



Guideline for Dairy Criteria relating to
Dairy Factory Water
(stated in DPC3)

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1 What is the purpose of this guideline?

This guideline is designed to assist staff of regulated parties (dairy product manufacturers, etc), Recognised Agencies (RAs) and New Zealand Food Safety Authority (NZFSA) in the practical implementation of the NZFSA Criteria for Dairy Factory Water. It provides guidance for the development of a Water Management Plan.

2 What is included in this guideline?

This is an NZFSA operational guideline. It provides guidance for developing a Water Management Plan and includes:

- identification of different water sources and systems;
- interpreting the Drinking Water Standards New Zealand (DWSNZ) 2005 for Dairy Factory Water;
- the use of alternative water standards;
- the development of water sampling and testing plans;
- the development of an Action Plan in event of non-conformance.

3 What are the desired outcomes?

It is anticipated that this guideline will provide all interested parties with sufficient guidance and information, to enable preparation, implementation and evaluation of a Water Management Plan as part of the Risk Management Programme (RMP) in accordance with Animal Products (Dairy) Approved Criteria for the Manufacturing of Dairy Materials and Products (DPC3).

4 Glossary of Terms

NZFSA definitions of terms can be found in the "Glossary of Terms for Dairy", available on the website (www.nzfsa.govt.nz/dairy/index.htm).

Contact Water – This is divided into two types. Definitions follow:

- **Direct Contact Water** – Water that is added to dairy material or dairy product or that may be residual on a process surface that then comes into immediate contact with dairy material or dairy product. e.g. cheese or casein wash water, CIP (clean in place) final rinse water and water used to flush milk or product through the plant at the end of a processing run.
- **Indirect Contact Water** – Water that comes into contact with dairy material or dairy product process surfaces, but which is followed by a chemical CIP re-circulation step and final water rinse before product comes into contact with the surface, e.g. CIP initial rinses after product displacement and CIP rinses between caustic and acid re-circulation.

Non-contact Water – Water that does not contact the product or product contact surfaces e.g. chilled water or hot water used in heat exchangers, pump seal water.

5 Guidelines

5.1 Purpose of the Water Management Plan

The purpose of the Water Management Plan is to detail or reference the procedures that operate within a manufacturing operation to ensure compliance with DPC3. The Water Management Plan may be incorporated in or referenced from the manufacturing RMP.

5.2 Requirements of the Water Management Plan

The requirements of the Water Management Plan are detailed in DPC3.

Further assistance may be gained from Appendices One and Two of this guideline where examples are given for possible formatting of a Water Management Plan.

5.3 Developing the Water Management Plan

This guideline suggests a stepwise approach to developing the Water Management Plan. Specifically it is recommended that the following steps be considered:

- familiarisation with DPC3, DWSNZ (2005) and HACCP principles (including NZFSA Animal Products (Dairy) Approved Criteria for General Dairy Processing (DPC1) Section 13 - Dairy HACCP Plans)
- identification of different water sources (5.3.1);
- identification of different water systems (5.3.2);
- consideration of treatment systems (5.3.3);
- consideration of water reticulation (5.3.4);
- selection of water quality criteria (5.3.5);
- water sampling and testing programme (5.3.6);
- action plan in the event of non-compliance (5.3.7).

5.3.1 Identification of different water sources

Each water source may have specific hazards associated with it so it is useful to identify, and perform a hazard analysis for, each different source that may supply water to a manufacturing environment.

Water to be used in a dairy factory may originate from a variety of sources, such as:

- rainwater;
- surface water (streams, rivers, lakes, reservoirs, ponds etc);
- ground water;
- water drawn from a council/community supply (i.e. water treated by a company or organisation other than the dairy manufacturer);
- the water extracted from milk during dairy product manufacture;
- the water recovered from dairy manufacturing processes.

Issues to consider when performing a hazard analysis of source water include:

- the effects of seasonal flow;
- variation in water quality due to climatic conditions;
- impacts other users may have on the water supply;
- risk of contamination to water source;
- contaminants known to already be present in the water source;
- regulatory requirements e.g. resource consent.

5.3.2 Identification of different water systems

The Water Management Plan must identify and characterise the different water systems used in manufacture. These may include the main process water supply, hot water systems, chilled water systems and any water re-use systems. Each site may have many different water systems. It is useful to categorise each water system as direct contact, indirect contact and non-contact for later determination of water quality criteria. It is also useful to characterise each water system with regard to source, treatment, reticulation and any known quality parameters.

Examples of water systems typically found on a dairy manufacturing site and the degree of product contact are:

- main process water supply
e.g. ingredient to process (direct contact), pre/initial CIP water (indirect contact) and heat exchangers (non-contact);
- hot water systems
e.g. heat exchangers (non-contact), CIP systems (direct contact or in-direct contact);
- chilled water systems
e.g. heat exchangers (non-contact);
- demineralised water systems
e.g. membrane cleaning, diafiltration water (direct contact);
- steam generation, reticulation and use
e.g. direct steam injection units (direct contact), heat exchangers (non-contact);

- CIP re-use systems
e.g. recovery of final and/or intermediate rinses for re-use in initial and intermediate rinses;
- evaporator condensate, reverse osmosis (RO) permeate re-use systems e.g.
 - CIP initial and intermediate rinses, tanker washing (indirect contact without treatment);
 - demineralised water (direct contact after treatment);
- cooling water systems
e.g. heat exchanger (non-contact).

5.3.3 Consideration of treatment systems

Water used in dairy factories may be treated in a variety of ways. The treatment systems available for use will affect water hazards differently. For example, a demineralisation plant will remove inorganic contamination but will not necessarily remove microbiological contamination from water, while a chlorination plant will control microbiological contamination but will not necessarily remove contaminating heavy metals.

In addition, some dairy manufacturing processes limit the types of water treatments that can be used, e.g. chlorinated water cannot be used in ultrafiltration (UF) membrane plants, as the chlorine irreparably damages the membranes. Therefore, each treatment system should be characterised to determine which hazards associated with the source water are controlled or affected by treatment, as well as determine any hazards that may be associated with the water treatment process.

5.3.4 Consideration of water reticulation

The water reticulation, or distribution network, should be assessed for risk of post-treatment water contamination. The following things could be considered:

- Distances water is being carried;
- Residence time of water in reticulation system in peak and non-peak usage times;
- Materials used in reticulation network;
- Whether cross-connections are adequately controlled (e.g. by block & bleed valve systems);
- Whether reticulation networks are able to be cleaned.

5.3.5 Selection of water quality criteria

In DPC3 there is a requirement that water that comes into direct or indirect contact with dairy material or dairy products is potable, or that a manufacturer may use an alternative water quality standard provided

- the water quality standard is determined by an analysis of hazards; and
- the hazard analysis includes all hazards to the point of use and considers the intended use of the water; and

- the water will not compromise the safety of the dairy material or dairy product being manufactured.

This effectively means that all water used in dairy processing must either meet the criteria for potable water or an alternative water quality standard must be developed for each water system or application and approved as part of the manufacturer's Water Management Plan.

In all cases a full HACCP (refer NZFSA DPC1 Section 13 Dairy HACCP Plans) should be conducted to identify and control the hazards that may result in the contamination of the water and potential for dairy produce or product contamination. The HACCP analysis will form the basis for nominating an appropriate sampling and testing regime for monitoring suitability of the water for dairy manufacture. The analysis of hazards should include the following:

- water source and potential for contaminants to be present in it;
- the treatment process used;
- the distribution network, including potential for contamination by cross connections;
- consequences to product quality and safety of using the water.

5.3.5.1 Adopting the potable water standard

The water quality criteria contained in the DWSNZ 2005 may be adopted by the dairy manufacturer, particularly if the water currently conforms to it.

It should be noted, however, that the DWSNZ 2005 is a prescriptive document developed to ensure safe drinking water for the population a water system supplies. Therefore many of the criteria used in this standard are population-based.

5.3.5.1.1 Sourcing potable water from a council/community supply

If the water is sourced from a registered community water scheme it is desirable that the grading of the scheme be "C" or better. This can be determined by viewing the classification on the community register available on the Ministry of Health/ESR (Environmental Science & Research) website <http://www.drinkingwater.org.nz/>

If water is sourced from another organisation, which is not a registered community water scheme, it may be useful to negotiate access to results of any water testing performed.

Further, it is recommended that the dairy manufacturer contact the water supplier in order to ascertain any hazards that may be indicated by contaminant levels in the water as supplied or associated with the water treatment system used.

It is also recommended that the dairy factory and water supplier develop a system whereby the dairy factory is notified of any unexpected results or events that may have an adverse effect on dairy product safety.

Even when the dairy factory obtains treated water from a council or community supply, it cannot be assumed the water quality is unchanged between the treatment point and the dairy factory. Therefore

the dairy factory should still develop a water management plan, including HACCP analysis and a sampling and testing plan to ensure the water is of suitable quality to maintain dairy product safety.

5.3.5.2 Developing an alternative water quality standard

To develop an alternative water quality standard following the analysis of hazards, the following process is recommended:

- a. Identify potential or actual contaminants (microbiological, inorganic, organic, pesticides or radiological determinants) in the water source that do not meet the DWSNZ 2005.

Note: identification may be based on actual measurements or the analysis of the water source, treatment process and possible sources of contamination.

- b. For each contaminant identified in step a. identify the consequences to the process. This may involve demonstrating why each of the identified contaminants will not compromise the safety of the dairy product being manufactured by such means as:
 - The hazard analysis shows that the contaminant is not critical to the process e.g. higher levels of the contaminant will not adversely affect product quality or safety.
 - Historical records demonstrate that the levels of contaminants do not have an adverse effect on product quality or safety.
- c. Determine acceptable levels for those contaminants identified in steps a and b that will ensure product safety.

Note: while an analysis of hazards will identify the critical parameters and critical control points in the manufacturing process, there will in many cases be little data that can be used to define safe levels of the various parameters that may not meet the potable water criteria. In these cases it may be necessary to set a level of complete absence of the critical parameter, or use historical records to demonstrate a safe level where product safety has not been affected in the past by that level of the critical parameter in the water.

Compliance with an alternative standard shall be determined as described in section 5.3.3. This can be determined by:

- Direct measurement to demonstrate the levels present
- Demonstrating the presence of a disinfectant such as chlorine residual, or
- The use of a suitable indicator test.

5.3.6 Water sampling and testing programme

Water sampling and testing will be required to monitor compliance with the water quality standard adopted as stated in DPC3.

You will need to develop a water sampling and testing programme for each water system based on HACCP analysis. You will need to demonstrate compliance for the water quality standard adopted, both after the treatment system, or water source, and at the point of use i.e. within the factory, after travelling through the various reticulation systems you may have within your site boundaries.

If results indicate CCPs are out of control, or that food safety is compromised it is necessary to take appropriate action (see section 5.3.4).

If the DWSNZ 2005 is followed this may provide the minimum dairy factory water sampling and testing programme that can be adopted. HACCP analysis should be used to determine whether, or how much, additional sampling or testing is required to ensure product safety.

5.3.6.1 Determining testing requirements

5.3.6.1.1 Compliance testing

DPC3 requires that, unless hazard analysis or an alternative standard can adequately demonstrate compliance, the determinands to be tested to demonstrate compliance with DPC3 include:

- the Priority One determinands specified in the DWSNZ 2005:
 - *Escherichia coli*; and
 - Protozoa (*Giardia* and *Cryptosporidium*) which are not tested directly, but an assessment of their presence in the water supply must be made; and
- the Priority Two determinands 2a-2c specified in the DWSNZ 2005:
 - 2a – Chemical and radiological determinands that could be introduced into the water supply by the treatment chemicals at levels potentially significant to health.
 - 2b – Chemical and radiological determinands of health significance that have been demonstrated to be in the water supply at levels potentially significant to health.
 - 2c – Micro-organisms of health significance that have been demonstrated to be present in the water supply significant to health.
- Priority 2 (cyanotoxins). Cyanotoxins can appear very rapidly, and there is no simple relationship between their appearance and the concentrations of the cyanobacteria (blue-green algae) that produce them.

Commentary

A The Priority 2 determinands depend on the characteristics of the water supply and water treatment process. Dairy factories sourcing water from different supplies and in different areas of the country may have different Priority 2 determinands.

It may be useful to contact the local council or accredited drinking water testing laboratory for an indication of which priority 2 determinands are recommended for water sourced within the region.

All testing to be used to demonstrate compliance with criteria for water coming into contact with dairy material or dairy products (NZFSA DPC3 Section 23 (3)), must be performed by a laboratory accredited to test drinking water.

All testing to demonstrate compliance with DWSNZ (2005) must be performed by a laboratory approved by the Ministry of Health (MoH) for this purpose. A list of approved drinking water testing laboratories is available from the MoH.

It is recommended that consideration be made for testing of other determinands, not currently required by DWSNZ (2005), that may be of particular importance to the product being manufactured e.g. *Pseudomonas* in water supplied to butter manufacture, *Clostridia perfringens* and/or *Bacillus cereus* in water supplied to products destined for use in infant formulae.

5.3.6.1.2 Process control monitoring

It is important to regularly monitor the treated water to ensure the treatment system is effective. The appropriate tests for monitoring effective treatment will depend on the treatment system used. Process control monitoring may include:

- residual chlorine testing
- pH measurement
- turbidity measurement

5.3.6.2 Sampling and testing frequency

Although DPC3 allows selection of DWSNZ (2005) as the potable water quality standard it is recognised that the sampling frequencies in DWSNZ (2005) are based on the population size served by the water system. It is not appropriate, nor would it necessarily be practical, to extrapolate the sampling and testing frequencies from DWSNZ (2005) to apply to dairy factory water. Therefore DPC3 provides that “The manufacturer determines the frequency of compliance testing taking the following into consideration:

- the variability of the source water; and
- the reliability of the water treatment process; and
- the severity of risk to product safety, which depends on the nature of the hazard.”

When determining the level of the sampling and testing required to ensure dairy material or dairy product quality or safety are not compromised it will be important to carefully consider for both compliance and monitoring:

- How much water is used on site each day/month/year?
- How much of the water used on site comes in direct contact with the product?
- What is the ratio of water to milk in direct contact situations?

- How much testing is performed on the milk entering this process (it may be appropriate to base the frequency of water sampling on the already established frequency of sampling for milk entering the same process)?
- Are any water systems used for both dairy factory supply and supply of drinking water to people on site?
- What are the DWSNZ (2005) requirements that must be met for supply of drinking water for the number of people on site (do these meet/exceed the sampling frequency that seems appropriate for water supplied to dairy manufacture)?
- Where does the water enter the manufacturing process?
- Are there product safety CCP's after the point of water entry into the process?
- Is there potential for contaminants in the water to be concentrated during the manufacturing process (e.g. concentration of bacterial cells during ultrafiltration)?
- Are the safety risks for water used in manufacturing the same as the risks for water used for supply to the general population?
- Will supply of a food source (e.g.milk) for bacteria provide an opportunity for growth and potential harm to consumers that may not exist if the water was consumed on its own?
- Are the safety risks different for different water sources or manufacturing processes?
- Is there a continuous measurement of residual disinfection (e.g. on-line chlorine measurement may reduce the sampling and testing required)?

5.3.6.3 Sampling requirements

Samples taken for testing to demonstrate compliance *with* DPC3 must be taken by a trained and competent person, following the sampling requirements specified in DWSNZ (2005). It is important to consider the following:

- Does the sampling method ensure a representative sample of the water source is taken?
- Does the sample require special treatment to remain representative until it is tested e.g. water that has been chlorinated may require the addition of sodium thiosulphate to neutralise the chlorine and preserve the microbiological snapshot of the water at the time of sampling?
- Does the sample need to undergo microbiological testing, and if so is the sample able to be taken aseptically?
- Is sampling continuous, or is the amount or frequency of sampling sufficient to demonstrate control of CCPs?
- Are the sample points relevant to use of the water within the manufacturing process e.g. is the sampling point at point of use or is there opportunity for contamination of the water between the sampling point and point of use?

5.3.6.4 Other issues

When determining the sampling and testing required to demonstrate compliance with the water quality standard the following considerations should be made:

- Are rapid, in or on-line testing procedures available for monitoring CCPs to ensure control of these points is not reliant on the results from time-consuming, lengthy analytical testing?
- Can physical and/or chemical measurements be used to indicate microbiological control of the product?
- What testing and test frequency is required to ensure food safety, as opposed to ensuring other desired quality standards for the final product are met?

5.3.7 Action Plan in the event of non-compliance

The Water Management Plan should contain an Action Plan in the event of water non-compliance. The Action Plan should cover such issues as:

- internal notification;
- identification and isolation of suspect product;
- investigation of non-compliance;
- corrective action (including prevention of future incidents);
- reporting as per NZFSA DPC1 Section Seven - Reporting Requirements;
- disposal of affected product as per NZFSA DPC1 Section Fourteen - Management of Non-conforming Dairy Material or Product.

5.4 Validation and Verification of the Water Management Plan

Validation and verification of the outcomes described in DPC3 relating to Dairy Factory Water is undertaken by as outlined in NZFSA Animal Products (Dairy Risk Management Programme Specifications) Notice 2005 and NZFSA DPC1 Section Six – Verification as part of a RMP assessment.

Version No.	Date of Issue	Reason for Revision
1	March 2003	

2	August 2006	Update to reflect provisions of APA and associated legislation and documentation

For more information or comments on this guideline

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APPENDIX ONE: EXAMPLE OF WATER MANAGEMENT PLAN INDEX

Method No:	METHOD TITLE	Current Version	Issue Date
	Title Page		
0.0	Contents List		
0.1	Scope		
	<i>Section A</i>		
1.0	Water Quality Criteria		
1.1	Water coming into contact with dairy produce & dairy products		
1.2	Water not coming into contact with dairy produce or dairy products		
1.3	Water Supplied to the Community		
2.0	Water Management		
	a) Accountable Persons		
	b) Training & Qualifications		
	c) Contractors & Visitors		
	d) Contracted Service Providers		
	e) Treatment Systems		
	f) Water Sampling & Testing		
	g) Records and traceback		
	h) References		
2.1	<i>Water Reticulation</i>		
	a) Quality at point of use		
	b) Unintentional mixing of systems		
	c) Preventing System Contamination		
	d) Sanitation Implementation		
2.2	<i>Water Testing</i>		
	a) Compliance Monitoring		
	b) Process Control		
2.3	<i>Non Complying</i>		
	Non-Complying Water		
3.0	<i>HACCP Analysis</i>		
	HACCP Analysis		
4.0	<i>Assessment of the Water Management Plan</i>		
	a) Validation & Verification of the Water Management Plan		
	b) Review & Update		
5.0	<i>Section B – DWS2005 Compliance (Potable Water)</i>		
	Domestic Cold Water		
	Domestic Hot Water		
6.0	<i>Section C – Alternative Quality (Direct/Non-direct contact Water)</i>		
	Treated Evaporator Water		
	RO Polish Water		
	Recovered Water		
	Demineralised Water		
7.0	<i>Section D – Alternative Quality (Non-contact water)</i>		
	Cooling Water		
	Chilled Water		
	High Temperature Hot Water		

APPENDIX TWO: EXAMPLE OF WATER SOURCE AND TREATMENT TABLE (SPECIFIC TO EACH WATER SOURCE)

1- Water Source & Treatment

Non Contact

Direct Product Contact

Dairy Factory Water Element	Reference to External Standard	Planned Activity	Reference to Company Procedure	Means of Verification	Responsibility And Authority
Source	<ul style="list-style-type: none"> • DWSNZ 2005 • NZFSA DPC3 • "HACCP System and Guidelines for its Application", Supplement to Volume 1B, Annex to CAC/RCP 1-1969, Rev 3 (1997) Codex Alimentarius Commission, 1997 • NZFSA DPC1 Section Seven , - Reporting Requirements 	<<List all activities carried out to monitor the source>>	<<List all company manuals and procedures that refer to this activity>>	<<List all logsheets to verify this activity is carried out >>	<<List all personnel who are responsible for this activity including signing off that this was carried out >>
Treatment	<ul style="list-style-type: none"> • DWSNZ 2005 • NZFSA DPC3 • "HACCP System and Guidelines for its Application", Supplement to Volume 1B, Annex to CAC/RCP 1-1969, Rev 3 (1997) Codex Alimentarius Commission, 1997 • NZFSA DPC1 Section Seven , - Reporting Requirements 	<<List all activities carried out to monitor the source>>	<<List all company manuals and procedures that refer to this activity>>	<<List all logsheets to verify this activity is carried out >>	<<List all personnel who are responsible for this activity including signing off that this was carried out >>

Dairy Factory Water Element	Reference to External Standard	Planned Activity	Reference to Company Procedure	Means of Verification	Responsibility And Authority
Sampling & Testing	<ul style="list-style-type: none"> • Chemical Testing Standards • Microbiological Testing requirements 	<<List all activities carried out to monitor the source>>	<<List all company manuals and procedures that refer to this activity>>	<<List all logsheets to verify this activity is carried out >>	<<List all personnel who are responsible for this activity including signing off that this was carried out >>
HACCP	<ul style="list-style-type: none"> • DWSNZ 2005 • NZFSA DPC3 • "HACCP System and Guidelines for its Application", Supplement to Volume 1B, Annex to CAC/RCP 1-1969, Rev 3 (1997) Codex Alimentarius Commission, 1997 • NZFSA DPC1 Section Seven , - Reporting Requirements • NZFSA DPC1 Section Thirteen - Dairy HACCP Plans 	<<List all activities carried out to monitor the source>>	<<List all company manuals and procedures that refer to this activity>>	<<List all logsheets to verify this activity is carried out >>	<<List all personnel who are responsible for this activity including signing off that this was carried out >>
Appropriate Corrective Action steps in place	<ul style="list-style-type: none"> • DWSNZ 2005 • NZFSA DPC3 • "HACCP System and Guidelines for its Application", Supplement to Volume 1B, Annex to CAC/RCP 1-1969, Rev 3 (1997) Codex Alimentarius Commission, 1997 • NZFSA DPC1 Section Seven , - Reporting Requirements 	<<List all activities carried out to monitor the source>>	<<List all company manuals and procedures that refer to this activity>>	<<List all logsheets to verify this activity is carried out >>	<<List all personnel who are responsible for this activity including signing off that this was carried out >>