Ash Management Policy in Florida

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Florida has recently revised its policy document concerning beneficial re-use of waste-to-energy ash. The following is a reprint of the body of that document, without the appendices.

DISCLAIMER: The information contained in this document is intended for guidance only. It is not a rule and does not create any standards or criteria which must be followed by the regulated community. While the use of waste-to-energy (WTE) ash or WTE ash products in accordance with this guidance is not expected to result in contamination of ground water or surface water, compliance with this document does not relieve the owner or operator from the responsibility for complying with the Department’s rules nor from any liability for environmental damages caused by the use of the ash or ash product.

PREFACE: This document was originally finalized on August 21, 2000. The primary purpose of this revision, Revision No. 1, is to include reuse target levels (RTLs) in this document for assistance to the regulated community. The use of the August 21, 2000 document should be discontinued. An applicant preparing a Beneficial Use Demonstration for waste-to-energy ash should follow the guidance contained in this revised document.
1.0 BACKGROUND

1.1 RCRA Issues

Prior to 1994, it was generally believed that the ash residue (ash) from municipal waste-to-energy (WTE) facilities was exempt from regulation under Subtitle C of the Resource Conservation and Recovery Act (RCRA). This changed on May 2, 1994, when the U.S. Supreme Court issued a decision in the City of Chicago v. Environmental Defense Fund, Inc., 114 S.Ct. 1588 (1994). In this case, the Court held that municipal WTE facilities could burn household waste alone or in combination with industrial or commercial wastes and not be regulated under Subtitle C of RCRA, but the ash generated by these facilities was not exempt from regulation. Consequently, owner/operators of WTE facilities had to determine if their ash was a hazardous waste. This decision placed a cloud of uncertainty on the prospects of using WTE ash as a product rather than disposing of it as a solid waste.

In response to this decision, on May 27, 1994, the U.S. Environmental Protection Agency (EPA) issued an implementation strategy which directed generators of ash from WTE facilities to conduct an initial hazardous waste characterization of their ash within 90 days of the effective date of the Supreme Court decision. On June 23, 1994 (59 FR 32427), the EPA released a draft guidance document to assist these generators in determining whether their ash exhibited the Toxicity Characteristic (TC). This draft guidance was entitled, "Sampling and Analysis of Municipal Refuse Incineration Ash." By September 1994, all WTE facilities in Florida had characterized their ash in accordance with EPA's draft protocol and determined that the ash was not a characteristic hazardous waste. However, the issue of sampling point location, or point of generation, for WTE ash had not yet been resolved, which left the initial characterizations in doubt.

On February 3, 1995, the EPA published its determination in the Federal Register (60 FR 6666) that the point of generation at which RCRA Subtitle C jurisdiction began for WTE ash was when the ash exited the combustion building following the combustion and air pollution control processes. This determination allowed WTE facilities to combine the fly ash and bottom ash inside the combustion building prior to sampling. It also allowed the

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1 The Supreme Court decision became effective on June 1, 1994.
2 On July 24, 1995 (60 FR 37896), this document became final and was entitled, "Guidance for the Sampling and Analysis of Municipal Waste Combustion Ash for the Toxicity Characteristic."
treatment or conditioning of the ash inside the combustion building prior to sampling. As a result of this determination, the Florida Department of Environmental Protection (Department) concluded that the initial ash characterizations for the Florida WTE facilities were acceptable. In addition, on October 5, 1995, the Department determined it would not require additional characterizations of the WTE ash prior to disposal because, in accordance with 40 CFR 262.11, these decisions are the responsibility of the generator and all the ash was being disposed of in lined landfills. Nonetheless, the Department continues to expect the generator to recharacterize its ash if there are changes in the WTE facility process, feed stream composition or other factors which could be reasonably expected to adversely affect the leachability of the ash.

1.2 State Issues

For many years, WTE plant owner/operators and third party recyclers have been investigating the possibility of using WTE ash as a product or as a raw material in the formulation of other products rather than disposing of this ash as a solid waste. It is estimated that the 13 WTE facilities currently operating in Florida burn approximately 5 million tons of waste per year and generate approximately 1.4 million tons per year of ash. Currently, this ash is disposed of in landfills located throughout the State which are lined and meet or exceed the RCRA Subtitle D requirements. To develop a uniform review process, the Solid Waste Association of North America (SWANA), the owner/operators of WTE facilities and ash recyclers asked the Department to develop guidelines for obtaining approvals to use WTE ash.

While considering this request, questions were raised about the Department’s authority to approve the use of ash. In 1988, the Legislature adopted Section 403.7045(5), Florida Statutes (F.S.), which encouraged the Department to develop methods for recycling and reuse of ash. However, Section 403.7045(5), F.S. also clearly stated that “ash shall be disposed of in a properly designed solid waste disposal area that complies with standards developed by the department.” This statute did not give specific authority to the Department to approve ash use projects or to adopt rules approving ash use projects. Furthermore, in 1996 the Legislature amended the Florida Administrative Procedure Act (APA) to restrict the rulemaking authority of all state agencies. In light of these changes to the APA, the Department became reluctant to consider or approve proposals for ash use projects.

In order to resolve this difficulty, in 1998 the Florida Legislature amended Section 403.7045(5), F.S. to read as follows:
(5) Ash residue generated by a solid waste management facility from the burning of solid waste must be disposed of in a properly designed solid waste disposal area that complies with standards developed by the department for the disposal of such ash residue. The department shall work with solid waste management facilities that burn solid waste to identify and develop methods for recycling and reuse of ash residue or treated ash residue, and the department may allow such recycling or reuse by an applicant who demonstrates that no significant threat to public health will result and that applicable department standards and criteria will not be violated. The Division of Waste Management shall direct the district offices and bureaus on matters relating to the interpretation and applicability of this subsection. The department may adopt rules necessary for administering this subsection, but the department is not required to amend its existing rules.

This new language granted the Department clear authority for approving WTE ash use projects, provided public health is protected and applicable Department standards and criteria are not violated. WTE facility owner/operators or third party recyclers or operators who wish to beneficially use WTE ash rather than dispose of it must demonstrate to the Department that the proposed use will satisfy these requirements.

2.0 PURPOSE

The purpose of this document is to implement the provisions of Section 403.7045(5), F.S. by providing guidance to the regulated community and the Department for the preparation of acceptable Beneficial Use Demonstrations (BUDs) which establish the basis for using WTE ash either as a product or as a raw material in the formulation of other products. While additional rulemaking is authorized by statute and is being considered by the Department, this document is not a rule and does not create any standards or criteria which must be followed by the regulated community.
3.0 GOALS FOR BENEFICIAL USE DEMONSTRATIONS

Consistent with Sections 403.7045(5), F.S. and 403.704(6), F.S., it is the Legislature’s and the Department’s policy to promote the recycling of WTE ash in a cost-effective manner, provided the recycling is protective of human health and applicable Department standards and criteria will not be violated. In order for a project to be approved by the Department, the BUD for WTE ash must provide reasonable assurance\(^3\) that the proposed use will satisfy Section 403.7045(5), F.S. The main goals for applicants seeking approvals for the beneficial use of ash or ash-derived products are summarized as follows:

(a) The ash must be managed and used so that it will not cause violations of applicable Department air standards or ground water or surface water standards and criteria.

(b) 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 $1 \times 10^{-6}$ 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.

(c) 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.

(d) The use of the ash must not create a public nuisance.

\(^3\) The Department requires "reasonable assurance" but not "absolute guarantees that a project will not under any circumstances cause pollution." See J.T. McCormick, et al. v. City of Jacksonville and Department of Environmental Regulation, 12 F.A.L.R. 960 (Final Order dated January 22, 1989). The reasonable assurance standard has been applied to a wide range of cases, including cases involving landfills, and the same standard would apply to the Department’s review of BUDs.
4.0 GENERAL BUD REQUIREMENTS

4.1 General Format and Process

The BUD should have text printed on 8 1/2 inch by 11 inch consecutively numbered pages with a cover sheet stating the project title, date and applicant's name and address. It should also include a table of contents describing the body of the report and the appendices. The BUD should be a complete document containing process descriptions for generation, handling and treatment of the ash, and all supporting calculations, figures, laboratory analytical data, risk assessments or other information required in this document or provided by the applicant supporting each proposed use of the WTE ash.

The BUD must show that the goals of Section 3.0 will be achieved for each proposed ash use. To evaluate potential human health risks, the requirements of Section 4.2 should be followed. In order to determine the potential of ash to contaminate ground or surface water, the applicant should normally compare the results of the Synthetic Precipitation Leaching Procedure (SPLP) testing, EPA Method 1312, required in Section 6.2 to the Department's ground water and surface water standards and criteria.

To begin the Department's review process, two copies of the BUD should be submitted to the Administrator of the Department's Solid Waste Section in Tallahassee, Florida. In addition, two copies of the BUD should be submitted to the Department's District office in the District where the WTE facility generating the ash, or the ash recycling facility, addressed in the BUD is located. A list of contacts and addresses for the Tallahassee and District offices is provided in APPENDIX A.

Submittal of a BUD, by itself, does not constitute a request to modify a permit or site certification. However, a BUD may be used as supporting documentation for any such request. A single BUD may be appropriate for requests to use ash in a product, while separate BUDs (or separate elements within a single BUD)

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4 This document assumes that an applicant will choose to use the results of the SPLP tests to evaluate leaching potential of the ash and is written from that perspective. However, potential ground water or surface water impacts can also be evaluated using column leaching tests (lysimeters). Also ground water impact evaluations can be supplemented using computerized ground water modeling or longer term studies of smaller demonstration projects constructed in the field under controlled conditions with approved ground water monitoring plans. The BUD should thoroughly explain these alternatives if they are proposed. In addition, potential ground water and surface water impacts can be evaluated by comparing the concentrations of chemicals detected in the ash to the RTL leachability values in APPENDIX D.
may be appropriate for different use projects. 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). A permit or certification modification may also be needed if the ash is specially managed on-site as part of a project. For off-site uses of ash that require Department approval under Section 10.0, separate Department approvals will be required for each proposed use specified in Section 10.0, although a single BUD may be used to support each request for approval. Denial of a proposal in a BUD does not constitute a denial of any previously approved activity at a WTE facility or landfill.

4.2 Human Health Risks From Direct Exposure

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\(^5\) (RTLs) contained in APPENDIX D, and show that the Department’s RTLs will not be exceeded for the proposed use; or (2) 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\(^6\) (ATLs) for that use; or (3) show that human exposure pathways are negligible or significantly reduced for the proposed ash use so that the risk goals of Section 3.0(b) will not be exceeded; or (4) 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\(^7\) or as protected structural fill\(^8\) or

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\(^5\) The RTLs only apply to the upper two feet of soil where the ash or proposed ash product is applied.

\(^6\) While the goal of the HRA will be to show that the health risk goals of Section 3.0(b) are achieved for use of the ash or ash-derived product, the concentrations of chemicals used as input values in a Department approved HRA may be considered "alternate target levels" for the purposes of determining chemicals of concern in Section 6.2. ATLs are further defined in Section 6.2.

\(^7\) For example, use of ash as part of the aggregate feed in the production of Portland cement, concrete or asphalt.

\(^8\) For the purposes of this document, "protected structural fill" means fill which will be used in construction projects but, through use of engineering controls such as barriers like concrete or asphalt, will not be exposed at its surface when the construction is complete and thus human exposure to the fill will be prevented. Examples of this use would include fill used underneath a building, below a paved parking lot, as subbase for a paved road or behind a solid retaining wall.
which is covered with at least two feet of clean fill\textsuperscript{9} 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. To ensure that the human exposure pathways are negligible for use as protected structural fill, the BUD should provide assurance, normally in the form of a legally enforceable institutional control, that the engineering controls of this use, such as retaining walls, concrete slabs or paved surfaces, will be maintained. To ensure that the human exposure pathways are negligible for use under two feet of clean fill, the BUD should provide assurance, normally in the form of a legally enforceable institutional control, that the two feet of cover will be maintained. Baseline analysis to characterize the ash or ash products in Section 6.2 will still be required even if the ash use provides negligible human exposure pathways. Weekly analysis for some constituents will not be required (see Sections 7.1(a) and 8.0(b)).

In some cases, ash use may be planned for a particular site in which the naturally occurring background conditions are known, or can be readily determined. When evaluating proposed ash uses, the Department will consider naturally occurring background conditions at a site provided: (1) the site is not planned for residential use; (2) naturally occurring background chemical concentrations have been properly determined; and (3) the concentrations of chemicals in the ash or ash product as determined by baseline analysis in Section 6.2 are at or below naturally occurring background concentrations.

An applicant may choose to use the Department’s RTLs for human health risk evaluations of proposed ash uses. However, as was stated in Section 2.0, this document is not a rule and does not create any standards or criteria which must be followed by the regulated community. Thus, it should be remembered that the Department’s RTLs are intended for guidance only and their use is not required.

An applicant may also evaluate the potential for direct human exposure to the ash or ash products by conducting a separate human HRA for each proposed ash use. This HRA must be prepared by a toxicologist, or other qualified professional with experience in the preparation of health risk assessments, and

\textsuperscript{9} For the purposes of this document, "clean fill" means soil which has not become contaminated by human activity or soil which meets the "cleaned soil" criteria of Chapter 62-713, F.A.C. Soil may include other similar materials if approved by the Department.
must conform to standard guidelines and practices for risk assessments. It should be based on an estimate of the reasonable maximum exposure (RME) expected to occur under both proposed and reasonably anticipated future land uses. The Department considers the RME to be the highest exposure reasonably expected to occur at a site where ash is used, rather than the "worst possible case." The HRA should include basic elements such as a description of the project and the contaminants of concern, an exposure assessment, a toxicity assessment and a risk characterization. The HRA should show that the goals of Section 3.0 will be achieved. If any ATLs are proposed to justify use of the ash or ash-derived products, then the HRA should provide the derivation and documentation for these ATLs. Baseline analysis in Section 6.2 will still be required to characterize the ash or ash-derived products.

5.0 BENEFICIAL USE AND PROCESS DESCRIPTION

5.1 Description of Ash and Proposed Use

The BUD should include a detailed description of the ash or ash-derived product that will be used and the proposed use or uses for that ash or ash-derived product. Since project approvals are given on a use-specific basis, the Department recommends that each proposed ash use or product, from the point at which it is generated to final use, be addressed separately in the BUD. The BUD should consider both the proposed uses and reasonably anticipated future uses of the ash or ash-derived product in its evaluation.

5.2 Usefulness as Raw Material or Product

The BUD should show that a proposed ash use is beneficial rather than solely an alternate means of disposal. An ash use is beneficial if the ash has chemical or physical properties similar to the raw material it is replacing, or if its use has enhancing qualities to the final product which would distinguish the proposed use from disposal. For example, if an ash is to be used as a protected structural fill such as road subbase, then the BUD could include documentation that the structural properties of the ash are similar to other materials normally used in road

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11 While the Department does not require a "life cycle analysis" of the ash, the BUD should consider future, reasonably anticipated land use changes which could result in additional impacts to human health and the environment from the ash in its proposed use.
12 Protected structural fill is defined in Section 4.2.
subbase applications. Or if an ash is proposed as an aggregate feed in cement manufacturing, then data could be provided to show this use is similar to other raw materials typically used in this process. To the extent possible, a BUD should also include use approval letters from other agencies which would regulate these applications such as the Florida Department of Transportation or agencies in other states that have reviewed the same or similar proposals.

5.3 Process Operation Plan

The BUD should include a Process Operation Plan which will describe the following:

(a) A description of how the ash will be generated and processed into the final product including (if necessary) any treatment of the ash;

(b) Procedures for routine analysis of the ash (Section 7.0) to ensure that the ash’s composition or proposed product’s composition have not changed significantly from the results of the baseline analysis (Section 6.2) so as to require another characterization (Section 6.4);

(c) Procedures for ensuring that the Quarterly Reports (Section 7.4) will be completed and submitted to the Department in a timely manner each quarter;

(d) Procedures for ensuring that fugitive dust emissions from the ash or proposed product will be controlled during transportation and off-site storage; and

(e) Procedures for ensuring that any off-site storage of the ash or proposed ash-derived product will not result in violations of the Department’s ground water or surface water standards. In place of proposing leachate and stormwater controls, the BUD could include a demonstration that the leachability of the ash or ash-derived product will be at or below ground water and surface water standards and criteria before leaving the WTE facility or ash recycling facility where it is generated. This testing could include evaluations of

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13 While the BUD must provide information that the proposed ash uses are beneficial, the Department will rely upon determinations made by other Florida agencies on the aspects of ash use proposals which are within the regulatory authority of those agencies and outside of the jurisdiction of the Department.
the ash in its raw form, in a conditioned form or as formulated in the proposed product.

6.0 ASH AND PRODUCT CHARACTERIZATIONS

6.1 Hazardous Waste Characterization

In order to be approved, a BUD proposed for WTE ash should include a demonstration that the ash to be used is not a hazardous waste. Several options are available to the applicant for providing this information.

First, as was stated in Section 1.0, by September 1995 all active WTE facilities in Florida had determined their ash waste streams were not characteristic hazardous wastes. This testing was considered the "initial characterization" of the ash. In most cases, prior to this sampling and analysis the fly ash and bottom ash streams were combined inside the combustion building following the combustion and air pollution control processes. In addition, some WTE facilities conditioned the ash prior to sampling. Both combining the fly ash with bottom ash and conditioning of the ash prior to sampling were allowed by EPA if this was conducted within the combustion building. Consequently, if the ash waste stream that was tested in 1995 is the same proposed for use in the BUD, then the information from that initial characterization can be used and should be submitted to support a non-hazardous waste determination for the ash. However, if the ash in the proposed BUD is not the same waste stream as that which was tested in September 1995, i.e., is a new waste stream, then a separate hazardous waste characterization will be required for the ash proposed in the BUD. Some reasons why an ash stream would be considered new and not the same as the ash tested in the initial characterization are as follows:

(a) The ash in the initial characterization consisted of combined fly ash and bottom ash, but the ash proposed in the BUD is not combined;

(b) Ash conditioning was conducted during the initial characterization but is either not proposed or a different treatment technology is proposed for the ash in the BUD;

(c) The current or proposed composition of the waste stream to the WTE facility for the BUD is significantly different from the waste stream during the initial characterization; or
The WTE facility has implemented significant process changes since the initial characterization which would reasonably be expected to adversely affect the leachability of the ash.

Any new ash waste stream\textsuperscript{14} proposed in the BUD should be sampled and analyzed in accordance with EPA's June 1995 protocol called, "Guidance For The Sampling And Analysis Of Municipal Waste Combustion Ash For The Toxicity Characteristic" (EPA, 1995). The results of this testing should be included in the BUD.

6.2 Baseline Analysis

Baseline analysis refers to a chemical characterization required of the ash or the product using ash which is proposed in the BUD. The goals of baseline analysis are: (1) to determine total and leachable concentrations of chemicals in the ash or proposed product for use as, or confirmation of, input parameters in a HRA (i.e., ATLs) or to determine concentrations of chemicals in the ash or proposed product for comparison to the Department's RTLs; (2) to determine if the ash or product will leach constituents at concentrations greater than the Department's ground water or surface water standards or criteria; and (3) to identify the chemicals of concern (COCs) or other chemicals, i.e. potential COCs, that should be monitored during routine analysis. Available, relevant data on ash or proposed product chemical characteristics from a WTE facility can be used to supplement the information needed for baseline analysis provided this data can be reasonably shown to be properly obtained and representative of the ash being evaluated. The decision to allow the use of available ash data will be made by the Department on a case-by-case basis.

Chemicals are considered COCs if they could create a potential human health risk from direct exposure or if they have the potential to contaminate ground water or surface water, i.e., leachability concerns. In this document, "COCs for direct human exposure" are defined as any chemicals detected in the baseline

\textsuperscript{14} While outside the scope of this guidance document, it is important to remember that WTE ash management changes implemented to accommodate a BUD may also result in changes to the residual ash stream (if not all the ash stream is proposed for use in the BUD). Since this residual ash would normally be disposed of at a landfill, the generator is also responsible for ensuring that the residual ash is not a hazardous waste. This determination may require a characterization of the residual ash using EPA's June 1995 sampling and analysis protocol.
analyses where the upper 95 percent confidence level\textsuperscript{15} for the mean concentrations are: (1) greater than the Department’s residential RTLs for direct exposure contained in APPENDIX D; or (2) greater than the ATLs for direct human exposure\textsuperscript{16} as determined by a Department approved HRA.

Chemicals detected in baseline analysis are considered "\textit{COCs for leachability}" when any of the following three conditions occur. In the first condition, detected chemicals are considered COCs for leachability when the upper 95 percent confidence level for the mean of their total concentrations in the baseline analyses exceed the corresponding RTL leachability values contained in APPENDIX D. If the total concentration of a chemical exceeds its RTL leachability value, the applicant may choose to conduct SPLP testing for that chemical to further evaluate its leachability. In that case, the chemical is considered a COC for leachability when the upper 95 percent confidence level for its mean concentration in the SPLP\textsuperscript{17} results is: (1) above the Department's ground water or surface water standards\textsuperscript{18} or criteria; or (2) above the ATL for leachability if determined by a HRA. If a chemical's leachability values in APPENDIX D are exceeded in the total analysis but the SPLP results do not indicate that the ATL for leachability or the appropriate Department standards or criteria will be violated, then the SPLP test shall be the determining factor.

\textsuperscript{15} Procedures for calculating upper confidence levels are contained in APPENDIX C.\textsuperscript{16} This document considers two types of ATLs which may be proposed in a HRA: (1) ATL for direct human exposure; and (2) ATL for leachability. The "ATLs for direct human exposure" would be functionally comparable to the Department's residential RTLs. The "ATLs for leachability" are proposed allowable ground water concentrations which, based on a ground water model, are not expected to result in violations of the Department's water quality standards or criteria at a designated point of compliance.\textsuperscript{17} The Department will also allow the use of Toxicity Characteristic Leaching Procedure (TCLP), EPA Method 1311, results to evaluate leachability of ash if these results are available.\textsuperscript{18} Many of the surface water standards for metals contained in Chapter 62-302, F.A.C. are a function of the total hardness (not alkalinity) of the receiving surface water body. This total hardness is expressed as mg/L of CaCO\textsubscript{3}. Some of these metals would likely be COCs in ash such as: cadmium, chromium (trivalent), copper, lead, nickel and zinc. When determining surface water metals criteria, Chapter 62-302, F.A.C. allows a total hardness range from 25 mg/L to 400 mg/L, i.e., from soft water to very hard water, in the receiving body of water. Since ash uses can be statewide, the Department recommends the metals criteria for these parameters be based on a total hardness value of 100 mg/L as CaCO\textsubscript{3} unless site-specific data on total hardness is available. Also, the SPLP results should be compared to the Department’s Class III surface water quality standards contained in Chapter 62-302, F.A.C.
For the second condition, there are some parameters in the ash or ash product that do not have a corresponding RTL for leachability values\textsuperscript{19} and must be evaluated using the SPLP test. They will be considered a COC for leachability when the upper 95 percent confidence level for their mean concentrations in the SPLP results is: (1) above the Department's ground water or surface water standards or criteria; or (2) above the ATL for leachability if determined by a HRA.

Finally, for the third condition, a chemical detected in baseline analysis is considered a COC for leachability when more than ten percent of: (1) its individual total concentrations exceed the corresponding RTL for leachability; or (2) its individual SPLP test results exceed the Department's corresponding ground water or surface water standard or criteria (or exceed the ATL for leachability).

Should this third condition occur, the applicant may attempt to remedy it in two ways. First, additional representative samples of the ash or product may be collected and subjected to total analysis or the SPLP analysis, as needed. These new results may then be combined with the original baseline total analyses or SPLP results for the chemical. If, when all of these results are used, the 10 percent threshold is no longer exceeded, then the condition has been remedied.

Second, a sample of ash or product which resulted in a chemical having elevated test results may be further analyzed, to confirm or reject the initial result, by conducting total or SPLP testing on three additional aliquots from the original sample, as needed. If none of the total concentrations for the chemical from analyzing the three additional aliquots exceed the corresponding RTL for leachability, then the initial total test result for that sample may be rejected. Or, if none of the SPLP results from analyzing the three additional aliquots for the chemical exceed the Department's corresponding ground water or surface water standard or criteria (or exceed the ATL for leachability), then the initial SPLP test result for that sample may be rejected.

In addition to identifying COCs, baseline analysis can also be used to evaluate potential COCs. In this document, "potential COCs for direct human exposure" occur when the upper 95 percent confidence level of the mean concentration for any chemical detected during the baseline analysis is less than the Department's corresponding residential RTL (or ATL for direct human exposure).

\textsuperscript{19} These parameters include at least pH, chloride, sulfate, total dissolved solids, manganese, iron, aluminum, copper, fluoride and lead.
human exposure) but greater than or equal to 50 percent of that value. Also, "potential COCs for leachability" occur when the upper 95 percent confidence level of the mean concentration for the total analysis or SPLP results of any chemical detected during baseline analysis is less than the corresponding RTL for leachability or ground water or surface water standard or criteria (or ATL for leachability) but greater than or equal to 50 percent of those respective values, standards or criteria.

To characterize newly generated ash or proposed products, a minimum of fourteen, representative 8-hour composite samples should be collected over seven to fourteen consecutive days of operation. In addition, seven grab samples shall be collected for analysis of volatile organic compounds. The samples must be collected from ash or ash-derived product that is representative of the material to be utilized. The samples should be collected and handled according to the procedures described in the Department's approved Standard Operating Procedures (SOP) contained in APPENDIX B.

For on-site ash stockpiles at existing facilities, the number of samples needed to characterize each stockpile should be determined from the procedures described in EPA publication SW-846, Chapter Nine (1982)\textsuperscript{20}. However, a minimum of fourteen representative composite samples are needed to characterize existing ash stockpiles. In addition, seven grab samples shall be collected for analysis of volatile organic compounds. The locations of the samples for these stockpiles shall be randomly selected using a grid pattern, as described in EPA publication SW-846, Chapter Nine. The samples should be collected and handled according to the procedures described in the Department's approved SOP contained in APPENDIX B.

The Department recognizes that for some WTE facilities or ash recycling facilities attempting to characterize their proposed product using WTE ash, it may not be practical or appropriate to collect fourteen separate 8-hour composite samples over a two week period. In some cases, time periods longer than two weeks may be needed. In others, the proposed ash product may not be generated continuously during an 8-hour shift or may not be generated continuously during the two week period. For some WTE or ash recycling facilities, it may be more appropriate to stockpile fresh proposed product for a period of time, and then sample the stockpile using the procedures described in EPA publication SW-846. Consequently, the Department is willing to consider revisions to this baseline sampling protocol provided a

\textsuperscript{20} This document can be ordered through the U.S. Government Printing Office in Jacksonville, Florida at 904/353-0569.
reasonable justification for an alternate protocol is provided and the alternate protocol is approved by the Department. The Department will review requests for alternate baseline sampling on a case-by-case basis. In all cases, however, a minimum of fourteen representative composite samples will be required.

The fourteen representative baseline 8-hour composite samples should be analyzed as follows:

(a) Total analysis should be conducted on all the composite samples for dioxin\(^{21}\) using EPA Method 8290, and for the eight RCRA metals\(^{22}\) and aluminum, copper, fluoride, iron, manganese and zinc using the approved EPA Methods.

(b) Total analysis should be conducted on seven\(^{23}\) of the fourteen composite samples for the following organic compounds: semi-volatile organic compounds using EPA Method 8270C, and pesticides using EPA Method 8081A.

(c) To further evaluate leaching potential\(^{24}\) of the ash or proposed product, all composite samples should also be prepared using the SPLP\(^{25}\). Using the approved EPA methods, all of the extracts prepared from this procedure should be analyzed for pH, chloride, sulfates\(^{26}\), total dissolved solids (TDS), manganese, iron, aluminum, copper, fluoride, lead and any other parameters that would be considered COCs for leachability on the basis of their total analyses. Seven\(^{27}\) of the extracts prepared from the composite

\(^{21}\) For the purposes of this document, all references to "dioxin" shall mean 2,3,7,8-tetrachlorodibenzo-p-dioxin, i.e. 2,3,7,8-TCDD.

\(^{22}\) These metals are: arsenic, barium, cadmium, chromium, lead, mercury, selenium and silver.

\(^{23}\) Due to the nature of the combustion process at WTE facilities, organic compounds are not expected to be a contamination problem in the ash. However, the Department will require analyses of seven ash composite samples to confirm this assumption. Should these analyses indicate organic compounds may be present at unacceptable concentrations in the ash, additional testing may be required to complete the baseline analysis.

\(^{24}\) Comparing total concentrations to the Department's RTL leachability value is the first step in evaluating this potential.

\(^{25}\) The Department will also allow the use of the TCLP, EPA Method 1311, to evaluate the leaching potential of ash or products using ash.

\(^{26}\) When analyzing for sulfates and TDS, it is likely that de-ionized water will need to be used as the extraction fluid in the SPLP test rather than the extraction fluid specified in the method itself.

\(^{27}\) Due to the nature of the combustion process at WTE facilities, organic compounds are not expected to be a contamination problem in the ash. However, the Department will require seven set of analyses of the ash extracts to confirm this assumption. Should these analyses indicate organic compounds may
samples should be analyzed for semi-volatile organic compounds using EPA Method 8270C, and for pesticides using EPA Method 8081A.

(d) Laboratories conducting the analyses must have a Department approved Comprehensive Quality Assurance Plan (CompQAP) in accordance with the requirements of Chapter 62-160, Florida Administrative Code (F.A.C.) or be certified by an accrediting authority recognized by the National Environmental Laboratory Accreditation Program (NELAP). Analysis of the SPLP extracts must be conducted using detection limits at or below the Department's groundwater standards and criteria. The laboratory shall supply the sample containers, appropriately cleaned, for the analyses required.

The baseline seven grab samples for volatile organic compounds should be analyzed as follows:

(a) Total analysis for volatile organic compounds using EPA Method 8260B on all the grab samples.

(b) To further evaluate leaching potential\(^{28}\), SPLP extracts should be prepared from the seven grab samples and analyzed for the individual volatile organic compounds using EPA Method 8260B that either had no RTL for leachability or would be considered a COC for leachability based on their total analyses.

(c) Laboratories conducting the analyses must have a Department approved Comprehensive Quality Assurance Plan (CompQAP) in accordance with the requirements of Chapter 62-160, Florida Administrative Code (F.A.C.) or be certified by an accrediting authority recognized by the National Environmental Laboratory Accreditation Program (NELAP). Analysis of the SPLP extracts must be conducted using detection limits at or below the Department's groundwater standards and criteria. The laboratory shall supply the sample containers, appropriately cleaned, for the analyses required.

6.3 Baseline Report

The BUD should include a Baseline Report summarizing the results of the ash or proposed product baseline sampling and leach out at unacceptable concentrations in the ash, additional testing may be required to complete the baseline analysis.

\(^{28}\) Comparing total concentrations to the Department's RTL leachability value is the first step in evaluating this potential.
analysis. This should include a complete set of all laboratory reports showing results of the baseline composite sampling, results of the total analyses and leaching tests, and a summary of the data. The summary of the baseline analysis data should include at least the following:

(a) The summary should be in a table format and should list all chemicals detected in both total and SPLP analyses for each sample analyzed with their corresponding analytical results. The table should also include information showing the Department's RTLs, and ATLs if determined by a HRA, for each chemical that is detected in the total analyses and the Department’s ground water or surface water standards for each chemical that is detected in the SPLP analyses.

(b) If the data for a detected chemical are normally distributed, then the arithmetic means and the upper 95 percent confidence levels for the means should be calculated using the calculation method in APPENDIX C.

(c) If the data for a chemical are not normally distributed, then a lognormal transformation of the data is allowed using the calculation method provided in APPENDIX C. If the log transformed data are normally distributed, then the transformed data can be used to calculate the geometric mean and the upper 95 percent confidence level value for the chemical. The procedures in APPENDIX C should be followed for this transformation.

6.4 Repeating Characterizations

If a significant change occurs in the operation of the WTE facility or ash recycling facility, in the composition of the waste stream processed by the facility, or in the method of producing the proposed product and the change may adversely affect the quality of ash or the proposed product, then the baseline analysis of the ash or proposed product from the facility should be repeated under these new conditions.

7.0 ROUTINE ANALYSIS

The BUD should propose a routine sampling and analysis protocol for ensuring that the chemical composition of the ash or proposed ash-derived product is consistent with the results of the baseline analysis. Routine analysis will primarily monitor
the COCs for direct human exposure and potential COCs\textsuperscript{29} that were identified in the baseline report. When calculating mean concentrations, if the data are normally distributed then the arithmetic mean can be used. If the data are not normally distributed, but a lognormal transformation of the data results in them being normally distributed, then the geometric mean can be used. Appendix C contains the methods and procedures for these calculations.

7.1 Weekly Analysis

One 8-hour composite sample of ash or proposed product generated at the facility or processed at an ash recycling facility should be collected at least once per week using the Department's SOP in APPENDIX B. Also, if volatile organic compounds are identified as COCs for direct human exposure or potential COCs for leachability, then a single grab sample shall be collected during the 8-hour composite sample using the Department's SOP in APPENDIX B. Using the approved EPA method, each weekly sample should be analyzed as follows:

(a) COCs for Direct Human Exposure - The weekly sample(s) should be analyzed for total concentrations of each COC(s) for direct human exposure identified in the baseline analysis in Section 6.2. For ash which is allowed use under Section 10.0(a), this weekly sampling is not required.

(b) Potential COCs for Leachability - The weekly samples(s) should be analyzed for total concentrations of potential COC(s) for leachability which were identified in the baseline analysis in Section 6.2 on the basis of their total concentrations. An SPLP extract, EPA Method 1312, for the weekly sample(s) should be prepared and analyzed for each potential COC for leachability identified in the baseline analysis in Section 6.2 on the basis of their SPLP analyses.

7.2 Quarterly Analysis

At a frequency of every three months, four 8-hour composite samples, and four grab samples for volatile organic compounds\textsuperscript{30}, of the ash or proposed ash product should be collected using the Department's approved SOP in APPENDIX B and transported to the laboratory for analysis. Using the approved EPA method, each

\textsuperscript{29} COCs and potential COCs are defined in Section 6.2.

\textsuperscript{30} If no VOCs are identified as potential COCs for direct human exposure, then it is not necessary to collect the four grab samples for VOCs.
sample should be analyzed for total concentrations of each potential COC(s) for direct human exposure identified in the baseline analysis.

7.3 General Requirements

(a) Samples can be collected by an operator from the WTE facility or an ash recycling facility trained in accordance with Rule 62-701.320(14), F.A.C., or by personnel from a Department approved laboratory. In either case, sample collection procedures shall follow the Department's approved SOP in APPENDIX B.

(b) Laboratories conducting the analysis must have a Department approved Comprehensive Quality Assurance Plan (CompQAP) in accordance with the requirements of Chapter 62-160, F.A.C or be certified by an accrediting authority recognized by the National Environmental Laboratory Accreditation Program (NELAP). Analysis of the SPLP extracts must be conducted using detection limits at or below the Department's ground water standards and criteria. The laboratory shall supply the sample containers, appropriately cleaned, for the analyses required.

7.4 Quarterly Report

The BUD should propose a format for a Quarterly Report which will summarize the results of the ash or proposed product weekly and quarterly analysis. This should include a complete set of all laboratory reports showing the analytical results. The quarterly report should also provide a summary of the weekly and quarterly data which should include at least the following:

(a) The summary should include a table listing the analytical results for the COCs and/or potential COCs evaluated in each weekly and quarterly sample analyzed during the quarter. The table should also include information showing the Department's RTLs, or ATLs if determined by a Department approved HRA, whichever is applicable, and ground water and surface water standards corresponding to each COC or potential COC.

(b) If the data for a COC or potential COC are normally distributed, then the arithmetic mean and the upper 95 percent confidence level for the mean should be calculated using the calculation method in APPENDIX C.
(c) If the data for a COC or potential COC are not normally
distributed, then a lognormal transformation of the
data is allowed using the calculation method provided
in APPENDIX C. If the log transformed data are
normally distributed, then the transformed data can be
used to calculate the geometric mean and the upper 95
percent confidence level value for the COC. The
procedures in APPENDIX C should be followed for this
transformation.

8.0 BUD EVALUATIONS

The Department will review the BUD submittals and determine
if the applicant has provided reasonable assurance that the
proposed uses of the ash or ash products satisfy the requirements
of Section 403.7045(5), F.S. Requests for additional
information, if necessary, will be made in writing to the
applicant. The use(s) of ash or ash-derived products is not
authorized until the Department approves the use(s) and
determines, from the results of the baseline analysis, HRA or
other relevant data, which chemicals should be monitored during
routine analysis. When making its determination whether to
approve the use(s) of ash or ash-derived products proposed by the
applicant, the Department will review the baseline report, the
HRA (if provided) and other relevant information contained in the
BUD or provided to the Department by the applicant.

(a) For proposed ash uses which do not qualify for use in
Section 10.0(a), any chemical detected during the
baseline analysis which meets the definition of a COC
for direct human exposure contained in Section 6.2,
shall be added to the parameters required for weekly
analysis.

(b) If the proposed ash use does qualify for use in Section
10.0(a), then weekly analysis for COCs for direct human
exposure is not required.

(c) Any chemical detected during baseline analysis which
meets the definition of a potential COC for direct
human exposure contained in Section 6.2, shall be added
to the parameters required for quarterly analysis.

(d) Any chemical detected during baseline analysis which
meets the definition of a potential COC for
leachability contained in Section 6.2, shall be added
to the parameters required for weekly analysis.
9.0 OPERATIONAL EVALUATIONS

The Department will review the Quarterly Reports and, depending on the results, may require or allow changes to the sampling procedures and ash uses. Also, during the collection and evaluation of the weekly samples, the WTE facility or ash recycling facility may notice changes in the analytical results for the ash which require notification to the Department and possible further action. Reporting or notification requirements will be specified in the permit or statewide approval on a case-by-case basis, and will be based primarily on any significant changes from the baseline analysis that could affect public health or the environment.

After one year of routine analysis of the ash or product using ash from a WTE facility, the owner/operator of the WTE facility or ash recycling facility may request a reduction in the sampling parameters and/or frequencies. The Department’s evaluation of this request will be based upon the results contained in the quarterly reports and other relevant data for the facility.

10.0 OFF-SITE USE REQUIREMENTS

This BUD document does not apply to the use of WTE ash or ash-derived products in jurisdictional surface waters or wetlands, in land application as a soil amendment or for agricultural purposes. However, WTE ash or ash-derived products may be used as fill material in jurisdictional surface waters or wetlands if a permit specifically authorizing this use of ash has been issued by the Department. In addition, use of ash or ash-derived products should comply with one of the following:

(a) Use of ash or products containing ash is allowed in any of the following circumstances, if:

1. The ash or product is covered by at least two feet of clean fill or is used as protected structural fill, the leaching tests or characterization data do not indicate that the use of the ash or product will result in violations of the Department's ground water standards or criteria, and the BUD demonstrates that the barrier of the protected structural fill or the two feet of cover will be maintained.

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31 Protected structural fill is defined in Section 4.2.
2. The ash or product is used at a permitted Class I or II landfill as subsurface construction material or as intermediate cover\textsuperscript{32} provided it also meets the criteria of Rule 62-701.200(55), F.A.C and provided the leaching tests or characterization data do not indicate that the use of the ash or product will result in violations of the Department's ground water or surface water standards or criteria. These uses of ash or product may require approval by the Department as part of the landfill permit.

3. The ash or product is used in encapsulation technologies, for example as part of the aggregate feed in the production of Portland cement, concrete or asphalt, provided the BUD demonstrates the proposed use achieves the risk goals of Section 3.0(b) and will not leach constituents so as to cause a violation of Department ground water standards or criteria.

(b) Use of ash or ash-derived product is allowed in accordance with the uses described in a BUD if the BUD, and a Department approved HRA, demonstrate that the goals of Section 3.0 will be achieved for those uses.

(c) Use of ash or products containing ash as fill is allowed in residential settings if: (1) the upper 95 percent confidence level for the mean of all chemicals detected in the ash is less than or equal to the Department's RTLs for residential settings corresponding to those chemicals; (2) neither the leaching tests nor characterization data indicate that the use of the ash will result in violations of the Department's ground water or surface water standards or criteria; and (3) notification to the land owner is provided which explains the approved uses of ash. The notification to the land owner should contain the following language:

This material contains ash from the combustion of municipal solid waste. The Florida Department of Environmental Protection has approved the use of this material as fill in land. Its use has not been approved as fill material in surface waters or wetlands unless a permit specifically authorizing the use

\textsuperscript{32} Use of WTE ash as initial cover at permitted, lined landfills is already allowed in accordance with the requirements of Rule 62-702.570(6), F.A.C.
of this material as fill in surface waters or wetlands has been issued by the Department.

(d) Use of ash or ash-derived product is allowed in industrial settings if: (1) the upper 95 percent confidence level for the mean of all chemicals detected in the ash or product is either at or below naturally occurring background total concentrations for the chemicals at the site selected for use or is less than or equal to the Department's RTLs for industrial settings corresponding to those chemicals; (2) neither the leaching tests nor characterization data indicate that the use of the ash will result in violations of the Department's ground water or surface water standards or criteria; and (3) institutional controls, such as property deed restrictions or access controls, will be used at each site receiving ash.

(e) Permission may be granted for ash or ash-derived product to be used in commercial areas under the same conditions as use in industrial settings on a case-by-case basis if the BUD demonstrates that the exposure potential from the proposed use is comparable to an industrial land use.

(f) Permission may be granted for ash or ash-derived product to be used in other applications on a case-by-case basis provided the applicant can demonstrate that the proposed use will meet the risk goals of Section 3.0. The Department may also require institutional controls for each site where the ash is to be used.
REFERENCES

DEP (Florida Department of Environmental Protection), 1992, Standard Operating Procedures For Laboratory Operations And Sample Collection Activities, DEP-QA-001/92, Quality Assurance Section, Tallahassee, Florida, September.


DEP (Florida Department of Environmental Protection), 1999, Solid Waste Management in Florida, Bureau of Solid and Hazardous Waste, Tallahassee, Florida, July.

