**Memorandum**

**Florida Department of**
# Environmental Protection

SOLID WASTE SECTION
JUN 14 2006

To: District Directors
District Water Program Administrators
District Waste Program Administrators
Other Interested Parties

From: Mary Jean Yon, Director MJY
Division of Waste Management

Mimi A. Drew, Director Mimi
Division of Water Resource Management

Date: June 12, 2006

Subject: Guidance for Land Application of Drinking Water Treatment Plant Sludge

Attached is a document titled "Guidance for Land Application of Drinking Water Treatment Plant Sludge." The purpose of this document is to provide guidance to the regulated community and Department staff on the beneficial use of lime, alum and ferric sludges from drinking water treatment plants. While this document is not a rule and does not create any standards or criteria that must be followed by the regulated community, the Department hopes it will clarify and standardize the approaches that are followed in Florida for beneficial use of these materials.

This document is based upon the results of research conducted by Dr. Tim Townsend and his students from the University of Florida. It was developed by a collaborative effort between the Division of Water Facilities and the Division of Waste Management. When implementing this document, the Division of Waste Management shall take the lead in decisions regarding the beneficial use of the sludges. The Division of Water Facilities shall take the lead in distributing this information to the owner/operators of water treatment facilities.

We hope you will find this guidance useful. If you have any questions concerning beneficial use of the sludges, please feel free to contact Richard Tedder, Lee Martin or Francine Joyal at 850/245-8706. For questions about distributing this information to the owner/operators of water treatment facilities, please feel free to contact Van Hoofnagle at 850/245-8624.

Attachment

cc: Elsa Potts
Charlie Goddard
Chris McGuire
Cynthia Christen
Van Hoofnagle

# GUIDANCE FOR LAND APPLICATION OF DRINKING WATER TREATMENT PLANT SLUDGE

**June 6, 2006**

Prepared by:

Florida Department of Environmental Protection
Solid Waste Section
and
Drinking Water Program
Tallahassee, Florida

## 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 management of drinking water sludge in accordance with this guidance is not expected to result in contamination of ground water or surface water or to pose a significant threat to human health, 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 management of these materials.

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## 1.0 INTRODUCTION

Periodically, the Department receives requests from operators of drinking water treatment facilities to approve the beneficial use of sludges generated by their treatment processes as an alternative to disposal. This is particularly true as more economical management methods for the sludges are sought because of increasing landfill disposal costs. The most common proposed use of these sludges is land application. In order to determine if the proposed uses of these materials are appropriate, it is important to evaluate their chemical characteristics and to determine the likelihood that their uses will pose an unacceptable environmental or human health risk. Therefore, in developing this guidance memorandum, a study[1] was funded in 2001 to chemically characterize the predominant sludges being generated by these facilities, which are lime, alum and ferric sludges. The results of this study are summarized below. It is the Department's intention to promote waste reduction and recycling, where it is feasible and protective of human health and the environment.

The purpose of this memorandum is to provide guidance to Department staff and the public on the land application of lime, alum and ferric sludges generated by drinking water treatment facilities. It is not a rule and does not create any standards or criteria that must be followed by the regulated community. While the management and use of drinking water sludges in accordance with this guidance is not expected to result in contamination of ground water or surface water or to pose a significant threat to human health, 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 these materials.

Based on the results of the characterization study, the Department 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.[2] On the other hand, 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.

This guidance document is intended to address only the beneficial land application of drinking water sludges. Land application constituting disposal (for example, if the sludge is deposited in piles or excessively thick layers and is not being temporarily stored prior to use) is prohibited except at a permitted facility or one specifically exempted from permitting requirements.

## 2.0 CHARACTERIZATION STUDY, RESULTS AND IMPLICATIONS

Matching funds for characterizing sludges generated by drinking water treatment systems were provided by the Department's Drinking Water Program and the Florida Center for Solid and Hazardous Waste Management. A contract was entered into with Dr. Tim Townsend, University of Florida, to collect and analyze samples of lime, alum

[1] Townsend, T.G., et al, "Characterization of Drinking Water Sludges for Beneficial Reuse and Disposal," November 2001.
[2] However, this use of the lime sludge must meet the three general criteria of Section 3.0 and should not exceed the recommended application rate set out in Section 5.0.

and ferric sludges. The samples were collected from 26 facilities during the summer of 2001. Table 1 identifies the facilities sampled, the sample identification codes used and the types of sludges produced at the facilities. Some of these facilities generated sludges from both water softening (i.e., lime) and coagulation (i.e., alum or ferric) treatment processes. The samples collected consisted of lime sludge from 20 facilities, alum sludge from 5 facilities and ferric sludge from 3 facilities. Samples were analyzed, by both total analysis and the Synthetic Precipitation Leaching Procedure[3] (SPLP), for metals, volatile organic compounds, semi-volatile organic compounds, chlorinated pesticides and nitrogen/phosphorus pesticides.

Tables 2 and 3 summarize the results obtained from analyzing the samples and identify those results that exceeded the cleanup target levels (CTLs) contained in Chapter 62-777, Florida Administrative Code (F.A.C.)[4]. The analytical results from the semi-volatile organic compounds, chlorinated pesticides and nitrogen/phosphorus pesticides tests are not included in this memorandum because they were never detected in concentrations above their detection limits. While acetone and methylene chloride were detected in the sampling for volatile organic compounds, their presence was attributed to laboratory contamination rather than to their existence in the sludge samples themselves. Table 4 shows the CTLs[5] that were used to evaluate the sample results in Tables 2 and 3.

An evaluation of the data from the characterization study indicated that no contaminants of concern were expected to leach from lime sludge in quantities that would pose a significant threat of exceeding Department water quality standards or criteria.[6] The only contaminants of concern found in concentrations that could pose a threat to human health through anticipated direct exposure pathways were barium and arsenic. In the twenty samples analyzed, barium was found above the residential soil CTLs in two cases, while arsenic was found above residential soil CTLs in four cases.

Although it is possible that land application of lime sludge could occasionally pose a minor direct exposure human health threat, an analysis of the data indicated that it would generally not be expected. The average concentration of barium in the lime

[3] This test, EPA Method 1312, is commonly used to evaluate the likelihood that a material exposed to rainwater will leach contaminants above the Department's water quality standards or criteria.
[4] The CTLs in Chapter 62-777, F.A.C., are the criteria that apply to cleanups of contaminated sites; they do not apply directly to projects involving beneficial use. The CTLs are used in this guidance document as a screening tool to determine the likelihood that a proposed use will pose a significant threat to public health under anticipated conditions of exposure. Exceedance of any of the CTLs (other than the water quality standards that are incorporated by reference) is not in itself a violation of any Department rule.
[5] It should be noted that the CTLs used in this memorandum are those contained in Chapter 62-777, F.A.C. which was effective on April 17, 2005. In some cases these CTLs are different from the ones used to prepare the 2001 characterization study. This is because the 2001 study was based upon CTL values from an earlier version of the rule. For example, on April 17, 2005 the residential direct exposure CTL for arsenic was changed from 0.8 mg/kg to 2.1 mg/kg.
[6] Out of twenty SPLP samples, one showed the presence of lead and one showed concentrations of total dissolved solids (TDS) above the Department's ground water standards. Because of the small number of detections it was not possible to perform a useful statistical analysis. Instead, these detections are considered to be anomalies which do not indicate any likelihood that land application of lime sludge will result in violations of water quality standards.

sludge was 58.8 mg/kg, and the 95% upper confidence limit (UCL) mean value for barium was 77.76 mg/kg. These are well below the residential soil CTL value of 120 mg/kg. The average concentration of arsenic in the lime sludge was 1.15 mg/kg, and the 95% UCL mean value for arsenic was 2.04 mg/kg, also below the residential soil CTL value of 2.1 mg/kg.[7]

However, in comparing the results of the characterization study with the soil CTLs, some chemicals of concern were identified for alum and ferric sludges. Because of these results, it was decided to develop specific criteria that would apply to land application of each of these sludges (see Sections 6.0 and 7.0). These criteria identify the additional testing that will be needed to obtain data in support of case-by-case approvals for use.

In the specific criteria for alum and ferric sludges, the parameters required for total analyses are listed if they were detected in total analysis samples from the characterization study at concentrations equal to or greater than their corresponding soil CTLs for residential exposures. The parameters required for leaching analyses are listed if they were detected in SPLP samples from the characterization study at concentrations equal to or greater than their corresponding ground water or surface water CTLs. It was further decided to omit pH from the list of parameters to be evaluated in leaching tests for these sludges.

## 3.0 GENERAL CRITERIA AND OTHER CONSIDERATIONS

The following three general criteria apply to any water treatment sludge which is to be land applied in Florida:

1. The sludge must not be a hazardous waste;

2. The use of the sludge must not cause violations of applicable Department ground water or surface water standards and criteria; and

3. The sludge must not cause fugitive dust emissions or objectionable odors, or create a public nuisance.

While not directly addressed by this memorandum, there are also a number of other factors that may have to be considered before land applying sludges. One such factor is that an increasing number of agricultural operations are developing nutrient management plans, and Total Maximum Daily Limits (TMDLs) for some nutrients are being established. Consequently, 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. This will normally be required if nutrient management plans are needed for land application. In those cases, a composite sample of the sludges could be analyzed for these

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[7] In the case of arsenic, one out of the 20 samples was BDL. One-half of the detection limit for that one sample result was used in the calculations.

parameters. If other information on the concentration of these parameters is already available for the sludge, then further sampling for these parameters may not be needed.

Another factor to consider is 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. Also, iron in ferric sludge may serve as a micronutrient, but its use should not exceed the adulteration levels for metals in fertilizers[8]. These other factors should be appropriately addressed by the user of the sludge but are not considered further in this memorandum.

## 4.0 GENERAL GUIDANCE ON SAMPLING

The specific criteria sections for the alum and ferric sludges in this memorandum require the collection of "three representative composite samples" of the sludge that is to be land applied. Unless otherwise approved by the Department, for existing sludge stockpiles or newly generated sludge, these samples should be collected as follows:

1. The sludge bed or pile shall be divided into approximately three equal sections. A composite sample shall be collected at a random location in each section (for a total of the three composite samples).

2. Leaves, grass, and other surface debris shall be removed from the area where each composite sample is to be collected using a clean stainless steel spoon or shovel.

3. Each composite sample shall consist of approximately equal-volume subsamples of sludge from the upper, middle and lower portions of sludge at each sample location. Each subsample shall be collected with a clean stainless steel spoon or shovel and placed into a clean stainless steel mixing bowl or glass tray.

4. The subsamples for each composite sample shall be thoroughly mixed and a sufficient amount of sample for analysis transferred into sample containers provided by the laboratory. The samples should be properly stored and shipped to the laboratory for analysis.

Guidance for collecting these composite samples can also be obtained from Chapter Nine of EPA Publication SW-846 or from Appendix B of the Department's "Guidance for Preparing Municipal Waste-to-Energy Ash Beneficial Use Demonstrations."[9] Additional guidance for the proper collection of solid samples can be obtained from the Department's Standard Operation Procedures (SOP) for Field Activities (DEP-SOP-001/01).[10]

## 5.0 LAND APPLICATION OF LIME SLUDGE

[8] See requirements by the Department of Agriculture and Consumer Affairs, Chapter 5E-1, F.A.C.
[9] This guidance is available electronically at the following web site: http://www.dep.state.fl.us/waste/quick_topics/publications/shw/solid_waste/RTedderASH.pdf.
[10] This document is available at: http://www.dep.state.fl.us/labs/qa/sops.htm.

Based upon the results of the characterization study, the Department has determined that beneficial land application of lime sludges from drinking water systems is not expected to create any significant threat to public health or the environment. For this reason, no additional regulation or approval by the Department is required prior to this use. 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.[11] In addition, the land application of the sludge must meet the three general criteria contained in Section 3.0.

## 6.0 SPECIFIC CRITERIA FOR LAND APPLICATION OF ALUM SLUDGE

The SPLP sample results from the characterization study indicated that aluminum, lead and manganese sometimes leached from alum sludge in quantities that could pose a threat of exceeding Department water quality standards or criteria. The results for total analyses indicated that the only contaminants of concern found in concentrations that could pose a threat to human health through anticipated direct exposure pathways are aluminum, barium and arsenic. In the five samples analyzed, aluminum and arsenic were found above the residential soil CTLs in all cases, while barium was found above residential soil CTLs in one case.

Based upon these results, the Department has determined that unlimited land application of alum sludges from drinking water systems could pose a small but significant threat to public health or the environment. For this reason, the Department will not approve the land application of alum sludge unless the person seeking to apply the sludge can provide reasonable assurance that no such threats will exist based upon site-specific or material-specific criteria. The Department offers the following guidance on how such assurances could be provided; however, this guidance is not mandatory and any person may submit a different risk-based analysis for approval.

1. The alum sludge must meet the three general criteria in Section 3.0.

2. <u>Parameter Analyses</u> – 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. Laboratories conducting the analyses must be certified by an accrediting authority recognized by the National Environmental Laboratory Accreditation Program (NELAP).

3. <u>Data Analysis</u> – Using the results of the analyses, the mean concentrations for aluminum, arsenic, barium, lead and manganese must be calculated and

[11] "Management of Water Treatment Plant Residuals, Technology Transfer Handbook," EPA/625/R-95/008, April 1996, mentions that movement of metals into ground water and into plant tissues can be minimized with moderate application rates of 20 dry metric tons per hectare and properly managed soils. Note that 20 dry metric tons per hectare equals about 9 dry tons per acre.

compared to their corresponding direct exposure or water quality CTLs contained in Chapter 62-777, F.A.C. (also shown in Table 4).

4. 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, such as is described in Appendix A, may be helpful. The Department will not approve the land application of alum sludge unless the data analysis and this proposal indicate that no significant threat to public health or the environment would be expected. Final decisions regarding land application of alum sludges will be made by the Division of Waste Management in coordination with the Division of Water Facilities.

5. Record Keeping – The generator of the alum sludge must keep the results of the laboratory analyses used to determine the method of land application for a minimum of three years and make them available to the Department upon request.

## 7.0 SPECIFIC CRITERIA FOR LAND APPLICATION OF FERRIC SLUDGE

The SPLP sample results from the characterization study indicated that aluminum, iron and manganese often leached from ferric sludge in quantities that could pose a threat of exceeding Department water quality standards or criteria. The results for total analyses indicated that the only contaminants of concern found in concentrations that could pose a threat to human health through anticipated direct exposure pathways are arsenic, copper and iron. In the three samples analyzed, iron was found above the residential soil CTLs in all cases, arsenic was found above residential soil CTLs in two cases, and copper was found above residential soil CTLs in one case.

Based upon these results, the Department has determined that unlimited land application of ferric sludges from drinking water systems could pose a small but significant threat to public health or the environment. For this reason, the Department will not approve the land application of ferric sludge unless the person seeking to apply the sludge can provide reasonable assurance that no such threats will exist based upon site-specific or material-specific criteria. The Department offers the following guidance on how such assurances could be provided; however, this guidance is not mandatory and any person may submit a different risk-based analysis for approval.

1. The ferric sludge must meet the three general criteria in Section 3.0.

2. Parameter Analyses – The generator of the ferric 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. Laboratories conducting the analyses must be certified by an

accrediting authority recognized by the National Environmental Laboratory Accreditation Program (NELAP).

3. Data Analysis – 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. (also shown in Table 4).

4. 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, such as described in Appendix A, may be helpful. The Department will not approve the land application of ferric sludge unless the data analysis and this proposal indicate that no significant threat to public health or the environment would be expected. Final decisions regarding land application of ferric sludges will be made by the Division of Waste Management in coordination with the Division of Water Facilities.

5. Record Keeping – The generator of the ferric sludge must keep the results of the laboratory analyses used to determine the method of land application for a minimum of three years and make them available to the Department upon request.

## 8.0 WHERE CAN I GET MORE INFORMATION?

Personnel in the Department's District or Tallahassee offices can provide additional information or help answer your questions. Staff in the Department's Division of Waste Management, Solid Waste Section can help answer questions about the beneficial use of drinking water sludge. Staff in the Department's Division of Water Facilities, Drinking Water Program can help with coordination and distribution of this guidance to the drinking water facility owner/operators. Contact information and District boundaries are shown below.

Department Headquarters Offices:

Twin Towers Office Building
2600 Blair Stone Road
Tallahassee, Florida 32399-2400
http://www.dep.state.fl.us/waste/

Solid Waste Section (850) 245-8706
Drinking Water Program (850) 245-8600

Department's District Offices:

Northwest District Office
160 Governmental Center, Room 308
Pensacola, Florida 32502
(850) 595-8300

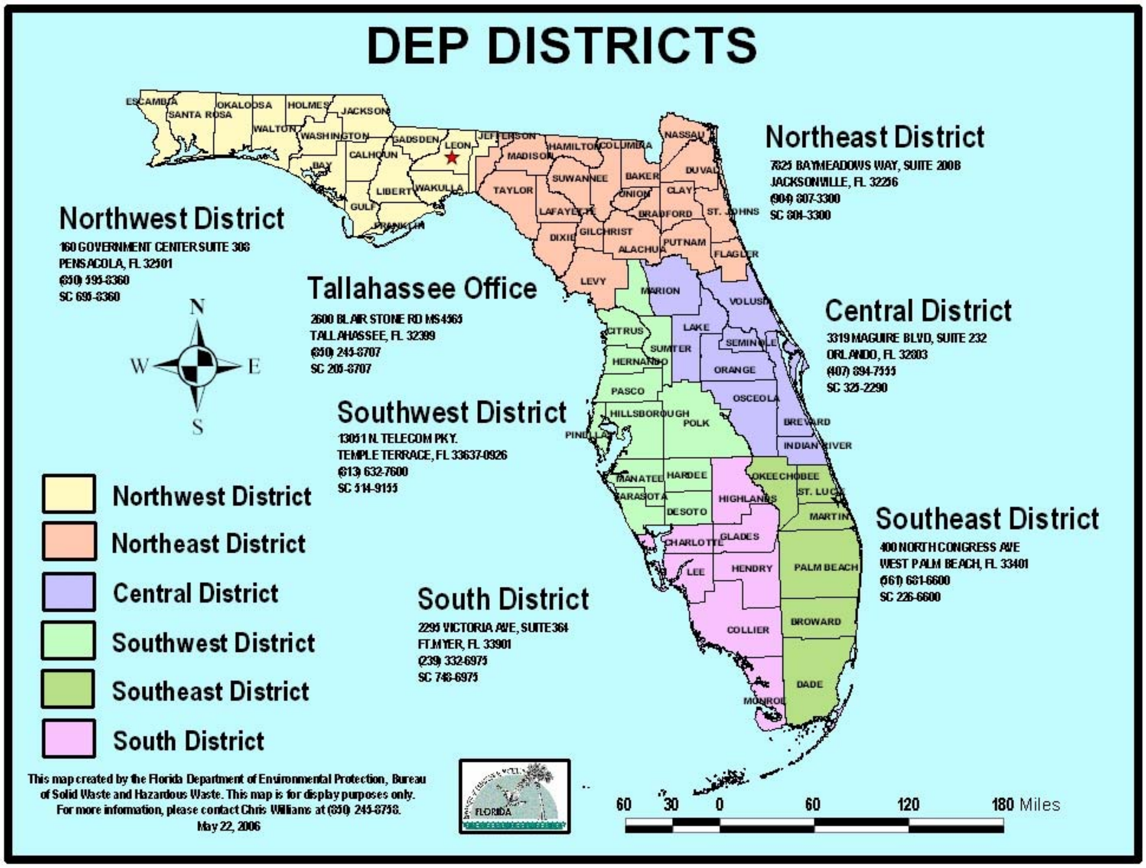
Northeast District Office
7825 Baymeadows Way, Suite 200B
Jacksonville, Florida 32256
(904) 807-3300

Southwest District Office
13051 N. Telecom Parkway
Temple Terrace, Florida 33637
(813) 632-7600

Central District Office
3319 Maguire Boulevard, Suite 232
Orlando, Florida 32803
(407) 894-7555

South District Office
P.O. Box 2549
2295 Victoria Avenue, Suite 364
Fort Myers, Florida 33901
(239) 332-6975

Southeast District Office
400 North Congress Avenue, Suite 200
West Palm Beach, Florida 33401
(561) 681-6600


DEP DISTRICTS
Northwest District
160 GOVERNMENT CENTER SUITE 308
PENSACOLA, FL 32501
(850) 595-8360
SC 695-8360
Tallahassee Office
2600 BLAIR STONE RD MS4565
TALLAHASSEE, FL 32399
(850) 245-8707
SC 205-8707
Northeast District
7825 BAYMEADOWS WAY, SUITE 200B
JACKSONVILLE, FL 32256
(904) 807-3300
SC 804-3300
Central District
3319 MAGUIRE BLVD, SUITE 232
ORLANDO, FL 32803
(407) 894-7555
SC 325-2290
Southwest District
13051 N. TELECOM PKY.
TEMPLE TERRACE, FL 33637-0926
(813) 632-7600
SC 514-9155
Southeast District
400 NORTH CONGRESS AVE
WEST PALM BEACH, FL 33401
(561) 681-6600
SC 226-6600
South District
2295 VICTORIA AVE, SUITE 364
FT.MYER, FL 33901
(239) 332-6975
SC 748-6975
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LAKE
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POLK
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BREVARD
INDIAN RIVER
MANATEE
HARDEE
OKEECHOBEE
SARASOTA
HIGHLANDS
ST. LUCIE
DESOTO
MARTIN
CHARLOTTE
GLADES
LEE
HENDRY
PALM BEACH
COLLIER
BROWARD
DADE
MONROE
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Northwest District
Northeast District
Central District
Southwest District
Southeast District
South District
This map created by the Florida Department of Environmental Protection, Bureau of Solid Waste and Hazardous Waste. This map is for display purposes only. For more information, please contact Chris Williams at (850) 245-8758.
May 22, 2006
FLORIDA
60 30 0 60 120 180 Miles

## Table 1- Sample Locations and Descriptions

| County | Treatment Facility | Sample ID | Sludge Type | | |
|---|---|---|---|---|---|
| | | | L | A | F |
| Alachua | Murphree Water Treatment Plant (Gainesville) | GAI | X | | |
| Bay | Bay County Water Treatment Facility | BAY | | | X |
| Brevard | City of Cocoa | COC A (lime), COC B (Ferric) | X | | X |
| Brevard | North Brevard County/Mims | MIM | X | | |
| Broward | Lauderdale Lakes BCOES 1A | LAU B | X | | |
| Broward | Pompano Beach BCOES 2A | PAM | X | | |
| Broward | City of North Lauderdale | LAU A | X | | |
| **Charlotte** | **Charlotte County Utilities** | **CHA** | **X** | | |
| Charlotte | City of Punta Gorda | PON | | X | |
| **Charlotte** | **City of Englewood** | **ENG** | **X** | | |
| Collier | Florida Water Services – Marco Island | MAR | X | | |
| DeSoto | Peace River | PRW | | X | |
| DeSoto | Arcadia Water Department | ARC | X | | |
| Flagler | Flagler Beach WTP | FLA | X | | |
| Lee | Bonita Springs Water System | BON | X | | |
| Manatee | Manatee County Public Works | MAN A (lime), MAN B (alum) | X | X | |
| Manatee | City of Bradenton | BRT | | | X |
| **Marion** | **City of Ocala WTF** | **OCA** | X | | |
| Okeechobee | Okeechobee WTF | OKE | | X | |
| Palm Beach | City of Pahokee | POH | X | | |
| Polk County | City of Lakeland | LAK | X | | |
| Saint Johns | St. Johns County (CR-214) | STJ | X | | |
| Saint Lucie | Fort Pierce Utilities | PTF | X | | |
| Saint Lucie | Port Saint Lucie Utilities | STL | X | | |
| Sarasota | North Port Utilities | NWP | | X | |
| **Suwannee** | **Live Oak WTP** | **OAK** | X | | |

Note: L = Lime, A = Alum, F = Ferric

- It should be noted that samples from some of the facilities on the original list were not obtained because no stockpile exists at the sites.
- Bolded facilities were added by researchers.

**Table 2 - Summary of Characterization Study Results - Total Analyses**
(All values are in mg/kg unless otherwise stated)

| Sludge Type | Sample Name | Aluminum | Arsenic | Barium | Cadmium* | Chromium | Copper | Iron | Lead* | Manganese |
|---|---|---|---|---|---|---|---|---|---|---|
| Alum | MAN B | 104,478 | 8.53 | 15.47 | < 0.37 | 54.82 | 63.67 | 6,410 | 2.65 | 42.98 |
| | NWP | 136,883 | 9.77 | 316.21 | < 0.50 | 151.36 | 14.92 | 16,603 | 7.52 | 102.64 |
| | OKE | 141,134 | 12.67 | 34.29 | < 2.99 | 109.67 | 17.2 | 15,572 | 11.72 | 134.66 |
| | PON | 150,908 | 8.71 | 20 | < 1.10 | 114.28 | 20.72 | 8,648 | 3.63 | 107.99 |
| | PRW | 176,700 | 16.89 | 38.64 | < 0.49 | 173.74 | 43.03 | 5,686 | 3.03 | 28.28 |
| | Avg | 142,020 | 11.32 | 84.92 | - | 120.77 | 31.91 | 10,584 | 5.71 | 83.31 |
| | Std Dev | 26,068 | 3.53 | 129.65 | - | 45.43 | 20.99 | 5,154 | 3.88 | 45.48 |
| | Min | 104,478 | 8.53 | 15.47 | 0.37 | 54.82 | 14.92 | 5,686 | 2.65 | 28.28 |
| | Max | 176,700 | 16.89 | 316.21 | 2.99 | 173.74 | 63.67 | 16,603 | 11.72 | 134.66 |
| Ferric | BAY | 5,884 | 9.51 | 16.05 | < 4.49 | 52.07 | 24.29 | 482,589 | 4.8 | 48.84 |
| | BRT | 4,467 | 9.68 | 32.88 | < 1.83 | 17.39 | 413.47 | 161,291 | 1.36 | 42.04 |
| | COC A | 2,802 | 1.92 | 58.15 | < 5.78 | 33.69 | 26.48 | 451,833 | 3.16 | 595.42 |
| | Avg | 4,384 | 7.04 | 35.69 | - | 34.39 | 154.75 | 365,238 | 3.11 | 228.77 |
| | Std Dev | 1,543 | 4.43 | 21.19 | - | 17.35 | 224.06 | 177,291 | 1.72 | 317.55 |
| | Min | 2,802 | 1.92 | 16.05 | 1.83 | 17.39 | 24.29 | 161,291 | 1.36 | 42.04 |
| | Max | 5,884 | 9.68 | 58.15 | 5.78 | 52.07 | 413.47 | 482,589 | 4.8 | 595.42 |
| Lime | ARC | 846 | 0.39 | 59.31 | < 0.75 | 4.14 | 6.55 | 813 | < 0.71 | 17.23 |
| | BON | 604 | < 0.20 | 40.7 | < 0.45 | 3.12 | 4.33 | 255 | < 0.40 | 12.11 |
| | CHA | 1,602 | 2.13 | 124.85 | < 0.80 | 4.55 | 10.12 | 3,182 | < 0.73 | 62.74 |
| | COC B | 1,805 | 0.31 | 47.81 | < 0.43 | 9.46 | 3.74 | 3,309 | 0.92 | 131.51 |
| | ENG | 933 | 0.4 | 38.99 | < 0.42 | 1.92 | 2.75 | 1,006 | < 0.39 | 26.96 |
| | FLA | 565 | 0.43 | 65.25 | < 0.40 | < 1.24 | 3.27 | 803 | < 0.37 | 33.18 |
| | GAI | 658 | 0.8 | 51.96 | < 0.41 | < 1.26 | 3.72 | 391 | < 0.37 | 15.14 |
| | LAK | 494 | 0.82 | 24.13 | < 0.42 | 1.31 | 4.96 | 497 | 0.56 | 86.88 |
| | LAU A | 422 | 0.95 | 34.83 | < 0.49 | 5.8 | 8.32 | 11,209 | < 0.46 | 65.35 |
| | LAU B | 367 | 0.2 | 40.56 | < 0.33 | 1.28 | 1.42 | 1,084 | < 0.32 | 20.27 |
| | MAN A | 3,752 | 4.93 | 210.49 | < 0.41 | < 1.25 | 2.38 | 2,617 | < 0.38 | 29.95 |
| | MAR | 2,257 | 0.69 | 43.6 | < 0.46 | 5.12 | 3.18 | 470 | < 0.42 | 18.96 |
| | MIM | 1,619 | 2.44 | 26.2 | < 0.45 | 2.61 | 38.58 | 4,635 | 0.49 | 39.39 |
| | OAK | 555 | 2.04 | 30.45 | < 0.41 | 4.33 | 7.39 | 5,341 | 0.4 | 41.50 |
| | OCA | 386 | 0.8 | 18.33 | < 0.30 | < 0.93 | 1.5 | 254 | 0.33 | 10.70 |
| | PAM | 475 | 0.47 | 31.52 | < 0.38 | 2.07 | 1.72 | 1,155 | < 0.35 | 25.47 |
| | POH | 14,498 | 3.69 | 117.14 | < 0.68 | 12.62 | 14.55 | 7,116 | 1.77 | 80.59 |
| | PTF | 592 | 0.37 | 81.61 | < 0.42 | 3.48 | 2.29 | 1,171 | < 0.38 | 12.66 |
| | STJ | 1,621 | 0.18 | 33.62 | < 0.39 | 2.69 | 2.15 | 1,087 | 0.47 | 117.75 |
| | STL | 1,514 | 0.73 | 54.6 | < 0.47 | < 1.44 | 4.31 | 12,734 | < 0.42 | 98.37 |
| | Avg | 1,778 | 1.15 | 58.8 | - | 3.2** | 6.36 | 2,957 | 0.53 | 47.33 |
| | Std Dev | 3,110 | 1.28 | 45.58 | - | 3.3*** | 8.27 | 3,625 | 0.33 | 37.44 |
| | Min | 367 | 0.18 | 18.33 | 0.3 | 0.93 | 1.42 | 254 | 0.32 | 10.70 |
| | Max | 14,498 | 4.93 | 210.49 | 0.8 | 12.62 | 38.58 | 12,734 | 1.77 | 131.51 |

= Exceeds residential direct exposure CTLs in Table II of Chapter 62-777, .F. A.C.
* Detection limits were based on a 2.0 g dry sample weight. However, since 2.0 g of wet samples were digested and samples had variable moisture content, each sample has a different detection limit when the concentration is expressed in mg/kg dry weight.

** Aitchison's adjusted mean

*** Aitchison's adjusted standard deviation

**Table 2 - Summary of Characterization Study Results - Total Analyses, Cont.**
(All values are in mg/kg unless otherwise stated)

| Sludge Type | Sample Name | Mercury | Molybdenum* | Nickel | Sodium | Selenium | Silver* | Zinc | Acetone ug/kg | Methylene Chloride ug/kg |
|---|---|---|---|---|---|---|---|---|---|---|
| Alum | MAN B | BDL | <67.83 | 6.7 | 34.64 | BDL | BDL | 17.63 | | |
| | NWP | BDL | <91.98 | 10.56 | 660.28 | BDL | BDL | 14.19 | | |
| | OKE | BDL | <536.61 | 13.28 | 1,083.68 | BDL | BDL | 26.94 | 181 | 71.4 |
| | PON | BDL | <193.83 | 4.99 | 1,089.48 | BDL | BDL | 20.84 | | |
| | PRW | BDL | <88.49 | 5.99 | 379.76 | BDL | BDL | 17.21 | | 154 |
| | Avg | - | - | 8.3 | 649.57 | | | 19.36 | | |
| | Std Dev | NA | | 3.49 | 456.35 | NA | NA | 4.85 | | |
| | Min | - | <67.83 | 4.99 | 34.64 | | | 14.19 | | |
| | Max | - | <536.61 | 13.28 | 1,089.48 | | | 26.94 | | |
| Ferric | BAY | BDL | <166.98 | 14.85 | 264.54 | BDL | BDL | 13.93 | 28 | 43.4 |
| | BRT | BDL | <77.81 | 7.66 | 71.26 | BDL | BDL | 8.31 | 7.9 | 29.2 |
| | COC A | BDL | <129.55 | 55.53 | 181.29 | BDL | BDL | 33.55 | | |
| | Avg | - | - | 26.01 | 172.36 | | | 18.6 | | |
| | Std Dev | NA | | 25.81 | 96.95 | NA | NA | 13.25 | | |
| | Min | - | <77.78 | 7.66 | 71.26 | | | 8.31 | | |
| | Max | - | <166.98 | 55.53 | 264.54 | | | 33.55 | | |
| Lime | ARC | BDL | <142.57 | < 2.06 | 475.5 | BDL | BDL | 8.8 | 2,210 | 99 |
| | BON | BDL | <80.14 | 2.18 | 656.33 | BDL | BDL | 3.88 | 280 | 2,720 |
| | CHA | BDL | <146.28 | < 2.17 | 716.54 | BDL | BDL | 11.42 | | |
| | COC B | BDL | <80.77 | 1.53 | 568.54 | BDL | BDL | 9.42 | | |
| | ENG | BDL | <78.43 | 1.41 | 472.26 | BDL | BDL | 8.59 | | |
| | FLA | BDL | <73.02 | < 1.09 | 403.15 | BDL | BDL | 6.34 | | |
| | GAI | BDL | <74.84 | 1.13 | 228.34 | BDL | BDL | 5.05 | 32.5 | 980 |
| | LAK | BDL | <78.96 | < 1.15 | 102.76 | BDL | BDL | 6.29 | | |
| | LAU A | BDL | <92.67 | 1.38 | 403.74 | BDL | BDL | 5.8 | | |
| | LAU B | BDL | <63.20 | < 0.91 | 423.33 | BDL | BDL | 4.19 | | |
| | MAN A | BDL | <75.43 | 9.54 | 66.54 | BDL | BDL | 7.08 | | |
| | MAR | BDL | <83.85 | 2.92 | 574.46 | BDL | BDL | 6.03 | | |
| | MIM | BDL | <82.44 | 1.26 | 616.37 | BDL | BDL | 9.67 | | |
| | OAK | BDL | <76.59 | 2.38 | 67.88 | BDL | BDL | 4.46 | | |
| | OCA | BDL | <56.50 | < 0.82 | 324.83 | BDL | BDL | 4.43 | 51.2 | 1,200 |
| | PAM | BDL | <69.43 | < 1.03 | 470.69 | BDL | BDL | 5.4 | | |
| | POH | BDL | <121.83 | 5.89 | 4,176.21 | BDL | BDL | 23.81 | 190 | 3,420 |
| | PTF | BDL | <76.49 | 2.19 | 431.65 | BDL | BDL | 5.42 | | |
| | STJ | BDL | <70.14 | 1.98 | 524.25 | BDL | BDL | 5.05 | | |
| | STL | BDL | <83.81 | < 1.27 | 485.29 | BDL | BDL | 15.85 | | |
| | Avg | - | - | 1.7** | 609.43 | | | 7.85 | | |
| | Std Dev | NA | | 2.05 | 859.6 | NA | NA | 4.77 | | |
| | Min | - | <56.5 | <0.82 | 66.54 | | | 3.88 | | |
| | Max | - | <146.28 | 9.54 | 4,176.21 | | | 23.81 | | |

= Exceeds residential direct exposure CTLs in Table II of Chapter 62-777, .F. A.C.
* Detection limits were based on a 2.0 g dry sample weight. However, since 2.0 g of wet samples were digested and samples had variable moisture content, each sample has a different detection limit when the concentration is expressed in mg/kg dry weight.

** Aitchison's adjusted mean

*** Aitchison's adjusted standard deviation

**Table 3 - Summary of Characterization Study Results – SPLP**
(All values are in mg/L unless otherwise stated)

| Sludge Type | Sample Name | Aluminum | Arsenic ug/L | Barium | Cadmium ug/L | Chromium | Copper | Iron | Lead ug/L | Manganese | Mercury ug/L | Molybdenum ug/L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Alum | MAN B | < 0.07 | < 2.5 | < 0.01 | < 0.5 | < 0.017 | < 0.014 | < 0.045 | 39.11 | 0.1197 | < 0.25 | < 2.5 |
| | NWP | 0.89 | < 2.5 | 0.02 | < 0.5 | 0.024 | 0.02 | 0.252 | < 5 | < 0.011 | < 0.25 | <2.5 |
| | OKE | 0.55 | < 2.5 | 0.01 | < 0.5 | 0.019 | < 0.014 | 0.125 | < 5 | < 0.011 | < 0.25 | < 2.5 |
| | PON | 4.12 | < 2.5 | 0.01 | < 0.5 | 0.019 | < 0.014 | 0.218 | < 5 | 0.0176 | < 0.25 | < 2.5 |
| | PRW | < 0.07 | < 2.5 | 0.01 | < 0.5 | < 0.017 | < 0.014 | < 0.045 | < 5 | 0.0141 | < 0.25 | < 2.5 |
| | Avg | 1.14 | 2.5 | 0.01 | 0.5 | 0.019 | 0.015 | 0.137 | 11.82 | 0.0347 | < 0.25 | 2.5 |
| | Std Dev | 1.7 | | 0 | | 0.003 | 0.003 | 0.096 | 15.25 | 0.0476 | | |
| | Min | 0.07 | 2.5 | 0.01 | 0.5 | 0.017 | 0.014 | 0.045 | < 5 | 0.011 | < 0.25 | 2.5 |
| | Max | 4.12 | 2.5 | 0.02 | 0.5 | 0.024 | 0.02 | 0.252 | 39.11 | 0.1197 | < 0.25 | 2.5 |
| Ferric | BAY | 0.12 | < 2.5 | < 0.01 | < 0.5 | < 0.017 | < 0.014 | 23.94 | <5 | 0.0406 | < 0.25 | < 2.5 |
| | BRT | 0.6 | < 2.5 | 0.07 | < 0.5 | < 0.017 | 0.115 | 4.36 | < 5 | 0.1586 | < 0.25 | < 2.5 |
| | COC A | 0.68 | < 2.5 | 0.01 | < 0.5 | < 0.017 | < 0.014 | 114.8 | <5 | 0.1982 | < 0.25 | < 2.5 |
| | Avg | 0.46 | 2.5 | 0.03 | 0.5 | 0.017 | 0.048 | 47.7 | 5.33 | 0.1325 | < 0.25 | 2.5 |
| | Std Dev | 0.3 | | 0.03 | | 0 | 0.058 | 58.929 | 0.58 | 0.082 | | |
| | Min | 0.12 | 2.5 | 0.01 | 0.5 | 0.017 | 0.014 | 4.36 | 5 | 0.0406 | < 0.25 | 2.5 |
| | Max | 0.68 | 2.5 | 0.07 | 0.5 | 0.017 | 0.115 | 114.8 | 6 | 0.1982 | < 0.25 | 2.5 |
| Lime | ARC | < 0.07 | < 2.5 | < 0.01 | < 0.5 | < 0.017 | < 0.014 | < 0.045 | < 5 | < 0.011 | < 0.25 | < 2.5 |
| | BON | < 0.07 | < 2.5 | 0.01 | < 0.5 | 0.017 | < 0.014 | < 0.045 | < 5 | < 0.011 | < 0.25 | < 2.5 |
| | CHA | < 0.07 | < 2.5 | 0.02 | < 0.5 | < 0.017 | < 0.014 | < 0.045 | < 5 | < 0.011 | < 0.25 | < 2.5 |
| | COC B | 0.17 | < 2.5 | < 0.01 | < 0.5 | < 0.017 | < 0.014 | 0.101 | < 5 | < 0.011 | < 0.25 | < 2.5 |
| | ENG | < 0.07 | < 2.5 | < 0.01 | < 0.5 | 0.019 | < 0.014 | 0.094 | < 5 | < 0.011 | < 0.25 | < 2.5 |
| | FLA | 0.13 | < 2.5 | 0.03 | < 0.5 | < 0.017 | < 0.014 | 0.102 | < 5 | 0.0111 | < 0.25 | < 2.5 |
| | GAI | < 0.07 | < 2.5 | 0.04 | < 0.5 | < 0.017 | < 0.014 | < 0.045 | < 5 | < 0.011 | < 0.25 | < 2.5 |
| | LAK | < 0.07 | < 2.5 | < 0.01 | < 0.5 | 0.018 | 0.025 | < 0.045 | < 5 | < 0.011 | < 0.25 | 6.68 |
| | LAU A | < 0.07 | < 2.5 | < 0.01 | < 0.5 | < 0.017 | < 0.014 | < 0.045 | 30.3 | < 0.011 | < 0.25 | < 2.5 |
| | LAU B | < 0.07 | < 2.5 | < 0.01 | < 0.5 | < 0.017 | < 0.014 | < 0.045 | < 5 | < 0.011 | < 0.25 | < 2.5 |
| | MAN A | 0.12 | < 2.5 | 1.43 | < 0.5 | 0.088 | < 0.014 | 0.121 | < 5 | < 0.011 | < 0.25 | 5.37 |
| | MAR | < 0.07 | < 2.5 | < 0.01 | < 0.5 | < 0.017 | 0.112 | < 0.045 | < 5 | < 0.011 | < 0.25 | < 2.5 |
| | MIM | < 0.07 | < 2.5 | < 0.01 | < 0.5 | < 0.017 | 0.034 | < 0.045 | < 5 | < 0.011 | < 0.25 | < 2.5 |
| | OAK | < 0.07 | < 2.5 | < 0.01 | < 0.5 | < 0.017 | < 0.014 | < 0.045 | < 5 | < 0.011 | < 0.25 | < 2.5 |
| | OCA | < 0.07 | < 2.5 | < 0.01 | < 0.5 | < 0.017 | 0.014 | 0.086 | < 5 | < 0.011 | < 0.25 | < 2.5 |
| | PAM | < 0.07 | < 2.5 | < 0.01 | < 0.5 | < 0.017 | < 0.014 | < 0.045 | <5 | < 0.011 | < 0.25 | < 2.5 |
| | POH | < 0.07 | < 2.5 | < 0.01 | < 0.5 | < 0.017 | < 0.014 | < 0.045 | < 5 | < 0.011 | < 0.25 | < 2.5 |
| | PTF | < 0.07 | < 2.5 | 0.09 | < 0.5 | 0.033 | < 0.014 | 0.047 | <5 | < 0.011 | < 0.25 | < 2.5 |
| | STJ | < 0.07 | < 2.5 | < 0.01 | < 0.5 | 0.027 | < 0.014 | 0.048 | < 5 | < 0.011 | < 0.25 | <2.5 |
| | STL | < 0.07 | 2.84 | < 0.01 | < 0.5 | < 0.017 | < 0.014 | 0.278 | <5 | < 0.011 | < 0.25 | < 2.5 |
| | Avg | 0.08 | 2.52 | 0.09 | 0.5 | 0.022 | 0.02 | 0.071 | 6.37 | 0.011 | < 0.25 | 2.99 |
| | Std Dev | 0.03 | 0.07 | 0.32 | | 0.016 | 0.022 | 0.055 | 5.65 | 0 | | 1.23 |
| | Min | 0.07 | 2.5 | 0.01 | 0.5 | 0.017 | 0.014 | < 0.045 | 5 | 0.011 | < 0.25 | 2.5 |
| | Max | 0.17 | 2.84 | 1.43 | 0.5 | 0.088 | 0.112 | 0.278 | 30.3 | 0.0111 | < 0.25 | 6.68 |

= Exceeds CTLs for ground water in Table I of Chapter 62-777, F.A.C.

**Table 3 - Summary of Characterization Study Results – SPLP, Cont.**
(All values are in mg/L unless otherwise stated)

| Sludge Type | Sample Name | Nickel | Sodium | Selenium ug/L | Silver | Zinc | Acetone ug/L | Methylene Chloride ug/L | pH | TDS | Fluoride | Chloride | Sulfate |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Alum | MAN B | < 0.015 | 0.97 | <2.5 | < 0.03 | < 0.025 | | | 5.54 | 220 | <1.0 | 5.1 | 31.2 |
| | NWP | 0.018 | 8.52 | <2.5 | < 0.03 | 0.0557 | | | 6.95 | 113 | <1.0 | 7.2 | 99.3 |
| | OKE | < 0.015 | 15.99 | <2.5 | < 0.03 | 0.0396 | 6.3 | | 6.41 | 160 | <1.0 | 5.9 | 40.9 |
| | PON | < 0.015 | 14.47 | <2.5 | < 0.03 | < 0.025 | | | 7.29 | 440 | <1.0 | 20.6 | 121 |
| | PRW | <0.015 | 10.45 | <2.5 | < 0.03 | < 0.025 | 14,400 | 5.3 | 5.92 | <50 | <1.0 | 8.8 | 70.8 |
| | Avg | 0.0153 | 10.08 | 2.5 | < 0.03 | 0.0341 | | | | | | | |
| | Std Dev | 0.0017 | 5.91 | | | 0.0136 | | | | | | | |
| | Min | 0.015 | 0.97 | 2.5 | < 0.03 | < 0.0250 | | | | | | | |
| | Max | 0.018 | 15.99 | 2.5 | < 0.03 | 0.0557 | | | | | | | |
| Ferric | BAY | < 0.015 | 13.68 | <2.5 | < 0.03 | 0.0319 | 18.4 | | 5.19 | 170 | <1.0 | 3.8 | 20.5 |
| | BRT | < 0.015 | 19.06 | <2.5 | < 0.03 | 0.0475 | 9.4 | | 5.15 | 370 | <1.0 | 3.4 | 125.3 |
| | COC A | < 0.015 | 11.34 | <2.5 | < 0.03 | 0.0471 | | | 6.88 | 75 | <1.0 | 4.1 | 54.4 |
| | Avg | 0.015 | 14.69 | 2.5 | < 0.03 | 0.0422 | | | | | | | |
| | Std Dev | | 3.96 | | | 0.0089 | | | | | | | |
| | Min | 0.015 | 11.34 | 2.5 | < 0.03 | 0.0319 | | | | | | | |
| | Max | 0.015 | 19.06 | 2.5 | < 0.03 | 0.0475 | | | | | | | |
| Lime | ARC | < 0.015 | 1.41 | <2.5 | < 0.03 | 0.0258 | 28.5 | | 8.81 | <50 | <1.0 | 4.9 | 9.4 |
| | BON | < 0.015 | 1.93 | <2.5 | < 0.03 | 0.0332 | 46.2 | | 11.9 | 193 | <1.0 | 5.4 | 11.5 |
| | CHA | < 0.015 | 4.5 | <2.5 | < 0.03 | < 0.025 | | | 10.4 | 230 | <1.0 | 10.7 | 10.6 |
| | COC B | < 0.015 | 1.8 | <2.5 | < 0.03 | 0.0555 | | | 9.48 | 60 | <1.0 | 6.9 | 14.9 |
| | ENG | 0.0206 | 0.8 | <2.5 | < 0.03 | 0.0421 | | | 9.31 | 190 | <1.0 | 4.3 | 4.3 |
| | FLA | < 0.015 | 3.29 | <2.5 | < 0.03 | 0.0278 | | | 9.75 | 210 | <1.0 | 6.9 | 40.2 |
| | GAI | 0.0206 | 0.56 | <2.5 | < 0.03 | < 0.025 | 13.5 | | 10.4 | 140 | <1.0 | 4 | 44.9 |
| | LAK | < 0.015 | 0.17 | <2.5 | < 0.03 | 0.0572 | | | 9.64 | 200 | <1.0 | 5.1 | 55.2 |
| | LAU A | < 0.015 | 1.64 | <2.5 | < 0.03 | < 0.025 | | | 10.2 | <50 | <1.0 | 5 | 12 |
| | LAU B | < 0.015 | 0.61 | <2.5 | < 0.03 | < 0.025 | | | 9.89 | <50 | <1.0 | 4.3 | 3.8 |
| | MAN A | 0.0154 | 3.2 | <2.5 | < 0.03 | 0.0472 | | | 12.6 | 2,540 | <1.0 | 24.9 | 13.6 |
| | MAR | 0.0351 | 2.28 | <2.5 | < 0.03 | 0.6858 | | | 9.99 | <50 | <1.0 | 6.6 | 12.6 |
| | MIM | < 0.015 | 0.76 | <2.5 | < 0.03 | 0.1844 | | | 10.5 | <50 | <1.0 | 4.8 | 12.1 |
| | OAK | < 0.015 | 0.42 | <2.5 | < 0.03 | < 0.025 | | | 10.6 | 130 | <1.0 | 3.3 | 4.4 |
| | OCA | 0.0259 | 1.81 | <2.5 | < 0.03 | 0.0748 | 9.8 | | 9.76 | 70 | <1.0 | 3.2 | 6.6 |
| | PAM | < 0.015 | 0.54 | <2.5 | < 0.03 | 0.0617 | | | 10.5 | <50 | <1.0 | 5.1 | 4.8 |
| | POH | < 0.015 | 67.21 | <2.5 | < 0.03 | < 0.025 | 5.1 | | 9.13 | 370 | <1.0 | 94.8 | 43.3 |
| | PTF | < 0.015 | 1.01 | <2.5 | < 0.03 | < 0.025 | | | 10.9 | 140 | <1.0 | 4.6 | 7.8 |
| | STJ | < 0.015 | 1.14 | <2.5 | < 0.03 | < 0.025 | | | 9.37 | <50 | <1.0 | 4.7 | 7 |
| | STL | < 0.015 | 2.1 | <2.5 | < 0.03 | < 0.025 | | | 9.81 | 90 | <1.0 | 8.2 | 5 |
| | Avg | 0.0171 | 4.86 | 2.5 | < 0.03 | 0.076 | | | | | | | |
| | Std Dev | 0.0051 | 14.72 | | | 0.1481 | | | | | | | |
| | Min | 0.015 | 0.17 | 2.5 | < 0.03 | 0.025 | | | | | | | |
| | Max | 0.0351 | 67.21 | 2.5 | < 0.03 | 0.6858 | | | | | | | |

= Exceeds CTLs for ground water in Table I of Chapter 62-777, F.A.C.

**Table 4 – Summary of Cleanup Target Levels and Water Quality Criteria**
(All values are in mg/L or mg/kg unless otherwise stated)

| Parameter | Cleanup Target Levels (Chapter 62-777, F.A.C.) | | | | | | Drinking Water Standards (Chapter 62-550, F.A.C.), mg/l | |
|---|---|---|---|---|---|---|---|---|
| | Soil (mg/kg) | | | | Water (ųg/l) | | | |
| | Direct Exposure | | Leachability | | | | | |
| | Residential | Industrial | Ground | Surface | Ground | Fresh | Primary | Secondary |
| Acetone | 11,000 | 68,000 | 25 | 6.8 | 6,300 | 1,700 | | |
| Aluminum | 80,000 | * | *** | *** | [1] (Secondary) | 13 | | 0.2 |
| Arsenic | 2.1 | 12 | *** | *** | [1] (Primary) | [2] | 0.01 | |
| Barium | 120** | 130,000 | 1,600 | NA | [1] (Primary) | NA | 2 | |
| Cadmium | 82 | 1,700 | 7.5 | NA | [1] (Primary) | [2] | 0.005 | |
| Chloride | No target level | | | | [1] (Secondary) | NA | | 250 |
| Chromium (Hex) | 210 | 470 | NA | 4.2 | [1] | [2] | | |
| Chromium (total) | 210 | 470 | 38 | 4.2 | [1] (Primary) | 11 (f) | 0.1 | |
| Copper | 150** | 89,000 | *** | NA | [1] (Secondary) | [2] | | 1 |
| Fluoride | 840** | 130,000 | 6,000 | 30,000 | [1] (Secondary) | [2] | 4 | 2 |
| Iron | 53,000 | * | *** | *** | [1] (Secondary) | [2] | | 0.3 |
| Lead | 400 | 1,400 | *** | NA | [1] (Primary) | [2] | 0.015 | |
| Manganese | 3,500 | 43,000 | *** | NA | [1] (Secondary) | NA | | 0.05 |
| Mercury | 3 | 17 | 2.1 | 0.01 | [1] (Primary) | [2] | 0.002 | |
| Methylene Chloride | 17 | 26 | 0.02 | 7.3 | [1] (Primary) | [2] | 0.005 | |
| Molybdenum | 440 | 11,000 | *** | NA | 35 | NA | | |
| Nickel | 340** | 35,000 | 130 | NA | [1] (Primary) | [2] | 0.1 | |
| pH | No target level | | | | No target level | | | 6.2 - 8.5 |
| Selenium | 440 | 11,000 | 5.2 | 0.5 | [1] (Primary) | [2] | 0.05 | |
| Silver | 410 | 8,200 | 17 | 0.01 | [1] (Secondary) | [2] | | 0.1 |
| Sodium | No target level | | | | [1] (Primary) | NA | 160 | |
| Sulfate | No target level | | | | [1] (Secondary) | NA | | 250 |
| TDS | No target level | | | | [1] (Secondary) | NA | | 500 |
| Zinc | 26,000 | 630,000 | *** | NA | [1] (Secondary) | [2] | | 5 |

* Contaminant is not a health concern for this exposure
** Direct exposure value based on acute toxicity considerations. This criterion is applicable in scenarios where children might be exposed to soils (e.g. residences, schools, playgrounds).
*** Leachability values may be derived using the SPLP Test to calculate site-specific SCTLs or may be determined using TCLP in the event oily wastes are present.

[1] As provided in Chapter 62-520, F.A.C.

[2] As provided in Chapter 62-302, F.A.C.

(f) In the absence of concentration data specific for the III AND iv valence state of chromium, total chromium concentrations in surface water should be compared to the criteria for Chromium (hexavalent).

NA = Not available at time of rule adoption.

Note: Except for acetone, ground water cleanup targel levels (GWCTL) in Chapter 62-777, F.A.C., are the primary and secondary drinking water requirements. These values have been included into these tables for convenience. Also, the drinking water rule specifies Dichloromethane, which has the same CAS# as Methylene Chloride (i.e., the same parameter with a different name).

# Appendix A
# Calculating Blending

## Blend Ratios

This guidance document allows the blending of sludge with uncontaminated soils in order to reduce the potential public health threat from exposure to the sludge, provided that the resulting mixture is still appropriate for beneficial use. If sludge is to be blended with an available stockpile of soil, it is recommended the following formula be used to determine the appropriate blend ratio (ratio of blend material to sludge) to use for lowering the concentrations of a contaminant contained in the sludge:

$$Blend\,Ratio = \frac{(A-B)}{(B-C)}$$

Where:

A = concentration of contaminant in the sludge, mg/kg
B = target concentration of the blended material, mg/kg
C = concentration of contaminant in the material used for blending, mg/kg

Example 1:

An alum sludge has an average concentration of barium of 316 mg/kg. To land apply the sludge, it is desired to lower the barium concentration to 110 mg/kg by blending the sludge with stockpiled soil having a barium concentration of 64 mg/kg. In this case the required blend ratio would be:

$$Blend\,Ratio = \frac{(316-110)}{(110-64)} = 4.5$$

Thus, to achieve the desired concentration of barium in the blended alum sludge, 4.5 parts of the soil would need to be blended with every part of sludge. To state it another way, every ton of sludge will have to be mixed with 4.5 tons of soil to achieve the desired target concentration.

## Blending by Tilling into the Top Six Inches of Soil

If the approach is to blend the sludge into the top six inches of soil at the land application site, then the following equation should be used to calculate the allowable application rate in tons per acre:

$$Application\,Rate = (10.89\rho_s)\frac{(B-C)}{(A-B)}$$

Where:

$\rho_s$ = density of soil in the top 6 inches, $lb/ft^3$
A = concentration of contaminant in the sludge, mg/kg
B = target concentration of the blended material, mg/kg
C = concentration of contaminant in the material used for blending, mg/kg

Example 2:

If the soil at the application site has a density of 115 $lbs/ft^3$ and if the sludge is to be tilled into the top 6 inches of soil, then using the values of A, B and C in Example 1 the application rate for the lime sludge would be:

$$Application\,Rate = (10.89)(115)\frac{(110-64)}{(316-110)} = 280\,tons\,sludge/acre$$