

SCI-TECH WATER TREATMENT LTD

STANDARD OPERATING PROCEDURE (SOP)

STWT-SOP-CWST-001: Cold-Water Storage Tank (CWST) Cleaning & Disinfection

SOP Reference: STWT-SOP-CWST-001

Department: Water Hygiene / Water Treatment

Applicable Standards: ACoP L8, HSG274 Part 2, COSHH Regulations and current applicable British Standards/guidance

Review Frequency: Annually or following significant legislative/guidance change

Authorised Personnel: Trained and competent Sci-Tech Water Treatment Ltd engineers only

1. PURPOSE

This Standard Operating Procedure defines the safe and effective method for the **cleaning and disinfection of cold-water storage tanks (CWSTs)** and, where specified, their associated distribution systems.

The procedure is intended to:

- Remove sediment, sludge, scale, corrosion products, organic material and biofilm.
 - Reduce microbiological contamination.
 - Restore the tank to a hygienically acceptable condition.
 - Minimise conditions favourable to the growth of *Legionella* and other waterborne microorganisms.
 - Maintain the integrity and cleanliness of the potable water system.
 - Provide a documented and auditable record of the work undertaken.
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2. REFERENCES

Work shall be undertaken with regard to the current editions of:

- Health and Safety at Work etc. Act 1974.
- Control of Substances Hazardous to Health Regulations (COSHH).
- ACoP L8 – *Legionnaires' disease: The control of legionella bacteria in water systems*.

- HSG274 Part 2 – *The control of legionella bacteria in hot and cold water systems*.
 - BS EN 806 series – Specifications for installations inside buildings conveying water for human consumption.
 - BS 8558 – Guide to the design, installation, testing and maintenance of services supplying water for domestic use.
 - PD 855468 – Guide to the flushing and disinfection of services supplying water for domestic use within buildings and their curtilages.
 - Water Supply (Water Fittings) Regulations 1999.
 - Manufacturer's instructions and Safety Data Sheets for chemicals used.
 - Site-specific Legionella Risk Assessment and Written Scheme of Control.
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3. WHEN CLEANING AND DISINFECTION IS REQUIRED

A CWST shall be inspected and its condition assessed in accordance with the site's Written Scheme of Control.

Cleaning and/or disinfection may be required where:

- Visible sediment, sludge or debris is present.
- Biofilm is identified.
- Significant corrosion, scale or organic contamination is present.
- Microbiological results indicate contamination.
- Legionella has been detected and remedial disinfection is required.
- The tank has been newly installed or substantially modified.
- The system has been out of use or subject to significant stagnation.
- Contamination has entered or is suspected to have entered the tank.
- Following significant maintenance or remedial works where contamination may have occurred.
- The Legionella Risk Assessment identifies cleaning/disinfection as necessary.
- The Responsible Person or competent water hygiene specialist determines that cleaning/disinfection is required.

Cleaning should **not automatically be undertaken solely because a fixed period has elapsed**. The requirement should be based upon inspection, risk assessment, system condition and the Written Scheme of Control.

4. RESPONSIBILITIES

4.1 Responsible Person / Client

The client or nominated Responsible Person should:

- Authorise the works.
- Confirm the affected water services.
- Inform relevant building users.
- Arrange suitable access.
- Identify vulnerable occupants or critical water users.
- Agree isolation arrangements.
- Provide relevant system information where available.
- Ensure that outlets are not used during the disinfection process.

4.2 Sci-Tech Engineer

The attending engineer shall:

- Be trained and competent to undertake CWST cleaning and disinfection.
 - Review the relevant RAMS and COSHH assessments.
 - Follow this SOP and site-specific instructions.
 - Use appropriate PPE/RPE.
 - Prevent unauthorised use of the system.
 - Record disinfectant concentrations and contact times.
 - Record all relevant observations and defects.
 - Complete the appropriate service report.
 - Obtain photographic evidence before and after cleaning.
 - Immediately report significant defects or uncontrolled risks.
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5. REQUIRED EQUIPMENT

Depending upon the tank and site conditions, equipment may include:

- Appropriate PPE.
- Chemical-resistant gloves.
- Safety footwear.
- Protective clothing/coveralls.
- Eye/face protection.
- Suitable RPE where identified by the risk assessment.
- Disinfectant approved for use within potable water systems.
- DPD No.1 free-chlorine test kit or equivalent suitable test equipment.
- Chemical measuring equipment.
- Suitable chemical dosing equipment.
- Clean buckets/containers.
- Dedicated tank-cleaning brushes and equipment.
- Wet vacuum.
- Submersible/drainage pump where appropriate.
- Clean hoses suitable for potable-water applications.
- Warning signs and barriers.
- Lock-off/tag-out equipment where required.
- Thermometer.
- Torch/inspection lighting.
- Camera or suitable electronic device for photographic records.
- Spill-control materials.
- Suitable neutralising agent where required.
- Appropriate test equipment required by the site-specific method statement.

All equipment introduced into the tank shall itself be suitably clean and must not introduce contamination.

6. PERSONAL PROTECTIVE EQUIPMENT

Minimum PPE shall be determined by the site-specific risk assessment and COSHH assessment.

This may include:

- Safety footwear.
- Disposable or chemical-resistant coveralls.
- Chemical-resistant gloves.
- Safety glasses or chemical splash goggles.
- Face shield where splash risk exists.
- Suitable RPE where required.
- Hard hat where site conditions require it.

Additional controls may be necessary for:

- Work at height.
- Restricted-access tanks.
- Confined spaces.
- Chemical handling.
- Manual handling.
- Electrical equipment.
- Biological contamination.

No engineer shall enter a tank where the work constitutes confined-space entry unless a separate confined-space assessment, permit, rescue plan and suitably trained personnel are in place.

7. PRE-WORK ASSESSMENT

Before commencing work, the engineer shall:

- Report to the Responsible Person/site contact.
- Confirm the identity and location of the tank.
- Confirm which outlets/services are supplied by the tank.
- Review the Legionella Risk Assessment where available.
- Review the Written Scheme of Control where applicable.

- Review RAMS.
- Review applicable COSHH assessments and chemical Safety Data Sheets.
- Identify vulnerable users and critical services.
- Confirm whether the tank can safely be isolated.
- Identify suitable drain/discharge arrangements.
- Assess access and working-at-height requirements.
- Assess whether tank entry is required.
- Confirm that electrical equipment can be safely isolated where necessary.
- Prevent unauthorised access/use during the work.

Where the tank cannot be safely isolated, drained, accessed or cleaned, work shall stop and the Responsible Person shall be informed.

8. PRE-CLEAN INSPECTION

Before disturbing the tank contents, undertake and record an initial inspection.

Record:

- Tank identification/reference.
- Tank construction/material.
- Approximate capacity.
- Water level.
- Stored-water temperature.
- General internal condition.
- General external condition.
- Condition and fit of lid.
- Condition of insulation.
- Condition of inlet/ball valve.
- Condition of outlet.
- Condition of overflow/warning pipe.
- Presence and condition of insect/vermin screens.

- Presence of sediment.
- Presence of sludge.
- Presence of scale.
- Evidence of corrosion.
- Evidence of biofilm.
- Evidence of organic contamination.
- Evidence of insects/vermin.
- Evidence of light ingress.
- Evidence of stagnation or poor turnover.
- Evidence of inappropriate connections or dead legs.
- Any structural damage or deterioration.

Mandatory Photographs

Where practicable, photographs shall include:

1. External tank condition.
2. Tank identification.
3. Internal condition before cleaning.
4. Any significant contamination.
5. Sediment/sludge present.
6. Defects identified.

9. ISOLATION

1. Inform the site representative that the cleaning/disinfection process is commencing.
2. Prevent affected outlets from being used.
3. Isolate the incoming water supply to the CWST.
4. Isolate electrical equipment associated with the tank where required.
5. Apply lock-off/tag-out controls where appropriate.
6. Display suitable warning signage.

Where the associated distribution system is also being disinfected, ensure all relevant outlets are identified before commencing.

10. DRAINING THE CWST

1. Drain the tank using the designated drain valve where available.
 2. Where necessary, use a suitable clean pump or wet vacuum.
 3. Discharge water only to a suitable location agreed with the site.
 4. Do not discharge chlorinated water to a location where it may:
 - Damage the environment.
 - Enter a sensitive watercourse.
 - Damage equipment or finishes.
 - Create a chemical exposure risk.
 5. Reduce the tank water level sufficiently to permit safe and effective cleaning.
 6. Prevent sediment from being unnecessarily drawn into the distribution system.
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11. PHYSICAL CLEANING

Physical cleaning shall be completed **before final disinfection wherever practicable**, as organic matter, sludge and biofilm can reduce disinfectant effectiveness.

Procedure

1. Remove loose debris.
2. Remove sediment and sludge using:
 - Wet vacuum.
 - Pumping.
 - Manual removal using suitable dedicated equipment.
3. Mechanically clean accessible internal surfaces.

Particular attention shall be given to:

- Tank floor.
- Corners.
- Seams.

- Joints.
 - Internal supports.
 - Around the inlet.
 - Around the outlet.
 - Areas around the ball/float valve.
 - Areas showing visible biofilm, scale or corrosion.
4. Do not use cleaning materials that may damage the tank lining or construction material.
 5. Remove all loosened material.
 6. Rinse the tank with clean wholesome water where required.
 7. Remove the rinse water.
 8. Repeat until the internal surfaces are visibly clean.
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12. INSPECTION FOLLOWING PHYSICAL CLEANING

Before disinfection, visually inspect the tank.

The tank should be:

- Free from visible sediment.
- Free from sludge.
- Free from loose debris.
- Free from significant visible biofilm.
- Free from cleaning residues.

Any defects identified shall be recorded.

Examples include:

- Corrosion.
- Damaged coatings.
- Cracks.
- Poorly fitting lids.
- Damaged insulation.

- Missing screens.
- Inappropriate overflows.
- Defective ball valves.
- Evidence of stagnation.
- Excessive storage capacity.
- Poor inlet/outlet configuration.

Defects that cannot be corrected during the visit shall be reported to the Responsible Person.

13. CHEMICAL DISINFECTION

13.1 Disinfectant

Only disinfectants suitable for the intended water system and compatible with its materials shall be used.

Where chlorine-based disinfection is selected, sodium hypochlorite is commonly used.

The engineer shall follow:

- The approved site-specific method.
 - Product manufacturer's instructions.
 - COSHH assessment.
 - Relevant current technical guidance.
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14. CHLORINE DOSING

A commonly applied method for potable-water system disinfection is to achieve approximately:

50 mg/L free chlorine for a minimum contact period of 1 hour

or another validated concentration/contact-time regime specified by the applicable procedure or competent person.

The required chlorine concentration shall be **measured and verified** rather than assumed from the calculated chemical dose alone.

Example Dosing Principle

The required amount of chemical depends upon:

- Tank/system volume.
- Required free-chlorine concentration.
- Strength of the sodium hypochlorite solution.
- Chlorine demand of the water/system.

Calculation

Required available chlorine (g) = Volume (L) × Required concentration (mg/L) ÷ 1000

The volume of sodium hypochlorite required must then be calculated from the actual available chlorine concentration stated for the product being used.

Engineers shall not rely on generic dosing volumes without checking the actual chemical strength.

15. DISINFECTING THE TANK

1. Introduce sufficient clean water to permit safe preparation/distribution of disinfectant.
2. Add the calculated disinfectant quantity safely.
3. Ensure adequate mixing.
4. Bring the tank to the required operating level where the procedure requires full-surface contact.
5. Ensure all internal surfaces requiring disinfection are adequately contacted by the disinfectant.
6. Measure the free-chlorine concentration using a suitable test method.

Record:

Initial Free Chlorine: _____ mg/L

Target Concentration: _____ mg/L

Disinfection Start Time: _____

Required Contact Period: _____

If the target concentration is not achieved, investigate and adjust the dose as necessary.

16. DISTRIBUTION SYSTEM DISINFECTION

Only undertake this section where disinfection of the associated distribution system forms part of the authorised scope.

Once the required concentration has been achieved within the tank:

1. Open each affected outlet sequentially.
 2. Draw chlorinated water through until the required disinfectant concentration is detected.
 3. Minimise aerosol production during flushing.
 4. Include, where applicable:
 - Hot and cold taps.
 - Showers.
 - TMV-fed outlets.
 - Drain points.
 - Relevant equipment supplied by the system.
 - Other identified terminal outlets.
 5. Test and record representative free-chlorine concentrations.
 6. Close each outlet once the required disinfectant level has been confirmed.
 7. Clearly prevent outlets from being used during the contact period.
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17. CONTACT PERIOD

Maintain the specified disinfectant concentration for the required contact period.

For the commonly used chlorine regime:

Target: approximately 50 mg/L free chlorine

Minimum contact time: 1 hour

The engineer shall verify the disinfectant concentration at the end of the contact period.

Record:

Start Concentration: _____ mg/L

Start Time: _____

Finish Time: _____

Final Concentration: _____ mg/L

Where the disinfectant concentration has fallen significantly, the engineer shall assess whether the disinfection has been satisfactory.

If satisfactory disinfection cannot be demonstrated, the process shall be repeated or escalated to the Responsible Person/technical manager.

18. DRAINING AFTER DISINFECTION

Following completion of the required contact period:

1. Drain the disinfected water safely.
 2. Neutralise the disinfectant before discharge where required by the site-specific assessment, discharge route or environmental requirements.
 3. Ensure discharge does not create a hazard to:
 - Personnel.
 - Drainage systems.
 - Watercourses.
 - Treatment plants.
 - Building finishes.
 - Equipment.
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19. REFILLING AND FLUSHING

1. Reopen the wholesome incoming water supply.
2. Refill the CWST.
3. Flush the tank/system with fresh wholesome water.
4. Where the distribution system has been disinfected, flush each affected outlet.
5. Continue flushing until residual disinfectant levels have returned to an acceptable level consistent with the incoming supply and the system is suitable for normal use.
6. Check the water for:
 - Clarity.

- Odour.
- Visible contamination.
- Appropriate disinfectant residual.

7. Reinstate all outlets.

20. POST-CLEAN INSPECTION

Following completion, inspect the CWST again.

Confirm:

- Tank visibly clean.
- No sediment/sludge remaining.
- No visible debris.
- No significant visible biofilm.
- Lid correctly fitted.
- Screens correctly fitted.
- Insulation correctly reinstated.
- Ball valve operating correctly.
- Overflow/warning arrangement satisfactory.
- Tank refilling correctly.
- No leaks identified.
- Normal water level restored.
- System returned to normal operation.

21. POST-CLEAN PHOTOGRAPHIC EVIDENCE

Take clear photographs showing:

1. Internal tank surfaces after cleaning.
2. Tank floor.
3. Inlet and outlet areas where accessible.
4. Tank lid correctly reinstated.

5. External tank condition.
6. Any outstanding defects.

Where possible, before-and-after photographs should be taken from similar positions to demonstrate the improvement in condition.

22. MICROBIOLOGICAL SAMPLING

Post-disinfection microbiological sampling shall be undertaken where required by:

- The Legionella Risk Assessment.
- Written Scheme of Control.
- Client instruction.
- Remedial action following adverse microbiological results.
- Technical assessment.
- Site-specific requirements.

Routine microbiological sampling is not automatically required following every CWST clean and disinfection.

Where Legionella sampling is required, samples shall be collected using an appropriate sampling methodology and submitted to an appropriately accredited laboratory.

23. RETURN TO SERVICE

The system shall only be returned to normal service once the engineer is satisfied that:

- Cleaning has been completed.
 - The required disinfection process has been achieved.
 - Chemical residuals are acceptable.
 - The tank contains clean wholesome water.
 - All equipment has been reinstated.
 - All valves are in their correct operational positions.
 - No uncontrolled hazards remain.
 - The Responsible Person/site contact has been informed.
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24. SERVICE REPORT REQUIREMENTS

A **Cold-Water Storage Tank Cleaning & Disinfection Service Report** shall be completed for every tank cleaned.

The report shall include:

Site Information

- Client.
- Site.
- Address.
- Date.
- Engineer(s).
- Responsible Person/site contact.

Tank Information

- Tank reference.
- Location.
- Tank construction.
- Approximate capacity.
- Stored-water temperature.
- Approximate water level.
- General condition.

Pre-Clean Condition

Record the presence/condition of:

- Sediment.
- Sludge.
- Scale.
- Biofilm.
- Corrosion.
- Debris.
- Lid.

- Insulation.
- Screens.
- Ball valve.
- Overflow.
- Inlet/outlet configuration.

Cleaning Details

Record:

- Cleaning method.
- Equipment used.
- Chemical used.
- Chemical batch/product details where required.
- Chemical concentration/strength.
- Calculated dose.
- Target free-chlorine concentration.
- Actual initial free-chlorine concentration.
- Contact start time.
- Contact finish time.
- Final free-chlorine concentration.
- Neutralisation undertaken, where applicable.
- Final residual after flushing where measured.

Findings

Record:

- Defects identified.
- Remedial works required.
- Recommendations.
- Any limitations to the work.

Evidence

Attach:

- Before photographs.
 - After photographs.
 - Relevant chlorine test results.
 - Sampling information/results where applicable.
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25. ACCEPTANCE CRITERIA

The CWST clean and disinfection may be considered satisfactorily completed when:

- Internal surfaces are visibly clean.
 - Significant sludge, sediment and debris have been removed.
 - Significant visible biofilm has been removed.
 - The required disinfectant concentration/contact-time regime has been demonstrated.
 - The system has been adequately flushed.
 - The tank has been correctly reinstated.
 - Water quality appears satisfactory.
 - No uncontrolled risks remain.
 - All required records have been completed.
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26. NON-CONFORMANCES

The engineer shall record and escalate any condition including:

- Heavy corrosion.
- Structural deterioration.
- Damaged tank lining.
- Inadequate tank lid.
- Missing/damaged screens.
- Poor insulation.
- Excessive stored-water temperature.
- Excessive storage volume.

- Evidence of poor turnover.
- Stagnation.
- Cross-connections.
- Incorrect inlet/outlet configuration.
- Persistent contamination.
- Inability to achieve or maintain the required disinfectant concentration.
- Inability to adequately drain or clean the tank.

Where an immediate health risk is suspected, the engineer shall inform the Responsible Person without delay and contact the Sci-Tech technical/management team.

27. HEALTH, SAFETY AND ENVIRONMENTAL CONTROLS

Chemical Safety

Never mix chlorine-based products with acids or incompatible chemicals.

Such mixing can release hazardous gases.

All chemical handling shall comply with the relevant COSHH assessment and Safety Data Sheet.

Aerosols

Avoid unnecessary generation of aerosols during cleaning and flushing.

Electrical Safety

Electrical equipment shall not be used in or around wet areas unless it is suitable for the environment and appropriate controls are in place.

Working at Height

Suitable access equipment shall be used. Engineers shall not climb on tank structures, pipework or unsuitable surfaces.

Confined Spaces

Tank entry shall not take place unless it has been specifically assessed and authorised under an appropriate confined-space procedure.

Environmental Protection

Disinfectant solutions shall be disposed of responsibly and shall not be discharged in a manner that may harm the environment.

28. ENGINEER'S FINAL CHECKLIST

Before leaving site, confirm:

- Correct CWST identified.
- RAMS reviewed.
- COSHH assessment reviewed.
- Tank isolated safely.
- Pre-clean inspection completed.
- Pre-clean photographs taken.
- Tank drained safely.
- Sediment/sludge removed.
- Internal surfaces physically cleaned.
- Tank rinsed as required.
- Disinfectant dose calculated.
- Initial disinfectant concentration measured.
- Required contact time achieved.
- Final disinfectant concentration measured.
- Disinfectant safely drained/neutralised as required.
- Tank refilled with wholesome water.
- System/outlets flushed where applicable.
- Residual disinfectant acceptable.
- Tank inspected following cleaning.
- Post-clean photographs taken.
- Lid/screens/insulation reinstated.
- Tank operating correctly.
- Defects recorded.

- Recommendations recorded.
 - Site representative informed.
 - Service report completed.
 - System returned to normal operation.
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29. IMPORTANT TECHNICAL NOTE

The objective of CWST cleaning and disinfection is not simply to achieve a chlorine reading.

Effective disinfection requires physical cleanliness first.

Sludge, sediment, scale and biofilm can protect microorganisms from chemical disinfectants and increase disinfectant demand. Where contamination is present, physical removal should therefore form an integral part of the cleaning and disinfection procedure.

The required disinfection regime shall always be selected by a competent person with consideration of:

- System construction.
- Water volume.
- Nature and severity of contamination.
- Microbiological results.
- System materials.
- Vulnerability of occupants.
- Risk assessment.
- Manufacturer's requirements.
- Current applicable technical guidance.