


**Standards for the  
Supply of  
Polyelectrolytes  
for Use in  
Drinking-Water  
Treatment**

- Standard for the Supply of Polyacrylamides for User in Drinking-Water Treatment
- Standard for the Supply of EPI-DMA Polyamides for Use in Drinking-Water Treatment
- Standard for the Supply of PolyDADMAC for Use in Drinking-Water Treatment

**First Edition**

**March 1999**





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# **STANDARD FOR THE SUPPLY OF POLYACRYLAMIDES FOR USE IN DRINKING- WATER TREATMENT**

**First Edition**

**March 1999**

This standard was compiled for the Water Supply Managers Sub-Group of the New Zealand Water and Wastes Association and the Ministry of Health by Opus International Consultants.

**ISBN 1-877134-08-2**

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## **FOREWORD**

This Standard shall be used for supply and purchase of polyacrylamides intended for drinking-water treatment.

When purchasing product under this Standard, the purchaser shall provide at least the following details.

1. Reference to this Standard.
2. Quantity, form of shipment, and size of containers to be used.
3. Required delivery point and time/frequency.
4. Required form of polyacrylamide product (powder, emulsion or solution).
5. Required charge type (anionic, cationic or non-ionic) and charge density.

Any modification of the provisions, definitions or terminology in this Standard must be provided in the purchaser's specifications.

# **1 GENERAL**

## **1.1 Scope**

This Standard covers the supply of polyacrylamides for use in the treatment of water for drinking-water supply.

## **1.2 Purpose**

The main purpose of this Standard is to provide purchasers, manufacturers, and suppliers with the minimum requirements for polyacrylamides including physical, chemical and testing requirements.

## **1.3 Application**

The stipulations of this Standard apply only when this document has been referenced, and only to polyacrylamides when used in the treatment of raw water for drinking-water supply. It does not cover the use of any other flocculants and/or coagulants.

## **1.4 Uses in Drinking-Water Treatment**

Polyacrylamides are coagulants, flocculants and filter aids used in the treatment of drinking-water supplies.

The purpose of a coagulant or flocculant is to promote the coagulation or flocculation of colloidal and smaller particles in the raw water and thereby aid in their removal in subsequent treatment steps.

The purpose of a filter aid is to improve filter performance.

## **1.5 Description of Polyacrylamides**

Polyacrylamides are a family of polymers which use acrylamide as their basic monomer. Polyacrylamides can either be nonionic, anionic, or cationic. The nonionic polymer is made solely from acrylamide monomer, while the anionic form also uses an acrylic acid monomer, and the cationic form also uses a cationic acrylamide based salt monomer (eg, ethanaminium, N,N,N-trimethyl-2-[(1-oxo-2-propenyl)oxy]-, chloride).

Polyacrylamides come in three forms: powders, emulsions and solutions. The powders are generally white or colourless, and the liquids are generally white.

Polyacrylamides are not considered hazardous either by contact, inhalation or by ingestion. However, there may be impurities present in the polyacrylamide solution, either unreacted ingredients, or by-products formed from further reactions, which may be hazardous. There is evidence that unreacted acrylamide is likely to be present in many polyacrylamide products. Acrylamide is an established neurotoxin, and studies indicate that it is a probable human carcinogen.

## **1.6 Manufacture of Polyacrylamides**

1.6.1 Polyacrylamides are manufactured in one of three ways:

*Free radical polymerisation:* The oxidising component of a redox reaction is added to the acrylamide monomer. The reducing agent is then added slowly to control the rate of polymerisation.

*Inverse emulsion polymerisation:* Acrylamide, in an aqueous phase, is dispersed as small droplets in an organic medium.

*Reaction with precipitation:* This process involves using a reaction medium in which the monomer is soluble, but the polymer is not. As the polymer forms it precipitates out from the reaction medium.

1.6.2 The three forms are manufactured as follows:

*Powder:* monomer(s) is (are) usually first polymerised to form a gel, which is then ground and dried.

*Emulsion:* droplets of monomer(s) is (are) first emulsified in hydrocarbon oil before polymerisation is initiated.

*Solution:* manufactured either by aqueous polymerisation of the monomer(s), or by dissolving emulsion or powdered form in water.

1.6.3 Most polyacrylamides used in New Zealand for drinking-water treatment are manufactured in the USA, Europe and Australia.

## 1.7 Methods of Dosing

Polyacrylamides are normally dosed directly to water from a mixing or day tank via a positive displacement metering pump.

## 1.8 Definitions

The following definitions shall apply in this Standard:

1.8.1 *Certificate of Compliance:* A certificate issued by an IANZ accredited laboratory or IANZ mutually recognised laboratory, which verifies that the product for which it is issued complies with all the applicable requirements of this Standard.

1.8.2 *Coagulant:* A substance added during water treatment to bring about destabilisation of colloidal particles. Refer also to Primary Coagulant and Secondary Coagulant.

1.8.3 *Filter Aid:* A polymer added immediately upstream of the filters which strengthens the attachment of particles to the filter media.

1.8.4 *Flocculant:* A polymer added to promote the agglomeration of destabilised particles.

1.8.5 *Manufacturer:* The party that manufactures, fabricates, or produces materials or products.

1.8.6 *Polyacrylamides:* Polyacrylamides are either white or colourless powders, or white liquids, used as coagulants, flocculants or filter aids in the treatment of drinking-water.

1.8.7 *Polyelectrolyte:* A polymer in which some or all of the monomeric units contain ionisable groups (eg, carboxyl or amino). Depending upon the type of ionisable group, a

polyelectrolyte may be cationic or anionic, although amphoteric types (containing both positive and negative groups) also exist. Polymers without ionisable groups are termed nonionic (and therefore are not strictly speaking polyelectrolytes). However, the word polyelectrolyte is commonly used to include cationic, anionic and nonionic products. Polyelectrolytes are used in water treatment as coagulants, flocculants and filter aids.

- 1.8.8 *Polymer*: A large molecular weight natural or synthetic compound formed into a chain from low molecular weight simple molecules (monomers). Some polymers are made from only one monomer; others contain two or three different monomers.
- 1.8.9 *Primary Coagulant*: A coagulant taking the sole or primary role in the coagulation process. Normally refers to either:
- (i) a cationic polyelectrolyte used as the sole coagulant, or
  - (ii) a metal salt coagulant when used with a polymer, when the polymer acts as a secondary coagulant.
- 1.8.10 *Purchaser*: The person, company or organisation that purchases any materials or works to be performed.
- 1.8.11 *Reception Point*: The point of physical transfer of materials from the supplier to the purchaser.
- 1.8.12 *Secondary Coagulant*: A coagulant assisting in the coagulation process (also called a coagulant aid). Normally refers to a polymer when used in combination with a metal salt, when the metal salt acts as primary coagulant.
- 1.8.13 *Supplier*: The party who supplies materials or service. A supplier may or may not be the manufacturer.
- 1.8.14 *w/w*: Weight per unit weight, for example, g/kg.



## 2 MATERIALS

### 2.1 Physical Properties

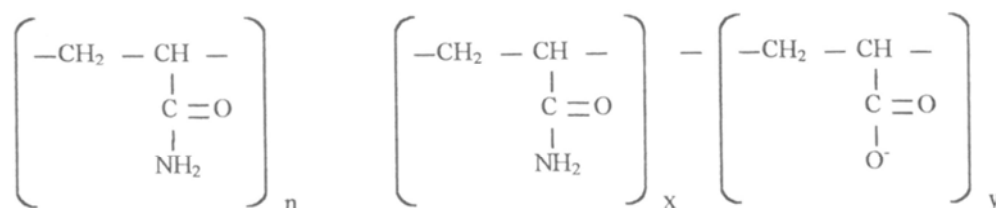
*Physical Description:* Polyacrylamides are either slightly hygroscopic white or colourless powders, or viscous white or translucent solutions or emulsions. They are supplied in a wide range of active polymer concentrations.

The product is likely to contain other impurities such as stabilisers, antioxidants, and emulsifiers.

*Composition:* The typical primary components of each form of polyacrylamide can be described generically as follows:

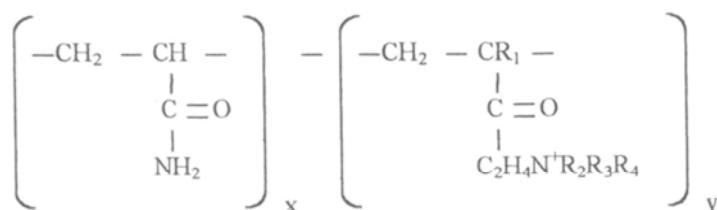
- *Powders:* polyacrylamide, moisture (water), may contain inert inorganic salts or inert organic compounds. Density is typically 0.5-0.9 kg/L. Soluble in cold water, with a gel being formed at concentrations of approximately 20 g/L and above.
- *Emulsions:* polyacrylamide, hydrocarbon oil (typically 20-50% w/w), water, surfactants.
- *Solutions:* usually dilute, viscous solutions of powder or emulsion. (Refer above.)

*Molecular Formulae:*



Nonionic  
Polyacrylamide

Anionic Polyacrylamide



Cationic Polyacrylamide

*Molecular Weight:* Low to high ( $10^3$  -  $\geq 10^7$ ).

*Charge Type:* Anionic, cationic and nonionic.

*Charge Density:* Anionic and cationic forms can range from low to high. Nonionic form has no charge.

## 2.2 Specific Product Properties

### 2.2.1 *Minimum Specifications for Determining Specific Product Properties*

The minimum specifications for determining specific product properties of polyacrylamide products shall be:

- (i) visual inspection
- (ii) total solids/percent moisture
- (iii) solution Brookfield viscosity.

The visual inspection shall be carried out by the purchaser, and the other two tests shall be carried out by the supplier. The standard tests for total solids/percent moisture and solution Brookfield viscosity are detailed in Section 5.4.

### 2.2.2 *Visual Inspection*

2.2.2.1 A visual inspection of the polyacrylamide product shall be made as soon as possible after the product has been received by the purchaser. Comparisons shall be made with a previously acceptable sample of the same product that has been stored properly and is within its shelf life.

2.2.2.2 *Emulsion Form Polyacrylamide:* The product shall be free from insoluble gel, visible foreign matter, and sediment. The product shall be examined for coagulum/agglomerates and contamination by rotating a glass container of the product in front of a light source to inspect for the coagulum (a globule) that adheres to the glass wall. Separation does not necessarily mean a bad product, but does indicate that mixing is required. Odour may reflect the presence of hydrocarbon oil.

2.2.2.3 *Powder Form Polyacrylamide:* The samples shall be inspected for discoloured particles or solid contaminants, especially for large particles that may indicate difficulty in solution preparation and would prevent the product from being free flowing. An ammonia smell may be present when the product is initially opened. A microscopic examination may be carried out to reveal changes in individual particle shape or appearance.

2.2.2.4 *Solution Form Polyacrylamide:* The product shall be free from insoluble gel, visible foreign matter, sediment and turbidity. The product shall be examined for coagulum/agglomerates and contamination by rotating a glass container of the product in front of a light source to inspect for the coagulum that adheres to the glass wall. Degradation of the product over time will be accompanied by a significant loss of viscosity and performance.

### 2.2.3 *Total Solids/Percent Moisture*

This relates to the active polymer content, and is needed to interpret other tests. When the total solids/percent moisture is related to the concentration of active polymer content, the concentration of active polymer shall be within 90-105% of the manufacturer's claimed concentration.

#### 2.2.4 *Solution Brookfield Viscosity*

The measurement of Brookfield viscosity of any polyacrylamide product at a specific concentration is a relatively easy way to determine whether product quality variation exists. The test can be applied to any of the three forms of polyacrylamide.

### 2.3 **Impurities**

#### 2.3.1 **General**

2.3.1.1 The polyacrylamides supplied according to this Standard shall not contain any impurities that when dosed into water in accordance with accepted water treatment practice, may be deleterious to health or aesthetically objectionable as determined by NSF Standard 60 (DWSNZ)<sup>1</sup> and the *Drinking-Water Standards for New Zealand*.

2.3.1.2 All polyacrylamide products shall be free of any impurities which would require the product to be strained prior to dilution or dosing.

#### 2.3.2 **Specific Impurity Limits (SIL)**

2.3.2.1 Acrylamide monomer levels shall not exceed 100 mg/kg of active polymer (100 ppm or 0.01% by weight).

2.3.2.2 Other SILs may be determined using the procedures included in Appendix A (unless set otherwise by the purchaser) to ensure that the product supplied is suitable for drinking-water treatment.

2.3.2.3 SILs shall be based on a maximum dosage of 0.5 mg active polymer/litre of water, the maximum acceptable value (MAV) of the impurity (taken from the *Drinking-Water Standards for New Zealand*), and a minimum safety factor of 10.

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<sup>1</sup> It is proposed that manufacturers gain certification to National Sanitation Foundation (NSF) Standard 60, but with evaluation against the *Drinking-Water Standards for New Zealand*. The New Zealand Ministry of Health is currently formalising an arrangement with NSF.

The National Sanitation Foundation is a USA based non-for-profit organisation that carries out third party certification of chemicals and materials used in potable waters. For enquiries, contact the General Manager – Drinking Water Additives. Fax: +1 313 769 0109. Email: [purkiss@nsf.org](mailto:purkiss@nsf.org)

### **3 DELIVERY**

#### **3.1 Packaging and Shipping**

Polyacrylamide product shall be shipped in suitable containers. The container shall be made of a material which will not be damaged in any way by the product, and/or during shipping. The container shall be tightly sealed to prevent leakage and/or contamination. All containers shall be clean, in good condition, and free from defects.

#### **3.2 Labelling**

Each shipment shall bear some means of identification. Each package shall be marked legibly with 'Polyacrylamide', and the following information:

Product Name:  
Net Weight:  
Name of the Manufacturer and/or the Supplier:  
Batch Number:  
Date of Manufacture:  
Concentration of Active Polymer (emulsions or solutions: kg/L):  
(powders: kg/kg):  
Density (kg/L): (only for emulsions or solutions)  
Charge Type:  
'Use-by' Date (day/month/year):

Packages shall have the appropriate labelling for NSF Standard 60 (DWSNZ) certification, and also be clearly labelled with the words "Complies with the NZWWA Standard for the Supply of Polyacrylamides for Use in Drinking-Water Treatment".

#### **3.3 Unloading and Storage**

- 3.3.1 The purchaser shall ensure that the containers are stored in a cool, dry, well-ventilated, covered designated storage area. The storage area should be away from direct sunlight, strong oxidising agents and acids, foodstuffs and extreme temperatures.
- 3.3.2 Containers of polyacrylamide product shall be delivered on pallets suitable for unloading at the purchaser's premises using a forklift truck or similar.
- 3.3.3 Containers damaged prior to delivery shall be the responsibility of the supplier, and containers damaged during unloading at the purchaser's premises shall be the responsibility of the agent undertaking the unloading. Removal of damaged goods shall be as set out in Section 7.4.2.

## **4 HEALTH, SAFETY AND ENVIRONMENTAL PROTECTION**

### **4.1 General**

Suppliers of polyacrylamides shall comply with the requirements of the Health and Safety in Employment Act 1992, and the Transport Act 1962. All practicable steps must be taken to protect the purchaser and others in the environment from hazards arising from the transportation, delivery and supply of polyacrylamides.

### **4.2 Material Safety Data Sheets**

4.2.1 Within three weeks of award of a contract to supply product, and prior to delivery, the supplier shall provide an updated copy of the Material Safety Data Sheet as detailed in "Guidelines for the Preparation of Material Safety Data Sheets in New Zealand", published by the Occupational Safety and Health Service of the Department of Labour, May 1995.

4.2.2 MSDS obtained from other countries, complying for example with ISO, ILO, EC or Worksafe Australia formats, should be modified to include the necessary information detailed in "Guidelines for the Preparation of Material Safety Data Sheets in New Zealand". The additional information should be appended to the MSDS and should be clearly marked to indicate that it is not part of the original MSDS.

### **4.3 Health and Safety Management Plan**

4.3.1 A copy of the purchaser's Health and Safety and Environmental Protection Management (HSEPM) Plan shall be made available to the supplier of the polyacrylamides. Any practices by the supplier which do not comply with the Health and Safety Management Plan may be grounds for the termination of a supply contract.

4.3.2 The HSEPM Plan shall state that the supplier, their agent or the authorised purchaser's representative responsible for unloading the polyacrylamide, shall immediately report any spills within the grounds of the property in which the reception point is located to the duty water treatment plant (WTP) operator. The duty WTP operator shall be responsible for the removal of the spill and ensuring that the area is safe.

### **4.4 Protective Equipment and Training**

The purchaser and the supplier will be responsible for providing their respective personnel or agents with any necessary training, safety and protective equipment and ensuring it is used as required.

## **5 SAMPLING AND TESTING**

### **5.1 Frequency**

- 5.1.1 The sampling and testing frequency for specific product properties, the concentration of residual monomer, and the concentration of active polymer shall be three monthly, and shall be carried out at the cost of the manufacturer or supplier.
- 5.1.2 The sampling and testing frequency for Specific Impurity Limits and toxicological safety shall be in accordance with the requirements for certification to NSF Standard 60 (DWSNZ), and shall be carried out at the cost of the manufacturer or supplier.

### **5.2 Sampling and Sample Preparation**

The sampling procedure shall be in accordance with the requirements for certification to NSF Standard 60 (DWSNZ).

### **5.3 Testing**

- 5.3.1 The product shall be tested at the manufacturer's or supplier's own cost in order to provide a Certificate of Compliance as required in Section 7.1. Records of sampling and testing of representative samples, process monitoring results, and any other relevant records shall be made available to the purchaser on request.
- 5.3.2 The purchaser may randomly take samples of the product and have these samples analysed for conformance with this Standard. The cost of the analysis shall be paid by the supplier if the material does not meet the requirements of this Standard, and shall be paid by the purchaser if the material does meet the requirements of this Standard.
- 5.3.3 Analytical testing methods shall be as specified in this Standard in Section 5.4.
- 5.3.4 If the analysis of a sample by the purchaser shows the product does not comply with the requirements of this Standard, a notice of non-conformance shall be provided by the purchaser to the supplier in accordance with Section 7.4.1.

### **5.4 Standard Tests**

- 5.4.1. For the standard tests for polyacrylamides refer to the following:
- (i) Total Solids/Percent Moisture:  
ANSI/AWWA Standard B453-96 Sections 5.4 and 5.5
  - (ii) Brookfield Viscosity of Solution:  
ANSI/AWWA Standard B453-96 Sections 5.4 and 5.5
  - (iii) Residual Acrylamide Monomer:  
'Determination of residual acrylamide monomer in solution and emulsion polymers by column-switching high-performance liquid chromatography.' See References.
- 5.4.2 For the procedures for toxicological safety, refer to NSF Standard 60.

- 5.4.3 Test methods for specific impurities which are not given in the above Standards shall be those of the current edition of Standard Methods for the Examination of Water and Wastewater (19th edition, 1995 at the time of drafting this specification), unless agreed otherwise.

## **6 SUPPLY CONTRACT**

### **6.1 Contract**

The purchaser may enter into a contract with a supplier for the supply of polyacrylamide product in accordance with this Standard.

### **6.2 Acceptable Conditions**

Acceptable conditions are outlined in Appendix B of this Standard, or as agreed between the supplier and the purchaser.



## **7 QUALITY ASSURANCE**

### **7.1 Compliance**

7.1.1 For the product supplied to fulfil the purchaser's order, the manufacturer or supplier shall provide the purchaser with each batch:

- (i) proof that the product is certified to NSF Standard 60 (DWSNZ), and
- (ii) a Certificate of Compliance.

The Certificate of Compliance shall state that the product supplied to fulfil the purchaser's order complies with all the applicable requirements of this Standard. The Certificate shall be issued by either an International Accreditation New Zealand (IANZ) accredited laboratory or an IANZ mutually recognised laboratory.

7.1.2 Polyacrylamides manufactured by a process:

- (i) which is certified to ISO9002; and
- (ii) which has been sampled and tested as least every six months for specific product properties, the concentration of residual monomer, and the concentration of active polymer; and
- (iii) for which sampling and testing of the Specific Impurity Limits and toxicological safety has been carried in accordance with NSF Standard 60 (DWSNZ); and
- (iv) for which the certification links every package to a unique batch number

shall be exempt from providing (i) and (ii) of Section 7.1.1 with each batch, but shall provide these if there has been any change to the materials or method of manufacture.

### **7.2 Method of Manufacture**

If the method of manufacture, source and/or quality of raw material used is changed during the period of the supply contract, then this shall be advised to the purchaser (in addition to the requirements under NSF Standard 60) prior to the delivery of the first shipment affected by the changes. Any additional sampling and testing that may be required shall be at the manufacturer's or supplier's cost.

### **7.3 Weight Certificate**

The delivered product shall be weighed over certified weighing machines, and the docket showing the net weight shall be produced upon delivery.

### **7.4 Rejection**

#### **7.4.1 Notice of Non-conformance**

If the polyacrylamide product delivered does not meet the requirements of this Standard, a Notice of Non-Conformance, detailing the particulars of the non-conformance, shall be provided by the purchaser to the supplier. This must be within ten working days after receipt of the shipment at the delivery point. The notice of non-conformance shall stand unless the supplier notifies the purchaser within five working days after receipt of the notice, that inspection or testing is desired. If the results from the inspection or testing do not show conformance, a referee laboratory agreed to by both parties shall inspect or test

the matter in dispute. The results of the referee analysis shall be accepted as final. The cost of the referee inspection or testing shall be paid by the supplier if the product does not meet the requirements of this Standard, and shall be paid by the purchaser if the product does meet the requirements of this Standard.

#### **7.4.2 Product Removal**

- 7.4.2.1 Upon issue of a Notice of Non-Conformance, as provided for by Section 7.4.1, the supplier shall remove the product from the premises of the purchaser within 7 days or such longer period as may be agreed. Removal of product shall be at no cost to the purchaser.
- 7.4.2.2 If the product simply does not meet the claimed concentration of active polymer, a price adjustment may be agreed between the supplier and the purchaser. In the event that a price adjustment cannot be agreed, the supplier shall remove the product from the premises of the purchaser at no cost to the purchaser.
- 7.4.2.3 The product that shall be removed shall include the rejected product and any other material the rejected product may have contaminated, for example contents of a tank into which a delivery has been unloaded, if required by the purchaser.
- 7.4.2.4 All product removed shall be concurrently replaced with product conforming to this Standard with an appropriate Certificate of Compliance at no cost to the purchaser or such monetary adjustment made as may be mutually agreed.

### **7.5 Audit**

- 7.5.1 The purchaser may wish to carry out an audit of the supplier for conditions of delivery, health, safety, environmental protection and compliance with this Standard.
- 7.5.2 An audit shall only be carried out with due notification and agreement of the supplier. A guide audit checklist has been included as Appendix C to this Standard.

## Appendix A: Specific Impurity Limits

Commercially available polyacrylamides for the purpose of drinking-water treatment are not known to contribute significant quantities of contaminants that adversely affect the potability of drinking-water.

Specific Impurity Limits (SIL) may be calculated based on a maximum dosage (MD) of polymer/litre of water and the maximum acceptable value (MAV) of a determinand taken from the *Drinking-Water Standards for New Zealand*, 1995. The safety factor (SF) used in the calculation shall be a minimum of 10, which reflects the view that no more than 10 percent of a MAV should be contributed by a given impurity in a water treatment chemical (the "1/10th" rule).

Purchasers may specify more stringent SILs to reflect their individual requirements.

The SIL, values were determined using the following equation:

$$SIL(mg/kg) = \frac{MAV (mg/litre) \times 10^6(mg/kg)}{MD (mg/litre) \times SF}$$

Where:

SIL	=	Specific Impurity Limit
MAV	=	Maximum Acceptable Value
MD	=	Maximum Dosage
SF	=	Safety Factor

An example calculation is as follows:

Acrylamide:	MAV	=	0.0005 mg/litre
	MD	=	0.5 active polymer/litre
	SF	=	10

$$SIL = \frac{0.0005 \times 10^6}{0.5 \times 10}$$

= 100 mg acrylamide/kg active polymer

For a 0.9 kg active polymer/kg powder this SIL equates as follows:

$$SI = 100 \text{ mg/kg} \times 0.9 \text{ kg/kg}$$

$$= 90 \text{ mg acrylamide/kg product}$$

## **Appendix B: Model Supply Contract**

### **B1 Contract**

The following provides an outline of acceptable conditions of supply of product, to be included in a contract between a purchaser and a supplier for the supply of polyacrylamide in accordance with this Standard, or as agreed by the purchaser and the supplier.

### **B2 Contract Period**

A nominated contract period shall be set as part of a supply contract and shall commence from the date of entering into contract.

### **B3 Annual Requirements**

An approximate annual requirement of product shall be provided for the information of the supplier. However no guarantee can be given to these amounts as they will vary with water treatment plant throughput, and customer consumption.

### **B4 Delivery**

- B4.1 The reception point for the supply of polyacrylamide shall be designated and agreed between the supplier and the purchaser.
- B4.2 Delivery of an order to the purchaser's specified reception point shall be made within 7 days of receipt of the order or at any other mutually agreed time.
- B4.3 Delivery shall be made between the hours of 7.30 am and 4.00 pm Monday to Friday, excluding public holidays, unless a prior arrangement is made between the supplier and the purchaser. The delivery shall be discharged only with the authorisation and in the presence of the purchaser's representative or operating personnel.
- B4.4 Delivery dockets shall be provided giving the weight of product. Deliveries shall be weighed over certified weighing machines. Certificates of Compliance shall also be provided as agreed between the supplier and the purchaser.
- B4.5 The quality of the product delivered shall comply with this Standard. A Certificate of Compliance with this Standard shall be produced by the supplier with the first delivery, and with each subsequent delivery where a new Certificate of Compliance has been issued since the last delivery.
- B4.6 The purchaser may check the percentage of active polymer in the polyacrylamide product after delivery.

### **B5 Payment**

- B5.1 Payment in full will be made by the 20th of the month following that in which deliveries are made and invoiced by the supplier unless otherwise agreed.
- B5.2 Invoices shall state the order number, docket number, and the weight of product (or active ingredient) supplied.

B5.3 Payment will be made on measured quantities unless otherwise agreed.

## **B6 Contract Sums**

B6.1 Suppliers shall submit quotes in NZ\$/tonne or NZ\$/kg for the product (or active ingredient) offered. The quoted price shall allow for delivery, including off-loading to the nominated reception points unless otherwise agreed.

B6.2 The quote shall hold firm for the duration of the contract period.

B6.3 The quote shall be exclusive of GST, but inclusive of any applicable duties or charges.

B6.4 If applicable the exchange rate at the time of quoting shall be advised by the supplier. Payment shall be made taking account of the exchange rate variation. The exchange rate variation shall be calculated on the exchange rate on the day nominated by the supplier in the quotation.

## **B7 Insurance**

The supplier shall make his own arrangements for insurance of the order while in transit to the reception point. Responsibility will pass to the purchaser once the delivery has been made to the purchaser's storage facility.

## **B8 Subletting**

The supplier shall not assign or sublet the contract or any part of the contract without the written consent of the purchaser.

## **B9 Cancellation**

The purchaser shall reserve the right to cancel the contract for non-compliance with the Standard or failure to deliver within the allotted time.

## Appendix C: Audit Checklist

<b>Delivery of Product</b>	<b>Yes</b>	<b>No</b>
Deliveries made on time?	<input type="checkbox"/>	<input type="checkbox"/>
Polyacrylamide product clearly and adequately labelled?	<input type="checkbox"/>	<input type="checkbox"/>
Product delivered in specified containers?	<input type="checkbox"/>	<input type="checkbox"/>
Containers in good condition and defect free?	<input type="checkbox"/>	<input type="checkbox"/>
Correct equipment to enable safe practices during unloading?	<input type="checkbox"/>	<input type="checkbox"/>
<b>Chemical Requirements</b>		
Product certified to NSF Standard 60 (DWSNZ)?	<input type="checkbox"/>	<input type="checkbox"/>
Certificate of compliance with Standard?	<input type="checkbox"/>	<input type="checkbox"/>
Percentage of active polymer in product as specified?	<input type="checkbox"/>	<input type="checkbox"/>
Has method of manufacture changed since entering into contract?	<input type="checkbox"/>	<input type="checkbox"/>
<b>Health and Safety and Environmental Protection</b>		
Is safe practice applied in transport, delivery and off loading?	<input type="checkbox"/>	<input type="checkbox"/>
Is an updated MSDS supplied?	<input type="checkbox"/>	<input type="checkbox"/>
Emergency plans in place for spill containment and clean-up procedures?	<input type="checkbox"/>	<input type="checkbox"/>

## **Appendix D: Some Polyacrylamide Products Commonly used in New Zealand**

- Note: (i) None of these products are specifically endorsed by the NZWWA.  
(ii) This list is not exhaustive.

Crystalfloc B570 PWG

Crystalfloc B570L PWG

Crystalfloc E30 PWG

Crystalfloc E40 PWG

Magnafloc LT20

Magnafloc LT22

Magnafloc LT22S

Profloc CX5I3 PW

## REFERENCES

### *Guidelines and Standards:*

*AWWA Standard for Polyacrylamides.* ANSI/AWWA B453-96, 1996. (Includes addendum AWWA B453a-97)

*Chemicals used for treatment of water intended for human consumption - anionic and nonionic polyacrylamides.* BSI. (Draft) BS EN 1407, 1994.

*Chemicals used for treatment of water intended for human consumption - cationic polyacrylamides.* BSI. (Draft) BS EN 1410, 1994.

*Determination of residual acrylamide monomer in solution and emulsion polymers by column-switching high performance liquid chromatography.* A.M. Tseng. *Journal of Chromatography*, 519:363-368, 1990.

*Drinking-Water Standards for New Zealand.* Ministry of Health, Wellington, 1995. (Or subsequent, current edition).

*Guidelines for the Preparation of Material Safety Data Sheets in New Zealand.* Occupational Safety and Health Service of the Department of Labour, May 1995.

*National Guidelines for Health and Safety in the New Zealand Water Industry.* New Zealand Water and Wastes Association, 1997.

*Standard for the Supply of EPI-DMA Polyamines for Use in Drinking-Water Treatment.* New Zealand Water and Wastes Association, 1999.

*Standard for the Supply of PolyDADMAC for Use in Drinking-Water Treatment.* New Zealand Water and Wastes Association, 1999.

*Polyacrylamides for the Water Treatment.* German Standard (Deutsche Normen). DIN 19 622, 1977.

*Standard 60: Drinking Water Treatment Chemical Health Effects.* National Sanitation Foundation (NSF), 1996

*Standard Methods for the Examination of Water and Wastewater.* 19th Edition. APHA, AWWA, WEF, 1995. (Or subsequent, current edition).


### *Legislation:*

*Health Act.* 1956.

*Health and Safety in Employment Act.* 1992.

*Transport Act.* 1992.





**Standard for the  
Supply of  
EPI-DMA Polyamines  
for Use in  
Drinking-Water  
Treatment**

**March 1999**

# **STANDARD FOR THE SUPPLY OF EPI-DMA POLYAMINES FOR USE IN DRINKING-WATER TREATMENT**

**First Edition**

**March 1999**

This standard was compiled for the Water Supply Managers Sub-Group of the New Zealand Water and Wastes Association and the Ministry of Health by Opus International Consultants.

**ISBN 1-877134-26-0**

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## **FOREWORD**

This Standard shall be used for supply and purchase of EPI-DMA (epichlorohydrin dimethylamine) polyamines intended for drinking-water treatment.

When purchasing product under this Standard, the purchaser shall provide at least the following details.

1. Reference to this Standard.
2. Quantity, form of shipment, and size of containers to be used.
3. Required delivery point and time/frequency.

Any modification of the provisions, definitions or terminology in this Standard must be provided in the purchaser's specifications.

# **1 GENERAL**

## **1.1 Scope**

This Standard covers the supply of EPI-DMA polyamines for use in the treatment of water for drinking-water supply.

## **1.2 Purpose**

The main purpose of this Standard is to provide purchasers, manufacturers, and suppliers with the minimum requirements for EPI-DMA polyamines including physical, chemical and testing requirements.

## **1.3 Application**

The stipulations of this Standard apply only when this document has been referenced, and only to EPI-DMA polyamines when used in the treatment of water for drinking-water supply. It does not cover the use of any other flocculants and/or coagulants.

## **1.4 Uses in Drinking-Water Treatment**

EPI-DMA polyamines are coagulants and coagulant aids (secondary coagulants) used in the treatment of drinking-water supplies.

The purpose of a coagulant is to promote the coagulation of colloidal and smaller particles in the raw water and thereby aid in their removal in subsequent treatment steps.

## **1.5 Description of EPI-DMA Polyamines**

EPI-DMA polyamines are straw to amber coloured liquids. They are polyquaternary polymers produced from the reaction of dimethylamine and epichlorohydrin. Polyquaternary means that the nitrogen atom in the structure is fully alkylated, and thus has very strong positive charge. It is therefore a cationic polyelectrolyte. The polymers have a low to medium molecular weight and a high charge density.

EPI-DMA polyamines are not considered hazardous either by contact, inhalation or by ingestion. However there may be impurities present in the polyamine solution, either unreacted ingredients, or by-products formed from further reactions, which may be hazardous. There is evidence that unreacted epichlorohydrin is likely to be present in many EPI-DMA polyamine products. Epichlorohydrin can be acutely toxic, and is classed by USEPA as a probable human carcinogen.

## **1.6 Manufacture of EPI-DMA Polyamines**

Less than the required amount of epichlorohydrin is added to a solution of dimethylamine in a pressurised reactor. Once this has all been reacted the rest of the epichlorohydrin is added to maximise polymerisation. The reaction is terminated by the addition of a small amount of dimethylamine. There are actually two reactions taking place: the formation of the monomer 2-hydroxy-3-dimethylaminopropyl, and then the formation of the polymer. The finished product may be diluted with water to achieve the desired concentration.

Most EPI-DMA polyamines used in New Zealand for drinking-water treatment are manufactured in the USA, Europe and Australia.

## 1.7 Methods of Dosing

Polyamines are normally dosed directly to water from a mixing or day tank via a positive displacement metering pump.

## 1.8 Definitions

The following definitions shall apply in this Standard:

- 1.8.1 *Certificate of Compliance*: A certificate issued by an IANZ accredited laboratory or IANZ mutually recognised laboratory, which verifies that the product for which it is issued complies with all the applicable requirements of this Standard.
- 1.8.2 *Coagulant*: A substance added during water treatment to bring about destabilisation of colloidal particles. Refer also to Primary Coagulant and Secondary Coagulant.
- 1.8.3 *EPI-DMA polyamines*: EPI-DMA polyamines are straw to amber coloured liquids used as coagulants and coagulant aids in the treatment of drinking-water.
- 1.8.4 *Manufacturer*: The party that manufactures, fabricates, or produces materials or products.
- 1.8.5 *Polyelectrolyte*: A polymer in which some or all of the monomeric units contain ionisable groups (eg, carboxyl or amino groups). Depending upon the type of ionisable group, a polyelectrolyte may be cationic or anionic, although amphoteric types (containing both positive and negative groups) also exist. Polymers without ionisable groups are termed nonionic (and therefore are not strictly speaking polyelectrolytes). However, the word polyelectrolyte is commonly used to include cationic, anionic and nonionic products. Polyelectrolytes are used in water treatment as coagulants, flocculants and filter aids.
- 1.8.6 *Polymer*: A large molecular weight natural or synthetic compound formed into a chain from low molecular weight simple molecules (monomers). Some polymers are made from only one monomer; others contain two or three different monomers.
- 1.8.7 *Primary Coagulant*: A coagulant taking the sole or primary role in the coagulation process. Normally refers to either:
- (i) a cationic polyelectrolyte used as the sole coagulant, or
  - (ii) a metal salt coagulant when used with a polymer, when the polymer acts as a secondary coagulant.
- 1.8.8 *Purchaser*: The person, company or organisation that purchases any materials or works to be performed.
- 1.8.9 *Reception Point*: The point of physical transfer of materials from the supplier to the purchaser.

- 1.8.10 *Secondary Coagulant*: A coagulant assisting in the coagulation process (also called a coagulant aid). Normally refers to a polymer when used in combination with a metal salt, when the metal salt acts as primary coagulant.
- 1.8.11 *Supplier*: The party who supplies materials or service. A supplier may or may not be the manufacturer.
- 1.8.12 *w/w*: Weight per unit weight, for example, g/kg.

## 2 MATERIALS

### 2.1 Physical Properties

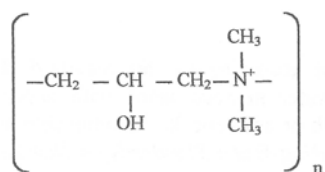
*Physical Description:* The aqueous polymer solution is a viscous, clear, straw to amber colour liquid, free from visible foreign matter, sediment and turbidity.

EPI-DMA polyamines are sold as aqueous solutions in concentrations from less than 10 percent to greater than 65 percent (w/w) active polymer, in a wide range of molecular weights.

EPI-DMA polyamine products may contain measurable amounts of inorganic salts (such as NaCl).

The product is likely to contain other impurities such as dimethylamine, stabilisers, antioxidants, and emulsifiers.

*Molecular Formulae:*



<i>Molecular Weight:</i>	Medium ( $10^5$ - $10^6$ ).
<i>Density:</i>	Typically 1.16 kg/L for 50% w/w polyamine at 20°C.
<i>Solubility in Water:</i>	Miscible at all concentrations.
<i>pH:</i>	Typically 4-7.
<i>Charge Type:</i>	Cationic.
<i>Charge Density:</i>	High.

### 2.2 Specific Product Properties

#### 2.2.1 Minimum Specifications for Determining Specific Product Properties

The minimum specifications for determining specific product properties of EPI-DMA polyamine products shall be:

- (i) visual inspection
- (ii) concentration of active polymer.

The observation of visual appearance shall be carried out by the purchaser, and the other test shall be carried out by the supplier. The standard test for total for concentration of active polymer is detailed in Section 5.4.

#### 2.2.2 Visual Appearance

EPI-DMA polyamines shall be free from insoluble gel, visible foreign matter, sediment and turbidity.



### 2.2.3 Concentration of Active Polymer

This shall be within 90-105% of manufacturer's claimed concentration of active polymer.

## 2.3 Impurities

### 2.3.1 General

2.3.1.1 The EPI-DMA polyamines supplied according to this Standard shall not contain any impurities that when dosed into water in accordance with accepted water treatment practice, may be deleterious to health or aesthetically objectionable as determined by NSF Standard 60 (DWSNZ)<sup>2</sup> and the *Drinking-Water Standards for New Zealand*.

2.3.1.2 All EPI-DMA polyamine products shall be free of any impurities which would require the product to be strained prior to dilution or dosing.

### 2.3.2 Specific Impurity Limits (SIL)

2.3.2.1 Epichlorohydrin levels shall not exceed 5 mg/kg of active polymer (5 ppm or  $5 \times 10^{-4}\%$  by weight).

2.3.2.2 The following organic chlorine-containing residuals shall not exceed 1000 mg/kg of active polymer (1000 ppm or 0.1% by weight)<sup>3</sup>:

- 1,3-dichloro-2-propanol;
- 2,3-dichloro-1-propanol; and
- 3-chloro-1,2-propanediol.

2.3.2.3 The total organic chlorine-containing residuals (by simply adding their concentrations) shall not exceed 2000 mg/kg of active polymer (2000 ppm or 0.2% by weight).

2.3.2.4 Other SILs may be determined using the procedures included in Appendix A (unless set otherwise by the purchaser) to ensure that the product supplied is suitable for drinking-water treatment.

2.3.2.4 SILs shall be based on a maximum dosage of 10 mg active polymer/litre of water, the maximum acceptable value (MAV) of the impurity (taken from the *Drinking-Water Standards for New Zealand*), and a minimum safety factor of 10.

---

<sup>2</sup> It is proposed that manufacturers gain certification to National Sanitation Foundation (NSF) Standard 60, but with evaluation against the *Drinking-Water Standards for New Zealand*. The New Zealand Ministry of Health is currently formalising an arrangement with NSF.

The National Sanitation Foundation is a USA based non-for-profit organisation that carries out third party certification of chemicals and materials used in potable waters. For enquiries, contact the General Manager – Drinking Water Additives. Fax: +1 313 769 0109. Email: [purkiss@nsf.org](mailto:purkiss@nsf.org)

<sup>3</sup> The impurity monochloropropane-diol is presently under scrutiny in EU and UK DWI.

### **3 DELIVERY**

#### **3.1 Packaging and Shipping**

EPI-DMA polyamine products shall be shipped in suitable containers. The container shall be made of materials which will not be damaged in any way by the product, and/or during shipping. The container shall be tightly sealed to prevent leakage and/or contamination. All containers shall be clean, in good condition, and free from defects.

#### **3.2 Labelling**

Each shipment shall bear some means of identification. Each package shall be marked legibly with 'EPI-DMA polyamine', and the following information:

Product Name:  
Net Weight:  
Name of the Manufacturer and/or the Supplier:  
Batch Number:  
Date of Manufacture:  
Concentration of Active Polymer (kg/L):  
Density (kg/L):  
'Use-by' Date (day/month/year):

Packages shall have the appropriate labelling for NSF Standard 60 (DWSNZ) certification, and also be clearly labelled with the words "Complies with the NZWWA Standard for the Supply of EPI-DMA polyamines for Use in Drinking-Water Treatment".

#### **3.3 Unloading and Storage**

- 3.3.1 The purchaser shall ensure that the containers are stored in a cool, dry, well-ventilated, covered designated storage area. The storage area should be away from direct sunlight, strong oxidising agents and acids, and foodstuffs.
- 3.3.2 Containers of EPI-DMA polyamine product shall be delivered on pallets suitable for unloading at the purchaser's premises using a forklift truck or similar.
- 3.3.3 Containers damaged prior to delivery shall be the responsibility of the supplier, and containers damaged during unloading at the purchaser's premises shall be the responsibility of the agent undertaking the unloading. Removal of damaged goods shall be as set out in Section 7.4.2.

## **4 HEALTH, SAFETY AND ENVIRONMENTAL PROTECTION**

### **4.1 General**

Suppliers of EPI-DMA polyamines shall comply with the requirements of the Health and Safety in Employment Act 1992, and the Transport Act 1962. All practicable steps must be taken to protect the purchaser and others in the environment from hazards arising from the transportation, delivery and supply of polyamines.

### **4.2 Material Safety Data Sheets**

- 4.2.1 Within three weeks of award of a contract to supply product, and prior to delivery, the supplier shall provide an updated copy of the Material Safety Data Sheet as detailed in "Guidelines for the Preparation of Material Safety Data Sheets in New Zealand", published by the Occupational Safety and Health Service of the Department of Labour, May 1995.
- 4.2.2 MSDS obtained from other countries, complying for example with ISO, ILO, EC or Worksafe Australia formats, should be modified to include the necessary information detailed in "Guidelines for the Preparation of Material Safety Data Sheets in New Zealand". The additional information should be appended to the MSDS and should be clearly marked to indicate that it is not part of the original MSDS.

### **4.3 Health and Safety Management Plan**

- 4.3.1 A copy of the purchaser's Health and Safety and Environmental Protection Management (HSEPM) Plan shall be made available to the supplier of the polyamines. Any practices by the supplier which do not comply with the Health and Safety Management Plan may be grounds for the termination of a supply contract.
- 4.3.2 The HSEPM Plan shall state that the supplier, their agent or the authorised purchaser's representative responsible for unloading the polyamines, shall immediately report any spills within the grounds of the property in which the reception point is located to the duty water treatment plant (WTP) operator. The duty WTP operator shall be responsible for the removal of the spill and ensuring that the area is safe.

### **4.4 Protective Equipment and Training**

The purchaser and the supplier will be responsible for providing their respective personnel or agents with any necessary training, safety and protective equipment and ensuring it is used as required.

## **5 SAMPLING AND TESTING**

### **5.1 Frequency**

- 5.1.1 The sampling and testing frequency for the concentration of active polymer shall be three monthly, and shall be carried out at the cost of the manufacturer or supplier.
- 5.1.2 The sampling and testing frequency for Specific Impurity Limits and toxicological safety shall be in accordance with the requirements for certification to NSF Standard 60 (DWSNZ), and shall be carried out at the cost of the manufacturer or supplier.

### **5.2 Sampling and Sample Preparation**

The sampling procedure shall be in accordance with the requirements for certification to NSF Standard 60 (DWSNZ).

### **5.3 Testing**

- 5.3.1 The product shall be tested at the manufacturer's or supplier's own cost in order to provide a Certificate of Compliance as required in Section 7.1. Records of sampling and testing of representative samples, process monitoring results, and any other relevant records shall be made available to the purchaser on request.
- 5.3.2 The purchaser may randomly take samples of the product and have these samples analysed for conformance with this Standard. The cost of the analysis shall be paid by the supplier if the material does not meet the requirements of this Standard, and shall be paid by the purchaser if the material does meet the requirements of this Standard.
- 5.3.3 Analytical testing methods shall be as specified in this Standard in Section 5.4.
- 5.3.4 If the analysis of a sample by the purchaser shows the product does not comply with the requirements of this Standard, a notice of non-conformance shall be provided by the purchaser to the supplier in accordance with Section 7.4.1.

### **5.4 Standard Tests**

- 5.4.1. For the standard tests for EPI-DMA polyamines, refer to ANSI/AWWA Standard B452-90:
- |                                     |                        |
|-------------------------------------|------------------------|
| (i) Concentration of active polymer | Sections 4.5 and 4.6.1 |
| (ii) Residual epichlorohydrin       | Section 4.7            |
| (iii) 1,3-dichloro-2-propanol       | Section 4.7            |
| (iv) 2,3-dichloro-1-propanol        | Section 4.7            |
| (v) 3-chloro-1,2-propanediol        | Section 4.7            |
- 5.4.2 For the procedures for toxicological safety, refer to NSF Standard 60.
- 5.4.3 Test methods for specific impurities which are not given in the above Standards shall be those of the current edition of Standard Methods for the Examination of Water and Wastewater (19th edition, 1995 at the time of drafting this specification), unless agreed otherwise.

## **6 SUPPLY CONTRACT**

### **6.1 Contract**

The purchaser may enter into a contract with a supplier for the supply of EPI-DMA polyamine product in accordance with this Standard.

### **6.2 Acceptable Conditions**

Acceptable conditions are outlined in Appendix B of this Standard, or as agreed between the supplier and the purchaser.

## **7 QUALITY ASSURANCE**

### **7.1 Compliance**

7.1.1 For the product supplied to fulfil the purchaser's order, the manufacturer or supplier shall provide the purchaser with:

- (i) proof that the product is certified to NSF Standard 60 (DWSNZ), and
- (ii) a Certificate of Compliance.

The Certificate of Compliance shall state that the product supplied to fulfil the purchaser's order complies with all the applicable requirements of this Standard. The Certificate shall be issued by either an International Accreditation New Zealand (IANZ) accredited laboratory or an IANZ mutually recognised laboratory.

7.1.2 Polyamines manufactured by a process:

- (i) which is certified to ISO9002; and
- (ii) which has been sampled and tested as least every six months for specific product properties, the concentration of residual monomer, and the concentration of active polymer; and
- (iii) for which sampling and testing of the Specific Impurity Limits and toxicological safety has been carried in accordance with NSF Standard 60 (DWSNZ); and
- (iv) for which the certification links every package to a unique batch number

shall be exempt from providing (i) and (ii) of Section 7.1.1 with each batch, but shall provide these if there has been any change to the materials or method of manufacture.

### **7.2 Method of Manufacture**

If the method of manufacture, source and/or quality of raw material used is changed during the period of the supply contract, then this shall be advised to the purchaser (in addition to the requirements under NSF Standard 60) prior to the delivery of the first shipment affected by the changes. Any additional sampling and testing that may be required shall be at the manufacturer's or supplier's cost.

### **7.3 Weight Certificate**

The delivered product shall be weighed over certified weighing machines, and the docket showing the net weight shall be produced upon delivery.

### **7.4 Rejection**

#### **7.4.1 Notice of Non-conformance**

If the EPI-DMA polyamine product delivered does not meet the requirements of this Standard, a Notice of Non-Conformance, detailing the particulars of the non-conformance, shall be provided by the purchaser to the supplier. This must be within ten working days after receipt of the shipment at the delivery point. The notice of non-conformance shall stand unless the supplier notifies the purchaser within five working days after receipt of the notice, that inspection or testing is desired. If the results from the inspection or testing do not show conformance, a referee laboratory agreed to by both parties shall inspect or test

the matter in dispute. The results of the referee analysis shall be accepted as final. The cost of the referee inspection or testing shall be paid by the supplier if the product does not meet the requirements of this Standard, and shall be paid by the purchaser if the product does meet the requirements of this Standard.

#### **7.4.2 Product Removal**

- 7.4.2.1 Upon issue of a Notice of Non-Conformance, as provided for by Section 7.4.1, the supplier shall remove the product from the premises of the purchaser within 7 days or such longer period as may be agreed. Removal of product shall be at no cost to the purchaser.
- 7.4.2.2 If the product simply does not meet the claimed concentration of active polymer, a price adjustment may be agreed between the supplier and the purchaser. In the event that a price adjustment cannot be agreed, the supplier shall remove the product from the premises of the purchaser at no cost to the purchaser.
- 7.4.2.3 The product that shall be removed shall include the rejected product and any other material the rejected product may have contaminated, for example contents of a tank into which a delivery has been unloaded, if required by the purchaser.
- 7.4.2.4 All product removed shall be concurrently replaced with product conforming to this Standard with an appropriate Certificate of Compliance at no cost to the purchaser or such monetary adjustment made as may be mutually agreed.

### **7.5 Audit**

- 7.5.1 The purchaser may wish to carry out an audit of the supplier for conditions of delivery, health, safety, environmental protection and compliance with this Standard.
- 7.5.2 An audit shall only be carried out with due notification and agreement of the supplier. A guide audit checklist has been included as Appendix C to this Standard.

## Appendix A: Specific Impurity Limits

Commercially available EPI-DMA polyamines for the purpose of drinking-water treatment are not known to contribute significant quantities of contaminants that adversely affect the potability of drinking-water.

Specific Impurity Limits (SIL) may be calculated based on a maximum dosage (MD) of polymer/litre of water and the maximum acceptable value (MAV) of a determinand taken from the *Drinking-Water Standards for New Zealand*, 1995. The safety factor (SF) used in the calculation shall be a minimum of 10, which reflects the view that no more than 10 percent of a MAV should be contributed by a given impurity in a water treatment chemical (the "1/10th" rule).

Purchasers may specify more stringent SILs to reflect their individual requirements.

The SIL, values were determined using the following equation:

$$SIL(mg/kg) = \frac{MAV (mg/litre) \times 10^6(mg/kg)}{MD (mg/litre) \times SF}$$

Where:

SIL	=	Specific Impurity Limit
MAV	=	Maximum Acceptable Value
MD	=	Maximum Dosage
SF	=	Safety Factor

An example calculation is as follows:

Epichlorohydrin:	MAV	=	0.0005 mg/litre
	MD	=	10 mg active polymer/litre
	SF	=	10

$$SIL = \frac{0.0005 \times 10^6}{10 \times 10}$$

$$= 5 \text{ mg epichlorohydrin/kg active polymer}$$

For a 0.5 kg active polymer/litre powder this SIL equates as follows:

$$\begin{aligned} SIL &= 5 \text{ mg/kg} \times 0.5 \text{ kg/litre} \\ &= 2.5 \text{ mg epichlorohydrin/litre of product} \end{aligned}$$



## **Appendix B: Model Supply Contract**

### **B1 Contract**

The following provides an outline of acceptable conditions of supply of product, to be included in a contract between a purchaser and a supplier for the supply of EPI-DMA polyamines in accordance with this Standard, or as agreed by the purchaser and the supplier.

### **B2 Contract Period**

A nominated contract period shall be set as part of a supply contract and shall commence from the date of entering into contract.

### **B3 Annual Requirements**

An approximate annual requirement of product shall be provided for the information of the supplier. However no guarantee can be given to these amounts as they will vary with water treatment plant throughput, and customer consumption.

### **B4 Delivery**

B4.1 The reception point for the supply of EPI-DMA polyamines shall be designated and agreed between the supplier and the purchaser.

B4.2 Delivery of an order to the purchaser's specified reception point shall be made within 7 days of receipt of the order or at any other mutually agreed time.

B4.3 Delivery shall be made between the hours of 7.30 am and 4.00 pm Monday to Friday, excluding public holidays, unless a prior arrangement is made between the supplier and the purchaser. The delivery shall be discharged only with the authorisation and in the presence of the purchaser's representative or operating personnel.

B4.4 Delivery dockets shall be provided giving the weight of product. Deliveries shall be weighed over certified weighing machines. Certificates of Compliance shall also be provided as agreed between the supplier and the purchaser.

B4.5 The quality of the product delivered shall comply with this Standard. A Certificate of Compliance with this Standard shall be produced by the supplier with the first delivery, and with each subsequent delivery where a new Certificate of Compliance has been issued since the last delivery.

B4.6 The purchaser may check the percentage of active polymer in the polyacrylamide product after delivery.

### **B5 Payment**

B5.1 Payment in full will be made by the 20th of the month following that in which deliveries are made and invoiced by the supplier unless otherwise agreed.

B5.2 Invoices shall state the order number, docket number, and the weight of product (or active ingredient) supplied.

B5.3 Payment will be made on measured quantities unless otherwise agreed.

## **B6 Contract Sums**

B6.1 Suppliers shall submit quotes in NZ\$/tonne or NZ\$/kg for the product (or active ingredient) offered. The quoted price shall allow for delivery, including off-loading to the nominated reception points unless otherwise agreed.

B6.2 The quote shall hold firm for the duration of the contract period.

B6.3 The quote shall be exclusive of GST, but inclusive of any applicable duties or charges.

B6.4 If applicable the exchange rate at the time of quoting shall be advised by the supplier. Payment shall be made taking account of the exchange rate variation. The exchange rate variation shall be calculated on the exchange rate on the day nominated by the supplier in the quotation.

## **B7 Insurance**

The supplier shall make his own arrangements for insurance of the order while in transit to the reception point. Responsibility will pass to the purchaser once the delivery has been made to the purchaser's storage facility.

## **B8 Subletting**

The supplier shall not assign or sublet the contract or any part of the contract without the written consent of the purchaser.

## **B9 Cancellation**

The purchaser shall reserve the right to cancel the contract for non-compliance with the Standard or failure to deliver within the allotted time.

## Appendix C: Audit Checklist

<b>Delivery of Product</b>	<b>Yes</b>	<b>No</b>
Deliveries made on time?	<input type="checkbox"/>	<input type="checkbox"/>
EPI-DMA Polyamine product clearly and adequately labelled?	<input type="checkbox"/>	<input type="checkbox"/>
Product delivered in specified containers?	<input type="checkbox"/>	<input type="checkbox"/>
Containers in good condition and defect free?	<input type="checkbox"/>	<input type="checkbox"/>
Correct equipment to enable safe practices during unloading?	<input type="checkbox"/>	<input type="checkbox"/>
<b>Chemical Requirements</b>		
Product certified to NSF Standard 60 (DWSNZ)?	<input type="checkbox"/>	<input type="checkbox"/>
Certificate of compliance with Standard?	<input type="checkbox"/>	<input type="checkbox"/>
Percentage of active polymer in product as specified?	<input type="checkbox"/>	<input type="checkbox"/>
Has method of manufacture changed since entering into contract?	<input type="checkbox"/>	<input type="checkbox"/>
<b>Health and Safety and Environmental Protection</b>		
Is safe practice applied in transport, delivery and off loading?	<input type="checkbox"/>	<input type="checkbox"/>
Is an updated MSDS supplied?	<input type="checkbox"/>	<input type="checkbox"/>
Emergency plans in place for spill containment and clean-up procedures?	<input type="checkbox"/>	<input type="checkbox"/>

## **Appendix D: Some EPI-DMA Polyamine Products Commonly used in New Zealand**

- Note: (i) None of these products are specifically endorsed by the NZWWA.  
(ii) This list is not exhaustive.

Magnafloc LT31

Profloc 9ZA

## REFERENCES

### *Guidelines and Standards:*

*AWWA Standard for EPI-DMA polyamines.* ANSI/AWWA B452-90, 1996. (Includes addendum AWWA B452a-97)

*Drinking-Water Standards for New Zealand.* Ministry of Health, Wellington, 1995. (Or subsequent, current edition).

*Chemicals used for treatment of water intended for human consumption - polyamines.* BSI. (Draft) BS EN 1409, 1994.

*Guidelines for the Preparation of Material Safety Data Sheets in New Zealand.* Occupational Safety and Health Service of the Department of Labour, May 1995.

*National Guidelines for Health and Safety in the New Zealand Water Industry.* New Zealand Water and Wastes Association, 1997.

*Standard for the Supply of Polyacrylamides for Use in Drinking-Water Treatment.* New Zealand Water and Wastes Association, 1999.

*Standard for the Supply of PolyDADMAC for Use in Drinking-Water Treatment.* New Zealand Water and Wastes Association, 1999.

*Standard 60: Drinking Water Treatment Chemical Health Effects.* National Sanitation Foundation (NSF), 1996


*Standard Methods for the Examination of Water and Wastewater.* 19th Edition. APHA, AWWA, WEF, 1995. (Or subsequent, current edition).

### *Legislation:*

*Health Act.* 1956.

*Health and Safety in Employment Act.* 1992.

*Transport Act.* 1992.



**Standard for the  
Supply of  
PolyaDADMAC  
for Use in  
Drinking-Water  
Treatment**

**March 1999**

# **STANDARD FOR THE SUPPLY OF POLYDADMAC FOR USE IN DRINKING-WATER TREATMENT**

**First Edition**

**1999**

This standard was compiled for the Water Supply Managers Sub-Group of the New Zealand Water and Wastes Association and the Ministry of Health by Opus International Consultants.

**ISBN 1-877134-25-2**

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## **FOREWORD**

This Standard shall be used for supply and purchase of PolyDADMAC (polydiallyldimethylammonium chloride) intended for drinking-water treatment.

When purchasing product under this Standard, the purchaser shall provide at least the following details.

1. Reference to this Standard.
2. Quantity, form of shipment, and size of containers to be used.
3. Required delivery point and time/frequency.

Any modification of the provisions, definitions or terminology in this Standard must be provided in the purchaser's specifications.

# **1 GENERAL**

## **1.1 Scope**

This Standard covers the supply of polyDADMAC for use in the treatment of water for drinking-water supply.

## **1.2 Purpose**

The main purpose of this Standard is to provide purchasers, manufacturers, and suppliers with the minimum requirements for polyDADMAC including physical, chemical and testing requirements.

## **1.3 Application**

The stipulations of this Standard apply only when this document has been referenced, and only to polyDADMAC when used in the treatment of water for drinking-water supply. It does not cover the use of any other flocculants and/or coagulants.

## **1.4 Uses in Drinking-Water Treatment**

PolyDADMAC is a coagulant and a coagulant aid (secondary coagulants) used in the treatment of drinking-water supplies.

The purpose of a coagulant is to promote the coagulation of colloidal and smaller particles in the raw water and thereby aid in their removal in subsequent treatment steps.

## **1.5 Description of PolyDADMAC**

PolyDADMAC is a colourless to pale yellow liquid. It is a polyquaternary polymer produced from the reaction of an aqueous solution of DADMAC monomer. Polyquaternary means that the nitrogen atom in the structure is fully alkylated, and thus has very strong positive charge. It is therefore a cationic polyelectrolyte. The polymers have a low to medium molecular weight and a high charge density.

PolyDADMAC is not considered hazardous either by contact, inhalation or by ingestion. There is very little literature on the toxicity of both polyDADMAC, and the DADMAC monomer, but it is generally regarded as very low.

## **1.6 Manufacture of PolyDADMAC**

The manufacture of polyDADMAC involved two sequential steps: formation of the monomer, and its polymerisation. The monomer is usually formed by a reaction of a stoichiometric excess of allyl chloride with dimethyl amine in an aqueous solution. After the DADMAC monomer is purged of various by-products, and stabilised, it is then polymerised using an initiator compound.

Most polyDADMAC used in New Zealand for drinking-water treatment are manufactured in the USA, Europe and Australia.

## 1.7 Methods of Dosing

PolyDADMAC is normally dosed directly to water from a mixing or day tank via a positive displacement metering pump.

## 1.8 Definitions

The following definitions shall apply in this Standard:

- 1.8.1 *Certificate of Compliance*: A certificate issued by an IANZ accredited laboratory or IANZ mutually recognised laboratory, which verifies that the product for which it is issued complies with all the applicable requirements of this Standard.
- 1.8.2 *Coagulant*: A substance added during water treatment to bring about destabilisation of colloidal particles. Refer also to Primary Coagulant and Secondary Coagulant.
- 1.8.3 *Manufacturer*: The party that manufactures, fabricates, or produces materials or products.
- 1.8.4 *PolyDADMAC*: PolyDADMAC (polydiallyldimethylammonium chloride) is a colourless to pale yellow liquid used as a coagulant and a coagulant aid in the treatment of drinking-water.
- 1.8.5. *Polyelectrolyte*: A polymer in which some or all of the monomeric units contain ionisable groups (eg, carboxyl or amino). Depending upon the type of ionisable group, a polyelectrolyte may be cationic or anionic, although amphoteric types (containing both positive and negative groups) also exist. Polymers without ionisable groups are termed nonionic (and therefore are not strictly speaking polyelectrolytes). However, the word polyelectrolyte is commonly used to include cationic, anionic and nonionic products. Polyelectrolytes are used in water treatment as coagulants, flocculants and filter aids.
- 1.8.6 *Polymer*: A large molecular weight natural or synthetic compound formed into a chain from low molecular weight simple molecules (monomers). Some polymers are made from only one monomer; others contain two or three different monomers.
- 1.8.7 *Primary Coagulant*: A coagulant taking the sole or primary role in the coagulation process. Normally refers to either:
- (i) a cationic polyelectrolyte used as the sole coagulant, or
  - (ii) a metal salt coagulant when used with a polymer, when the polymer acts as a secondary coagulant.
- 1.8.8 *Purchaser*: The person, company or organisation that purchases any materials or works to be performed.
- 1.8.9 *Reception Point*: The point of physical transfer of materials from the supplier to the purchaser.
- 1.8.10 *Secondary Coagulant*: A coagulant assisting in the coagulation process (also called a coagulant aid). Normally refers to a polymer when used in combination with a metal salt, when the metal salt acts as primary coagulant.

- 
- 1.8.11 *Supplier*: The party who supplies materials or service. A supplier may or may not be the manufacturer.
- 1.8.12 *w/w*: Weight per unit weight, for example, g/kg.

## 2 MATERIALS

### 2.1 Physical Properties

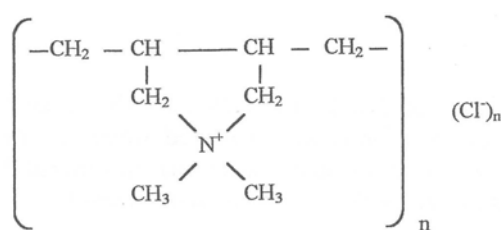
*Physical Description:* The aqueous polymer solution is a viscous, clear, colourless to pale yellow liquid, free from visible foreign matter, sediment and turbidity.

PolyDADMAC is sold as an aqueous solutions in concentrations equal to or greater than 10 percent, and less than or equal to 50 percent (w/w) active polymer, in various molecular weight ranges.

As a result of the manufacturing process, sodium chloride or another chloride-containing salt will be a constituent of the product solution. The amount of salt present will vary, depending on the weight percent of polyDADMAC in each product.

The product is likely to contain other impurities such as dimethylamine, allyl chloride, diallyl ether, 5-hexanal, as well as initiators, stabilisers, antioxidants, and emulsifiers.

*Molecular Formulae:*



<i>Molecular Weight:</i>	Medium ( $10^5$ - $10^6$ ).
<i>Density:</i>	Typically 1.09 kg/L for 40% w/w polyDADMAC at 20°C.
<i>Solubility in Water:</i>	Miscible at all concentrations.
<i>pH:</i>	Typically 4-7.
<i>Charge Type:</i>	Cationic.
<i>Charge Density:</i>	High.

### 2.2 Specific Product Properties

#### 2.2.1 Minimum Specifications for Determining Specific Product Properties

The minimum specifications for determining specific product properties of polyDADMAC products shall be:

- (i) visual inspection
- (ii) concentration of active polymer.

The observation of visual appearance shall be carried out by the purchaser, and the other test shall be carried out by the supplier. The standard test for total for concentration of active polymer is detailed in Section 5.4.

#### 2.2.2 Visual Appearance

PolyDADMAC shall be free from insoluble gel, visible foreign matter, sediment and turbidity.

### 2.2.3 Concentration of Active Polymer

This shall be within 90-105% of manufacturer's claimed concentration of active polymer.

## 2.3 Impurities

### 2.3.1 General

2.3.1.1 The PolyDADMAC supplied according to this Standard shall not contain any impurities that, when dosed into water in accordance with accepted water treatment practice, may be deleterious to health or aesthetically objectionable as determined by NSF Standard 60 (DWSNZ)<sup>4</sup> and the *Drinking-Water Standards for New Zealand*.

2.3.1.2 All polyDADMAC products shall be free of any impurities which would require the product to be strained prior to dilution or dosing.

### 2.3.2 Specific Impurity Limits (SIL)

2.3.2.1 DADMAC monomer levels shall not exceed 20 g/kg of active polymer (20,000 ppm or 2% by weight)<sup>5</sup>.

2.3.2.2 Other SILs may be determined using the procedures included in Appendix A (unless set otherwise by the purchaser) to ensure that the product supplied is suitable for drinking-water treatment.

2.3.2.3 SILs shall be based on a maximum dosage of 10 mg active polymer/litre of water, the maximum acceptable value (MAV) of the impurity (taken from the *Drinking-Water Standards for New Zealand*), and a minimum safety factor of 10.

---

<sup>4</sup> It is proposed that manufacturers gain certification to National Sanitation Foundation (NSF) Standard 60, but with evaluation against the *Drinking-Water Standards for New Zealand*. The New Zealand Ministry of Health is currently formalising an arrangement with NSF.

The National Sanitation Foundation is a USA based non-for-profit organisation that carries out third party certification of chemicals and materials used in potable waters. For enquiries, contact the General Manager – Drinking Water Additives. Fax: +1 313 769 0109. Email: purkiss@nsf.org

<sup>5</sup> Concentration limit based on AWWA Standard for PolyDADMAC and the Report of the 93<sup>rd</sup> Session of the NHMRC.

### **3 DELIVERY**

#### **3.1 Packaging and Shipping**

PolyDADMAC product shall be shipped in suitable containers. The container shall be made of materials which will not be damaged in any way by the product, and/or during shipping. The container shall be tightly sealed to prevent leakage and/or contamination. All containers shall be clean, in good condition, and free from defects.

#### **3.2 Labelling**

Each shipment shall bear some means of identification. Each package shall be marked legibly with 'polyDADMAC', and the following information:

Product Name:  
Net Weight:  
Name of the Manufacturer and/or the Supplier:  
Batch Number:  
Date of Manufacture:  
Concentration of Active Polymer (kg/L):  
Density (kg/L):  
'Use-by' Date (day/month/year):

Packages shall have the appropriate labelling for NSF Standard 60 (DWSNZ) certification, and also be clearly labelled with the words "Complies with the NZWWA Standard for the Supply of PolyDADMAC for Use in Drinking-Water Treatment".

#### **3.3 Unloading and Storage**

- 3.3.1 The purchaser shall ensure that the containers are stored in a cool, dry, well-ventilated, covered designated storage area. The storage area should be away from direct sunlight, strong oxidising agents and acids, and foodstuffs.
- 3.3.2 Containers of polyDADMAC product shall be delivered on pallets suitable for unloading at the purchaser's premises using a forklift truck or similar.
- 3.3.3 Containers damaged prior to delivery shall be the responsibility of the supplier, and containers damaged during unloading at the purchaser's premises shall be the responsibility of the agent undertaking the unloading. Removal of damaged goods shall be as set out in Section 7.4.2.

## **4 HEALTH, SAFETY AND ENVIRONMENTAL PROTECTION**

### **4.1 General**

Suppliers of polyDADMAC shall comply with the requirements of the Health and Safety in Employment Act 1992, and the Transport Act 1962. All practicable steps must be taken to protect the purchaser and others in the environment from hazards arising from the transportation, delivery and supply of polyDADMAC.

### **4.2 Material Safety Data Sheets**

4.2.1 Within three weeks of award of a contract to supply product, and prior to delivery, the supplier shall provide an updated copy of the Material Safety Data Sheet as detailed in "Guidelines for the Preparation of Material Safety Data Sheets in New Zealand", published by the Occupational Safety and Health Service of the Department of Labour, May 1995.

4.2.2 MSDS obtained from other countries, complying for example with ISO, ILO, EC or Worksafe Australia formats, should be modified to include the necessary information detailed in "Guidelines for the Preparation of Material Safety Data Sheets in New Zealand". The additional information should be appended to the MSDS and should be clearly marked to indicate that it is not part of the original MSDS.

### **4.3 Health and Safety Management Plan**

4.3.1 A copy of the purchaser's Health and Safety and Environmental Protection Management (HSEPM) Plan shall be made available to the supplier of the polyDADMAC. Any practices by the supplier which do not comply with the Health and Safety Management Plan may be grounds for the termination of a supply contract.

4.3.2 The HSEPM Plan shall state that the supplier, their agent or the authorised purchaser's representative responsible for unloading the polyDADMAC, shall immediately report any spills within the grounds of the property in which the reception point is located to the duty water treatment plant (WTP) operator. The duty WTP operator shall be responsible for the removal of the spill and ensuring that the area is safe.

### **4.4 Protective Equipment and Training**

The purchaser and the supplier will be responsible for providing their respective personnel or agents with any necessary training, safety and protective equipment and ensuring it is used as required.



## **5 SAMPLING AND TESTING**

### **5.1 Frequency**

- 5.1.1 The sampling and testing frequency for the concentration of active polymer shall be three monthly, and shall be carried out at the cost of the manufacturer or supplier.
- 5.1.2 The sampling and testing frequency for Specific Impurity Limits and toxicological safety shall be in accordance with the requirements for certification to NSF Standard 60 (DWSNZ), and shall be carried out at the cost of the manufacturer or supplier.

### **5.2 Sampling and Sample Preparation**

The sampling procedure shall be in accordance with the requirements for certification to NSF Standard 60 (DWSNZ).

### **5.3 Testing**

- 5.3.1 The product shall be tested at the manufacturer's or supplier's own cost in order to provide a Certificate of Compliance as required in Section 7.1. Records of sampling and testing of representative samples, process monitoring results, and any other relevant records shall be made available to the purchaser on request.
- 5.3.2 The purchaser may randomly take samples of the product and have these samples analysed for conformance with this Standard. The cost of the analysis shall be paid by the supplier if the material does not meet the requirements of this Standard, and shall be paid by the purchaser if the material does meet the requirements of this Standard.
- 5.3.3 Analytical testing methods shall be as specified in this Standard in Section 5.4.
- 5.3.4 If the analysis of a sample by the purchaser shows the product does not comply with the requirements of this Standard, a notice of non-conformance shall be provided by the purchaser to the supplier in accordance with Section 7.4.1.

### **5.4 Standard Tests**

- 5.4.1. For the standard tests for polyDADMAC, refer to ANSI/AWWA Standard B451-92:

(i) Concentration of active polymer	Section 4.5
(ii) Residual DADMAC monomer	Section 4.5
(iii) Concentration of NaCl	Section 4.5

- 5.4.2 For the procedures for toxicological safety, refer to NSF Standard 60.

- 5.4.3 Test methods for specific impurities which are not given in the above Standards shall be those of the current edition of Standard Methods for the Examination of Water and Wastewater (19th edition, 1995 at the time of drafting this specification), unless agreed otherwise.

## **6 SUPPLY CONTRACT**

### **6.1 Contract**

The purchaser may enter into a contract with a supplier for the supply of polyDADMAC product in accordance with this Standard.

### **6.2 Acceptable Conditions**

Acceptable conditions are outlined in Appendix B of this Standard, or as agreed between the supplier and the purchaser.

## **7 QUALITY ASSURANCE**

### **7.1 Compliance**

7.1.1 For the product supplied to fulfil the purchaser's order, the manufacturer or supplier shall provide the purchaser with:

- (i) proof that the product is certified to NSF Standard 60 (DWSNZ), and
- (ii) a Certificate of Compliance.

The Certificate of Compliance shall state that the product supplied to fulfil the purchaser's order complies with all the applicable requirements of this Standard. The Certificate shall be issued by either an International Accreditation New Zealand (IANZ) accredited laboratory or an IANZ mutually recognised laboratory.

7.1.2 PolyDADMAC manufactured by a process:

- (i) which is certified to ISO9002; and
- (ii) which has been sampled and tested as least every six months for specific product properties, the concentration of residual monomer, and the concentration of active polymer; and
- (iii) for which sampling and testing of the Specific Impurity Limits and toxicological safety has been carried in accordance with NSF Standard 60 (DWSNZ); and
- (iv) for which the certification links every package to a unique batch number

shall be exempt from providing (i) and (ii) of Section 7.1.1 with each batch, but shall provide these if there has been any change to the materials or method of manufacture.

### **7.2 Method of Manufacture**

If the method of manufacture, source and/or quality of raw material used is changed during the period of the supply contract, then this shall be advised to the purchaser (in addition to the requirements under NSF Standard 60) prior to the delivery of the first shipment affected by the changes. Any additional sampling and testing that may be required shall be at the manufacturer's or supplier's cost.

### **7.3 Weight Certificate**

The delivered product shall be weighed over certified weighing machines, and the docket showing the net weight shall be produced upon delivery.

### **7.4 Rejection**

#### **7.4.1 Notice of Non-conformance**

If the polyDADMAC product delivered does not meet the requirements of this Standard, a Notice of Non-Conformance, detailing the particulars of the non-conformance, shall be provided by the purchaser to the supplier. This must be within ten working days after receipt of the shipment at the delivery point. The notice of non-conformance shall stand unless the supplier notifies the purchaser within five working days after receipt of the notice, that inspection or testing is desired. If the results from the inspection or testing do not show conformance, a referee laboratory agreed to by both parties shall inspect or test

the matter in dispute. The results of the referee analysis shall be accepted as final. The cost of the referee inspection or testing shall be paid by the supplier if the product does not meet the requirements of this Standard, and shall be paid by the purchaser if the product does meet the requirements of this Standard.

#### **7.4.2 Product Removal**

7.4.2.1 Upon issue of a Notice of Non-Conformance, as provided for by Section 7.4.1, the supplier shall remove the product from the premises of the purchaser within 7 days or such longer period as may be agreed. Removal of product shall be at no cost to the purchaser.

7.4.2.2 If the product simply does not meet the claimed concentration of active polymer, a price adjustment may be agreed between the supplier and the purchaser. In the event that a price adjustment cannot be agreed, the supplier shall remove the product from the premises of the purchaser at no cost to the purchaser.

7.4.2.3 The product that shall be removed shall include the rejected product and any other material the rejected product may have contaminated, for example contents of a tank into which a delivery has been unloaded, if required by the purchaser.

7.4.2.4 All product removed shall be concurrently replaced with product conforming to this Standard with an appropriate Certificate of Compliance at no cost to the purchaser or such monetary adjustment made as may be mutually agreed.

### **7.5 Audit**

7.5.1 The purchaser may wish to carry out an audit of the supplier for conditions of delivery, health, safety, environmental protection and compliance with this Standard.

7.5.2 An audit shall only be carried out with due notification and agreement of the supplier. A guide audit checklist has been included as Appendix C to this Standard.

## Appendix A: Specific Impurity Limits

Commercially available PolyDADMAC for the purpose of drinking-water treatment is not known to contribute significant quantities of contaminants that adversely affect the potability of drinking-water.

Specific Impurity Limits (SIL) may be calculated based on a maximum dosage (MD) of polymer/litre of water and the maximum acceptable value (MAV) of a determinand taken from the *Drinking-Water Standards for New Zealand*, 1995. The safety factor (SF) used in the calculation shall be a minimum of 10, which reflects the view that no more than 10 percent of a MAV should be contributed by a given impurity in a water treatment chemical (the "1/10th" rule).

Purchasers may specify more stringent SILs to reflect their individual requirements.

The SIL, values were determined using the following equation:

$$SIL(mg/kg) = \frac{MAV (mg/litre) \times 10^6(mg/kg)}{MD (mg/litre) \times SF}$$

Where:

SIL	=	Specific Impurity Limit
MAV	=	Maximum Acceptable Value
MD	=	Maximum Dosage
SF	=	Safety Factor

An example calculation is as follows:

Barium <sup>6</sup> :	MAV	=	0.7 mg/litre
	MD	=	10 mg active polymer/litre
	SF	=	10

$$SIL = \frac{0.7 \times 10^6}{10 \times 10}$$

= 7000 mg barium/kg active polymer

= 7 g barium/kg active polymer

For a 0.4 kg active polymer/litre powder this SIL equates as follows:

$$SIL = 7 \text{ g/kg} \times 0.4 \text{ kg/litre}$$

$$= 2.8 \text{ g barium/litre of product}$$

<sup>6</sup> Note that barium is not a known impurity in polyDADMAC, and is used only as an illustrative example.

## **Appendix B: Model Supply Contract**

### **B1 Contract**

The following provides an outline of acceptable conditions of supply of product, to be included in a contract between a purchaser and a supplier for the supply of polyDADMAC in accordance with this Standard, or as agreed by the purchaser and the supplier.

### **B2 Contract Period**

A nominated contract period shall be set as part of a supply contract and shall commence from the date of entering into contract.

### **B3 Annual Requirements**

An approximate annual requirement of product shall be provided for the information of the supplier. However no guarantee can be given to these amounts as they will vary with water treatment plant throughput, and customer consumption.

### **B4 Delivery**

B4.1 The reception point for the supply of PolyDADMAC shall be designated and agreed between the supplier and the purchaser.

B4.2 Delivery of an order to the purchaser's specified reception point shall be made within 7 days of receipt of the order or at any other mutually agreed time.

B4.3 Delivery shall be made between the hours of 7.30 am and 4.00 pm Monday to Friday, excluding public holidays, unless a prior arrangement is made between the supplier and the purchaser. The delivery shall be discharged only with the authorisation and in the presence of the purchaser's representative or operating personnel.

B4.4 Delivery dockets shall be provided giving the weight of product. Deliveries shall be weighed over certified weighing machines. Certificates of Compliance shall also be provided as agreed between the supplier and the purchaser.

B4.5 The quality of the product delivered shall comply with this Standard. A Certificate of Compliance with this Standard shall be produced by the supplier with the first delivery, and with each subsequent delivery where a new Certificate of Compliance has been issued since the last delivery.

B4.6 The purchaser may check the percentage of active polymer in the polyacrylamide product after delivery.

### **B5 Payment**

B5.1 Payment in full will be made by the 20th of the month following that in which deliveries are made and invoiced by the supplier unless otherwise agreed.

B5.2 Invoices shall state the order number, docket number, and the weight of product (or active ingredient) supplied.

B5.3 Payment will be made on measured quantities unless otherwise agreed.

## **B6 Contract Sums**

B6.1 Suppliers shall submit quotes in NZ\$/tonne or NZ\$/kg for the product (or active ingredient) offered. The quoted price shall allow for delivery, including off-loading to the nominated reception points unless otherwise agreed.

B6.2 The quote shall hold firm for the duration of the contract period.

B6.3 The quote shall be exclusive of GST, but inclusive of any applicable duties or charges.

B6.4 If applicable the exchange rate at the time of quoting shall be advised by the supplier. Payment shall be made taking account of the exchange rate variation. The exchange rate variation shall be calculated on the exchange rate on the day nominated by the supplier in the quotation.

## **B7 Insurance**

The supplier shall make his own arrangements for insurance of the order while in transit to the reception point. Responsibility will pass to the purchaser once the delivery has been made to the purchaser's storage facility.

## **B8 Subletting**

The supplier shall not assign or sublet the contract or any part of the contract without the written consent of the purchaser.

## **B9 Cancellation**

The purchaser shall reserve the right to cancel the contract for non-compliance with the Standard or failure to deliver within the allotted time.

## Appendix C: Audit Checklist

<b>Delivery of Product</b>	<b>Yes</b>	<b>No</b>
Deliveries made on time?	<input type="checkbox"/>	<input type="checkbox"/>
PolyDADMAC product clearly and adequately labelled?	<input type="checkbox"/>	<input type="checkbox"/>
Product delivered in specified containers?	<input type="checkbox"/>	<input type="checkbox"/>
Containers in good condition and defect free?	<input type="checkbox"/>	<input type="checkbox"/>
Correct equipment to enable safe practices during unloading?	<input type="checkbox"/>	<input type="checkbox"/>
 <b>Chemical Requirements</b>		
Product certified to NSF Standard 60 (DWSNZ)?	<input type="checkbox"/>	<input type="checkbox"/>
Certificate of compliance with Standard?	<input type="checkbox"/>	<input type="checkbox"/>
Percentage of active polymer in product as specified?	<input type="checkbox"/>	<input type="checkbox"/>
Has method of manufacture changed since entering into contract?	<input type="checkbox"/>	<input type="checkbox"/>
 <b>Health and Safety and Environmental Protection</b>		
Is safe practice applied in transport, delivery and off loading?	<input type="checkbox"/>	<input type="checkbox"/>
Is an updated MSDS supplied?	<input type="checkbox"/>	<input type="checkbox"/>
Emergency plans in place for spill containment and clean-up procedures?	<input type="checkbox"/>	<input type="checkbox"/>



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## **Appendix D: Some PolyDADMAC Products Commonly used in New Zealand**

- Note: (i) None of these products are specifically endorsed by the NZWWA.  
(ii) This list is not exhaustive.

Crystalfloc L3RC

NALCO 8103

## REFERENCES

### *Guidelines and Standards:*

*AWWA Standard for PolyDADMAC.* ANSI/AWWA B451-92, 1992. (Includes addendum AWWA B451a-97)

*Drinking-Water Standards for New Zealand.* Ministry of Health, Wellington, 1995. (Or subsequent, current edition).

*Chemicals used for treatment of water intended for human consumption - polyDADMAC.* BSI. (Draft) BS EN 1408, 1994.

*Guidelines for the Preparation of Material Safety Data Sheets in New Zealand.* Occupational Safety and Health Service of the Department of Labour, May 1995.

*National Guidelines for Health and Safety in the New Zealand Water Industry.* New Zealand Water and Wastes Association, 1997.

*Standard for the Supply of Polyacrylamides for Use in Drinking-Water Treatment.* New Zealand Water and Wastes Association, 1999.

*Standard for the Supply of EPI-DMA Polyamines for Use in Drinking-Water Treatment.* New Zealand Water and Wastes Association, 1999.

*Report of the Ninety-Third Session.* National Health and Medical Research Council (NHMRC), Australia, 1982.

*Standard 60: Drinking Water Treatment Chemical Health Effects.* National Sanitation Foundation (NSF), 1996

*Standard Methods for the Examination of Water and Wastewater.* 19th Edition. APHA, AWWA, WEF, 1995. (Or subsequent, current edition).

### *Legislation:*

*Health Act.* 1956.

*Health and Safety in Employment Act.* 1992.

*Transport Act.* 1992.