

## PART 5:

# GENERAL RESTRICTIONS AND REQUIREMENTS FOR AGRICULTURAL USE OF WASTEWATER SLUDGE

Irrespective of the classification, some general restrictions apply for the agricultural use of sludge.

### RESTRICTION/REQUIREMENT 1: SLUDGE STORAGE BEFORE AGRICULTURAL USE

It is recognised that not all sludge produced can be utilised immediately after production and processing. Treated sludge destined for agricultural application must be stored in a properly designed facility that minimises the impact on the environment. The sludge should be applied as soon as possible or, alternatively, adequate precautions must be taken not to generate odours or attract vectors.

### RESTRICTION/REQUIREMENT 2: SLUDGE APPLICATION RATES

Sludge should be applied at rates that do not exceed the plant nutrient requirements (agronomic rates). In addition, an application rate of **10 tons dry mass per hectare per year** may not be exceeded.

**Note:** There may be cases where the maximum rate of 10 tons per hectare per year may not be sufficient for a specific crop's requirements. For these cases, a motivation can be submitted to the Department of Water Affairs and Forestry for consideration. Remember that the Pollutant class restrictions (metal limits) may need to be adapted when the sludge is applied at rates higher than 10 tons per hectare per year.

The nutrient content of the sludge must be confirmed before each major planting season by determining the nitrogen, phosphorus and potassium concentration on at least four composite samples.

Table 9 illustrate the typical sludge nutrient load based on the data presented in Table 1. Note that the nutrients are not immediately available, but are released slowly over time. For example, only 30 to 50% of the nitrogen becomes available during the first year after application.

At a sludge application rate of 10 tons dry mass per hectare per year, approximately 320 kg of N is added per hectare per year, of which 96 to 160 kg N/ha becomes available in the first year.

**TABLE 9: TYPICAL NUTRIENT LOADS AT DIFFERENT APPLICATION RATES**

<b>Application rate</b>	<b>N application</b>	<b>P application</b>	<b>K application</b>
<b>ton/ha/year</b>	<b>kg N/ha/year</b>	<b>kg P/ha/year</b>	<b>kg K/ha/year</b>
1	32 - 45	15 - 17	2 - 3
2	64 - 90	30 - 34	4 - 6
3	96 - 135	45 - 51	6 - 9
4	128 - 180	60 - 68	8 - 12
5	160 - 225	75 - 85	10 - 15
6	192 - 270	90 - 102	12 - 18
7	224 - 315	105 - 119	14 - 21
8	256 - 360	120 - 136	16 - 24
9	288 - 405	135 - 153	18 - 27
10	320 - 450	150 - 170	20 - 30

Note : Typically 30 - 50% of the N will become available in the first year.

### **RESTRICTION/REQUIREMENT 3: PREVENTION OF SOIL EROSION**

Topography (slope) and agricultural land preparation influence the amount of soil erosion and potential surface run-off of applied sludge. The application method of sludge should not contribute to soil erosion.

### **RESTRICTION/REQUIREMENT 4: BUFFER ZONES FOR GROUNDWATER AND/OR SURFACE WATER**

To protect groundwater and surface water from pollution, the following buffer zones are recommended between the area of application and the water receptor:

- Depth to aquifer - >5m
- Distance from surface water/borehole - >200m

**Note:** The buffer zone may be relaxed on condition that proof is provided that the groundwater and surface water is adequately protected.

### **RESTRICTION/REQUIREMENT 5: DISTANCE FROM URBAN AREAS AND INFORMAL SETTLEMENTS**

To protect the community from possible vectors and odours, sludge should not be applied to land within 500 m from dwellings.

**Note:** The restriction can be relaxed on condition that adequate vector attraction reduction and odour control is implemented.

## RESTRICTION/REQUIREMENT 6: MONITORING PROGRAMME

The sludge quality and where applicable soil quality needs to be monitored and records kept.

### Sludge monitoring programme

Table 10 provides guidance in this regard.

**TABLE 10: SLUDGE SAMPLING AND ANALYSES FOR MONITORING**

<b>What should be monitored ?</b>	<ul style="list-style-type: none"> <li>○ Microbiological quality</li> <li>○ Physical characteristics</li> <li>○ Chemical characteristics</li> </ul>		
<b>How often should samples be taken ?</b>	<b>Amount of sludge produced (t<sub>dry weight</sub>)</b>		<b>Monitoring frequency</b>
	<b>Daily average</b>	<b>Yearly average</b>	
	<1	<365	Once per year
	1 - 5	365 - 1 825	4 times per year
	5 - 45	1 825 - 16 500	6 times per year
	>45	>16 500	Monthly
<b>Type of samples</b>	Grab samples to constitute a representative composite		
<b>How many samples ?</b>	At least 3 composite samples for each sludge stream		
<b>When to sample ?</b>	Before use or disposal		
<b>Where to collect samples ?</b>	Anaerobically digested	Collect from sampling valves on the discharge side of sludge pumps	
	Aerobically digested	Collect from sampling valves on discharge side of pumps	
	Thickened	Collect from valves on the discharge side of pumps	
	Heat treated	Collect from valves on the discharge side of pumps after decanting	
	Dewatered, dried, composted	Collect from collection conveyors or bulk containers	
	Dewatered by belt filter press, centrifuge	Collect from discharge chute	
	Dewatered in drying beds	Divide bed into quarters, sample from each quarter and combine samples	
	Compost piles	Collect from product	
<b>Sample sizes</b>	At least 500g dry mass		
<b>Analytical methods</b>	See Volume 1 - Appendix 2 and Volume 2 - Appendix 2		

## Soil monitoring programme

A soil monitoring programme is recommended for the agricultural use of sludge. Monitoring should be done to:

- Determine nutrient requirements. Collect soil samples from all agricultural fields and analyse to determine the nutrient requirement for the particular crop to be cultivated (Table 11). This will ensure that the sludge application rate does not exceed agronomic rates. (Refer to fertiliser suppliers for sampling method and size).
- Determine whether the soil can continue receiving **Pollutant class b** sludge in cases where the:
  - Total metal content does not exceed the Total Investigative Level (TIL).
  - Total metal content (any metal) exceeds the Total Investigative Level (TIL), but is lower than the Total Maximum Threshold (TMT) in which case the available metal content ( $\text{NH}_4\text{NO}_3$ ) should also be determined and the results compared with the Maximum Available Threshold (MAT).

**TABLE 11: SOIL SAMPLING AND MONITORING**

<b>What should be monitored and how often ?</b>	<b>Which soils to monitor</b>	<b>What to monitor</b>	<b>Frequency</b>
	All agricultural fields receiving sludge	Soil nutrient content (N, P, K)	Before each planting season
	Total metal content < TIL	Total metals	Once every 5 years
	TMT>Total metal content >TIL and Available metal content<MAT	Total and available metals	Once every 2 years
<b>Type of samples</b>	Composite samples of total area where sludge is applied.		
<b>How many samples ?</b>	Collect numerous samples, mix well and submit at least one composite sample for each field.		
<b>When to sample ?</b>	After planting season, before next sludge application.		
<b>Sample sizes</b>	1kg dry mass.		
<b>Analytical methods</b>	Volume 1 - Appendix 2 and Volume 2 - Appendix 2.		

## RESTRICTION/REQUIREMENT 7: RECORD KEEPING

Once the applicable permits and licences have been granted sludge disposal and utilisation essentially become self-regulatory. This implies that certain records must be kept by the sludge producer and sludge user.

Table 12 summarises the general record keeping requirements for the producer (irrespective of the class of sludge produced). It is the responsibility of the producer to get data from the user as per their contract (see Appendix 1).

**TABLE 12: RECORD KEEPING REQUIREMENTS FOR THE SLUDGE PRODUCER**

Nr	Description of records to be kept
	Sludge records
1	Mass, solids content and volume of each sludge stream produced and a supporting wastewater treatment plant mass balance
2	Detailed description of sludge management process
3	Classification of each sludge stream that leaves the plant
4	Results supporting initial classification in terms of the : <ul style="list-style-type: none"> <li>○ Microbiological class</li> <li>○ Stability class</li> <li>○ Pollutant class</li> </ul>
5	The original or certified copy of the contract between the sludge producer and user (if applicable)
6	A copy of applicable permits and licences
7	Monitoring data pertaining to the : <ul style="list-style-type: none"> <li>○ Microbiological class</li> <li>○ Stability class</li> <li>○ Pollutant class</li> </ul>
8	Operational problem register: It is recognised that no plant runs smoothly 100% of the time. Document any operational problems that could affect the sludge management by detailing: <ul style="list-style-type: none"> <li>○ The nature of the problem</li> <li>○ Duration of the problem</li> <li>○ What was done with off-spec sludge</li> <li>○ How the problem was rectified</li> </ul>
9	Complaints register: (This includes complaints by the user as well as the public or other I&AP) which includes the: <ul style="list-style-type: none"> <li>○ Date, time of complaint</li> <li>○ Nature of the complaint</li> <li>○ A description of steps taken to address the complaint</li> </ul>
<b>Soil records</b>	
10	Monitoring data pertaining to the: <ul style="list-style-type: none"> <li>○ Nutrient status of the soil</li> <li>○ Metal content of the soil (total and/or NH<sub>4</sub>NO<sub>3</sub> extractable)</li> </ul>

## CONCLUSION

Volume 2 of the Sludge Guidelines informs the reader regarding the classification of sludge for agricultural use and the legal requirements for sludge producers and agricultural users relating its use. The specific restrictions pertaining to the different sludge classes and the general restrictions/requirements for the agricultural use of sludge are also detailed.

Sludge and soil monitoring programmes are introduced to collect data on the variability in sludge composition over time and to ensure that the maximum permissible concentrations for the application of sludge to agricultural land are not exceeded.

It is recognised that new information is constantly being generated. For example the management of pathogens and the associated restrictions are still debated both nationally and internationally. Guidelines pertaining to the management of pathogens have therefore been developed using available information. It is therefore recommended that the Guidelines be revised every 5 to 10 years. This will allow the South African wastewater industry sufficient time to implement these Guidelines and highlight shortcomings, constraints and operational difficulties. Furthermore, by implementing the monitoring requirements stipulated in these Guidelines, case specific data will be generated that will enrich our local knowledge base.