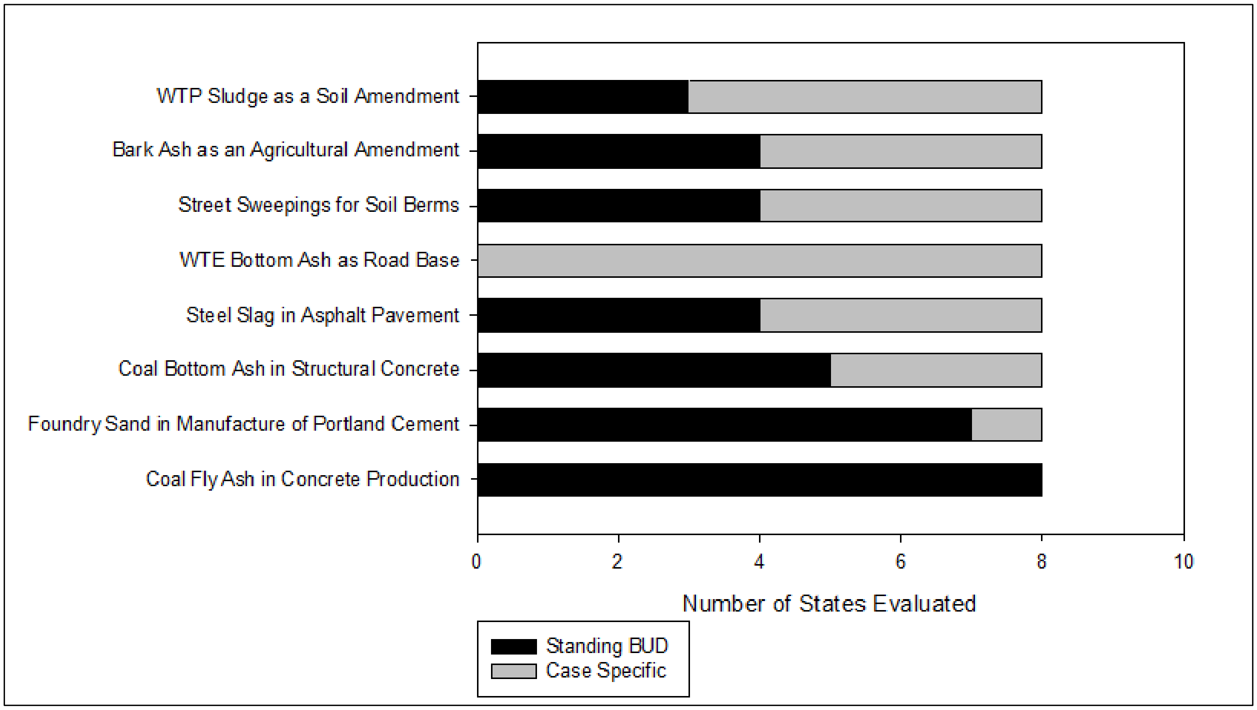

**Figure 4-1. Summary of Eight-State Comparison for the Eight Waste-Use Combinations Examined in Section 4**

# 5. Data Gaps and Future Steps

## 5.1 Data Gaps Identified in State Review

One of the objectives of the review of beneficial use state programs in the United States was to identify common themes and contrasting approaches, both in terms of broad regulatory mechanisms as well as detailed considerations such as analytical testing and related risk assessment procedures. The intent was not to provide any judgment as to the completeness or to identify “model” programs. However, one major objective identified was to assess specific data gaps that exist, particularly those data gaps that could help improve sustainability outcomes pertaining to beneficial use of waste materials. The data gaps identified were as follows:

1. What is the appropriate approach to take when considering risk evaluations? The data gathered in this evaluation demonstrated frequent significant differences in terms of broad approaches to risk assessment, and, in cases where procedures to conduct a risk assessment were specified, details of risk assessments often varied widely even for similar waste material beneficial uses. Additional

investigation and guidance regarding specific approaches to risk assessment could be further developed to provide states with a more comprehensive understanding of the approaches that have been used for specific wastes and uses. Some examples of this were developed in the evaluation presented in this report, but these evaluations represent a subset of the potential evaluations since a limited number of states were included.

2. What are specific mechanisms that can be implemented for states to better track beneficial use activities? Several cases were identified where potentially significant beneficial use activities were ongoing in a state, but there was no mechanism to track these activities. Such tracking mechanisms may provide useful information regarding the flow of materials. Obtaining specific statistical information regarding quantity and frequency of specific wastes and use activities was not an objective of this effort.
3. What is an appropriate technique to apply leaching data in a risk framework, and how can leaching data be more effectively used to assess short-term and long-term risk? Discussion presented in this research shows that different testing procedures are used, and the data show that different numerical limits are used. Compilation and examination of data regarding the rationale behind several more state-established risk target levels could help to inform the states on both the differences in approaches (several examples that were presented in this analysis) as well as the rationale behind the differences (which was broadly examined in this analysis).
4. Under what conditions can materials be applied on land? What factors should be examined to identify setback distances that provide appropriate surface water or groundwater protection?
5. How can long-term performance of beneficially-used waste materials be evaluated from the perspective of economic, environmental, and social considerations over the material's life cycle? Some beneficial uses (such as those used in highway applications) have fairly extensive short-term and long-term performance data. However, the long-term performance of a large range of waste materials that are beneficially used has not been widely studied. Long-term performance includes the functional stability of the product made with the beneficially used material and the environmental performance (e.g., does the material pose an unacceptable leaching risk of the product decays or is deliberately deconstructed). Such information would be helpful to understand potential limitations or circumstances that were unforeseen when a beneficial use was originally implemented.

## 5.2 Potential Elements of a Tool to Facilitate Beneficial Use in the United States

Another objective of this study was to identify elements of dynamic tools that could be developed that would assist communities (e.g., state regulatory agencies) in encouraging the sustainable management of waste materials in a manner that acknowledges economics, the environment, and society. Based on the information gathered in this evaluation, including direct discussions with state regulatory agency staff that conveyed elements of a tool that they would use, several considerations are offered that could be incorporated into a tool that could facilitate the beneficial use of waste materials in the U.S.:

1. A tool that is Web-based, open source, and validated would be an appropriate platform to allow widespread access.
2. The tool should include organized data and documentation related to beneficial use. Information that would be valuable to include may consist of the following:
    a. Beneficial-use applications in a given state
    b. Beneficial-use approvals in a given state, including related documentation (e.g., approval letters, supporting data), subject to limitations related to confidential business information.
    c. Useful links or embedded information to allow the user to understand regulatory context.

3. The tool should be searchable (search-engine style) to enhance user flexibility, in addition to employment of online database elements (e.g., drop-down menus).
4. The tool would incorporate some or all of the analysis that would be used to address the data gaps listed in **Section 5.1**.
5. The data in the tool should be updated at routine intervals to maximize usefulness to state regulators and other interested parties.

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# Appendix A. Annotated Table of Waste Materials that May Be Part of a Beneficial Use Program

| Waste | Waste Description | Discussion of Research and Information |
|---|---|---|
| Asphalt Shingles | Asphalt shingle waste may consist of post-manufacturer scrap or post-consumer (i.e., tear-off). Post-consumer may consist of materials generated from re-roofing projects or new construction. The most common use of asphalt shingle waste is incorporation into hot mix asphalt, as the asphalt content of the discarded shingle can offset the use of virgin liquid asphalt in this process. The asphalt composition of a shingle varies depending on shingle type, and physical properties may vary depending on weathering. Approximately 11 million tons of roofing shingles waste is generated annually in the US. | The chemical and physical characteristics of asphalt shingles have been reported by several investigators (CMRA 2007a, CMRA 2007b, FDEP 2010, FHWA 2012). Common reported beneficial uses for asphalt shingles include use with paving applications, aggregate for road construction, dust control on gravel roads, cold patch asphalt, and as feedstock/fuel for cement kilns and coal-fired boilers, with the primary use of recycled shingles being integration into hot mix asphalt (ASTSWMO 2007, FDEP 2010, US EPA 2001b). Studies regarding asbestos content of asphalt shingles have been reported (CMRA 2007a, CMRA 2007b, FDEP 2010). Most have found asbestos was not widely used in shingles themselves but may be found in other roofing products that could be commingled with shingle waste (e.g., mastics, tarpaper). Many scientific studies have reported on uses of asphalt shingles in asphalt type reuse (Marks and Petermeier 1997, Watson et al. 1998, Foo et al. 1999, Sengoz and Topal 2005); a bibliography of literature and websites is available (FIE 2011). |

| Waste | Waste Description | Discussion of Research and Information |
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| Biosolids | Biosolids are produced as solid residuals of domestic wastewater treatment. Biosolids contain nutrients and organic matter, which are the primary beneficial constituents of the material. Approximately seven million dry tons of biosolids are generated annually in the US. | EPA established chemical constituent thresholds for land application of biosolids (US EPA 1994). Land application of biosolids can provide valuable nutrients to the soil, improving crop production as demonstrated by several investigators (Henry et al. 1999, Speir et al. 2004, US EPA 2006a, CDM 2011, Kabirinejad and Hoodaji 2012). Biosolids may provide enhanced biodegradation of undesirable contaminants (Chang et al. 2009). Given that land application is the most prevalent use of biosolids, the leaching potential of biosolids is important and has been investigated by numerous researchers (Shanableh and Ginige 1999, Gove et al. 2001, Stehouwer et al. 2006, Brenton et al. 2007, Su et al. 2007). Odors (Rosenfield et al. 2000; Barth et al. 2010), overall ecological impacts and risk (Chaney et al. 1996, Rogers and Smith 2005,), and biosolids as a source of emerging contaminants (e.g., triclosan, antibiotics, perfluorinated chemicals, etc.) (Chenxi et al. 2008, Clarke and Smith 2011) are other areas of potential concern. |
| Cement Kiln Dust (CKD) | Cement kilns manufacture Portland cement by reacting calcium carbonate and silica bearing materials. CKD is composed of the particles that are captured by air pollution control devices filtering the cement kiln exhaust gas. Cement kiln dust is a fine-grained, highly alkaline, powdery substance. Approximately 15 million tons of CKD are generated annually in the US. | The chemical characteristics of CKD have been reported (US EPA 2012a, IEEE-IAS et al. 2008) and there has been significant involvement from EPA in determining appropriate management of CKD (US EPA 2012b). Scientific studies have examined CKD impacts on groundwater and potential health effects from exposure to airborne CKD (US EPA 1997, US EPA 1998, US EPA 2001a). A majority of CKD is recycled back into the cement kiln as raw feed. CKD's absorptive and alkaline qualities may be useful in land application settings, replacement of lime and cement in the stabilization and solidification and treatment of coal mine waste, industrial wastewater, sewage, and oil sludges. CKD can also be used as mineral filler in asphalt pavements, lightweight aggregate or fill material, and as cementitious material in flowable fill and slurry seals. CKD has also been used as landfill cover (University of Maine 2006, ASTSWMO 2007, IEEE-IAS et al. 2008). |

| Waste | Waste Description | Discussion of Research and Information |
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| Coal Combustion Bottom Ash | Coal combustion bottom ash is created from heavy ash particles that are formed in pulverized coal furnaces. The ash is too heavy to be carried out in the flue gases or impinge on the furnace walls, and falls into an ash hopper. Bottom ash is a coarse material, with a grain size ranging from fine sand to fine gravel. Approximately 17.8 million tons of bottom ash were generated and 7.5 million tons were beneficially used in the US in 2010 (ACAA 2011). | The chemical characteristics of coal bottom ash have been reported by several organizations (EPRI 2006a) and have been the topic of research in recent years by US EPA. Characteristics of bottom ash depend on the type of coal burned and the process characteristics at the generating plant where they are produced. Common reported beneficial uses for coal bottom ash include use as an aggregate in concrete production, for construction fill applications such as structural fill, flowable fill, road base, and other uses including snow and ice control, mining applications, waste stabilization, and agriculture (ASTSWMO 2007, ACAA 2011). Several scientific studies have been reported examining the strength and effectiveness of concrete products and fill uses when coal bottom ash is used (Rogbeck & Knutz 1996, Kurama & Kaya 2008, Kim & Do 2012). |
| Coal Combustion Fly Ash | Coal combustion fly ash is removed in exhaust gases during the combustion of coal for electricity production. Fly ash is a very fine material composed of mostly of silica, silt, and clay sized spherical particles. Fly ash may be in wet or dry form, dependent on the process used to store the ash. Fly ash can be identified by class, as defined by ASTM: Class F fly ash is generated from the combustion of anthracite or bituminous coal, while Class C fly ash is generated from the combustion of lignite or bituminous coal. 68 million tons of fly ash were produced in the US in 2010 (ACAA 2011). | The chemical characteristics of coal fly ash have been reported by several US organizations (US DOE 2006, EPRI 2010, IRC 2012a, US EPA 2012c) and the leachate characteristics of coal fly ash have been examined by several investigators (Roy et al. 1984, Roy and Griffin 1984, Bhattacharyya et al. 2008, EPRI 2010, Cetin et al. 2012). Common beneficial uses for coal fly ash include use as an ingredient in cement manufacture, an aggregate in concrete production, for soil stabilization, as alternate daily cover, and for construction fill applications such as road base and structural fill (Naik and Singh 1993, ASTSWMO 2007). Several scientific studies have been published examining the strength of concrete products when coal fly ash is used as an aggregate (Carette et al. 1993, Neufeld et al. 1994, Paya et al. 2002, Rostami and Brendley 2003, Siddque 2003). |

| Waste | Waste Description | Discussion of Research and Information |
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| Contaminated Soils | Contaminated soils are those that come in contact with potentially hazardous solid or liquid chemical substances that are either attached to soil particles or trapped in pore spaces within the soil matrix. A common contaminant of soil is petroleum products, which is often generated as a result of leaking underground storage tanks, though several states define a contaminated soil as one that contains chemical constituent concentrations above risk-based target levels. | Most contaminated soils considered for beneficial use are contaminated lightly with petroleum; though soils can become contaminated with heavy metals or other organic pollutants. Reported beneficial uses for contaminated soil include use as alternative daily cover at landfills, as an aggregate in asphalt and concrete production, and for construction fill applications such as road base or highway embankments (ASTSWMO 2007). Contaminated soils can be amended with ash (e.g., fly ash) to stabilize the contaminants (Demirkan et al. 1975, Ruttens et al. 2010, Lopareva-Pohu et al. 2011. The composition/characterization of contaminated soils is highly variable, and has been examined in the scientific literature (Bojes and Pope 2007, Adebiyi and Adeyemi 2010). Some states have published guidelines and/or standards related to the beneficial use of contaminated soil, restricting the levels of parameters such as diesel range organics, gasoline range organics, and total petroleum hydrocarbons (NJ DEP 1998, MDNR 2006, MPCA 2012a). Leaching from contaminated soil/sediments as well as containing materials (concrete) has been investigated by several researchers (Rixey et al. 2000, Hago et al. 2007, Pinto et al. 2011, Kogbara et al. 2012), also risk to ecological systems has been examined (Saterbak et al. 1999, Mao et al. 2009). |
| Crushed Concrete | Crushed concrete is generated from the demolition of Portland cement concrete structures, sidewalks, curbs, pavement, building slabs, and runways. Following demolition of the structures, concrete may be crushed on site using mobile equipment, or stockpiled and hauled to a processing facility where the material is screened to remove soil and other material. The crushed concrete is composed of mineral aggregates bonded to pieces of hardened cement paste. An estimated 140 million tons of concrete are recycled annually in the US. | The chemical and physical characteristics of crushed concrete have been reported by several organizations (FHWA 2004, IRC 2012e), including leaching characteristics (Limbachiya et al. 2007, Engelsen et al. 2009, Engelsen et al. 2010). Common reported beneficial uses for crushed concrete include use as an aggregate in concrete production, landfill alternate daily cover, general fill material, and for construction fill applications such as road base (ASTSWMO 2007). Several scientific studies have been reported examining the strength and effectiveness of products utilizing recycled crushed concrete (Chen et al. 2003, Plaza et al. 2007, Meyer 2009). |

| Waste | Waste Description | Discussion of Research and Information |
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| Dredging Material | Dredged material consists of accumulated sediments that have been removed from the bottom of waterways. The physical characteristics of dredged material can vary from fine clays to silts and coarse sand. Approximately 200 to 300 million yd$^3$ of material are dredged from ports, harbors, and waterways annually (US EPA 2007). | The characteristics of dredged material have been reported by several organizations (US EPA 2007, US ACE 2007), and the leaching of dredged material has been examined in the literature (Long et al. 1998, Perrodin et al. 2006). Beneficial uses for dredging material include use as landfill alternate daily cover, landfill closure material, as an aggregate in concrete production, and for construction fill applications such as road base and general fill, and also for beach restoration, beach nourishment, foundation for parks and recreational facilities, soil stabilization, reclamation of strip mines, and in agriculture to replace eroded soils (US EPA 2004, ASTSWMO 2007). Studies have reported examining the strength, reliability, and practicality of beneficial use projects utilizing dredged material (Mohan et al. 1997, Yozzo et al. 2004). |
| Flue Gas Desulfurization (FGD) Byproducts | FGD byproduct is formed as a result of sulfur dioxide ($SO_2$) removal from coal-fired boiler exhaust gas. Depending on the procedure used for $SO_2$ removal, FGD byproduct can be in the form of FGD gypsum, a wet sludge (wet scrubber byproduct) or a dry powdery material (dry scrubber byproduct). Dry FGD may also be referred to as lime spray dryer ash. The chemical composition of the final FGD byproduct depends on the general type of scrubbing system (i.e., wet or dry) and the scrubbing reagent (i.e., lime or limestone), and can exist in a gypsum (calcium sulfate) or hannebachite (calcium sulfite) form. Production rates for the varying types of FGD byproduct for 2011 were reported as: 25 million tons as FGD gypsum, 11.1 million tons as FGD materials from wet scrubbers, 2.2 million tons as FGD material from dry scrubbers, and 143,000 tons of "other" FGD byproducts (ACAA 2012). | The chemical characteristics of FGD byproduct have been examined (ACAA 2012, US EPA 2008a, US EPA 2012d). Studies have examined FGD leachate and metals content (DOE-NETL 2006, EPRI 2006a, Gustin and Ladwig 2010). Beneficial uses for FGD byproduct include use to replace virgin gypsum in wallboard, raw feed for cement clinker, fill, landfill cover, as an agricultural soil amendment, for land application, and for soil stabilization and mine reclamation (EPRI 2006b, ASTSWMO 2007, US EPA 2008a, US EPA 2008b, ACAA 2012c). Various scientific studies have examined the effectiveness of using FGD byproducts in various soil, agricultural and construction applications (Alva 1994, Clark et al 2001, Qiao et al 2006, Hua et al 2010, Schlomberg et al 2011). |

| Waste | Waste Description | Discussion of Research and Information |
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| Foundry sands | Foundry sands are a product of the metal casting process that takes place in metal foundries. New, virgin sand is used to make casting molds for metals. The sand is reused within the casting process multiple times, until the sand becomes unsuitable and is removed and replaced. Generally two types of foundry sands are generated. Green sand is the most commonly generated foundry sand and is comprised of silica sand, 10% bentonite clay and 2-5% water. Chemically bonded sand consists of one or more organic binders, along with catalysts to provide carrying hardening and setting procedures; the sand comprises nearly 97% of the mixture. 9 to 13 million tons of foundry sands are produced annually (FHWA 2004, US EPA 2006b). | The chemical characteristics of foundry sand have been reported by several investigators (NCASI 2003, US EPA 2006b, IRC 2012d), including leaching properties (Lahl 1992, Dungan and Dees 2009, Siddique et al. 2010). Beneficial uses for foundry sands include applications requiring fine aggregates such as structural fills, embankments, road base layers, flowable fill, Portland cement, concrete products, soil blending and hot mix asphalt (NCASI 2003, FHWA 2004, ASTSWMO 2007, IRC 2012d). Many scientific studies have examined the leaching potential and physical strength of bricks, concrete, and flowable fill products created with varying blends of foundry sands (Deng et al. 2008, Siddique and Noumowe 2008, Siddique et al. 2009, Guney et al. 2010, Siddique et al. 2011, Siddique and Gurpreet 2011, Alonso-Santurde et al. 2012, Basar and Aksoy 2012, Singh and Siddique 2012). |
| Glass, Glass Cullet | Glass is a durable and brittle material most commonly composed of soda ash, sand, limestone, and cullet. 13 million tons of glass is generated annually in the US (2011), of which 90% is for food and beverage containers. In addition to glass in food and drink containers, glass is present in furniture, appliances, consumer electronics, kitchen tiles, counter tops, and wall insulation. | For reuse applications, glass is typically ground (glass cullet). Common reported beneficial uses for glass/glass cullet are as an aggregate material used as a component in cement for concrete production, fill material, drainage material, and as a sandblasting agent (ASTSHWMO 2007). Many scientific studies reporting on glass cullet beneficial use compare the strength of concrete products when glass cullet is used as an aggregate or in the making of cement (Dyer and Dhir 2001, Naik and Wu 2001, Shayan 2002, Wartman et al. 2004, Karamberi et al. 2007). |
| Ground Woody Debris | Ground woody debris can originate from a variety of sources including lumber, branches and yard waste, stumps and trees from land clearing, used lumber, shipping pallets, and other wood debris from construction and demolition of residential and commercial structures. Residential new construction accounts for 40%-50% of generated wood waste volume. In 2003, nearly 6 million tons of wood waste was generated from urban wood sources, woody debris from suburban land clearing, and forestry residuals. | The characteristics of wood waste and woody debris have been reported by several organizations (USDA 2002, CalRecycle 2011), and leaching of ground woody debris (including treated wood) has also been reported (Falk 1997, Townsend et al. 2003, Jacobi et al. 2007). Common reported beneficial uses include animal bedding, as mulch and other landscaping uses, in composting, and as a fuel source (ASTSWMO 2007). Several scientific studies have examined the capabilities of products and advantage of projects when wood waste and woody debris is used (Lloyd et al. 2002, Ince and McKeever 1995). |

| Waste | Waste Description | Discussion of Research and Information |
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| Gypsum Drywall, Wallboard | Wallboard is primarily composed of a gypsum plaster (calcium sulfate), and a thin paper backing, manufactured in a variety of thicknesses. Gypsum drywall is mainly a component of construction and demolition (C&D) waste (as unused scrap material and demolished material). Approximately 14 million tons of wallboard waste is generated annually in the US. | The chemical characteristics of wallboard have been reported by several organizations, including summaries by federal and state agencies (CalRecycle 2007, MDEQ 2007, US EPA 2010a, NEWMOA 2010,) as well as industry organizations (GA 2012, NERC 2012). Beneficial uses include replacing quantities of virgin gypsum in new wallboard manufacturing, replacing virgin gypsum in cement manufacturing, and as a soil conditioning amendment (due to gypsum's liming properties) (ASTSWMO 2007, NEWMOA 2010). Several studies have reported mineral and trace metal composition of drywall gypsum and compared results with the 40 CFR Part 503 standards for disposal of sewage sludge (UGA 2002, OSU 2012) for agricultural and reuse applications. |
| Hydrofracking (Hydraulic Fracturing) Waste | Hydrofracking is a method used to extract underground resources such as natural gas, oil, and geothermal energy from hydrocarbon reservoirs, such as coal beds and shales. The process generally involves the drilling of a well (including horizontally), injecting a fracturing fluid consisting of water, a proppant (typically sand), and chemical additives. The process produces several waste streams including drill cuttings and mud, flowback (fluid pumped to the surface of a well), and production brine. | The chemical characteristics and pollutants found within hydrofracking waste have been reported (US EPA 2010b). EPA studies are pending that evaluate the potential impact of hydraulic fracturing on drinking water resources (US EPA 2011a, US EPA 2012e). Proposed beneficial use options for produced water from hydrofracking include: land application (for crop production), livestock and wildlife watering, and industrial uses such as dust suppression or machine washing (US EPA 2010b). Examination of characteristics of waste is an emerging area. New York State DEC drafted a supplemental generic environmental impact statement related to hydrofracking wastes in 2011, which indicated drill cuttings are typically viewed as non-hazardous industrial wastes, and the beneficial use of production brine (e.g., for spreading on roads) must be requested by the NYSDEC on a case-by-case basis, as the NYSDEC indicated not enough information regarding production brine is known. |

| Waste | Waste Description | Discussion of Research and Information |
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| Phosphogypsum | Phosphogypsum is a byproduct formed from the treatment of phosphate rock (ore) with phosphoric acid to produce fertilizer. Phosphogypsum consists primarily of calcium sulfate and contains naturally-occurring radioactive material from the phosphate ore. Approximately 40-47 million tons of phosphogypsum are generated annually, with a majority generated in Central Florida. | The chemical characteristics of phophogyspsum have been reported by several organizations (FHWA 2012, US EPA 2012d). Reported beneficial uses of phosphogysum include use as a soil amendment and for use in cement and concrete manufacturing (Mehta and Brady 1977, Degirmenci 2008, Sumner 2000, FHWA 2012, Shen et al. 2012). Several scientific studies have been reported on radiation levels resulting from phosphogypsum storage piles (Haridasan et al 2002, Duenas et al 2010, Attar et al 2011). |
| Poultry litter | Poultry litter is a solid waste byproduct of the poultry industry and is typically comprised of a mixture of bedding material, manure, spilled feed and water. Poultry litter can be in the form of liquid manure, which is generated when manure is scraped or falls into a storage container; a common practice used with laying hens and ducks. The US produces approximately 10.2 million tons of poultry litter annually. | Several scientific studies have examined the leaching of metals, trace elements and nutrients from poultry litter (Minogue et al. 2012, Oyewumi and Schreiber 2012). Reported beneficial uses for poultry litter include use as compost, fertilizer, in land application and as a potential fuel source (OSU ND, ASTSWMO 2007, Perera et al. 2010, Dunkley et al. 2011, Kirubakaran 2012, Mankolo et al. 2012). |

| Waste | Waste Description | Discussion of Research and Information |
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| Pulp and Paper Waste | Pulp and paper mill waste is created at different phases within mill processes. Wastewater treatment plant (WWTP) residuals are comprised of primary treatment sludges (deinking residuals consisting of wood fiber and mineral matter such as clay and calcium carbonate after inks have been separated) and secondary treatment activated sludge waste (bacterial biomass). WWTP residuals make up nearly 5.5 million dry tons of the pulp and paper mill waste annually. Boiler Ash is generated from the burning of different types of fuel (wood, coal, and combinations of the two) to provide steam necessary for various processes within the mills. Depending on the fuel type used, boiler ash may have characteristics similar to wood ash or coal ash. Boiler ash constitutes nearly 4 million dry tons of pulp and paper mill waste annually. Process rejects, wood yard debris, causticizing residues and flue gas desulfurization material make up the remainder of pulp and paper mill wastes, nearly 5.5 million dry tons. A total of 15 million dry tons of byproduct are generated annually (Thacker 2007). | Several organizations have reported research and discussion on beneficial uses of pulp and paper wastes (NCASI 2003, Bird and Talberth 2008, and IRC 2012c). The chemical characteristics of wood and coal boiler ash have been studied at length (see coal ash and wood ash entries elsewhere in this table). WWTP residuals have been used as a soil amendment and compost, as a hydraulic barrier or as a landfill or mine tailings cover. Boiler ash (depending on if wood or coal is used) as a compost, in land application, as a liming agent, as an additive in concrete, as a soil stabilizer, or for earthen construction applications. Causticizing residues have been used as compost, landfill cover, and soil or as a component of cement (NCASI 2003, NCEI 2003, ASTSWMO 2007, Thacker 2007). |
| Recovered Screen Material (RSM), C&D Fines | RSM consists of dirt along with fragments of rock, wood, drywall, and plastic. These materials are the left over “fines” from screening out larger pieces of debris in the C&D waste stream at C&D processing facilities. | The chemical characteristics of RSM have been examined by Florida Department of Environmental Protection (FDEP 2011). A limited number of scientific studies have examined the leaching of heavy metals, sulfate and organic pollutants from RSM (Jang and Townsend 2001a, Jang and Townsend 2001b, Townsend et al. 2004). Common reported beneficial uses for RSM include use as landfill daily cover and grading or shaping material (ASTSWMO 2007). Studies have examined the uses of RSM, as well as gypsum content of C&D fines highlighting potential odor problems that can occur when using RSM as a landfill cover (Musson et al. 2008, Clark et al 2010). |

| Waste | Waste Description | Discussion of Research and Information |
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| Recycled (Reclaimed) Asphalt Pavement (RAP), Milled Asphalt | RAP includes removed and/or processed materials containing asphalt and aggregates. These materials are generated when asphalt pavements are removed for construction, resurfacing, or to obtain access to buried utilities. When properly crushed and screened, RAP consists of high- quality, well-graded aggregates coated by asphalt cement (bitumen). FHWA estimated up to 41 million metric tons of RAP are generated in the US annually. | RAP has been characterized by many governmental organizations (Flintsch et al. 2007, Beeson et al. 2010); however, more common is the characterization of the mixtures/products containing RAP, expected, given the necessity that pavement containing RAP must conform to performance standards (i.e., DOT specifications) (Chen et al. 2007, Hoyos et al. 2011). RAP is often recycled into new asphalt concrete as an aggregate, or included as an ingredient in either hot-mix or cold-mix asphalt (NAPA 2011). The leaching behavior of milled asphalt has been studied and reported in the academic literature (Brantley and Townsend, 1999, Legret et al. 2005, Kang et al. 2011). Several scientific studies have examined the performance qualities (e.g., compressive strength, moisture susceptibility, etc.) of cement treated products containing RAP (Kandhal et al. 1995, Taha et al. 2002, Copeland et al. 2010, Hajj et al. 2010, Yuan et al. 2011). |
| Scrap tires | The scrap tire waste stream is comprised of spent tires from personal vehicles, tractors and industrial, commercial, and recreational equipment and includes whole scrap tires and pieces of scrap tires. The relatively lower costs, as well as decreased sulfur and $NO_x$ gas emissions, when compared to other fuels, make tires a desirable fuel source in some cases. The US generated approximately 290 million scrap tires in 2003, approximately 223 million of which were consumed via scrap tire markets. | Tire-derived fuel is a major beneficial use for waste tires (US EPA 2012f), and several investigators have reported on specific beneficial uses (Gu 2005, Hazarika and Yasushara 2007), and several states have published guidance documents on the beneficial use of scrap tires (Mississippi DEQ 2002, MDE 2008, NMED 2011). Nearly half of the annually generated waste tires are used for fuel by the cement and paper industries or generate electricity (IRC 2012b). Tires may also be cut and shredded to produce tire derived aggregate (TDA), which can be used in civil engineering projects, embankments for roads and light rail projects (IRC 2012b). Additionally, waste and scrap tires may be ground into fine rubber particles for a wide variety of uses from athletic fields and recreation areas to new rubber products (ASTSWMO 2007). |

| Waste | Waste Description | Discussion of Research and Information |
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| Slag (Blast Furnace) | Blast furnace slag is generated from the components removed from the processing of iron ore and other iron oxide sources to form elemental iron in a blast furnace. The slag is non-metallic and consists of iron ore impurities, silicates and aluminosilicates, of calcium and other bases as well as sulfur and ash from the coke if it is used. Depending on how the slag is cooled, a variety of slag products can be formed, such as granulated slag, pelletized or expanded slag, and aggregate seal coating. US generation of blast furnace slag was estimated at 7 to 8 million metric tons in 2010 (van Oss 2012). | The chemical and mineral characteristics of blast furnace slag have been reported by several industry organizations (Lewis 1982, IRC 2012f, van Oss 2012) as part of efforts to beneficially use the material. A limited number of scientific studies have examined the leaching of blast furnace slag, as well as additional characteristics (e.g., particle size, hydraulic index) (Proctor et al. 2000, Pal et al. 2003). Common reported beneficial uses for blast furnace slag include use as an ingredient in cement manufacture, an aggregate in concrete production, and as lightweight aggregate for masonry blocks (ASTSWMO 2007, IRC 2012f). Several scientific studies have examined the strength of concrete products when blast furnace slag is used as an ingredient in cement and concrete manufacture (Osborne 1998, Hooton 2000). |
| Slag (Boiler) | Boiler slag is a product of coal combustion slag-tap boilers and cyclone boilers (wet bottom boilers). For both boilers, an ash hopper is located below the boiler to collect bottom ash and contains water to quench the ash once it falls in. When molten ash comes into contact with the water, it instantly crystallizes and forms pellets, resulting in a boiler slag that is a coarse, glassy material and black in color. For a slag-tap boiler, approximately 50% of the ash is retained as boiler slag and for a cyclone boiler, as much as 70%-80% of the ash is retained as boiler slag. Approximately 2 million tons of boiler slag were generated in 2011 (ACAA 2012). | The chemical characteristics of boiler slag have been reported by several organizations, including both the federal government (NETL DOE 2006, US EPA 2008, US EPA 2012b, FHWA 2012) and industry organizations (ACAA 2012). Common reported beneficial uses for boiler slag include use as blasting grit, structural fill, as a substitute for soil, sand, shale, aggregate and gravel, and for snow and ice control (US EPA 2008a, FHWA 2012, ACAA 2012). The abrasive properties of boiler slag have led to its use as blasting grit and an ingredient in asphalt shingle production (US EPA 2008a). |
| Slag (Foundry) | Foundry slag is a byproduct generated during the melting process in foundries. Slag consists primarily of metal oxides from the metal melting, and amounts of sand from castings and coke ash. Physically, slag may be in a variety of shapes, depending on the cooling method utilized. If quenched in water, slag will form in gravel size particles, or in boulder shapes if poured into molds and allowed to air cool. | Common reported beneficial uses for foundry slag include use as a coarse aggregate for concrete, asphalt, and highway subbase, and as a raw material for cement manufacturing and masonry products (Naik et al. 1996, NCASI 2003, ASTSWMO 2007, IRC 2012d). Leaching behavior of foundry slag has also been investigated (Deng and Tilkalsky 2006). |

| Waste | Waste Description | Discussion of Research and Information |
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| Slag (Steel) | Steel slag is a byproduct specific to steel manufacturing. The slag is formed by the additions of limestone or dolomite and silica sand to steel furnaces, which strip impurities from scrap steel. Steel slag is most commonly air-cooled; the molten slag cools slowly under ambient conditions and is then sprayed with water towards the end of cooling. Steel slag is typically comprised of calcium silicates, calcium alumino-ferrites, calcium, iron, magnesium, and manganese oxides, and has a higher lime-silica ratio than other types of slag. United States generation of steel slag was estimated to be between 8 and 12 million metric tons in 2010 (van Oss 2012). | The chemical characteristics of steel slag have been reported by several organizations (Lewis 1982, Das et al. 2007, Wang et al. 2010, van Oss 2012, IRC 2012f). Commonly-reported beneficial uses for steel slag include use as an aggregate in Portland cement and asphalt concrete production, as a lightweight aggregate in masonry blocks, and as construction fill applications such as road base and structural fill (ASTSWMO 2007). Several scientific studies have examined the strength of steel slag products when used as an aggregate or road base (Malehuddin et al. 2002, Shen et al. 2009). |
| Spent Abrasive Blasting Media | Air-based blasting is the use of a compressed gas (usually air with or without added abrasives) to remove paint, other coatings, or corrosion such as rust from a surface, or to prepare a surface for a new coating. It is often called sandblasting, although abrasives other than sand – or no abrasive at all – may be used. Common materials used for the abrasive blasting material include: silica sand, coal slag, glass bead, steel shot/grit, plastic media or crushed nutshells. | The chemical characteristics of spent abrasive blasting media has been identified by state and federal organizations primarily with respect to the federal Renovation, Repair, and Painting Rule (which addresses blasting lead based paint) (ODEQ 1994, MPCA 2011). Scientific studies have examined the leaching of spent abrasive blasting media and the beneficial use of the material in concrete applications (NCDOT 1989, Brabrand and Loehr 1993, Webster and Loehr 1996, Carlson and Townsend 1998). Additional, commonly reported beneficial uses for spent abrasive blasting media include use as a fill, aggregate or component in cement (ASTSWMO 2007). |
| Spent Oil Shale | Oil shale is mined as a source of recoverable oil. Spent oil shale is the waste by-product remaining after the extraction of oil. It is a black residue generated when oil shale is retorted (vaporized and distilled) to produce an organic oil-bearing substance. Spent oil shale can range in size from very fine particles, smaller than 0.075 mm (No. 200 sieve), to large chunks, up to 230 mm (9 in) or more in diameter. Coarse spent oil shale can resemble waste rock because of its large particle size. | The chemical characteristics of spent oil shale have been reported by several organizations, including summaries by both the federal government (US EPA 2012g) and industry organizations (WRAP 2011), and the leaching behavior has also been assessed (Krol et al. 1988, Essington 1991, Shirav and Robl 1993, Mõtlep et al. 2010). Reported beneficial uses for spent oil shale include use as an ingredient in cement manufacture, an aggregate in concrete production, and for construction fill applications such as road base (Winter 2001, Al-Otoom 2006). Several scientific studies have examined the strength of concrete products incorporating oil shale ash (Smadi and Haddad 2003, Oymael 2009, Raado et al. 2011). |

| Waste | Waste Description | Discussion of Research and Information |
|---|---|---|
| Stormwater Sediments | Stormwater system sediments are generated when sediments accumulate in stormwater systems, requiring removal in order for the system to continue functioning properly and may include soil, vegetative matter, and possibly small amounts of solid waste that may be washed into the system during rainfall events. Stormwater sediments typically do not include sediments collected in roadside ditches or canals. Sediments can be generated from industrial or non-industrial stormwater areas. | The chemical characteristics of stormwater sediments have been reported by several organizations (Jacopin et al. 1999, Polta et al. 2006; Weinstein et al. 2008, Weston Solutions, Inc. 2009) and in the academic literature (Zanders 2005, Hwang and Foster 2006). The leaching behavior of stormwater sediments has also been reported (Anderson et al. 1998, Joshi et al. 2009, Clément et al. 2010, Jang et al. 2010), including the potential for ecological impacts from leachates (Clément et al. 2010). Several states (e.g., Florida, Minnesota) have published guidance documents regarding the management and beneficial use of stormwater sediments, which primarily identify beneficial uses as landfill cover, road construction/maintenance applications, or as a construction or industrial fill (FDEP 2004, MPCA 2012b). These guidance documents also suggest that elevated polynuclear hydrocarbon content of stormwater sediments may be prohibitive for some beneficial uses. |
| Street Sweepings | Street sweepings are the materials collected and removed from streets, parking lots, and sidewalks, for aesthetics and as a preventive measure to keep these materials from entering sewers and surface waters. Street sweepings can contain sand, salt, leaves, broken glass, small pieces of metal, and other litter and debris. Street sweepings do not include materials generated during the cleanup of an oil spill or hazardous material spill. | The chemical characteristics of street sweepings have been reported by several organizations (FDEP 2004, CDEP 2007), including leaching and potential environmental impacts (Brinkmann et al. 1999, Liebens 2001, Jang et al. 2009). Reported beneficial uses for street sweepings include use for construction as fill material, noise berms, aggregate, landfill cover, and as soil replacement in engineering applications (ASTSWMO 2007, MPCA 2010). |
| Water Treatment Plant (WTP) Sludge | Drinking water sludge is a byproduct of the water treatment processes used in water treatment plants (WTP). Coagulants are used in water treatment to facilitate flocculation for the removal of turbidity and pathogens, and to reduce hardness via precipitation softening. Through sedimentation and filtration, these residuals are removed in the form of sludge. Sludge is typically produced in the form of lime, alum, or ferric sludge depending on the treatment type used. | The chemical characteristics of water treatment sludge have been reported by several organizations (US EPA 1996, Townsend et al. 2001, Meng et al. 2001, Jain et al. 2005, FDEP 2006, Mortula et al. 2009, Hafer et al. 2011, US EPA 2011b). Common reported beneficial uses for water treatment sludge include use as an agricultural soil amendment, alternative daily cover for landfills, and for construction fill applications such as road base (ASTSWMO 2007). Several scientific studies have examined the efficiency of water treatment sludge when beneficially used (Che et al. 1988, Lin et al. 2007). |

| Waste | Waste Description | Discussion of Research and Information |
|---|---|---|
| Wood ash | Wood ash is the byproduct from the combustion of wood or wood fiber. Wood ash composition can vary depending on the wood source (industrial, municipal) and the characteristics of the combustion system. Forest management residues and lumber mill waste are typically considered sources of clean wood, while chemically treated and painted wood, as well as C&D wood waste may not be considered clean wood. The chemical composition of wood ash also depends on whether fly ash and bottom ash are combined or if they are kept separate. Approximately 3 million tons of wood ash is generated in the United States annually (Risse 2010). | The chemical characteristics of wood ash, along with its management, have been reported by several organizations (Kopecky et al. 1995, Demeyer et al. 2001, Zhang et al. 2002, Risse 2010, ODEQ 2011, Norstrom et al. 2012). Common reported beneficial uses for wood ash include use as a soil amendment in agriculture for the purpose of providing minerals of potential value such as potassium, as well as acting as a liming agent (NEWMOA 2001, ASTSWMO 2007). |
| WTE Ash, MSW Ash | Waste to Energy (WTE) ash is the byproduct of the combustion of MSW for energy use at mass burn or refuse derived fuel (RDF) facilities. Mass burn facilities combust unsorted MSW, whereas at RDF facilities the incoming waste is presorted to remove ferrous metals and recyclables from the waste stream and is then shredded prior to combustion. The byproducts of combustion are fly ash, collected from the facility air pollution controls, and bottom ash, collected as it falls to the bottom of the combustion chamber; a common practice is to mix bottom ash and fly ash. It is estimated that 4.35 and 7.25 million tons of MSW WTE ash were generated in 2010. | The physical and chemical characteristics of WTE ash have been evaluated (US EPA 1990, Chimenos et al. 1999, FDEP 2001, van der Sloot et al. 2001, ASME 2003, Sabbas et al. 2003, Dubey and Townsend 2007). Reported beneficial uses for WTE ash include use as an aggregate in concrete production, in the manufacture of asphalt, as landfill alternate daily cover and landfill construction material, and for construction fill applications such as road base, embankments, and structural fill, as well as agricultural applications (ASTSWMO 2007, FHWA 2008). Several scientific studies have reported on the strength and reliability of products containing WTE ash that has been beneficially used (Aubert et al. 2004, Shih et al. 2003). |

# APPENDIX B

## SUMMARY OF U.S. STATE RULES REGARDING BENEFICIAL USE

## Alabama BU Profile

Applicable rule: ADEM Administrative Code 335-13, April 3, 2012

- No definition of beneficial use in the rules.
- Definitions in rules include “Special Wastes” which are those wastes which are handled differently. Examples include (but are not limited to) mining wastes, fly ash, bottom ash, sludges, industrial waste, foundry waste, MSW ash, and contaminated soil.

- Materials that are beneficially used in the state are considered “recovered materials”. Solid waste rules do not apply (per ADEM AC 335-13-3-.01, Applicability) if recovered materials are received by a facility for use in manufacturing as a fuel, raw material, or substitute for a commercial product

- ADEM rules do have specific language regarding foundry wastes. The wastes must be evaluated using the TCLP (metals only). If levels measured from TCLP testing are less than 50% of the corresponding toxicity characteristic limit, then the foundry waste can be managed in the following manner:

  - Areas other than flood plains, wetlands, residential areas, and areas less than 5 ft above the uppermost aquifer
  - Managed in a way such that records showing location and amount of material disposed at each location are kept
  - Quarterly certification by the generator or whenever the generator’s process changes in a way that would alter TCLP results. The certification must include a solid and hazardous waste determination form and TCLP metals analysis
- For MSW incinerator ash, the material must be disposed of at a landfill that meets minimum ADEM design criteria. Other disposal or use must be approved by ADEM.
- Exemptions to recycling facility registration are provided in ADEM AC 335-13-3-.02(3); select exemptions are summarized as follows:
  - Facilities that receive source-separated recyclable asphalt and pre-consumer asphalt shingles or other asphalt-based roofing, or a combination thereof by an asphalt manufacturing plant prior to its introduction into the asphalt manufacturing process
  - The recycling or reuse of materials which are generated, processed, and reused as a product, raw material, or fuel exclusively at the point of generation by facility personnel or on-site contractor operations which are directly related to the operation of the facility
  - The receipt, storage, processing, or transfer of grass clippings or other yard wastes, branches, stumps, brush, wood chips derived from tree parts, and/or other non-putrescible, non-food wastes which is regulated separately by ADEM under regulations regarding composting facilities and/or is specifically exempted from solid waste regulations

## Alaska BU Profile

- 18 AAC 60, Solid Waste Management, rules (amended through 8 April 2012)

Several materials are exempted in the 18 AAC 60 solid waste rules, including:

- Landclearing waste
- Tree limbs and other woody debris
- Bricks, mortar, Portland cement concrete (including steel)
- Crumb rubber used in asphalt pavement
- Crushed glass
- Waste mining rock
- Wood waste that is:
    - Used to build roads, building pads, and parking areas
    - Less than 10 ft thick
    - Complies with water quality standards found in 18 AAC 70
- Crushed asphalt pavement used in the following manner:
    - In building pad or parking area as road base or pavement
    - To build containment berms for tank farms
- Other land-applied wastes that meet the conditions of 18 AAC 60.007 (fill rules)

The Alaska fill rules found in 18 AAC 60.007 indicate that the following materials can be land applied, subject to the conditions described below:

- Wood waste
- Inert waste
- Coal ash
- Crushed pavement
- Other similar approved wastes

The above-listed materials can be land applied provided the following conditions are met:

- Submittal of a proposal to the Alaska Department of Environmental Conservation with the following information:
    - Appraisal showing the current property value where the waste is to be placed
    - List of waste to be placed, including amount and type of each
    - Proposed future use of the site
    - Property value estimate after waste is placed on the property
    - Operations plan showing where the waste will be placed
    - Expected loading capacity and density of finished fill
    - List of each permit and approval issued or expected to be issued by other agencies
    - Construction drawings showing grades, surface contours, drainage and roads
- Approval by the ADEC may be given if it is found that the project will:
    - Increase the market value of the property
    - Not erode or shift in a way to preclude future use of the site
    - Not create harmful leachate
    - Not undergo combustion
    - Not cause a threat to public health, safety, welfare, or to the environment

Per 18 AAC 60.008 regarding Beneficial Use, if a waste other than that listed above (in 18 AAC 60.007) is proposed for beneficial use, the applicant must submit a proposal explaining the use and the features that will be incorporated to protect human health, safety, welfare, and the environment. The ADEC will review the proposal and determine if health, safety, welfare, and the environment are protected. If so, the applicant may be exempt from some or all of the requirements of 18 AAC 60.

Discussions with ADEC indicated that beneficial use proposals for materials other than those listed in 18 AAC 60.007 have been received, particularly coal ash use in the northern part of the state. There is no formal guidance or procedure that is used for evaluating leaching risks, each instance is reviewed on a case by case basis.

http://www.dec.alaska.gov/eh/sw/index.htm

## **Arizona BU Profile**

The Arizona Department of Environmental Quality (ADEQ) regulates solid waste; Arizona Statutes, Title 49 (The Environment), Chapter 4 (Solid Waste Management) contains solid waste provisions.

There are several exemptions from definition of a solid waste in the Title 49 rules.

- 49-701.15 “Inert material” means material that satisfies all of the following conditions:
  - Is not flammable
  - Will not decompose
  - Will not leach substances in concentrations that exceed applicable aquifer water quality standards prescribed by section 49-201, paragraph 20 when subjected to a water leach test that is designed to approximate natural infiltrating waters
  - Includes concrete, asphaltic pavement, brick, rock, gravel, sand, soil and metal, if used as reinforcement in concrete, but does not include special waste, hazardous waste, glass, or other metal
- 49-701.20 On-site generated wastes processing and reuse conditions:
  - On-site processing or reuse of the materials is technically feasible
  - At least 75% by weight or volume of the materials that are accumulated on site for processing or reuse each year are processed or reused in that same year
  - Materials that are accumulated on site for processing or reuse are managed in a manner that:
    - Controls wind dispersion and other surface dispersion of the materials so that the materials do not create a public nuisance or pose an imminent and substantial endangerment to public health or the environment. Visible materials that are dispersed beyond the boundaries of the site shall be collected on a regular basis by the operator of the site.
    - Does not discharge hazardous substances as defined in section 49-281 to surface water, groundwater or subsurface soils in a manner that creates a public nuisance or poses an imminent and substantial endangerment to public health or the environment.
    - Controls vector breeding and fire hazards.
    - Controls public access to the materials by the use of reasonable measures.
  - Any person may petition the director to exempt a substance as solid waste by submitting a written request to the director. The request may be for a statewide or site-specific exemption. Within ninety days after receipt of a written request, the director shall determine whether to exempt the substance. The director's determination shall be based on a demonstration that the substance is unlikely to cause or substantially contribute to a threat to the public health or the environment. The procedure is as follows:

        - Within thirty days after the director's determination to add a substance on a site-specific basis, a notice of that determination shall be published in the Arizona administrative register. A site-specific determination is effective on the date of the director's determination.
        - Within thirty days after the director's determination to add a substance on a statewide basis, the director shall initiate rule making to add the substance to the list of exemptions. This rule making is exempt from the requirements of title 41, chapter 6, except for the requirements regarding public notice. The effective date for the final rule is the effective date for the exemption.
    - Nothing in this section shall affect the department's authority to require abatement of any environmental nuisance pursuant to chapter 1, article 3 of this title.

Arizona Statutes Title 18 Chapter 13 Article Solid Waste Definitions: Exemptions

- Land Application of Biosolids
    - Must be applied in accordance with 18 AAC 13, Article 15 and ARS 49-761(F)
    - Exemption applies after the site of land application has ceased to receive biosolids application
    - Biosolids and soil to which biosolids are applied must remain at the site of application
- Coal Slurry Discharges from Pipeline Leaks
    - Resulting from accidental pipeline leaks
    - The thickness of the layer of coal slurry on the ground is 3 inches or less

## Arkansas BU Profile

Arkansas Department of Environmental Quality (ADEQ) regulates the beneficial use of solid waste via the Solid Waste Management Regulations 22.103(i) and 22.103(j)

- 22.103(i) – Use of Recovered Materials - Provided that the Department may rescind this authorization based on environmental, public health or other factors, the use of recovered materials as defined in Reg.22.102, whether the recovered material is directly reused, used in a manufacturing process, used as a construction material, or is inert material used as beneficial fill material, shall not constitute the disposal of solid waste for purposes of this regulation provided that such use of recovered materials will not result in adverse impacts to the air or surface and ground water quality.
- 22.103(j) – Approval may not be required for the use of recovered materials except that the Director may impose conditions on the use and re-use of materials otherwise classified as solid waste on a case by case basis to assure protection of air, or surface and ground water quality.
- There are no specific beneficial use program regulations other than items i and j of Reg. 22.103
  - Items i and j of Reg. 22.103 serve as a broad standing approval to reuse waste in general
  - As long as the waste has no means to cause a threat or harmful conditions to human health and the environment, it can be reused
  - ADEQ may provide conditions for reuse if the waste is submitted to the department by the generator if it is unclear whether waste may be beneficially used
- Facilities may look to ADEQ for concurrence that a waste may be reused, for which review request is analyzed and approved or approved with conditions
  - Letter for use granted by the department is not a permit and therefore not tracked by ADEQ
  - Typically receive about 12 requests per year
  - When waste requests are received by ADEQ, TCLP analytical results are evaluated against characteristic hazardous waste levels. This is the only criteria they are compared to.
- Per discussions with ADEQ, the materials most commonly beneficially used in the state include the following:
  - Wood ash
  - Coal combustion byproducts from the 5 coal generating facilities
  - Wood waste
  - Sediments from stormwater, process, and settling ponds
  - Rock crushing residual (granite dust)
  - Cement kiln dust
  - Steel slag (for use in road base)
  - Drill cuttings (have not found a proper alternate use as of yet)
  - Tires

From the ADEQ document "Guidance for Determining Beneficial Use", the following guidelines are provided regarding the beneficial use of any non-inert solid waste stream and to demonstrate that the proposed use does not constitute disposal of solid waste.

1. For land application, the waste stream must be certified as a having a beneficial use as a product. If no beneficial use of the material as a soil amendment can be demonstrated, the material will be classified as a waste and must be properly disposed in a permitted facility.

2. The beneficial use certification must include testing and written documentation from a qualified soil scientist or agronomist that describes in detail the beneficial use of the material. The person certifying that the waste stream is acceptable for land application or use as a soil amendment must determine and comment on the potential long-term effects the material will have on surface water, ground water, human health and the environment in and around the land application site(s). The certification must include the recommended loading rates for the material in allowable quantities per acre based on existing soil conditions and the waste stream analysis.

3. Analytical results must show what compounds or nutrients are present in the material, the concentrations of those elements (weight basis), and the beneficial characteristics of the constituents.

4. The BU applicant must submit a Beneficial Use Plan that describes storage prior to implementing the beneficial use (e.g., storage pond liners, surface runoff controls, staging areas, how material will be transported, how it is applied, equipment used, buffer zones employed, location(s) of land application areas, property ownership records and right-of-entry documentations, etc.).

5. Authorization allowing beneficial use is not a release from any environmental liability. Any unauthorized waste or waste disposal shall be subject to penalties as defined by the Arkansas Code Annotated 8-6-204 et seq., and the Arkansas Solid Waste Management Regulation 22.

## California BU Profile

California does not have a formal beneficial use program in the solid waste regulations, nor is the term beneficial use defined in the solid waste regulations. However, a few mechanisms exist that may allow for the beneficial use of certain waste materials.

- Title 14, Division 7, Chapter 3.1 lists the rules for "Compostable Materials Handling Operations and Facilities Regulatory Requirements" and under Section 17852.15(B) includes exclusions from the definition of disposal, which includes the use of compostable material for alternative daily cover material at a solid waste landfill and land application of compostable organic material, which means compostable material (excluding food material or mixed solid waste) to forest, agricultural, and range land at agronomic rates.
- Title 14, Division 7, Chapter 3, Article 5.8 includes a discussion of nonhazardous ash regulatory tier requirements. Nonhazardous ash is defined as the residue from the combustion of material. Exclusions from the definition of "disposal" in article 5.8 of this rule include:
    - Use as a cover material at a solid waste landfill
    - Use of the ash in a (mine) reclamation project
    - Use for snow and ice control
    - Road base and subbase
    - Walking areas, parking areas, airport runways, trails
    - Dairy or feedlot stabilization
    - Structural fill
    - Sludge/manure/waste stabilizing material
    - Compost mineral filler
    - Smelter flux
    - Soil product blending
    - Other similar uses in accordance with Public Resources Code section 40180
    - Land application to forest, agricultural, and range land in accordance with California Department of Food and Agriculture requirements for a beneficial use as authorized by Food and Agricultural Code section 14501 et seq.
- Title 14, Division 7, Chapter 3, Article 5.95 includes a definition of inert debris (which includes, in part, concrete, crushed glass, cured asphalt, asphalt or fiberglass shingles, brick, slag, ceramic, and plaster). This section of the regulation defines inert debris engineered fill operations, which allows for filling of inert debris to facilitate "productive uses" of the land, where the inert debris is compacted into a dense mass capable of supporting structural loading, as necessary, or supporting other uses such as recreation, agriculture, and open space to provide land that is appropriate for an end use consistent with approved local general and specific plans.
- Exemptions from the requirements for transfer and processing facilities may allow for additional beneficial use of waste materials, provided that the facility meets the definition of a "manufacturer", which is defined as a "person or business entity that uses new or separated for reuse materials as a raw material in making a finished product that is distinct from those raw materials."
- A generator may petition a local enforcement agency (EA) for an exemption from requirements that the operator of a facility or operation obtain a permit to comply with state-mandated regulatory tier requirements. Exemptions may be granted if the exemption is not against the public interest, the quantity of solid wastes is insignificant, and the nature of the solid wastes poses no significant threat to health, safety, or the environment. Discussions with staff at CalRecycle indicated that this exemption is rarely pursued.

Wastes that are not explicitly discussed in the rules as described above may submit a request to CalRecycle to obtain permission to beneficially use the waste material. Based on California Statutes, specifically Public Resources Code 40191, the burden of evaluating whether the use of a waste material is one that is not defined as “disposal” or “solid waste disposal” is on the generator. In general, a generator would contact a local EA to evaluate the requirements that the generator must meet as part of a beneficial use application. Depending on the type of waste and the proposed use, multi-agency involvement may be required, which may involve CalRecycle, the Regional Water Quality Board(s), the California Department of Food and Agriculture, and possibly others. The procedures followed (e.g., analytical testing required) is waste – and use-specific, and often involves multi-agency involvement including CalRecycle, the Regional Water Quality Board(s), the California Department of Food and Agriculture, and possibly others.

## **Colorado BU Profile**

Beneficial use of solid waste is regulated by the Colorado Department of Public Health and Environment via the Colorado Code of Regulations 6 CCR 1007-2, Part I, Section 8 Recycling and Beneficial Use

- "Beneficial use" means the use of solid waste as an ingredient in a manufacturing process, or as an effective substitute for natural or commercial products, in a manner that does not pose a threat to human health or the environment. Avoidance of processing or disposal cost alone does not constitute beneficial use.

8.1.4 Exemptions Recycling and Beneficial Use

- This section 8 does not apply to the following:
    - Biosolids and activities regulated under section 25-8-205(1)(e), C.R.S;
    - Composting facilities that are regulated under Section 14 of these regulations, unless recycling operations are conducted at that facility;
    - Waste grease recycling regulated under Section 18 of these regulations, unless recycling operations are conducted at that facility;
    - Waste tire collection facilities or waste tire processors or end-users that are regulated under Section 10 of these regulations, unless recycling operations are conducted at that facility;
    - Facilities that collect and process only scrap automobiles, scrap appliances, or other processed scrap metal, unprocessed home scrap metal, unprocessed prompt scrap metal, and obsolete scrap metal, as those terms are defined in section 30-20-101, C.R.S.;
    - Facilities that collect and process only shredded circuit boards;
    - Recyclable hazardous waste and household hazardous waste; and
    - Household hazardous waste roundup events, community cleanup events, and other one-time or occasional collection events where yard waste and other recyclable materials are accepted for drop-off by private citizens for cleanup events.

Section 8.6 Beneficial Use

- Table 3 of Section 8 includes the Pre-Approved Beneficial Use Table. Waste and uses listed here do not require testing or characterization
- Management of the beneficial use waste may not have
    - A negative impact on groundwater quality
    - Environmental impacts exceeding those expected from available commercial products or raw materials
    - Environmental impacts exceeding department approved unrestricted use concentrations
    - Environmental impacts exceeding any residual constituents exceeding background concentrations for those constituents
- Weight or volume of recyclable materials that are recycled shall be at least 90% of the total weight or volume of materials received over a 3 year rolling average

- Use of waste material shall
    - Adhere to established engineering specifications
    - Adhere to established product, end use specifications
    - Demonstrate benefit associated with the use
    - Have use as a substitute for or in conjunction with a commercial product or raw material
- Pre-approved beneficial uses meeting these criteria allow wastes to be used without prior approval from the Department, unless there is reason to believe the waste contains contaminants that exceed department approved unrestricted use concentrations that are protective of ground and surface water.

8.6.5 Beneficial Use Waste Material Characterization

- Beneficial uses for wastes that are not listed in the Pre-Approved Beneficial Use Table, Category 1 Total Elemental Analysis Table, Category 1 & 2 Analyte Mobility Analysis Table, or the Beneficial Use by Category Table are reviewed by the department on a case by case basis
- Wastes shall follow characterization testing requirements and the department will assign an appropriate category as specified in 8.6.6.
    - All wastes to be beneficially used shall be determined not the be a hazardous waste
    - Wastes to be characterized for eligibility for Category 1 and 2 shall be analyzed using EPA SW-846 methods for determining the mobility of analytes in liquid, soils, and wastes.
        - Mobility analysis most commonly conducted via TCLP or SPLP (more commonly TCLP)
    - Wastes to be characterized for eligibility for Category 1 shall be analyzed using EPA SW-846 methods for determining total elemental analytes present in liquids, soils, or waste.
    - Unless the department approves of an alternative recharacterization method and/or frequency, wastes shall be recharacterized by:
        - Representative sampling of each Category 1 waste shall be performed in the same manner as specified for the initial characterization once each year.
        - Representative sampling of each Category 2 waste shall be performed in the same manner as specified for the initial characterization once every 2 years.
        - Additionally, representative sampling of each waste shall be performed whenever there is any change in the waste generation process.

8.6.6 Beneficial Use Materials Category

- Category 1 – Wastes containing constituent concentrations less than those specified in Category 1 Total Elemental Analysis Table and Category 1 and 2 Analyte Mobility Analysis Table may be used as Category 1 beneficial use materials.
- Category 2 – If a waste does not meet the criteria for Category 1, the characterization test as approved by the Department shall be run on a representative number of samples of the final product. Waste products containing constituent concentrations less than those

specified in Category 1 and 2 Analyte Mobility Analysis Table may be used as Category 2 beneficial use materials.

8.6.7 Beneficial Uses

- Once characterization is complete, the Beneficial Use by Category Table is used for a list of the potential beneficial uses
- Wastes may not be placed below groundwater, or into permanent standing water, unless they are a part of a solidified application that has been demonstrated to not impact groundwater.

There have been 10 BUDs recorded for Colorado as of 2011, as reported by the NEWMOA Database.

**Table 3**

**Pre-Approved Beneficial Uses**

| | |
|---|---|
| **Waste Tire Sidewalls** | silage covers<br>Construction barrell weights |
| **Shredded Waste Tires** | drainage media substitute<br>fuel source with appropriate air permitting<br>landfill alternative daily cover when approved in D&O Plan<br>lightweight aggregate with an engineered plan |
| **Waste Mining Tires** | livestock/equestrian feeders |
| **Waste Mining Tire Sidewalls** | windbreaks |
| **Reclaimed Asphalt** | road base<br>component hot or cold mix apshalt<br>recompacted asphalt<br>roadside dressing<br>chip seal material<br>culvert cover<br>base stabilization |
| **Reclaimed Concrete, Brick, and Stone (non-asbestos bearing materials)** | road base<br>concrete aggregate<br>component of engineered structural backfill<br>aggregate substitue<br>engineered rip rap<br>road side dressing |
| **Non chemically treated Wood** | mulch<br>bio-filter |
| **Glass (lead free)** | concrete aggregate<br>pavement aggregate<br>aggregate substitute<br>filter pavement |
| **Clean reclaimed porcelin** | aggregate substitute |
| **Steel Slag** | aggregate substitute |
| **Autofluff** | alternative daily cover for landfills when approved in D&O Plan |
| **Shredded paper/cardboard** | animal bedding<br>insulation |

| Table 2 | | | |
|---|---|---|---|
| **Beneficial Use-by-Category** | | | |
| | **Waste Category** | | |
| | **1** | **2** | **3** |
| 1) Raw material for product manufacture | X | X | |
| 2) Waste Stabilization/Solidification | X | X | X |
| 3) Landfill Daily Cover | X | X | X |
| 4) Confined Geotechnical Fill: | X | X | |
| a) commercial, industrial or institutional building subbase | X | X | |
| b) paved lot base, subbase and subgrade fill | X | X | |
| c) paved roadway base, subbase & subgrade fill | X | X | |
| d) utility trench backfill | X | X | |
| e) bridge abutment backfill | X | X | |
| f) tank, vault, or tunnel abandonment | X | X | |
| g) slabjacking material | X | X | |
| h) soil and pavement base stabilization | X | X | |
| i) controlled low strength material (flowable fill) | X | X | |
| 5) Unconfined Geotechnical Fill | X | | |
| 6) Unbonded Surface Course | X | | |
| 7) Bonded Surface Course | X | X | |
| 8) Decorative Stone | X | X | |
| 9) Cold Weather Road Abrasive | X | | |

## **Connecticut BU Profile**

The Connecticut Department of Environmental Protection's Department of Materials Management and Compliance Assurance governs beneficial use of solid waste and issues BUD approvals.

Connecticut General Statutes (CGS) Section 22a-209f is the authority under which BUDs are issued:

- (a)(1) General permits
    - Approval of registration is required
    - Issuance of general permit shall be governed by procedures established in Section 22a-208a(i)
        - Does not include the authority to issue general permits to resource recovery facilities, biomedical waste facilities, solid waste disposal areas, or MSW composting facilities
        - General permit may regulate a category of activities
            - Involving the same or substantially similar types of operations
            - Involving the transfer, storage, processing, or disposal of the same types of substances
            - Requiring the same operating conditions or standards
            - Requiring the same or similar monitoring
    - Existing approved wastes
        - Asphalt shingles
        - Scrap tires
- (b)(1) Individual authorizations
    - Case by case approval
- Both require
    - Authorization must not allow an activity for which an individual or general permit has been issued
    - Authorization must not be inconsistent with RCRA requirements (42 USC 6901 et seq.)
    - Commissioner finds solid waste can be reused without harming or presenting a threat of harm to public health, safety, or the environment

Guidelines for BUD Authorizations published by CDEP (2010)

- Application fees are based on the expected annual use quantity
    - <120 tons/yr: $1,000 initial fee; $500 renewal fee
    - 120 to 1,200 tons/yr: $2,500 initial fee; $1,250 renewal fee
    - >1,200 tons/yr: $5,000 initial fee; $2,500 renewal fee
- Review criteria considered by CDEP
    - Identification type of solid waste material, how it is generated, and quantities generated annually
    - Description of previous handling of the solid waste (i.e. disposal and/or management)

    - Description of how the solid waste material will be used, testing/monitoring of the waste material, and how the material will effectively be used in manufacturing or as a substitute in a commercial product
    - Rationale for use of the material in a beneficial use; identification of chemical constituents present in the material, life cycles and potential environmental or health impacts; solid waste characterization studies and comparison to the analogous raw material; hazardous waste characteristics differing from the material it is replacing, performance comparison to an analogous raw material; identification of proposed mixing ratios, variation in quantity used in the product over a raw material, identification and degree of any pre-processing of the solid waste prior to use
    - Economic value of the waste compared to the analogous raw material, economics of recycling/reuse process, and consideration for fees paid by the waste generator
    - Any approvals or permits applied for from CDEP or another state for this specific type of beneficial use
    - Documentation of a market for the final product, contracts/letters of agreement between generator and purchaser or end user of the final product, commodity value of the final product, industry-recognized

BUD Approval

- A pre-application meeting with CDEP is recommended
- The CDEP commissioner approves and signs BUDs into effect
- BUD approvals are valid for 10 years
- Existing BUDs may be renewed
- CDEP will not consider a waste if it can be classified as hazardous (fails TCLP or another CDEP approved method of determination, such as SPLP)
- If risks are unknown, a demonstration project can be proposed and conducted for a period of 2 years
    - Allowed for wasted that do not have data to show it is a successful BUD
    - Need to prove reuse would be successful and there is a market available
    - University of Connecticut, Department of Transportation, and CDEP can facilitate reuse demonstration projects

A total of seven BUDs have been issued. Examples of case by case approved BUDs include the following:

- Alum drinking water treatment residuals as a soil amendment (improve the moisture content and organic matter) to be blended with compost, loam, and other soils
- Coal combustion products (mixed fly ash, bottom ash, and slag) for the following activities:
    - Aggregate in concrete, concrete products, or as a raw feed in manufacturing cement mixtures
    - Fly ash as an ingredient in lightweight blocks and aggregate
    - Fly ash as an ingredient in flowable fill
    - Fly ash as mineral filler is asphalt pavements

    - Fly ash in production of grouts for pavement sub-sealing
    - Bottom ash and slag as an aggregate for asphalt manufacturing in hot mix asphalt base courses; to produce a quality stabilized base course (pozzolanic-stabilized mixture)
- Scrubber residue as a soil amendment (liming agent)
- Excess soil generated in maintenance and construction operations for use as fill material in pipeline trenches and/or as compactable aggregate in road sub-base systems beneath asphalt pavement

General Permit Registration forms are available online as well as instructions

- Asphalt shingles
    - Document DEP-RCY-INST-011 details instructions
    - Fee of $2,500
    - Requires
        - A copy of the written Environmental Justice Public Participation Plan Approval Letter, if applicable
- Scrap tires
    - Document DEP-RCY-INST-013 details instructions
    - Fee of $1,250
    - Requires
        - Facility site plan
        - Facility description
        - Final closure plan and cost estimate (Type II and III facilities)
        - Proposed form of the financial assurance instrument (Type II and III facilities)
- Municipality fees are 50% of listed rates
- Both require
    - USGS Quadrangle map of facility or site
    - Coastal Consistency Review Form (DEP-APP-004), if applicable
    - Request for Natural Diversity Data Base State Listed Species Review Form (DEP-APP-007), if applicable
    - Conservation of Preservation Restriction Information, if applicable

Connecticut has 47 active BUDs as reported in the NEWMOA database.

# Delaware BU Profile

The Delaware Department of Natural Resources and Environmental Control has the authority to issue beneficial use determinations through the Solid Waste Regulations (Section 1301 of Title 7 of the Delaware Administrative Code), 2.5.2 Recycling Approvals

- 2.5.2 Recycling Approvals: Recycling solid waste into specific market applications requires written approval prior to commencing this activity. To obtain an approval, a person must submit the following information to the Department:
  - 2.5.2.1 A written plan of operation describing the types and quantities of materials that will be accepted at the facility, the processing methods and equipment that will be used, and the products that will be produced, and
  - 2.5.2.2 Documentation demonstrating the existence of a market or markets for the product(s).
  - 2.6 Other Applicable Requirements. Nothing in these regulations shall be construed as relieving an owner or operator of a facility from the obligation of complying with any other laws, regulations, orders, or requirements which may be applicable.
- If a recycling approval is granted it is considered an exemption from solid waste regulations

Asphalt Shingle Recycling

- Recycled asphalt shingles into hot-mix asphalt (HMA)
- One shingle recycler in the state

BUDs are thus issued on a case by case basis by the Department

- A total of 40 BUDs have been issued with 12 currently active BUDs
- New beneficial use regulations have been drafted
- The Department meets with new businesses to assess their recycling needs

## Florida BU Profile

The Florida Department of Environmental Protection (FDEP) regulates beneficial use of waste in Florida. Authority for a beneficial use program is found in Florida Administrative Code (FAC) 62-701 and Part IV of Chapter 403 Florida Statutes, Solid Waste Management Act.

- "Solid waste" – Materials not regulated as solid waste pursuant to this chapter are: recovered materials; nuclear source or byproduct materials regulated under Chapter 404, F.S., or under the Federal Atomic Energy Act of 1954 as amended; suspended or dissolved materials in domestic sewage effluent or irrigation return flows, or other regulated point source discharges; regulated air emissions; and fluids or wastes associated with natural gas or crude oil exploration or production.

Beneficial use, clean debris, and industrial byproducts are directly and indirectly referenced in the Florida Solid Waste Rules, FAC 62-701, as exceptions to solid waste management facility regulations, as well as in the Florida Statutes.

F.S. 403.7045 (1) – The following wastes or activities shall not be regulated pursuant to this act (Solid Waste Management Act):

- Recovered materials or recovered materials processing facilities, except as provided in s. 403.7046, if:
  - A majority of the recovered materials at the facility are demonstrated to be sold, used, or reused within 1 year.
  - The recovered materials handled by the facility or the products or byproducts of operations that process recovered materials are not discharged, deposited, injected, dumped, spilled, leaked, or placed into or upon any land or water by the owner or operator of such facility so that such recovered materials, products or byproducts, or any constituent thereof may enter other lands or be emitted into the air or discharged into any waters, including groundwaters, or otherwise enter the environment such that a threat of contamination in excess of applicable department standards and criteria is caused.
  - The recovered materials handled by the facility are not hazardous wastes as defined under s. 403.703, and rules promulgated pursuant thereto.
  - The facility is registered as required in s. 403.7046.
- Industrial byproducts, if:
  - A majority of the industrial byproducts are demonstrated to be sold, used, or reused within 1 year.
  - The industrial byproducts are not discharged, deposited, injected, dumped, spilled, leaked, or placed upon any land or water so that such industrial byproducts, or any constituent thereof, may enter other lands or be emitted into the air or discharged into any waters, including groundwaters, or otherwise enter the environment such that a

    - threat of contamination in excess of applicable department standards and criteria or a significant threat to public health is caused.
    - The industrial byproducts are not hazardous wastes as defined under s. 403.703 and rules adopted under this section.

Beneficial use decisions are evaluated on a case by case basis by FDEP

Guidelines have been developed for the beneficial use of WTE ash, recovered screen material (RSM), and guidance documents regarding drinking water sludge management and street sweepings and similar residuals have been developed, but none have been adopted by rule.

There are no established criteria (in a rule or statute) for what FDEP should be using to evaluate whether a reuse project is safe for the public or the environment.
Rulemaking regarding beneficial use of industrial waste materials was initiated in 2003 as the Industrial Waste Disposal and Reuse Rule (IWDR). Rulemaking is not currently active, though.

With case by case beneficial use determinations, generally a minimum number of initial samples is required for comparison to relevant target limits. Sampling normally involves totals analysis and leachability analysis (using the SPLP). Target limits for comparison include state soil cleanup target levels and groundwater and surface water cleanup target levels. The proposed beneficial use as well as the anticipated or proposed storage of material prior to use is commonly examined.

Guidelines for the Management of Recovered Screen Material from C&D Debris Recycling Facilities in Florida (2011)

- "Recovered screen material" means the fines fraction, consisting of soil and other small materials, derived from the processing or recycling of construction and demolition debris which passes through a final screen size no greater than ¾ of an inch.
- Data samples must be collected using FDEP standard operating procedures
- The Department may approve the beneficial use of RSM only after the C&D processor conducts a baseline chemical analysis on a representative population of RSM sampled from the processor’s waste stream.
    - If elevated trace constituents are identified, they will be placed on a list of contaminants of concern (COC) for targeted routine monitoring.
    - Potential contaminants of concern include As, Ba, Cd, Cr, Pb, Hg, Se, Ag (RCRA metals), volatile organic compounds, semi-volatile organic compounds, and pesticides.
    - To establish baseline conditions the processor must prepare a minimum of 14, 8-hour composite RSM samples collected over a time period of 7 to 14 days.
    - The analytical laboratory must also be instructed to conduct the SPLP on the composite samples to examine COCs in the SPLP extract.

  - The COC list is populated by comparing the 95% upper confidence level (UCL) of the mean concentration of each potential COC against the respective cleanup-target level published in Table I or Table II of Chapter 62-777 F.A.C. (FDEP, 2005).
  - The total concentrations of COCs in the material are compared with the direct exposure criteria listed in the SCTL table of 62-777 F.A.C.
  - The total concentration of each measured chemical constituent present in the SPLP extract must be compared with the groundwater criteria listed in the GCTL table to assess risk of groundwater contamination associated with land application scenarios.
- Before the Department will issue a BUD the C&D Processor must submit a complete report of all findings to their regional district office and the Solid Waste Section
  - The processor's RSM is not authorized for sale or beneficial use until the Department provides written approval.
  - The Department's approval letter will detail the list of COCs that require routine monitoring.
- Special Beneficial use – use of RSM allowed under following special circumstances with written approval from FDEP:
  - RSM may be used at a permitted Class I or III landfill as subsurface construction material, or as initial and intermediate cover provided it also meets the criteria of Rule 62-701.200(53) and (55) F.A.C. (FDEP, 2010). Use as initial and intermediate cover may require approval by the Department as part of the landfill permit.
  - RSM may be used with encapsulation technologies, for example, as part of the aggregate feed in the production of concrete or asphalt, provided the applicant can demonstrate the proposed use will not result in violations of the Department's groundwater standards or criteria.
- Residential Beneficial use – written approval must be granted to RSM processing facility before the RSM may be installed in a residential setting. Residential use may be allowed under the following conditions:
  - The 95% UCL of the mean for each COC is below its respective residential SCTL.
  - The leaching tests and other characterization data do not indicate that the use of the RSM will result in violations of the Department's groundwater standards or criteria.
- Other Beneficial Use – permission may be granted on a case by case basis provided that the applicant can demonstrate that the proposed use will not pose a significant risk to human health and the environment (as outlined).

Guidance for Land Application of Drinking Water Treatment Plant Sludge (2006)

- FDEP has determined that lime sludge can be beneficially land applied without the need for additional analysis and without the need for specific approval by the Department.
  - The Department recommends that sludge be applied at a rate no greater than 9 dry tons per acre per year in order to minimize movement of metals into the environment

- Alum and ferric sludges may pose a small but significant threat to human health and the environment when land applied, and proposed beneficial uses of these materials will need to be evaluated on a case by case basis.
- General criteria – the following three general criteria apply to any water treatment sludge which is to be land applied in Florida:
    - The sludge must not be a hazardous waste
    - The use of the sludge must not cause violations of applicable Department groundwater or surface water standards and criteria
    - The sludge must not cause fugitive dust emissions, objectionable odors, or create a public nuisance
- Other factors that may have to be considered before land applying sludges
    - Total Maximum Daily Limits (TMDLs) for some nutrients (currently being established)
    - It may be necessary to analyze for nitrogen and phosphorus so that agricultural operations can take into account the presence of these nutrients in drinking water treatment plant sludges before they are land applied
    - How to balance the uses of alum and ferric sludges to bind phosphorus without causing aluminum phytotoxicity (in the case of alum sludge) or excessively low phosphorus availability in the receiving soils
- Special Criteria for Land Application of Alum Sludge
    - The generator of the alum sludge must collect three representative composite samples of the sludge and conduct total analysis on each of those samples for aluminum, arsenic and barium, using approved EPA methods.
        - An aliquot of each of these composite samples must also be prepared with the SPLP and the resulting extracts must be analyzed for aluminum, lead, and manganese.
    - Using the results of the analyses, the mean concentrations for aluminum, arsenic, barium, lead, and manganese must be calculated and compared to their corresponding direct exposure or water quality CTLs contained in Chapter 62-777, F.A.C.
    - Since it is likely the alum sludge will exceed the CTL for aluminum, the generator will need to prepare a land application proposal for review by the Department. In some cases blending may be helpful.
- Special Criteria for Land Application of Ferric Sludge
    - The generator of the alum sludge must collect three representative composite samples of the sludge and conduct total analysis on each of those samples for arsenic, copper, and iron, using approved EPA methods.
        - An aliquot of each of these composite samples must also be prepared with the SPLP and the resulting extracts must be analyzed for aluminum, iron and manganese.
    - Using the results of the analyses, the mean concentrations for aluminum, arsenic, copper, iron, and manganese must be calculated and compared to their corresponding direct exposure or water quality CTLs contained in Chapter 62-777, F.A.C.

    - Since it is likely the ferric sludge will exceed the CTL for iron, the generator will need to prepare a land application proposal for review by the Department. In some cases blending may be helpful.

Guidance for the Management of Street Sweepings, Catch Basin Sediments, and Stormwater System Sediments (2004)

- Street Sweepings
    - Street sweepings may be used as initial cover at Class I (MSW) landfills.
        - They may also be used as initial cover at Class III landfills if they could otherwise be disposed of at that same landfill.
        - In order to be used as initial cover at any landfill, the street sweepings must also be able to meet the requirements for initial cover contained in Rule 62-701.200(59), F.A.C.
    - Street sweepings may be beneficially used without the need for further testing in road construction or road maintenance.
    - Street sweepings may also be beneficially used in nonresidential areas as construction or industrial fill or as a soil amendment provided any benzo(a)pyrene in the street sweepings will not create a significant threat to public health or the environment as managed.
        - In no case may it be used within 200 feet of a potable well or as fill below the water table or in bodies of water.
        - Generators are not allowed to distribute or sell the wastes for use by others unless authorized by the Department
- Catch Basin Sediments
    - Catch basin sediments may be beneficially used in a manner similar to street sweepings in Section 6.1 provided they are dewatered first and there is no reason to believe they are contaminated, e.g., impaction by a chemical spill.
    - Prior to beneficial use, the catch basin sediments must be sufficiently dewatered so that they do not meet the definition of liquid wastes contained in Rule 62-701.200(72), F.A.C.
- Stormwater System Sediments
    - Sediments from non-industrial stormwater systems may be beneficially used in a manner similar to street sweepings in Section 6.1 provided they are dewatered first and there is no reason to believe they are contaminated, e.g., impaction by a chemical spill.
        - Prior to beneficial use, the stormwater system sediments must be sufficiently dewatered so that they are not considered a liquid by Rule 62-701.200(72), F.A.C.
    - Sediments from industrial stormwater systems may not be beneficially used without prior approval by the Department.
        - This may require additional testing of the sediments and the generator should seek further guidance before proceeding with disposal of the wastes by

contacting the Department's District office in the District where the wastes are located

Guidance for Preparing Municipal Waste to Energy Ash Beneficial Use Demonstrations (2001)

- The main goals for applicants seeking approvals for the beneficial use of ash or ash-derived products are summarized as follows:
    - The ash must be managed and used so that it will not cause violations of applicable Department air standards or groundwater or surface water standards and criteria.
    - The use of the ash must not pose a significant threat to human health, which, for the purposes of this document, means an incremental risk of no greater than $1x10^{-6}$ for carcinogens and a hazard index of no greater than one (1.0) for non-carcinogens.
        - When providing this demonstration, the BUD must consider human exposure pathways such as inhalation, ingestion, and dermal contact with the ash in its proposed use.
    - In order to qualify as a product or raw material, the use of the ash must be beneficial, i.e., the ash must have chemical or physical properties similar to the raw material it is replacing or its use must have enhancing qualities to the final product which would distinguish that use from disposal.
    - The use of the ash must not create a public nuisance.
- General BUD Requirements
    - In order to determine the potential of ash to contaminate ground or surface water, the applicant should normally compare the results of the SPLP testing, EPA Method 1312, required in Section 6.2 to the Department's groundwater and surface water standards and criteria.
    - Depending upon the nature of the proposed use, Department approval may take the form of a permit or certification modification (for specific projects located within a Department District) or a generic statewide approval (for products using ash).
- Human Health Risks
    - In order to demonstrate that no significant threat to human health is expected from direct exposure to the ash or ash products, the BUD should either: (1) compare the results of the baseline total analysis of the ash or ash-derived product required in Section 6.2 to the Department's Reuse Target Levels (RTLs, and show that the Department's RTLs will not be exceeded for the proposed use; or
    - Provide a satisfactory independent human health risk assessment (HRA) which demonstrates that the risk goals in Section 3.0(b) will be achieved with the proposed ash use and develops Alternate Target Levels (ATLs) for that use; or
    - Show that human exposure pathways are negligible or significantly reduced for the proposed ash use so that the risk goals described will not be exceeded; or
    - Show that the chemical concentrations in the ash or ash product are at or below the naturally occurring background concentrations at sites destined for ash use

    - The Department recognizes that ash which is used in encapsulation technologies or as protected structural fill or which is covered with at least two feet of clean fill can significantly reduce the likelihood of direct human exposure.
        - To ensure that the human exposure pathways are negligible for use in encapsulation technologies, the BUD should provide details of the technology to be used, including percentage of ash in the final product and an estimate of the long-term durability of the product.
- Ash characterization and submittal requirements are outlines in section 6 of the guidelines document
- BUD Evaluation Considerations are outlined in sections 8 and 9 of the guidelines document

CCP Utilization in Florida

- There are no guidelines developed, and use is considered on a case by case basis
- Florida Department of Transportation (FDOT) specifies the use of fly ash in concrete and supports use of CCP in concrete projects (EERC 2006)
- Almost all of the concrete-grade Class F fly ash produced in the state (EERC 2006)
- CCPs are beneficially used in the state, though requirements to notify FDEP of these activities vary depending on the facility and the facility's associated power plant conditions of certification

Examples of case by case approved BUDs include the following:

- Coal bottom ash as a substitute for other raw materials in the production of cement and asphalt
- Byproduct generated in circulating fluidized bed boilers (EZBase) used in compacted form for the final top surface of roads, parking lots, lay down yards, and similar industrial and commercial application; as a compacted base course for civil applications in accordance with FDOT Standard Specification Section 200 where EZBase will be covered with a friction surface such as asphalt or concrete or compacted EZBase
    - Shrink/swell properties of the product inhibited the project's success
- Spent core foundry sand for road construction and maintenance projects; as fill for property leveling, in either public or private applications
- Treated bottom and combined ash as an aggregate in concrete and asphalt manufacturing
    - Indicated that further research and demonstration of safety is necessary for future approval for use as a roadway subbase, structural fill, or any land applications

There have been 10 BUDs recorded for Florida as of 2011, as reported in the NEWMOA Database.

## Georgia BU Profile

Georgia Department of Natural Resources (GDNR), Environmental Protection Division manages the beneficial use program although there is no formal policy outlined in the rules or regulations

Georgia's Rules for Solid Waste Management 391-3-4-.01 define:

- "Recovered Materials" means those materials which have known use, reuse, or recycling potential; can be feasibly used, reused or recycled; and have been diverted or removed from the solid waste stream for sale

- "Solid Waste" but does not include recovered materials; solid or dissolved materials in domestic sewage; solid or dissolved materials in irrigation return flows or industrial discharges that are point sources subject to permit under 33 U.S.C. Section 1342; or source, special nuclear, or by-product material as defined by the federal Atomic Energy Act of 1954, as amended (68 Stat. 923).

391-3-4-.04(7) Recovered Materials

- Regulations for recovered material lay the groundwork for DNR beneficial use evaluation
- Recovered materials and recovered materials processing facilities are excluded from regulation as solid wastes and solid waste handling facilities
- To be considered exempt from regulation, the material must have a known use, reuse, or recycling potential; must be feasibly used, reused, or recycled; and must have been diverted or removed from the solid waste stream for sale, use, reuse, or recycling, whether or not requiring subsequent separation and processing
- A recovered material is "used, reused or recycled" if it is either:
    - Employed as an ingredient (including use as an intermediate) in a process to make a product
    - Employed in the same or different fashion as its original intended purpose without physically changing its composition
    - Employed in a particular function or application as an effective substitute for a commercial product (for example, utilizing shredded tires in asphalt or utilizing refuse derived fuel as a substitute for fuel oil, natural gas, coal, or wood in a boiler or industrial furnace) as long as such substitution does not pose a threat to human health or the environment and so long as the facility is not a solid waste thermal treatment facility.
    - Employed in a particular function or application as an effective substitute for a commercial product (for example, utilizing shredded tires in asphalt or utilizing refuse derived fuel as a substitute for fuel oil, natural gas, coal, or wood in a boiler or industrial furnace) as long as such substitution does not pose a threat to human health or the environment and so long as the facility is not a solid waste thermal treatment facility.

Beneficial use inquiries are reviewed by the solid waste program manager

Guidelines for land application of scrap gypsum wallboard have been published by the UGA Cooperative Extension (University of Georgia) and are based on US EPA 503 Biosolids regulations.

# Hawaii BU Profile

The Hawaii Department of Health (HDOH) Solid and Hazardous Waste Branch regulates the beneficial use of waste

- Title 11 (Department of Health) of the Hawaii Administrative Rules, Chapter 58.1, Solid Waste Management Control provides the authority for Beneficial Use in Hawaii
  - No additional guidance documents have been published regarding beneficial use

58.1-32 Recycling and Materials Recovery Facilities further provides authority for the state to conduct a beneficial use program

- Recycling regulations of this section are exempt for:
  - Manufacturers that use clean, source separated paper products, glass, and plastic as feedstock for their manufacturing process, and which as a result of this process, produce an end-product for resale.
  - Composting operations which separate or treat green waste, sludge, or ash. These are regulated in sections 11-58.1-04 and 11-58.1-41.

Beneficial use determinations (BUDs) are made on a case by case basis by HDOH

- Beneficial use may take place when it is
  - Identified in the Solid Waste Management Permit for a facility or generator
  - Used in the replacement of virgin materials for a process of manufacturing. In this case, demonstrations must be made which includes:
    - Evaluation of chemical characteristics
    - Unrestricted environmental action levels must be met
    - Hazard evaluation, which includes a comparison to Emergency Response Levels
    - Assessing pathways or routes of exposure
- BUDs are built into facility permits, not as separate individual permits
  - Thus, BUDs are not individually tracked by HDOH
  - BUDs at C&D landfills are tracked as part of the permit, such as the use of coal ash

## Idaho BU Profile

Idaho Department of Environmental Quality (IDEQ) issues beneficial use determinations (BUDs), currently there are no beneficial use-related statutes or regulations. Regional offices in the state handle BUDs for their areas.

Waste tire recycling is sanctioned by Idaho statutes Title 39 (Health and Safety) Chapter 65 (Waste Tire Disposal) 6506:

- "The state of Idaho seeks to protect human health and the environment by encouraging the recycling and reuse of waste tires. Accordingly, the legislature directs the department to identify approved methods of recycling and reuse of waste tires."
- All waste tire projects which involve tire transport require IDEQ approval
- Recycling activities are encouraged:
    - Tire derived fuel
    - Embankment fill (tire shreds only)
    - Alternative daily cover
    - Mulch (tire shreds only)

All BUDs are issued on a case by case basis. For a determination, the BU applicant must:

- Show that the material is used beneficially
- Identify potential impacts to public health and the environment

For case-by-case evaluations, the IDEQ can require a materials analysis and site evaluation including characterization of surface and groundwater features.

Examples of case by case BUDs that have been considered.

- Coal combustion ash as structural fill in a highway interchange was approved. Details of the use and demonstrations made included:
    - Total metals analyses were provided
    - 500 ft to groundwater with 11 inches of rain per year at the site
    - Covered with 2-3 ft of soil

## **Illinois BU Profile**

Illinois Environmental Protection Agency (IEPA) regulates the beneficial use of solid waste through 415 Illinois Compiled Statutes (ILCS) 5/22.54 of the Illinois Environmental Protection Act: Beneficial Use Determinations.

415 ILCS 5/22.54: Beneficial Use Determinations:

- A material otherwise required to be managed as waste may be managed as non-waste if that material is used beneficially and in a manner that is protective of human health and the environment.
- The Agency may, upon the request of an applicant, make a written determination that a material is used beneficially and, therefore, not a waste if the applicant demonstrates all of the following:
    - The chemical and physical properties of the material are comparable to similar commercially available materials.
    - The market demand for the material is such that all of the following requirements are met
    - The material is legitimately beneficially used by demonstrating the following:
        - The material is used as a valuable raw material or ingredient to produce a legitimate end product.
        - The material is used directly as a legitimate end product in place of a similar commercially available product.
        - The material replaces a catalyst or carrier to produce a legitimate end product.
- Applications for beneficial use determinations are submitted on a case by case basis to IEPA.
    - Agency approval, approval with conditions, or disapproval of an application for a beneficial use determination must be in writing.
    - Approvals with conditions and disapprovals of applications for a beneficial use determination must include the Agency's reasons for the conditions or disapproval, and they are subject to review under Section 40 of this Act.
- This Section does not apply to:
    - Hazardous waste, coal combustion waste, coal combustion by-product, sludge applied to the land, potentially infectious medical waste, or used oil.
    - Material that is burned for energy recovery, that is used to produce a fuel, or that is otherwise contained in a fuel.
    - Waste from the steel and foundry industries that is classified as beneficially usable waste under Board rules and beneficially used in accordance with Board rules governing the management of beneficially usable waste from the steel and foundry industries.
- No person shall use iron slags, steelmaking slags, or foundry sands for land reclamation purposes unless they have obtained a beneficial use determination for such use under this Section.

The risk standards used for chemical evaluation typically involve comparing leachable concentrations of the proposed waste to federal drinking water standards.

- If the material exceeds one or more standards, a risk assessment is typically required.
- The specific demonstrations and testing required during the risk assessment varies depending on the waste material and the proposed use.

415 ILCS 5/3.135: Coal Combustion Byproduct (CCB)

- CCB means coal combustion waste when used beneficially in any of the following ways described in this section.
- CCBs used in the following manner do not require notification to IEPA:
  - The extraction or recovery of material compounds contained within CCB.
  - The use of CCB as a raw ingredient or mineral filler in the manufacture of the following commercial products:
    - Cement
    - Concrete and concrete mortars
    - Cementitious products including block, pipe, and precast/prestressed components
    - Asphalt or cementitious roofing products
    - Plastic products including pipes and fittings
    - Paints and metal alloys
    - Kiln fired products including bricks, blocks, and tiles
    - Abrasive media
    - Gypsum wallboard
    - Asphaltic concrete
    - Asphalt based paving material
  - CCB used under the approval of the Department of Transportation for IDOT projects.
  - Bottom ash used as antiskid material, athletic tracks, or foot paths.
  - Use in the stabilization or modification of soils providing the CCB meets the IDOT specifications for soil modifiers.
  - CCB used as a functionally equivalent substitute for agricultural lime as a soil conditioner.
- CCBs used in the following manners require notification to IEPA for each project, including documenting the quantity of CCB utilized and certification of compliance with conditions:
  - CCB used (A) in accordance with the Illinois Department of Transportation ("IDOT") standard specifications and subsection (a-5) of this section (3.135).
  - Bottom ash used in non-IDOT pavement sub-base or base, pipe bedding, or foundation backfill.
  - Structural fill designed and constructed according to ASTM standard E2277-03 or Illinois Department of Transportation specifications, when used in an engineered application or combined with cement, sand, or water to produce a controlled strength fill material and

covered with 12 inches of soil unless infiltration is prevented by the material itself or other cover material.
    - Mine subsidence, mine fire control, mine sealing, and mine reclamation.
- CCB uses that require notification to IEPA (as listed) must also satisfy the following requirements:
    - CCB shall not have been mixed with hazardous waste prior to use.
    - CCB shall not exceed Class I Groundwater Standards for metals when tested utilizing test method ASTM D3987-85. The sample or samples tested shall be representative of the CCB being considered for use.
- To encourage and promote the utilization of CCB in productive and beneficial applications, upon request by the applicant, IEPA shall make a written beneficial use determination that a coal-combustion waste is considered CCB when used in a manner other than those uses specified if the applicant demonstrates that use of the coal-combustion waste satisfies all of the following criteria:
    - The use will not cause, threaten, or allow the discharge of any contaminant into the environment
    - The use will otherwise protect human health and safety and the environment
    - The use constitutes a legitimate use of the coal-combustion waste as an ingredient or raw material that is an effective substitute for an analogous ingredient or raw material.

Current Active BUDs in Illinois:

| **Material Proposed** | **Beneficial Use** | **Final Action** |
|---|---|---|
| Ion exchange resin | Raw Material | Denied |
| Sand blasting material | Used directly as a product | Denied |
| Brush, grass, leaves | Raw Material | No Final Action |
| Asphalt shingles | Raw Material | Approved |
| Used Tires | Used directly as a product | Approved |
| Asphalt shingles | Ingredient - Replace a portion of virgin material in asphalt pavement | Approved |
| Brush, grass, leaves | Raw Material | Denied |
| Asphalt shingles | Ingredient | Approved |
| Asphalt shingles | Raw Material | Denied |
| Antifreeze Flush | Ingredient | Approved |
| Ethyl alcohol | Raw Material | |
| Asphalt shingles | Ingredient | Approved |
| Asphalt shingles | Raw Material | Approved |
| Glass Cullet | Raw Material | Approved |
| Line flush solvent | Used directly as a product | Denied |
| Slag, coal | Used directly as a product | Denied |

| **Material Proposed** | **Beneficial Use** | **Final Action** |
|---|---|---|
| Asphalt shingles | Raw Material | Approved |
| Antifreeze Flush | Ingredient | Approved |
| Ink | Ingredient | Approved |
| Asphalt shingles | Raw Material | Approved |
| Iron shavings (sludge) | Raw Material |  |
| Brush, grass, leaves | Used directly as product |  |
| Stumps, branches, logs | Used directly as product | Withdrawn |
| Asphalt Shingles | Raw Material | Approved |
| Brush, grass, leaves | Used Directly as Product | Approved |
| Asphalt Shingles | Ingredient | Approved |
| Asphalt Shingles | Raw Material | Denied |
| Asphalt Shingles | Ingredient |  |
| Used Tires | Used directly as a product | Denied |
| Ethylene Glycol Solution | Ingredient | Denied |
| Shredded Clean Wood | Used Directly as Product | Approved |
| Antifreeze flush | Ingredient- feedstock in a distillation process | Approved |
| Asphalt Shingles | Ingredient- Replace a portion of virgin material in asphalt pavement by recycling asphalt shingles | Approved |
| Contaminated Soil | Raw Material | Denied |
| Asphalt Shingles | Raw Material- Recycled roofing shingles into asphalt road mix | Withdrawn |
| Solidified liquid wastes | Used Directly as Product | Withdrawn |
| Cement Kiln Dust | Raw Material- Use CKD as a raw material in the manufacturing of cement | Approved |
| Asphalt Shingles | Ingredient | Approved |
| Concrete Planks | Used Directly as Product | Denied |
| Coal Combustion Waste | n/a, request approval to fill inactive flux pit with ash | Denied |
| Asphalt Shingles | Raw Materials |  |
| C&D Debris | Used Directly as Product- as ADC for landfilling operations | Withdrawn |

## Indiana BU Profile

The Indiana Department of Environmental Management (IDEM) governs beneficial use of solid wastevia the Indiana Administrative Code (IAC)

- A waste classification determination is made by IDEM after a request for a BUD is considered
- IDEM determines if the classification is applicable based on whether the project constitutes a "legitimate use", the catch-all criteria which allows flexibility in beneficial use determination
- Materials explicitly excluded in 329 IAC 10-3-1 do not require a waste classification and activities are not monitored by IDEM
- Waste classifications can be appealed if there are aggrieved parties

Title 329 (Solid Waste Management Board) IAC Article 10 3-1 lists exclusions to the article Solid Waste Land Disposal Facilities as follows:

- Disposal of only uncontaminated rocks, bricks, concrete, road demolition waste materials, or dirt.
- Land application activities regulated under rules of the water pollution control board at 327 IAC 6.1 and 327 IAC 7.1
- Confined feeding control activities regulated under rules of the water pollution control board at 327 IAC 5
- Solid waste management activities regulated under 329 IAC 11 (Solid waste processing facilities)
- Disposal of uncontaminated and untreated natural growth solid waste, including tree limbs, stumps, leaves, and grass clippings
- Disposal of saw dust derived from processing untreated natural wood.
- Disposal of coal ash, transported by water, into an ash pond which has received a water pollution control facility construction permit under rules of the water pollution control board at 327 IAC 3
- The operation of surface impoundments; however, the final disposal of solid waste in such facilities at the end of their operation is subject to approval by the commissioner except as excluded under subdivisions (8) and (10). The commissioner's approval is based on management practices that are protective of human health and the environment
- Disposal of coal ash at a site receiving a total of less than one hundred (100) cubic yards per year from generators who each produce less than one hundred (100) cubic yards per year
- The uses and disposal of coal waste as exempted under IC 13-19-3-3.
- Activities concerning wastes containing polychlorinated biphenyls (PCBs) regulated under 329 IAC 4.1, except those regulated as alternative daily cover under 329 IAC 10-20-14 1.
- Storage, transportation, and processing of used oil as regulated under 329 IAC 13.
- The legitimate use of slag under IC 13-19-3-8.
- The legitimate use of foundry sand under IC 13-19-3-7.
- Any other use of solid waste approved by the commissioner based on the commissioner's determination that the use is a legitimate use that does not pose a threat to public health or the environment.

Waste type classification is detailed in 329 IAC 10-9-4

- Four waste types
    - Differentiated by chemical constituent levels in leaching extraction fluid (TCLP/neutral water leaching test) and material pH

    - Type IV: lowest constituent levels
    - Type I: Neutral leaching test not required
- Determined by TCLP (constituents allowed listed in Table 1) and/or Neutral Leaching Method Test (constituents allowed listed in Table 2), and pH (Table 3)
    - Some constituents appear in both tables, others only appear in one or the other
    - Coal ash:
        - TCLP for specified constituents
        - Neutral leaching method or SPLP for specified constituents
    - Foundry waste:
        - TCLP for specified constituents
        - Neutral leaching method or SPLP for specified constituents
    - All other waste:
        - IDEM determines methods from SW-846
- Waste types are utilized for restricted waste sites which can only accept waste types specified in the facility permit

IDEM Policy document on Storage of Foundry Sands Prior to Legitimate Use (2000)

- Applies to Type III foundry sands (Type III criteria specified in 329 IAC 10-9-4)
- IDEM must determine if a foundry sand meets the Type III criteria
- Storage criteria
    - Storage facilities must prevent contamination of groundwater
    - Stockpiles must be located on a low permeability barrier
    - Seasonal high groundwater table must be separated from stockpiled foundry sand by 2 ft
    - Surface water run-on should be diverted away from foundry sand stockpiles and run-off from stockpiles should be properly managed
        - Must be compliant with NPDES permit program
    - Stockpiles should be separated by at least 600 ft of a potable water well; may be reduced to 200 ft if a well record is on file confirming well integrity is maintained in compliance with the well construction requirements in 310 IAC 16-6
    - Stored to prevent washout
    - Should not be located in the critical habitat of an endangered species, within areas of karst topography or within 50 ft of the facility property boundaries
    - Control and restrict public access during business hours and non-operational periods
    - Implement appropriate management practices to prevent offensive odors and fugitive dust from off-site migration
    - Screening procedures at the generating facility and storage facility must be in place
        - May require Microtox$^{TM}$ test
    - Final disposition of foundry sand should be in compliance with all applicable regulations

IDEM Policy document on Use of Foundry Sands in Accordance with House Enrolled Act 1541 (2000)

- No written IDEM approval for the detailed wastes and uses, IDEM written approval needed for other wastes/uses
- Type III and IV foundry sands
- Landfill facility permit modification
    - Daily cover at landfill

    - Protective cover for landfill leachate collection system, material sites above the drainage layer
- Capped embankments, supportive structures covered with 1 ft soil
- Ground and site barriers (<10,000 cubic yards), non-supporting structures, long, low, narrow structures
- May be used as structural fill base for
    - Roads
    - Road shoulders
    - Parking lots
    - Floor slabs (concrete or asphalt)
    - Utility trenches
    - Bridge abutments
    - Tanks and vaults- can be filled with foundry sand or placed on compacted foundry sand
    - Construction or architectural fill- does not include land reclamation purposes
    - Other similar uses
- Have uses as a raw material in
    - Flowable fill
    - Concrete
    - Asphalt
    - Brick
    - Block
    - Portland Cement
    - Glass
    - Roofing materials
    - Rock wool
    - Plastics
    - Fiberglass
    - Mineral wool
    - Lightweight aggregate
    - Paint
    - Plaster
    - Other similar products

IDEM Policy document on Use of Waste Tires as an Alternative Fuel Source (2010)

- Tire-derived fuel (TDF) comes in 2 forms- shredded or altered waste tire material or whole waste tires
- Tires which contribute up to 30% (by weight) of the fuel can be granted a case by case exemption of solid waste processing requirements
- If a facility uses >30% tires a solid waste processing permit is necessary, Office of Land Quality (OLQ) recommends limiting TDF to 30% of fuel
- If an exemption is needed a written request for a legitimate use exclusion must be submitted with details on waste tire volumes, ratio of TDF to total fuel feed and storage and processing of tires
- If waste tires are burned in a boiler or industrial furnace in the same manner as hazardous waste, facility is exempt from a processing permit
- Waste tire registrations

- Waste tire storage registration under 329 IAC 15 is required for storage of ≥1,000 waste tires outside or ≥2,000 stored inside. Storage for <30 days in a properly licensed vehicle does not require a storage registration
- If tires are shredded at the TDF facility a processor registration certificate from IDEM is required under 15-3-1
- TDF producer must have documentation which proves an authorized end-user exists

Indiana has a total of 12 active BUDs as reported in the NEWMOA database.

# Iowa BU Profile

The Iowa Department of Natural Resources (IDNR) governs beneficial use through the Iowa Administrative Code 567 (Environmental Protection) Chapter 108 (Beneficial Use Determinations)

- "Beneficial use" means a specific utilization of a solid by-product as a resource, that constitutes reuse rather than disposal, does not adversely affect human health or the environment, and is approved by the department
- "Beneficial use determination" means a written formal decision or rule issued by the department as approval for a solid by-product to be utilized in a specific manner as a beneficial use
- Beneficial use determinations (universal or determined) may be revoked by IDNR (567 IAC 108.11)

Discussion of universally-approved BUDs (567 IAC 108.4):

- Unless a user is notified by IDNR, utilization in the universally approved manner does not require approval from the department

| Material | Use(s) |
|---|---|
| Alumina | • Raw material in the manufacture of cement or concrete products |
| Asphalt Shingles | • Raw material in the manufacture of asphalt products<br>• Subbase for hard-surface road construction<br>• Road surfacing granular material<br>• Alternative cover material at a sanitary landfill pursuant to 567-108.8 |
| Cement kiln dust | • Raw material in the manufacture of absorbents<br>• Raw material in the manufacture of cement of concrete products<br>• Subbase for hard-surface road construction<br>• A soil amendment pursuant to 567-Chapter 121 and the rules of the Iowa department of agriculture and land stewardship or a compost amendment |
| Coal combustion by-products- fly ash and flue gas desulfurization by-products | • Raw material in manufactured gypsum, wallboard, plaster, or similar product<br>• Raw material in manufactured calcium chloride<br>• Raw material in the manufacture of absorbents<br>• Fill material pursuant to 108.6(1)<br>• Alternative cover material at a sanitary landfill pursuant to 567-108.8 |

| Material | Use(s) |
|---|---|
| Coal combustion by-products- fly ash, bottom ash, or boiler slag | • Raw material in the manufacture of cement or concrete products<br>• Raw material to be used in mineral recovery<br>• Raw material in the manufacture of asphalt products<br>• Raw material in plastic products<br>• Subbase for hard-surface road construction<br>• Soil stabilization for construction purposes<br>• Fill material pursuant to 108.6(1)<br>• Alternative cover material at a sanitary landfill pursuant to 567-108.8 |
| Coal combustion by-products- bottom ash | • Traction agent for surfaces used by vehicles<br>• Sandblasting abrasive |
| Compost- cured or finished | Any purpose recognized by the US Composting Council or IDNR |
| Foundry sand | • Raw material in the manufacture of asphalt products<br>• Raw material in the manufacture of cement or concrete products<br>• Leachate control drainage material at a sanitary landfill<br>• Subbase for hard-surface road construction<br>• Fill material pursuant to 108.6(1)<br>• Alternative cover material at a sanitary landfill pursuant to 567-108.8 |
| Glass- uncontaminated, unleaded | • Raw material in the manufacture of asphalt products<br>• Fill material pursuant to 108.6(1)<br>• Sandblasting or other abrasive<br>• Leachate control drainage material at a sanitary landfill<br>• Filter media<br>• Subbase for hard-surface road construction<br>• Alternative cover material at a sanitary landfill pursuant to 567-108.8 |
| Gypsum and gypsum wallboard | • Raw material in the manufacture of absorbents<br>• Raw material in the manufacture of other gypsum products, wallboard, plaster, or similar products<br>• Alternative cover material at a sanitary landfill pursuant to 567-108.8<br>• Gypsum and gypsum wallboard that have not been treated to be water-resistant or flame-retardant may be used as a calcium additive for agricultural use or soil amendment pursuant to 567-Chapter 121 or a compost amendment |
| Lime- produced as a by-product of public water supplies | • A soil amendment pursuant to 567-Chapter 121 and rules of Iowa department of agriculture and land stewardship or a compost amendment<br>• Raw material in the manufacture of calcium carbonate or similar substance |

| Material | Use(s) |
|---|---|
| Lime kiln dust | • Raw material in the manufacture of absorbents<br>• Raw material in the manufacture of cement or concrete products<br>• Subbase for bard-surface road construction<br>• A soil amendment pursuant to 567-Chapter 121 and rules of Iowa department of agriculture and land stewardship or a compost amendment<br>• A stabilizer for manure and waste sludge<br>• A soil stabilizer for construction purposes<br>• Fill material pursuant to 108.6(1) |
| Paper mill sludge-uncontaminated and dewatered | • Fuel or energy source<br>• Bulking agent or carbon source for composting<br>• Animal bedding<br>• Raw material in the manufacture of absorbents<br>• Alternative cover material at a sanitary landfill pursuant to 567-108.8 |
| Rubble-uncontaminated rubble such as concrete, brick, asphalt pavement, soil and rock | • Fill, landscaping, excavation, or grading or as a substitute for conventional aggregate<br>• Asphalt shall not be used if asphalt will be placed in a waterway or wetland or any waters of the state or within the high water table |
| Sandblasting abrasives- not containing lead based paint | • Raw material in manufacture of cement or concrete products<br>• Raw material in the manufacture of asphalt products<br>• Subbase for hard-surface road construction<br>• Raw material in the manufacture of abrasive products<br>• Fill material pursuant to 108.6(1)<br>• Alternative cover material at a sanitary landfill pursuant to 567-108.8 |
| Soil, including petroleum-contaminated soil | • Uncontaminated soil may be used for fill, landscaping, excavation or grading, or other suitable purpose.<br>• Petroleum contaminated soils decontaminated to the satisfaction of IDNR pursuant to 567-Chapter 120:<br>o Fill material at the original excavation site<br>o Alternative cover material at a sanitary landfill pursuant to 567-108.8 |
| Tires | Tires as alternative daily cover<br>567- Chapter 117 |
| Wastewater filter sand | • Fill material pursuant to 108.6(1)<br>• Subbase for hard-surface road construction |

| Material | Use(s) |
|---|---|
| Wood- uncontaminated, untreated or raw wood | • A fuel or energy source<br>• Bulking agent for composting<br>• Mulch<br>• Animal bedding<br>• Raw material in the manufacture of paper products, particle board, or similar materials |
| Wood ash- from the combustion of uncontaminated, untreated or raw wood | • A soil amendment pursuant to 567-Chapter 121<br>• A carbon source for composting<br>• Raw material in the manufacture of cement or concrete products<br>• Fill material pursuant to 108.6(1) |

Applications are required for BUDs other than alternative cover material, the applicant for a beneficial use determination must provide in the application:

- A description of the solid by-product under review and its proposed use
- The chemical and physical characteristics of the solid by-product
- A demonstration that there is a known or reasonably probably market for the intended use of the solid by-product
- A demonstration that the proposed use of the solid by-product will not adversely affect human health and environment, may include, but not limited to:
    - TCLP
    - Total metals analysis
- Potential required documentation:
    - Solid by-product management plan (IAC 567 Chapter 108.5(6))
    - Site map
    - Solid by-product analytical results (IAC 567 Chapter 108.5)

Requirements for beneficial uses other than alternative cover material (567 IAC 108.6)

- Materials used as fill material, other than rubble and soil, require the following:
    - Leachate characteristics of the solid by-product measured by the SPLP
        - Target levels of ≤10x the maximum contaminant levels for drinking water
            - Foundry sand and CCPs may limit the SPLP analytes to total metals for drinking water
    - Total metals testing
- Generators of foundry sands and coal combustion products must submit a product management plan to the IDNR which includes information on quantities use and locations of proposed uses. Data are reported annually to the INDNR. Other universal wastes are not tracked.

Record-keeping and reporting requirements for beneficial use projects other than alternative cover material are found in 567 IAC 108.7

- All beneficial use activities with the exception of alternative cover material projects, rubble and soil by-products
- Records shall be maintained for a minimum of 5 yrs
- Reports shall be filed with the IDNR's central office and the field office with jurisdication
    - Reports shall submit reports within 60 days of the end of a the calendar year or whenever a solid by-product management plan is revised
    - By-products used as fill material shall submit the following information
        - Project location
        - Tons of solid by-product utilized

Sanitary Landfill Alternative Cover Material Projects

- Projects universally approved

| **Universally-Approved Alternative Landfill Cover Material** | **Specifications** |
|---|---|
| Asphalt shingles | <1% asbestos<br>≤3 inch particle size in any dimension<br>Mixed with soil in 50/50 ratio by volume |
| Coal combustion by-products | Mixed with soil in 50/50 ratio by volume |
| Compost | No restrictions, can include compost rejects |
| Diatomaceous earth | Mixed with soil in 50/50 ratio by volume |
| Foundry sand | Mixed with soil in 50/50 ratio by volume |
| Glass | ≤1/2 inch in any dimension<br>Mixed with soil at 10 percent |
| Gypsum and gypsum wallboard | ≤3 inch particle size in any dimension<br>Mixed with soil in 50/50 ratio by volume |
| Paper mill sludge | Mixed with soil in 50/50 ratio by volume |
| Sandblasting abrasive | Mixed with soil in 50/50 ratio by volume |
| Soil, including petroleum-contaminated soil | No restrictions if decontaminated pursuant to 567-Chapter 120 |
| Tire chips | ≤3 inch particle size in any dimension<br>Mixed with soil in 50/50 ratio by volume |

- Projects requiring beneficial use determination
    - Application must be submitted to IDNR
    - All information in the regular case by case application plus:
        - Proposed volume ratios for alternative cover material to soil
    - Amendment of sanitary landfill permit is required
    - Temporary BUD may be issued on a trial basis
- Alternative cover material is exempted from landfill tonnage measurements for state goal progress and waste diversion calculations

A beneficial use determination application form (DNR Form 542-0056) is found online for case by case approvals. Iowa has 107 active BUDs according to the NEWMOA database (2011).

# Kansas BU Profile

The Kansas Department of Health and Environment (KDHE) regulates the beneficial use of waste. Kansas Statutes Annotated (K.S.A) Chapter 65 (Public Health) Article 34 (Solid and Hazardous Waste) Statute 65-3424 (updated 2003), defines the following:

- "Beneficial use" means the use or storage of waste tires in a way that:
    - Creates an on-site economic benefit to the owner of the tires, including, but not limited to, bumpers for boat docks or boats, playground equipment, silo covers, traffic control, feed bunks, water tanks, windbreaks constructed of baled tires or in a manner consistent with rules and regulations of the secretary, erosion control on the face of an earthen dam and stabilization of soil or sand blow-outs caused by wind; and
    - as determined by the secretary, causes no adverse impacts to human health or the environment and complies with all applicable zoning requirements

Beneficial use of industrial byproducts is authorized by K.S.A 65-3409(a)(1)(A) (updated 2001):

- Dispose of any solid waste by open dumping, but this provision shall not prohibit: (A) The use of solid wastes, except for waste tires, as defined by K.S.A. 65-3424, and amendments thereto, in normal farming operations or in the processing or manufacturing of other products in a manner that will not create a public nuisance or adversely affect the public health

There are two application forms that are developed related to case-by-case beneficial use determinations, one for waste tires and one for industrial byproducts. Details and discussions of information required in each application are provided below.

- Waste tire use
    - Applicant information
    - Site information
    - Zoning certification
    - Landowner certification
    - A drawing detailing the size and design of the project using waste tires (plan and profile views) completed by an engineer for civil engineering applications.
    - A written document detailing
        - Quantities of tires to be used
        - Method to keep the tires drained of water (to prevent mosquito breeding)
        - Provisions for fire control
        - Method of disposal when the BU project has ceased
    - Proposed project completion date
- Industrial byproduct use
    - Facility information (where byproduct is generated)
    - Applicant information
    - Byproduct information
    - Beneficial use information (how the byproduct will be used)
    - Beneficial use plan
        - Background
            - Describe the process used to create the material
            - What characteristics does it possess?
            - Laboratory analysis characterizing material

- Byproduct preparation
    - Initial condition of byproduct
    - Preparation necessary to make it suitable for use, include details of:
        - Drying processes
        - Storage locations
        - Surface water run-off/run-on control measures
        - Schematic showing surface water controls
- Proposed use, includes
    - Soil to residual mixing ratios
    - Method of application
    - Placement/proposed locations
    - Volume to be used
- Contingency plan
    - Weather conditions which may preclude the use of the byproduct
    - Storage available at the generator or application site
    - Information on disposal facilities that will be used if beneficial use is not possible

Evaluation criteria for BUD applications

- Dependent on waste and use
- Often analytical data is not required
- For land application, agronomic rates and nutrient analysis data are typically required
- Process knowledge is utilized in determination

Based on discussions with KDHE staff, approximately 20 BUDs are issued annually.

# Kentucky BU Profile

Rules applicable to the beneficial reuse of solid waste in Kentucky include Kentucky Revised Statutes KRS 224 and Kentucky Administrative Regulations 401 KAR Chapters 30, 45, and 47

- As defined in KRS 224.01-010(31)(a) – Solid waste does not include those materials including, but not limited to, sand, soil, rock, gravel, or bridge debris extracted as part of a public road construction project, funded wholly or in part with state funds, recovered material, tire-derived fuel, special wastes as designated by KRS 224.50-760, solid or dissolved material in domestic sewage, manure, crops, crop residue, or a combination thereof which are placed on the soil for return to the soil as fertilizers or soil conditioners, or solid or dissolved material in irrigation return flows or industrial discharges which are point sources subject to permits under Section 402 of the Federal Water Pollution Control Act, as amended, or source, special nuclear, or by-product material as defined by the Atomic Energy Act of 1954, as amended.
- 401 KAR Chapter 47:150 identifies the beneficial reuse of solid waste as requiring a permit by rule
- There are two paths to take when considering beneficial use for a material:
    - Special waste regulation for coal combustion products (CCPs), water treatment plant residuals, and wastewater treatment plant (WWTP) residuals are considered special waste under 401 KAR Chapter 45.
        - Land application of WWTP residuals are not considered beneficial use
        - WTP residuals have been permitted as fill and for agricultural use previously
        - Permit by rule is required for these materials
    - Permit by rule for CCPs is granted without requiring a permit application or registration with KDEP, as long as it is not in violation of environmental standards in 401 KAR 30:031, if it is used :
        - As an ingredient in manufacturing a product
        - As an ingredient in cement, concrete, paint and plastics
        - As anti-skid material
        - As highway base course
        - Structural fill
        - As blasting grit
        - As roofing granules
        - For disposal in an active mining operation if the mine owner/operator has a mining permit which authorizes disposal of special waste. (See also KY. REV. STAT. ANN. §350.270.)
    - Other materials for beneficial use are considered under 401 KAR Chapter 47:150
- Analytical testing in the form of TCLP for RCRA metals is required
    - Upon speaking with KDEP, it is common to analyze a material for total concentrations, including VOCs
    - KDEP is moving towards using SPLP for CCPs

    - To address the concern of risk, results are compared with the US EPA Region 3 Regional Screening Levels for residential soil and groundwater limits
        - If material fails screening, it is an automatic denial for permit by rule
- Annual reports are required for permit by rule holders

Application for a Permit-By-Rule for Beneficial Reuse of Solid Waste (Form DEP 7098, 1999)

- Contains general instructions for filing application for a permit by rule in order to beneficially reuse waste
- Requirements for a permit by rule include:
    - Description of the type and anticipated volume of waste to be beneficially reused
    - Description of the beneficial reuse and an explanation of the benefit provided by this reuse
    - Description of how the beneficial reuse meets the environmental performance standards of 401 KAR 30:031 regarding floodplains, endangered species, surface waters, groundwater, disease, air, and safety
    - Site plan drawing
    - USGS 7.5 minute topographic map showing location of proposed activity and property boundaries of where reuse is to take place

# Louisiana BU Profile

Louisiana Department of Environmental Quality (LDEQ) governs the beneficial use of solid waste via Title 33 Part VII Subpart I Chapter 11: Solid Waste Beneficial Use and Soil Reuse (LAC 33: VII Chapter 11)

Section 115 Defines:

- Beneficial Use—the use of waste material for some profitable purpose (e.g., incorporating sludge into soil to amend the soil). Avoidance of processing or disposal cost alone does not constitute beneficial use.

Section 1103 identifies requirements for on-site reuse of soil

- Soil to be reused on site that contains levels of contaminants at or below the pertinent risk evaluation corrective action program (RECAP) standards are exempt from regulation
- Soils not exempt from regulation to be used on site must follow the parameters provided in 1103(B):
    - Characterize the soil in question
    - Description of the property in question
    - Description of the proposed uses of the soil on-site
    - An on-site soil reuse plan regarding the soil in question

Section 1105 identifies the requirements for the beneficial use of other solid waste

- All beneficial use determinations are managed on a case-by-case basis
- An application for beneficial use of solid waste streams shall provide the following information:
    - Name, address, and contact information of the applicant, applicant's attorney or representative, and the site of origin of the material
    - The chemical and physical characteristics of the material
        - Analysis only required to prove that waste is not hazardous
    - Statements of quantity, quality, consistency, and source of the material
    - Description of the process by which the solid waste is generated, and a demonstration that the generator has minimized the quantity and toxicity of the solid waste proposed for beneficial use to the extent reasonably practicable
    - A detailed description of the processing activity, if applicable, that will be used to make the solid waste suitable for beneficial use
    - A demonstration that there is a known or reasonably probable market for the intended use of the beneficial use material, such as a contract to purchase or utilize the material, a description of how the material will be used, and a demonstration that the material complies with industry standards for a product, or other documentation that a market exists
    - A description of the proposed methods of handling, storing, and utilizing the beneficial use material to ensure that it will not adversely affect the public health or safety
    - An acknowledgement that at least 75 percent of the material placed in storage during a year will be sent to market or to other secure storage within the following year, unless

    the operator demonstrates that a particular order requires greater than one year of product storage prior to shipment
    - A demonstration that the end use of the material is protective of public health, safety, and the environment
    - Discussion of the end users of the material and its end use location
- Louisiana Pulp and Paper Association agreement with LDEQ may result in no need for beneficial use application for certain pulp and papermill products due to standing approvals (LAC 33:VII.3017.Appendix I)
- There are currently 27 active beneficial use determinations in Louisiana, for materials including (LDEQ):
    - Blasting media
    - Boiler ash
    - Spent carbon
    - Petroleum contaminated soils
    - WWTP Incinerator ash
    - Asphalt shingles
    - Fats, oils, and greases
    - Fluorogypsum
    - Impoundment soil
    - Biosolids
    - Construction related soils

## Maine BU Profile

Maine Department of Environmental Protection (MDEP) regulates the beneficial use of solid waste via the Maine Solid Waste Management Rules: Chapter 418 Beneficial Use of Solid Wastes, and definitions from Chapter 400 General Provisions.

- "Beneficial use" means to use or reuse a solid waste or waste derived product:
  (1) As a raw material substitute in manufacturing,
  (2) As construction material or construction fill,
  (3) As fuel, or
  (4) In agronomic utilization.
- "Solid waste" means useless, unwanted or discarded solid material with insufficient liquid content to be free flowing, including but not limited to rubbish, garbage, refuse-derived fuel, scrap materials, junk, refuse, inert fill material, and landscape refuse, but does not include hazardous waste, biomedical waste, septic tank sludge, or agricultural wastes. The fact that a solid waste, or constituent of the waste, may have value, be beneficially used, have other use, or be sold or exchanged, does not exclude it from this definition.
- "Secondary material" means a solid waste, separated from other solid wastes, which may be suitable for beneficial use.

There are generally four categories that a waste or use may fall into (in order of increasing level of demonstration necessary for beneficial use)

- Exempt materials
- Permit by rule
- Reduced procedures
- Beneficial use determination (BUD) application

Chapter 418: Beneficial Use of Solid Wastes

- Exemptions – The following beneficial use activities are exempt from regulation under the chapter:
  - The beneficial use of chipped wood from trees, brush, and other plant material generated from land clearing or timber harvesting activities provided that the material is used for fill on the same parcel of land or right-of-way where the waste is generated and the total affected area is less than one (1) acre, or used for fuel, mulch, or erosion.
  - The beneficial use of inert fill as fill, drainage material in construction projects or as a raw material in cement, concrete or asphalt production.
  - The beneficial use of processed cured asphalt and soil material in paving material production, and road and parking lot construction and maintenance.
  - The beneficial use of oil-contaminated soil material that has been stabilized with emulsified asphalt as a substitute for virgin aggregate in the production of asphalt pavement.
  - The beneficial use of:

    - 100 cubic yards or less of dredge material used on the site of generation and draining into the dredged water body.
    - Dredge material from class A, class AA and class SA water bodies.
    - Dredge material used on the site of generation containing less than 15% fines (material passing the #200 sieve) from representative sampling, in conformance with USEPA SW-846, of a minimum of four samples, or one sample per acre, whichever is more frequent.
    - Dredge material from agricultural or residential ponds, ditches and drainage ways when the use occurs on the site of generation.
    - Dredge material free from oil, grease, litter and other contaminants and that is generated from normal maintenance of storm water and erosion control structures regulated under 38 M.R.S.A. Section 420-C and Section 420-D.
    - Dredge material containing less than 15% fines and that meet Appendix A levels for the listed constituents in Section 5.(A)(3) of this rule used as beach nourishment fill.
- Dredge material containing less than 15% fines and that meet Appendix A levels for the listed constituents in Section 5.(A)(3) of this rule used as beach nourishment fill.
- The combustion or processing of secondary materials generated exclusively at a facility in that facility's lime kiln, cement kiln, bark and hogged fuel boiler, biomass or conventional fuel boiler, Kraft recovery boiler or sulfite process recovery boiler, and the combustion of wood wastes from land clearing or wood waste from wood products facilities at these facilities.
- The beneficial use of no more than 1,000 tires in a recreation area open for use by the public.
- The beneficial use of no more than 1,000 whole tires at a farm or a landfill as weights.
- The household beneficial use of no more than a total of 50 whole tires.
- The beneficial use of pre-separated paper, cardboard, glass, plastic, lumber, and scrap metal, including metal processed from white goods and junk vehicles, as a raw material in the manufacture of commercial products.
- The beneficial use of non-hazardous blast furnace slag, silica fume, and coal ash in cement production, flowable fill or concrete batching; and of non-hazardous coal, multi-fuel, or wood bottom ash in asphalt batching.
- The beneficial use of secondary materials generated in Maine when it is exported to another state or country.
- The beneficial use of tire chips used in subsurface waste water disposal units as permitted in the Maine Subsurface Waste Water Disposal Rules.
- The beneficial use of waste from Department supervised remedial activities when the beneficial use activity occurs at the site of generation and has been found by the Department to be acceptable following a risk evaluation.
- The beneficial use of utility poles as utility poles in another location.
- Wood ash from the burning of wood wastes is not subject to the requirements of this chapter and is not considered a solid waste if the person proposing to beneficially use

    the wood ash submits written documentation to the department demonstrating that the wood ash is being used as an effective substitute for commercially available products. The user of the wood ash must submit this documentation initially and if the characteristics of the wood ash change.

- General standards – all beneficial use activities must meet the following general standards:
    - The beneficially used secondary material must perform as an acceptable substitute for the material it is replacing.
    - The beneficial use will not pollute any waters of the state, contaminate the ambient air, constitute a hazard to health or welfare or create a nuisance.
    - Applicability, financial ability, technical ability, variances, and other applicable requirements of Chapter 400
    - A beneficial use activity may not be located in, on, or over any protected natural resource or be located adjacent to and operated in such a manner that material or soil may be washed into any protected natural resource unless approved pursuant to Maine's Natural Resource Protection Act
    - The beneficial use of waste in construction must be in conformance with the applicable provisions of Maine Erosion and Sediment Control Handbook for Construction: Best Management Practices
    - The beneficial use activity must not include the use of hazardous wastes identified pursuant to Maine's Identification of Hazardous Waste rule, 06-096 CMR 850
- Permit By Rule Provisions -- The permit-by-rule provisions apply only to the wastes and specific uses outlined, and provide no variances to the permit by rule requirements.
    - Permit by Rule for Beneficial Use of Tire Chips as Fill Material – provisions of this section apply to the use of tire chips as a light weight, insulating, or free draining fill for roads, retaining walls, landslide stabilization, and other civil engineering applications where all of the standards of this section are met.
        - Application not required – at least 24 calendar days prior to the initiation of the proposed activity an applicant shall submit a signed permit-by-rule notification on a form provided by MDEP. It must include:
            - A description of the tire chips size and proposed use
            - A U.S.G.S 7.5 minute topographic map or equivalent map clearly marking the project location. GPS coordinates of the activity shall be provided in the project description.
            - For proposed roads, a cross-sectional view, with a horizontal scale of 1 inch = 5 ft and a vertical scale of 1 inch = 12 inches. The cross-section must clearly indicate the location and depth of each material layer as applicable (gravel, tire chips, geotextile, surface course, etc.).
        - Standards:
            - Tire chips shall conform to the specification of ASTM Standards referenced in D 6270-98 or Maine Department of Transportation type A or B tire chips.

    - The use of geotextile, Maine Department of Transportation specification 722.01 or approved equivalent, between material layers where specified is required.
    - The maximum compacted thickness of each tire chip lift shall not exceed twelve (12) inches.
    - The tire chip layer is restricted to a maximum thickness of 9.8 ft
    - Surface Course Requirements for Unpaved Roads
      - For travel ways subject to loading from passenger car and light truck traffic, a minimum of twelve (12) inches of soil material shall be placed over the tire chip layer.
      - For travel ways subject to loading from moderate to heavy truck traffic, a minimum of eighteen (18) inches of soil material shall be placed over the tire chip layer.
    - The tire chips shall be covered with a minimum layer of 12 inches of soil material, concrete, pavement or other suitable material, such that no waste is exposed.
    - Tire chips to be used may be stored in a secure location near the project that is under the control of the licensee. All excess tire chips and residue must be removed from the project area upon completion of the project.
- Permit by Rule for the Beneficial Use of Emulsified Asphalt Encapsulated Oil Contaminated Soil as Construction Fill – provisions of this section apply to the use of emulsified asphalt encapsulated oil contaminated soil as a construction fill underneath paved roads and parking lots, and in other civil engineering applications where all of the standards of this section are met.
  - "Construction fill" means, fill that may contain solid waste utilized to provide material for construction projects such as roads, parking lots, buildings or other structures. It does not include fill needed to re-contour an area within a landfill or where no further construction is occurring. If the construction fill contains solid waste other than inert fill, the use of the fill is regulated under Chapter 418, on a case by case basis.
  - Application not required – at least 10 calendar days prior to the initiation of the proposed activity or use an applicant shall submit a signed permit-by-rule notification on a form provided by MDEP. It must include:
    - A description of the proposed use of the construction fill.
    - A U.S.G.S 7.5-minute topographic map or equivalent map clearly marking the project location. GPS coordinates of the activity shall be provided in the project description.
    - For proposed roads, a cross-sectional view, with a horizontal scale of 1 inch = 5 ft and a vertical scale of 1 inch = 12 inches. The cross-section must clearly indicate the location and depth of each material layer as

            applicable (construction fill, paved surface course, other construction, etc.).
        - Standards:
            - Emulsified asphalt encapsulated oil contaminated soil may not be placed in standing water or in a channeled drainage flow. It may not be used to fill any wetlands, be placed below the water table, or be allowed to wash into any water of the state.
            - A layer of asphalt, concrete or a 6 inch layer of soil must completely cover the stabilized contaminated soil and must be permanently maintained. No surface exposure is allowed.
            - Encapsulated soil intended to be used for a project may be stored in a secure location near the project that is under the control of the licensee. All excess construction fill and residue must be removed from the project area upon completion of the project.
            - The beneficial use may not take place on a residential, school or public recreational property.
- Reduced Procedures for Select Beneficial Use Activities
    - The reduced procedure provisions of this section apply to the beneficial use when all of the general standards described above. These standards are found in section 5 of Chapter 418.
    - Reduced procedures are available for:
        - Beneficial use of de-watered dredge material as fill
        - Beneficial use of multi-fuel boiler ash or bottom ash from wood fired boilers as fill in road construction, parking lots, and other traveled ways
        - Beneficial use of multi-fuel boiler ash or bottom ash from wood fired boilers as flowable fill
    - The Department finds that the beneficial use of non-hazardous dredge material, bottom ash from wood fired boilers, and multi-fuel ash as flowable fill licensed under this reduced procedure will meet the standards of Section 3 of this rule because of the limited likelihood of adverse environmental or human health impact.
    - Reduced application requirements are outlined in part D of section 5.
- Beneficial Use Licenses – if a secondary material doesn't fall under the exemptions, permit by rule, or reduced provision categories, it will require a beneficial use license issued on a case by case basis.
    - A pre-application meeting must be conducted with MDEP.
        - The meeting will discuss the beneficial use proposal, and provide an opportunity for the applicant to receive guidance on risk assessment.
        - Two weeks prior to the meeting, the applicant shall submit to MDEP:
            - Description of the secondary material and its proposed use. Must include sufficient information to demonstrate that the proposed project is a beneficial use.

            - Information regarding physical, chemical, and biological characteristics of the secondary material.
            - Results of analytical testing in accordance with the requirements of Chapter 405 Section 6 A, B, and C.
                - Chemical analysis data normally consists at least of total analysis, but TCLP may be required in some cases.
            - Quantities by weight and/or volume.
            - A description of any risk management techniques being considered.
                - Beneficial use of the waste material must not result in a greater risk than that posed by current construction practices and materials, or in an aggregate risk to a highly-exposed individual under the proposed use or all future planned uses exceeding an Incremental Lifetime Cancer Risk of 5 x $10^{-6}$ and a Hazard Index of ½.
                - Chapter 418 rules include a list of 575 different chemical constituents (each with an associated screening standard, in mg/kg) – wastes with test results below the applicable Appendix A levels are considered to meet the risk standard.
    - Additional application requirements are outlined in part C of Section 7.
- For licensed, on-going beneficial use activities, the licensee shall submit, for review and approval, an annual report to MDEP. This report must contain a summary of activity during the past year, including:
    - The quantity of secondary material distributed or received for beneficial use
    - The sources of the secondary material received
    - The results of any required testing or on-going characterization
    - Where required by license condition, the licensee is required to include in the annual report the location of the beneficial use activity for the past year.

Land Application

- Residual material proposed for agronomic utilization is subject to Chapter 419 of these rules *(Agronomic Utilization of Residuals)* CMR 06-096 Chapter 419. Agronomic utilization of a residual material and another beneficial use of the residual as a secondary material may be approved in one license.

Maine has 2 active BUDs, and has received 28 BUDs overall, as of 2011 as reported by the NEWMOA Beneficial Use Database.

# Maryland BU Profile

Solid waste in Maryland is regulated by the Maryland Department of the Environment. There is not a formal beneficial use system in place per the Code of Maryland Regulations (COMAR). Beneficial use is not defined, but 26.04.09.02 in COMAR (Definitions) includes the following relevant definitions:

> (7) "Recyclable materials" means those materials that:
> (a) Would otherwise become solid waste for disposal in a refuse disposal system; and
> (b) May be collected, separated, or processed and returned to the marketplace in the form of raw materials or products.
> (8) "Recycling" means any process in which materials that would otherwise become solid waste are collected, separated, or processed and returned to the marketplace in the form of raw materials or products.

Regulations for the beneficial use of coal combustion products (CCPs) were proposed in the February 26, 2010 edition of the Maryland Register and comments were accepted through March 29, 2010 and are currently under review.

Limited information regarding beneficial use was available directly from the state, but several observations were noted based on a review of the state's responses to the 2007 ASTSWMO beneficial use survey.

- The system of allowing the beneficial use of waste materials has been in existence since approximately 1987
- An estimated 50 beneficial use approvals had been issued as of 2007, and the state receives an average of 1 to 10 beneficial use requests annually.
- In general, if a material is approved for beneficial use, then it is exempt from further regulation as a solid waste.
- Materials proposed for beneficial use in a land application setting requires the approval of the material by the Maryland Department of Agriculture, but in these cases, the material itself is not approved but the site of beneficial use is not. For most materials, if a material qualifies as recyclable (per the definition presented above), then the material is regulated like any other product.

The table below presents a listing of wastes and uses that have been approved for beneficial use based on responses by Maryland to the 2007 ASTSWMO survey.

| Waste | Use(s) |
|---|---|
| Auto Shredder Residue | MSW landfill daily cover |
| Cement Kiln Dust | Liming agent |
| Chicken litter | Fertilizer, fuel |
| C&D Debris | Shredded (landfill cover) |
| Contaminated soil | Daily, intermediate, and final cover at MSW Landfills |
| Dredge material | Landfill cover |
| Drinking water sludge (alum, ferric, and lime) | Soil amendment, if approved by Maryland Department of Agriculture |

| Waste | Use(s) |
|---|---|
| Gypsum drywall | Compost amendment, soil amendment (if approved by Maryland Department of Agriculture) |
| Coal fly ash | Cement additive, fill |
| Coal bottom ash | Cement additive, fill |
| Flue gas desulfurization sludge | Cement additive, fill |
| Asphalt shingles | Asphalt additive, roadbed |
| Foundry sand (green sand) | Cement additive, topsoil additive |
| Chemically bonded sand | Cement additive, topsoil additive |
| Steel slag | Roadbed aggregate |
| Street sweepings | Highway revegetation |
| Stormwater sediments | MSW landfill daily cover |
| Waste-to-energy ash | MSW landfill daily cover |
| Wood ash | Soil amendment (if approved by Maryland Department of Agriculture) |
| Waste tires | Aggregate, fuel |

## Massachusetts BU Profile

Massachusetts Department of Environmental Protection (MDEP) regulates the beneficial use of solid waste through the Beneficial Use Regulations 310 CMR 19.060.

Definitions from Solid Waste Management 310 CMR 19.006 include:

- Beneficial Use means the use of a material as an effective substitute for a commercial product or commodity.
- Secondary material means a waste material that has characteristics that make it an effective substitute for an ingredient in an existing or new product or commodity.
- “Solid Waste” does not include:
  (a) Hazardous wastes as defined and regulated pursuant to 310 CMR 30.000;
  (b) Sludge or septage which is land applied in compliance with 310 CMR 32.00;
  (c) waste water treatment facility residuals and sludge ash from either publicly or privately owned waste water treatment facilities that treat only sewage, which is treated and/or disposed at a site regulated pursuant to M.G.L. c. 83, §§ 6 & 7 and/or M.G.L. c. 21, §§ 26 through 53 and the regulations promulgated thereunder, unless the waste water treatment residuals and/or sludge ash are co-disposed with solid waste;
  (d) Septage and sewage as defined and regulated pursuant 314 CMR 5.00: Ground Water Discharge Permit Program, and regulated pursuant to either M.G.L. c. 21, §§ 26 through 53 or 310 CMR 15.00: The State Environmental Code, Title 5: Standard Requirements for the Siting, Construction, Inspection, Upgrade and Expansion of On-site Sewage Treatment and Disposal Systems and for the Transport and Disposal of Septage, provided that 310 CMR 19.000 do apply to solid waste management facilities which co-dispose septage and sewage with solid waste;
  (e) Ash produced from the combustion of coal when reused as prescribed pursuant to M.G.L. c. 111, § 150A;
  (f) Solid or dissolved materials in irrigation return flows;
  (g) Source, special nuclear or by-product material as defined by the Atomic Energy Act of 1954, as amended;
  (h) Those materials and by-products generated from and reused within an original manufacturing process; and
  (i) Compostable or recyclable materials when composted or recycled in an operation not required to be assigned pursuant to 310 CMR 16.05(2) through (5).

Solid Waste Management Regulations 310 CMR 19.060 Beneficial Use of Solid Waste

- Beneficial use of solid waste and relies on the classification of a solid waste as a secondary material in one of four categories:
  - **Category 1** – Use of Secondary Materials in Commercial Products
    - Products manufactured from secondary materials or secondary materials that are directly used as products are considered commercial products under the following conditions:

        - When the product is used in a manner that is consistent with industry accepted product specifications or performance standards
        - When the product is controlled and managed throughout its life cycle in a manner that effectively limits potential for illegal or inadvertent disposal or releases of hazardous material to the environment and exposure to people
        - When any adverse impacts or significant risks to public health, safety and the environment, including, but not limited to, nuisance conditions, can be evaluated and controlled.
        - Products applied to the land cannot be considered commercial products.
    - **Category 2** – Use of Secondary Materials in Regulated Systems
        - Beneficial use of secondary materials at facilities permitted, approved or otherwise regulated by the Department.
    - **Category 3** – Use of Secondary Materials in Restricted Applications
        - Secondary materials that are beneficially used in applications that utilize risk management techniques in order to prevent adverse impact or significant risks to public health, safety and the environment, including, but not limited to, nuisances.
    - **Category 4** – Use of Secondary Material in Unrestricted Applications
        - Secondary materials that are beneficially used in applications that do not limit exposure to potential human or environmental receptors from secondary material constituents that have the potential to adversely impact or create a risk to public health, safety, or the environment, including, but not limited to, nuisance conditions. Unrestricted beneficial use proposals are subject to the most comprehensive risk evaluations.
- Each of the four categories has a different application requiring the same general information and differing in specific details, from forms BWP SW 39 for Category 1 materials through BWP SW 42 for Category 4 materials.
- The burden of proof is on the applicant to demonstrate that the proposed use of the secondary materials and uses are beneficial and pose an insignificant potential hazard to public health, safety, and the environment.
- A pre-application meeting with MDEP is encouraged to determine needs for the beneficial use application
- Before application is possible, a request for determination of applicability must first be submitted to MDEP via a pre-application package including:
    - A facility or operation description
    - A list of products currently and historically manufactured by the facility
    - A description of the secondary material, including a physical and chemical characterization of the material including results of analytical testing for hazardous materials that may be thought to be present. A representative sampling plan in

    - accordance with SW-846 shall be outlined, including Critical Contaminants of Concern (CCCs)
    - Specifications for use of the secondary material
    - A list of licenses, permits or other prior approvals issued for the use of the secondary material
- When the processing of a proposed secondary material is necessary for its beneficial use the Department shall determine the type and amount of processing allowable which does not constitute a solid waste processing activity
- General application requirements – An application must be filed with the department, as well as a copy with the board of health of jurisdiction when proposed use is in a specific location. The following information is required as determined in a pre-application when applicable:
    - All information required in the pre-application package
    - If hazardous materials, including CCCs, are identified during the pre-application or application process the project proponent shall prepare and submit a Toxics Reduction Plan (TRP) that details options to minimize the concentration of hazardous material that could be released to the environment. The TRP shall document steps that will be taken to implement economically and technologically feasible options.
    - Submission of all appropriate data derived from the sampling plan required in accordance with 310 CMR 19.060(4)(c)3. The Applicant must include a statistically valid analysis of the concentration and distribution of all hazardous materials that may be contained in the proposed secondary material.
- MDEP may grant temporary approval for a pilot project or demonstration project pursuant to 310 CMR 19.062: Demonstration Projects or Facilities. The application requirements for a pilot project or demonstration project will be determined on a case-by-case basis by the Department.
- The permittee shall maintain records and shall submit reports to the MDEP as required in the permittee's Beneficial Use Determination permit, summarizing beneficial use activities during the past year, including the quantity of secondary material received or distributed for beneficial use, the sources of the secondary material received, and the results of any required testing or on-going characterization and any other information required as a condition of the permit.
- The Department may issue general beneficial use determinations, as general permits, that apply to a specific beneficial use of a secondary material
    - Any person or entity may use the secondary material as identified in the general beneficial use determination as long as the person or entity adheres to the requirements and conditions contained therein.
- Reuse Criteria.
    - No significant risk to public health shall be created.
    - No significant adverse environmental impacts shall be created.
    - No condition shall be treated that adversely impacts public health, safety, or the environment.

    - Reuse may not result in increases in the environmental concentrations of any critical contaminants of concern (CCCs), including persistent, bioaccumulative toxins (PBT) and other priority chemical pollutants as may be identified by the Department.
    - Reuse shall be in compliance with all applicable requirements of the Department.

Draft Interim Guidance Document for Beneficial Use Determination Regulations (March 2004) provides information to assist beneficial use applicants and includes a table of numerical values for secondary material constituents calculated using pre-defined exposure assumptions.

- The Department has developed a quantitative risk assessment approach for use in restricted and unrestricted applications for use when evaluating risk. This approach is similar to the approach used by the Bureau of Waste Site Cleanup as documented in the Massachusetts Contingency Plan (MCP).
    - The MCP provides three approaches for characterizing risks and the need for remediation at sites. These are: use of standards established by DEP (Method 1), use of standards developed by the applicant using appropriate methods as delineated by DEP (Method 2), and comprehensive site-specific risk evaluation (Method 3).
    - Method 1 incorporates a list of hazardous material values that have been calculated based upon a predetermined set of exposure scenarios. Secondary materials that contain constituents of concern that do not exceed these values have demonstrated no significant risk to the public health, safety and the Environment.
    - Method 2 may be used to derive risk criteria when unavailable in the Method 1 assessment.
    - Method 3 involves an assessment of total risk based on site-specific information.

Preapproved uses for street sweepings identified under Policy #BWP-94-092, Reuse and Disposal of Street Sweepings

- Use at landfills as daily cover
- Fill in public ways (when criteria are met)
- Additive to compost (when criteria are met)

Massachusetts has 168 active BUDs as of 2011 as reported in the NEWMOA database.

## Michigan BU Profile

Michigan Department of Environmental Quality (MDEQ) currently (as well as prior to 2009) regulates the beneficial use of solid waste—from 2009 to January 2011, the DEQ was combined with the Department of Natural Resources to form the Department of Natural Resources and Environment (DNRE) and regulated beneficial use of solid waste during that period – via the Solid Waste Management Administrative Rules Promulgated to Part 115 (of the Natural Resources and Environmental Protection Act) Index, Part 1 General Provisions.

- R299.4113 Coal ash used to reclaim, develop, or enhance land
    - This rule outlines the necessary requirements for land application of coal ash
    - Must demonstrate ash is “inert” under R299.4114-4117

No permit is necessary for the beneficial use of statutory-defined inert materials

- R299.4114 Inert Materials
    - The use of inert material on land does not require a construction permit or operating license. The following are inert materials:
        - Rock
        - Trees, stumps, and other land clearing debris buried on the site of generation
        - Excavated soil (not inert if contaminated with hazardous substances)
        - Construction brick, masonry, pavement, and broken concrete that is reused for fill, riprap, slope stabilization, or other construction (not inert if contaminated with hazardous substances)
        - Chipped tires used in the construction and operation of a sanitary landfill
        - Portland cement clinker produced by cement kiln using solid waste as a fuel or feed stock, but not including cement kiln dust generated as a waste in the process
        - Low hazard industrial waste that is in compliance with the inertness criteria contained in R299.4115
            - According to MDEQ, listed low hazard waste can be declared inert, and can usually just inform the department and get concurrence.
        - Low hazard industrial waste used as aggregate, road, or building material and which in ultimate use will be stabilized or bonded by cement, limes, or asphalt
        - Other materials that are designated as inert under R299.4118.

Beneficial Use Determinations

- R299.4115 provides criteria for designating inert materials appropriate for general reuse
    - May petition for the director to designate a solid waste as an inert material that is appropriate for general reuse
    - If the petition demonstrates that the concentration of hazardous substances is below one of the following criteria:
        - Background concentration of the substance or substances

        - The method detection limit for the substance or substances
        - Type B criteria for soil specified in R299.5711 (Director shall waive type B criteria based on inhalation hazards if it is demonstrated that waste is not of a respirable particle size)
    - A petition to designate a material as inert for general reuse shall contain information specified in R299.4118
- R299.4116 Criteria for designating inert materials appropriate for reuse at a specific location
    - A person may petition the director to designate a solid waste as an inert material that is appropriate for reuse at a specific property.
    - The director shall approve a petition that is submitted pursuant to the concentration of each hazardous substance in the leachate of the waste is less than 1 of the following
        - The leachate concentration generated by background soil
        - Method detection limit for the substance in question
        - All of the following concentrations
            - For a carcinogen acting by a threshold or a non-threshold mechanism, the concentration that represents an increased cancer risk of 1 in 1,000,000 calculated according to the procedures in R 299.5723
            - For a hazardous substance that is not a carcinogen, a genotoxic teratogen, or a germ line mutagen, the concentration that represents the human life cycle safe concentration calculated according to the procedures in R 299.5725
            - For a hazardous substance that has a secondary maximum contaminant level, that level.
            - For a hazardous substance that, singly or in combination with other hazardous substances present at the site, imparts adverse aesthetic characteristics to groundwater, the concentration that is documented as the taste or odor threshold or the concentration below which appearance or other aesthetic characteristics are not adversely affected.
        - A concentration that is otherwise authorized pursuant to the provisions of act 245
    - A petition to designate a material as inert at a specific location shall contain the information specified in R 299.4118
- R299.4117 Criteria for designating inert materials appropriate for specific reuse instead of virgin material
    - A person may petition the director to designate a solid waste as an inert material appropriate for a specific type of reuse instead of virgin material.
    - MDEQ shall approve if the petition demonstrates any of the following
        - The material meets the criteria of R 299.4115

    - The material does not pose a threat to groundwater, as specified in R 299.4116, and the conditions of reuse will prohibit exposures that result in unacceptable risks as defined in R 299.5711
    - The material does not pose a greater hazard to human health and the environment during reuse than the virgin material that it replaces when used in the following manner:
      - As a component of concrete, grout, mortar, or casting molds
      - When used as a raw material in asphalt for road construction
      - As aggregate, road, or building material that will be stabilized or bonded by cement, limes, or asphalt
  - A petition to designate a material as inert for specific reuse shall contain the information specified in R 299.4118 for the raw material, the product that contains waste as a component, the raw material that the waste replaces, and the product that contains material other than waste
  - A person may petition the director to designate a solid waste that is not in compliance with the definition of a low-hazard industrial waste as an inert material for the purpose of conducting a pilot project on the suitability of the waste for a specific reuse
- R229.4118 Petitions to classify wastes
  - Allow a person to petition MDEQ to designate a solid waste as an inert material, compostable material, or low hazard industrial waste
  - Petition shall include
    - A description of the process that is used to produce the material, including a schematic diagram of the process and a list of raw materials that are used in the process.
    - Maximum and average amounts of material generated monthly and annually
    - Documentation that the material is not a hazardous waste as defined in part 111
      - MDEQ can accept literature and studies proving characteristics of waste
    - For uses where the waste may present an inhalation or direct contact hazard, a description of the total concentration of each of the following chemical constituents that may be present in the material in light of the process used including
      - Any hazardous constituents listed in 40 C.F.R. part 258, appendix II, that may be present in the material
      - Total chloride
      - Total nitrogen
      - Total iron
      - Total manganese
      - Total sulfates
      - Total molybdenum
      - Total sodium

        - Constituents that are present in the material at potential levels of concern shall determine the leaching potential via TCLP, SPLP, or other test methods approved by the department that accurately simulate conditions at the site.
        - Within 180 days of receiving all of the information necessary to evaluate the petition, either approve the petition with any conditions that are necessary to protect human health and the environment or deny the petition
    - Material that is classified by the director based on a petition under this rule shall be retested to confirm the classification not less than annually
- R229.4119 The approval of site and source-separated materials not listed in the act
    - The director shall approve materials that are not specified in the act as site or source separated material if the person who seeks the exemption demonstrates that the materials can be converted into raw materials or new products by any of the following means:
        - By being returned to the original process from which they were generated
        - By being used or reused as ingredients in an industrial process to make a product
        - By being used or reused as effective substitutes for commercial products
    - Waste materials shall not be considered site or source separated for the purpose of conversion into raw materials or new products if the materials are any of the following:
        - Stored in a manner constituting speculative accumulation
        - Mixed with other material so that the waste materials cannot be converted into raw materials or new products without processing to remove the other material
        - Applied to or placed on the land, or used to produce products that are placed on the land, in a manner that constitutes disposal
    - All of the following shall be considered source-separated material if the criteria of this rule are met
        - Utility poles or pole segments reused as poles, posts, or similar uses
        - Railroad ties reused in landscaping, embankments, or similar uses
        - Any of the following, when used to stabilize, solidify, or otherwise treat waste at a site of environmental contamination or at a facility licensed under part 111 or part 115 of the act:
            - Cement kiln dust
            - Lime kiln dust
            - Water softening limes
            - Sugar beet limes
            - Coal fly ash
            - Wood ash
- Generic exemptions have been issued for:
    - Drywall
    - Scrap wood
    - Tires

    - Concrete grinding slurry
    - Water softening limes
    - Manure
    - Fish waste
- There is no reporting required for listed statutory-defined exempt materials
- When using 1,000 cubic yards or more of material, annual reporting is required
    - Reporting requirements are case by case dependant on the characteristics of the material

MDEQ published documents related to the generic exemptions of the following materials:

- Organic residuals (on-farm anaerobic digestion) (2010)
- Lime sludges from public water treatment plants (Agricultural Use Approval #05-AUA-001) (2005)
- Asphalt shingles (2010)
- Concrete Grinding Slurry (2003)
- Manure, paunch, and pen waste (2007)
- Scrap wood (2010)
- Fish waste (2011)
- Gypsum drywall (2003)

The recycling activity of certain industrial byproducts is tracked by MDEQ. Data for year 2009, 2010 and 2011 were provided by MDEQ for some wastes, as summarized below.

    - Pulp/paper/wood sludge
        - 2010: 61% recycled
        - 2011: 25% recycled
    - Asphalt shingles
    - Scrap wood
    - Cement kiln dust
        - 2009: 13.7 recycled
        - 2010: 16.4% recycled
        - 2011: 9% recycled
    - Foundry sand
        - 2010: 34% recycled
        - 2011: 26% recycled
    - Food processing
    - Coal ash
        - 2010: 17% recycled
        - 2011: 18% recycled
    - Drywall
    - Flue gas desulfurization
    - Wood ash

    - 2010: 5% recycled
    - 2011: 2% recycled
- Overall data:
  - 2009: 411,863 tons recycled
  - 2010: 672,200 tons recycled
  - 2011: 792,435 tons recycled

Scrap tire reuse is regulated by Part 169 of the Natural Resources and Environmental Protection Act

Michigan has 115 active BUDs as reported in the NEWMOA database as of 2011.

## Minnesota BU Profile

Beneficial use is regulated by the Minnesota Pollution Control Agency (MPCA) via Minnesota Administrative Rules Chapter 7035, Solid Waste.

7035.0300 Definitions

- Beneficial Use Determinations – refers to standing or case-specific beneficial use determinations under part 7035.2860, subparts 4 or 5, respectively.
- Solid Waste – does not include hazardous waste; animal waste used as fertilizer; earthen fill, boulders, rock; sewage sludge; solid or dissolved material in domestic sewage or other common pollutants in water resources, such as silt, dissolved or suspended solids in industrial waste water effluents or discharges which are point sources subject to permits under section 402 of the Federal Water Pollution Control Act, as amended, dissolved materials in irrigation return flows; or source, special nuclear, or by-product material as defined by The Atomic Energy Act of 1954, as amended.
- Subpart 62a. Manufactured Product – means an item that through processing becomes chemically and physically stable and remains so during its intended use. Examples of manufactured products include wallboard, ceiling tile, plywood, lumber, office furniture, containers, and bricks. Items that are not considered manufactured products include materials used in bulk in direct contact with the environment such as flowable fill, lightweight fill, clean fill, and aggregate, and materials used in bulk that are intended to be chemically active such as agricultural soil amendments and fertilizers.

Minnesota manages beneficial use of solid waste in two manners: through standing beneficial use determinations and case by case determinations, outlined in 7035.2680

7035.2680 Beneficial Use of Solid Waste

- Recyclable materials incorporated into a manufactured product are exempt from the requirement to obtain a case by case beneficial use determination.
- Composts that are used in accordance with the standards contained in part 7035.2836 are exempt from beneficial use determinations.
- Standards required to constitute a beneficial use:
  - Waste must not be stored in anticipation of speculative future markets
  - Solid waste must be characterized in accordance with part 7035.2861.
    - A person seeking to characterize a solid waste must
      - Be evaluated to determine if it is a hazardous waste via 7045.0214
      - List potential chemical constituents present in the waste, by evaluation of processes at the facility, production of waste, materials safety data sheets, ingredient labels, and other pertinent information.
      - Be analyzed to provide information on its chemical and physical properties including the potential chemical constituents (as described

        above) and physical properties that may affect the use of the solid waste.
            - Analysis must be consistent with the beneficial use being proposed
            - Totals analysis required in most cases
            - Leaching procedures may be required, from SW-846
    - Solid waste must be effective substitute for material or a necessary ingredient in a new product
    - Use must not adversely impact human health and the environment
    - The solid waste must not be used in quantities that exceed accepted engineering or commercial standards
- A material remains a solid waste until it is incorporated into a manufactured product or utilized in accordance with a standing or a case-specific beneficial use determination, and until this time must remain stored in compliance with 7035.2855 and managed as a solid waste
- **Standing Beneficial Use Determinations** – generator or end user of these listed materials and uses can handle the material without contacting the agency. There are no reporting requirements for standing beneficial uses
    - Unadulterated wood, wood chips, bark, or sawdust when these materials are used as mulch, landscaping, animal bedding, erosion control, wood fuel production, a bulking agent at a compost facility operated in compliance with part 7035.2836, or as a substitute for wood.
    - Unadulterated newspaper and newsprint when used as animal bedding, insulation, or as a substitute for paper products.
    - Uncontaminated glass when used as a sandblast agent.
    - Unusable latex paints, characterized as high solid content, off-specification colors, sour, frozen, or poor quality, when used to produce processed latex pigment for use as an additive for the production of ASTM-specified specialty cement.
    - Reclaimed glass and porcelain fixtures when used as a substitute for conventional aggregate or subgrade applications in accordance with Minnesota Department of Transportation Standard Specifications for Construction 2000 Edition, 3138.2 A2.
    - Crumb rubber when used in asphalt paving or applications where it is used as a substitute for rubber or similar elastic material.
    - Tire shreds when used as lightweight fill in the construction of public roads in accordance with Minnesota Statutes, section 115A.912, subdivision 4.
    - Tire chips when used as a substitute for conventional aggregate in construction applications when the ratio of this substitution is no greater than one to one by volume. This does not include use of tire chips as general construction fill or clean fill.
    - Uncontaminated recognizable concrete, recycled concrete and concrete products, and brick when used for service as a substitute for conventional aggregate.
    - Salvaged bituminous when used as a substitute for conventional aggregate in accordance with Minnesota Department of Transportation Standard Specifications for Construction 2000 Edition, 3138.2 A2.

    - Coal combustion slag when used as a component in manufactured products such as roofing shingles, ceiling tiles, or asphalt products.
    - Coal combustion slag when used as a sand blast abrasive.
    - Coal combustion fly ash as defined by ASTM C 618 when used as a pozzolan or cement replacement in the formation of high-strength concrete.
    - Coal combustion fly ash or coal combustion gas scrubbing by-products when used as an ingredient for production of aggregate that will be used in concrete or concrete products. This does not include use in flowable fill.
    - Foundry sand when used as a feed material for the manufacture of Portland cement.
    - Uncontaminated by-product limes when used as agricultural liming materials and distributed in accordance with chapter 1508 and Minnesota Statutes, sections 18C.531 to 18C.575. Application rates for by-product limes must be based on the lime recommendations of the University of Minnesota Extension Service and cannot cause the soil pH to exceed 7.1 after application.
        - Site-specific application rates for by-product lime must be determined by an individual that has a background and understanding of crop nutrient management such as a crop consultant or University of Minnesota Extension Specialist .
        - Recommended rates for lime can be obtained from the University of Minnesota Extension Service publication "Fertilizer Recommendations for Agronomic Crops in Minnesota " BU-06240-S, and the Minnesota Department of Agriculture publication "Ag-Lime Recommendations in Pounds ENP per acre"
    - Manufactured shingle scrap and ground tear-off shingle scrap when used in asphalt pavement or road subbases
- **Case Specific Beneficial Use Determinations** – for any wastes and/or uses not identified under the standing beneficial use determinations, the agency shall make a case by case determination based on whether the proposed use of the waste is a beneficial use.
    - Information required by the department in order to make the beneficial use determination includes:
        - Description of the waste, manner in which it is generated, proposed use and quantity to be utilized
        - Results of chemical and physical characterization as described above from 7035.2861
            - MPCA has stated that in lieu of analytical data, sources can be cited and provided to serve as documentation regarding the material and its analytical properties. Source citation is more typically used than laboratory analysis in most case specific beneficial use applications.
        - Evaluation of the human health and environmental impacts the proposed use may have, and a comparison with those from other management alternatives for the waste

        - Verification that the end product complies with the industry standards and specifications for the intended use, and a comparison of characteristics with the material it will replace
        - Description of the routine sampling and analysis that will be conducted of the solid waste, and must include the procedure and frequency of sampling and analysis, parameters to be analyzed, analysis methods, and laboratory reporting limits to be used
        - A copy of a contract to purchase or use the proposed product or other documentation proving that a market for the proposed product or use exists
        - A detailed description of how and where the product will be distributed
        - A complete description of the types of storage to be used prior to beneficial use, and how the solid waste will be managed to meet the requirements of 7035.2855 (Solid Waste Storage Standards)
        - A description of any wastes that will need to be managed as a result of beneficially using the solid waste
        - Verification that local units of government with authority to regulate the proposed process or use of the solid waste have received a copy of this application and have been provided information on who to contact at the agency to provide comments on the proposed beneficial use activity
        - A proposal for notification of interested or affected parties
    - In cases where the information required by this subpart is not available, a demonstration/research project designed to provide the missing information may be proposed in accordance with part 7035.0450 (Demonstration/Research Projects).
- Proposers that have applied for and received case-specific beneficial use determinations must submit a report to the county in which the solid waste is generated annually, and must contain a description of the type and quantity of solid waste beneficially used during the time period from January 1 to December 31 of the previous year.

Solid Waste Case Specific Beneficial Use Determination Proposal Submittal Form (2005) provides the guidance and requirements necessary for submitting a case specific beneficial use determination application.

Minnesota has 70 active BUDs as reported in the NEWMOA database as of 2011.

## Mississippi BU Profile

The Mississippi Department of Environmental Quality (MDEQ) governs beneficial use of solid waste via "Regulations for the Beneficial Use of Nonhazardous Solid Waste", adopted June 2005, under the regulatory authority of Section I.B.5 Mississippi Nonhazardous Solid Waste Management Regulations.

- "Beneficial Use" means the legitimate use of a solid waste in the manufacture of a product or as a product, for construction, soil amendment or other purposes, where the solid waste replaces a natural or other resource material by its utilization.
- "Beneficial Use Determination" means a written determination issued by the Mississippi Department of Environmental Quality to an applicant after review and approval of an application, to allow the legitimate beneficial use of a solid waste or by-product as a product.

Exclusions from Beneficial Use Regulations

- Common residential and commercial recyclable material
- Compost materials in compliance with Section IX of the Mississippi Nonhazardous Waste Management Regulations
- The use of solid wastes in beneficial fill activities detailed in Section I.B.6 of the Mississippi Nonhazardous Waste Management Regulations
    - Fact sheet on beneficial fill activities was published by MDEQ, must comply with all of the following conditions to be self-implementing, and do not require a beneficial use determination.
        - Fill material may only be composed of concrete, brick, mortar, and other similar metals. Metal, lumber, plastics, and natural vegetation are not suitable beneficial fill materials.
        - May only be conducted to bring an existing low area to grade, digging or excavating are not permitted.
        - Beneficial purposes may include landscaping, erosion control and repair, land stabilization, construction base preparations, or other similar land improvements
        - Must not obstruct the flow of natural stream river or take place in a wetland
        - <1 acre in size
        - No monetary compensation under any circumstances
        - Occurring for not more than 120 days
        - Upon completion fill area must be closed and covered with 2 ft of earthen material
        - If it does not comply, it is considered an unauthorized dump
        - Size and time limits may be modified by a MDEQ exemption
    - Hazardous wastes are excluded from beneficial use consideration

        - Solid wastes or by-products must be nonhazardous in the generated state without modification or treatment to render the material nonhazardous

Standing Use Determinations are approved for **Category I** Wastes, no application nor review and approval by the department required:

    - Uncontaminated and untreated wood, wood chips, bark, or sawdust where such materials are used as mulch, landscaping, animal bedding, wood fuel production, bulking agents or additives at a permitted composting facility, or other directly comparable uses
    - Rubbish (C&D Debris) that is legitimately used, reused, recycled or reclaimed
    - Mississippi Waste Tire Management Regulations as they pertain to the beneficial use of waste tires or waste tire derived materials
    - Uses in which a by-product is utilized as a contained and/or encapsulated additive in the manufacture of a product
    - Other uses which have been sufficiently demonstrated and subsequently approved by the Department for a Standing Use Determination.

Case by case requests must be submitted to the MDEQ for the following

- Category II are uses in which the by-product is utilized in engineered construction or other civil engineering uses
- Category III are uses in which the by-product is utilized as a soil amendment, soil amendment additive, or direct application to the land
- Category IV uses are all other miscellaneous uses

Materials approved on a case-by-case basis in 2011:

- Coal ash for construction
- Lime mud as a soil amendment
- Wood ash as a soil amendment
- Bark and hogged fuel combination ash as a soil amendment
- Dewatered fiber as a soil amendment
- Iron oxide as a soil amendment

Requests for BUDs must provide

- **Category II** uses
    - By-product characterization
        - Totals and TCLP or other leaching test (if applicable)
        - Additional analysis data compared to standards as determined by MDEQ
        - An alternate demonstration to MDEQ to suitability of by-product
    - Certification of a professional engineer to suitability of by-product to proposed construction or civil engineering use
    - Written best management practices, as applicable determined by MDEQ
- **Category III** uses
    - By-product characterization
        - All category II requirements

        - Analysis showing the pollutant concentrations not exceeding the secondary soil amendment constituent standards in Appendix 2
    - Supplier or distributor advising end users of the acceptable agronomic application rate and agronomic practices; written best management practices as applicable determined by MDEQ
    - A proper certification from the Mississippi Department of Agriculture and Commerce (MDAC) for use of material as a soil amendment, where applicable
- **Category IV** uses
    - Part of all of the Category II and III requirements as determined by MDEQ

Target comparison levels (from Appendix 1 in Regulations for the Beneficial Use of Nonhazardous Solid Waste)

- Total metals are compared to Total Metals Thresholds in Table A; if exceeded
- TCLP analysis should be conducted and compared to Table B values (10% of RCRA TCLP hazardous waste limits)

Other considerations:

- If TCLP Table B limits are exceeded a risk assessment can be conducted
    - Modeling can be used
- No one proposing a beneficial use has conducted a risk assessment
- Most of materials proposed for a BUD are common wastes with common, acceptable uses
    - Fly ash in concrete
    - Wood ash as a soil amendment
    - Paper mill lime mud as a soil amendment
- Demonstration projects with monitoring can be conducted
- Odd requests are typically generators seeking a method of disposal
    - Typically cannot show that they are actually replacing a material and filling a need
- US EPA 503 biosolids rules are used for material characteristic comparison when a waste is proposed as a soil amendment (included as Appendix 2 in Regulations for the Beneficial Use of Nonhazardous Solid Waste)
- One BUD may cover multiple by-products

If a road/highway use is proposed MDEQ will work with DOT to ensure material quality.

Out of state wastes are accepted for BUD

- Other state regulatory agencies are sometimes contacted
- Mainly only the material generators are dealt with

A request form for a Beneficial Use determination is available online through MDEQ.

Annual reporting should include

- Approximate quantities of by-product used and/or distributed annually

- Physical and chemical characterization or a signed certificate from generator or other party approved by MDEQ stating that the characterization has not been altered from the information in the approved application.
- Any other information specified as a reporting condition of the BUD
- Renewed or original product certification from MDAC, where applicable (submitted within 21 days of issuance).

The annual 2011 Mississippi solid waste report published data regarding beneficial use of solid waste

- 42 total BUDs were approved
- According to annual reports (only apply to categories II, III, and IV) data were reported (32 reporting BUD holders)
- From 2010 the tonnage of beneficially used material was down (based on annual reports)
    - In 2011 1,039,231 tons of material were utilized
    - In 2010 1,278,693 tons of material were utilized
- Construction related uses dominated overall tonnage used, 971,777 tons (93.51%) vs. 67,454 tons (6.49%) for soil amendment application material

## Missouri BU Profile

Missouri Department of Natural Resources exempts materials from solid waste via 10 CSR 80-2

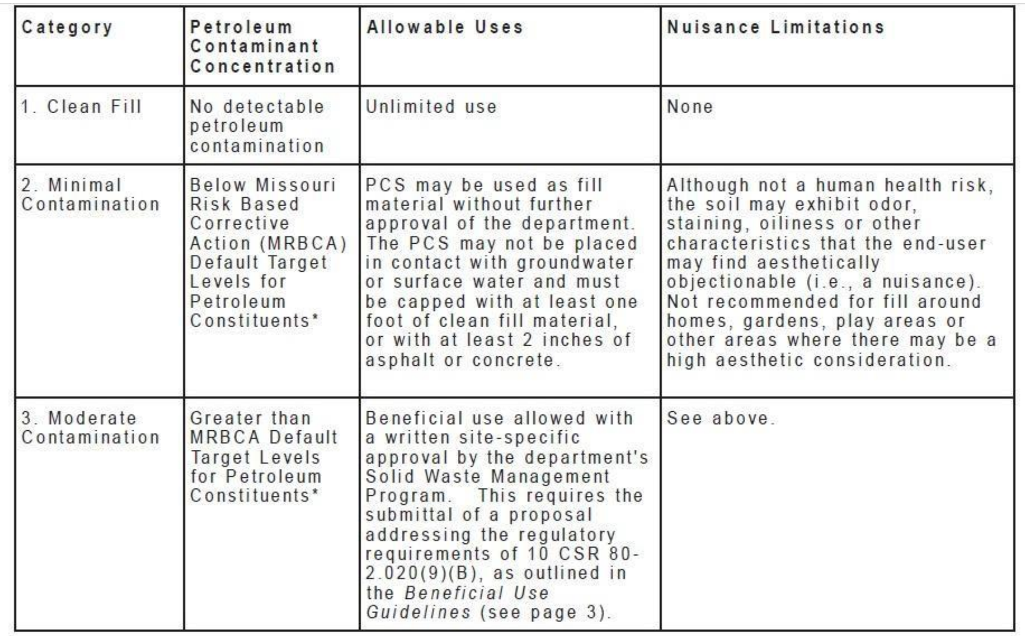
- The term Solid waste does not include hazardous waste as defined in sections 260.360 to 260.434, recovered screen materials, overburden, rock, tailings, matte, slag or other waste material resulting from mining, milling, or smelting.
- The following types of activities are not required to obtain a permit provided that pollution, a public nuisance or a health hazard is not created (80-2.02(9)(A))
    - Any area receiving only uncontaminated soil, rock, sand, gravel, concrete, asphaltic concrete, cinderblocks, and bricks for fill or reclamation
    - The use of solid waste in normal farming operations
    - The use of solid waste in the processing or manufacturing of products
    - the composting or co-composting of yard waste, wood waste, paper waste, and/or poultry waste as long as such activity has a permit or approval from the Missouri Clean Water Commission.
    - The beneficial use of bottom ash or boiler slag generated primarily from the combustion of coal or other fossil fuels for snow and ice control
- The department may grant an exemption from having to obtain a solid waste disposal area permit for a proposal to beneficially reuse solid waste on a case by case basis, provided that beneficial use and/or reclamation can be demonstrated and provided that pollution, a public nuisance, or a health hazard will not be created.
    - In the event a person desires to request an exemption from the requirement to obtain a permit, that person shall submit a detailed, written request to the department which includes the following:
        - Detailed explanation of the beneficial use of the material, site location, surrounding land use, and site characteristics
        - An estimate of the quantity of waste needed to complete the project, the length of time required for completing the project and documentation specifying the source of the waste
        - Background soils and water quality characteristics immediately within and/or adjacent to the project area
        - Laboratory tests including, at a minimum, TCLP testing analyses or modified TCLP testing analyses
        - Verification that the placement of the waste will be kept above the seasonal high groundwater table
- The department may grant exemptions for small scale pilot or demonstration beneficial use projects
- The department may also grant a general exemption for the beneficial use of
    - Composting or co-composting of solid waste not specifically addressed in 10 CSR 80-2.020(9)(A)9. (e.g., food waste) provided that beneficial use of the compost can be

demonstrated and provided that the composting and beneficial use activities will not create pollution, a public nuisance or health hazard

    - The processing of construction and demolition waste provided that such activities will not create pollution
    - The beneficial use of type C fly ash and associated bottom ash and boiler slag generated primarily from the combustion of coal or other fossil fuels for beneficial use as road base or structural fill
        - The beneficial use of type C fly ash and bottom ash or boiler slag for road base will be allowed if the total mixture of soil and ash beneath the road will not exceed two feet (2')
        - The beneficial use of type C fly ash and bottom ash or boiler slag for structural fill will be allowed provided the area to be disturbed is less than five (5) acres in size and the maximum depth of ash will not exceed two feet (2')
    - The department may grant a general exemption for the beneficial use of type C fly ash generated primarily from the combustion of coal or other fossil fuels for beneficial use as soil amendment or for soil stabilization
        - The beneficial use of type C fly ash for soil amendment will be allowed if the total mixture of soil and ash used will not exceed six inches (6")
        - The beneficial use of type C fly ash for soil stabilization will be allowed provided the area disturbed is less than five (5) acres in size and the maximum depth of ash will not exceed two feet (2')
    - The department may grant an exemption for the beneficial use of type C fly ash and associated bottom ash and boiler slag in amounts greater than those specified above as long as the beneficial use activity has a permit or exemption from the Missouri Clean Water Commission.
    - The department may grant a general exemption for the beneficial use of bottom ash or boiler slag for daily cover at a landfill

Beneficial Use of Petroleum Contaminated Soil

- Guidelines published in 2006 as a Solid Waste and Hazardous Waste Program Technical Bulletin
- Authorizes the beneficial use of petroleum contaminated soil (PCS) as fill material under several conditions:
    - Contaminated soils determined to be a listed or characteristic hazardous waste are excluded from this beneficial use authorizations
    - Material will not result in pollution, public nuisance, or a health hazard
- Conditions are based on the Missouri Solid Waste Management Act, Missouri Clean Water Law, and the Missouri Hazardous Waste Law
- PCS includes only soil affected by virgin petroleum products for this authorization
    - Not soil contaminated with used oil



| Category | Petroleum Contaminant Concentration | Allowable Uses | Nuisance Limitations |
|---|---|---|---|
| 1. Clean Fill | No detectable petroleum contamination | Unlimited use | None |
| 2. Minimal Contamination | Below Missouri Risk Based Corrective Action (MRBCA) Default Target Levels for Petroleum Constituents* | PCS may be used as fill material without further approval of the department. The PCS may not be placed in contact with groundwater or surface water and must be capped with at least one foot of clean fill material, or with at least 2 inches of asphalt or concrete. | Although not a human health risk, the soil may exhibit odor, staining, oiliness or other characteristics that the end-user may find aesthetically objectionable (i.e., a nuisance). Not recommended for fill around homes, gardens, play areas or other areas where there may be a high aesthetic consideration. |
| 3. Moderate Contamination | Greater than MRBCA Default Target Levels for Petroleum Constituents* | Beneficial use allowed with a written site-specific approval by the department's Solid Waste Management Program. This requires the submittal of a proposal addressing the regulatory requirements of 10 CSR 80-2.020(9)(B), as outlined in the *Beneficial Use Guidelines* (see page 3). | See above. |

# Montana BU Profile

Montana Department of Environmental Quality (MDEQ) regulates the beneficial use of solid waste.

Rules of Montana (ARM) Environmental Quality, Solid Waste, Refuse Disposal 17.50.502

- "Waste" means useless, unwanted, or discarded materials in any physical form, i.e., solid, semi-solid, liquid, or gaseous. The term is not intended to apply to by-products or materials which have economic value and may be used by the person producing the material or sold to another person for resource recovery or use in a beneficial manner.

MDEQ Guide to Beneficial Use Determinations of Waste Industrial and Manufacturing Byproducts (2010).

- The guidelines apply to non-hazardous industrial waste and manufacturing by-products
- “Beneficial Use Determination” (BUD) is a determination that an industrial waste or manufacturing by-product, otherwise destined for disposal, will be used in a specific <u>and</u> beneficial manner
- “By-product” is defined as materials produced during the manufacture of some other product
- Does not apply to:
    - Land application of wastewater treatment wastes
    - Metallic and mining wastes
    - Listed or characteristic hazardous wastes
- Standing approvals
    - Coal combustion residue
    - Lime kiln dust
    - Even with standing approvals, an application must still be filed, which acts as a registration
- Material must be used in the form it is generated (no processing)
    - Processing is considered handling of a solid waste and a solid waste management or resource recovery license must then be obtained
- While the material remains classified as a “solid waste” it may be used in the specific manner proposed prior to the issuance of a BUD
- Applicants must include the following
    - A description of the material and its use
    - Description of benefits realized by the use
        - Landfill space saved
        - Resources saved
        - Costs saved
        - Energy saved
    - Description of management procedures
    - Chemical and physical characteristics of byproduct
    - Chemical and physical characteristics of end product
    - Demonstration of market sustainability
        - By-product

        - End product
    - A demonstration that the by-product complies with industry standards and specifications for the analogous virgin material or commercial ingredient
    - A demonstration that the management of the by-product will not adversely affect human health and safety, the environment, or natural resources by providing a materials control plan
    - A contingency plan including all relevant emergency management procedures, availability of emergency services, evacuation plan, and emergency coordinator information
- Annual reporting is required
    - Volume/tonnage of material used
    - Specific use of by-product material
    - Use locations
    - Testing results (as applicable)
        - Re-characterization is necessary when a change in the process that produces the material occurs which could influence the material characteristics
        - MDEQ must be consulted to determine analytical requirements
    - Disposition of solid waste resulting from the approved end use
- MDEQ considers the following when reviewing/evaluating a BUD application
    - Site location
    - Set back from water resources
    - Depth to groundwater
    - Environmental benefits
    - Risk assessments
    - Conditions may be placed on approval
        - Volume restrictions
- BUD may be revoked by MDEQ for the following reasons:
    - Initial application details were incorrect or no longer valid
    - Violations of conditions of approval
    - A public nuisance has resulted
- A decision will be made in 90 days
- Analytical requirements are case specific but can include
    - TCLP
    - SPLP
    - Neutral water leaching procedure (ASTM Method D3987-06)
    - Physical properties
- Values which analytical results are compared to (target contaminant levels) vary on case by case basis
    - Selected as appropriate to the waste and use
- An application form is available as Appendix A of the Guidance Document; it may be completed by one of the following:

  - Waste generator
  - Broker
  - End User
  - Other
- No fee is required

Montana has a total of 8 active BUDs.

## Nebraska BU Profile

The mechanism of obtaining approval to beneficially use a waste material in Nebraska is not explicitly defined in the regulations, but the Nebraska Department of Environmental Quality (NDEQ) may examine the definitions in Title 132 Integrated Waste Management Chapter 1 to assess whether the waste or activity proposed is subject to the solid waste permitting rules. Guidance has also been developed for certain waste materials.

- NDEQ does not have a mechanism to track or follow non-permitted activities in the state.
- NDEQ's risk evaluation for beneficial use determinations consists of totals analysis and leaching tests
    - Leaching tests are decided upon case by case but may include ASTM D3986-85 Water Leach Test or TCLP
    - Analytical results are compared to the Surface Water Quality Standards (Title 117) and Groundwater Quality Standards (Title 118)
    - Analytical results are also compared to the US EPA Region 9 Preliminary Remediation Goals
    - The specific compounds that are analyzed for are determined on a case by case basis
        - May include VOCs, semi-volatiles, pesticides, PCBs, petroleum hydrocarbons or any others as specified by the department
- C&D Debris material has been allowed for beneficial use as fill material

NDEQ Environmental Guidance Document—Beneficial Use of Coal Combustion Byproducts, Steel Manufacturing Byproducts, and Other Similar Materials

- Chapter 2, section 002 of Title 132 identifies exceptions to waste being disposed of at a permitted solid waste management facility
    - Materials are not mixed with other solid wastes
    - Materials do not have the potential to cause contamination that may threaten human health and the environment
    - Exceptions include use of fill for the purposes of erosion control, erosion repair, channel stabilization, landscaping, roadbed preparation, and other land improvement.
- Based upon the determination of NDEQ that there is no apparent threat to human health or the environment from the use of these materials, this guidance outlines the use of coal combustion and steel manufacturing byproducts and other similar materials
- Coal combustion byproducts—activities not regulated under Title 132 and not requiring a permit or prior approval from NDEQ are as follows:
    - Construction or manufacture of products
    - Hazardous waste stabilization
    - Ice control
    - Stabilizing agents and soil modification
    - Aggregate for roads
    - Structural fill

    - Controlled density slurry fill
    - Soil amendment
    - Feedlot applications
    - Activities must meet the exemption requirements of Title 128 Hazardous Waste Regulations
- Steel manufacturing byproducts—uses of byproducts such as slag, spent refractory, and scale are not regulated under Title 132 and do not require prior approval from NDEQ are as follows:
    - Construction or manufacture of products
    - Stabilizing agents and soil modification
    - Aggregate for roads
    - Anti-skid (snow and ice) control
    - Railroad ballast
    - Activities must meet the exemption requirements of Title 128 Hazardous Waste Regulations

Evaluation process for other uses and other similar materials

- It is decided on a case by case basis by the department, and criteria evaluated includes those listed above for case by case determinations

Nebraska has 25 active BUDs, as reported in the NEWMOA database as of 2011.

# Nevada BU Profile

Information regarding beneficial use in Nevada is fairly limited. There are no sections in applicable Nevada regulations that directly address beneficial use, nor are there relevant definitions or discussions in regulatory applicability sections that indirectly address beneficial use. The Nevada Department of Environmental Protection (NDEP) supports biosolids reuse as a beneficial soil amendment and as a means of reducing material with high liquid content out of the state's landfills.

- Digested biosolids meeting Class B levels are suitable for forage crop (animal feed) production at publicly restricted land application sites.
- Nitrogen application is limited to the crop's agronomic requirement to avoid leaching.
- Public distribution of Class A biosolids may require additional testing of *Salmonella* bacteria, helminthes ova (parasitic worms) or enteric (intestinal) viruses.
- Regulated by the Bureau of Water Pollution Control
- Land application target levels that have to be met are consistent with federal Part 503 rules. Nevada has no additional regulations (NEBRA, 2007)

Limited information regarding current and recent beneficial use related activities was available. The state did not respond to the ASTSWMO survey in 2006, but did respond to the 2000 survey. Relevant information based on responses provided in the 200 survey include the following:

- A formal or informal beneficial use program was implemented in approximately 1999.
- Staff resources and lack of regulatory to implement a beneficial use program were identified as the biggest barriers to development and management of a beneficial use program.
- A total of 1 beneficial use request (for C&D debris) was received but the request was denied.
- The state required total metal and total organics analysis as part of material characterization.
- The state examines whether a material has a market and whether the proposed use is actually beneficial and a use constituting disposal.

## New Hampshire BU Profile

The New Hampshire Department of Environmental Services (NHDES) regulates beneficial use of solid waste through the New Hampshire Code of Administrative Rules Env-Sw 100, 1500, 1700, and, to a lesser extent, Env-Sw 900.

- Env-Sw 104.61, "Waste-derived product" means a material or item which is produced, in whole or in part, using materials or items which are recovered or diverted from the solid waste stream
- Actively managed waste-derived products which are certified for distribution and use pursuant to Env-Sw 1500 are excluded from the definition of "solid waste" in Env-Sw 104.36

Env-Sw 1500, Certification of Waste-derived products

- Certified waste-derived products are exempt from solid waste rules and not considered a solid waste
- Waste-derived products may become certified by either a standing certification by rule or on a case specific basis for additional materials and uses.
- General provisions for obtaining certification
    - Must not contain
        - Hazardous waste
        - Hazardous air pollutants (including asbestos)
        - Wastes identified in Env-Sw 900 as non-reusable
        - Any wastes requiring treatment and disposal to protect human health and the environment
    - Distributors and users of certified waste-derived products shall manage them in accordance with Env-Sw 1002 (Universal Environmental Performance Standards)
    - Waste-derived products not certified by rule can become certified by filing an application pursuant to Env-Sw 1505 for a project which meets criteria in Env-Sw 1504
- Waste-Derived Products Certified By Rule (Env-Sw 1503.04-.17)
    - Salvaged Materials and Items
        - Scrap materials repurposed for the same, original use (i.e., used brick as brick)
    - Cloned Products
        - Products made from the same materials which have been discarded (i.e., glass products made from discarded glass products)
    - Products from Select Processed Recyclables
        - Substituting a processed select recyclable for a raw material comparable in form and function but not necessarily material composition; not used to fill land or water bodies, or to amend or mix with soils, unless the product is certified by 1503.07 (i.e., synthetic fabrics made from used plastic soda bottles)
    - Products Meeting Published State or National Standards
        - Standard shall be published by an agency with no financial stake in the product (i.e., ASTM, Department of Transportation) or pose no greater risk that a

        - comparable non-waste-derived product (i.e., Coal fly ash as lightweight aggregate per ASTM C-331-03)
    - Waste Paper for Bulking
        - Shredded waste paper and cardboard as a bulking agent for composting and landfilling (including sludge and septage based composting and landfilling)
    - Derivatives of Discarded Wood
        - Chips, shavings, and sawdust from virgin wood from pallets or crates for fuel, mulch, animal bedding, and a bulking agent for composting or landfill (including sledge and septage composting and landfilling with ≥80% of material ≤3/4 inch in size)
    - Waste-derived Compost
        - Class dependent (i.e., class AA can be used without restriction)
    - Soils Decontaminated by Treatment Processes
        - Treated at an authorized facility to meet Env-Sw 903 standards excluding specific uses (i.e., in residential uses, within the 100-yr flood plain or wetland)
    - Wood Ash as a Bulking Agent or Odor Control Agent
        - Ash must be certified by Env-Sw 1700
    - Manufactured Topsoil
        - Manufactured using wood ash (certified by Env-Sw 1700) and other ingredients limited to sludge (in compliance with Env-Ws 800), yard waste, or uncontaminated soil (not including decontaminated soil pursuant to Env-Sw 1503.11)
    - Coal Ash
        - Boiler slag from coal combustion used as a raw material for industrial and commercial purposes
    - Methane Fuel
        - Derived from waste decomposition at an authorized facility, provided it meets market fuel standards
    - Energy
        - Derived from combustion of solid waste at authorized facilities for use as power
    - Cement Kiln Dust
        - Used as an odor control agent for sludge and septage, as provided in Env-Ws 800 and 1600
- Certification Criteria for Waste Derived Products not certified by rule (case by case certification) require (Env-Sw 1504):
    - Demonstration of need for the proposed material/product.
    - Description of product quality and quality control
    - Must demonstrate a minimal net impact on society
        - State personnel stated that typically a specific risk profile assessment is conducted, risk for proposed material is compared to the material it is replacing
- Application Requirements
    - Applicant Identification

  - Waste-derived Product Identification and General Description
    - Characterization of the product, including through analytical means for constituents reasonably thought to be present in the waste, which are known or suspected by way of published scientific documentation to pose a potential risk to human health or the environment
    - NHDES may request waste-derived product samples to either enhance NHDES's understanding of the appearance and characteristics of the waste, of to verify the applicant's analytical test results
  - Manufacturer Identification
    - Whether the waste-derived product is proprietary and applicable proprietors or manufacturers
  - Describe the production process
    - Identification and characterization of the waste used to produce the waste-derived product (analogous to waste-derived product identification and general description)
  - Provide information on how the product will be distributed and demonstrate the existence of a market for the product
- NHDES may or may not provide forms for applications
- NHDES will determine application completeness within 60 days after submittal
- NHDES maintains records of all certified waste derived products
  - Grandfathered wastes certified prior to October 29, 1997 shall remain certified
- NHDES reserves the right to revoke or suspend certifications
  - Prior to revocation or suspension, an adjunctive hearing shall be held

Typically after a waste is certified for a waste-derived product, limited follow-up and tracking is conducted by NHDES

Env-Sw 1700, Requirements for Land Application of Wood Ash

- General provisions for obtaining certification
  - Must file application with NHDES
  - Meet land application criteria (Env-Sw 1703)
    - Only ash from combustion of clean wood shall be land applied
    - Wood shall not contain
      - Paints
      - Stains
      - Preservatives
      - Other materials not naturally occurring in wood
    - Wood ash shall not contain heavy metals in excess of the following concentrations (determined on a dry weight basis):

| Metal | Concentration (mg/kg dry) |
|---|---|
| Arsenic | 41 |
| Cadmium | 39 |
| Chromium | 1,200 |
| Copper | 1,500 |
| Lead | 300 |
| Mercury | 17 |
| Molybdenum | 75 |
| Nickel | 420 |
| Selenium | 100 |
| Zinc | 2,800 |

        - Ash must be free of uncombusted material
    - Continually monitor quality of the ash, unless certified on a one-time basis
    - Application sites must meet the permit requirements of Env-Sw 1704
- No application fee
- Testing and reporting requirements
    - Quarterly testing of monthly composite samples
        - Totals data required for 20 constituents
    - Annual report shall be filed with NHDES
        - Identification and records of all land application sites
        - Tonnages of wood ash received by each land application site
        - Cumulative loading calculations for metals for each land application site

Scrap tire management is governed by regulation in Env-Sw 900, and an environmental fact sheet (WMD-SW-22) was published (2011):

- Collection, Storage, and Transfer
    - Standards in Env-Sw 905 must be met
    - Solid waste permit is not required for
        - Collection, storage, and transfer of source separated tires which may be legally re-used as tires
    - Otherwise solid waste permit is required
- Processing and/or Treatment
    - Must minimize noise, odor, and fugitive dust emissions
    - Permits required for most processing facilities
    - Incineration must follow additional requirements in Env-Sw 700 (open burning is prohibited)
    - All waste derived products must be certified via rules in Env Sw-1500 (either by rule or through case by case application)
- Scrap Tire-Derived Products and Uses Certified-by-rule
    - ASTM D 6270-98 Standard Practices for Use of Scrap Tires in Civil Engineering Applications

    - Scrap tires must serve a legitimate use, i.e., use as general fill is not allowed

A total of 23 case by case certifications have been issued; the greatest number of which apply to use as alternative daily cover material. Examples of case by case approved certifications include:

- Clean, shucked clam or mollusk shells for driveway wearing course
- Crushed glass for construction aggregate
- Dewatered coffee grounds used as a soil amendment
- Spent brewery diatomaceous earth used as a silt substitute for incorporation into topsoil
- Coal ash used in flowable fill material
- Metal shredder residue used as alternative daily cover for Subtitle D lined landfills
- Processed vegetable oil used as a fuel substitute for Number 6 diesel fuel or feedstock to manufacture biodiesel

## New Jersey BU Profile

Beneficial use in New Jersey is regulated via the New Jersey Administrative Code 7:26-1. Solid Waste General Provisions

- 7:26-1.1—The use or reuse of material, which would otherwise become solid waste under this chapter, directly as a product or incorporated into any form of raw material to be used in the manufacturing of a product shall meet the generally accepted product specifications and standards for similar manufactured products or raw materials. The used or reused material shall not present a greater risk to human health or the environment than the use of the product or raw material it is replacing.
- "Beneficial use" means the use or reuse of a material, which would otherwise become solid waste under this chapter, as landfill cover, aggregate substitute, fuel substitute or fill material or the use or reuse in a manufacturing process to make a product or as an effective substitute for a commercial product. Beneficial use of a material shall not constitute recycling or disposal of that material.
- The term "solid waste" shall not include the following:
  - Source separated food waste collected by livestock producers
  - Recyclable materials that are exempted from regulation pursuant to N.J.A.C. 7:26A
  - Materials approved for beneficial use or categorically approved for beneficial use pursuant to N.J.A.C. 7:26-1.7(g)
  - Spent sulfuric acid which is used to produce virgin sulfuric acid, provided at least 75 percent of the amount accumulated in recycled in one year
  - Dredged material, from New Jersey's coastal or tidal waters, which is regulated under the provisions listed in 7:26-1.6(a)(5)
  - Other waste material including, but not limited to spent material, sludge, by-product, discarded commercial chemical products, or scrap metal resulting from industrial, commercial, mining or agricultural operations, from community activities, or any other material which has served or can no longer serve its original intended use, which:
    - Is discarded or intended to be discarded
    - Is accumulated, stored, or treated prior to or in lieu of being discarded
    - Is burned for energy recovery
    - Is applied to the land of placed on the land in a manner constituting disposal
    - Is recycled

7:26-1.7(g) Exemption from Solid Waste Facility (SWF) Permitting, Specific Criteria for Exempting Beneficial Use Projects

- Certificate of Authority to Operate (CAO) for a beneficial use project shall be issued by the NJ DEP. The project shall be developed and operated in accordance with the specific conditions of the certificate of authority to operate
- Not applicable to materials used or reused directly as a product or as a substitute for raw material which is incorporated into a product that meets the original product specifications,

provided the material poses no greater risk to human health or the environment than the use of the product or raw material it is replacing.

- The following materials are categorically approved for beneficial use and require no future approval or authorization for use or reuse provided they are used or reused in a manner consistent with N.J.A.C. 7:26-1.1

Table. Materials Categorically Approved for Beneficial Use and Require No Approval Or Authorization for Use or Reuse

| **Material** | **Use** |
|---|---|
| Uncontaminated glass | substitute for conventional aggregate in asphalt or concrete applications |
| Tire chips/whole tires | aggregate for road base materials or asphalt pavements in accordance with New Jersey Department of Transportation standard specifications, or whole tires or tire chips when used for energy recovery |
| Soil | on-site reuse that contain contaminants at levels below the most stringent site clean-up levels established by the Department for a specific site, except for sites located in the Pinelands Area Contaminated soil that has been decontaminated to the satisfaction of the Department and is used or reused in a manner acceptable to the Department |
| Nonhazardous solid waste, paper mill fiber, or paper fiber combustion ash | cover material, landfill liner, cap material, or other landfill design and management components |
| Coal combustion bottom ash or paper fiber combustion ash | ash used or reused as a component in the manufacture of roofing shingles or bituminous asphalt products |
| Coal combustion fly ash, gas scrubbing by-products, or paper fiber combustion ash | used or reused as an ingredient to produce light-weight block, light-weight aggregate, manufactured gypsum or manufactured calcium chloride<br>used or reused as a cement or aggregate substitute in structural concrete, structural concrete products, or a raw feedstock in the manufacture of cement or as a cement substitute for structural grade products, or subbase in roadway construction<br>used or reused to serve as an aggregate substitute in structural asphalt product |

- Wastes not categorically approved shall submit an application for a case by case beneficial use determination
- The generator and/or owner who originally produced the material under consideration for use in a beneficial use project in the State of New Jersey shall submit an application to and receive a certificate of authority from the Department prior to any sale, distribution, shipment of the material to any person or implementation of the beneficial use project.
    - The application shall include the requirements listed in 7:26-1.7(g)(5)(i)

    - An evaluation of the general quality of the material including a contaminant profile of the material in relation to current Department soil cleanup criteria (SCC) guidance levels and other standards as specified by the Department on a case-by-case basis
- The department shall issue or deny a certificate of authority to operate for a beneficial use project in writing within 90 days or receipt of a complete application

Land application is regulated via 7:26-1.8 Exemption from registration—Land Application and Sewage Sludge Operations

NJ DEP has issued more than 290 CAOs for BUDs. New Jersey has 128 active BUDs as reported in the NEWMOA database as of 2011.

## New Mexico BU Profile

The New Mexico Environment Department (NMED) regulates beneficial use through solid waste or recycler facility permits; exemptions to the definition of solid waste can allow for beneficial use of other materials. New Mexico Administrative Code (NMAC) Title 20 (EnvironmentalProtection) Chapter 9 (Solid Waste) contains the state's solid waste regulations; the state's Solid Waste Act can be found in the New Mexico Statutory Authority (NMSA) 74-9. NMAC 20.9.2.7 contains the following definition of solid waste:

- "Solid waste" means any garbage, refuse, sludge from a waste treatment plant, water supply treatment plant, or air pollution control facility and other discarded material including solid, liquid, semisolid, or contained gaseous material resulting from industrial, commercial, mining, construction, demolition and agricultural operations and from community activities, but does not include (only those which could be relevant to beneficial use are listed):
    - Drilling fluids, produced waters and other non-domestic wastes associated with the exploration, development or production, transportation, storage, treatment or refinement of crude oil, natural gas, carbon dioxide gas or geothermal energy, except for waste that has been authorized for disposal at a solid waste facility under provisions of 19.15.9.712 NMAC and has been delivered to a solid waste facility permitted to receive such waste
    - Fly ash waste, bottom ash waste, slag waste and flue gas emission control waste generated primarily from the combustion of coal or other fossil fuels and wastes produced in conjunction with the combustion of fossil fuels that are necessarily associated with the production of energy and that traditionally have been and actually are mixed with and are disposed of or treated at the same time with fly ash, bottom ash, boiler slag or flue gas emission control wastes from coal combustion
    - Waste from the extraction, beneficiation and processing of ores and minerals, including phosphate rock and overburden from the mining of uranium ore, coal, copper, molybdenum and other ores and minerals
    - Agricultural waste, including, but not limited to, manures and crop residues converted to beneficial value added products such as energy products or building materials or retuned to the soil as fertilizer or soil conditioner
    - Cement kiln dust
    - Sand and gravel
    - Solid or dissolved material in domestic sewage, or solid or dissolved materials in irrigation return flows or industrial discharges that are point sources subject to permits under Section 402 of the federal Water Pollution Control Act, 33 U.S.C. Section 1342
    - Densified refuse-derived fuel
    - Any material regulated by Subtitle C or Subtitle I of RCRA (except petroleum contaminated soils)
    - Substances other than asbestos regulated by the federal Toxic Substances Control Act, 15 U.S.C. Sections 2601, et seq., as amended

    - Whole or processed scrap tires that are stored or used in compliance with provisions of the New Mexico Tire Recycling rule, 20.9.20 NMAC, and applicable law
    - Any recyclable material in transit or temporary storage
    - Compost

Beneficial use approval or tracking is limited to permitted facilities required to submit annual reports, i.e., landfills, recyclers. Beneficially-used material, i.e., material used as daily cover, is counted towards waste diversion, though not recycling. Some examples of beneficial uses conducted and reported as part of permit requirements includes:

- Crushed glass used as alternative daily cover
- Petroleum contaminated soil used as top soil after analytical testing which shows total petroleum hydrocarbons, BTEX contaminates have been remediated to a certain extent

Guidance Document for Determining Acceptable Beneficial Agricultural Use of Scrap Tires (2011):

- Relevant Statutes and Rules
    - Recycling and Illegal Dumping Act (RAIDA) NMSA 74-13-1 to 74-13-20
    - Recycling, Illegal Dumping and Scrap Tire Management Rule (RIDSTMR) 20.9.20 NMAC
    - Solid Waste Act (SWA) NMSA 74-9-1 to 74-9-42
- "Agricultural" means all methods of production and management of livestock, crops, vegetation and soil. This includes, but is not limited to, raising, harvesting and marketing. It also includes, but is not limited to, the activities of feeding, housing and maintaining animals such as cattle, dairy cows, sheep, goats, hogs, horses and poultry.
- NMAC states that any person claiming to be exempt from RAIDA permitting requirements "must show, upon request, that the scrap tires are being put to a beneficial agricultural use"
- Problematic tire use has occurred in the past
    - As a result of placement within or adjacent to a waterway, wetland, or eroded channel, for the purpose of erosion prevention
    - Migration of scrap tires to neighboring properties
    - Presentation of a substantial risk of fire or disease vector harborage, creating a public nuisance
    - Resulting in large stockpiles of scrap tires upon the ground
- Unpermitted use of scrap tires for erosion control and land reclamation is not appropriate and provisions were enacted to limit scrap tire use in potentially nuisance inducing manners

Solid Waste Management Annual Report forms as well as form instructions are available online through the NMED Solid Waste Bureau. Instructions relevant to beneficial use for the form include:

- Recyclable Materials
    - "The owner/operator of any facility that collects, recycles, processes or beneficially uses any materials listed on this form must complete the pertinent portions on the form."
    - Managed On-Site

        - Beneficially Used (On-Site): Material that was removed from the incoming waste stream or collected that could be beneficially used or reused on-site must be reported in this column. (Examples: If the Facility provides a material exchange area where household items are made available for use or re-use, such as paints, clothing, furniture, etc.; Glass is crushed during the reporting period and stockpiled or used on-site in landscaping projects.)
- Managed Off-Site
    - Material that was removed from the incoming waste stream or collected and sent off-site to be beneficially used or reused must be reported in this column. (Examples: Electronic equipment collected and sent to electronic refurbishers for repair and resale or reuse.)

## New York BU Profile

New York Department of Environmental Conservation (NYDEC) governs beneficial use of solid waste, and beneficial use determinations are made by the NYDEC.

Pre-approved standing uses are detailed in NYDEC Regulations Chapter IV Part 360-1.15 (b) for specified materials and uses.

### Pre-approved Standing Beneficial Use Designations

| Waste | Use |
|---|---|
| Materials not identified as solid wastes in NYDEC regulations Part 371.1(e)(1)(vi-viii) | Listed in relevant regulation |
| Compost and other waste derived soil | Products satisfying applicable requirements in 360-5 |
| Unadulterated wood, wood chips, or bark from land clearing, logging operations, utility line clearing and maintenance operations, pulp and paper production, and wood products manufacturing | In commerce for service as mulch, landscaping, animal bedding, erosion control, wood fuel production, and bulking agent at a compost facility (operated in compliance with 360-5) |
| Uncontaminated newspaper/newsprint | Animal bedding |
| Uncontaminated glass | Substitute for conventional aggregate in asphalt or subgrade applications |
| Tire chips | As aggregate for road base materials or asphalt pavements in accordance with New York State DOT standard specifications, or whole tires or tire chips when used for energy recovery. |
| Uncontaminated soil excavated as part of a construction project | As a fill material in place of soil native to the site of disposition |
| Nonhazardous, contaminated soil excavated as part of a construction project | As backfill for the same excavation or excavations containing similar contaminates at the same site. |
| Nonhazardous petroleum contaminated soil decontaminated to the satisfaction of NYDEC | In a manner acceptable to the department |
| Solid wastes approved in advance by NYDEC | Daily cover or other landfill liner or final cover system components pursuant to 360-2.13(w) |
| Recognizable, uncontaminated concrete and concrete products, asphalt pavement, brick, glass, soil and rock | In commerce for service as a substitute for conventional aggregate |
| Nonhazardous petroleum contaminated soil | In asphalt pavement products by a producer authorized by the department |

| Waste | Use |
|---|---|
| Unadulterated wood combustion bottom ash, fly ash, or combined ash | As a soil amendment or fertilizer, provided the application rate is limited to the nutrient need of the crop grown on the land which the ash is to be applied (not to exceed 16 dry tons per acre per year) |
| Coal combustion bottom ash | In commerce to serve as a component in the manufacture of roofing shingles or asphalt products, or as a traction agent on roadways, parking lots, and other driving surfaces |
| Coal combustion fly ash or gas scrubbing by-products | In commerce to serve as an ingredient to produce light weight block, light weight aggregate, low strength backfill material, manufactured gypsum, or manufactured calcium chloride |
| Coal combustion fly ash or bottom ash | In commerce to serve as a cement or aggregate substitute in concrete or concrete products, as raw feed in the manufacture of cement, or in commerce to serve as structural fill within building foundations when placed above the seasonal high groundwater table |

Case-by-case determinations are petitioned and approved by the Department and must provide the following unless directed by the department:

- Description of the solid waste under review and its proposed use
- Chemical and physical characteristics of the solid waste under review and of each type of proposed product.
- A demonstration that there is a known or reasonably probable market for the intended use of the solid waste under review and of all proposed products by providing one or more of the following:
    - A contract to purchase the proposed product or to have the solid waste under review used in the manner proposed
    - A description of how the proposed product will be used
    - a demonstration that the proposed product complies with industry standards and specifications for that product
    - Other documentation that a market for the proposed product or use exists

Examples of some waste/use combinations approved on a case-by-case basis for beneficial use include:

- Dried paper mill sludge as animal bedding and poultry litter
- Foundry sand as an aggregate in the production of concrete and as construction fill material
- Tire chips in civil engineering applications such as construction fill
- Non-recyclable waxed cardboard as an alternative fuel

Review and evaluation criteria utilized by NYDEC to make a beneficial use determination:

- The essential nature of the proposed use of the material constitutes a reuse rather than disposal

- The proposal is consistent with the solid waste management policy contained in section 27-0106 of the ECL
- The material under review must be intended to function or serve as an effective substitute for an analogous raw material or fuel. When used as a fuel, the material must meet the requirements of paragraph 360-3.1(c)(4) of this Part and the facility combusting the material must comply with the registration requirements in subdivision 360-3.1(c) of this Part, if appropriate
- For a material which is proposed for incorporation into a manufacturing process, the material must not be required to be decontaminated or otherwise specially handled or processed before such incorporation, in order to minimize loss of material or to provide adequate protection, as needed, of public health, safety or welfare, the environment or natural resources
- Whether a market is existing or is reasonably certain to be developed for the proposed use of the material under review or the product into which the solid waste under review is proposed to be incorporated
- Other criteria as the department shall determine in its discretion to be appropriate.

Analytical data is evaluated based on the material and the proposed use, for example, the NYDEC has utilized sediment criteria to evaluate dredged material proposed to create a wetland; New York soil cleanup objectives (SCO) or other standards for comparison have also been used.

Based on the data listed in the NEWMOA database (2011), there are 703 active BUDs in the state.

# North Carolina BU Profile

North Carolina Division of Waste Management regulates the beneficial use of waste materials through the North Carolina Administrative Code (NCAC).

15A NCAC 13B Section .0562 Beneficial Fill

- A permit is not required for beneficial fill activity that meets all of the following conditions:
    - The fill material consists only of inert debris strictly limited to concrete, brick, concrete block, uncontaminated soil, rock, and gravel.
    - The fill activity involves no excavation.
    - The purpose of the fill activity is to improve land use potential or other approved beneficial reuses.
    - The fill activity is not exempt from, and must comply with, all other applicable Federal, State, and Local laws, ordinances, rules, and regulations, including but not limited to zoning restrictions, flood plain restrictions, wetland restrictions, mining regulations, sedimentation and erosion control regulations. Fill activity shall not contravene groundwater standards.

The ASTSWMO (2007) survey indicates several materials have been approved for land application-related beneficial use, including wood ash, flue gas desulfurization sludge, and gypsum drywall. Additional, relevant information from the ASTSWMO survey includes:

- The state has guidance/policy related to the beneficial use of wood ash
- Approximately 1 to 10 beneficial use requests are received annually, and mostly consist of coal ash-related uses

The North Carolina General Statutes also list exclusions from management as a solid waste in § 130A-309.05. Regulated wastes; certain exclusions.

> (c) Recovered material is not subject to regulation as solid waste under this Article. In order for a material that would otherwise be regulated as solid waste to qualify as a recovered material, the Department may require any person who owns or has control over the material to demonstrate that the material meets the requirements of this subsection. In order to protect public health and the environment, the Commission may adopt rules to implement this subsection. In order to qualify as a recovered material:
>
> (1) A majority of the recovered material at a facility shall be sold, used, or reused within one year;
>
> (2) The recovered material or the products or by-products of operations that process recovered material shall not be discharged, deposited, injected, dumped, spilled, leaked, or placed into or upon any land or water so that the products or by-products or any constituent thereof may enter

other lands or be emitted into the air or discharged into any waters including groundwaters, or otherwise enter the environment or pose a threat to public health and safety; and

(3) The recovered material shall not be a hazardous waste or have been recovered from a hazardous waste. (1989, c. 784, s. 2; 1995 (Reg. Sess., 1996), c. 594, s. 9.)

The North Carolina Division of waste management refers to this statutory exclusion in some specific cases regarding beneficial use (e.g., the best practices guide for recycling tear-off asphalt shingles).

15A NCAC 13B Section .1700 provides the Requirements for Beneficial Use of Coal Combustion Byproducts

- "Beneficial and beneficial use" means projects promoting public health and environmental protection, offering equivalent success relative to other alternatives, and preserving natural resources.
- "Coal combustion by-products" means residuals, including fly ash, bottom ash, boiler slag and flue gas desulfurization residue produced by coal fired electrical or steam generation units.
- "Structural fill" means an engineered fill with a projected beneficial end use constructed using coal combustion by-products properly placed and compacted.
- "Use or reuse of coal combustion by-products" means the procedure whereby coal combustion by-products are directly used as follows:
    - As an ingredient in an industrial process to make a product, unless distinct components of the coal combustion by-products are recovered as separate end products.
    - In a function or application as an effective substitute for a commercial product or natural resource.
- Structural Fill Projects
    - A minimum of 30 days before using coal combustion by-products in structural fill projects, the person proposing the use shall submit a written notice to NCDWM containing:
        - A description of the nature, purpose and location of the project.
        - The estimated start and completion dates for the project
        - An estimate of the volume of coal combustion by-products to be used for the project.
        - A TCLP analysis from a representative sample of each different CCB source to be used in the project.
            - A TCLP analysis shall be conducted at least annually.
            - A minimum analysis shall include the RCRA 8 metals.
        - A signed and dated statement by the owner(s) of the land on which the structural fill is to be placed, acknowledging and consenting to the use of coal combustion by-products as structural fill.
    - At least 30 days before using coal combustion by-products as a structural fill in projects with a volume of more than 10,000 cubic yards, the person proposing the use shall submit a written notice to the Division containing construction plans for the structural

    fill facility, including a stability analysis when necessary, which shall be prepared, signed and sealed by a registered professional engineer in accordance with sound engineering practices.
  - Siting restrictions for CCB landfills are located in section .1704
  - Coal combustion by-products shall be placed uniformly and compacted in lifts not exceeding one foot in thickness and shall be compacted to standards, including in-situ density, compaction effort and relative density, specified by a registered professional engineer for a specific end use purpose.
  - The coal combustion by-product structural fill facility shall be effectively maintained and operated to ensure no violations of ground water standards, 15A NCAC 2L.
  - Surface waters resulting from precipitation shall be diverted away from the active coal combustion by-product placement area during filling and construction activity.
  - No later than 30 working days or 60 calendar days, whichever is less after coal combustion by-product placement has ceased, the final cover shall be applied over the coal combustion by-product placement area. The final surface of the structural fill shall be graded and provided with drainage systems that:
    - Minimize erosion of cover materials
    - Promote drainage of area precipitation, minimize infiltration and prevent ponding of surface water on the structural fill.
    - The constructor or operator shall submit a certification to the Division signed and sealed by a registered professional engineer or signed by the Secretary of the Department of Transportation or his designee certifying that all requirements have been met.
- Other uses for CCBs
  - Coal combustion by-products may be beneficially used on one or more of the following applications or when handled, processed, transported or stockpiled for such beneficial use applications and do not require a solid waste permit provided the uses are consistent with the requirements identified below:
    - Coal combustion by-products used as soil nutrient additives or other agricultural purposes under the authority of the North Carolina Department of Agriculture.
    - Coal combustion bottom ash or boiler slag used as a traction control material or road surface material if the use is approved by the North Carolina Department of Transportation.
    - Coal combustion by-products used as material in the manufacturing of another product, including, but not limited to concrete products, lightweight aggregate, roofing materials, plastics, paint, flowable fill and roller compacted concrete or as a substitute for a product or material resource, including but not limited to, blasting grit, roofing granules, filter cloth precoat for sludge dewatering and pipe bedding.

        - Coal combustion by-products used as a structural fill for the base, sub-base, under a structure or the footprint of a paved road, a parking lot, sidewalk, walkway or similar structure.
        - Coal combustion by-products used for the extraction or recovery of materials and compounds contained within the coal combustion by-products. Residuals from the processing operations shall remain solid waste and be subject to this Section and Section .1600.
        - Coal combustion by-products processed with a cementitious binder to produce a stabilized structural fill product which is spread and compacted for the construction of a project with a planned end use.
- By October 1 of each year, the generators of coal combustion by-products shall submit an annual summary to the Division. The annual summary shall be for the period July 1 through June 31 and shall include:
    - Volume of coal combustion by-products produced
    - Volume of coal combustion by-products disposed
    - Volume of coal combustion by-products used in structural fill facilities
    - Volume of coal combustion by-products used for other uses as described

## North Dakota BU Profile

The North Dakota Solid Waste Management Rules (Chapter 33-20-01.1) do not directly provide information on beneficial use, but a definition in the rules has a direct relation to beneficial use guidelines that have been developed by the state.

- "Inert waste" means non-putrescible solid waste that will not contaminate water or form a contaminated leachate. Inert waste does not serve as food for vectors. Inert waste includes, but is not limited to:
    - construction and demolition material such as metal, wood, bricks, masonry and cement concrete
    - asphalt concrete
    - metal
    - tree branches
    - bottom ash from coal-fired boilers
    - waste coal fines from air pollution control equipment

The state has Guidelines that provide information regarding the beneficial use of inert waste and ash utilization. These guidelines are described further below.

General Beneficial Use

- Inert Waste Beneficial Use Application must be submitted to the North Dakota Department of Health, and in turn generators or users must receive a Beneficial Use Variance prior to use.
- For North Dakota Department of Transportation (NDDOT) Projects, a Department Of Transportation Projects Inert Waste Beneficial Use Application is necessary.
- Based on discussions with regulatory personnel in North Dakota, many beneficial uses involve the use of concrete and wood.

Guideline 38 – Beneficial Use of Inert Waste

- Identifies that inert materials have beneficial uses such as in aggregate, landscaping purposes, as fill materials, and for roadbed preparation, foundation support, drainage layers, erosion control, erosion repair, bank stabilization, and other land improvement purposes.
- Inert waste appropriate for beneficial use includes:
    - Sand, gravel, etc.
    - Stone, rock, etc.
    - Soil
    - Brick
    - Concrete and asphalt rubble
    - Untreated wood or wood not painted with lead-based paint
    - Other material approved by the ND Department of Health

- While fill may be approved for erosion control, erosion repair and bank stabilization, special considerations are required for its use in waters of the U.S. as regulated by the Army Corps of Engineers
    - Any fill within these waters requires coordination with the Army Corps of Engineers
- Informal risk assessments are conducted dependent on the waste

Guideline 11 – Ash Utilization for Soil Stabilization, Filler Materials, and Other Engineering Uses

- Projects such as road stabilization, underground mine stabilization, controlled strength flowable fill, and other uses have been reviewed and approved by the Department based on an evaluation of the material's engineering and environmental properties.
- The ND DOH reviews
    - Ash quality and quantity
    - Proposed use of the ash
    - Site characteristics, potential receptors, how material will be handled
    - Contingency plans in case adverse environmental conditions arise
    - How the site will be monitored to ensure environmental protection
    - Use of material when completed
- Proposals should include
    - Background information
        - Boilers, pollution control equipment, source and type of fuel, storage and handling
    - Ash leach test utilizing a modified EPA SPLP Method 1312 or a modified ASTM D-3987 procedure, both with a solution to solid ratio of 4:1
        - Detection limits must be substantially below the safe drinking water standards
        - Basic parameters:
            - Appearance
            - pH
            - Specific conductance
            - Temperature
        - Geochemical Parameters:
            - Ammonia nitrogen
            - Total hardness
            - Iron
            - Aluminum
            - Calcium
            - Magnesium
            - Manganese
            - Potassium
            - Total alkalinity
            - Bicarbonate
            - Carbonate

        - Chloride
        - Fluoride
        - Nitrate + Nitrite, as N
        - Total phosphorus
        - Sulfate
        - Sodium
        - TDS, TSS
        - Cation/anion balance
        - Sodium adsorption ratio
    - Heavy metals Group A:
        - Arsenic
        - Barium
        - Boron
        - Cadmium
        - Chromium
        - Lead
        - Mercury
        - Selenium
        - Silver
    - Heavy Metals Group B:
        - Antimony
        - Beryllium
        - Cobalt
        - Copper
        - Nickel
        - Thallium
        - Vanadium
        - Zinc
    - For Fly Ash, NORM:
        - Gross alpha particle radioactivity (pCi/1)
        - Radium 226 and 228 (pCi/1)
        - Uranium
- Detailed discussion of the proposed use of the ash
    - Admixtures, fill materials, soil, etc.
    - Mix ratio and design lift thickness, moisture levels, compaction
    - Engineering properties
- Laboratory simulation of the environmental properties of the proposed use.
    - Replicated field condition
- Potential receptors
    - Nearby communities, residences, parks, natural areas, waterways

## Ohio BU Profile

The beneficial use of solid waste is regulated under the Chapter 3732: Solid and Hazardous Waste Law and Chapter 6111: Water Pollution Control

- The definition of "Solid wastes" excludes:
    - Earth or material from construction, mining, or demolition operations, or other waste materials of the type that normally would be included in demolition debris
    - Nontoxic fly ash and bottom ash, including at least ash that results from the combustion of coal and ash that results from the combustion of coal in combination with scrap tires where scrap tires comprise not more than fifty per cent of heat input in any month
    - Spent nontoxic foundry sand, and slag
    - Other substances that are not harmful or inimical to public health, and includes, but is not limited to, garbage, scrap tires, combustible and noncombustible material, street dirt, and debris.
- "Beneficially use" means to use a scrap tire in a manner that results in a commodity for sale or exchange or in any other manner authorized as a beneficial use in rules adopted by the director in accordance with Chapter 119 of the Revised Code.
- Currently, beneficial use is conducted as an Alternative Waste Management Project
    - Beneficial use is still considered a form of disposal in Ohio
    - The Integrated Alternative Waste Management Program (IAWMP) approves beneficial use projects pursuant to OAC 3735-27-05(A)(4)
    - Alternative Waste Management Project Request (OEPA 2004) must be submitted to the department for consideration (case by case determination)
    - The incorporation of waste into the manufacture of a final product is not considered disposal, and therefore currently nor regulated by the agency
    - Shingles fall under C&D regulations in Ohio and are under a non regulated program, not considered beneficial use.

Guidance for the Beneficial Use of Scrap Tires (GD 671)

- In accordance with Ohio Administrative Code Rule 3745-27-78
- Pre-approved beneficial uses of whole or cut scrap tires listed in Ohio Administrative Code Rule 3745-27-78(D) include:
    - agricultural and landfill use to hold down tarps and covers (250 whole tires and 5,000 sidewalls maximum)
    - crash barriers around race tracks (1,500 tires maximum)
    - backstops for rifle ranges (1,500 tires maximum)
- Pre-approved uses of processed scrap tires include several different civil engineering uses such as a drainage aggregate (i.e., sand and gravel) substitute in:
    - solid waste landfill leachate collection systems and other civil engineering uses in the landfill as authorized in the landfill's permit

    - construction and demolition debris landfill leachate collection systems and other civil engineering uses in the landfill as authorized in the facility license or permit
    - on-site residential septic system leach fields
    - drainage around building foundations and building foundation insulation
    - covering material for playgrounds if all wire is removed
    - construction material and lightweight fill in the construction of public roadways, public parking, and public road embankment construction, if the use of shredded scrap tires is specifically approved by a government official responsible for the engineering and construction of the public roads and the public construction projects

All beneficial use projects require that a report of project completion be made to Ohio EPADSIWM's Scrap Tire Unit within 60 days of project completion.

***Note: As of 2012, OEPA is developing rules specific to beneficial use of waste materials. The information provided below is based on the proposed regulatory framework as of December 2012. Thus the information contained below has not been finalized.***

- A concept of the rules has been released as the Early Stakeholder Outreach Beneficial Use Regulatory Program Development (OEPA 2012).
- The new rules will be organized into their own program chapter
- Tier 1 Pre-approvals for beneficial use are being considered for the following materials:
    - Asphalt/asphalt concrete
    - Cement/cement concrete
    - Chip and seal pavement
    - Drywall
    - Flowable fill
    - Glass
    - Grout
    - Annual reporting of information such as quantities, types of materials, and how they were used under preapproval is also being considered.
- In addition to a pre-approved Tier 1, Tier 2 general permits for beneficial use are being considered. General permits would be used for those industrial byproducts not qualifying for preapproved use and needing characterization, but for which there is enough information in the scientific literature that byproduct characterization and use specifications can be developed specific to the byproduct. Would require:
    - Notice of intent indicating voluntary compliance
    - Materials characterization plan
    - Analytical results
    - Application fee
    - Can deny permit due to:
        - The beneficial use is proposed in a drinking water source protection area for a community public water system using ground water

    - Being within 500 ft of a well providing potable drinking water for human or livestock consumption
    - Being within an emergency management zone
    - Being at a location where beneficial use of the given material may endanger human health or the environment
- Tier 3 Individual permits would be the remaining option for beneficial use in Ohio. Individual permits would be analyzed on a case by case basis and may require:
  - A description of the industrial byproduct and the process through which it is generated
  - a description of the proposed beneficial use
  - estimated volume to be used, the location of the use, and the expected chemical characteristics of any discharge
  - A characterization plan and results of initial characterization
  - Application fee
  - Notices of deficiency could be sent, requiring completion of the application or submission of additional information
  - Individual permits would be effective for up to 5 years
  - Denials can be made for reasons similar to those in Tier 2
- Risk assessment is expected to be comparable to Throwdown Standards of $10^{-6}$ risk, although $10^{-5}$ risk may be considered.

Ohio has 35 active BUDs as reported in the NEWMOA Beneficial Use Database in 2011.

## Oklahoma BU Profile

The Oklahoma Department of Environmental Quality (ODEQ) regulates the beneficial use of solid waste via the authority given in Title 252 (Department of Environmental Quality) Chapter 515 Management of Solid Waste.

- The term "solid waste" does not include:
  - a. scrap materials which are source separated for collection and processing as industrial raw materials, except when contained in the waste collected by or in behalf of a solid waste management system, or
  - b. used motor oil, which shall not be considered to be a solid waste, but shall be considered a deleterious substance, if the used motor oil is recycled for energy reclamation and is ultimately destroyed when recycled

252:515-1-7 Beneficial Reuse

- Upon request, and with supporting documentation, the ODEQ may make a determination that a waste material is not a solid waste when it can be shown that the material is:
  - Being used as an ingredient in an industrial process to make a product
  - Used as an effective substitute for commercial products
  - Being returned to the original process from which it is generated, without first being reclaimed
    - The material must be returned as a substitute for raw material feed-stock and the process must use raw materials as principal feed-stocks
  - In the possession of persons who actually possess the equipment necessary to process the material to comply with one of the above conditions
- The ODEQ may also make a reuse determination on other proposals based upon an evaluation of the contemplated use of the material and potential effects on human health and the environment.
- Analytical testing is conducted depending on the nature of the material being proposed for beneficial use
  - TCLP or SPLP conducted to confirm material is non hazardous
  - When there is no question of non hazardous, a total metals analysis would provide more information for the material in question
- The question of risk is not seen as an issue regarding materials that have been considered for beneficial use
  - If risk issues arise, beneficial use is held to the same standards as the Oklahoma Superfund Program
- If waste is accumulated in anticipation of future markets or is stored in a quantity exceeding that which may be reasonably expected to be used or recycled within one (1) year, the material is regulated as a solid waste.

## Oregon BU Profile

Oregon Department of Environmental Quality governs beneficial use of solid waste via regulations OAR 340-093-0260 through 340-093-0290, 2011.

OAR 340-093-0030 defines:

- "Beneficial use" means the productive use of solid waste in a manner that will not create an adverse impact to public health, safety, welfare, or the environment.
- "Beneficial use determination" means the approval of a beneficial use of a solid waste pursuant to OAR 340-093-0260 through 340-093-0290 either as a standing beneficial use or as a case-specific authorization.
- "Solid waste" does not include
    - Hazardous waste as defined in ORS 466.005
    - Agricultural use exclusion for land application: Materials used for fertilizer, soil conditioning, humus restoration, or for other productive purposes or which are salvageable for these purposes and are used on land in agricultural operations and the growing or harvesting of crops and the raising of fowls or animals, provided the materials are used at or below agronomic application rates.

Wastes with standing beneficial use determinations not requiring a beneficial use determination are discussed under OAR 340-093-0270:

- A person managing the solid waste as a standing beneficial use must:
    - Manage to prevent releases to the environment or nuisance conditions
    - Use material consistent with applicable engineering and commercial standards and agricultural and horticultural practices
    - Ensure that hazardous substances in the material meet specific criteria
    - Ensure that use does not result in an increase of a hazardous substance in a sensitive environment
    - Use material in compliance with applicable federal, state and local regulations
- Documentation from the supplier to the user identifying information on the material.
- The person managing the waste must be able to demonstrate the material complies with this rule upon request of ODEQ.
- Annual reporting is required.
- Specific waste/use combinations are approved for beneficial use under standing determinations with conditions on use (OAR 340-093-0270(5)):

**Standing Beneficial Use Determinations**

| Solid Waste | Beneficial Use | Conditions on Use |
|---|---|---|
| Asphalt pavement or asphalt grindings from road projects | As asphalt and aggregate in new asphalt pavement or as fill within road prisms | Asphalt grindings must be compacted when used within road prisms |

| **Solid Waste** | **Beneficial Use** | **Conditions on Use** |
|---|---|---|
| Asphalt shingle waste from roof tear-offs and manufacturer scrap | As asphalt binder in asphalt mixtures | The waste does not contain asbestos or other non-asphalt single materials from roof tear-offs, such as nails, metal flashing, paper, or wood waste |
| Dredged sediment approved by the department's water quality program form unconfined in-water placement based on chemical screening | Non-residential construction fill, surcharge, utility trench fill, or roadbase; habitat improvement, beach nourishment or other similar uses | A person using the material must submit a report to the Department in accordance with section (4) of this rule |
| Dredged sediment not approved by the department's water quality program for in-water placement | Non-residential construction fill, utility trench fill, or roadbase | Concentrations of hazardous substances are below the higher of Department-approved human health occupational risk-based screening levels or naturally occurring background; placed where it will not be in contact with or adversely impact waters of the state; covered in a manner that minimizes exposure to ecological receptors; and a person using the material must submit a report to the Department in accordance with section (4) of this rule |
| Foundry sand produced by iron, steel, or aluminum foundries | As aggregate in asphalt mixtures, concrete, Portland cement, or masonry mortar | None specified beyond the requirements of this rule |

| Solid Waste | Beneficial Use | Conditions on Use |
|---|---|---|
| Foundry sand produced by iron, steel, or aluminum foundries | Non-residential construction fill, utility trench fill, or roadbase | Concentrations of hazardous substances are below the higher or Department-approved human health occupational risk-based screening levels or naturally occurring background; placed where it will not be in contact with or adversely impact waters of the state; covered in a manner that minimizes exposure to ecological receptors; and a person using the material must submit a report to the Department in accordance with section (4) of this rule |
| Soil from cleanup sites | Non-residential construction fill, utility trench fill, or roadbase | Concentrations of hazardous substances are below the higher or Department-approved human health occupational risk-based screening levels or naturally occurring background; placed where it will not be in contact with or adversely impact waters of the state; covered in a manner that minimizes exposure to ecological receptors; and a person using the material must submit a report to the Department in accordance with section (4) of this rule |
| Soil from petroleum cleanup sites | As aggregate in asphalt mixtures | Petroleum contamination from releases of heating oil or motor fuel only |
| Steel slag | As aggregate in asphalt mixtures, concrete, or Portland cement | None specified beyond the requirements of this rule |
| Street sweeping fines | Spill response absorbent | After use of the waste a hazardous waste determination must be conducted and the material disposed at an appropriate permitted disposal site |

| **Solid Waste** | **Beneficial Use** | **Conditions on Use** |
|---|---|---|
| Street sweeping sand from winter storm applications | Road sanding | Swept up within 6 months of application or being re-exposed on the road after snowmelt; and the sand is separated from the street sweepings |
| Wood-derived bottom ash, boiler rock, or clinkers, including rock, sand, dirt, and fused wood ash, from wood and wood waste fired boilers | As aggregate in asphalt mixtures, concrete, or Portland cement | None specified beyond the requirements of this rule |

Application for case-by-case approvals for beneficial use of solid waste are specified by the following:

- Tier 1: A solid waste with no hazardous substances significantly exceeding the concentration in a comparable raw material or commercial product and that will be used in a manufactured product (a fee of $1,000 applies).
- Tier 2: A solid waste that contains hazardous substances significantly exceeding the concentration in a comparable raw material or commercial product, or involves land application (a fee of $2,000 applies).
- Tier 3: A solid waste that requires research (such as a literature review or risk assessment) or a demonstration project to demonstrate compliance with the rule (a fee of $5,000 applies).
    - No Tier 3 requests have been received by ODEQ

Case-by-case approvals of material for beneficial use include:

- Iron and steel slag for land application (non-residential construction fill, utility trench fill, or road base).
- Dredged sediments used as fill material in a development area
- Wet scrubber mud as an agricultural and nursery soil amendment/mulch and livestock bedding
- Silica fume waste as a concrete additive

Review and evaluation of case-by-case beneficial use applications includes assessment of the following:

- Sufficient waste characterization
    - For tier 1
        - Material description
        - Manner of generation
        - Estimated quantities
        - Description of use and justification for how it is beneficial
        - Sufficient comparison to material it is replacing
        - Is the use compliant with performance criteria in OAR 340-093-0280
    - For tier 2
        - All tier 1
        - Additional data and when applicable information, such as risk screening levels, location and land use type if land application, etc.
    - For tier 3
        - All tier 2

        - Additional justification and information related to demonstration projects
- Productive beneficial use of the solid waste
    - Identified use
    - Reasonably likely use
    - Not speculative accumulation
- Effect of proposed beneficial use on public health, safety, welfare, and/or the environment
    - Demonstrated to be non-hazardous
    - Prior to use, has been demonstrated it will be managed to prevent environmental releases and nuisance conditions
    - If hazardous, does it meet specific criteria
    - During use, has demonstrated it will be managed to prevent odors, dust, unsightliness, fire, or other nuisance conditions
- Public involvement evaluation (not required beneficial use evaluation criterion).
    - Can be recommended for applications.

Based on discussions with ODEQ and evaluation of individual BUD approval letters, the following are examples of screening levels that may be used in a beneficial use evaluation:

- Human health occupational risk-based concentrations
- Naturally-occurring background levels
- ODEQ ecological screening level values
- Clean fill screening levels
- Hazardous Substance Remediation Action Levels

A beneficial use application form is available and details the procedure, necessary submittals, performance criteria, and fees necessary for a completed application.

Some materials, such as wood ash to be land applied, may be governed by either the solid waste agricultural use exclusion or the beneficial use regulations.

The state has 18 active BUDs based on information provided by ODEQ.

## Pennsylvania BU Profile

Subchapter H of 25 Pennsylvania Code 287 governs beneficial use of solid waste; related regulations are located in 25 Pennsylvania Code 271 (municipal waste management), 281 (composting facilities), 290 (beneficial use of coal ash), 295 (composting facilities for residual waste), and 299 (storage and transportation of residual waste).

"Beneficial use" is defined as use or reuse of residual waste or residual material derived from residual waste for commercial, industrial or governmental purposes, if the use does not harm or threaten public health, safety, welfare or the environment, or the use or reuse of processed municipal waste for any purpose, if the use does not harm or threaten public health, safety, welfare or the environment.

Beneficial use can be covered by:

- Permit by rule: on-site reclamation of municipal and residual waste
- Processing permits
- General permits: off-site reclamation of municipal and residual waste

General permits are issued for municipal solid waste beneficial use and residual waste processing and beneficial use:

- Conditioned so that other potential generators or users of a solid waste can apply for coverage under a general permit.
- General permits are not equivalent to exempt standing uses or blanket approval.
- New general permits can be issued on an as needed basis for applications for wastes/uses not covered under an existing general permit.

**Active General Permits for Beneficial Use**

| PERMIT | DESCRIPTION |
|---|---|
| WMGR002 | Beneficial use of paper and pulp mill wastewater treatment sludge for use as a soil additive to facilitate revegetation on disturbed land at permitted and abandoned mine sites. |
| WMGR003 | Beneficial use of spent fired "ceramic" wastes (i.e., colloidal silica) generated from the lost wax casting process by a ferrous metal foundry, (Standard Industrial Classification Code 3324), as an aggregate, road base material, pipe bedding material or as a roadway construction material. |
| WMGR011 | Reconditioning of spent ethylene glycol antifreeze using a mobile processing unit. |
| WMGR013 | Processing (i.e., sorting, de-reeling, shearing, stripping, and sweating of lead sheathed cables and other lead materials) and beneficial use of waste telecommunication cables as a raw or reclaimed materials. |
| WMGR016 | Beneficial use of waste molding sand generated by gray and ductile iron foundries for use as pipe bedding. |
| WMGR017 | Beneficial use of drinking water plant treatment sludge for use as a soil additive on agricultural lands. |

| PERMIT | DESCRIPTION |
|---|---|
| WMGR019 | Beneficial use of waste foundry sand for use as roadway construction material, a component or ingredient in the manufacturing of concrete or asphalt products, a soil additive or soil substitute, and non-roadway construction. |
| WMGR023 | Reconditioning of waste oil for reuse by generator. |
| WMGR024 | Processing and recycling spent cleaning solvent back to original form. |
| WMGR025 | Composting and beneficial use of the following source-separated wastes: agricultural waste other than mortalities, butcher waste other than whole carcass, food processing waste, pre-consumer and post-consumer food residuals, yard waste, land clearing and grubbing material, untreated wood waste, gypsum wallboard, paper, cardboard, waxed cardboard, virgin paper mill sludge and spent mushroom substrate. The beneficial uses of the finished compost approved in this permit are for use, marketing or distribution as a soil conditioner, soil amendment, fertilizer, mulch or for erosion control. The finished compost is not considered a waste when it has satisfied the conditions of this permit and is ready for use, marketing or distribution as a soil conditioner, soil amendment, fertilizer, mulch or for erosion control. |
| WMGR028 | Beneficial use of baghouse fines and/or scrubber pond precipitates, generated by hot-mix asphalt plants, for use as: (i) an aggregate in roadway construction, (ii) a soil additive, (iii) a soil conditioner, or (iv) a component or ingredient in the manufacturing of construction products. |
| WMGR029 | Operation of transfer facility for the processing of waste oil (including waste oil mixed with hazardous waste), spent antifreeze, used oil filters and waste oil/water mixture. |
| WMGR031 | Retorting of metallic grinding swarfs and spent catalysts. |
| WMGR038 | Processing waste tires and tire-derived material for fuel and consumer products. |
| WMGR039 | Processing prior to beneficial use of the operation of a transfer facility and rail transloading facility for the processing of waste oil, waste oil/water mixtures, and asphalt condensate. |
| WMGR040 | Processing of waste oil (including waste oil mixed with hazardous waste), spent antifreeze and waste oil/water mixtures from motor vehicles to rail cars for transport (rail transloading). |
| WMGR042 | Beneficial use of slag fines from basic oxygen process (BOP) for use as construction material. |
| WMGR046 | Processing and beneficial use of drinking water treatment sludges, yard waste, bark ash, coal ash, agricultural residues, waste cardboard and paper, sludge generated by paper of pulp mills, waste from vegetable food processing, unused sands, waste foundry sand that is authorized for use as a soil additive or soil substitute under General Permit Number WMGR019, spent mushroom substrate and freshwater, brackish and marine dredged material use as manufactured soil or soil amendments. |

| PERMIT | DESCRIPTION |
|---|---|
| WMGR047 | Beneficial use of the residual aggregate generated from the extraction of stainless steel from stainless steel slag for use as an agricultural liming agent, an ingredient in specialty fertilizers and an ingredient in mine grouting material. |
| WMGR050 | Beneficial use of a mixture of 75 percent coal ash and 25 percent ash material from the incineration of waste carpet scraps for use as an antiskid material. |
| WMGR052 | Beneficial use of Low Permeability Cementitious material (a mixture of flue gas desulfurization (FGD) sludge, coal ash, and lime) for use as a construction material and for mine sealing, in mine fire and subsidence control, and for mine reclamation. |
| WMGR053 | Processing prior to beneficial use of recyclable containers from off-specification or out-of-date consumer commodity-type materials for use as raw material. |
| WMGR061 | Processing prior to beneficial use of food processing and agricultural waste, solid and liquid rendering waste, offal, animal parts, animal feed waste, potato and grain mill processing waste, and materials used to pack the waste (cardboard and polyethylene sewage sludge, mixed plastics, waste tires, and pre-sorted municipal waste) and spent mushroom substrate for use as fuel, fuel feedstock or as an ingredient in fertilizer. |
| WMGR064 | Beneficial use of natural gas well brines for roadway pre-wetting (brines mixed with antiskid materials prior to roadway application), anti-icing (brines applied directly to roadway and walkway surfaces prior to precipitation event), and for roadway de-icing purposes (brine is applied directly to roadway surfaces after precipitation event). |
| WMGR065 Northeast Region Only | Beneficial use of the following types of residual wastes related to the manufacturing of iron and steel, refractories, foundry sands, slags, air emission control solids, and the media associated with their excavation as construction fill at an Act 2 remediation site. |
| WMGR066 | Processing of waste oil, virgin fuel oil tank bottoms, spent antifreeze and waste oil/water mixture via operation of a transfer facility. |
| WMGR067 | Beneficial use of dried holding pond sediment consisting of filter backwash, coal pile runoff, river silt, boiler and cooling tower blowdown as a soil additive to facilitate revegetation on disturbed land at permitted and abandoned mine sites. |
| WMGR069 | Beneficial use of wastewater treatment sludge generated from meat processing operations as top dressing or soil conditioner on agricultural lands. |
| WMGR070 | Beneficial use of baghouse fines from air pollution devices generated at hot-mixed asphalt plants as a construction material or as levee core impermeable fill and pipe bedding. |
| WMGR072 | Beneficial use of dewatered dredge waste for use as a roadbed material in roadway construction. |

| PERMIT | DESCRIPTION |
|---|---|
| WMGR074 | Processing prior to beneficial use of biosolids, water treatment plant sludge, paper pulp sludge and lime neutralized industrial water sludge to be blended with thermally treated soil as landscaping soil materials. |
| WMGR079 | Processing and beneficial use of waste asphalt shingles as an aggregate in the production of hot mix asphalt paving material and as a sub-base for road and driveway construction. |
| WMGR080 | Beneficial use of weak alkali liquor as an alkaline material to treat acid mine drainage wastewater. |
| WMGR081 | Processing and beneficial use of electronic equipment and components by sorting, disassembling or mechanical processing. |
| WMGR082 | Processing and beneficial use of steel and iron slag and refractory bricks mined from an existing slag pile for use as a construction material. |
| WMGR083 | Processing and beneficial use of dewatered dredge as a roadway construction material; soil amendment; landscaping soil; higher-grade topsoil; lightweight aggregate in concrete; stream bank stabilization or scour protection; and a cover, cap, or other component of a remediation or closure project. |
| WMGR084 | Beneficial use of wastewater treatment sludge from the production of Formaldehyde, Trimethyloethane (TME), Dimethyloproprionic acid (DMPA), and Calcium Formate as a soil additive for agricultural utilization and land reclamation, and as an ingredient to produce other soil additives. |
| WMGR085 | Processing and beneficial use of freshwater, brackish and marine dredge material, cement kiln dust, lime kiln dust, coal ash, and cogeneration ash by screening, mechanical blending and compaction in mine reclamation. |
| WMGR086 | Beneficial use of wastewater treatment sludge generated from leather production as a soil conditioner for land application on agricultural lands and mine sites. |
| WMGR088 | Beneficial use of drinking water treatment plant sludge for use as a soil additive on agricultural lands. |
| WMGR089 | Beneficial use of lime kiln dust as a soil amendment, for stabilization/solidification of soils and sludges, treatment of acid mine drainage, alkaline activator in cements, grouts in mine reclamation, for roadway subbase, stabilization and conditioning, as filler in agricultural and construction products, and as construction material in nonresidential projects. |
| WMGR090 | Processing and beneficial use of reclaimed asphalt pavement (RAP) materials as roadway construction material. |
| WMGR091 | Processing and beneficial use of used oil filters as a scrap metal and waste oil generated from the filters. |

| PERMIT | DESCRIPTION |
|---|---|
| WMGR093 | Processing of: (a) dewatered dredge waste blended with commercial products (i.e., gravel and virgin sand, clean and uncontaminated topsoil, etc.), (b) dewatered dredge waste blended with waste-derived materials (i.e., crushed, clean and segregated concrete and asphalt, fly ash, foundry sand, lime kiln dust, cement kiln dust, etc.), (c) dewatered dredge waste blended with glass waste unsuitable for recycling, and (d) dewatered dredge waste blended with steel slag, for beneficial use as: (1) an aggregate, a sub-base or sub-grade material for roadway construction, and (2) a lightweight aggregate in concrete or landscaping blocks. |
| WMGR094 | Beneficial use of cement kiln dust in road construction applications for the stabilization of road subgrade, and for embankment and backfill construction. |
| WMGR096 | Beneficial use of regulated fill when moved offsite or received onsite in accordance with DEP Guidance Document 258-2182-773 (Management of Fill). Application for Regulated Fill General Permit 2540-PM-LRWM0403 |
| WMGR097 | Processing and beneficial use of residual and/or municipal waste for R&D activities. |
| WMGR098 | Beneficial use of foundry sand and sand system dust generated by ferrous metal foundries and steel for use as construction material, or as soil additive or soil amendment. |
| WMGR099 | Processing and beneficial use of the combined domestic sewage and industrial wastewater treatment sludge for agricultural utilization and mine reclamation by land application as a soil conditioner or an effective fertilizer. |
| WMGR100 | Transfer and/or composting of spent mushroom substrate (SMS), a residual waste, prior to its beneficial use, through construction and operation of storage and composting facilities, and where applicable, the management of resulting wastewater through construction and operation of wastewater storage and land application. |
| WMGR101 | Processing and beneficial use of steel slag, iron slag, and refractory bricks that were co-disposed with slag, reclaimed asphalt pavement materials (RAP) in quantities greater than 10 cubic yards and uncontaminated brick, block and concrete from sidewalk and highway projects as a construction material. |
| WMGR103 | Processing by (i) grinding, mixing, screening and biological decomposition of tree stumps, roots, leaf waste, stump grindings, and grubbing material for the beneficial use as a mulch material, and (ii) grinding, screening and mixing of freshwater dredged material from Seyferts basin, spent mushroom substrate, leaf waste, water treatment residual and waste foundry sand (authorized under WMGR019 or WMGR098) with uncontaminated soil for beneficial use as a manufactured topsoil. Freshwater dredged material from basins other than Seyferts must meet the definition of clean fill and comply with the requirements provided in the department’s Guidance Document, "Management of Fill, Document No. 258-2182-773" |

| PERMIT | DESCRIPTION |
|---|---|
| WMGR104 | Processing and beneficial use of used oil filters as a scrap metal and waste oil generated from the filters. |
| WMGR105 | Beneficial use of bottom ash generated from the burning of coal, bark, wood and pulp and paper mill sludge as construction material, antiskid, and in reclamation of active and abandoned mines. |
| WMGR106 | Processing of Types 4 through 7 plastics ("waste") from municipal recycling facilities and residual waste generators to produce plastic-derived fuel ("PDF"). |
| WMGR107 | Processing of non-PCB transformer oil in mobile processing units for the purpose of reconditioning the transformer oil. The approved reconditioning process is limited to filtration, heating, application of vacuum, and the addition of antioxidant. |
| WMGR108 | Beneficial use of chocolate confectionary residuals and cocoa bean shells as ingredients in fertilizer and incorporation into mushroom soil and cocoa bean shells as mulch. |
| WMGR109 | Processing of used restaurant oil, yellow grease, grease trap waste, oils and animal fat from food processing or rendering plants, waste from ethanol production, soybean soap stock, float grease (from wastewater treatment plants), and off-specification vegetable oils ("oil and grease waste") to produce biofuel, including biodiesel, for beneficial use as fuel.Registration Form 2540-PM-BWM0016 (eLibrary) |
| WMGR110 | Beneficial use of: (a) residential septage, (b) food processing residuals and (c) restaurant grease trap waste, hereinafter referred to as “blended waste” materials, as a soil conditioner or a fertilizer for agricultural purposes. The blended waste shall be treated to non-exceptional quality biosolid values. |
| WMGR111 | Processing (mixing or blending) at waste generation or mine sites of: (i) synthetic gypsum from forced oxidation flue gas desulfurization (FGD) systems generated at coal-fired electric power plants, (ii) coal ash, and (iii) approved alkaline agent to produce for beneficial use as a stabilized FGD-gypsum material, for mine reclamation purposes. |
| WMGR113 | Beneficial use of non-hazardous coal tar and oil-contaminated waste as alternate fuels to be combined with waste coal/coal to produce specification fuel for circulating fluidized bed boilers (CFB). This general permit also authorizes the beneficial use of the resulting ash generated by co-firing the approved alternative fuels with waste coal/coal, hereinafter referred to as “ash”, for the beneficial uses authorized for coal ash in accordance with 25 Pa. Code, §§287.661-666 (relating to beneficial use of coal ash). |
| WMGR114 | The processing of 1) spent polyethylene glycol slurry containing silicon and silicon carbide or diamond for beneficial use in fresh slurry and in production of silicon ingots and 2) spent aluminum cold rolling fluids for reuse as aluminum cold rolling fluid |

| PERMIT | DESCRIPTION |
|---|---|
| WMGR116 | Beneficial use of wastes as alternative fuels to be combined with waste coal/coal to produce specification fuel for CFB/BFB/PC facilities and beneficial use of resulting ash at active or abandoned mine sites. |
| WMGR123 | Processing, transfer and beneficial use of oil and gas liquid waste to develop or hydraulically fracture an oil or gas well.<br>Oil and gas liquid waste includes liquid wastes from the drilling, development and operation of oil and gas wells and transmission facilities. The term includes contaminated water from well sites, the development of transmission pipelines and the facility operating under this general permit, provided the generating facility has satisfied all other permitting requirements that may apply to contaminated water. The term does not include condensate from oil and gas transmission pipeline compressor stations that exhibits a characteristic of hazardous waste under 40 CFR Part 261, Subpart C, as incorporated by reference at 25 Pa. Code § 261a.1. |
| WMGR124 | Processing and beneficial use of waste materials, recovered from a captive lime/bark landfill area, as follows:<br>1. Segregation of bark and wood waste from the paper making process, prior to sale or delivered to a permitted processing facility for further processing for beneficial use as an ingredient or a component in the production of mulch material for landscaping purposes.<br>2. Stockpile of soil material segregated from the lime/bark landfill area for beneficial use as a topsoil or common borrow material for on-site landfill or impoundment closure activities.<br>3. Sorting of scrap metals (i.e., cables and wires used in the paper mill's wood yard operation) from the lime/bark landfill area prior to sale or delivery to a permitted processing facility for recycling purposes. |
| WMGR125 | Beneficial use of a mixture of dry flue gas desulfurization waste (FGD waste) and coal ash from coal-fired power plants for reclamation of coal mine sites. |
| WMGR126 | Processing of silver bearing films and sludges ("waste") prior to further silver reclamation and plastic recycling through granulation, film washing using sodium hydroxide or enzymes and surfactants, flocculation, filtration, and calcining. |
| WMGR128 | Beneficial use of crystalized sodium chloride and liquid calcium chloride generated at distilation facilities operating under General Permit Number WMGR123 for use as a deicer, for roadway dust supression and for soil stabilization, as an ingredient in an industrial process to make a product, and as an effective substitute for a commercial product. |

| PERMIT | DESCRIPTION |
|---|---|
| WMGR129 | Beneficial use of Alcoa's Alkaline Clay (AAC) as a soil additive for reclamation of acidic coal refuse mine sites by land application to approximately 24 inches depth on top of waste coal refuse material followed by hydro-seeding and mulching. |
| WMGR131 | Beneficial use of carbonaceous wastes: (i) petroleum coke, (ii) uncontaminated and untreated wood chips generated during the pulp and/or paper making process, and (iii) other paper and wood industry wastes comprised of primarily wood fibers, and tire-derived fuel as alternative fuels to be combined with waste coal/coal for circulating fluidized bed (CFB) boilers at the facility.<br>The resulting boiler ash generated by co-firing the approved alternative fuels referenced is beneficially used as (a) structural fill, (b) soil substitute or soil additive, (c) at coal mining activity sites, (d) at abandoned surface mining sites, and (e) other beneficial uses. |
| WMGR132 | Beneficial use of coal bed methane water as coal preparation process water and as an ingredient in flowable structural material for deep mine support structures. |
| WMGR133 | Processing prior to beneficial use of end-of-use lamp phosphors by installing and operating a production process to remove remaining crushed glass from the spent lamp phosphor powder and chemically process the powder to refine valuable elements for sale or further processing. |
| WMGR134 | Beneficial use of synthetic gypsum from forced oxidation, flue gas desulfurization (FGD) systems generated at coal-fired electric power plants when mixed with coal ash, hereinafter referred to as stabilized FGD-gypsum material to enhance compaction of fine coal refuse at coal refuse disposal sites. |

Review and evaluation of an application for a general permit includes the following:

- A public notice and review period
- An assessment of the proposed beneficial use activities
    - The application for the permit is accurate and complete
    - At a minimum the use of the waste will not present a greater harm or threat of harm than the use of the product or ingredient which the waste is replacing.
    - The physical character and chemical composition of the waste does not interfere with the proposed beneficial use
- Typically, TCLP and totals analytical data are required for characterization; the SPLP is sometimes used, it depends on the proposed use.
- Analytical data are compared to applicable cleanup limits

Permit forms for beneficial use are available on the PDEP website

- Separate forms are used for different purposes, i.e. compliance history, waste analysis and classification, etc. Fees apply for application:
    - $2,000 for a general permit

  - $250 for registration
  - $500 for determination of applicability

# Rhode Island BU Profile

The Rhode Island Department of Environmental Management (RIDEM) regulates beneficial use of waste materials.

Rhode Island General Law Title 23 Health and Safety, Chapter 23.18.9, Refuse Disposal, defines:

- "Beneficial reuse material" means a processed, nonhazardous, solid waste not already defined as recyclable material by this chapter and by regulations of the Rhode Island department of environmental management that the director has determined can be reused in an environmentally beneficial manner without creating potential threats to public health, safety, welfare or the environment or creating potential nuisance conditions.
- "Beneficial use determination" (BUD) means the case-by-case process by which the director evaluates a proposal to use a specific solid waste as a beneficial reuse material for a specific purpose at a specific location within the host municipality.
- The definition of solid waste does not include:
  - solids or dissolved material in domestic sewage or sewage sludge or dredge material as defined in chapter 6.1 of Title 46
  - hazardous waste as defined in chapter 19.1 of this title
  - used asphalt, concrete, or Portland cement concrete

Rhode Island General Law Title 23 Health and Safety, Chapter 23.18.9-16: Beneficial Reuse of Solid Waste

- All beneficial use determinations occur on a case by case approval basis
- In determining whether a solid waste can be safely used as a beneficial reuse material, the director may consider factors such as:
  - The physical and chemical characteristics of the solid waste in question
  - The proposed use of the waste
  - The location where the waste is proposed to be used according to criteria established by rule or policy as the director deems appropriate.
- Beneficial Use material proposals approved shall include:
  - Public notice in a newspaper of general circulation
  - Notice to the manager or mayor and council of the municipality in question
  - Hearing to be held in the municipality affected
  - When a BUD proposes the reuse of more than three cubic yards of solid waste in one location, applicants shall forward a copy of their application to the municipality where the beneficial reuse material will be used.
  - Director may require financial assurance that the BUD will be completed and/or any unused solid waste/beneficial reuse material will be properly removed and disposed of upon completion of the project or if project operations cease.

In 2007, Beneficial Use Determination Guidelines for Source Segregated Solid Waste were published to encourage recycling.

- Department of Environmental Management reviews requests for recycling of specific waste not already defined as recyclable material as a Beneficial Use Determination.
- BUDs can be requested by acceptors of wastes or generators if they are also the recycler and making the material available for beneficial use.
- 1 year initial approval basis, may be renewed for up to 3 years
    - Approval may impose conditions.
- BUD requests are considered a variance from solid waste regulations, DEM recommends material characterization plan and meeting with DEM prior to submittal of specific proposals.
- Applications should address the conditions:
    - Environmental hazards associated with proposed recycling to be minimized
    - The degree to which recycled material is similar to raw material
    - How will reuse protect natural resources?
    - Is there a guaranteed end market?
    - Why will proposed recycling and reuse not degrade the environment, and what controls will be used?

- Typical analysis includes a physical analysis, TCLP, and pH measurement
- Risk assessment is minimal due to the low threat characteristics assumed for non hazardous waste
    - Case by case periodic sampling for totals analysis may be conducted
- Risk assessment for land application of materials for beneficial use must meet soil Residential Direct Exposure Criteria (Rule 8.02)

Rules and Regulations for Dredging and the Management of Dredged Material were released in September 2010

- Addresses the beneficial use of dredged material in section 9
- An application for beneficial use must be submitted including:
    - Site plans
    - Documentation of uses
    - Classification of groundwater and surface water around use location
    - Stamped calculations performed by a Professional Engineer (PE) verifying beneficial use location and dewatering area capacity
- All dredged material must be dewatered prior to use except for in the case of beach nourishment and restoration of a salt marsh
- Dredged material may be beneficially used without further conditions if:
    - Dredged material must not exceed 10% silt/clay, 25% moisture, and must be free of trash and debris to be used for beach nourishment
    - Chloride concentration does not exceed 200 mg/kg dry material

- Dredged material that does not exceed the Residential Direct Exposure Criteria may be beneficially used under the following conditions:
  - Where there are no points of groundwater use within 1750 feet of the proposed disposal or use location (within 400 feet if use is within 200 feet of the coastal zone)
    - Groundwater at the proposed site is classified GB; or
    - Groundwater at the proposed site is classified GA, the location is not prohibited in section 5.4, the material meets GA Leachability Criteria (dredged material within 200 feet of coastal zone is not required to meet GA Leachability Criteria).
  - Where there is groundwater use within 1750 feet of the proposed disposal or use location (within 400 feet if use is within 200 feet of the coastal zone), and the chloride concentration exceeds 200 mg/kg dry material, an initial assessment of the impacts must be submitted
    - If the chloride concentration in groundwater will not exceed the federal drinking water standard of 250 mg/l at the point of groundwater use the material may be beneficially used as described above (sections 9.2.4.1.1. or 9.2.4.1.2)
    - If the chloride concentration in groundwater will exceed 250 mg/L, a pollutant transport analysis may be submitted. If the pollutant transport analysis indicates the chloride concentration will not exceed 250 mg/l at the point of groundwater use, material may be beneficially used as described above.
- Dredged material that exceeds Residential Direct Exposure Criteria but does not exceed the Commercial/Industrial Direct Exposure Criteria may be beneficially used on property that is and will be used for industrial/commercial activities in accordance with an Environmental Land Use Restriction or Conservation Easement
  - Where there are no points of groundwater use within 1750 feet of the proposed disposal or use location (within 400 feet if use is within 200 feet of the coastal zone)the material may be beneficially used
  - Where there is groundwater use within 1750 feet of the proposed disposal or use location (within 400 feet if use is within 200 feet of the coastal zone), and the chloride concentration does not exceed 200 mg/kg dry material, material may be beneficially used when:
    - Groundwater is classified as GB or GA
    - Location is not prohibited (section 5.4)
    - Material does not exceed GA Leachability Criteria
  - Where there is groundwater use within 1,750 feet of the proposed disposal or use location (within 400 feet if use is within 200 feet of the coastal zone), and the chloride concentration exceeds 200 mg/kg dry material, an initial assessment of the impacts must be submitted
    - If the chloride concentration in groundwater will not exceed the federal drinking water standard of 250 mg/L at the point of groundwater use the material may be beneficially used as described above (sections 9.2.4.1.1. or 9.2.4.1.2)

    - If the chloride concentration in groundwater will exceed 250 mg/L, a pollutant transport analysis may be submitted. If the pollutant transport analysis indicates the chloride concentration will not exceed 250 mg/l at the point of groundwater use, material may be beneficially used as described above.
- Land disposal projects that may impact freshwater wetlands must adhere to section 9.3 g
- The Department reserves the right to require testing beyond the above listed parameters if reasonable potential exists to exceed residential direct exposure criteria or water quality criteria.

Based on discussions with RIDEM in late 2012, there are three active BUDs.

# South Carolina BU Profile

Title 44 Chapter 96: South Carolina Solid Waste Policy and Management Act is the foundation for beneficial use determinations in South Carolina.

"Recovered materials" means those materials which have known use, reuse, or recycling potential; can be feasibly used, reused, or recycled; and have been diverted or removed from the solid waste stream for sale, use, reuse, or recycling, whether or not requiring subsequent separation and processing. At least seventy-five percent by weight of the materials received during the previous calendar year must be used, reused, recycled, or transferred to a different site for use, reuse, or recycling in order to qualify as a recovered material.

Not included in the definition of solid waste:

- solid or dissolved material in domestic sewage
- recovered materials
- solid or dissolved materials in irrigation return flows or industrial discharges which are point sources subject to NPDES permits under the Federal Water Pollution Control Act, as amended, or the Pollution Control Act of South Carolina, as amended, or source, special nuclear, or by-product material as defined by the Atomic Energy Act of 1954, as amended.
- application of fertilizer and animal manure during normal agricultural operations
- Refuse as defined and regulated pursuant to the South Carolina Mining Act, including processed mineral waste, which will not have a significant adverse impact on the environment.

There are no specific rules or guidance documents outlining the beneficial use determination process in South Carolina. Based on discussions with South Carolina Department of Health and Environmental Control (SCDHEC), beneficial use determinations are normally conducted on a case-by-case basis, and the degree of testing conducted is based on the waste in question and the proposed use. Testing requirements normally include either the TCLP or SPLP. Routine reporting following the initiation of beneficial use of a waste material is typically not required. When evaluating potential beneficial uses, the SCDHEC typically looks at the criteria developed in a US EPA memo from April 26, 1989 regarding F006 hazardous waste recycling.

Biosolids and land application are regulated by the Bureau of Water, which determines beneficial rates for land application

CCPs are generally not allowed for beneficial use land application or fill activities, but may be allowed when the use involves encapsulation (e.g., in concrete or asphalt).

Short-term structural fills are permitted for a life span of 12 months and one acre or less in size (R.61-107.19 Solid Waste Landfills and Structural Fill, Part II).

- Structural fill is permitted for future beneficial use utilizing land clearing debris, hardened concrete, asphalt, bricks, blocks, and other similar materials
- To register for permit-by-rule for structural fill activities registration form must be filled out, maps showing locations, proof of ownership, site information, and explanation of how waste will be compacted and cover applied.
- Some location restrictions apply.

# South Dakota BU Profile

South Dakota Department of Environment and Natural resources reviews every beneficial use request on a case by case basis, dependent on the waste and its characteristics. There is no information regarding beneficial use in South Dakota outlined in solid waste regulations or guidance documents. Beneficial use evaluations typically include:

- TCLP for RCRA metals
- Nutrient information may be requested (for land application projects).
- If the material is being proposed for a land application beneficial use, how the material may affect the soil and vegetation is considered
    - Soil testing and involvement of an agronomist may be required by the department.
- If the material is intended to replace a product a comparison may be required.

Materials that have been approved on a case-by-case basis include:

- Lime sludge
- Coal ash

- Some beneficial uses are required to conduct annual reporting, others are not. The unique circumstances of each material and use are considered.
    - Follow up and random inspections of beneficial use activities are conducted, particularly in cases where they do not receive annual reports.

Based on feedback provided on the ASTSWMO (2007) survey, the state receives approximately 1 to 10 beneficial use requests annually.

## Tennessee BU Profile

Beneficial use is not defined by statute or rule, however, the Tennessee Department of Environment and Conservation published a policy guidance manual regarding beneficial use in November 2010. A summary of key points is provided below.

- Some materials/uses are specifically addressed.
    - Nontoxic Foundry Sand used for the following do not require approval or review:
        - Manufacturing another product
        - Stabilization/solidification of other waste (for disposal)
        - Use in a composting process
        - Daily cover/final cover at landfill
        - Landfill liner protective layer
        - Small construction projects
    - Nontoxic foundry sand used for the following require division review:
        - Structural fill
        - Mines/strip mine projects
        - Other uses
    - Civil engineering applications for the end use of scrap tires
    - Land application of solid wastes (covered under rule 1200-1-7-.13)
        - Food processing wastes: permit by rule at each facility
        - Land clearing/landscaping wastes: exempt from permit requirements
        - Manure: may require beneficial use determination for appropriate application rate
        - All other wastes: beneficial use determination required
- Written petitions for a beneficial use determination of other wastes are to be submitted for case-by-case determinations. Additionally, proposals are required for civil engineering applications for the end use of scrap tires.
- TCLP and totals analysis are required for foundry sands to demonstrate that they are nontoxic. For other wastes the TCLP is typically required for characterization.
- TCLP data and totals data for nontoxic foundry sands are compared to Table I of the policy/guidance document. Analytical data on other wastes are evaluated on a case-by-case basis.
    - TCLP limits for foundry sands are not always prohibitive if a strong case can be made for the beneficial use determination, as determined by the department.
- Notification forms are available for nontoxic foundry sand (uses requiring division review).

Pilot projects can also be approved for beneficial use determination; generally the department is flexible if a beneficial use can be demonstrated.

- In determining what characterization is necessary for a material Tennessee will check if other states have encountered similar material and the characterization required in those cases.

# Texas BU Profile

The Texas Commission on Environmental Quality regulates beneficial use of solid waste through the Texas Administrative Code (TAC) Title 30 (Environmental Quality) Part 1 (Texas Commission on Environmental Quality) Chapter 335 (Industrial Solid Waste and Municipal Hazardous Waste).

- 30 TAC 335.138(H) Exemption criteria from being considered a solid waste (eight waste criteria rule):
  - A legitimate market exists for the recycling material as well as its products
  - Recycling material is managed and protected from loss as will be raw materials or ingredients or products
  - Quality of the product is not degraded by substitution of raw material/product with the recycling material
  - Use of the recycling material is an ordinary use and it meets or exceeds the specifications of the product it is replacing without treatment or reclamation, or if the recycling material is not replacing a product, the recycling material is a legitimate ingredient in a production process and meets or exceeds raw material specifications without treatment or reclamation
  - Recycling material is not burned for energy recovery, used to produce a fuel, or contained in a fuel
  - Recycling material can be used as a product itself or to produce products as it is generated without treatment or reclamation
  - Recycling material must not present an increased risk to human health, the environment or waters of the state when applied to the land or used in products which are applied to the land and the material
- Generators, receivers, and recyclers of non-wastes may also be subject to Texas Water Code Section 26.121 and 30 TAC Section 335.4 (General Prohibitions)
- Generators of industrial waste which will be recycled are required to notify TCEQ via form TCEQ-0525 or electronically via the State of Texas Environmental Electronic Reporting System (STEERS); facilities which receive and recycle the industrial waste must submit notification via form TCEQ-0524. If the material is not a waste, no notification or permitting is required.

Review of Texas Regulations, Standards, and Practices Related to the Use of Coal Combustion Products (2005):

- The Texas Coal Ash Utilization Group (TCAUG) acts as a support network for CCP use in the state
- Texas has a 60-70% CCP utilization rate
- Authorized uses include:
  - Cement/concrete products
  - Flowable fill
  - Road base/subbase
  - Mineral filler in asphalt
  - Roofing shingles
  - Blasting grit
  - Grouting

    - Waste stabilization
    - Filler in plastics/paints/metals
    - Ingredient in product
    - Aggregate
    - Walking/driving surface
    - Bricks/ceramics/insulation
    - Artificial reefs
    - Well construction
- No tracking of CCP recycling/reuse is required

TCEQ Regulatory Guidance (RG-240) (2006):

- Recycling of nonhazardous industrial waste is generally only subject to 30 TAC 335.4 and 335.6
- Permits may be necessary only for storage of materials, even if they are a waste; the recycling activity itself does not require a permit
- The generator and recycler are responsible for properly determining a material is a waste

TCEQ Guidance for Projects Involving the Beneficial Use of Used or Scrap Tires (2008):

- Some scrap tire uses are regulated by TCEQ
    - "Land Reclamation Projects Using Tires"
- Projects are beneficial use if they meet the following criteria:
    - Activity which tires are used for is not regulated by TCEQ
    - Beneficial use is not limited to disposal of tires
    - Project does not present a potential fire hazard
    - Project does not represent a potential vector problem, or if it does, proper vector control measures have been incorporated into the operation of the project
    - Tires are managed in such a manner that they do not migrate from the project site
    - Project does not violate local regulations, ordinances, or requirements
    - Project does not violate State regulations or requirements
    - Project does not pose an actual or potential endangerment to public health and safety or to the environment
- Storage of tires is governed by 30 TAC Chapter 328, Subchapter F

Forms and notifications (required if the material is defined as a waste):

- Form TCEQ-0525, "Generator Notification Form for Recycling Hazardous or Industrial Waste"
- Form TCEQ-0524, "Notification Form for Receiving and Recycling Hazardous or Industrial Waste," notification is necessary 90 days prior to recycling operation commencement
- Forms are available on the TCEQ website

The TCEQ does not maintain a database on beneficial use activity

- Recycling/beneficial use activities are self-implementing
- Risk assessments are rarely or never conducted
- Initial characterizations of materials commonly consists only of generator knowledge
- If alarm is caused in a notification for a waste recycling activity TCEQ will request more information about the waste and its characteristics
- Otherwise written approval by TCEQ in not necessary

## Utah BU Profile

The Utah Department of Environmental Quality (UDEQ) governs industrial byproduct reuse via the Environmental Quality Code - Industrial Byproduct Reuse (Title 19, Chapter 6, Part 11, Sections 1101-1104).

- Industrial byproduct reuse is defined by Utah Code, Environmental Quality Code.
- Industrial byproduct means an industrial residual, including:
    - Inert construction debris
    - Fly ash
    - Bottom ash
    - Slag
    - Flue gas emission control residuals generated primarily from the combustion of coal or other fossil fuel
    - Residual from the extraction, beneficiation, and processing of an ore or mineral
    - Cement kiln dust
    - Contaminated soil extracted as a result of a corrective action subject to an operation plan under Part 1 of the Solid and Hazardous Waste Act.
- Reuse is defined as to use an industrial byproduct in place of a raw material.
- The beneficial use review process includes an assessment of whether the industrial byproduct meets the applicable health risk standard, satisfies the TCLP, and the proposed method of installation and type of reuse meet the applicable health risk standard.
- Analytical data are typically compared to health risk standards
- Once an application for industrial byproduct reuse is approved, the need for oversight on projects is determined on a case-by-case basis.

Based on information provided by UDEQ, there is one active beneficial use determination (industrial byproduct reuse) in the state, related to industrial byproduct reuse in road base.

## Vermont BU Profile

The Vermont Agency of Natural Resources governs beneficial use of solid waste, solid waste management rules, 11P-03 6-301 last revised March 2012. Procedures addressing acceptable use of solid wastes were published in July 2000. Beneficial or acceptable use is not explicitly defined in rules or statutes.

- Land application of sludge and septage wastes are not covered by the acceptable use procedures but could still be beneficially used. Additionally other beneficial uses which are exempted from acceptable use procedures are limited duration disposal activities (6-301(c)), exempted materials/activities (6-301(b)), composting activities (6-1103), reuse of material or product more than once, and solid waste which is recycled.
- Standing exemptions for specific materials when used under specific conditions are listed in the procedures; they are exempted from submittal of written requests for acceptable use of a solid waste, and are addressed via various agency procedures and guidelines.
    - Uncontaminated glass aggregate as a substitute for earthen material in roadway, utility trench, or drainage fill applications.
    - Shredded tires as a substitute for earthen material in roadway or drainage fill applications.
    - Petroleum contaminated soil in an asphalt batching process
    - Solid waste as acceptable daily cover at a certified landfill facility
    - Solid waste for purposes other than acceptable daily cover within a certified landfill facility, if approved by the agency (no guidelines or procedure)
    - Wood ash generated by the McNeill Electric Generation Plant
    - Any other solid waste which the Agency approves the use of through a procedure or guidance document
- The specific guidance documents related to these wastes provide additional guidelines; some beneficial use activities are subject to tracking whereas others are exempt.
- Case-by-case requests for acceptable use determination other than the wastes or uses granted standing exemptions should include one or more of the following:
    - A description of the proposed solid waste to be used, identification of the source of the waste, characteristics of the proposed waste (physical, chemical, and biological) and the quantities to be used.
    - Description of the proposed use of the waste, including an indication of where the material will be used, duration of use, a description of any manufacturing/processing process by which an end product is produced, and characteristics of the end product if an end product is to be marketed.
    - A demonstration that the proposed use will not adversely affect human health and safety and the environment, or create a nuisance, containing one or more of the following
        - A characterization plan
        - Historic analytical test data

        - Risk assessment and/or
        - Risk management plan
    - A management plan which addresses the management of the solid waste from its source through its use, including but not limited to storage of the waste prior to use, QA/QC, stormwater control, risk management, application rates, monitoring, and a contingency plan
    - If required by the agency financial assurance adequate to cover the costs associated with implementing the contingency plan
- Examples of materials approved on a case-by-case basis include
    - Spent sandblast media for incorporation into a winter sand pile
    - Dewatered anaerobic digester solids for land application as a soil amendment/fertilizer
    - Waste concrete and asphalt for road base material.
- The evaluation procedure for other wastes requiring a case-by-case determination is highly dependent on the material; a new or unfamiliar material may require detailed analysis, such as TCLP and totals analysis. If the VANR are familiar with the waste little or no requirements for analytical data may be required. If approved, the department may impose conditions of approval.

Vermont has 16 Active BUDs listed in the NEWMOA database (2011).

# Virginia BU Profile

The Virginia Administrative Code (VAC) provides information regarding beneficial use and has provisions that allow certain materials to be excluded from definition as a solid waste.

9 VAC 20-81-10 Definitions: "Beneficial use" means a use that is of benefit as a substitute for natural or commercial products and does not contribute to adverse effects on health or environment.

9 VAC 20-81-95 provides the definition of solid waste and associated exclusions. Materials that are not considered solid waste are:

- Materials generated from the growing and harvesting of agricultural crops, or the raising and husbanding of animals, including manures and bedding, which are returned to the soil as fertilizers.
- Mining overburden returned to mine site
- Recyclable materials used in a manner constituting disposal per 9 VAC 20-60-266
- Wood wastes burned for energy recovery
- Materials that are used or reused, or prepared for use and reuse, as an ingredient in an industrial process to make a product, or as effective substitutes for commercial products or natural resources provided the materials are not being reclaimed or accumulated speculatively
- Materials that are returned to the original process from which they are generated
- Materials that are beneficially used as determined by the department
- The following materials as long as they are managed so they do not create an open dump, hazard, or public nuisance
    - Clean wood and wood chips or bark from land clearing operations, utility line cleaing and maintenance operations, pulp and paper production and wood products manufacturing, when these materials are placed in commerce for service as mulch, landscaping, animal bedding, erosion control, habitat mitigation, wetlands restoration, or bulking agent at a compost facility operated in compliance with Part IV of the chapter
    - Clean wood combustion residues when used for pH adjustment in compost, liquid absorbent in compost, or as a soil amendment or fertilizer, provided the application rate of the wood ash is limited to the nutrient need of the crop grown on the land on which the wood combustion residues will be applied (2VAC5-400 and 2VAC5-410)
    - Compost that satisfies the applicable requirements of the Virginia Department of Agriculture and Consumer Services (2VAC5-400 and 2VAC5-410)
    - Nonhazardous, contaminated soil that has been excavated as part of a construction project and that is used as backfill for the same excavation or excavations containing similar contaminants at the same site, at concentrations at the same level or higher
    - Nonhazardous petroleum contaminated soil that has been treated to the satisfaction of the department in accordance with 9VAC20-81-660
    - Nonhazardous petroleum contaminated soil when incorporated into asphalt pavement products
    - Solid wastes that are approved in advance of the placement for use as alternate daily cover material or other protective materials for landfill liner or final cover system components
    - Fossil fuel combustion products when used as a material in the manufacturing of another product or as a substitute for a product or material resource
    - Tire chips and tire shred when used:

        - as sub base fill for road base materials or asphalt pavements
        - in the production of commercial products such as mats, pavement sealers, playground surfaces, brake pads, blasting mats, and other rubberized commercial products
        - as backfill in landfill gas or leachate collection pipes, recirculation lines, and drainage material in landfill liner and cover systems, and gas interception or remediation applications
        - when burned for energy recovery or when used in pyrolysis, gasification, or similar treatment process to produce fuel
    - Waste derived fuel product derived from nonhazardous solid waste (9 VAC 20-81-10)
    - Uncontaminated concrete and concrete products, asphalt pavement, brick, glass, soil, and rock placed in commerce for service as a substitute for conventional aggregate
    - Clean, ground gypsum wallboard when used as a soil amendment or fertilizer, provided:
        - No components of the gypsum wallboard have been glued, painted, or otherwise contaminated from manufacture or use
        - The gypsum wallboard shall be processed so that 95% of the gypsum wallboard is less than 1/4 inch by 1/4 inch in size
        - The gypsum wallboard shall be applied only to agricultural, silvicultural, landscaped, or mined lands or roadway construction sites that need fertilization
    - Using rocks, brick, block, dirt, broken concrete, crushed glass, porcelain, and road pavement as clean fill.
    - Using fossil fuel combustion products in one or more of the following applications
        - As a base, sub-base or fill material under a paved road
        - footprint of a structure paved parking lot, sidewalk,
        - walkway or similar structure
        - in the embankment of a road
        - Processed with a cementitious binder to produce a stabilized structural fill product that is spread and compacted
    - wastes associated with the exploration, development, or production of crude oil, natural gas, or geothermal energy
    - waste from the extraction, beneficiation, and processing of ores and minerals, including coal
    - Fossil fuel combustion products used for mine reclamation
    - Waste or byproduct derived from an industrial process that meets the definition of fertilizer, soil amendment, soil conditioner whose intended purpose is to neutralize soil acidity(3.2-3600 of the Code of Virginia)
    - Fossil fuel combustion products bottom ash or boiler slag used as a traction control material or road surface material
    - Paper and paper products
    - Cloth
    - Clean wood waste that is to undergo size reduction in order to produce a saleable product
    - Glass
    - Plastics
    - Tire chips, tire shred, and ground rubber

The products identified in VAC 20-81-95 exempt from solid waste are pre-approved beneficial uses

    - May require comfort letter from the department

9 VAC 20-81-97 Beneficial Use Demonstrations

- Any wastes or uses not identified may request a beneficial use determination
- Managed on a case-by-case basis
- A description of the waste and its proposed use, the chemical and physical characteristics, a demonstration that there is a known or reasonable market available, and a demonstration that the waste will not adversely affect human health and safety and the environment are required by the department.
- Risk assessment is dependent on the type of waste and intended use—there is no specific protocol

Virginia has 48 active BUDs based on information provided by the Virginia Department of Environmental Quality.

## Washington BU Profile

Washington state rules (WAC 173-350) allow for solid waste permit exemptions for beneficial use activities and define beneficial use as the "use of a solid waste as an ingredient in a manufacturing process, or as an effective substitute for natural or commercial products, in a manner that does not pose a threat to human health or the environment. Avoidance of processing or disposal cost alone does not constitute beneficial use." (WAC 173-350-100).

- The Beneficial Use Permit Exemption rule (WAC 173-350-200) states that an application must be prepared and submitted to obtain a statewide permit exemption – the application is reviewed by the Washington State Department of Ecology as well as 32 jurisdictional health departments throughout the state.
- Applications for a beneficial use exemption are valid only for the original applicant (i.e., the approval of a given beneficial use for a given waste does not permit another generator with a similar waste the same exemption – that other generator would have to submit the appropriate application independently).
- Per discussions with Washington Department of Ecology personnel, there are cases where materials can be recycled as part of a manufacturing process (e.g., as an aggregate use) that would not require to go through the beneficial use permit exemption procedure, as this is an example of a case where a material is recycled and therefore a facility that takes in the material and operates in accordance with the recycling provisions of WAC 173-350-210 is not subject to the state's solid waste permitting requirements.

The Washington statutes allow generators of waste materials that may have agronomic value that wish to land apply their waste to register the material as part of a commercial fertilizer through the Washington Department of Agriculture. WAC 173-200-7062 through 7064 list the testing requirements and constituent target levels that must be met for commercial fertilizers, shown below, noting that the following equation is used to calculate the maximum nutrient or metal content for a given commercial fertilizer:

$$\frac{(\text{Pounds of Product Applied Per Year} \times \text{Metal Content of Product (ppm)}}{1{,}000{,}000}$$

**State of Washington Metals and Nutrient Application Rates (WAC 173-200-7062)**

| Nutrient | 4 Year Cumulative Total (lbs./acre) |
|---|---|
| Nitrogen (N) | 1,600 |
| Phosphorus (as P2O5) | 700 |
| Potassium (as K2O) | 1,600 |
| Boron (B) | 12 |
| Calcium (Ca) | 800 |
| Chlorine (Cl) | 300 |
| Copper (Cu) | 10 |
| Iron (Fe) | 80 |
| Magnesium (Mg) | 400 |
| Manganese (Mn) | 40 |

| **Nutrient** | **4 Year Cumulative Total (lbs./acre)** |
|---|---|
| Molybdenum (Mo) | 4 |
| Sulfur (S) | 400 |
| Zinc (Zn) | 30 |
| Lime (CaCO3 equivalent) | 20,000 |
| Gypsum (CaSO4) | 16,000 |

Washington also developed maximum annual metals land application rates for commercial fertilizers, as shown in the table below.

Summary of Maximum Annual Metal rates for land-applied commercial fertilizers

| **Metals** | **Lbs./acre/yr.** |
|---|---|
| Arsenic (As) | 0.297 |
| Cadmium (Cd) | 0.079 |
| Cobalt (Co) | 0.594 |
| Mercury (Hg) | 0.019 |
| Molybdenum (Mo) | 0.079 |
| Nickel (Ni) | 0.713 |
| Lead (Pb) | 1.981 |
| Selenium (Se) | 0.055 |
| Zinc (Zn) | 7.329 |

Note that if cobalt, molybdenum, and zinc are claimed as plant nutrients in the fertilizer, then limits higher than those shown in the table may be permitted.

A total of six BUD exemptions were listed in the Department of Ecology’s webpage, which included the following:

- Mint waste (soil amendment)
- Dried waste activated sludge (soil amendment)
- Sludge from food processing wastewater treatment lagoons (soil amendment)
- Silage (soil amendment)
- Agricultural wastes including wheat straw, chicken manure,canola meal, cotton seed meal combined with commercial urea and gypsum (combined and composted to make mushroom substrate)
- Dried waste activated sludge (soil amendment)

## West Virginia BU Profile

West Virginia Department of Environmental Protection (WVDEP) regulates the beneficial use of various products, which is defined by Title 33 Solid Waste Management Rules.

- Series 1, 5.5.b.4: The following uses of coal combustion by-products are deemed to be beneficial and do not require a permit under this rule:
    - As a material in manufacturing another product (e.g., concrete, flowable fill, lightweight aggregate, concrete block, roofing materials, plastics, paint) or as a substitute for a product or natural resource (e.g., blasting grit, filter cloth precoat for sludge dewatering)
    - For extraction or recovery of materials and compounds contained within the CCPs
    - Used as a stabilization/solidification agent for other wastes; it will be considered beneficial use if used singly or in combination with other additives or agents to stabilize or solidify another waste product and if:
        - Person or entity proposing the use has first given advance written notice to the Secretary
        - The use results in altered physical or chemical characteristics of the other waste and a reduction of the potential for the resulting stabilized mixture to leach constituents into the environment
    - Used under the authority of the Abandoned Mine Lands and Reclamation Act (W. Va. Code 22-2-1, et seq.) and the Surface Coal Mining and Reclamation Act (W. Va. Code 22-3-1, et seq.)
    - Used as pipe bedding or as a composite liner drainage layer
    - Used as a daily or intermediate cover for Class A, Class B, or Class C solid waste facilities, if the specific permit allows for such use
    - Coal combustion bottom ash or boiler slag used as an anti-skid material, if such use is consistent with West Virginia Division of Highways specifications. The use of fly ash as an anti-skid material is not deemed to be a beneficial use
    - Used as a construction material (e.g., subbases, bases) for roads or parking lots that have asphalt or concrete wearing surfaces, if approved by the West Virginia Division of Highways or the project owner

- Series 8, Standards for Beneficial Use of Materials Similar to Sewage Sludge
    - Does not apply to:
        - Sewage sludge, products derived from sewage sludge, or materials regulated as hazardous waste
    - 2.4: "Beneficial Use" means the use of a non-hazardous material for a specific beneficial purpose where it is done in a manner that protects groundwater and surface water quality, soil quality, air quality, human health, and the environment. This may include use as a fertilizer substitute or other purpose approved by the Secretary.
    - 3. Standards for Beneficial Use of Sludge or Other Approved Materials:

- Beneficial use determination- materials determined by the Secretary to have beneficial characteristics similar to sewage sludge may be beneficially used in a manner approved by the Secretary in accordance with this rule
- Secretary shall make a determination based, at a minimum on:
  - Analysis of material or other information demonstrating its beneficial use characteristics, an evaluation of the sources contributing to the waste stream from which the material originates, an evaluation of the pollutant levels contained in the material, and an evaluation of the potential impact to human health and the environment from the proposed method of use.
- Land application Location Standards and Restrictions
  - Enumerates prohibitive conditions
  - e.g., within 50 ft of a highway, frozen, snow covered, or regularly flooded land
- Permits required
  - No person may land apply without obtaining a land application permit
  - Other permits for beneficial use shall be subject to permit issuance, modification, reissuance, suspension, and revocation procedures of sections 6 through 7 of this rule
- Permit Application requirements
  - Name, address, and location of generating facility
  - Description of the activities conducted or to be conducted
  - Operator and owner contact information
  - Other environmental permits issued
  - A description of the following:
    - Specific source(s) of sludge or other material
    - Process used to generate the sludge or other material including, but not limited to, raw materials used, contributing waste streams, and other by-products produced
    - The amount of sludge or other material generated, processed, or proposed for beneficial use
    - Beneficial characteristics of the sludge or other material
    - Current method of disposal or use for sludge or other material
    - Physical characteristics
      - Moisture content
      - Odor
      - Particle size
      - Appearance
    - Contents of heavy metals, pathogens, and other pollutants
    - Hazardous waste determination

        - Method used to collect or control leachate and surface water runoff from any storage areas
        - Existing and potential land-use of the area within 1 mile of the facility
        - For land application
            - Soil analysis including all metals in Table 1
            - Nutrient content information
            - Description of soil types present on the site
            - Agreement between generator and owner of land application site
            - Description of existing and future uses of the land application site
            - Information relative to past application to each land application site
            - Additional chemical analysis data requested by the Secretary
            - Description of
                - Methods for land application
                - Methods for transport
                - Pathogen and vector control methods
                - Methods to inhibit metal mobility
                - Crop and it's use to be grown on the site
            - Copy of NPDES permits
            - Determination on site location (i.e., wetlands or wellhead or source water protection area)
    - Public Notice is required for draft permits
    - Appendix A- Frequency of Monitoring
        - <290 tons/yr: once/6 months
        - ≥290, <1,500 tons/yr: 4x/year
        - ≥1,500, <15,000 tons/yr: once/month
        - ≥15,000 tons/yr: weekly
    - Appendix B- Permit Application Fees
        - New permit: $5,000
        - Permit reissuance: $1,000
        - Minor Permit Modification: $100
        - Other Permit Modification: $500

The West Virginia Permit Handbook published Section 18- Utilization of Coal Ash, Tires, Sludge, and Other Items (1998)

- Coal combustion products (1998)

  - For pre-approved uses written notification 30 days in advance is sufficient to meet application requirements, notification should include
    - Description of use
    - Start and completion dates
    - A map showing the areas where reuse will occur
    - Details of proposed mix components and proportions
    - Estimated quantity of CCPs to be used
- Tires
  - Controlled by the Office of Waste Management
  - No permit is required for placement of waste tires at mining facilities with permits so long as the following conditions are satisfied:
    - “Waste tires” shall mean off road mining equipment tires generated at the permitted mining operation.
    - Surface mining permit must be revised to reflect waste tire disposal
    - Waste tires must be generated by the permitted operation.
    - Waste tires may not be placed in the 100 year flood plain, wetlands, or within 100 ft of a surface drainage channel or within the limits of proposed valley fills.
    - Waste tires must be placed in a single layer, under a sufficient depth of overburden in a manner that will assure that the waste tires do not emerge, create a potential for fire, or provide harborage for disease-carrying vectors. Media where waste tires are disposed shall have a minimum pH of 5.0, depth of cover >20 ft in all directions. Waste tires shall be placed on solid ground and covered to ensure long term stability, prevent surface subsidence, and ponding of surface water.
    - Monthly reports shall be maintained detailing the number, origin, and size of all waste tires on the site. A site map with locations of waste tire disposal shall record a deed notation.
- Municipal waste sewage sludge as a soil amendment on mined lands (1993)
  - Requirements
    - A permit revision from the Division of Mining and Reclamation
    - Generator must have a valid permit from the Office of Water Resources
  - Procedures
    - Submittal of forms prescribed by the Secretary,
    - Submit 5 copies of the revision proposal
    - A map showing all original permit area and the area proposed for sludge disposal/use- signed by an inspector, if they recommend approval
    - Submit a cover letter describing the type and purpose of the proposed revision
    - Include a copy of the approval issued by the Office of Water Resources for the land application project
    - Include sewage sludge application rate as approved by the Office of Water Resources and copies of all analyses of the sewage sludge
    - WVDEP regional permit supervisor will approve

Spent Foundry Sand Beneficial Use Guidelines published by WVDEP (2000)

- No permit is required from WVDEP if spent foundry sand is used in accordance with the following guidelines:
- A plan approval is required from WVDEP
- Sampling and analysis is required
  - A representative sample of the waste shall be obtained by forming a composite of 6 to 12 discrete samples
  - TCLP, a modified TCLP extraction (ASTM D 3987-85), or other EPA approved hazardous waste toxicity measurement; includes the following parameters
    - RCRA 8 metals
    - Phenols
    - Cyanide
    - Fluoride
  - Total metals testing and analysis (US EPA method SW-846-6010), includes:
    - Copper
    - Molybdenum
    - Nickel
    - Zinc
  - At least 3 initial test results must show nontoxic criteria (3 distinct composite samples) or if a larger database is available (e.g., monthly analysis from 12 months) an upper confidence limit of 80% can be used
  - At a minimum, annual tests must be performed and stored for at least 5 years to be available to MVDEP upon request; whenever the production process changes an analysis should be conducted
- Ceiling Analytical Thresholds are listed in Tables 1 (extraction fluid limits) and 2 (total metals limits)
- If analytical data is acceptable and below the ceiling concentrations the following uses are pre-approved
  - Manufacture of another product
  - Stablization/solidification of other wastes (for disposal purposes)
  - Anti-skid agent/road surface preparation material
  - Daily cover for landfills
  - Protective cover for landfill leachate collection system
  - Structural fill
  - Pipe bedding
  - Roads and Parking lots, capped embankment, ground and site barriers
- General requirements
  - Storage, maintenance, and run-off control
  - Isolation distances
  - Use Restrictions

- A proposal form for spent foundry sand beneficial use is included as Attachment 1 of the guideline.

# Wisconsin BU Profile

Chapter NR 538 of the Wisconsin Administrative Code regulates the beneficial use of industrial byproducts. The Wisconsin Department of Natural Resources is the regulatory authority related to solid waste and beneficial use issues.

"Beneficial use" or "beneficial reuse" means the utilization of a solid waste or an industrial by-product in a productive manner (NR 500.03)

Byproduct Characterization requirements (NR 538.06-.08)

- Industrial byproducts to be beneficially used must be characterized to determine their appropriate categories. Industrial byproducts characterized to determine eligibility for categories
    - **Category 1**—Industrial byproducts that have been determined to contain less than the concentration specified for the parameters listed in Tables 1A and 1B
    - **Category 2**— Industrial byproducts that have been determined to contain less than the concentration specified for the parameters listed in Tables 2A and 2B and are not category 1 products. Total elemental analysis for industrial byproducts not listed in Table 2B shall also include aluminum, antimony, barium, boron, cadmium, hexavalent chromium, cobalt, copper, lead, mercury, molybdenum, nickel, phenol, selenium, silver, strontium, thallium, vanadium and zinc.
    - **Category 3**— Industrial byproducts that have been determined to contain less than the concentration specified for the parameters listed in Table 2A and are not category 1 or 2 products. Coal ashes are category 3 industrial byproducts if the concentration of boron is less than 3.4 mg/l and the concentration of all other parameters are less than those listed in Tables 2A
    - **Category 4**— Industrial byproducts that have been determined to contain less than the concentration specified for the parameters listed in Table 3 and are not category 1 through 3 products
    - **Category 5** –Industrial byproducts that have been determined not to be a hazardous waste and are not category 1 to 4 products

- Industrial byproducts to be classified under Categories 1 to 4 shall be analyzed using water leach test (ASTM D3987-85)
- Industrial byproducts to be classified under Categories 1 and 2 shall be analyzed using a total elemental analysis
- There are case specific characterizations done by the department, where the department may review the characterization results for an industrial byproduct in response to a request from the generator and assign categories for the material or conditionally approve a beneficial use.
    - The turnaround time is approximately 10 days for an approval, denial, or request for more information

- A representative sample of each industrial byproduct shall be recharacterized in the same manner as specified for the initial characterization:
    - Category 1—once each year (not required when less than 1,000 cubic yards used or stored for beneficial use in the year)
    - Category 2—once every 2 years (not required when less than 2,000 cubic yards used or stored for beneficial use in the 2 year period)
    - Category 3—once every 3 years (not required when less than 3,000 cubic yards used or stored for beneficial use in the3 year period)
    - Category 4—once every 5 years (not required when less than 5,000 cubic yards used or stored for beneficial use in the5 year period)

Uses Exempt from Regulation (NR 538.10)

1) Raw materials for manufacturing of a product in which the measurable leaching, emissions or decomposition characteristics of the industrial byproduct are substantially eliminated. Products that would meet these criteria include cement, lightweight aggregate, structural or ornamental concrete or ceramic materials, Portland cement concrete pavement, asphaltic concrete pavement, roofing materials, plastics, paint, fiberglass, mineral wool, wallboard, and plaster.
2) Agents for physical or chemical stabilization, solidification or other treatment of solid waste that is to be used at a lined landfill having a leachate collection system
3) Supplemental fuels that provide energy through controlled burning.
4) Daily cover or internal structures at lined landfills having a leachate collection system. Byproducts used as landfill daily cover may contain no more than 15% of silt and clay sized materials and may not be placed in layers greater than 6 inches thick
5) Confined geotechnical fill material in accordance with the project criteria and uses specified. Written notification to the department is necessary for projects using more than 5,000 cubic yards. Concurrence is granted if the department does not respond within 10 days. Uses include:
    a) Base course, subbase or subgrade fill for the construction of commercial, industrial or non–residential institutional buildings—placement no more than 4 feet beyond edge of concrete slab or frostwalls of building, specifically prohibited in the construction of residential buildings
    b) Base course, subbase or subgrade fill for the construction of a portland cement concrete or asphaltic concrete paved lot—may not extend more than 4 feet beyond paved area, fill may not exceed 3,000 cubic yards per half acre of project area, the depth of fill may not exceed 4 feet below the natural ground surface, prohibited in residential areas
    c) Base course, subbase or subgrade fill for the construction of a paved federal, state or municipal roadway—may not extend beyond the subgrade shoulder point and the depth of the fill may not exceed 4 feet except for incidental sections of the fill. Fills greater than 4 feet in depth using category 4 materials follow the design criteria in subsection 6; fills using category 3 or less materials follow the design criteria in subsection 7. Use is prohibited in residential areas unless roadway is designed with rural cross-section.

    d) Utility trench backfill – part of backfill of a trench constructed for the placement of sanitary or storm sewer, non-potable water line, gas main, telecommunications, electrical, or other utility lines shall be beneath a paved roadway, parking lot, or other Portland cement or asphaltic concrete paved structure. Industrial byproducts may not extend more than 4 feet beyond pavement structure.
    e) Bridge abutment backfill – Industrial byproducts places as part of bridge abutment backfill shall be covered by a roadway structure. Prohibited in residential areas unless in a roadway designed with a rural type cross-section.
    f) Abandonment of tanks, vaults or tunnels that will provide total encapsulation of the industrial byproduct—does not include placement of industrial byproduct in a location where environmental pollution has been identified unless approved by department.
    g) Slabjacking material – industrial byproducts used as a component in slabjacking material in combination with Portland cement, lime, or bentonite shall be placed beneath Portland cement concrete paves structures to raise areas that have settled. Using more than 2 cubic yards is prohibited in residential areas.
    h) Soil and pavement stabilization – as listed in a to c, shall be used in accordance with ASTM C616-03 or the Wisconsin DOT specifications for highway and structure construction.
    i) Controlled low strength material (flowable fill) – Industrial byproducts incorporated into low strength material (listed in parts a,d,e,f) shall be used in accordance with ACI 229R-99 or the Wisconsin DOT specifications for highway and structure construction, or other good engineering practices acceptable to the department.

6) Fully encapsulated transportation facility embankments constructed under the authority of the Wisconsin department of transportation, or a municipality. Examples include linear roadway sound and sight barrier berm embankments, airport embankments and roadway bridge or overpass embankments. For projects using more than 100,000 cubic yards of industrial byproducts, or with a maximum thickness of industrial byproduct greater than 20 feet, department concurrence shall be obtained prior to initiating the project. These embankments shall be constructed, documented and monitored as outlined in NR 538.10(6)
7) Clay capped and sidewalled transportation facility embankments constructed under the authority of the Wisconsin DOT, or a municipality, that meet the criteria of NR 538.10(7) including:
    - Linear roadway sound and sight barrier embankments
    - Roadway bridge or overpass embankments

   For projects using more than 100,000 cubic yards of industrial byproducts, or with a maximum thickness of industrial byproduct greater than 20 feet, department concurrence shall be obtained prior to initiating the project.
8) Unconfined geotechnical fill material used as fill material for sight, sound and structural berms, reclamation of nonmetallic mines, public recreational trails, construction of sporting venues, limited use parking areas, access lanes, utility trenches or other beneficial uses demonstrated to be acceptable by the department. Prior written notification in accordance with s. NR 538.14 (4)

and concurrence by the department are needed for all unconfined geotechnical fills, based on site conditions and good engineering practice. Concurrence is considered granted if the department does not respond within 10 days. It is prohibited in residential areas.

9) Unbonded surface course material used in accordance with the criteria of NR 538.10(9). This includes the use of industrial byproducts as a surface course material in unpaved driveways, parking areas and recreation or exercise trails. Industrial byproducts used as surface course shall conform to the requirements of Wisconsin DOT standard specifications for highway and structure construction applicable to base materials, and may be placed at a cumulative thickness of 6 inches or less and in areas separated by at least a 25 foot vegetated buffer to a navigable surface water. Concurrence is considered granted if the department does not respond within 10 days. It is prohibited in residential areas.
10) Bonded surface course material used in accordance with the criteria of this subsection. This use includes placement of industrial byproducts as a bonded surface course material such as seal coats in roads, driveways, parking areas and recreational or exercise trails. If more than 10,000 cubic yards of industrial byproducts are to be used in an individual bonded surface course application, prior written notification. Concurrence is considered granted if the department does not respond within 10 days.
11) Bonded surface course material – this use includes placement of industrial byproducts as a bonded surface course material such as seal coats in paved federal, state or municipal roadways specified in sub. (5) (c). If more than 10,000 cubic yards of industrial byproducts are to be used in an individual bonded surface course application, prior written notification. Concurrence is considered granted if the department does not respond within 10 days. The use of industrial byproducts as seal coats is prohibited in residential areas, unless used in a roadway designed with a rural type cross−section.
12) Decorative stone applications using industrial byproducts – shall conform to Wisconsin DOT specifications for highway and structure construction applicable to base aggregates.
13) Winter weather road abrasive on roadways with a rural cross−section, including areas with incidental sections of curb and gutter – the winter road abrasives using industrial byproducts, wholly or as part of a mixture of abrasives, shall meet Wisconsin department of transportation gradation and application rate recommendations for winter highway maintenance contained in the state highway maintenance manual.

Persons who beneficially use category 1 to 5 industrial byproducts in accordance with section NR 538.12 for the uses identified are exempt from licensing

Land application beneficial use rules are found in Chapter NR 518

- Must show that the use must demonstrate there is no harm to the environment and that the use improves soil condition
- The material needs a license from the agriculture department, which regulates fertilizer
- Use is dependent on different analytical and the effects on the crop

The development of the Category 1, 2 and 3 leaching levels criteria was done in comparison to the NR Chapter 140 Groundwater Standards

- These were developed in 1997
- Category 4 standards based on 5 times the enforce health parameters and 10 times the enforced welfare parameters
- Category 1 was based on the preventative action levels (lower number)
- Categories 2 and 3 show a dilution factor of 10, from the original 140 standards (they have since been updated, however the leaching criteria have not)

Wastes exempt from permitting simply submit annual report stating volume of material used and a general description of the use

Out-of-state wastes that are beneficially used in the state include those from Illinois, Indiana, Michigan, Minnesota, and South Dakota

Form 4400-197 represents the Beneficial Use of Industrial Byproducts Initial Certification, and form 4400-198 represents the Beneficial Use of Industrial Byproducts Annual Certification

Wisconsin has 6 active BUDs as reported in the NEWMOA Beneficial Use Database as of 2011.

# Wyoming BU Profile

The Wyoming Department of Environmental Quality regulates the beneficial use of solid waste.

Solid Waste Rules: Chapter 1, General Provisions, (l)(xxi)

- Beneficial use is defined indirectly by rule based on an examination of exemptions from regulation as a solid waste:
    - (l) Exemptions: The administrator may exempt the following from a permit or any requirement to obtain a waste management authorization under these regulations, provided that persons engaged in activities which are otherwise exempted may be required to supply information to the administrator which demonstrates that the act, practice, or facility is exempt, and shall allow entry of department inspectors for purposes of verification of such information: (xxi) "The reuse of wastes in a manner which is both beneficial and protective of human health and the environment, as approved by the administrator."

Some examples of case-by-case approvals include:

- Tires as lightweight fill material
- Ferrous granules fixed in cement
- Calcium chloride sludge in cement

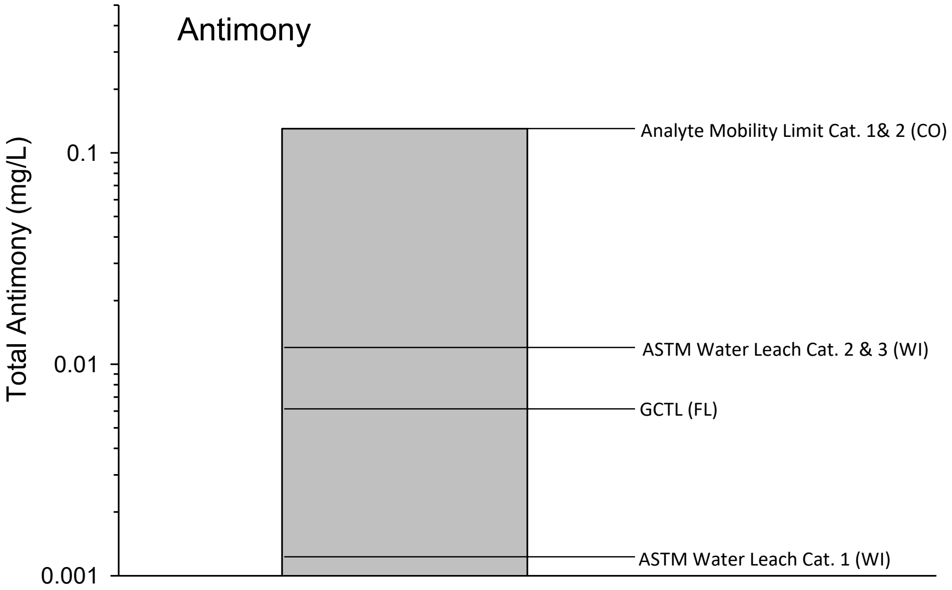
The review process is conducted by the Wyoming Department of Environmental Quality and generally consists of the following:

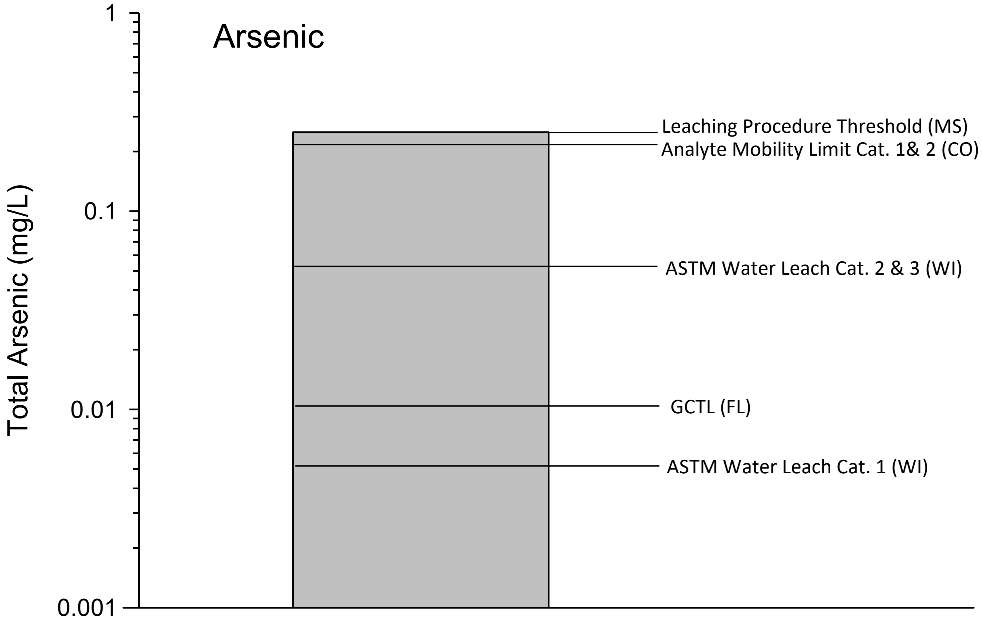
- Depending on the material and the use, the department can require material to be contained/encapsulated (such as fixed in concrete) or include other stipulations.
- Total composition analysis of the material is required.
- Material analysis information are compared to the limits in the Voluntary Remediation Program (VRP) soil cleanup levels fact Sheets #12 which are based on direct contact with material and the potential for contamination to migrate to groundwater, Wyoming utilizes the migration to groundwater risk-based screening levels.

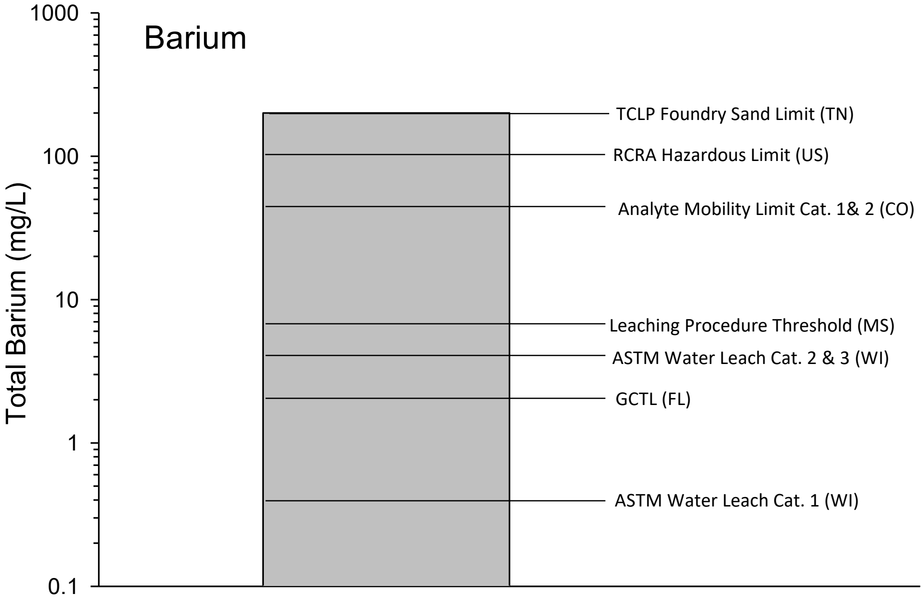
Feedback from the Wyoming Department of Environmental Quality indicates that new regulations regarding beneficial use may be developed or drafted by mid-2013. Though the proposed regulations have not been drafted, different considerations (such as evaluating leaching data) may be included. The state is also developing a guidance document to assist generators in determining how to apply for a beneficial use determination.

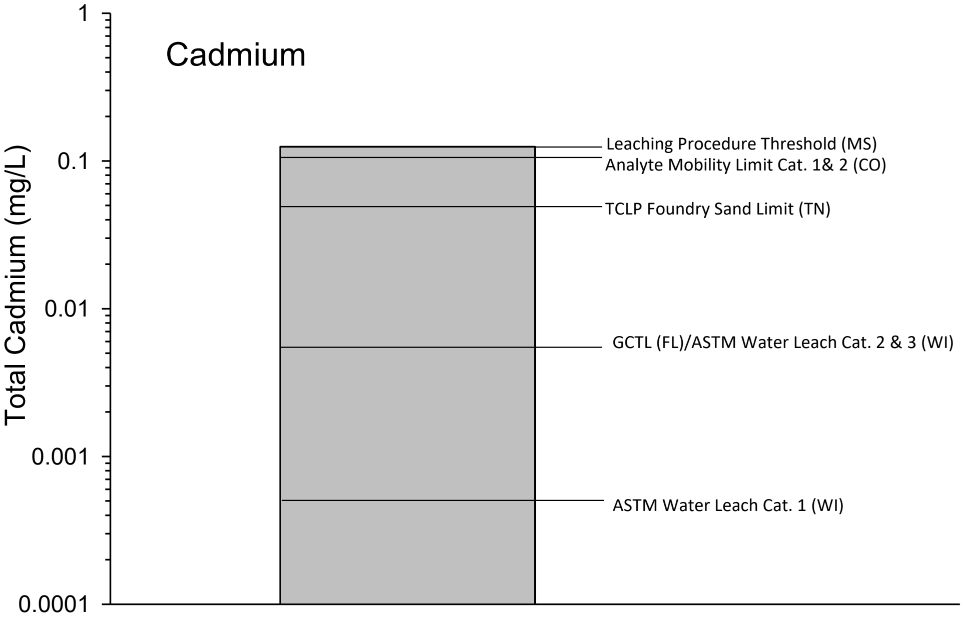
## Appendix C. Comparison of Leaching Limits for Inorganic Parameters Between Several U.S. States

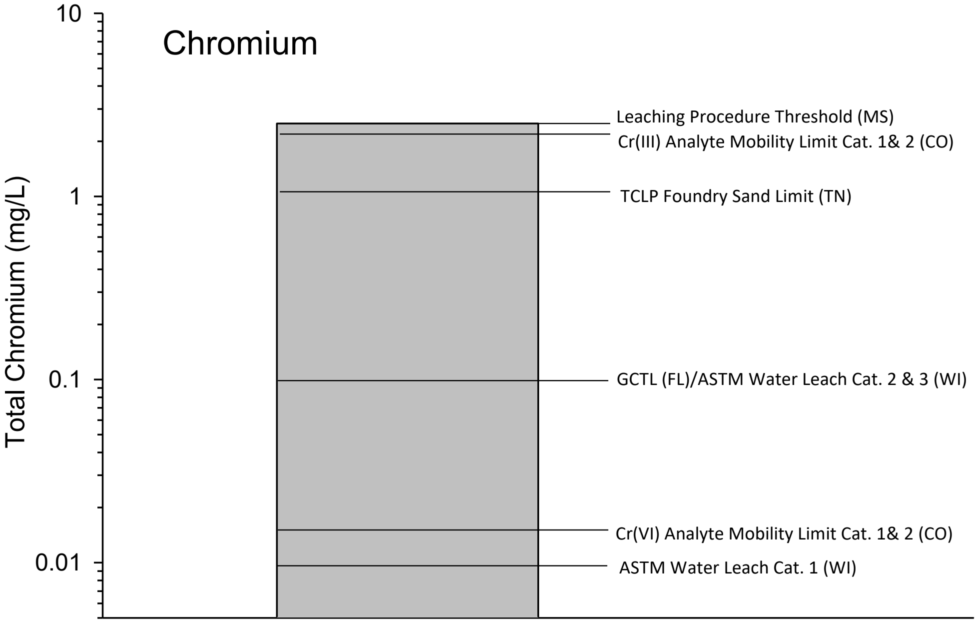
Abbreviations/Acronyms/Initialisms used: Cat. (Category), ASTM (American Society for Testing and Materials), GCTL (Groundwater Cleanup Target Level), TCLP (Toxicity Characteristic Leaching Procedure), RCRA (Resource Conservation and Recovery Act). The differences in limits shown may be a function or a reflection of various factors, and the intent of the data presentation is to simply demonstrate that chemical limits from leaching tests may vary from one state to another.

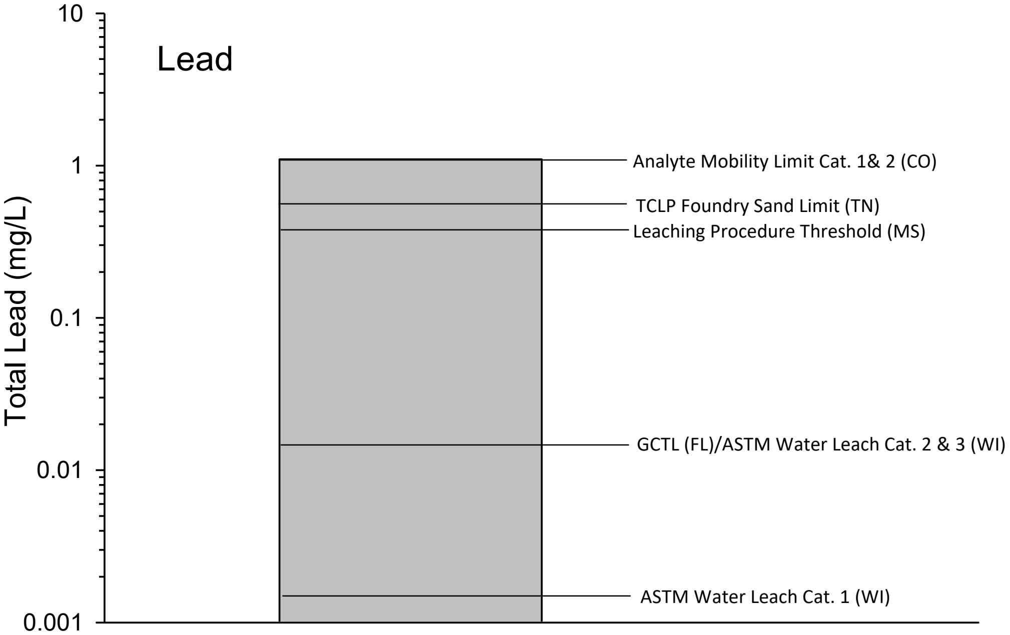


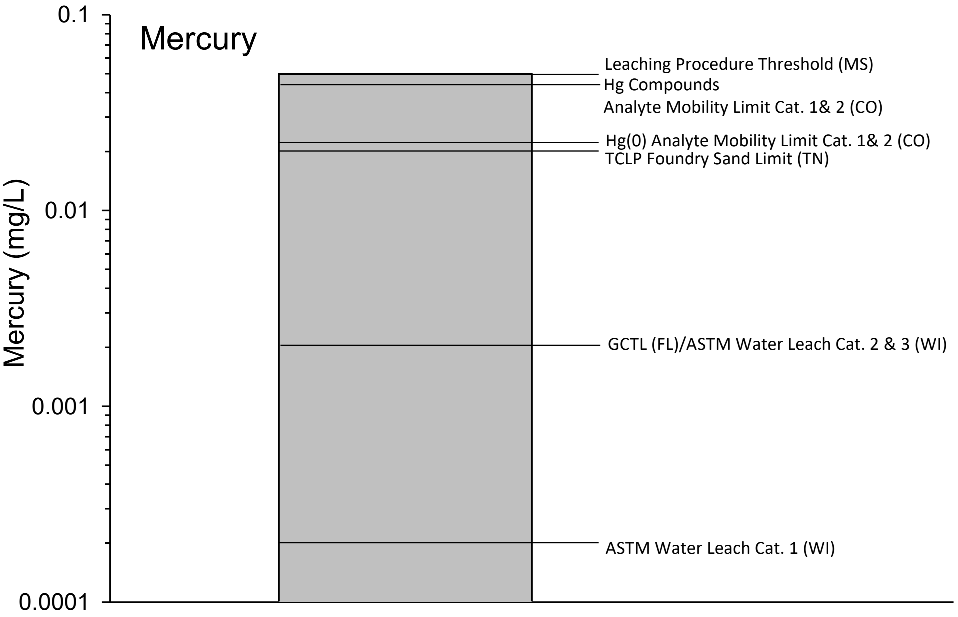


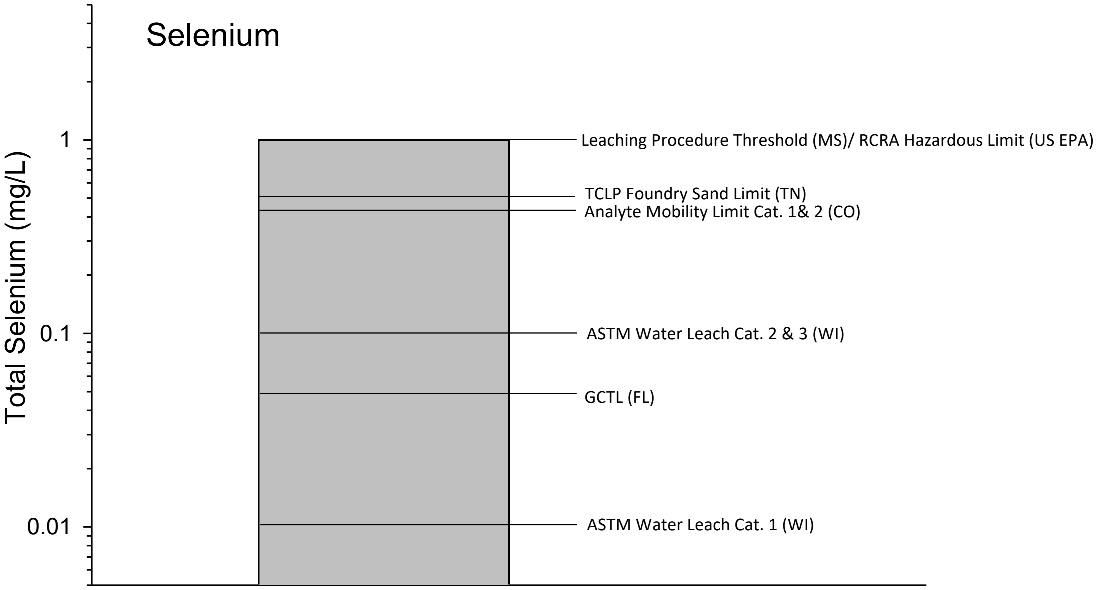

Barium
Total Barium (mg/L)
1000
100
10
1
0.1
TCLP Foundry Sand Limit (TN)
RCRA Hazardous Limit (US)
Analyte Mobility Limit Cat. 1& 2 (CO)
Leaching Procedure Threshold (MS)
ASTM Water Leach Cat. 2 & 3 (WI)
GCTL (FL)
ASTM Water Leach Cat. 1 (WI)

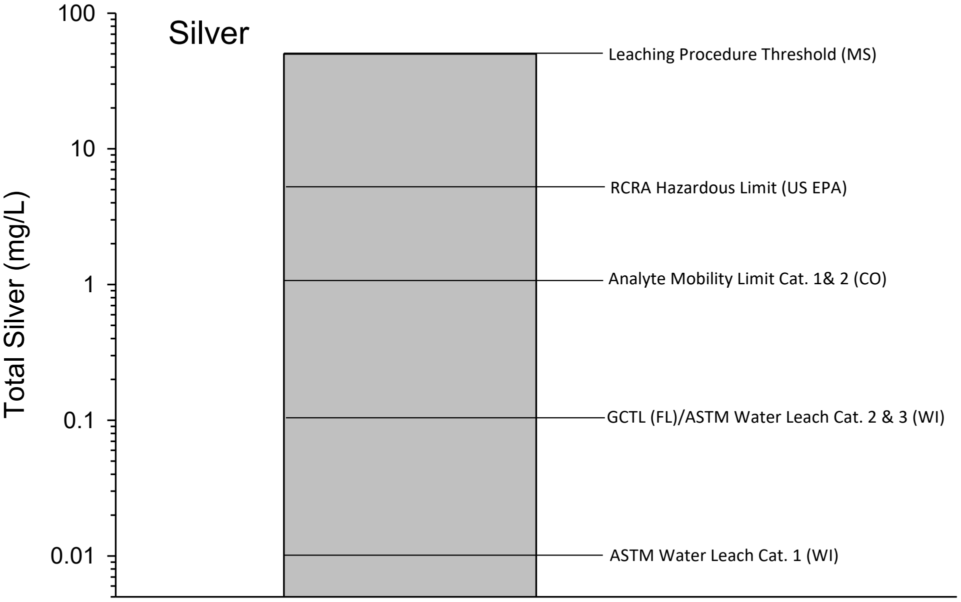

Cadmium
Total Cadmium (mg/L)
1
0.1
0.01
0.001
0.0001
Leaching Procedure Threshold (MS)
Analyte Mobility Limit Cat. 1& 2 (CO)
TCLP Foundry Sand Limit (TN)
GCTL (FL)/ASTM Water Leach Cat. 2 & 3 (WI)
ASTM Water Leach Cat. 1 (WI)

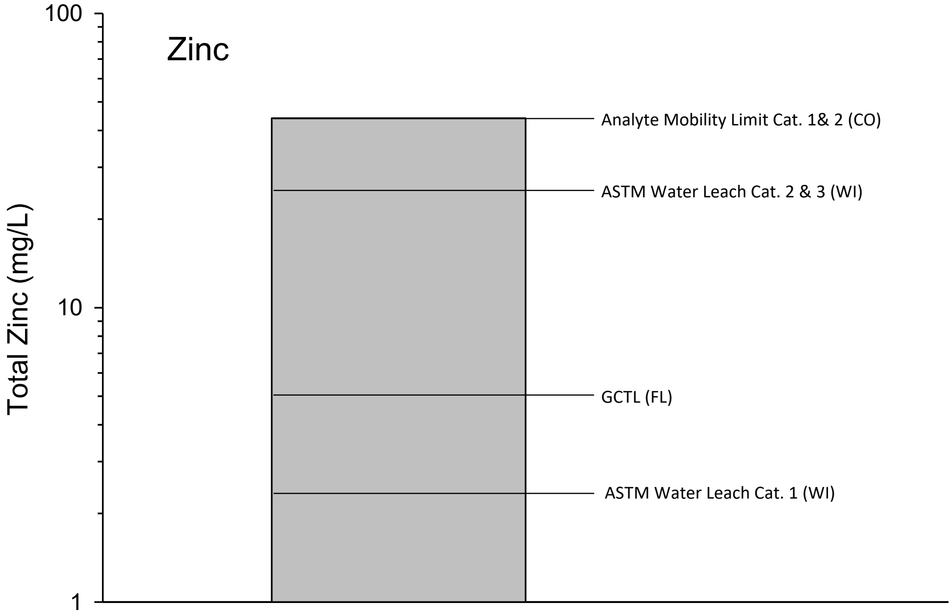

Chromium
Total Chromium (mg/L)
10
1
0.1
0.01
Leaching Procedure Threshold (MS)
Cr(III) Analyte Mobility Limit Cat. 1& 2 (CO)
TCLP Foundry Sand Limit (TN)
GCTL (FL)/ASTM Water Leach Cat. 2 & 3 (WI)
Cr(VI) Analyte Mobility Limit Cat. 1& 2 (CO)
ASTM Water Leach Cat. 1 (WI)


Lead
Total Lead (mg/L)
10
1
0.1
0.01
0.001
Analyte Mobility Limit Cat. 1& 2 (CO)
TCLP Foundry Sand Limit (TN)
Leaching Procedure Threshold (MS)
GCTL (FL)/ASTM Water Leach Cat. 2 & 3 (WI)
ASTM Water Leach Cat. 1 (WI)


Mercury
Mercury (mg/L)
0.1
0.01
0.001
0.0001
Leaching Procedure Threshold (MS)
Hg Compounds
Analyte Mobility Limit Cat. 1& 2 (CO)
Hg(0) Analyte Mobility Limit Cat. 1& 2 (CO)
TCLP Foundry Sand Limit (TN)
GCTL (FL)/ASTM Water Leach Cat. 2 & 3 (WI)
ASTM Water Leach Cat. 1 (WI)


Selenium
Total Selenium (mg/L)
1
0.1
0.01
Leaching Procedure Threshold (MS)/ RCRA Hazardous Limit (US EPA)
TCLP Foundry Sand Limit (TN)
Analyte Mobility Limit Cat. 1& 2 (CO)
ASTM Water Leach Cat. 2 & 3 (WI)
GCTL (FL)
ASTM Water Leach Cat. 1 (WI)

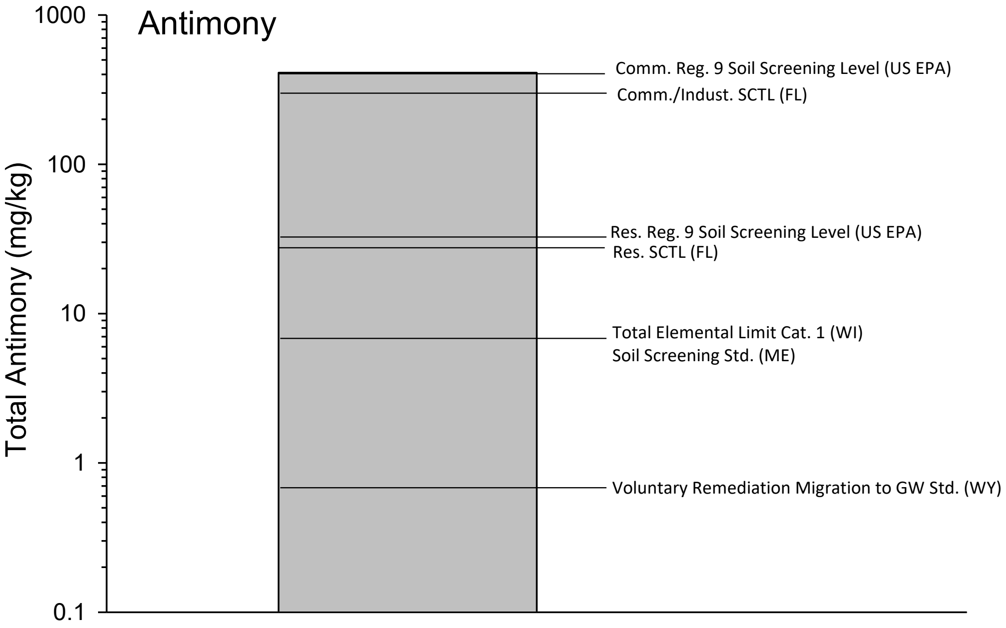

Silver
Total Silver (mg/L)
100
10
1
0.1
0.01
Leaching Procedure Threshold (MS)
RCRA Hazardous Limit (US EPA)
Analyte Mobility Limit Cat. 1& 2 (CO)
GCTL (FL)/ASTM Water Leach Cat. 2 & 3 (WI)
ASTM Water Leach Cat. 1 (WI)

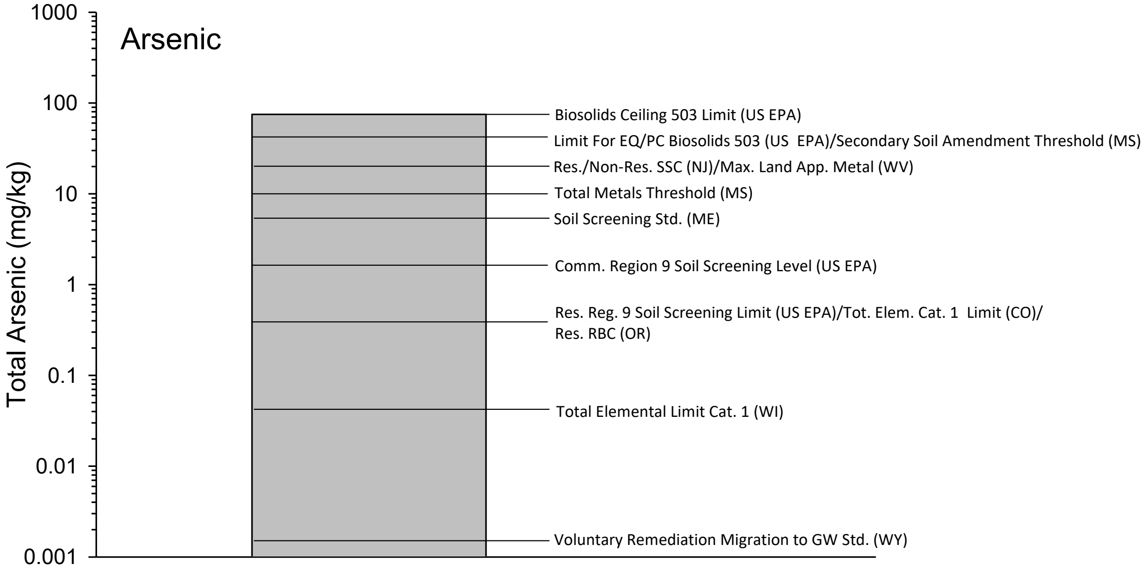

Zinc
Total Zinc (mg/L)
100
10
1
Analyte Mobility Limit Cat. 1& 2 (CO)
ASTM Water Leach Cat. 2 & 3 (WI)
GCTL (FL)
ASTM Water Leach Cat. 1 (WI)

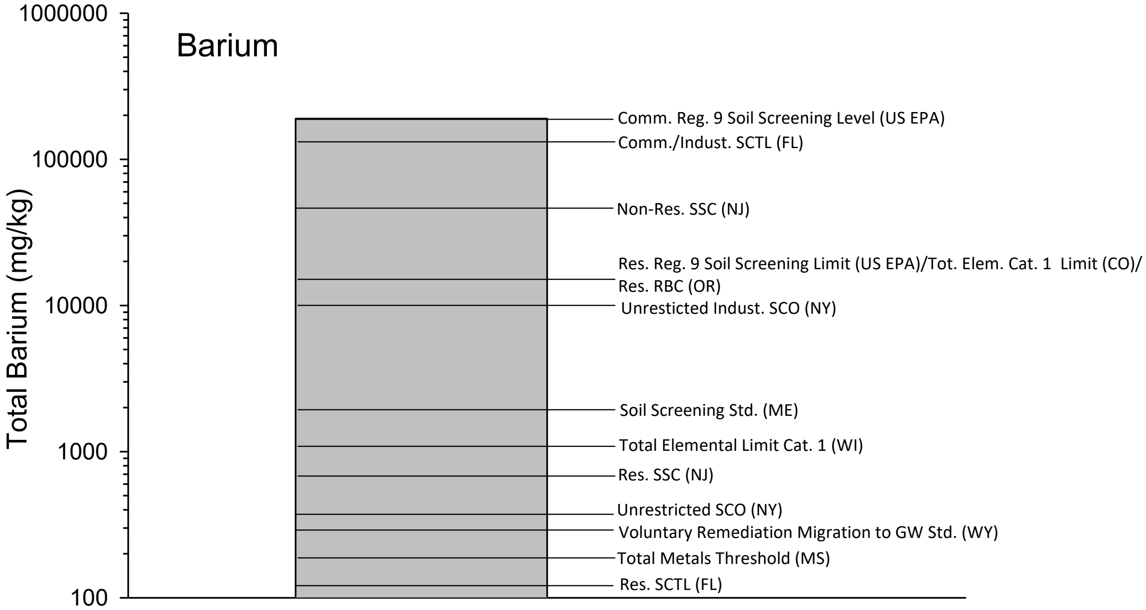
# Comparison of Total Concentration Limits for Inorganic Parameters

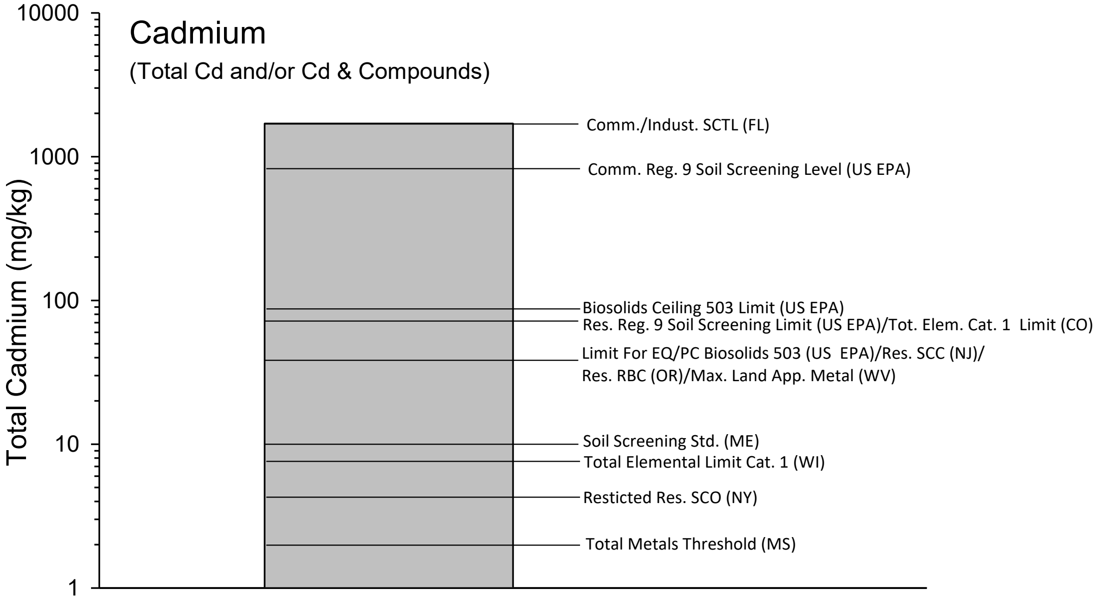
Abbreviations Used: Comm. (Commercial), Indust. (Industrial), Res. (Residential), Cat. (Category), Max. (Maximum), App. (Application), Reg. (Region)

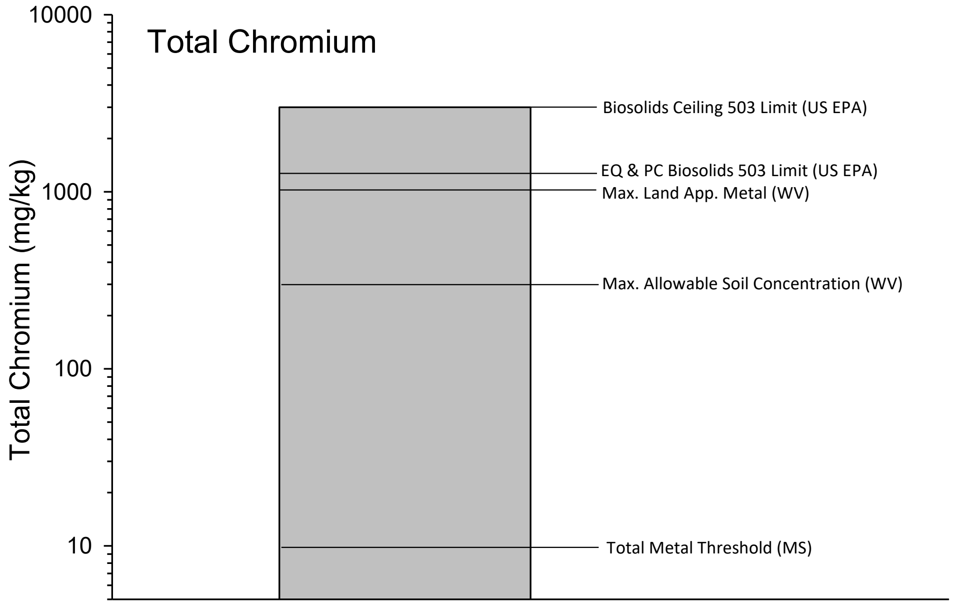
Acronyms/Initialisms Used: SCTL (Soil Cleanup Target Level), SCO (Soil Cleanup Objective), SSC (Soil Cleanup Criteria), RBC (Risk Based Concentration), GW (groundwater), EQ (Exceptional Quality), PC (Pollutant Concentration)

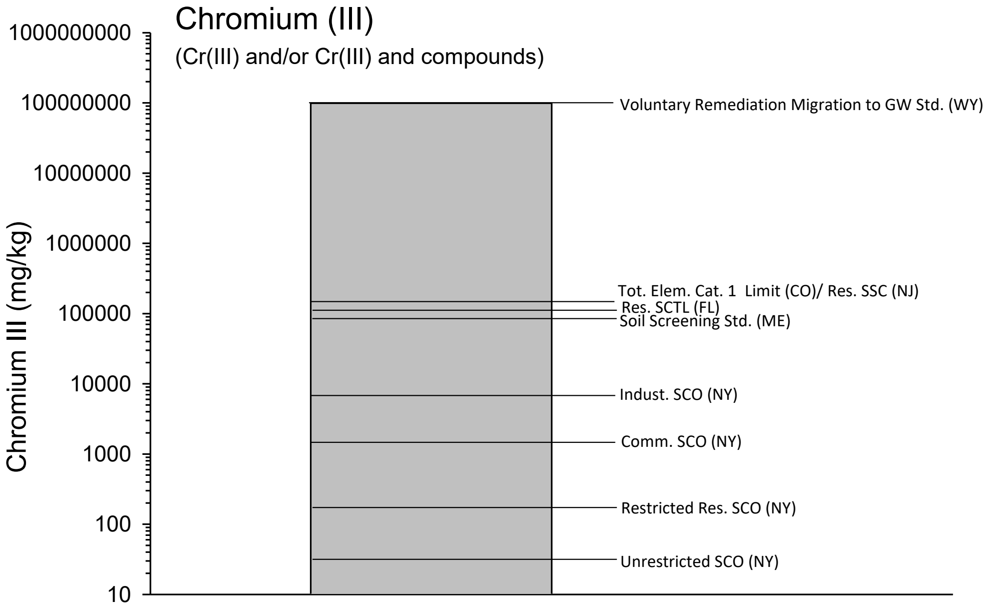


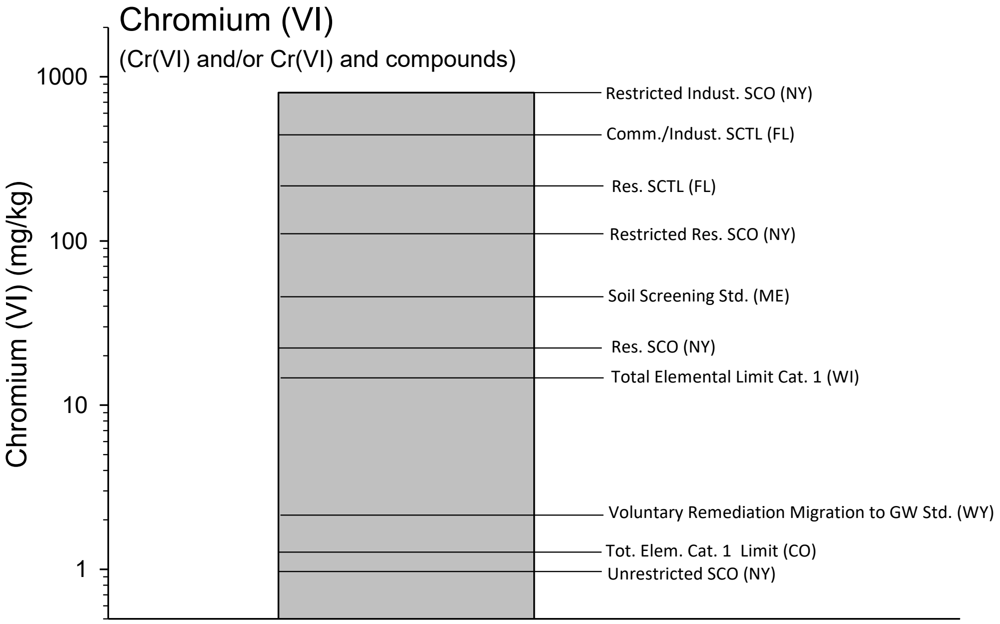


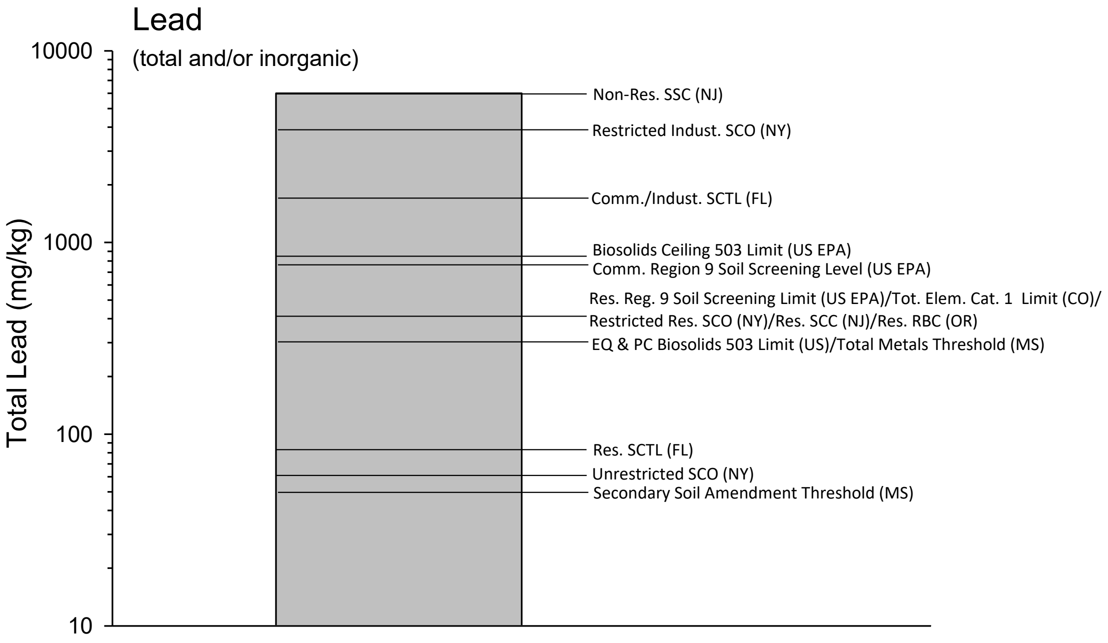

Barium
Total Barium (mg/kg)
1000000
100000
10000
1000
100
Comm. Reg. 9 Soil Screening Level (US EPA)
Comm./Indust. SCTL (FL)
Non-Res. SSC (NJ)
Res. Reg. 9 Soil Screening Limit (US EPA)/Tot. Elem. Cat. 1 Limit (CO)/
Res. RBC (OR)
Unresticted Indust. SCO (NY)
Soil Screening Std. (ME)
Total Elemental Limit Cat. 1 (WI)
Res. SSC (NJ)
Unrestricted SCO (NY)
Voluntary Remediation Migration to GW Std. (WY)
Total Metals Threshold (MS)
Res. SCTL (FL)

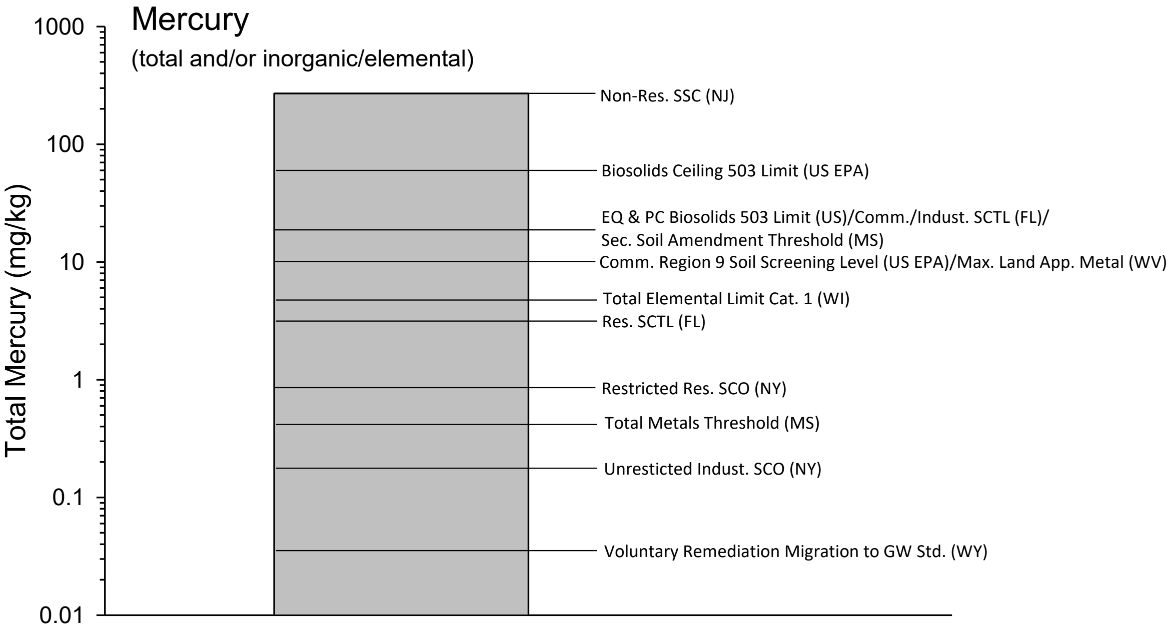

Cadmium
(Total Cd and/or Cd & Compounds)
Total Cadmium (mg/kg)
10000
1000
100
10
1
Comm./Indust. SCTL (FL)
Comm. Reg. 9 Soil Screening Level (US EPA)
Biosolids Ceiling 503 Limit (US EPA)
Res. Reg. 9 Soil Screening Limit (US EPA)/Tot. Elem. Cat. 1 Limit (CO)
Limit For EQ/PC Biosolids 503 (US EPA)/Res. SCC (NJ)/
Res. RBC (OR)/Max. Land App. Metal (WV)
Soil Screening Std. (ME)
Total Elemental Limit Cat. 1 (WI)
Resticted Res. SCO (NY)
Total Metals Threshold (MS)

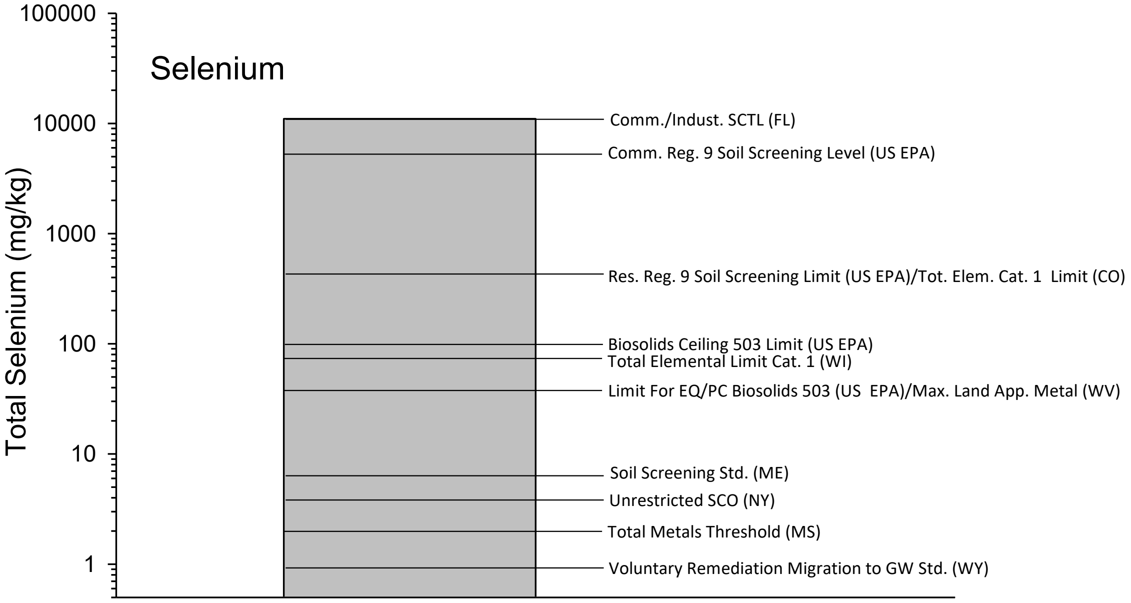

Total Chromium
Total Chromium (mg/kg)
10000
1000
100
10
Biosolids Ceiling 503 Limit (US EPA)
EQ & PC Biosolids 503 Limit (US EPA)
Max. Land App. Metal (WV)
Max. Allowable Soil Concentration (WV)
Total Metal Threshold (MS)

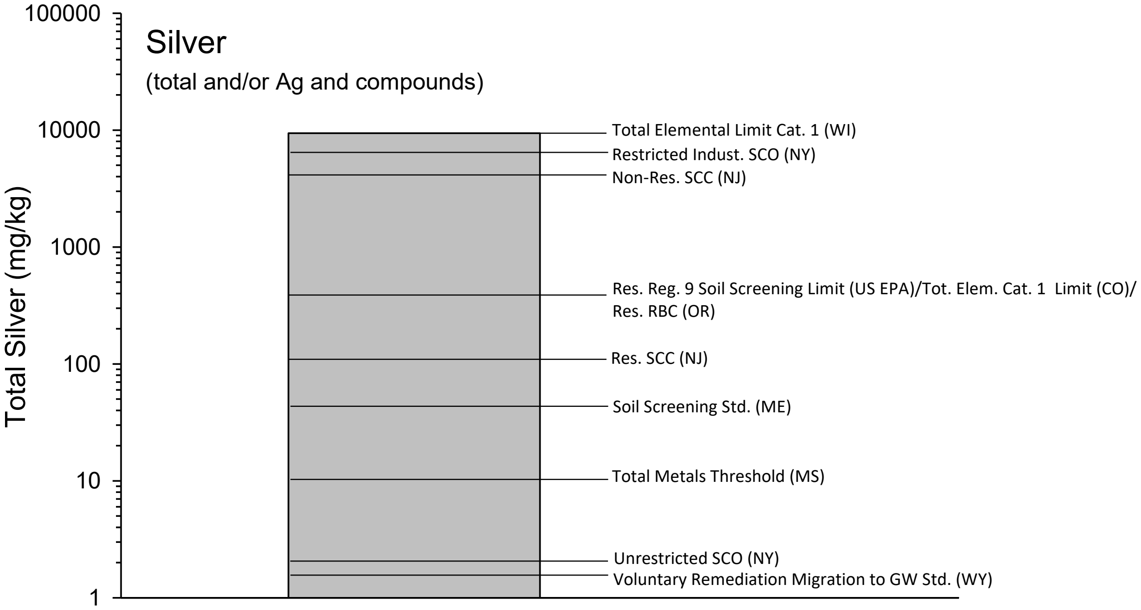

Chromium (III)
(Cr(III) and/or Cr(III) and compounds)
Chromium III (mg/kg)
1000000000
100000000
10000000
1000000
100000
10000
1000
100
10
Voluntary Remediation Migration to GW Std. (WY)
Tot. Elem. Cat. 1 Limit (CO)/ Res. SSC (NJ)
Res. SCTL (FL)
Soil Screening Std. (ME)
Indust. SCO (NY)
Comm. SCO (NY)
Restricted Res. SCO (NY)
Unrestricted SCO (NY)

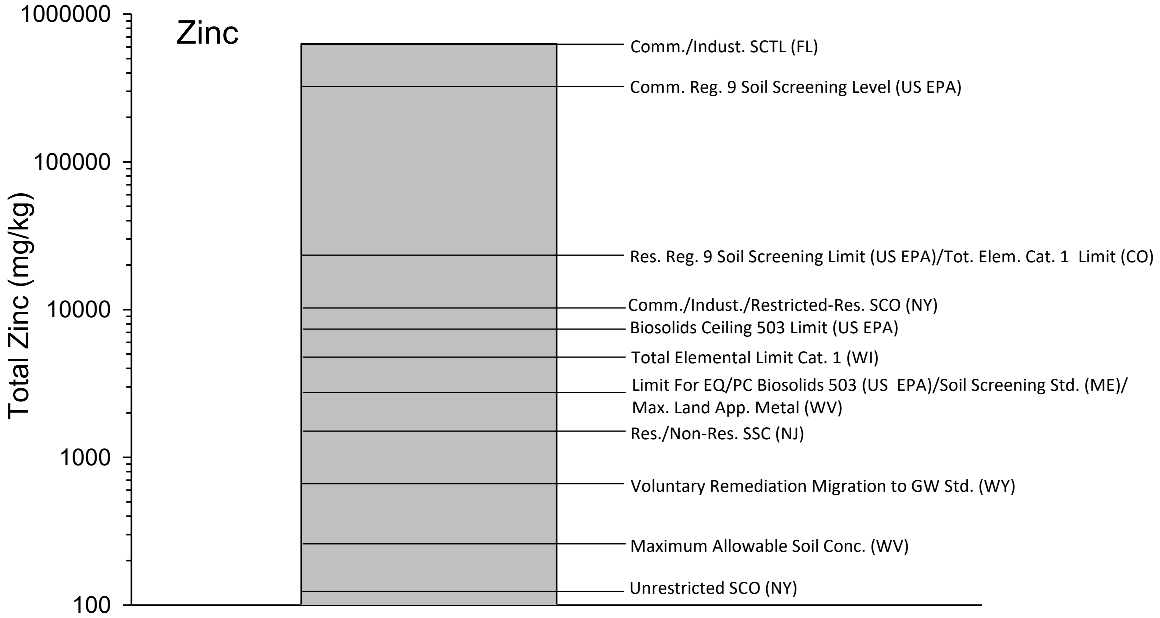

Chromium (VI)
(Cr(VI) and/or Cr(VI) and compounds)
Chromium (VI) (mg/kg)
1000
100
10
1
Restricted Indust. SCO (NY)
Comm./Indust. SCTL (FL)
Res. SCTL (FL)
Restricted Res. SCO (NY)
Soil Screening Std. (ME)
Res. SCO (NY)
Total Elemental Limit Cat. 1 (WI)
Voluntary Remediation Migration to GW Std. (WY)
Tot. Elem. Cat. 1 Limit (CO)
Unrestricted SCO (NY)


Lead
(total and/or inorganic)
Total Lead (mg/kg)
10000
1000
100
10
Non-Res. SSC (NJ)
Restricted Indust. SCO (NY)
Comm./Indust. SCTL (FL)
Biosolids Ceiling 503 Limit (US EPA)
Comm. Region 9 Soil Screening Level (US EPA)
Res. Reg. 9 Soil Screening Limit (US EPA)/Tot. Elem. Cat. 1 Limit (CO)/
Restricted Res. SCO (NY)/Res. SCC (NJ)/Res. RBC (OR)
EQ & PC Biosolids 503 Limit (US)/Total Metals Threshold (MS)
Res. SCTL (FL)
Unrestricted SCO (NY)
Secondary Soil Amendment Threshold (MS)


Mercury
(total and/or inorganic/elemental)
Total Mercury (mg/kg)
1000
100
10
1
0.1
0.01
Non-Res. SSC (NJ)
Biosolids Ceiling 503 Limit (US EPA)
EQ & PC Biosolids 503 Limit (US)/Comm./Indust. SCTL (FL)/
Sec. Soil Amendment Threshold (MS)
Comm. Region 9 Soil Screening Level (US EPA)/Max. Land App. Metal (WV)
Total Elemental Limit Cat. 1 (WI)
Res. SCTL (FL)
Restricted Res. SCO (NY)
Total Metals Threshold (MS)
Unresticted Indust. SCO (NY)
Voluntary Remediation Migration to GW Std. (WY)


Selenium
Total Selenium (mg/kg)
100000
10000
1000
100
10
1
Comm./Indust. SCTL (FL)
Comm. Reg. 9 Soil Screening Level (US EPA)
Res. Reg. 9 Soil Screening Limit (US EPA)/Tot. Elem. Cat. 1 Limit (CO)
Biosolids Ceiling 503 Limit (US EPA)
Total Elemental Limit Cat. 1 (WI)
Limit For EQ/PC Biosolids 503 (US EPA)/Max. Land App. Metal (WV)
Soil Screening Std. (ME)
Unrestricted SCO (NY)
Total Metals Threshold (MS)
Voluntary Remediation Migration to GW Std. (WY)


Silver
(total and/or Ag and compounds)
Total Silver (mg/kg)
100000
10000
1000
100
10
1
Total Elemental Limit Cat. 1 (WI)
Restricted Indust. SCO (NY)
Non-Res. SCC (NJ)
Res. Reg. 9 Soil Screening Limit (US EPA)/Tot. Elem. Cat. 1 Limit (CO)/
Res. RBC (OR)
Res. SCC (NJ)
Soil Screening Std. (ME)
Total Metals Threshold (MS)
Unrestricted SCO (NY)
Voluntary Remediation Migration to GW Std. (WY)


Zinc
Total Zinc (mg/kg)
1000000
100000
10000
1000
100
Comm./Indust. SCTL (FL)
Comm. Reg. 9 Soil Screening Level (US EPA)
Res. Reg. 9 Soil Screening Limit (US EPA)/Tot. Elem. Cat. 1 Limit (CO)
Comm./Indust./Restricted-Res. SCO (NY)
Biosolids Ceiling 503 Limit (US EPA)
Total Elemental Limit Cat. 1 (WI)
Limit For EQ/PC Biosolids 503 (US EPA)/Soil Screening Std. (ME)/
Max. Land App. Metal (WV)
Res./Non-Res. SSC (NJ)
Voluntary Remediation Migration to GW Std. (WY)
Maximum Allowable Soil Conc. (WV)
Unrestricted SCO (NY)

# Appendix D. Detailed Case Studies Comparing Eight Waste-Use Combinations Between Eight U.S. States

**Table D-1. Comparison of Eight State Approaches to Beneficial Use of Coal Fly Ash as a Pozzolan in Concrete Production**

| State | Discussion of Beneficial Use |
|---|---|
| **Florida** | Florida does not have a specific beneficial waste rule, nor does the FDEP normally regulate the use and application of products. Solid waste regulations allow for the recycling of industrial byproducts if (1) the majority of materials are recycled in one year, (2) the materials are not managed to cause contamination in excess of water quality standards and criteria as well as air quality criteria, and (3) the material is not a hazardous waste.<br>No specific rule regulates this practice, but statutes provide limited information regarding the storage and use of industrial byproducts. Beneficial use of coal fly ash as partial substitute for Portland cement is a common practice in Florida. |
| **Minnesota** | Permitted as a standing use BUD for "coal fly ash as defined by ASTM C618 when used as a pozzolan or cement replacement in the formation of high strength concrete." Uses with Standing BUD do not require reporting to MPCA. |
| **Mississippi** | Permitted as a standing use determination by the MDEQ as "a by-product utilized as a contained or encapsulated additive in the manufacture of a product." Compliance with beneficial use eligibility requirements is necessary (e.g., must be by-product, must be a suitable replacement for raw material, and must not be solely a disposal activity). Uses with standing determinations do not require a use specific application, or review and approval by MDEQ. Annual reporting is not required. |
| **New Jersey** | Categorically approved for beneficial use and exempt from the requirement to obtain a Certificate of Authorization. The following use is permitted: "coal fly ash, bottom ash ….that is used … as a raw feedstock in the manufacture of cement…" (New Jersey Administrative Code 7:26-1.7(g)) |
| **New York** | Not considered a solid waste used in this fashion (Rule section 360-1.15(b)(16), and is identified as having a pre-approved standing use: "coal combustion fly ash or bottom ash placed in commerce to serve as a cement or aggregate substitute in concrete and concrete products." |
| **Oregon** | No standing determination or case-specific approval for this use currently. There is one coal-fired power plant in the state that has beneficially used fly ash (and bottom ash) since before the promulgation of Oregon's beneficial use rules in 2010. To date, no formal request for a standing or case-specific determination has been made for coal ash from the state's power plant, but this request is not necessarily required as the current beneficial use of coal ash is conducted under another permit-related program specific to the power plant. |

**Table D-1 (continued)**

| State | Discussion of Beneficial Use |
|---|---|
| **Pennsylvania** | Under state regulations, the use of coal ash in the manufacture of cement or concrete is allowed and does not require a permit. "A person or municipality is not required to obtain a permit under this article for the beneficial use of coal ash under Chapter 290 (relating to beneficial use of coal ash)" (287.101). Under Chapter 290, coal ash may be beneficially used in the manufacture of cement or concrete given "the coal ash shall be utilized within 24 hours of its delivery to the site unless stored in accordance with Subchapter E (relating to coal ash storage)" (290.106). |
| **Wisconsin** | Provided that the coal ash considered for beneficial use meets the minimum requirements of a Category 5 Industrial Byproduct (determined not to be a hazardous waste as defined in s. NR 660.10 (52) and not category 1 to 4 industrial byproducts (538.08)) the beneficial use of a raw material for manufacturing of a product including Portland cement and structural concrete is exempt from the regulations of NR 538.12. (NR 538.10). Annual certification following 538.14(2) is required. |

**Table D-2. Comparison of Eight State Approaches to Beneficial Use of Foundry Sand as a Feed Material in the Manufacture of Portland Cement**

| State | Discussion of Beneficial Use |
|---|---|
| **Florida** | Florida does not have a specific beneficial waste rule, nor does the FDEP normally regulate the use and application of products. Solid waste regulations allow for the recycling of industrial byproducts if (1) the majority of materials are recycled in one year, (2) the materials are not managed to cause contamination in excess of water quality standards and criteria as well as air quality criteria, and (3) the material is not a hazardous waste. |
| **Minnesota** | A standing use BUD for "foundry sand when used as a feed material in the manufacture of Portland cement." is listed. Uses with Standing BUD do not require reporting to MPCA. |
| **Mississippi** | Permitted as a standing use determination by the MDEQ as "a by-product utilized as a contained or encapsulated additive in the manufacture of a product." Compliance with beneficial eligibility requirements is necessary (e.g., must be by-product, must be a suitable replacement for raw material, and must not be solely a disposal activity). Uses with standing determinations do not require a use specific application, or review and approval by MDEQ. Annual reporting is not required. |

**Table D-2 (continued)**

| State | Discussion of Beneficial Use |
|---|---|
| **New Jersey** | Materials used or reused directly as a product or as a substitute for raw material which is incorporated into a product that meets the original product specifications (provided the material poses no greater risk to human health and the environment) are exempted from the requirement to obtain a Certificate of Authorization to Operate. The NJDEP can exercise a burden of proof regulatory provision to require demonstration that the beneficial use meets the exemption requirements. |
| **New York** | A case-specific petition for a determination that this waste may be beneficially used must be filed. The petition must include a description of the waste stream, the beneficial market, management practices, and justification with respect to its potential for beneficial use. This would include information on "chemical and physical characteristics of the waste." The NYSDEC would evaluate the petition, including an assessment of "toxic constituents" and how these compare to those found in analogous products or feedstock.<br>The NYSDEC will review the petition and designate it as either approved or disapproved, or allowed use under specific conditions. As part of this approval, the point at which the material is no longer considered a waste will be identified. |
| **Oregon** | Standing beneficial use determination for "foundry sand produced by iron, steel, or aluminum foundries when used as aggregate in asphalt mixtures, concrete, Portland cement, or masonry mortar." |
| **Pennsylvania** | The beneficial use of foundry sand as "a component or ingredient in the manufacturing of concrete or asphalt products", which includes use as a feed material in the manufacture of Portland cement, is allowed through beneficial use general permit WMGR019. |
| **Wisconsin** | Foundry sands must first be categorized as an industrial byproduct following procedures outlined in NR 538.06. Provided that the foundry sands considered for beneficial use meet the minimum requirements of a Category 5 Industrial Byproduct (determined not to be a hazardous waste as defined in s. NR 660.10 (52) and not category 1 to 4 industrial byproducts (538.08)) the beneficial use of a raw material for manufacturing of a product including Portland cement is exempt from the regulations of NR 538.12. (NR 538.10). Annual certification following 538.14(2) is required. |

**Table D-3. Comparison of Eight State Approaches to Beneficial Use of Coal Bottom Ash in Structural Concrete**

<table>
<tr><th>State</th><th>Discussion of Beneficial Use</th></tr>
<tr><td><b>Florida</b></td><td>Florida does not have a specific beneficial waste rule, but they do have a set of protocols typically followed when evaluating a BUD application. For cases where a waste material is encapsulated into a matrix such as structural concrete, the typical evaluation practice is to require leaching test data (typically from SPLP) and comparing the results to appropriate risk-based target thresholds (the Florida Groundwater Cleanup Target Levels, GCTLs). Florida GCTLs for common inorganic chemical constituents are as follows:
<table>
<tr><th>Element</th><th>GCTL (mg/L)</th></tr>
<tr><td>Antimony</td><td>0.006</td></tr>
<tr><td>Arsenic</td><td>0.01</td></tr>
<tr><td>Barium</td><td>2</td></tr>
<tr><td>Beryllium</td><td>0.004</td></tr>
<tr><td>Cadmium</td><td>0.005</td></tr>
<tr><td>Chromium</td><td>0.1</td></tr>
<tr><td>Copper</td><td>1.0</td></tr>
<tr><td>Cobalt</td><td>0.14</td></tr>
<tr><td>Lead</td><td>0.015</td></tr>
<tr><td>Mercury</td><td>0.002</td></tr>
<tr><td>Selenium</td><td>0.05</td></tr>
<tr><td>Thallium</td><td>0.002</td></tr>
<tr><td>Vanadium</td><td>0.049</td></tr>
<tr><td>Zinc</td><td>5</td></tr>
</table>
Other leaching data or risk assessment might be required as part of the BUD evaluation process.</td></tr>
</table>

**Table D-3 (continued)**

| State | Discussion of Beneficial Use |
|---|---|
| **Minnesota** | Since there is no standing beneficial use determination for this application, a beneficial use proposal form must be submitted to the MPCA requesting the agency to make a case specific beneficial use determination. The application should include information on the type of waste, its amount generated and proposed for utilization, proposed end use, and evidence that a market exists. Chemical and physical characterization data must be provided. The chemical constituents to be assessed should be developed in consideration of the processes at the facility producing the waste and a review of material safety data sheets, ingredient label and other pertinent information. Per 7035.2861 in the Minnesota Administrative rules, total compositional analysis is needed in most cases, and leaching procedures may also be required depending on how the solid waste will be managed prior to its beneficial use. The application should also include an "evaluation of the human health and environmental impacts the proposed use may have and a comparison of these impacts with those from other management alternatives for the solid waste," though no specific risk-based thresholds are identified for use. In lieu of analytical testing data, MPCA may accept sources that can be cited and provided to serve as documentation regarding the material and its analytical properties. |
| **Mississippi** | Permitted as a standing use determination by the MDEQ as "a by-product utilized as a contained or encapsulated additive in the manufacture of a product." Compliance with beneficial eligibility requirements is necessary (e.g., must be by-product, must be a suitable replacement for raw material, and must not be solely a disposal activity). Uses with standing determinations do not require a use specific application, or review and approval by MDEQ. Annual reporting is not required. |
| **New Jersey** | Categorically approved for beneficial use and exempted from the need to obtain a Certificate of Authorization for beneficial use. The following use is permitted: "coal fly ash, bottom ash ….that is used … as a cement or aggregate substitute in structural concrete…" (New Jersey Administrative Code 7:26-1.7(g)) |
| **New York** | Not considered a solid waste used in this fashion (Rule section 360-1.15(b)(16): "coal combustion fly ash or bottom ash placed in commerce to serve as a cement or aggregate substitute in concrete and concrete products" is designated as a pre-approved standing use. |
| **Oregon** | No standing determination or case-specific approval for this use currently. The one coal-fired power plant in the state has beneficially used bottom ash since before the promulgation of Oregon's beneficial use rules in 2010. To date, no formal request for a standing or case-specific determination has been made for coal bottom ash from the state's power plant, but this request is not necessarily required as the current beneficial use of coal bottom ash is conducted under another permit-related program specific to the power plant (e.g., US Energy Information Administration Data Form EIA-923, "Power Plant Operations Report" 2011 indicates that the coal-fired power plant in Oregon "sold" fly ash and bottom ash in year 2011). |

**Table D-3 (continued)**

| State | Discussion of Beneficial Use |
|---|---|
| **Pennsylvania** | Under state regulations, the use of coal ash in the manufacture of cement or concrete is allowed and does not require a permit. "A person or municipality is not required to obtain a permit under this article for the beneficial use of coal ash under Chapter 290 (relating to beneficial use of coal ash)" (287.101). Under Chapter 290, coal ash may be beneficially used in the manufacture of cement or concrete given "the coal ash shall be utilized within 24 hours of its delivery to the site unless stored in accordance with Subchapter E (relating to coal ash storage)" (290.106). |
| **Wisconsin** | Provided that the coal ash considered for beneficial use meets the minimum requirements of a Category 5 Industrial Byproduct (determined not to be a hazardous waste as defined in s. NR 660.10 (52) and not category 1 to 4 industrial byproducts (538.08)) the beneficial use of a raw material for manufacturing of a product including structural concrete and Portland cement manufacturing is exempt from the regulations of NR 538.12. (NR 538.10)<br>Coal ash is an industrial byproduct by rule as categorized under 538.08. Annual certification following 538.14(2) is required. |

### Table D-4. Comparison of Eight State Approaches to Beneficial Use of Steel Slag in Asphalt Pavement

| State | Discussion of Beneficial Use |
|---|---|
| **Florida** | Florida does not have a specific beneficial use rule, but they do have a set of protocols typically followed when evaluating a BUD application. For cases where a waste material is encapsulated into a matrix such as asphalt pavement, the typical evaluation practice is to require leaching test data (typically from SPLP) and comparing the results to appropriate risk-based target thresholds (the Florida Groundwater Cleanup Target Levels, GCTLs), which were presented in Table D-3. Other leaching data or risk assessment might be evaluated as part of the BUD evaluation process. |
| **Minnesota** | Since there is no standing beneficial use determination for this application, a beneficial use proposal form must be submitted to the MPCA requesting the agency to make a case specific beneficial use determination. The application should include information on the type of waste, its amount generated and proposed for utilization, proposed end use, and evidence that a market exists. Chemical and physical characterization data must be provided. The chemical constituents to be assessed should be developed in consideration of the processes at the facility producing the waste and a review of material safety data, sheets, ingredient label and other pertinent information. The application should also include an "evaluation of the human health and environmental impacts the proposed use may have and a comparison of these impacts with those from other management alternatives for the solid waste," though no specific risk-based thresholds are identified for use. In lieu of analytical testing data, MPCA may accept sources that can be cited and provided to serve as documentation regarding the material and its analytical properties. |

**Table D-4 (continued)**

<table>
<tr><th>State</th><th>Discussion of Beneficial Use</th></tr>
<tr><td><b>Mississippi</b></td><td>Permitted as a standing use determination by the MDEQ as “a by-product utilized as a contained or encapsulated additive in the manufacture of a product.” Compliance with beneficial eligibility requirements is necessary (e.g., must be by-product, must be a suitable replacement for raw material, and must not be solely a disposal activity). Uses with standing determinations do not require a use specific application, or review and approval by MDEQ. Annual reporting is not required.</td></tr>
<tr><td><b>New Jersey</b></td><td>Based on NJDEP rules and an examination of cases where steel slag use in asphalt pavement required a CAO (e.g., B00-479), it is expected that a CAO application would need to be submitted to NJDEP. The application should include the results of chemical analysis for contaminants in the state’s latest soil cleanup criteria (SCC). Direct exposure SCC are provided for inorganic elements in the following table.
<table>
<tr><th>Element</th><th>Residential Direct Contact SCC (mg/kg)</th><th>Non-Residential Direct Contact SCC (mg/kg)</th></tr>
<tr><td>Arsenic</td><td>20</td><td>20</td></tr>
<tr><td>Barium</td><td>700</td><td>47,000</td></tr>
<tr><td>Beryllium</td><td>2</td><td>2</td></tr>
<tr><td>Cadmium</td><td>39</td><td>100</td></tr>
<tr><td>Chromium</td><td>120,000/240</td><td>--/6,100</td></tr>
<tr><td>Copper</td><td>600</td><td>600</td></tr>
<tr><td>Lead</td><td>400</td><td>600</td></tr>
<tr><td>Mercury</td><td>14</td><td>270</td></tr>
<tr><td>Nickel</td><td>250</td><td>2,400</td></tr>
<tr><td>Selenium</td><td>63</td><td>3,100</td></tr>
<tr><td>Silver</td><td>110</td><td>4,100</td></tr>
<tr><td>Thallium</td><td>2</td><td>2</td></tr>
<tr><td>Vanadium</td><td>370</td><td>7,100</td></tr>
<tr><td>Zinc</td><td>1,500</td><td>1,500</td></tr>
</table>
SCC for “impact to groundwater” are also provided for organic chemicals, but for inorganic chemicals, the remediation criteria require that “impact to groundwater values for inorganic constituents will be developed based upon site specific chemical and physical parameters.”</td></tr>
</table>

**Table D-4 (continued)**

| **State** | Discussion of Beneficial Use |
|---|---|
| **New York** | A case-specific petition for a determination that this waste may be beneficially used must be filed. The petition must include a description of the waste stream, the beneficial market, management practices, and justification with respect to its potential for beneficial use. This would include information on “chemical and physical characteristics of the waste.” The NYSDEC would evaluate the petition, including an assessment of “toxic constituents” and how these compare to those found in analogous products or feedstock.<br>The NYSDEC will review the petition and designate it as either approved or disapproved, or allowed use under specific conditions. As part of this approval, the point at which the material is no longer considered a waste will be identified. |
| **Oregon** | Standing beneficial use for “steel slag” when used “as aggregate in asphalt mixtures.” |

<table>
<tr>
<td><b>Pennsylvania</b></td>
<td>
<p>Under General Permit WMGR082, steel slag may be beneficially used as an ingredient in bituminous concrete if measured chemical concentrations are less than the following risk-based threshold:</p>
<table>
<tr><th>Element</th><th>Total Concentration (mg/kg)</th><th>TCLP or SPLP Leachable Concentration (mg/L)</th></tr>
<tr><td>Antimony</td><td>30</td><td>0.15</td></tr>
<tr><td>Arsenic</td><td>41</td><td>1.25</td></tr>
<tr><td>Cadmium</td><td>39</td><td>0.25</td></tr>
<tr><td>Chromium</td><td>94/190,000</td><td>1.25</td></tr>
<tr><td>Copper</td><td>1,500</td><td>32.5</td></tr>
<tr><td>Iron</td><td>--</td><td>7.5</td></tr>
<tr><td>Lead</td><td>200</td><td>1.25</td></tr>
<tr><td>Manganese</td><td>--</td><td>15</td></tr>
<tr><td>Nickel</td><td>420</td><td>2.5</td></tr>
<tr><td>Thallium</td><td>1,100</td><td>0.0125</td></tr>
<tr><td>Zinc</td><td>2,800</td><td>125</td></tr>
<tr><td>PCBs</td><td>2/1</td><td>--</td></tr>
</table>
<p>Slag shall not be used as an ingredient in bituminous concrete if the above levels are exceeded, unless the leachable levels in the bituminous concrete are less than indicated in the table below.</p>
<table>
<tr><th>Element</th><th>Leachable Concentration (mg/L)</th></tr>
<tr><td>Antimony</td><td>0.15</td></tr>
<tr><td>Arsenic</td><td>1.25</td></tr>
<tr><td>Cadmium</td><td>0.25</td></tr>
<tr><td>Chromium</td><td>1.25</td></tr>
<tr><td>Copper</td><td>32.5</td></tr>
<tr><td>Lead</td><td>1.25</td></tr>
<tr><td>Nickel</td><td>2.5</td></tr>
<tr><td>Thallium</td><td>0.0125</td></tr>
<tr><td>Zinc</td><td>125</td></tr>
</table>
</td>
</tr>
</table>

**Table D-4 (continued)**

| State | Discussion of Beneficial Use |
|---|---|
| **Wisconsin** | Provided that the steel slag considered for beneficial use meets the minimum requirements of a Category 5 Industrial Byproduct (determined not to be a hazardous waste as defined in s. NR 660.10 (52) and not category 1 to 4 industrial byproducts (538.08)) the beneficial use of a raw material for manufacturing of a product including asphaltic concrete pavement is exempt from the regulations of NR 538.12 (NR 538.10). Annual certification following 538.14(2) is required. |

**Table D-5. Comparison of Eight State Approaches to Beneficial Use of Waste to Energy Bottom Ash as Road Base**

| State | Discussion of Beneficial Use |
|---|---|
| **Florida** | Beneficial use is not addressed in any current state rule, but the FDEP has produced a document outlining the processing for developing and submitting a BUD (Guidance for preparing municipal waste-to-energy ash beneficial use demonstration; February 27, 2001). This document outlines state objectives and goals for acceptable risk, procedures for characterization ash and products made from ash for BUD assessment, both as part of an initial baseline study and for routine monitoring. The document provides guidance for assessing risk to human health through direct exposure and risk to groundwater.<br>FDEP will consider an independent human health risk assessment that meets the stated risk goals, but it also provides risk-based thresholds to use as part of this assessment. Risk-based based reuse target levels (RTLs; derived from the state's soil cleanup target levels (SCTLs)) are used to assess risk from direct exposure (combined ingestion, dermal and inhalation exposure). To evaluate risk to groundwater, performing SPLP and comparing leachate concentrations to the FDEP's risk-based target thresholds for groundwater (the Florida GCTLs). A table of inorganic RTLs and GCTLs are provided in the table below.<br>The guidance documents suggests that if the material is managed in a fashion that reduces direct exposure (e.g., such as under a road way) along with documented institutional control, the risk from some pathways will be greatly reduced. |

**Table D-5 (continued)**

<table>
<tr><th>State</th><th>Discussion of Beneficial Use</th></tr>
<tr><td><b>Florida (continued)</b></td><td>
<table>
<tr><th>Element</th><th>Residential RTL (mg/kg)</th><th>Commercial/ Industrial RTL (mg/kg)</th><th>GCTL (mg/L)</th></tr>
<tr><td>Antimony</td><td>27</td><td>370</td><td>0.006</td></tr>
<tr><td>Arsenic</td><td>2.1</td><td>12</td><td>0.01</td></tr>
<tr><td>Barium</td><td>120</td><td>130,000</td><td>2</td></tr>
<tr><td>Beryllium</td><td>120</td><td>1,400</td><td>0.004</td></tr>
<tr><td>Cadmium</td><td>82</td><td>1,700</td><td>0.005</td></tr>
<tr><td>Chromium</td><td>210</td><td>470</td><td>0.1</td></tr>
<tr><td>Copper</td><td>150</td><td>89,000</td><td>1.0</td></tr>
<tr><td>Cobalt</td><td>1,700</td><td>42,000</td><td>0.14</td></tr>
<tr><td>Lead</td><td>400</td><td>1,400</td><td>0.015</td></tr>
<tr><td>Mercury</td><td>3</td><td>17</td><td>0.002</td></tr>
<tr><td>Selenium</td><td>440</td><td>11,000</td><td>0.05</td></tr>
<tr><td>Thallium</td><td>6.1</td><td>150</td><td>0.002</td></tr>
<tr><td>Vanadium</td><td>67</td><td>10,000</td><td>0.049</td></tr>
<tr><td>Zinc</td><td>26,000</td><td>630,000</td><td>5</td></tr>
</table>
</td></tr>
<tr><td><b>Minnesota</b></td><td>Since there is no standing beneficial use determination for this application, a beneficial use proposal form must be submitted to the MPCA requesting the agency to make a case specific beneficial use determination. The application should include information on the type of waste, its amount generated and proposed for utilization, proposed end use, and evidence that a market exists. Chemical and physical characterization data must be provided. The chemical constituents to be assessed should be developed in consideration of the processes at the facility producing the waste and a review of material safety data, sheets, ingredient label and other pertinent information. The application should also include an “evaluation of the human health and environmental impacts the proposed use may have and a comparison of these impacts with those from other management alternatives for the solid waste,” though no specific risk-based thresholds are identified for use. In lieu of analytical testing data, MPCA may accept sources that can be cited and provided to serve as documentation regarding the material and its analytical properties.</td></tr>
</table>

**Table D-5 (continued)**

<table>
<tr><th>State</th><th>Discussion of Beneficial Use</th></tr>
<tr><td><b>Mississippi</b></td><td>No standing BUD exists for beneficial use of WTE bottom ash a road base. A BUD application would need to be submitted. The beneficial use described would constitute a Category III use (utilization in engineered construction or other civil engineering uses). Compliance with beneficial eligibility requirements is necessary (e.g., must be by-product, must be a suitable replacement for raw material, and must not be solely a disposal activity). At a minimum, total metal thresholds in the table below should be analyzed, and if any elements exceed the threshold, the TCLP (other tests can be requested) must be conducted and the results should be less than the leaching procedure thresholds.
<table>
<tr><th>Element</th><th>Total Metal Thresholds (mg/kg)</th><th>Leaching Procedure Thresholds (mg/L)</th></tr>
<tr><td>Arsenic</td><td>10.0</td><td>0.25</td></tr>
<tr><td>Barium</td><td>200.0</td><td>7.0</td></tr>
<tr><td>Cadmium</td><td>2.0</td><td>0.125</td></tr>
<tr><td>Chromium</td><td>10.0</td><td>2.5</td></tr>
<tr><td>Lead</td><td>10.0</td><td>0.375</td></tr>
<tr><td>Mercury</td><td>0.4</td><td>0.05</td></tr>
<tr><td>Selenium</td><td>2.0</td><td>1</td></tr>
<tr><td>Silver</td><td>10.0</td><td>50</td></tr>
</table>
Annual reporting is required.</td></tr>
</table>

**Table D-5 (continued)**

<table>
<tr><th>State</th><th>Discussion of Beneficial Use</th></tr>
<tr><td><strong>New Jersey</strong></td><td>
<p>A CAO application would need to be submitted to NJDEP. The application should include a profile of the material including the results of chemical analysis for contaminants in the state's latest soil cleanup criteria (SCC). Direct exposure SCC are provided for inorganic elements in the following table.</p>
<table>
<tr><th>Element</th><th>Residential Direct Contact SCC (mg/kg)</th><th>Non-Residential Direct Contact SCC (mg/kg)</th></tr>
<tr><td>Arsenic</td><td>20</td><td>20</td></tr>
<tr><td>Barium</td><td>700</td><td>47,000</td></tr>
<tr><td>Beryllium</td><td>2</td><td>2</td></tr>
<tr><td>Cadmium</td><td>39</td><td>100</td></tr>
<tr><td>Chromium (III/VI)</td><td>120,000/240</td><td>--/6,100</td></tr>
<tr><td>Copper</td><td>600</td><td>600</td></tr>
<tr><td>Lead</td><td>400</td><td>600</td></tr>
<tr><td>Mercury</td><td>14</td><td>270</td></tr>
<tr><td>Nickel</td><td>250</td><td>2,400</td></tr>
<tr><td>Selenium</td><td>63</td><td>3,100</td></tr>
<tr><td>Silver</td><td>110</td><td>4,100</td></tr>
<tr><td>Thallium</td><td>2</td><td>2</td></tr>
<tr><td>Vanadium</td><td>370</td><td>7,100</td></tr>
<tr><td>Zinc</td><td>1,500</td><td>1,500</td></tr>
</table>
<p>SCC for "impact to groundwater" are also provided for organic chemicals, but for inorganic chemicals, the remediation criteria require that "impact to groundwater values for inorganic constituents will be developed based upon site specific chemical and physical parameters." A limited number CAOs for WTE ash beneficial uses have been issued, but none included use as a road base.</p>
</td></tr>
<tr><td><strong>New York</strong></td><td>
<p>A case-specific petition for a determination that this waste may be beneficially used must filed. The petition must include a description of the waste stream, the beneficial market, management practices, and justification with respect to its potential for beneficial use. This would include information on "chemical and physical characteristics of the waste." The NYSDEC would evaluate the petition, including an assessment of "toxic constituents" and how these compare to those found in analogous products or feedstock.</p>
<p>The NYSDEC will review the petition and either approve or disapprove, or allowed use under specific conditions. As part of this approval, the point at which the material is no longer considered a waste will be identified.</p>
</td></tr>
</table>

**Table D-5 (continued)**

<table>
<tr><th>State</th><th>Discussion of Beneficial Use</th></tr>
<tr><td><b>Oregon</b></td><td>
<p>No standing determination for this use currently. Applicant would need to apply to the ODEQ for case-specific approval of the beneficial use. If the waste stream “does not contain hazardous substances significantly exceeding the concentration in a comparable raw product or commercial product” a Tier One application can be filed which does not require comparison to risk-based screening levels.</p>
<p>In the case that hazardous substances significantly exceed concentration in a comparable raw product, the application must include risk screening which compares concentrations in the material to ODEQ-approved risk-based screening levels. Examples of ODEQ risk-based screening levels are provided for inorganic chemicals in the following table; other screening levels may be applicable as well.</p>
<table>
<tr><th>Element</th><th>Residential RBC (mg/kg)</th><th>Urban Residential RBC (mg/kg)</th><th>Construction Worker RBC (mg/kg)</th></tr>
<tr><td>Arsenic</td><td>0.39</td><td>1.0</td><td>13</td></tr>
<tr><td>Barium</td><td>15,000</td><td>31,000</td><td>60,000</td></tr>
<tr><td>Beryllium</td><td>160</td><td>310</td><td>610</td></tr>
<tr><td>Cadmium</td><td>39</td><td>78</td><td>150</td></tr>
<tr><td>Chromium</td><td>120,000/0.29</td><td>230,000/0.66</td><td>460,000/43</td></tr>
<tr><td>Copper</td><td>3,100</td><td>6,200</td><td>12,000</td></tr>
<tr><td>Cyanide</td><td>47</td><td>94</td><td>190</td></tr>
<tr><td>Lead</td><td>400</td><td>400</td><td>800</td></tr>
<tr><td>Manganese</td><td>1,800</td><td>3,600</td><td>7,200</td></tr>
<tr><td>Mercury</td><td>23</td><td>47</td><td>93</td></tr>
<tr><td>Nickel</td><td>1,500</td><td>3,100</td><td>6,100</td></tr>
<tr><td>Silver</td><td>390</td><td>780</td><td>1,500</td></tr>
</table>
</td></tr>
<tr><td><b>Pennsylvania</b></td><td>There is no beneficial use general permit for use of municipal waste incinerator bottom ash as a road base. The generator that is interested in pursuing this use must apply to the Pennsylvania DEP for a general permit. This process includes the chemical characterization of the material in accordance with 287.132 and the establishment of constituent target limits for the proposed waste and use. The chemical characterization and associated limits would generally include total concentration and leachable concentration (using TCLP or SPLP), and the target limits would be established on an individual basis.</td></tr>
</table>

**Table D-5 (continued)**

<table>
<tr><th>State</th><th>Discussion of Beneficial Use</th></tr>
<tr><td><b>Wisconsin</b></td><td>WTE ash is defined industrial byproduct, so a BUD applicant would need to demonstrate “similar characteristics” to a defined industrial byproduct; a proposed non-hazardous solid waste under consideration for beneficial use needs to demonstrate similarity via means specified by WDNR. Use as road base would constitute “confined geotechnical fill.”<br>Confined geotechnical fill could be classified in industrial byproduct categories 1-4. If more than 5,000 cubic yards are to be utilized in an individual project prior written notification by the generator or a designee to WDNR is needed with concurrence by WDNR. A category determination is made based on chemical constituent levels in ASTM water leach extract and in the material itself (only for categories 1 and 2), category 1 is the most restrictive classification with the most stringent chemical constituent levels. WTE ash only has to meet category 4 criteria to qualify for beneficial use, see criteria in the following table:
<table>
<tr><th>Element</th><th>ASTM Water Leach Test Concentration Limit (mg/L)</th></tr>
<tr><td>Antimony</td><td>0.03</td></tr>
<tr><td>Arsenic</td><td>0.25</td></tr>
<tr><td>Barium</td><td>10</td></tr>
<tr><td>Beryllium</td><td>0.02</td></tr>
<tr><td>Boron</td><td>4.8</td></tr>
<tr><td>Cadmium</td><td>0.025</td></tr>
<tr><td>Chloride</td><td>2,500</td></tr>
<tr><td>Chromium</td><td>0.5</td></tr>
<tr><td>Copper</td><td>6.5</td></tr>
<tr><td>Cyanide (total)</td><td>1</td></tr>
<tr><td>Fluoride</td><td>20</td></tr>
<tr><td>Iron</td><td>3</td></tr>
<tr><td>Lead</td><td>0.075</td></tr>
<tr><td>Manganese</td><td>0.5</td></tr>
<tr><td>Mercury</td><td>0.01</td></tr>
<tr><td>Nickel</td><td>0.5</td></tr>
<tr><td>Nitrite + Nitrate</td><td>50</td></tr>
<tr><td>Phenol</td><td>30</td></tr>
<tr><td>Selenium</td><td>0.25</td></tr>
<tr><td>Silver</td><td>0.25</td></tr>
<tr><td>Sulfate</td><td>2,500</td></tr>
<tr><td>Thallium</td><td>0.01</td></tr>
<tr><td>Zinc</td><td>50</td></tr>
</table>
If approved, certification, reporting and notification requirements must be followed.</td></tr>
</table>

**Table D-6. Comparison of Eight State Approaches to Beneficial Use of Street Sweepings for Soil Berms**

| State | Discussion of Beneficial Use |
|---|---|
| **Florida** | Beneficial use is not addressed in any current state rule, but the FDEP has utilized research conducted within the state to provide guidance to those wishing to beneficially use street sweeping and similar residuals (Guidance for the management of street sweepings, catch basin sediments, and stormwater system sediments (FDEP 2004)). The FDEP used data collected for both the total concentration (mg/kg) and the SPLP leachable concentrations (mg/L) of various constituents of street sweepings samples from around the state to develop beneficial use guidelines that, if followed, enable the material to be used without a case specific BUD. Street sweepings may be used for non-residential construction projects or industrial fill provided that benzo(a)pyrene will not pose a significant threat to human health or the environment, and the use is greater than 200 feet from the nearest potable water well, the material is placed above the groundwater table, not placed into a body of water, and the use is in a manner that is under the control of the generator (i.e., the material is not distributed or sold to another party unless authorized by the FDEP). |
| **Minnesota** | The MPCA (2010) developed a guidance document entitled "Managing Street Sweepings" which provides guidelines for reuse. All sweepings must be screened to remove trash and debris, including defining areas where they cannot be reused (e.g., residential yards, sites with karst features). Also provided are ways the screened street sweepings can be used without prior MPCA approval provided requirements on separation distances from various sensitive features (e.g., lakes, rivers, fractured bedrock), and cover material based on the constructed slope are met. Prescribed use as material in commercial and industrial development projects, road restoration, or construction projects would apply to use in a soil berm<br>For use in another manner an application to the MPCA may be required, submitted to gain a case specific BUD. The application should include information on the type of waste, its amount generated and proposed for utilization, proposed end use, and evidence that a market exists. Chemical and physical characterization data must be provided. The chemical constituents to be assessed should be developed in consideration of the processes at the facility producing the waste and a review of material safety data, sheets, ingredient label and other pertinent information. The application should also include an "evaluation of the human health and environmental impacts the proposed use may have and a comparison of these impacts with those from other management alternatives for the solid waste," though no specific risk-based thresholds are identified for use. In lieu of analytical testing data, MPCA may accept sources that can be cited and provided to serve as documentation regarding the material and its analytical properties. |

**Table D-6 (continued)**

<table>
<tr><th>State</th><th>Discussion of Beneficial Use</th></tr>
<tr><td><b>Mississippi</b></td><td>No standing BUD exists for beneficial use of street sweepings in a constructed berm. A BUD application would need to be submitted. The beneficial use described would constitute a Category III use (utilization in engineered construction or other civil engineering uses). Compliance with beneficial eligibility requirements is necessary (e.g., must be by-product, must be a suitable replacement for raw material, and must not be solely a disposal activity). At a minimum, total metal thresholds in the table below should be analyzed, and if any elements exceed the threshold, the TCLP (other tests can be requested) must be conducted and the results should be less than the leaching procedure thresholds.
<table>
<tr><th>Element</th><th>Total Metal Thresholds (mg/kg)</th><th>Leaching Procedure Thresholds (mg/L)</th></tr>
<tr><td>Arsenic</td><td>10.0</td><td>0.25</td></tr>
<tr><td>Barium</td><td>200.0</td><td>7.0</td></tr>
<tr><td>Cadmium</td><td>2.0</td><td>0.125</td></tr>
<tr><td>Chromium</td><td>10.0</td><td>2.5</td></tr>
<tr><td>Lead</td><td>10.0</td><td>0.375</td></tr>
<tr><td>Mercury</td><td>0.4</td><td>0.05</td></tr>
<tr><td>Selenium</td><td>2.0</td><td>1</td></tr>
<tr><td>Silver</td><td>10.0</td><td>50</td></tr>
</table>
Annual reporting is required.</td></tr>
</table>

**Table D-6 (continued)**

| State | Discussion of Beneficial Use |
|---|---|
| **New Jersey** | The NJDEP (2004) has provided a guidance document entitled "Guidance Document for the Management of Street Sweepings and Other Road Cleanup Materials". The guidance states that a one-time land application use of street sweepings would be possible if all contamination levels are below the most stringent applicable SCC, otherwise (or for multiple applications of street sweepings or other material meeting the most stringent SCC) a CAO application would need to be submitted to NJDEP for beneficial use. The application should include a profile of the material including the results of chemical analysis for contaminants in the state's latest soil cleanup criteria (SCC). Direct exposure SCC are provided for inorganic elements in the following table. |

| Element | Residential Direct Contact SCC (mg/kg) | Non-Residential Direct Contact SCC (mg/kg) |
|---|---|---|
| Arsenic | 20 | 20 |
| Barium | 700 | 47,000 |
| Beryllium | 2 | 2 |
| Cadmium | 39 | 100 |
| Chromium | 120,000/240 | --/6,100 |
| Copper | 600 | 600 |
| Lead | 400 | 600 |
| Mercury | 14 | 270 |
| Nickel | 250 | 2,400 |
| Selenium | 63 | 3,100 |
| Silver | 110 | 4,100 |
| Thallium | 2 | 2 |
| Vanadium | 370 | 7,100 |
| Zinc | 1,500 | 1,500 |

SCC for "impact to groundwater" are also provided for organic chemicals, but for inorganic chemicals, the remediation criteria require that "impact to groundwater values for inorganic constituents will be developed based upon site specific chemical and physical parameters."

**Table D-6 (continued)**

<table>
<tr><th>State</th><th>Discussion of Beneficial Use</th></tr>
<tr><td><b>New York</b></td><td>
<p>A case-specific petition for a determination that this waste may be beneficially used must filed. The petition must include a description of the waste stream, the beneficial market, management practices, and justification with respect to its potential for beneficial use. This would include information on “chemical and physical characteristics of the waste.” The NYSDEC would evaluate the petition, including an assessment of “toxic constituents” and how these compare to those found in analogous products or feedstock. State soil cleanup objectives (SCOs) developed by the state’s environmental remediation program may be used as benchmarks as part of the evaluation processing. SCOs are provided for a range of inorganic and organic chemicals, for a multiple different exposure pathways and receptors.</p>
<p>Examples of SCOs for inorganic chemicals and several pathways are as follows:</p>
<table>
<tr><th>Contaminant</th><th>Unrestricted SCO (mg/kg)</th><th>Residential SCO (mg/kg)</th><th>Industrial SCO (mg/kg)</th><th>Protection of Groundwater SCO (mg/kg)</th></tr>
<tr><td>Arsenic</td><td>13</td><td>16</td><td>16</td><td>16</td></tr>
<tr><td>Barium</td><td>350</td><td>350</td><td>10,000</td><td>820</td></tr>
<tr><td>Beryllium</td><td>7.2</td><td>14</td><td>2,700</td><td>47</td></tr>
<tr><td>Cadmium</td><td>2.5</td><td>2.5</td><td>60</td><td>7.5</td></tr>
<tr><td>Chromium (III/VI)</td><td>30/1</td><td>36/22</td><td>6,800/800</td><td>19/--</td></tr>
<tr><td>Copper</td><td>50</td><td>270</td><td>10,000</td><td>1,720</td></tr>
<tr><td>Cyanide</td><td>27</td><td>27</td><td>10,000</td><td>40</td></tr>
<tr><td>Lead</td><td>63</td><td>400</td><td>3,900</td><td>450</td></tr>
<tr><td>Manganese</td><td>1,600</td><td>2,000</td><td>10,000</td><td>2,000</td></tr>
<tr><td>Mercury</td><td>0.18</td><td>0.81</td><td>5.7</td><td>0.73</td></tr>
<tr><td>Nickel</td><td>30</td><td>140</td><td>10,000</td><td>130</td></tr>
<tr><td>Selenium</td><td>3.9</td><td>36</td><td>6,800</td><td>4</td></tr>
<tr><td>Silver</td><td>2</td><td>36</td><td>6,800</td><td>8.3</td></tr>
<tr><td>Zinc</td><td>109</td><td>2,200</td><td>10,000</td><td>2,480</td></tr>
</table>
<p>The NYSDEC will review the petition and designate it as either approved or disapproved, or allowed use under specific conditions. As part of this approval, the point at which the material is no longer considered a waste will be identified.</p>
</td></tr>
</table>

**Table D-6 (continued)**

<table>
<tr><th>State</th><th>Discussion of Beneficial Use</th></tr>
<tr><td><b>Oregon</b></td><td>No standing determination for this use waste-use combination currently.  An applicant would need to apply to the ODEQ for case-specific approval of the beneficial use.  If the waste stream “does not contain hazardous substances significantly exceeding the concentration in a comparable raw product or commercial product” a Tier One application can be filed which does not require comparison to risk-based screening levels.<br><br>In the case that hazardous substances significantly exceed concentration in a comparable raw product, application must include risk screening which compares concentrations in the material to ODEQ-approved risk-based screening levels.  Examples of ODEQ risk-based screening levels are provided for inorganic chemicals in the following table; other screening levels may be assessed as well.<br><br>
<table>
<tr><th>Element</th><th>Residential RBC (mg/kg)</th><th>Urban Residential RBC (mg/kg)</th><th>Construction Worker RBC (mg/kg)</th></tr>
<tr><td>Arsenic</td><td>0.39</td><td>1.0</td><td>13</td></tr>
<tr><td>Barium</td><td>15,000</td><td>31,000</td><td>60,000</td></tr>
<tr><td>Beryllium</td><td>160</td><td>310</td><td>610</td></tr>
<tr><td>Cadmium</td><td>39</td><td>78</td><td>150</td></tr>
<tr><td>Chromium</td><td>120,000/0.29</td><td>230,000/0.66</td><td>460,000/43</td></tr>
<tr><td>Copper</td><td>3,100</td><td>6,200</td><td>12,000</td></tr>
<tr><td>Cyanide</td><td>47</td><td>94</td><td>190</td></tr>
<tr><td>Lead</td><td>400</td><td>400</td><td>800</td></tr>
<tr><td>Manganese</td><td>1,800</td><td>3,600</td><td>7,200</td></tr>
<tr><td>Mercury</td><td>23</td><td>47</td><td>93</td></tr>
<tr><td>Nickel</td><td>1,500</td><td>3,100</td><td>6,100</td></tr>
<tr><td>Silver</td><td>390</td><td>780</td><td>1,500</td></tr>
</table>
</td></tr>
<tr><td><b>Pennsylvania</b></td><td>There is no beneficial use general permit for use of street sweepings in a soil berm.  The generator that is interested in pursuing this use must apply the Pennsylvania DEP for a general permit.  This process includes the chemical characterization of the material in accordance with 287.132 and the establishment of constituent target limits for the proposed waste and use.  The chemical characterization and associated limits would generally include total concentration and leachable concentration (using TCLP or SPLP), and the target limits would be established on an individual basis.</td></tr>
</table>

**Table D-6 (continued)**

<table>
<tr><th>State</th><th>Discussion of Beneficial Use</th></tr>
<tr><td><b>Wisconsin</b></td><td>
<p>Street sweepings are a defined industrial byproducts in the Wisconsin rules, so a BUD applicant would need to demonstrate “similar characteristics” as defined industrial byproducts (e.g., foundry sand). Use as a soil berm would constitute “unconfined geotechnical fill,” thus the fill would have to be sloped to prevent ponding and covered with 2 ft of native soils and seeded. Application in a residential area is not permitted.</p>
<p>Unconfined geotechnical fill would be permitted for byproduct categories 1-3. Chemical requirements to meet category 3 (the least stringent applicable category) are:</p>
<table>
<tr><th>Element</th><th>ASTM Water Leach Test Concentration (mg/L)</th></tr>
<tr><td>Antimony</td><td>0.012</td></tr>
<tr><td>Arsenic</td><td>0.05</td></tr>
<tr><td>Barium</td><td>4.0</td></tr>
<tr><td>Beryllium</td><td>0.004</td></tr>
<tr><td>Boron</td><td>1.9</td></tr>
<tr><td>Cadmium</td><td>0.005</td></tr>
<tr><td>Chloride</td><td>1,250</td></tr>
<tr><td>Chromium</td><td>0.10</td></tr>
<tr><td>Copper</td><td>1.30</td></tr>
<tr><td>Cyanide (total)</td><td>0.40</td></tr>
<tr><td>Fluoride</td><td>8.0</td></tr>
<tr><td>Iron</td><td>1.5</td></tr>
<tr><td>Lead</td><td>0.015</td></tr>
<tr><td>Manganese</td><td>0.25</td></tr>
<tr><td>Mercury</td><td>0.002</td></tr>
<tr><td>Nickel</td><td>0.20</td></tr>
<tr><td>Nitrite + Nitrate</td><td>20</td></tr>
<tr><td>Phenol</td><td>12</td></tr>
<tr><td>Selenium</td><td>0.10</td></tr>
<tr><td>Silver</td><td>0.10</td></tr>
<tr><td>Sulfate</td><td>1,250</td></tr>
<tr><td>Thallium</td><td>0.004</td></tr>
<tr><td>Zinc</td><td>25</td></tr>
</table>
<p>If approved, certification, reporting and notification requirements must be followed.</p>
</td></tr>
</table>

### Table D-7. Comparison of Eight State Approaches to Beneficial Use of Bark Ash as an Agricultural Amendment

| State | Discussion of Beneficial Use |
|---|---|
| **Florida** | Florida does not have a specific beneficial waste rule, nor does the FDEP normally regulate the use and application of products. Solid waste regulations allow for the recycling of industrial byproducts if (1) the majority of materials are recycled in one year, (2) the materials are not managed to cause contamination in excess of water quality standards and criteria as well as air quality criteria, and (3) the material is not a hazardous waste. A guidance document published in 2002 by the FDEP implies that bark ash may be beneficially used in a land application without FDEP approval, provided that the material was not derived from wood that was painted or chemically treated. |
| **Minnesota** | Since there is no standing beneficial use determination for this application, a beneficial use proposal form must be submitted to the MPCA requesting the agency to make a case specific beneficial use determination. The application should include information on the type of waste, its amount generated and proposed for utilization, proposed end use, and evidence that a market exists. Chemical and physical characterization data must be provided. The chemical constituents to be assessed should be developed in consideration of the processes at the facility producing the waste and a review of material safety data, sheets, ingredient label and other pertinent information. The application should also include an "evaluation of the human health and environmental impacts the proposed use may have and a comparison of these impacts with those from other management alternatives for the solid waste," though no specific risk-based thresholds are identified for use. In lieu of analytical testing data, MPCA may accept sources that can be cited and provided to serve as documentation regarding the material and its analytical properties. |

**Table D-7 (continued)**

<table>
<tr><th>State</th><th>Discussion of Beneficial Use</th></tr>
<tr><td><b>Mississippi</b></td><td>
<p>No standing BUD exists for land application of wood ash. A BUD application would need to be submitted. Land application as a soil amendment would constitute a Category III use. Compliance with beneficial use eligibility requirements is necessary (e.g., must be a by-product, must be a suitable replacement for a raw material, and must not be solely a disposal activity). At a minimum, total metal thresholds in the table below should be analyzed, and if any elements exceed the threshold, the TCLP (other tests can be requested) must be conducted and the results should be less than the leaching procedure thresholds.</p>
<table>
<tr><th>Element</th><th>Total Metal Thresholds (mg/kg)</th><th>Leaching Procedure Thresholds (mg/L)</th></tr>
<tr><td>Arsenic</td><td>10.0</td><td>0.25</td></tr>
<tr><td>Barium</td><td>200.0</td><td>7.0</td></tr>
<tr><td>Cadmium</td><td>2.0</td><td>0.125</td></tr>
<tr><td>Chromium</td><td>10.0</td><td>2.5</td></tr>
<tr><td>Lead</td><td>10.0</td><td>0.375</td></tr>
<tr><td>Mercury</td><td>0.4</td><td>0.05</td></tr>
<tr><td>Selenium</td><td>2.0</td><td>1</td></tr>
<tr><td>Silver</td><td>10.0</td><td>50</td></tr>
</table>
<p>In addition, concentrations should be less than the secondary soil amendment thresholds in the following table.</p>
<table>
<tr><th>Element</th><th>Secondary Soil Amendment Threshold (mg/kg)</th></tr>
<tr><td>Arsenic</td><td>41</td></tr>
<tr><td>Cadmium</td><td>39</td></tr>
<tr><td>Copper</td><td>1,500</td></tr>
<tr><td>Lead</td><td>300</td></tr>
<tr><td>Mercury</td><td>17</td></tr>
<tr><td>Molybdenum</td><td>18</td></tr>
<tr><td>Nickel</td><td>420</td></tr>
<tr><td>Selenium</td><td>36</td></tr>
<tr><td>Zinc</td><td>2,800</td></tr>
</table>
</td></tr>
</table>

**Table D-7 (continued)**

<table>
<tr><th>State</th><th>Discussion of Beneficial Use</th></tr>
<tr><td><b>New Jersey</b></td><td>A CAO applications would need to be submitted to NJDEP. Since the waste is being land applied, the application should include a profile of the material including the results of chemical analysis for contaminants in the state’s latest soil cleanup criteria (SCC). Direct exposure SCC are provided for inorganic elements in the following table.
<table>
<tr><th>Element</th><th>Residential Direct Contact SCC (mg/kg)</th><th>Non-Residential Direct Contact SCC (mg/kg)</th></tr>
<tr><td>Arsenic</td><td>20</td><td>20</td></tr>
<tr><td>Barium</td><td>700</td><td>47,000</td></tr>
<tr><td>Beryllium</td><td>2</td><td>2</td></tr>
<tr><td>Cadmium</td><td>39</td><td>100</td></tr>
<tr><td>Chromium (III/VI)</td><td>120,000/240</td><td>--/6,100</td></tr>
<tr><td>Copper</td><td>600</td><td>600</td></tr>
<tr><td>Lead</td><td>400</td><td>600</td></tr>
<tr><td>Mercury</td><td>14</td><td>270</td></tr>
<tr><td>Nickel</td><td>250</td><td>2,400</td></tr>
<tr><td>Selenium</td><td>63</td><td>3,100</td></tr>
<tr><td>Silver</td><td>110</td><td>4,100</td></tr>
<tr><td>Thallium</td><td>2</td><td>2</td></tr>
<tr><td>Vanadium</td><td>370</td><td>7,100</td></tr>
<tr><td>Zinc</td><td>1,500</td><td>1,500</td></tr>
</table>
SCC for “impact to groundwater” are also provided for organic chemicals, but for inorganic chemicals, the remediation criteria require that “impact to groundwater values for inorganic constituents will be developed based upon site specific chemical and physical parameters.”</td></tr>
<tr><td><b>New York</b></td><td>The beneficial use of unadulterated wood combustion ash, fly ash, or combined ash is allowed as it is not considered a solid waste (Rule section 360-1.15(b)(16)) when used as a soil amendment or fertilizer. The application rate must be limited to the nutrient need of the crop grown on the land on which the wood ash will be applied and does not exceed 16 dry tons per acre per year.</td></tr>
</table>

**Table D-7 (continued)**

<table>
<tr><th>State</th><th>Discussion of Beneficial Use</th></tr>
<tr><td>**Oregon**</td><td>
In a fact sheet “Management of Wood Ash Generated from Biomass Combustion Facilities,” ODEQ acknowledges the potential for wood ash as an agricultural amendment. The ODEQ guidance indicates that wood ash used in a land application setting could be examined for an agricultural use exemption or a solid waste beneficial use determination, but in either case the data would be examined on an ash-specific and application site-specific basis.<br><br>If the beneficial use application route is required, the application would be submitted as there is no standing determination for this use currently. Applicant would need to apply to the ODEQ for case-specific approval of the beneficial use. If the waste stream “does not contain hazardous substances significantly exceeding the concentration in a comparable raw product or commercial product” a Tier One application can be filed which does not require comparison to risk-based screening levels.<br><br>In the case that hazardous substances significantly exceed concentration in a comparable raw product, application must include risk screening which compares concentrations in the material to ODEQ-approved risk-based screening levels. Examples of ODEQ risk-based screening levels are provided for inorganic chemicals in the following table; other screening levels may be appropriate as well.
<table>
<tr><th>Element</th><th>Residential RBC (mg/kg)</th><th>Urban Residential RBC (mg/kg)</th><th>Construction Worker RBC (mg/kg)</th></tr>
<tr><td>Arsenic</td><td>0.39</td><td>1.0</td><td>13</td></tr>
<tr><td>Barium</td><td>15,000</td><td>31,000</td><td>60,000</td></tr>
<tr><td>Beryllium</td><td>160</td><td>310</td><td>610</td></tr>
<tr><td>Cadmium</td><td>39</td><td>78</td><td>150</td></tr>
<tr><td>Chromium (III/VI)</td><td>120,000/0.29</td><td>230,000/0.66</td><td>460,000/43</td></tr>
<tr><td>Copper</td><td>3,100</td><td>6,200</td><td>12,000</td></tr>
<tr><td>Cyanide</td><td>47</td><td>94</td><td>190</td></tr>
<tr><td>Lead</td><td>400</td><td>400</td><td>800</td></tr>
<tr><td>Manganese</td><td>1,800</td><td>3,600</td><td>7,200</td></tr>
<tr><td>Mercury</td><td>23</td><td>47</td><td>93</td></tr>
<tr><td>Nickel</td><td>1,500</td><td>3,100</td><td>6,100</td></tr>
<tr><td>Silver</td><td>390</td><td>780</td><td>1,500</td></tr>
</table>
</td></tr>
</table>

**Table D-7 (continued)**

<table>
<tr><th>State</th><th>Discussion of Beneficial Use</th></tr>
<tr><td><b>Pennsylvania</b></td><td>Under General Permit WMGR046, bark ash may be beneficially used as a soil amendment if measured chemical concentrations are less than the following risk-based thresholds:<br>
<table>
<tr><th>Element</th><th>Total Concentration (mg/kg)</th><th>TCLP or SPLP Leachable Concentration (mg/L)</th></tr>
<tr><td>Arsenic</td><td>29</td><td>0.25</td></tr>
<tr><td>Boron</td><td>--</td><td>7.0</td></tr>
<tr><td>Cadmium</td><td>47</td><td>0.125</td></tr>
<tr><td>Chloride</td><td>--</td><td>250</td></tr>
<tr><td>Chromium (III/VI/total)</td><td>1,200/94/-</td><td>-/-/2.5</td></tr>
<tr><td>Copper</td><td>1,500</td><td>25</td></tr>
<tr><td>Lead</td><td>500</td><td>0.375</td></tr>
<tr><td>Mercury</td><td>86</td><td>0.05</td></tr>
<tr><td>Nickel</td><td>420</td><td>2.5</td></tr>
<tr><td>Selenium</td><td>1,100</td><td>1</td></tr>
<tr><td>Zinc</td><td>2,800</td><td>50</td></tr>
</table>
<br>Other permit conditions apply as detailed in WMGR046.</td></tr>
</table>

**Table D-7 (continued)**

| State | Discussion of Beneficial Use |
|---|---|
| **Wisconsin** | Lands upon which wood ash from the combustion of untreated wood with no additives, preservatives or other alterations other than kiln drying are exempt from the requirements of Chapter NR 518 provided that best practices for storage, handling, transportation, and spreading are followed. storage, handling, transportation and landspreading follow best management practices to minimize uncontrolled dispersion by wind and water and provided that the following requirements are met by those responsible for landspreading activities or the wood ash operator:<br>1. An initial bulk chemical analysis shall be performed on a representative sample of wood ash to determine the composition and neutralizing index using a testing procedure approved by the WDNR. The WDNR may limit landspreading based on the level of contaminants found in this testing procedure.<br>2. Landspreading shall be for the purpose of beneficially using the wood ash for soil pH adjustment or nutrient addition using accepted agricultural practices.<br>3. Maximum one time application rates shall be limited to 15 dry tons per acre and a total cumulative application limited to 50 dry tons per acre.<br>There are restrictions on wood ash that is “top dressed”, including within 100 feet of navigable bodies of water, such as streams or ponds, a wetland or a floodplain; within 1,000 feet of public water supply wells or 200 feet of private water supply wells; within 200 feet of residences unless written consent is obtained from the residents; within 25 feet of public roads; within 25 feet of intermittent streams, drainage ways, road ditches, surface tile inlets or other areas which concentrate runoff; on any fields with slopes greater than 6% unless the land is in a soil conservation management plan (otherwise, slopes must be <12%); and on frozen ground.<br>Records must be maintained regarding the quantities of ash produced, areas where ash was distributed, and analytical results.<br>WDNR has additional provisions for wood ash derived from wood with additives such as waxes used as marking crayons, end coatings or adhesives used for fingerjointing, edgegluing or face laminating. The generator must submit an initial request to WDNR describing the wood fuels and material safety data sheets of additives along with an initial characterization of the ash. With this type of ash, annual bulk chemical analysis must be conducted annually from a monthly composited sample of wood ash to determine the composition and neutralizing index and an annual report indicating the quantity generated and the quantity landspread is required. |

Table D-8.  Comparison of Eight State Approaches to Beneficial Use of Drinking Water Treatment Sludge as a Soil Amendment

| State | Discussion of Beneficial Use |
|---|---|
| **Florida** | Beneficial use is not addressed in any current state rule, but the FDEP has utilized research conducted within the state to provide guidance to those wishing to beneficially use drinking water treatment plant sludge (Guidance for land application of drinking water treatment plant sludge; June 6, 2006).  The FDEP used data collected for both the total concentration (mg/kg) and the SPLP leachable concentration (mg/L) of sludge samples from treatment facilities using lime softening, alum coagulation and ferric coagulation to develop beneficial use guidelines that if followed meet FDEP policy objectives.<br>In the drinking water sludge guidance, the FDEP determined that lime-based drinking water sludge could be land applied without FDEP approval provided: (1) the material is not a hazardous waste, (2) the application does not cause a violation of the FDEP groundwater and surface water standards and criteria, (3) the material is not applied in a way that causes fugitive dust emissions, objectionable odors, or a public nuisance, and (4) the application rate is less than 9 dry tons per acre per year.<br>The FDEP stated in its guidance that alum or ferric based drinking water sludges in the state must be considered for beneficial use only on a case-by-case basis based on test results that suggested a potential impact to human health and the environment. |

**Table D-8 (continued)**

<table>
<tr><th>State</th><th>Discussion of Beneficial Use</th></tr>
<tr><td><b>Minnesota</b></td><td>
<p>Permitted as a standing use BUD for “Uncontaminated by-product limes when used as agricultural liming materials.” The material must be distributed following appropriate state regulations and statutes. Application rates for by-product limes must be based on the lime recommendations of the University of Minnesota Extension Service and cannot cause the soil pH to exceed 7.1 after application. Site-specific application rates for by-product lime must be determined by an individual that has a background and understanding of crop nutrient management.</p>
<p>The MPCA factsheet “Guidelines for Land Application of By-Product Limes” recommend as best management practices setback distances from surface water bodies and slope restrictions for application sites. The guidelines also recommend the following limits for pollutant concentrations (derived from EPA 503 biosolids rules):</p>
<table>
<tr><th>Element</th><th>Monthly Average Concentration Limit (mg/kg)</th></tr>
<tr><td>Arsenic</td><td>41</td></tr>
<tr><td>Cadmium</td><td>39</td></tr>
<tr><td>Copper</td><td>1,500</td></tr>
<tr><td>Lead</td><td>300</td></tr>
<tr><td>Mercury</td><td>17</td></tr>
<tr><td>Molybdenum</td><td>18</td></tr>
<tr><td>Nickel</td><td>420</td></tr>
<tr><td>Selenium</td><td>36</td></tr>
<tr><td>Zinc</td><td>2,800</td></tr>
</table>
<p>No specific guidance is provided for other types of water treatment facility sludge (e.g., ferric sludge, alum sludge), and thus a beneficial use proposal form must be submitted to the MPCA requesting the agency to make a case specific beneficial use determination for these wastes.</p>
</td></tr>
</table>

**Table D-8 (continued)**

<table>
<tr><th>State</th><th>Discussion of Beneficial Use</th></tr>
<tr><td><b>Mississippi</b></td><td>No standing BUD exists for land application of water treatment sludge. A BUD application would need to be submitted. Land application as a soil amendment would constitute a Category III use. Compliance with beneficial use eligibility requirements is necessary (e.g., must be by-product, must be a suitable replacement for raw material, and must not be solely a disposal activity). At a minimum, total metal thresholds in the table below should be analyzed, and if any elements exceed the threshold, the TCLP (other tests can be requested) must be conducted and the results should be less than the leaching procedure thresholds.
<table>
<tr><th>Element</th><th>Total Metal Thresholds (mg/kg)</th><th>Leaching Procedure Thresholds (mg/L)</th></tr>
<tr><td>Arsenic</td><td>10.0</td><td>0.25</td></tr>
<tr><td>Barium</td><td>200.0</td><td>7.0</td></tr>
<tr><td>Cadmium</td><td>2.0</td><td>0.125</td></tr>
<tr><td>Chromium</td><td>10.0</td><td>2.5</td></tr>
<tr><td>Lead</td><td>10.0</td><td>0.375</td></tr>
<tr><td>Mercury</td><td>0.4</td><td>0.05</td></tr>
<tr><td>Selenium</td><td>2.0</td><td>1</td></tr>
<tr><td>Silver</td><td>10.0</td><td>50</td></tr>
</table>
In addition, concentrations should be less than the secondary soil amendment thresholds in the following table.
<table>
<tr><th>Element</th><th>Secondary Soil Amendment Threshold (mg/kg)</th></tr>
<tr><td>Arsenic</td><td>41</td></tr>
<tr><td>Cadmium</td><td>39</td></tr>
<tr><td>Copper</td><td>1,500</td></tr>
<tr><td>Lead</td><td>300</td></tr>
<tr><td>Mercury</td><td>17</td></tr>
<tr><td>Molybdenum</td><td>18</td></tr>
<tr><td>Nickel</td><td>420</td></tr>
<tr><td>Selenium</td><td>36</td></tr>
<tr><td>Zinc</td><td>2,800</td></tr>
</table>
</td></tr>
</table>

**Table D-8 (continued)**

<table>
<tr><th>State</th><th>Discussion of Beneficial Use</th></tr>
<tr><td><b>New Jersey</b></td><td>
<p>A CAO application would need to be submitted to NJDEP.  Since the waste is being land applied, the application should include a profile of the material including the results of chemical analysis for contaminants in the state's latest soil cleanup criteria (SCC). Direct exposure SCC are provided for inorganic elements in the following table.</p>
<table>
<tr><th>Element</th><th>Residential Direct Contact SCC (mg/kg)</th><th>Non-Residential Direct Contact SCC (mg/kg)</th></tr>
<tr><td>Arsenic</td><td>20</td><td>20</td></tr>
<tr><td>Barium</td><td>700</td><td>47,000</td></tr>
<tr><td>Beryllium</td><td>2</td><td>2</td></tr>
<tr><td>Cadmium</td><td>39</td><td>100</td></tr>
<tr><td>Chromium</td><td>120,000/240</td><td>--/6,100</td></tr>
<tr><td>Copper</td><td>600</td><td>600</td></tr>
<tr><td>Lead</td><td>400</td><td>600</td></tr>
<tr><td>Mercury</td><td>14</td><td>270</td></tr>
<tr><td>Nickel</td><td>250</td><td>2,400</td></tr>
<tr><td>Selenium</td><td>63</td><td>3,100</td></tr>
<tr><td>Silver</td><td>110</td><td>4,100</td></tr>
<tr><td>Thallium</td><td>2</td><td>2</td></tr>
<tr><td>Vanadium</td><td>370</td><td>7,100</td></tr>
<tr><td>Zinc</td><td>1,500</td><td>1,500</td></tr>
</table>
<p>SCC for "impact to groundwater" are also provided for organic chemicals, but for inorganic chemicals, the remediation criteria require that "impact to groundwater values for inorganic constituents will be developed based upon site specific chemical and physical parameters."  Case-specific CAOs have been issued by NJDEP for some uses of water treatment plant sludge application to agricultural land.</p>
</td></tr>
</table>

**Table D-8 (continued)**

<table>
<tr><th>State</th><th>Discussion of Beneficial Use</th></tr>
<tr><td><b>New York</b></td><td>
<p>A case-specific petition for a determination that this waste may be beneficially used must filed. The petition must include a description of the waste stream, the beneficial use market, management practices, and justification with respect to its potential for beneficial use. This would include information on “chemical and physical characteristics of the waste.” The NYSDEC would evaluate the petition, including an assessment of “toxic constituents” and how these compare to those found in analogous products or feedstock. State soil cleanup objectives (SCOs) developed by the state’s environmental remediation program may be used as benchmarks as part of the evaluation processing. SCOs are provided for a range of inorganic and organic chemicals, for a multiple different exposure pathways and receptors.</p>
<p>Examples of SCOs for inorganic chemicals and several pathways are as follows:</p>
<table>
<tr><th>Element</th><th>Unrestricted SCO (mg/kg)</th><th>Unrestricted Residential SCO (mg/kg)</th><th>Protection of Ecological Resources SCO (mg/kg)</th><th>Protection of Groundwater SCO (mg/kg)</th></tr>
<tr><td>Arsenic</td><td>13</td><td>16</td><td>13</td><td>16</td></tr>
<tr><td>Barium</td><td>350</td><td>350</td><td>433</td><td>820</td></tr>
<tr><td>Beryllium</td><td>7.2</td><td>14</td><td>10</td><td>47</td></tr>
<tr><td>Cadmium</td><td>2.5</td><td>2.5</td><td>4</td><td>7.5</td></tr>
<tr><td>Chromium (III/VI)</td><td>30/1</td><td>36/22</td><td>41/1</td><td>-/19</td></tr>
<tr><td>Copper</td><td>50</td><td>270</td><td>50</td><td>1,720</td></tr>
<tr><td>Cyanide</td><td>27</td><td>27</td><td>--</td><td>40</td></tr>
<tr><td>Lead</td><td>63</td><td>400</td><td>63</td><td>450</td></tr>
<tr><td>Manganese</td><td>1,600</td><td>2,000</td><td>1,600</td><td>2,000</td></tr>
<tr><td>Mercury</td><td>0.18</td><td>0.81</td><td>0.18</td><td>0.73</td></tr>
<tr><td>Nickel</td><td>30</td><td>140</td><td>30</td><td>130</td></tr>
<tr><td>Selenium</td><td>3.9</td><td>36</td><td>3.9</td><td>4</td></tr>
<tr><td>Silver</td><td>2</td><td>36</td><td>2</td><td>8.3</td></tr>
<tr><td>Zinc</td><td>109</td><td>2,200</td><td>109</td><td>2,480</td></tr>
</table>
<p>The NYSDEC will review the petition and designate it as either approved or disapproved, or allowed use under specific conditions. As part of this approval, the point at which the material is no longer considered a waste will be identified.</p>
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**Table D-8 (continued)**

<table>
<tr><th>State</th><th>Discussion of Beneficial Use</th></tr>
<tr><td><b>Oregon</b></td><td>
<p>No standing determination for this use currently.  Applicant would need to apply to the ODEQ for case-specific approval of the beneficial use.  If the waste stream “does not contain hazardous substances significantly exceeding the concentration in a comparable raw product or commercial product” a Tier One application can be filed which does not require comparison to risk-based screening levels.</p>
<p>In the case that hazardous substances significantly exceed concentration in a comparable raw product, application must include risk screening which compares concentrations in the material to ODEQ-approved risk-based screening levels.  Examples of ODEQ risk-based screening levels are provided for inorganic chemicals in the following table; other screening levels may be appropriate as well.</p>
<table>
<tr><th>Element</th><th>Residential RBC (mg/kg)</th><th>Urban Residential RBC (mg/kg)</th><th>Construction Worker RBC (mg/kg)</th></tr>
<tr><td>Arsenic</td><td>0.39</td><td>1.0</td><td>13</td></tr>
<tr><td>Barium</td><td>15,000</td><td>31,000</td><td>60,000</td></tr>
<tr><td>Beryllium</td><td>160</td><td>310</td><td>610</td></tr>
<tr><td>Cadmium</td><td>39</td><td>78</td><td>150</td></tr>
<tr><td>Chromium</td><td>120,000/0.29</td><td>230,000/0.66</td><td>460,000/43</td></tr>
<tr><td>Copper</td><td>3,100</td><td>6,200</td><td>12,000</td></tr>
<tr><td>Cyanide</td><td>47</td><td>94</td><td>190</td></tr>
<tr><td>Lead</td><td>400</td><td>400</td><td>800</td></tr>
<tr><td>Manganese</td><td>1,800</td><td>3,600</td><td>7,200</td></tr>
<tr><td>Mercury</td><td>23</td><td>47</td><td>93</td></tr>
<tr><td>Nickel</td><td>1,500</td><td>3,100</td><td>6,100</td></tr>
<tr><td>Silver</td><td>390</td><td>780</td><td>1,500</td></tr>
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**Table D-8 (continued)**

<table>
<tr><th>State</th><th>Discussion of Beneficial Use</th></tr>
<tr><td><b>Pennsylvania</b></td><td>Under Beneficial Use Permit WMGR088, drinking water treatment sludge may be beneficially used for application on agricultural lands if the following conditions are met:
<table>
<tr><th>Constituent</th><th>Total Concentration Should be Less Than (mg/kg)</th><th>Maximum Lifetime Loading Rates Should Not Exceed (lb/acre)</th></tr>
<tr><td>pH</td><td>5.5 – 8.5</td><td>--</td></tr>
<tr><td>Arsenic</td><td>41</td><td>36</td></tr>
<tr><td>Cadmium</td><td>25</td><td>34</td></tr>
<tr><td>Chloride</td><td>--</td><td>--</td></tr>
<tr><td>Chromium</td><td>1,200</td><td>--</td></tr>
<tr><td>Copper</td><td>1,500</td><td>1320</td></tr>
<tr><td>Lead</td><td>300</td><td>264</td></tr>
<tr><td>Mercury</td><td>17</td><td>15</td></tr>
<tr><td>Molybdenum</td><td>18</td><td>--</td></tr>
<tr><td>Nickel</td><td>420</td><td>370</td></tr>
<tr><td>Selenium</td><td>36</td><td>88</td></tr>
<tr><td>Sodium</td><td>3,500</td><td>--</td></tr>
<tr><td>Zinc</td><td>2,800</td><td>2.464</td></tr>
<tr><td>PCBs</td><td>3</td><td>--</td></tr>
</table>
</td></tr>
<tr><td><b>Wisconsin</b></td><td>Use of lime sludge as an agricultural amendment are exempted from the requirement found in Chapter NR 518, Landspreading of Solid Waste, provided that facilities that use lime sludge conduct analysis to determine the physical and chemical characteristics of the material, including pH, nutrient content, salts content, and metals content. If the WDNR identifies the material as having value as a soil conditioner or fertilizer, it may be land applied in accordance with accepted agricultural practices.</td></tr>
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