Management of pH in trade waste

This fact sheet provides guidance on pH management for trade waste discharges to sewer.

What is pH?

pH is a measure of how acidic or basic a solution is. A pH of 7 is considered neutral; any solution with a pH value below 7 is considered acidic while any solution with a pH value above 7 is considered basic or alkaline. Greater Western Water's standard Trade Waste Acceptance Criteria for pH is between 6 and 10.

Why is pH important?

Trade waste that is outside the standard Trade Waste Acceptance Criteria for pH may present a risk within the sewerage system which can impact on:

- the occupational health and safety of sewer workers due to release of gases in the sewerage system. Alkaline trade waste has the potential to increase the likelihood of ammonia generation in the sewer, which is a severe irritant. Acidic trade waste increases the generation of hydrogen sulphide, which has a strong odour and is highly toxic. If trade waste contains significant levels of ammonia or sulphide, Greater Western Water may vary the Trade Waste Acceptance Criteria for pH.
- sewer pipe integrity through accelerated corrosion especially in acidic conditions. Greater Western Water regularly conducts monitoring of sewers and can identify areas where the structural integrity of the pipes has been degraded as a result of corrosion due to pH non-compliance.

What are the options for pH correction?

For customers whose pH does not meet acceptance criteria specified in their Trade Waste Agreement, pH correction systems will be required.

Options for low trade waste flows

For sites with low trade waste flows, two options are generally appropriate:

- **Standard neutralisation tanks:** For trade waste discharges such as school laboratories the installation of an Acid Neutralising Marble Chip Tank as per Greater Western Water Trade Waste Drawing TW-STD-005 may be suitable[1]. It is important to confirm the applicability of this neutralisation device with Greater Western Water prior to its installation as they are only appropriate for a limited number of smaller trade waste sites.
- **Batch neutralisation tanks:** Where there are minor trade waste flows, but strong acids and bases are being used (eg metal etching, radiator repairs etc.) a batch tank can be used to capture the trade waste for manual pH adjustment. The captured trade waste is retained in the batch tank until its pH is appropriately adjusted using chemical additives. Once specification is met the batch can be discharged to sewer.[2] Figure 1 shows a single probe configuration, where the valve is not opened until the tank is within pH specification. Each batch is handled separately, so if the influent from the process is continuous, a number of batch tanks may be required, allowing the influent to be stored in a second mixed tank while a corrected batch is being discharged.

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1 Available at: http://www.gww.com.au/business/industrial.aspx

2 Following any additional treatment, as specified in the applicable Trade Waste Agreement, that may be needed to meet other Trade Waste Acceptance Criteria, such as metal concentrations.

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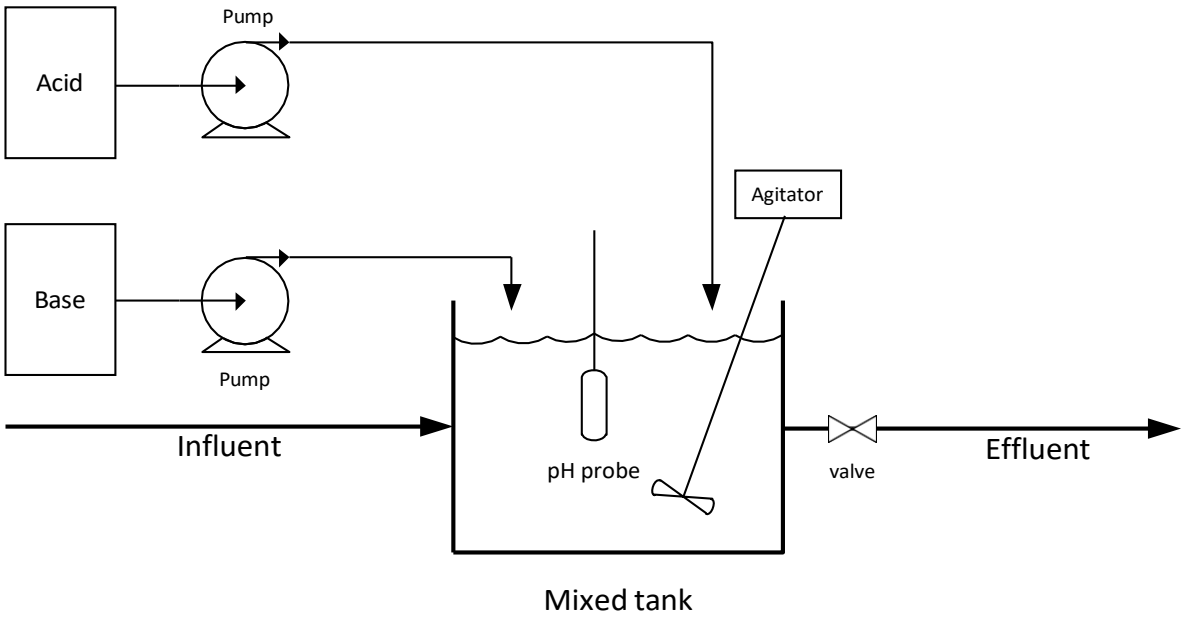
Figure 1:



Option for larger trade waste flows

- **pH neutralisation system:** For sites with larger trade waste flows, a batch neutralisation tank is not appropriate as the footprint of the tank (to accommodate one or more days of trade waste flow) is excessive. In this instance a pH neutralisation system which facilitates continuous trade waste flow to sewer is more likely to be more appropriate.

  A pH neutralisation system may include the following equipment and features:

  1. A mixing tank (an equalisation tank is often used) with at least a 20 minute retention time.
  2. A method to ensure the contents of the mixing tank are well mixed and uniform. This can be achieved using mechanical agitation, pump recirculation or air sparging.
  3. A pH probe and instrumentation to measure the pH
  4. Acid and/or base to neutralise the effluent.
  5. Chemical dosing pumps.
  6. A feedback controller (for automatic pH adjustment).
  7. An alarm that can notify the operator when pH is out of specification (visible and audible).
  8. A final pH probe to validate and record the pH prior to discharge to sewer
  9. A shut-off valve and in some cases a contingency arrangement for flow diversion
  10. Data logging of pH, flow and/or temperature at intervals of around five minutes

Aspects to consider when installing a pH neutralisation system

There are several aspects to consider when installing a pH monitoring and adjustment system, as site conditions and the composition of trade waste vary significantly from site to site. While some general aspects are outlined below, Greater Western Water recommends contacting a suitably qualified technical specialist to assist in the design and installation of the pH neutralisation system.

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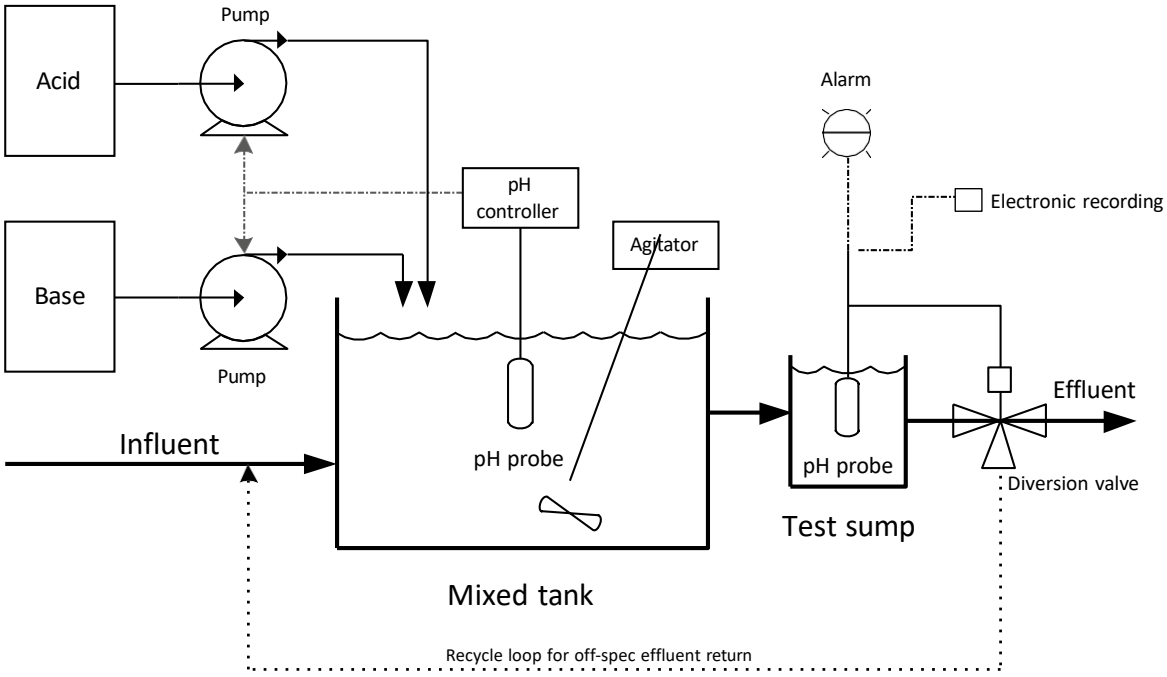
As a guide, a typical continuous pH neutralisation setup might look like Figure 2 below. To ensure adequate mixing and pH correction is occurring in the mixed tank the effluent is tested in the test sump prior to being discharged to sewer. When pH is out of specification and effluent cannot be discharged to sewer the flow is diverted, either to another tank or back to the pH correction system's influent, for additional neutralisation.

Figure 2:



- **pH probes** pH probes should be placed in a location where the effluent is sufficiently well-mixed and representative of what is being discharged to sewer. Regardless of the number of pH probes, there should always be a probe measuring the pH of the effluent downstream of the pH neutralisation system.

- **Set-points** The set-points programmed into the automatic pH dosing system should not be set exactly at the discharge limits (pH 6 or 10), but rather with a safety margin to minimise the chance of trade waste with non-compliant pH during periods of rapid change in pH. The safety margin to be applied will depend on factors such as the pH variability of the waste stream, how effective the dosing chemicals are, flow rates and the agitation within the mixing tank. Greater Western Water recommends that a suitably qualified technical specialist determine the most appropriate set-points during system commissioning.

- **Automatic diversion** To ensure effluent with non- compliant pH does not enter the sewer, an automatic diversion or shut-off valve arrangement should be considered, and in some cases may be mandated by Greater Western Water.

- **Data-logging** It is recommended that the measured final pH values of the effluent be recorded on a regular basis, whether manually per batch or via an electronic data-logger at 5 minute intervals. This may aid in:
  - troubleshooting process problems
  - identifying opportunities for minimising the amount of pH adjustment chemical needed
  - identifying where set-points should be set.
  - Greater Western Water requires data logging at some sites and the submission of data logging results. This is specified in Trade Waste Agreements.

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What pH adjustment chemical should be used?

Due to the wide range of industrial effluents, Greater Western Water cannot recommend a specific chemical to use, and a technical specialist should be consulted if you are unsure of what is appropriate. All chemicals should be stored safely and in accordance with relevant requirements.

Common acid and base chemicals used for pH adjustment

Neutralising acidic effluent	Neutralising basic effluent
Sodium Hydroxide (Caustic) (NaOH)	Sulphuric Acid (H_2SO_4)
Magnesium Hydroxide ($Mg[OH]_2$)	Hydrochloric Acid (HCl)
Calcium Hydroxide (Lime) (Ca[OH]2)	Nitric Acid (HNO3)
	Carbon Dioxide (CO2)

Considerations include likelihood of over-correction (greater with strong bases/acids), contribution to concentrations of other substances for which there are acceptance criteria (such as oxidised sulphur or total dissolved solids), precipitation reactions, cost and health and safety.

Buffering

A buffer is a solution that can resist pH change upon the addition of acidic or basic components. This means that the amount of adjustment chemical that needs to be added to neutralise a wastewater stream will vary depending on the amount of buffering chemicals that are present in the stream. The more buffer present, the more dosing chemical that needs to be added. Weak acids or bases are examples of buffers.

Total Dissolved Solids (TDS), Total Kjeldahl Nitrogen (TKN) and Total Oxidised Sulphur (TOS) compliance

It is important that an acceptable pH is achieved. However, neutralising the pH of your effluent by dosing chemicals has the potential to increase the total dissolved solids (TDS) load of your trade waste, and this may have implications for compliance with the standard Acceptance Criteria for this parameter. Similarly, if you dose with sulphuric or nitric acid, the Total Oxidised Sulphur or Total Kjeldahl Nitrogen concentrations of your trade waste discharge may increase. This may lead to increased Trade Waste charges for these parameters. A wastewater treatment specialist will be able to assist you with minimising costs whilst achieving compliance.

Maintenance

To ensure that pH monitoring equipment is operating well, it is important to:

- calibrate the pH equipment at least quarterly (or as per manufacturer's specification) and submit calibration results to Greater Western Water if required by your Trade Waste Agreement
- maintain cleanliness of the pH probe
- keep the pH probe in solution at all times
- inspect the pH equipment frequently and top-up dosing chemicals as required
- document and repair any faulty equipment.

A suitably qualified technical specialist will be able to provide guidance on the above maintenance requirements.

For more information, call 9313 8366, email tradewaste@gww.com.au or speak to your site's assigned Trade Waste Consultant.