

Water treatment

Guidelines for the utilisation and disposal of water treatment residues

A WRC-funded guideline was developed to ensure safe use and disposal of water treatment residues.

Background

Potable water treatment plants (WTPs) produce a hygienically safe drinking water for consumption through a variety of treatment processes. However, they also produce waste products (water treatment residues), including organic and inorganic compounds in liquid, solid and gaseous phases.

The solid particles accumulated in the water treatment residues are the result of chemical coagulation, flocculation and sedimentation of raw water. Aluminium sulphate, ferric salts, lime and polyelectrolytes are among the chemicals added to promote flocculation. The type and concentration of chemical(s) present in the residues depend on the quality of the raw water, added chemicals and the purification process.

Traditionally, water treatment residues have been sent to landfill for disposal, but an option gaining acceptance internationally is land application, where the residues are applied directly onto land. The reasoning behind this approach is that physical, chemical and biological properties of the soil can be used to digest the applied waste without inducing negative effects on soil quality, groundwater or plant growth.

Guideline

The WRC guideline on water treatment residues deals with the requirements of different management options for the utilisation and/or disposal of water treatment residues. The guideline aims to assist the water treatment residues producer to:

- Use/dispose of water treatment residues in an environmentally responsible way;
- Ensure that water treatment residues are handled within the legislative framework;
- Mitigate any potential adverse environmental effects caused by the selected management options; and
- Implement the monitoring requirements for the selected management option.

The guideline is intended for use by water treatment plant operators and service providers, water service authorities, water treatment plant planners, water engineers/scientists, legislators/regulatory authorities, technical advisors, water treatment residue users, landfill site owners/operators and educators.

Characteristics of water treatment residues

In the section dealing with the characteristics of water treatment residues the types of water treatment plants are firstly discussed. Then the guideline delves into the categories of water treatment residues.

The majority of residuals from WTPs fall into one of four categories:

- Naturally occurring, colloidal/particulate matter (e.g. clay, silt, algae) removed from raw water by sedimentation, filtration membranes or other processes and inert material in treatment chemicals;
- Naturally occurring, soluble substances (e.g. iron, manganese, calcium and magnesium) converted into the insoluble precipitate forms by oxidation or pH adjustment;
- Precipitates formed when chemicals are added to the water; and
- Spent material (e.g. granular activated carbon, powdered activated carbon, resins) that must periodically be removed from unit treatment processes after exceeding their useful lives.

Also discussed are residuals handling process types, characteristics of different types of water treatment residues, physical and chemical properties of water treatment residues, and potential management options.

Legal framework

A section then follows dealing with the legal framework for use and disposal of water treatment residues. The South African

environmental legislation is complex and authorisation by more than one government department needs to be considered. The Departments of Water Affairs, Environmental Affairs, Health, and Agriculture have a regulatory role to play in the utilisation and disposal of water treatment residues. The different departments have committed to cooperative governance and to improve inter-departmental communication, which should simplify the regulatory process.

Among the legislation to consider include the National Water Act (Act 36 of 1998), National Environmental Management Act (Act 107 of 1998), and the Environmental Conservation Act (Act 73 of 1989) in addition to various authorisations and licenses.

Land application

Land application of water treatment residues is an increasingly popular management option in the water supply industry due to the escalating regulatory and environmental constraints associated with disposal. This application process may beneficially modify soil properties while recycling residual components.

This section of the guideline covers characterisation of water treatment residues intended for land application, impact of residues on receiving soils, initial soil investigation, legal requirements applicable to land application, restrictions and requirements for land application, and monitoring and record keeping requirements for land application sites.

Disposal

Water treatment residues is an industry specific waste with specific characteristics and properties pertaining to it. The nature and characteristics of water treatment residues compared to other wastes warrants the need for sector-specific guidelines to ensure its responsible management.

The reality is that many WTPs use on-site lagoons as management and final disposal options. These facilities are not designed as waste disposal facilities and do not comply with the Minimum Requirements. This part of the guideline attempts to form a 'bridge' between the waste management industry and the water industry, and aims to consolidate all the requirements of managing water treatment residues as a waste in one document.

Discharge to wastewater treatment plants

Discharge of water treatment residues to a wastewater treatment plant (WWTP) is another disposal option for water services institutions. These options are often economically attractive and transfer disposal liability to the WWTP. Conventional water treatment residues (coagulation, sedimentation and filtration)

commonly discharge filter backwash solids and/or clarification basin residuals to a sanitary sewer system for eventual treatment at a WWTP.

Several factors must be considered when evaluating the feasibility of discharging residuals to a WWTP. The interests and concerns of WWTP managers and operators are different from those of similar personnel in water utilities. Factors for a WWTP to consider are available capacity, treatment process compatibility and final disposal requirements. Introducing water treatment residues to a WWTP may offer some benefits in terms of process performance. On the water treatment facility side, pre-treatment requirements, storage facilities and conveyance systems must be considered. Costs and service agreement terms must also be evaluated.

Reuse of water treatment residues

The last section of the WRC guidelines deals with reuse of water treatment residues. Although not practiced in South Africa, potential reuse alternatives (other than land application) practiced internationally include:

- Recovery of coagulants;
- Use in making bricks; and
- Use in Portland cement.

This section discusses recovery and reuse of coagulants, use in making bricks, use in manufacturing of cement, and other potential options.

Conclusion

Although there are limited information available of the characteristics of water treatment residues and their impact on soil, surface- and groundwater, this guidelines will serve as a first step to ensure responsible handling, application and/or disposal of water treatment residues into the environment.

This guideline was developed to assist the water treatment residue producer to decide on an appropriate management option for water treatment residues. It informs the reader regarding the legal requirements for each management option as well as restrictions and requirements applicable to the different options. Monitoring programmes are introduced to collect data on the variability of water treatment residue quality as well as to determine the potential impact of the management options on the receiving environment.

Further reading:

To order the report, *Guidelines for the utilisation and disposal of water treatment residues* (Report No. TT 559/13) contact Publications at Tel: (012) 330-0340, Email: orders@wrc.org.za, or Visit: www.wrc.org.za to download a free copy.