ISO 19698:2020 (E)

Sludge recovery, recycling, treatment and disposal — Beneficial use of biosolids — Land application

Contents

Foreword

Introduction

1 Scope

2 Normative references

3 Terms and definitions

4 Benefits of biosolids land application

5 Nutrients in biosolids

5.1 General
5.2 Nitrogen
5.2.1 General
5.2.2 Nitrogen content and availability in biosolids
5.2.3 Determination of biosolids application rate according to nitrogen content
5.3 Phosphorus
5.4 Potassium
5.5 Calcium
5.6 Sulfur

6 Nuisance and risks associated with biosolids land application

6.1 General
6.2 Odours
6.3 Vector attraction
6.4 Pathogens
6.4.1 General
6.4.2 Viruses
6.4.3 Bacteria
6.4.4 Protozoa
6.4.5 Helminths
6.5 Trace elements
6.6 Organic compounds
6.6.1 General
6.6.2 Source control of potential contaminants
6.7 Environmental considerations
6.7.1 General
6.7.2 Climate and season
6.7.3 Topography
6.7.4 Protection of water sources
6.7.5 Identification of sensitive uses and associated setbacks
6.8 Biosolids treatment
6.8.1 General
6.8.2 Foreign matter
6.8.3 Odour reduction
6.8.4 Vector attraction reduction
6.8.5 Pathogen reduction
6.8.5.1 General
6.8.5.2 Conventional treatments
6.8.5.3 Advanced treatments
6.9 Biosolids quality criteria — Groups of biosolids

6.9.1 General
6.9.2 Group 1 biosolids
6.9.3 Group 2 biosolids
6.10 Potential uses
6.11 Biosolids and soil monitoring

7 Biosolids application programme development and management

7.1 General
7.2 Community consultation
7.2.1 Involving the community
7.2.2 Consultation principles
7.2.2.1 Knowing the community
7.2.2.2 Timing consideration
7.2.2.3 Transparency and open mindedness
7.2.2.4 Dissemination of information
7.2.2.5 Consultation process
7.3 Programme development
7.3.1 General
7.3.2 Programme design and decision considerations
7.4 Programme management
7.4.1 General
7.4.2 Programme management considerations
7.4.3 Biosolids and soil monitoring
7.4.3.1 Biosolids sampling and analyses
7.4.3.1.1 Frequency of sampling
7.4.3.1.2 Sample handling
7.4.3.1.3 Biosolids analyses
7.4.3.1.4 Chemical analyses
7.4.3.1.5 Biological analyses
7.4.3.2 Soil sampling
7.4.4 Continuous improvement
7.4.5 Voluntary agreement and quality assurance

8 Objectives of agricultural land application

8.1 General
8.2 Agronomic considerations
8.2.1 Nitrogen management — General
8.2.2 Nitrogen in biosolids
8.2.2.1 General
8.2.2.2 Determination of biosolids application rate according to nitrogen content
8.2.2.3 Net nitrogen
8.2.2.4 Plant available N
8.2.2.5 Biosolids mineralization rates for the year of application
8.2.2.6 Mineralization rates for years following application
8.2.2.7 Volatilization of ammonia
8.2.2.8 Nitrogen based biosolids application rate (BAR–N)
8.3 Phosphorus management
8.3.1 General
8.3.2 Determination of biosolids application rate according to phosphorus content
8.4 Annual biosolids application rate

9 Storage, staging, fencing and signage

9.1 General
9.2 Signage

10 Haulage and field deliveries

11 Application techniques

12 Specific pathogen mitigation measures for agricultural land application

13 Record keeping

13.1 General
13.2 Spreading records

13.3 Field inspection

14 Objectives of land reclamation

14.1 General
14.2 Site management
14.2.1 General
14.2.2 Soil/substrate properties
14.3 Environmental considerations
14.3.1 Climate and season
14.3.2 Topography
14.3.3 Protection of water sources
14.3.4 Identification of sensitive uses and associated buffer zones
14.4 Operations management
14.4.1 Site preparation
14.4.2 Biosolids batch management and transport
14.4.3 Substrate sampling
14.4.4 Substrate analysis
14.5 Biosolids applications equipment and considerations
14.6 Determination of biosolids application rate
14.6.1 General
14.6.2 Biosolids application rates based on agronomic nitrogen application rate
14.6.3 Biosolids application rates based on maximum nutrient loads
14.6.4 Biosolids application rates based on target carbon to nitrogen ratio (C:N)
14.6.5 Biosolids application rates based on target organic matter
14.6.6 Biosolids application rates based on target pH adjustment
14.7 Revegetation
14.8 Environmental post application monitoring
14.8.1 General
14.8.2 Soil monitoring
14.8.3 Water monitoring
14.8.4 Foliage monitoring
14.9 Quality assurance

15 Nuisance and risk management for biosolids use for land reclamation

16 Biosolids treatment

16.1 Biosolids quality criteria
16.2 Pathogens
16.3 Vector attraction
16.4 Odour
16.5 Fencing and signage
16.6 Record keeping

Annex A (informative) Soil carbon dynamics

A.1 Biosolids for soil carbon storage
A.2 Estimation of soil carbon storage from biosolids amendment

Annex B (informative) Benefits of biosolids land application

B.1 General
B.2 Effects of biosolids on increased soil organic matter
B.3 Soil biological activity
B.4 Soil porosity and bulk density
B.5 Soil water infiltration rate
B.6 Aggregate stability and soil erosion
B.7 Cation exchange capacity
B.8 Effects of land application of lime stabilized biosolids on soil pH
B.9 Effects of land application of biosolids on overall nutrient recovery and nutrient cycle
B.10 Effects of land application of biosolids on soil carbon sequestration and greenhouse gas emissions

Annex C (informative) Average concentrations of organic matter and plant macronutrients in biosolids

Annex D (informative) Comparative pathogen and indicator limits for Group 1 biosolids

Annex E (informative) Source of trace elements in wastewater and biosolids and examples of trace elements standards in biosolids and in soil after biosolids application

Annex F (informative) Standards for maximum concentration of organic compounds in biosolids

Annex G (informative) Organic compounds

Annex H (informative) Setbacks (buffer zones) in different regions

Annex I (informative) Biosolids quality based on treatment method

Annex J (informative) Determination of plant available phosphate

Annex K (informative) Determination of maximum biosolids application rates based on trace elements

- K.1 General
- K.2 Trace element concentration in biosolids
- K.3 Cumulative trace element loading rate limits in biosolids (maximum mass applied — dry mass basis)
- K.4 Maximum trace element loading over 365 days
- K.5 Annual trace element loading rate (ATELR)
- K.6 Annual biosolids application rate (ABAR)
- K.7 Limit values for concentration of trace elements in soils (Soil end point concentration method)

Annex L (informative) Examples of source control/pollution prevention tools and regulating industrial discharges

- L.1 General
- L.2 Industrial discharge to the sewer
- L.3 Bans and voluntary phase–outs
- L.4 Stakeholder education/outreach initiatives

Annex M (informative) Biosolids sampling frequencies

Annex N (informative) Soil and biosolids tests and methodologies

Annex O (informative) Community consultative workshop

- O.1 Stakeholder and community dialogue/workshops structure
- O.2 Workshop design considerations
- O.3 Workshop outcomes

Annex P (informative) Benefits and value of biosolids use in rehabilitation

Annex Q (informative) Examples of restricted activities and withholding periods for Group 2 biosolids

Annex R (informative) Revegetation

Page count: 91