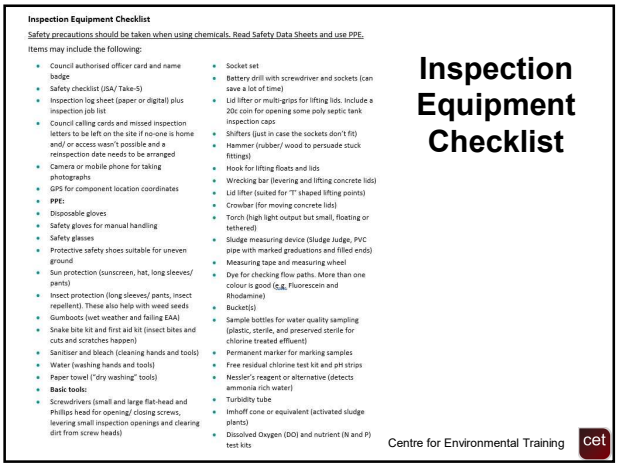
Inspection and Troubleshooting of Onsite Wastewater Management Systems

Inspection Equipment and Use

Testing and Monitoring On-site Systems

Inspection Equipment and Use

- Every inspection will need equipment
- Each item has a particular role
  - WHS - PPE
  - Access
  - Testing and monitoring
  - Tracing
  - Records



Inspection Equipment Checklist

Safety precautions should be taken when using chemicals. Read Safety Data Sheets and use PPE.

Items may include the following:

- Council authorised officer card and name badge
- Safety checklist (JSA/ Take-5)
- Inspection log sheet (paper or digital) plus inspection job list
- Council calling cards and missed inspection letters to be left on the site if no-one is home and/ or access wasn't possible and a reinspection date needs to be arranged
- Camera or mobile phone for taking photographs
- GPS for component location coordinates
- **PPE:**
- Disposable gloves
- Safety gloves for manual handling
- Safety glasses
- Protective safety shoes suitable for uneven ground
- Sun protection (sunscreen, hat, long sleeves/ pants)
- Insect protection (long sleeves/ pants, insect repellent). These also help with weed seeds
- Gumboots (wet weather and failing EAA)
- Snake bite kit and first aid kit (insect bites and cuts and scratches happen)
- Sanitiser and bleach (cleaning hands and tools)
- Water (washing hands and tools)
- Paper towel ("dry washing" tools)
- **Basic tools:**
- Screwdrivers (small and large flat-head and Phillips head for opening/ closing screws, levering small inspection openings and clearing dirt from screw heads)
- Socket set
- Battery drill with screwdriver and sockets (can save a lot of time)
- Lid lifter or multi-grips for lifting lids. Include a 20c coin for opening some poly septic tank inspection caps
- Shifters (just in case the sockets don't fit)
- Hammer (rubber/ wood to persuade stuck fittings)
- Hook for lifting floats and lids
- Wrecking bar (levering and lifting concrete lids)
- Lid lifter (suited for 'T' shaped lifting points)
- Crowbar (for moving concrete lids)
- Torch (high light output but small, floating or tethered)
- Sludge measuring device (Sludge Judge, PVC pipe with marked graduations and filled ends)
- Measuring tape and measuring wheel
- Dye for checking flow paths. More than one colour is good (e.g. Fluorescein and Rhodamine)
- Bucket(s)
- Sample bottles for water quality sampling (plastic, sterile, and preserved sterile for chlorine treated effluent)
- Permanent marker for marking samples
- Free residual chlorine test kit and pH strips
- Nessler's reagent or alternative (detects ammonia rich water)
- Turbidity tube
- Imhoff cone or equivalent (activated sludge plants)
- Dissolved Oxygen (DO) and nutrient (N and P) test kits

Inspection Equipment Checklist

Inspection Equipment

- The relevant PPE must be available
  - UV protection (e.g. clothing, hat and sunscreen)
  - Gloves (disposable and safety gloves)
  - Safety glasses
  - Insect protection (repellent, gaiters)
  - Shoes (uneven ground/ safety and gumboots)
- First aid and snake bite kits

Testing and Monitoring On-site Systems

- Monitoring is essential when the performance of a system must be accurately quantified
- However, rigorous monitoring of wastewater quality and quantity requires a significant amount of time and resources
- Monitoring of on-site systems may be justified where problem identification is difficult or where the performance of a new / emerging technology needs to be verified

Monitoring Parameters

<u>Hydraulic Load</u>

- Without useful data on hydraulic load, wastewater quality data can be of little value
- As a minimum it should be measured at the same frequency as bio-chemical data
- Water meter readings may be adequate (excluding external water use) but data loggers should be considered

Monitoring Parameters

Household Behaviour

- Where possible, try to establish the timing of specific activities that generate wastewater (e.g. laundry, showers)
- If appropriate, ask the residents to keep a diary of these details
- Identify the type of cleaning agents, detergents, disinfectants and antibiotic inputs to the system

Monitoring Parameters

Biochemical Oxygen Demand (BOD_5)

- BOD_5 is the quantity of oxygen used in the degradation of organic matter in water
- BOD_5 analysis is undertaken in a laboratory using a standard analytical technique
- A reduction in organic load is the key aim of Secondary treatment

Monitoring Parameters

Total Suspended Solids (TSS)

- TSS include organic and inorganic material suspended in a sample
- TSS analysis undertaken in a laboratory using a standard analytical technique
- High TSS loads can have a detrimental effect on downstream processes and cause blockages in land application areas

Monitoring Parameters

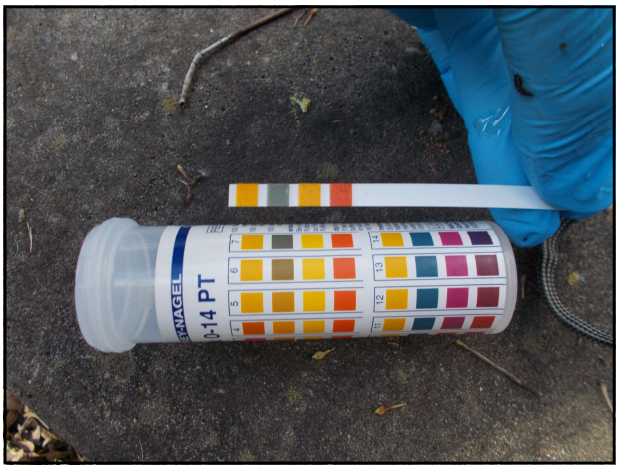
Faecal Coliforms (FC)

- FC bacteria are commonly used as an indicator of faecal contamination. Can be used as an indicator of the likelihood of pathogen contamination
- FC analysis is undertaken in a laboratory using a standard analytical technique
- FC concentrations will vary by orders of magnitude depending on the level of treatment

Monitoring Parameters

pH

- Approximate pH can be checked using a calibrated instrument or colour comparator strips
- Should be near neutral (7.0). Wide / frequent fluctuation of pH is detrimental to processes (reduced solids settleability / micro-biological activity)
- pH should be kept between 6.0 and 9.0



Monitoring Parameters

Electrical Conductivity

- Measure of the ability of a solution to conduct an electrical current
- Conductivity increases as the proportion of ions in solution increase
- Typically measured in the field using a calibrated analytical probe. Results typically expressed as deciSiemens per metre (dS/m) or microSiemens per centimetre (uS/cm)

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Monitoring Parameters

Nitrogen

- Nitrogen (N) is found in three forms – organic N, ammoniacal N and oxidised N
- Total Kjeldahl Nitrogen (TKN) is the concentration of organic N and ammoniacal N. These forms of N are dominant in anaerobic effluent
- Total Oxidised Nitrogen (TON) is the concentration of nitrate (NO_3) and nitrite (NO_2)

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Monitoring Parameters

Nitrogen

- The dominant form of nitrogen will depend mainly on oxygen status, but also pH
- Dominant form of nitrogen can vary over very short periods of time
- Need to look at specific forms when monitoring to gain an understanding of treatment efficiency

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Monitoring Parameters

Phosphorus

- Typically found in one of three forms in domestic wastewater: orthophosphate (e.g. PO_4^{-3}, HPO_4^{-2}); polyphosphate (e.g. P_2O^{-4}) and organic phosphate
- Orthophosphates are readily available for biological metabolism, while poly and organic phosphates must first undergo some form of conversion

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Monitoring Parameters

Dissolved Oxygen (DO)

- DO can be used to assess the efficiency of most Secondary treatment processes
- Secondary treated effluent should generally have a high DO (>2mg/L)
- But… be careful, DO can fluctuate significantly within very short periods

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Monitoring Parameters

Other Parameters

- Total Oil and Grease (TOG)
- Surfactants (MBAS - methylene blue active substances)
- Chemical Oxygen Demand (COD)
- Free Residual Chlorine (FRC)
- Volatile Suspended Solids (VSS)

Sampling Programs

- Care should be taken when sampling effluent to use correct procedure
- Sample bottles must be rinsed with deionised water before being taken out to site. Bottles for laboratory analysis may need to be acid washed
- Consult individual laboratories for advice on sample bottles (number, volume of sample)
- Appropriate PPE must be worn (e.g. latex or vinyl coated gloves)

Sampling Programs

- Bottle should be rinsed with the sample liquid three times before collection (except for microbiological sample bottles)
- Do not leave an air gap in the bottle as this can affect the result of some analyses
- Clearly label each sample bottle (location, time, date, sampled by)
- Keep laboratory samples at ~4°C (i.e. esky on ice) and deliver / analyse as soon as possible

Sampling Programs

- Careful consideration is required when selecting:
  - Sampling location
  - Sampling time
  - Sampling frequency
  - Parameters for analysis

Sampling Programs

- Programs to measure the specific treatment efficiency of a particular component must include monitoring of both influent and effluent
- Domestic wastewater is subject to significant temporal variation. Grab samples are only a snapshot of performance
- Composite sampling can allow assessment of average wastewater quality over a period

Sampling Programs

- Notwithstanding, grab samples can be useful when conducting compliance testing of multiple systems
- Realistically, only situations with significant legal / market implications or a high risk of impact will justify greater focus
- However it is important to recognise that effluent quality data does not automatically provide an accurate diagnosis of system performance

Monitoring Periods

- What is an appropriate frequency and duration for monitoring?
- Basic compliance testing: a grab sample of effluent once a week for a month (each sample should be taken at a different time of day)?
- Long-term treatment efficiency: 24 hour composite samples of influent and effluent every day for a month?

Interpretation of Results

- It is not always advisable to assess the results of monitoring against regulatory standards in isolation
  - Consider the resolution of the data (i.e. the suitability of sampling frequency and duration)
  - Consider temporal variation (e.g. hydraulic load / peak pollutant periods)
  - Consider potential external impacts on readings (sampling errors, rainfall, higher than average pollutant inputs)

Typical Treatment Performance

Parameter	Septic Tank	Secondary[1]	Advanced Secondary[2]
BOD_5 (mg/L)	140-200 (180)	5-50 (20)	5-15 (10)
TSS (mg/L)	30-100 (80)	5-50 (30)	5-15 (10)
Faecal Coliforms (cfu/100ml)[3]	10^6-10^8	10^3-10^4	10^1-10^3
TN	40-100 (60)	15-50 (30)	10-50 (20)
TP	5-15 (10)	5-10 (8)	5-10 (8)

Source: USEPA Onsite Wastewater Treatment Systems Manual 2002.

Note 1: Traditional package plants and reed beds with no disinfection.

Note 2: Sand filters, some biofilters and textile filters.

Note 3: Secondary or advanced secondary effluent can achieve faecal coliform concentrations <100cfu/100ml with active disinfection.

Inspection Equipment

- Access
  - Basic tools – screwdrivers, sockets, multi-grips, shifters, hammer etc.
  - Battery drill or impact driver and
  - Crowbar, wrecking bar, hook, lid lifter

Inspection Equipment

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- Tracing Flows
  - Fluorescein or Rhodamine dye for checking flow paths
  - Nessler's reagent (detects ammonia rich water)

Fluorescein Dye Testing

Inspection Equipment

- Measuring solids and wastewater characteristics:
  - Sludge measuring device (e.g. Sludge Judge)
  - Imhoff cone or equivalent (activated sludge plants)
  - Dissolved Oxygen (DO) test kit
  - pH strips
  - Turbidity tube
  - Free residual chlorine test kit

Inspection Equipment

Sludge and Scum Accumulation

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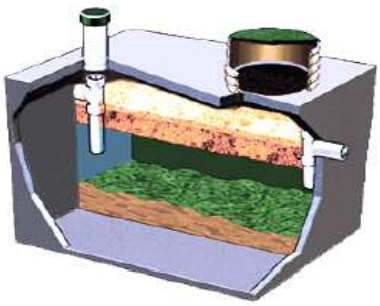

Inspection Equipment

Inspection Equipment

- Sampling
  - Sampling pole
  - Sample jars
  - Esky and ice
  - Chain of Custody sheet/s
  - Sharps container

Inspection Equipment

- Hygiene
  - PPE (gloves, glasses)
  - Sanitiser
  - Disinfectant
  - Soap and water
  - Paper towel
  - Rubbish bag