



A. L. ABBOTT & ASSOCIATES (PTY) LTD

Reg. No. 1982/004379/07

Established 1964

THE WATER & WASTE WATER SPECIALISTS

No.1, Vine Park
Vine Road
7925
P.O. Box 483
WOODSTOCK, CAPE
7915
SOUTH AFRICA
Telephone: (021) 448 6340/1
After Hours: 083-3263887
E-Mail Address: info@alabbott.co.za

20/3638

2 September 2020

BVI CONSULTING ENGINEERS

Attention : GERT MEIRING

Dear Sir,

CLASSIFICATION OF SLUDGE

We attach our classification of sludge from the Klaarstroom Oxidation Pond WWTW, received on 22 July 2020.

Disposal options are included.

Yours faithfully,

.....
N. VAN BINSBERGEN Pr.Sci.Nat.
DIRECTOR



(No. T0276)

No.1, Vine Park
Vine Road
7925
P.O. Box 483
WOODSTOCK, CAPE
7915

SOUTH AFRICA

Telephone: (021) 448 6340/1

After Hours: 083-3263887

E-Mail Address: info@alabbott.co.za

Certificate of Analysis

BVI CONSULTING ENGINEERS

Sample : **Three Samples of Sludge**
(ex Klaarstroom Oxidation Pond WWTW)

Date Received : **22 July 2020** **Lab. Data Sheet No.: 20/3638**

Our Ref. : **bm/3638**
2 September 2020

| | | KLAARSTROOM Sludge #1 |
|---------------------------------------|--------------------------|----------------------------------|
| Physical Characteristics : | pH | 5.70 |
| | Total Solids (%) | 81.9 |
| | Volatile Solids (%) | 35.6 |
| | Volatile Fraction (%) | 43.5 |
| | Volatile Fatty Acids (%) | 0.02 |

| | | KLAARSTROOM Sludge #1 |
|--------------------|---|----------------------------------|
| Nutrients : | Total Kjeldahl Nitrogen (mg/kg as N) | 14138 |
| | Total Phosphate (mg/kg as P) | 2434 |
| | Potassium (mg/kg as K) | 1373 |

| | | KLAARSTROOM Sludge #1 | Classification |
|--|------------------------|----------------------------------|-----------------------|
| Metal Limits and Micro Elements : | Metal Limits : | | |
| | Arsenic (mg/kg as As) | <1 | a |
| | Cadmium (mg/kg as Cd) | <1 | a |
| | Chromium (mg/kg as Cr) | 15.8 | a |
| | Copper (mg/kg as Cu) | 24.0 | a |
| | Lead (mg/kg as Pb) | 8.9 | a |
| | Mercury (mg/kg as Hg) | <1 | a |
| | Nickel (mg/kg as Ni) | 0.69 | a |
| | Zinc (mg/kg as Zn) | 182 | a |

| | | KLAARSTROOM Sludge #1 | Classification |
|--------------------------------------|--|----------------------------------|-----------------------|
| Microbiological Quality : | Faecal Coliforms (organisms per g) | 27200 | B |
| | Total Viable Helminth Ova (ova/4 g) | 1 | B |

| | | |
|---------------|----|---|
| NOTES: | 1. | Routine analysis of organic pollutants is not required for domestic sludge. |
| | 2. | According to O'Shaunessy's formula, the volatile solids reduction was 85.4% = Stability Class 1 |

| | | KLAARSTROOM Sludge #2 |
|---------------------------------------|--------------------------|----------------------------------|
| Physical Characteristics : | pH | 5.68 |
| | Total Solids (%) | 89.0 |
| | Volatile Solids (%) | 38.2 |
| | Volatile Fraction (%) | 42.9 |
| | Volatile Fatty Acids (%) | 0.02 |

| | | KLAARSTROOM Sludge #2 |
|--------------------|---|----------------------------------|
| Nutrients : | Total Kjeldahl Nitrogen (mg/kg as N) | 14759 |
| | Total Phosphate (mg/kg as P) | 1975 |
| | Potassium (mg/kg as K) | 1132 |

| | | KLAARSTROOM Sludge #2 | Classification |
|--|------------------------|----------------------------------|-----------------------|
| Metal Limits and Micro Elements : | Metal Limits : | | |
| | Arsenic (mg/kg as As) | <1 | a |
| | Cadmium (mg/kg as Cd) | <1 | a |
| | Chromium (mg/kg as Cr) | 15.1 | a |
| | Copper (mg/kg as Cu) | 18.5 | a |
| | Lead (mg/kg as Pb) | 9.8 | a |
| | Mercury (mg/kg as Hg) | <1 | a |
| | Nickel (mg/kg as Ni) | 1.5 | a |
| | Zinc (mg/kg as Zn) | 260 | a |

| | | KLAARSTROOM Sludge #2 | Classification |
|--------------------------------------|--|----------------------------------|-----------------------|
| Microbiological Quality : | Faecal Coliforms (organisms per g) | 24200 | B |
| | Total Viable Helminth Ova (ova/4 g) | 1 | B |

| | |
|----------------|--|
| NOTES : | 1. Routine analysis of organic pollutants is not required for domestic sludge. |
| | 2. According to O'Shaunessy's formula, the volatile solids reduction was 85.7% = Stability Class 1 |

| | | KLAARSTROOM Sludge #3 |
|---------------------------------------|--------------------------|----------------------------------|
| Physical Characteristics : | pH | 5.81 |
| | Total Solids (%) | 88.9 |
| | Volatile Solids (%) | 38.0 |
| | Volatile Fraction (%) | 42.7 |
| | Volatile Fatty Acids (%) | 0.02 |

| | | KLAARSTROOM Sludge #3 |
|--------------------|---|----------------------------------|
| Nutrients : | Total Kjeldahl Nitrogen (mg/kg as N) | 14896 |
| | Total Phosphate (mg/kg as P) | 2176 |
| | Potassium (mg/kg as K) | 1161 |


| | | KLAARSTROOM Sludge #3 | Classification |
|--|------------------------|----------------------------------|-----------------------|
| Metal Limits and Micro Elements : | Metal Limits : | | |
| | Arsenic (mg/kg as As) | <1 | a |
| | Cadmium (mg/kg as Cd) | <1 | a |
| | Chromium (mg/kg as Cr) | 8.0 | a |
| | Copper (mg/kg as Cu) | 20.8 | a |
| | Lead (mg/kg as Pb) | 9.5 | a |
| | Mercury (mg/kg as Hg) | <1 | a |
| | Nickel (mg/kg as Ni) | 1.8 | a |
| | Zinc (mg/kg as Zn) | 258 | a |

| | | KLAARSTROOM Sludge #3 | Classification |
|--------------------------------------|--|----------------------------------|-----------------------|
| Microbiological Quality : | Faecal Coliforms (organisms per g) | 18800 | B |
| | Total Viable Helminth Ova (ova/4 g) | 2 | B |

| | | |
|----------------|----|---|
| NOTES : | 1. | Routine analysis of organic pollutants is not required for domestic sludge. |
| | 2. | According to O'Shaunessy's formula, the volatile solids reduction was 85.8% = Stability Class 1 |

**CHARACTERISATION AND PRELIMINARY CLASSIFICATION OF
DRY SLUDGE FROM KLAARSTROOM OXIDATION POND WWTW**

| | KLAARSTROOM OXIDATION POND WWTW SLUDGE |
|--|---|
| Sludge Type | Composted Sludge |
| Sampling Point | Stockpile |
| Microbiological Parameters | B |
| Vector Attraction Reduction Options Applied | 1 |
| Pollutant Class | a |
| Classification | B1a |


.....
N. VAN BINSBERGEN Pr.Sci.Nat.
DIRECTOR

bm/3638
2 September 2020

TO: BVI CONSULTING ENGINEERS

Attention : GERT MEIRING

TABLE 8: USING THE PRELIMINARY MICROBIOLOGICAL CLASSIFICATION TO ASSESS THE APPROPRIATENESS OF A MANAGEMENT OPTION

| Class | Management option | Appropriate Sludge Guideline | Appropriateness of this option? | What are the major restrictions in terms of the Microbiological class? |
|--------------------------------|---|------------------------------|---------------------------------|--|
| Microbiological class A | Agricultural use at agronomic rates | Volume 2 | Yes (i) | None. |
| | On-site or off-site disposal | Volume 3 | May be (iii) | It is an inappropriate option for the disposal of a disinfected sludge. Disinfection technologies are costly and this management option therefore represents wasting of potential resource recovery. |
| | Beneficial use (other than agricultural use at agronomic rates) | Volume 4 | Yes (i) | None pertain to this Microbiological class. |
| | Thermal treatment methods | Volume 5 | No (v) | It is not recommended to use thermal methods, such as incineration to manage a Microbiological class A sludge, as it was costly to achieve this classification in the first place. |
| | Produce saleable products | Volume 5 | Yes (i) | Most saleable products will require disinfection process. |
| Microbiological class B | Agricultural use at agronomic rates | Volume 2 | Qualified yes (ii) | May not be appropriate for some crops with edible parts below the soil surface. |
| | On-site or off-site disposal | Volume 3 | May be (iii) | It could potentially be used beneficially, as this is a partially disinfected product. |
| | Beneficial use (other than agricultural use at agronomic rates) | Volume 4 | May be (iii) | Due to the incomplete disinfection process it could affect the beneficial use depending on the application. |
| | Thermal treatment methods | Volume 5 | Qualified no (iv) | It is not recommended to use thermal methods, such as incineration to manage a Microbiological class B sludge, as it was costly to achieve this classification. |
| | Produce saleable products | Volume 5 | Qualified no (iv) | Due to the incomplete disinfection process it could influence the quality of the product. |
| Microbiological class C | Agricultural use at agronomic rates | Volume 2 | Qualified no (iv) | Microbiological class C sludge can only be used if stability class 1 or 2 is achieved. Restrictions to crop types also apply. |
| | On-site or off-site disposal | Volume 3 | Yes (i) | None. |
| | Beneficial use (other than agricultural use at agronomic rates) | Volume 4 | Qualified no (iv) | Care should be taken not to expose the public and workers to pathogens. |
| | Thermal treatment methods | Volume 5 | Yes (i) | Thermal process is an appropriate technology for this microbiological class. |
| | Produce saleable products | Volume 5 | No (v) | Risk of infection is unacceptable. |

TABLE 9: USING THE PRELIMINARY STABILITY CLASSIFICATION TO ASSESS THE APPROPRIATENESS OF A MANAGEMENT OPTION

| Class | Management option | Appropriate Sludge Guideline | Appropriateness of this option? | What are the major restrictions in terms of the Stability class? |
|-------------------|---|------------------------------|---------------------------------|---|
| Stability class 1 | Agricultural use at agronomic rates | Volume 2 | Yes (i) | None. |
| | On-site or off-site disposal | Volume 3 | Yes (i) | None. Note that vector attraction reduction options 9 and 10 do not apply. |
| | Beneficial use (other than agricultural use at agronomic rates) | Volume 4 | Qualified yes (ii) | Vector attraction reduction options 1 to 8 would be appropriate. |
| | Thermal treatment methods | Volume 5 | May be (iii) | Vector attraction reduction options 7 and 8 or an appropriate dewatering step should be applied as a pre-treatment step before thermal treatment. |
| | Produce saleable products | Volume 5 | Yes (i) | Long-term stability would be required for saleable products. |
| Stability class 2 | Agricultural use at agronomic rates | Volume 2 | Qualified yes (ii) | Due to the reliability of the vector attraction reduction measures implemented, additional management systems may be required. |
| | On-site or off-site disposal | Volume 3 | Qualified yes (ii) | Vector attraction options 9 and 10 do not apply. Make sure that the vector reduction processes are reliable to prevent odours or other nuisances. |
| | Beneficial use (other than agricultural use at agronomic rates) | Volume 4 | May be (iii) | This will depend on the beneficial use selected |
| | Thermal treatment methods | Volume 5 | Qualified yes (ii) | Vector attraction reduction options 7 and 8 or an appropriate dewatering step should be applied as a pre-treatment step before thermal treatment. |
| | Produce saleable products | Volume 5 | Qualified no (iv) | Long-term stability is required for saleable products and the reliability of this Stability class may not be appropriate. |
| Stability class 3 | Agricultural use at agronomic rates | Volume 2 | No (v) | At least one vector attraction reduction option should be implemented. |
| | On-site or off-site disposal | Volume 3 | Qualified no (iv) | Unstable sludges such as raw/primary sludge may not be accepted at landfill sites. |
| Stability class 3 | Beneficial use (other than agricultural use at agronomic rates) | Volume 4 | Qualified no (iv) | Care should be taken not to expose the public and workers to unstable sludge. |
| | Thermal treatment methods | Volume 5 | Yes (i) | Vector attraction options 9 and 10 do not apply. Make sure that the vector reduction processes are reliable to prevent odours or other nuisances. |
| | Produce saleable products | Volume 5 | No (v) | The product is not stable and the public will find this unacceptable. |

TABLE 10: USING THE PRELIMINARY POLLUTANT CLASSIFICATION TO ASSESS THE APPROPRIATENESS OF A MANAGEMENT OPTION

| Class | Management option | Appropriate Sludge Guideline | Appropriateness of this option? | What are the major restrictions in terms of the Pollutant class? |
|-------------------|---|------------------------------|---------------------------------|---|
| Pollutant class a | Agricultural use at agronomic rates | Volume 2 | Yes (i) | No limitations apart from the sludge application rate should not exceed agronomic rates. |
| | On-site or off-site disposal | Volume 3 | Qualified no (iv) | This sludge should not be disposed off as it is a high quality product that should be used beneficially. |
| | Beneficial use (other than agricultural use at agronomic rates) | Volume 4 | Yes (i) | No limitations with regard to the pollutant class, for the beneficial uses identified in this Volume. |
| | Thermal treatment methods | Volume 5 | Yes (i) | Thermal process will have limited environmental impacts in respect of the metals. |
| | Produce saleable products | Volume 5 | Yes (i) | No limitations with regard to the Pollutant class. (This excludes the production of edible products from sludge). |
| Pollutant class b | Agricultural use at agronomic rates | Volume 2 | Qualified yes (ii) | Additional analyses will be required to assess whether the receiving soil can accommodate the load. |
| | On-site or off-site disposal | Volume 3 | May be (iii) | Delisting according to the Minimum Requirements will be required. |
| | Beneficial use (other than agricultural use at agronomic rates) | Volume 4 | May be (iii) | High rate application of this sludge could cause long-term effects and source control should be implemented. |
| | Thermal treatment methods | Volume 5 | Qualified yes (ii) | Emissions of gaseous contaminants and the ash should be monitored and managed. |
| | Produce saleable products | Volume 5 | May be (iii) | This depends on the product. |
| Pollutant class c | Agricultural use at agronomic rates | Volume 2 | No (v) | The sludge metal content is too high for agricultural use. Source control should be implemented. |
| | On-site or off-site disposal | Volume 3 | May be (iii) | Delisting according to the Minimum Requirements will be required. |
| | Beneficial use (other than agricultural use at agronomic rates) | Volume 4 | Qualified no (iv) | High rate application of this sludge could cause long-term effects and source control should be implemented. |
| | Thermal treatment methods | Volume 5 | Qualified yes (ii) | Emissions of gaseous contaminants and the ash should be monitored and managed. |
| | Produce saleable products | Volume 5 | May be (iii) | This depends on the product. |