

LS&Co. Water Recycle/Reuse Standard

1.1 Introduction

Fresh water is a precious resource. Limited fresh water resources are under increasing pressure as populations grow around the world and from possible impacts of global climate change, which may reduce water supplies in some areas compared to their historic levels. To help preserve fresh water supplies for drinking and other necessary uses, Levi Strauss & Co. (LS&Co.) has issued this standard to encourage preservation of fresh water through water recycling.

1.2 Application

This Levi Strauss & Co. guideline applies to all finishing facilities that are in compliance with the Global Effluent Requirement (GER) to recycle or reuse effluent water as full or partial replacement of fresh water at the facility.

This document applies to:

1. Facilities which are not currently recycling or re-using effluent water.
2. Facilities receiving reclaimed/recycled water from their water provider **and/or** are already recycling/reusing water.

Finishing facilities are those which conduct wet-laundry processes, and can include but are not exclusive to the following techniques:

- a. Finishing of garments (e.g. bleaching, stonewashing, detergent, enzymes, softeners, etc.)
- b. Dyeing and/or over-dyeing of garment

For the purposes of this standard, “reclaimed water” or “recycled water” applies to water treated for reuse from one of the three following sources:

1. Treated effluent from facility’s separate system (only industrial wastewater).
2. Treated effluent from facility’s combined system (industrial wastewater plus domestic wastewater).
3. Treated effluent from offsite privately- or publicly-owned treatment works (POTW).

1.3 Purpose

Water reuse/recycling is a proven method to conserve fresh water resources and has been demonstrated to be safe given treatment appropriate to the intended use. This *Water Recycle/Reuse Standard* provides facilities that finish garments for LS&Co. with guidelines to be followed to implement a water reuse/recycling program and reduce impacts to fresh water resources. The *Water*

Recycle/Reuse Standard provides **minimum requirements for the protection of human health and the environment based on global reuse standards from various countries (see [Appendix E](#)) and the World Health Organization (WHO), and guidelines for various allowable facilities' reuse application.**

1.4 Scope

Allowable uses—Recycled water may be used for facility process water (laundry), facility landscape irrigation, facility cooling tower makeup water, onsite sanitary toilet flushing, or **aquifer recharge (special cases requiring due diligence and expert consultation)** provided that the minimum guidelines set forth in this *Water Recycle/Reuse Standard* are met and all legal requirements, permits, and permit conditions are met.

Prohibited uses—Recycled water shall not be used for activities involving direct human or food contact, including bathing, bidets, washing hands, preparing food, irrigation of food crops and animal food crops (hay) or drinking. Recycled water shall not be provided for use outside of the facility (except where water meets the stricter of local legal requirements or LS&Co. requirement AND the facility is in possession of valid authorizations/permits and control programs are applied).

Restricted Access—Recycled water used for landscape irrigation shall be limited to areas where public access can be controlled. Recycled water used for sanitary toilet flushing shall be used in a way that minimizes potential for contact with humans. Restricted access shall be maintained as set forth in this *Water Recycle/Reuse Standard* and will include signage indicating that reclaimed water is being used. Any irrigation with recycled water of landscaped areas that are accessible to employees shall be done during the hours that employees are not working or utilizing drip irrigation method.

1.5 Standard for Onsite Recycling of Treated Water

The following are provided for factories that treat effluent and reuse the treated water onsite ("onsite recycle"):

1. Escort LS&Co. personnel (or individuals designated by LS&Co.) to appropriate locations to inspect all onsite recycling treatment equipment, associated piping, and all recycled water usage locations.

2. Develop a supplemental water source to receive water if treatment fails, is offline for maintenance, or is unable to provide sufficient supply or quality of recycled water. The source should have capacity to meet 100% of the facility's daily water requirements. Develop procedures to switch facility's water source. Storage of recycled water beyond daily usage requirements may also help provide water at times when treatment is offline.
3. Develop an industrial wastewater emergency plan per LS&Co.'s *Global Effluent Requirements (GER)* (See [Appendix E, page 279](#)), storage and discharge plan to be used in case the factory's wastewater treatment process breaks down; or in case recycled water does not meet applicable regulations or the requirements described herein.
4. Have a current and valid permit to operate the Wastewater treatment facility and recycled water from all applicable governing agencies, if required. Show the permit(s) to the LS&Co. representative upon request.
5. Meet the stricter of:
 - a. All applicable governing agency requirements
 - b. LS&Co. *Water Recycle/Reuse Standard*
6. Conduct laboratory analysis of recycled water to demonstrate that it complies with the stricter of the applicable governing agency requirements and/or LS&Co.'s *Water Recycle/Reuse Standard* for the parameter limits listed in **Table 1 of this Water Recycle/Reuse Standard**.
 - a. Sample recycled water at least once a year by October 1st. Maintain analytical data onsite for LS&Co.'s *Water Recycle/Reuse Standard* parameters and make data available for inspection by LS&Co. or external monitor assigned by LS&Co.
 - b. Arrange collection, analyses, and laboratory reporting of recycled water samples per requirements set forth in LS&Co. *Global Effluent Requirement* for "Direct Dischargers," Number 5, subsections b, c, and d.
 - c. For recycled water sampling points and collection, follow the procedures in Section 2.0 *Sampling Points and Sample Collection* of this *Water Recycle/Reuse Standard*.
7. Enter all recycled/reused flow data into the Information Management System (IMS), as required.

8. Implement the measures described below under “Required Preventive Measures.”
9. Maintain the following minimum laboratory equipment to ensure recycled water is of sufficient quality: dissolved oxygen (DO) meter, pH meter, and thermometer. See [Appendix E, Topic 2.3](#) for additional information.
10. If a recycled water treatment system is utilized at the factory, maintain an up-to-date flow diagram of the recycled water treatment system and provide to LS&Co. representative if requested.
11. Maintain a log of dissolved oxygen, pH and temperature for all stored recycled water in tanks, ponds, or other impoundments. At a minimum, the log should include levels, dates and times on daily basis onsite and provide a copy to LS&Co. representative if requested.
12. For any water that is discharged to the environment, ensure that final effluent discharges meet all applicable local requirements along with LS&Co. Global Effluent Requirements.

1.6 Standard for Facilities Using Recycled Water Originating from Offsite Recycled Treated Water

The following guidelines are provided for factories that receive recycled water from a privately- or publicly-owned treatment works (“POTW recycle”):

1. Develop a supplemental water source so that water could be received if the flow of outside supplied recycled water is stopped or is unable to deliver a sufficient supply or quality of recycled water. The source should have capacity to meet 100% of the facility’s water requirements. Procedures must be developed to switch the facility’s water source and must be documented in the facility’s operations procedures. Storage of recycled water beyond daily usage requirements may help to reduce dependency on POTW.
2. Measure and record the volume of incoming recycled water supplied to the factory and enter the volume into the IMS on a monthly basis.
3. Meet the stricter of:
 - a. All applicable governing agency requirements
 - b. LS&Co. *Water Recycle/Reuse Standard*
4. Conduct laboratory analysis of recycled water to demonstrate that it complies with the stricter of the applicable governing agency requirements and/or LS&Co.’s *Water Recycle/Reuse Standard* for the parameter limits listed in Table 1.
 - a. Sample recycled water at least once a year by October 1st (if the source stays the same). Maintain analytical data onsite for LS&Co.’s *Water Recycle/Reuse*

Standard parameters and make data available for inspection by LS&Co. or external monitor assigned by LS&Co.

- b. Arrange collection, analyses, and laboratory reporting of recycled water samples per requirements set forth in LS&Co. *Global Effluent Requirement (GER)* for "Direct Dischargers," Number 5, subsections b, c, and d.
 - c. For recycled water sampling points and collection, see Section 2.0 *Sampling Points and Sample Collection* of this LS&Co. *Water Recycle/Reuse Standard*.
5. Enter all recycled water flow data into the Information Management System (IMS), as required.
 6. Implement the measures described below under "**Required Preventive Measures.**"
 7. Have a current and valid permit to utilize recycled water from all applicable governing agencies if required. Show the permit(s) to the LS&Co. representative upon request.
 8. Request and receive documentation of the privately-owned facilities' or POTW's compliance with local, state, provincial or federal recycled water regulations and requirements. Provide this documentation to the LS&Co. representative if requested.
 9. Maintain a log of dissolved oxygen, pH, and temperature for all stored recycled water in tanks, ponds, or other impoundments. At a minimum, the log should include levels, dates, and times on a weekly basis onsite. Provide a copy to the LS&Co. representative if requested.
 10. Ensure that final effluent discharges meet all applicable legal requirements along with LS&Co. *Global Effluent Requirements (GER)*.

1.7 Required Preventive Measures

The following preventative measures are to be followed for protection of **human health and the environment** when recycled/reused water is being utilized in the facility:

1. Notify LS&Co. of intent to produce or receive recycled water prior to first producing or utilizing recycled water.
2. Landscape irrigation with recycled water is allowable. Restricted access facility property areas are defined as areas where public access (employee, members of public) is controlled with a fence, wall, or other barrier. The following guidelines are for landscape irrigation with recycled water:
 - a. Do not use recycled water to irrigate any areas where uncontrolled public access is permitted.
 - b. Do not irrigate with recycled water within 2 meters (buffer zone) of any domestic drinking water supply well if using spray irrigation method (prevent introduction of recycled water to drinking water source). Drip irrigation is preferred method; no buffer zone is needed if drinking water supply is encapsulated.
 - c. Setback distances of 2 meters (buffer zone) from the property lines of public places shall be maintained when spray irrigating. Public places include private residence, park, playground, outside cafeteria, or other areas with public access. This restriction will not apply if drip irrigation system is utilized.
 - d. Manage the timing of recycled water irrigation to minimize the potential for direct human contact. Do not spray irrigate at times when people (facility employees or public) may be nearby preparing or eating food. Any spray irrigation with recycled water of landscaped areas that are accessible to employees shall be done during the hours that employees are not present at the irrigation area; or utilize drip irrigation method.

3. Sanitary toilet flushing with recycled water is allowable for 'restricted access facility toilets' only. Restricted-access facility toilets are defined as toilets that are used by facility owners, managers, and employees only (public access is controlled). Do not use recycled water for any systems involving human contact with the water (e.g., bidets, sink, or other washing).
4. System shall be designed to prevent ponding of recycled water outside bermed areas, basins, or tanks intended to store recycled water. All impoundments or tanks used for storage of delivered recycled water must have a minimum of 0.5 meters of "freeboard"—or vertical clearance from overflow pipes or top of impoundment or tank—at all times (Figures 1 & 2). Provide agitator, aeration, and/or mixing equipment (Figure 3) to prevent algal blooms and for aerating the stored water to maintain a minimum dissolved oxygen content of 2 mg/L at all times.

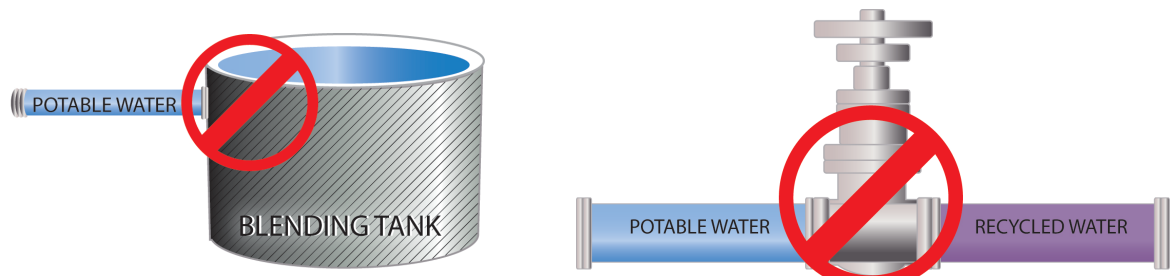


Figure 1. Potable water should never be directly connected to blending tank or recycled water system.

5. If recycled water is either placed in a surface impoundment or used for irrigation, the

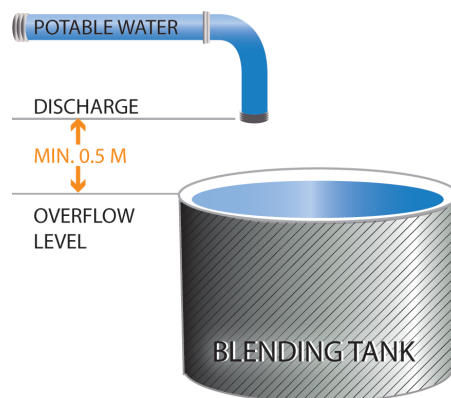


Figure 2. Maintain minimum air gap.

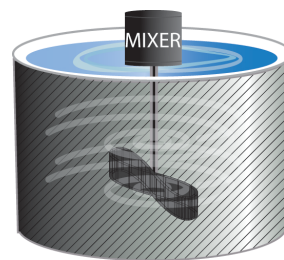


Figure 3. Provide mixing equipment for aeration for all stored recycled water (tanks, ponds, orb basins).

system should be designed to prevent all overflows or offsite runoff of recycled water from being collected so that it cannot be used again for irrigation, washing, or other uses.

6. Do not allow recycled water to enter potable water system under any circumstance (Figure 1). If mixing of potable water and recycled water is required, provide the following at all potable water discharges for cross-connection control:
 - a. Minimum elevation difference (air gap) of 0.5-meters between supplemental water supply outlet and top of receiving vessel or piping for distribution system (Figure 2).
7. Provide signs at each location where recycled water is used (landscape irrigation discharges, laundry, toilet, cooling tower). Signs shall read “Recycled Water – Do Not Drink,” in the language(s) understandable by all employees and be readily visible.



Figure 2. Post signs in the language understandable by all employees.



Figure 3. Post signs at each recycled water point of use.

8. Provide personal protective equipment (at a minimum, gloves and goggles per the SES Guidebook) to all employees working with recycled water.
9. Color code all recycled water and potable water pipes: purple for recycled water pipelines and fittings and blue for potable water pipelines and fittings. Recycled water piping and potable water piping must be dissimilar in color from each other and from other piping in the facility. Labels (“potable water” or “recycled water”) will further help identification and should be provided in the language(s) understandable by all employees.

1.8 Aquifer Recharge

Ensuring that the use of reclaimed water for aquifer recharge does not result in adverse health effects, a systematic science-based approach and expert consultation is needed to design around critical control points. Such an approach to potable aquifer recharge requires a thorough evaluation of the best practices that will protect public health and consideration of environmental and sociocultural concerns.

If aquifer recharge is poorly planned, chemical or microbial contaminants in the water could harm the health of consumers, particularly when reclaimed water is being used. Reclaimed water may contain numerous contaminants (many of them poorly characterized) that could have health implications if introduced to drinking-water sources.

1.9 Recycled Water Parameter Limits

Table 1 summarizes the recycled water parameter limits for compliance with the LS&Co. *Water Recycle/Reuse Standard* based on protection of human health and the environment and suitability for the intended reuse application (e.g., process water/laundry, landscape irrigation, cooling tower makeup water, and sanitary toilet flushing). This standard is based on related industry limits and limited process information and is meant to provide a starting point for development of refined water quality limits appropriate for LS&Co. finishing facilities. The limits may need to be adjusted to accommodate variability between the facilities, specifically water source quality, process equipment, and operational differences. Local regulations or permits may specify additional requirements for recycled water, including higher quality or operational requirements.

Table 1: Recycle/Reuse Parameter Limits

Parameter	Unit	REUSE APPLICATION				Notes
		1 Facility Process (Laundry) Water	2 Landscape Irrigation (Restricted Access) ^{1, 2}	3 Cooling Tower Water ³	4 Sanitary Toilet Flushing (Restricted Access) ²	
pH	NA	6.0 – 9.0 ^a	6.0 – 9.0 ^h	6.0 – 9.0 ^a	6.0 – 9.0 ^a	Acceptable if within the given range; not acceptable if out of range.
Biochemical Oxygen Demand (BOD ⁵)	mg/L	10 ^a	30 ^h	10 ^a	30 ⁱ	Based on a 5-day BOD test.
Total Suspended Solids (TSS)	mg/L	10 ^c	30 ^h	100 ^b	30 ⁱ	
Fecal Coliform (for combined systems ^k)	CFU/ 100 mL	75% ND, 25 max ^{d *}	200 average; 800 max ^{h **}	75% ND, 25 max ^{d *}	200 average; 800 max ^{i **}	* Non-detect for 75% of samples, 25 CFU/100 mL max. ** 200 CFU/100 mL average for year, 800 CFU/100 mL max.
Turbidity	NTU	2 ^a	NL	NL	NL	Higher turbidity levels may be allowed if they can be shown to correlate to the required TSS levels.
Chlorine Residual	mg/L	1 ^a – 4 ^e	1 ^h – 2 ^{f *}	1 ^a – 4 ^e	1 ^a – 4 ^e	Acceptable if within the given range; not acceptable if out of range. * Sensitive plants may be damaged at levels as low as 0.5 mg/L.
Total Dissolved Solids (TDS)	mg/L	2000 ^c	1000 ^{f *}	500 ^b	NL	* Sensitive plants may require lower TDS, down to 500.
Iron	mg/L	0.1 ^c	5 ^f	0.5 ^b	0.3 *	* Standard is based on potential to stain fixtures.
Manganese	mg/L	0.1 ^c	0.2 ^f	0.5 ^b	0.05 *	* Standard is based on potential to stain fixtures
Total Hardness	mg/L as CaCO ₃	90 ^c	NL	130 ^b	NL	
Sodium	mg/L	NL	70 ^g	NL	NL	
Chloride	mg/L	NL	100 ^{g *}	500 ^b	NL	* Chloride sensitivity varies widely. Consult local agronomists as part of the preliminary design efforts.
Color	color units (CU)	5 ^j	NL	NL	40 *	* Standard is based on aesthetics.

Parameter	Unit	REUSE APPLICATION				Notes
		1 Facility Process (Laundry) Water	2 Landscape Irrigation (Restricted Access) ^{1, 2}	3 Cooling Tower Water ³	4 Sanitary Toilet Flushing (Restricted Access) ²	
Other Metals	Hg	0.01 mg/l	n/a	n/a	0.015 mg/l	Mercury
	Cd	0.01 mg/l	n/a	n/a	0.015 mg/l	Cadmium
	Pb	0.10 mg/l	n/a	n/a	0.15 mg/l	Lead
	As	0.01 mg/l	n/a	n/a	0.015 mg/l	Arsenic
	Cu	0.25 mg/l	n/a	n/a	0.375 mg/l	Copper
	Ni	0.20 mg/l	n/a	n/a	0.30 mg/l	Nickel
	Cr	0.10 mg/l	n/a	n/a	0.15 mg/l	Chromium
	Zn	1.0 mg/l	n/a	n/a	1.50 mg/l	Zinc
	Cn	0.20 mg/l	n/a	n/a	0.30 mg/l	Cyanide
	Co	0.02 mg/l	n/a	n/a	0.03 mg/l	Cobalt Applicable to non-denim facilities only

Table 1 Notes:

ND = Non-detect or below detection limit / NL = No limit

¹ If drip irrigation is used, lower water quality limits are recommended for iron and manganese.

² Water quality requirements based on RESTRICTED ACCESS. Minimize the potential for human contact with recycled water.

³ Additional pretreatment may be required due to variability among manufacturer recommendations.

^a Adapted from Suggested Guidelines for Urban Reuse (US EPA).

^b Adapted from Typical Reclaimed Water Quality Requirements for Cooling Water, makeup for recirculation (Asano, Burton, Leverenz). A lower TSS may be required to comply with the fecal Coliform limits. Higher TDS concentrations may be used but this will reduce potential cycles of concentration and increase precipitation and corrosion problems.

^c Based on correspondence with LS&Co. process experts (September 2010).

^d Adapted from State of Florida mandatory reuse standards.

^e Based on USEPA National Primary Drinking Water Standards.

^f Adapted from recommended limits for irrigation (USEPA).

^g Adapted from Quality of Water for Irrigation (Ayers).

^h Adapted from Suggested Guidelines for Restricted Access Irrigation (US EPA).

ⁱ Adapted from Suggested Guidelines for Industrial Reuse (US EPA).

^j Adapted from Typical Reclaimed Water Quality Requirements for Textiles (Asano, Burton, Leverenz).

^k Combined systems contain domestic wastewater, in addition to industrial (process) wastewater.

For full references, see References sheet at the end of this document.