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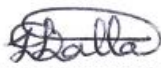



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## 1. INTRODUCTION

Eskom uses a variety of chemicals in the water and waste water treatment processes. The basis of design for water treatment processes considers a specific quality of chemicals received. The impacts of non-compliant chemicals include impurities entering plant systems with the consequent potential for multi-unit shutdown, and potential corrosion of plant components. These impacts affect the efficiency of treatment processes and the compliance with chemistry specifications in the process.

The management of the delivery and receipt of the bulk chemicals used in the Water Treatment processes lies with the Power Station Chemical Services personnel. These bulk chemicals are contracted and managed centrally within Eskom for a period of typically five years, with each Power Station placing orders via the main contract when required.

Guidance is required for the Chemical Services/Chemistry personnel to ensure that the supplied chemicals meet the desired quality and purity stipulated in the contract as well as the actions to be taken in the event of non-conformance.

## 2. SUPPORTING CLAUSES

### 2.1 SCOPE

This guideline specifies the actions necessary by the Chemical Services / Chemistry personnel to ensure that the bulk chemicals delivered to Eskom sites comply with the applicable specification. It also outlines the actions to be taken should these chemicals not conform to the specifications.

#### 2.1.1 Purpose

The purpose of this document is to provide guidance on the delivery and receipt of bulk chemicals to ensure the chemicals offloaded into bulk chemical tanks comply with the specifications and that the integrity of the Eskom asset is maintained. This document focuses on the quality of the chemicals received and does not address plant related design issues.

#### 2.1.2 Applicability

This document shall apply throughout Eskom Generation Division where bulk chemicals are received. Although the guideline does not detail the specific considerations applicable to the delivery of all chemicals i.e. those in Intermediate Bulk Containers (up to 1m<sup>3</sup> volume) and bulk oils, the general principles as outlined in this document are applicable.

### 2.2 NORMATIVE/INFORMATIVE REFERENCES

Parties using this document shall apply the most recent edition of the documents listed in the following paragraphs.

#### 2.2.1 Normative

- [1] ISO 9001 Quality Management Systems.
- [2] 240-44175038 Control of Non-Conforming Product or Service Procedure
- [3] RWE Npower Technical Procedure, The Reception and Unloading of Bulk Water Treatment Chemicals, October 2008

#### 2.2.2 Informative

- [4] [http://serc.carleton.edu/microbelife/research\\_methods/biogeochemical/ic.html](http://serc.carleton.edu/microbelife/research_methods/biogeochemical/ic.html)
- [5] Manual for Testing of Water and Wastewater Treatment Chemicals, SD Freese, DL Trollip & DJ Nozaic, WRC Report No. K5/1184 (2003)

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[6] KAA-641 Control of Receipt of Materials, Nuclear Restricted

[7] KAA-733 Monitoring of Receipt Inspection Processes, Nuclear Restricted

## 2.3 DEFINITIONS/TERMINOLOGY

Definition	Description
Atomic Absorption Spectroscopy	A spectro-analytical procedure for the quantitative determination of elemental metallic species using the absorption of optical radiation (light) by free atoms in the gaseous state.
Bulk Liquid Chemical	Any liquid chemical delivered to site and offloaded by tanker into a storage vessel.
Inductively Coupled Plasma-Optical Emission Spectrometry	Spectro-analytical procedure for the quantitative determination of elemental metals or derivative compounds based on the emission spectra specific to that element or compound.
Ion Chromatography	An analytical process that allows the separation of cations or anions based on their affinity to the ion exchanger and detection of the concentration of the aforesaid cation or anion based on comparison with pre-prepared calibration curves. Detection in aqueous solution is generally by conductivity. UV photometry and fluorescence detectors are sometimes used but mostly for specialised applications.

### 2.3.1 Disclosure Classification

**Controlled Disclosure:** Controlled Disclosure to external parties (either enforced by law, or discretionary).

## 2.4 ABBREVIATIONS

Abbreviation	Description
AAS	Atomic Absorption Spectroscopy
As	Arsenic
CaO	Calcium Oxide
Cl	Chloride
Cl <sub>2</sub>	Chlorine
CO <sub>3</sub>	Carbonate
COA	Certificate of Analysis
Fe	Iron
H <sub>2</sub> O	Water
HCl	Hydrochloric Acid
Hg	Mercury
ICP-OES	Inductively Coupled Plasma-Optical Emission Spectrometry
LIMS	Laboratory Information Management System
m/m	Mass per unit mass
ml	Millilitre
Na	Sodium
NaOH	Sodium Hydroxide

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Abbreviation	Description
NO <sub>3</sub>	Nitrate
O <sub>2</sub>	Oxygen
Pb	Lead
ppb	Parts per billion
ppm	Parts per million or equivalent as mg l <sup>-1</sup>
SANS	South African National Standards
SiO <sub>2</sub>	Silica
SO <sub>4</sub>	Sulfate
µm	Micrometer

## 2.5 ROLES AND RESPONSIBILITIES

The Power Station Chemical Services Manager/Site Manager shall be responsible for the implementation of this Guideline and ensuring that the requirements are met.

The Corporate Consultant (Power Plant Chemistry) (PEIC) is responsible for review of compliance with the requirements of this Guideline.

The Centre of Excellence Manager (Chemical) within Group Technology Engineering is the custodian of this Guideline and shall be responsible for periodic review and updating.

The Contract Manager is responsible to ensure the requirements as per the National Contract are adhered to and will address any deficiencies with the suppliers as identified by the Chemical Services Managers.

The contractor is responsible to ensure the chemicals are delivered as per the stipulated contract qualities and volumes, is responsible to obtain the samples from the tanker prior to offloading and is responsible for the safe offloading of the bulk chemicals into Eskom's Bulk Chemical Storage Tanks.

## 2.6 PROCESS FOR MONITORING

Periodic reviews shall be conducted to ensure continuous compliance to this guideline.

## 2.7 RELATED/SUPPORTING DOCUMENTS

[8] 240-44175038 Control of Non-Conforming Product or Service Procedure

[9] KAA-641 Control of Receipt of Materials, Nuclear Restricted, Rev 6

## 3. DELIVERY OF CHEMICALS

The following safety, operational and administrative requirements need to be considered:

- Personnel involved
- Safety procedures and equipment
- Pre-delivery checks
- Barricading of the delivery area and connection of delivery tanker
- Post-delivery checks and procedures
- Emergency procedures for controlling and containing an accidental release of bulk chemicals
- If delivery is by compressed air, on completion of off-loading an aerosol of the delivered chemical may be generated. Exposure of personnel to this chemical aerosol must be considered and avoided.

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### **3.1 PERSONNEL INVOLVED**

Chemical Services personnel who are assigned the responsibility, by the Chemical Services Manager, of receiving bulk chemicals shall receive training on this Guideline as well as the site specific safety procedures in place regarding the chemicals being received; to avoid exposing themselves and/or others to danger by being aware of, for example, the location and use of fire extinguishers, safety showers, neutralising chemicals in cases of a spill, etc.. The individuals should also receive training on the emergency procedures to be adopted in the event of the need to stop the delivery from the tanker, i.e. should the failure occur on the delivery tanker.

The Chemical Services personnel(s) should ensure all safety, operational and administrative procedures are implemented for the receipt and unloading of specific bulk chemicals. Each site should nominate and identify their responsible person(s).

A responsible person should carry out the following activities:

- Administrative and operational control of a bulk chemical delivery and discharge
- Supervision of the safe unloading of chemicals
- Restoration of the system following a chemical delivery

Handling of individual bulk chemicals needs to be procedurised at each specific site, based on their Material Safety Data Sheets. Staff should be trained and deemed competent to perform this task. Names of competent staff should be documented and referenced when deliveries take place.

Laboratory Personnel must be trained to handle the individual bulk chemicals as well as trained in the methods to verify compliance of the chemicals.

### **3.2 SAFETY EQUIPMENT AND PROCEDURES**

- All chemical safety procedures must be strictly adhered to.
- All personnel involved in a chemical delivery must wear suitable protective clothing as required by the station whenever chemicals are being delivered or when dealing with spillages. The full range of protective equipment shall be available to personnel involved with the reception and delivery of bulk chemicals. A spare set of safety equipment should be held at strategic locations that are clearly identified as determined by the Power Stations Emergency Plan.
- A potable water supply with fitted hose of adequate length to reach all parts of the chemical delivery area must be available.
- A clearly signed safety shower should be located at the chemical offloading area. The shower should be visible and be shielded from any tanker discharge point.
- Eye baths or sealed sterile type eye wash bottles should be located with the safety shower and clearly signed. Diphoterine or similar products should also be made available in order to reduce the impact of chemical burns in the event of exposure. Operating staff shall be trained in the correct use of the product.
- Site specific procedures must be documented and available to ensure that the responsible person who is supervising the delivery is conversant with the discharge method being used – e.g. Air compressor, gravity or mechanical pumping.
- The tanker and/or installation designs should be such that the driver or the responsible person can immediately stop the chemical delivery by a simple operation such as closing a valve, switching off an engine or motor.
- A fire risk assessment must be conducted and the suitable protection equipment must be made available.

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### 3.3 PRE-DELIVERY CHECKS

Bulk chemicals should normally be delivered during the following working hours during the week, namely between 08:00 to 15:00, except for Fridays where deliveries shall only be accepted up to 10:00. The deliveries of different chemicals on the same day should be avoided whenever possible to minimise the risk of incorrect identification of the deliveries.

Where deliveries cannot be made during the times stipulated above, the Chemical Services Manager shall ensure that the competent staff (as per 3.1 above) is present during the delivery to support the requirements of this guideline.

Only one tanker at a time must be unloaded at a specific unloading area. The responsible person supervising the delivery should:

- Ensure that the control room personnel is aware that a chemical delivery is taking place
- The following documentation shall be shown to the Eskom personnel in the Water Treatment Plant Control Room upon arrival at the power station:
  - Competency declaration for the person responsible for off-loading and sampling of bulk chemical being delivered
  - Tanker Inspection Form, confirming:
    - Vehicle road worthiness
    - Functionality of air/pump off-loading system
    - Condition of flexible pipes and connections (cleanliness and wear)
    - Date of off-loading pipe pressure test
    - Tanker content cleanliness
  - Weigh bridge certificate.
  - Certificate of Analysis showing that the chemical in the tanker meets the specification as highlighted in Appendix B. Should it not comply, refer to section 4 and 5 of this Guideline, for the actions to be taken.
  - Delivery note, which must include the Eskom order number, the name of the power station and the power station address.
- The delivery tanker shall be safely parked at the off-loading bay and all necessary barricades must be installed.
- Request the delivery tanker driver to obtain a sample of the bulk chemical for analysis\*
- Confirm that the receiving bulk tank has adequate space for the delivery
- Test and confirm the operation of the emergency shower, the flushing water supply and that eye baths/wash bottles are in place
- Confirm, where possible, that the “High Level Alarm” is functional for the bulk tank receiving the delivery
- Sign the delivery note to allow the delivery to proceed.

\* The Eskom personnel shall make three (3) x 250ml sample bottles available which shall be clearly marked to indicate the chemical sampled and the date the sample is taken. The delivery truck driver shall

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be requested to take the samples from the delivery truck and must be witnessed by the Eskom Chemical Services personnel.

The samples shall be utilised as follows:

- 1 for pre-delivery checks;
- 1 for post-delivery checks;
- and a 3<sup>rd</sup> sample set aside to be used for dispute resolution (1 to Eskom, 1 to Chemical Supplier and 1 to independent laboratory acceptable to both disputing parties).

The pre-delivery and post-delivery analysis shall be captured on the Laboratory Information Management System (LIMS).

In the event that the analysis is in compliance with the specification, the remaining samples may be disposed of in a controlled manner.

### **3.3.1 Chemical Analysis**

This section outlines only the minimum checks necessary to provide assurance that the chemical delivered meets the Eskom contract Specification and compares well with the Certificate of Analysis (COA) provided by the supplier. The minimum checks for each chemical is outlined in Appendix B.

#### **3.3.1.1 Minimum acceptance criteria for Offloading**

The minimum acceptance criteria for offloading must fulfil the following requirements:

- Must comply with the COA in all aspects
- Must comply with the critical parameters as defined below

The critical parameters are defined as those parameters that can be measured in a relatively short space of time and form the minimum acceptable criteria for offloading. Appendix B defines these parameters for bulk chemicals at Eskom.

For chemical deliveries where the analysis indicates compliance with both of the above criteria, the delivery truck driver shall be instructed to proceed with the offloading of the tanker in accordance with the specific Chemical Offloading Procedures. If the quality of the Chemical does not meet the Eskom specification, the actions as indicated in section 4 and 5 of this Guideline shall be followed.

#### **3.3.1.2 Chemical analysis Post-offloading**

The samples shall be analysed for the parameters as listed in Appendix B under tables headed "Contractual Quality Parameters for X to be confirmed post offloading", where X refers to individual bulk chemicals delivered.

This analysis shall be performed within 24 hours of the offloading of the bulk chemical.

The results of the analysis shall be captured on LIMS. Should the analysis deviate from the values as specified in the Eskom National Contract as stipulated in the tables in Appendix B, the procedure 240-44175038, Control of Non-Conforming Product or Service Procedure for managing a non-conforming product shall be followed by the Chemical Services Manager for the delivery of the non-compliant chemical within 3 days of the incident.

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### 3.4 ISOLATION OF THE DELIVERY AREA AND CONNECTION OF DELIVERY TANKER

The responsible person supervising the delivery should ensure that:

- The delivery tanker is within a restricted/barricaded area. The barriers should be at least 8 m from the delivery point or 5 m from the tanker, whichever is the greater.
- The off-loading hose is not damaged
- No uncontrolled access should be allowed to the barricaded area during the delivery activity.
- A plastic red and white chain barrier hooked on to metal uprights is recommended or any other solid barricading. The barricade should extend around at least the perimeter of the restricted area outside of the off-loading bay. If there are gaps through which pedestrians can pass on the off-loading bay side of the restricted area, these must also be barricaded off. The use of red and white tape is prohibited.
- Adequate warning signage should be erected for example, "DANGER: Chemical Delivery in Progress: Keep Out", spread over three lines of text, with character size of 120 mm for the capitalised "DANGER" and 60 mm for lower case characters for the rest.
- SANS 101140-1/2:2008 should be complied with for the Identification Colour Marking on the signage. Characters should be White on Red (Danger).
- The signs may be affixed to the metal supports for the chains. As a minimum 1 sign on each of the smaller perimeter sides and 2 on the longer side (assuming only the three sides of the off-loading bay are potentially accessible to pedestrian traffic).
- Ensure flushing (potable) water is constantly running with a reasonable flow during the actual off-loading operation.
- All persons entering the barricaded area to wear suitable protective clothing.
- The tanker driver wears protective clothing during connection to a fixed tank, chemical delivery, disconnection from fixed tank and stowing of delivery equipment.
- Casual pedestrian access around the barricaded area must be avoided during tanker off-loading.
- There shall be no activities local to the bulk tank which is to receive the delivery. There may be a need to temporarily stop any activities in the vicinity of the bulk tank if the chemical delivery should pose a risk to individuals. This is particularly relevant if there is a potential for the release of hazardous fumes from the tanker's vents.

Following successful completion of the pre-delivery checks and isolation of the delivery area, the person supervising the delivery shall:

- Instruct the delivery driver to connect his/her delivery hose to the intake flange
- Check that the flexible hose connections have been properly made. All bolts shall be fitted to the flange connection at each end of the hose
- Open the bulk tank intake valve
- Whilst under his/her control and continuous supervision, instruct the driver to deliver the chemical load. Where the delivery pump is under Eskom's control, the Eskom personnel shall operate the pump for delivery
- The tank shall be monitored for any overflow

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- In the event of the occurrence of a leak on the pipework during the delivery, immediately stop the transfer, shut the delivery valves and deal with the leak.

The Chemical Services Personnel shall be present during the entire delivery procedure.

### **3.5 POST-DELIVERY CHECKS AND PROCEDURES**

- The tanker driver shall confirm when the delivery is complete and that the equipment is isolated
- The Chemical Services Personnel shall confirm that the bulk tank contents have increased in agreement with the volume/mass delivered, i.e. the weight or volume must be verified and recorded to ensure that the correct amount has been received. This is a functional test of the tank's measuring gauge(s)
- The Chemical Services Personnel shall carefully open the tank's inlet drain valve to confirm that the fixed inlet line is empty and to allow the tanker driver to empty the flexible filling line of any residual chemical. All drainages should be collected in a controlled manner. They should be directed to the approved drainage point to the Effluent Neutralisation Sump (ENS). If no such drainage point is available, then some other temporary containment shall be deployed, neutralised and transported to the ENS for disposal.
- Once the flexible filling line is confirmed empty, the Chemical Services Personnel shall close the bulk tank's inlet valve and the inlet drain valve
- The Chemical Services Personnel shall instruct the driver to disconnect his equipment.
- All drainage shall be collected and disposed of in a controlled manner
- The Chemical Services Personnel shall confirm the area is free of any spilled chemicals and restore the delivery area to a clear area, by removing all temporary barricades, signage, etc. used during the offloading process.
- The Chemical Services Personnel shall de-isolate any local drains that were isolated during the chemical delivery
- The Chemical Services Personnel shall sign the chemical delivery note to confirm that the delivery has been completed
- The Chemical Services Personnel shall inform the control room that the chemical delivery has been completed
- The Chemical Services Personnel shall forward a copy of the signed delivery note to the relevant procurement department to allow payment for the delivery

### **3.6 EMERGENCY PLAN**

Each site should have an emergency plan available that details actions following the accidental release of chemicals or if personnel have come into contact with the chemicals. To assist in the control of a significant accidental chemical release, individual sites should consider the establishment of an external contract with a suitable support organisation.

The emergency plan shall detail:

- Communication chain in the event of a chemical incident
- Location and scope of spare safety equipment held at strategic locations
- Methods of containing and dealing with accidental spills of chemicals – influenced by the severity of the release

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- Essential first aid actions on personnel contacted by chemicals and communication chain for professional medical assistance. Basic first aid advice is generic for the specific bulk chemicals involved:
  - Speed is essential – all actions shall be taken immediately
  - On skin or clothing – drench the body with copious amounts of water and remove any contaminated clothing. Seek medical attention immediately. Diphoterine or similar products should also be made available in order to reduce the impact of chemical burns in the event of exposure.
  - In the eyes – irrigate freely with water or eye wash solution for at least 15 minutes. Copious volumes are initially more important than the use of small volumes of isotonic saline eye solutions. Seek medical attention immediately.
  - Ingestion – if the chemical is confined to the mouth give large quantities of water as a mouthwash ensuring that the mouthwash is not swallowed.
  - Inhalation – give oxygen if there are signs of respiratory distress. Seek medical attention immediately
- Communication chain with any external service company that could provide assistance

#### **4. NON CONFORMING CHEMICAL DELIVERIES**

- Should the “Prior to offloading chemical analysis” reveal that the chemical in the tanker does not meet the specification, the Eskom Chemical Services / Chemistry personnel delegated to contact the Chemical Supplier, shall be notified immediately. The Contract Owner (Eskom Representative) shall be informed of the Non-Conformance and plan of action.
- The contents of the tanker shall be rejected and no off-loading should take place. The Supplier shall be notified to make a delivery of Chemical, within 3 days of rejection, which complies with the specification. The steps in this Guideline shall be repeated for the subsequent chemical delivery.
- As per the contractual agreement, a sample will be forwarded to Eskom’s Research, Testing and Development Laboratory to verify the analysis. The Contractor may be present to witness all steps in the process of sampling and analysis.
- The procedure 240-44175038, Control of Non-Conforming Product or Service Procedure for managing a non-conforming product shall be followed by the Chemical Services Manager for the delivery of the non-compliant chemical within 3 days of the incident.
- Should the delivery following an initial rejection not comply with the specification, the Contracts Manager shall be notified to obtain the chemical from an alternative supplier.
- If the full analysis (post off-loading chemical analysis) be non-compliant, the non-conformance shall be raised with the Contracts Manager by the Chemical Services Manager.
- The Chemical Supplier will be required to remove the chemical from the bulk tank while ensuring delivery of a compliant replacement batch of chemicals.

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## 6. REVISIONS

Date	Rev.	Compiler	Remarks
March 2017	0.1	M.A. Naidoo	Guideline required to monitor delivery of Bulk Chemicals
March 2017	0.2	M.A. Naidoo	Final Draft Document for Comments Review
October 2017	0.3	D. Lalla	Incorporated comments into document
October 2017	1	D. Lalla	Final Document for Authorisation and Publication

## 7. DEVELOPMENT TEAM

The following people were involved in the development of this document:

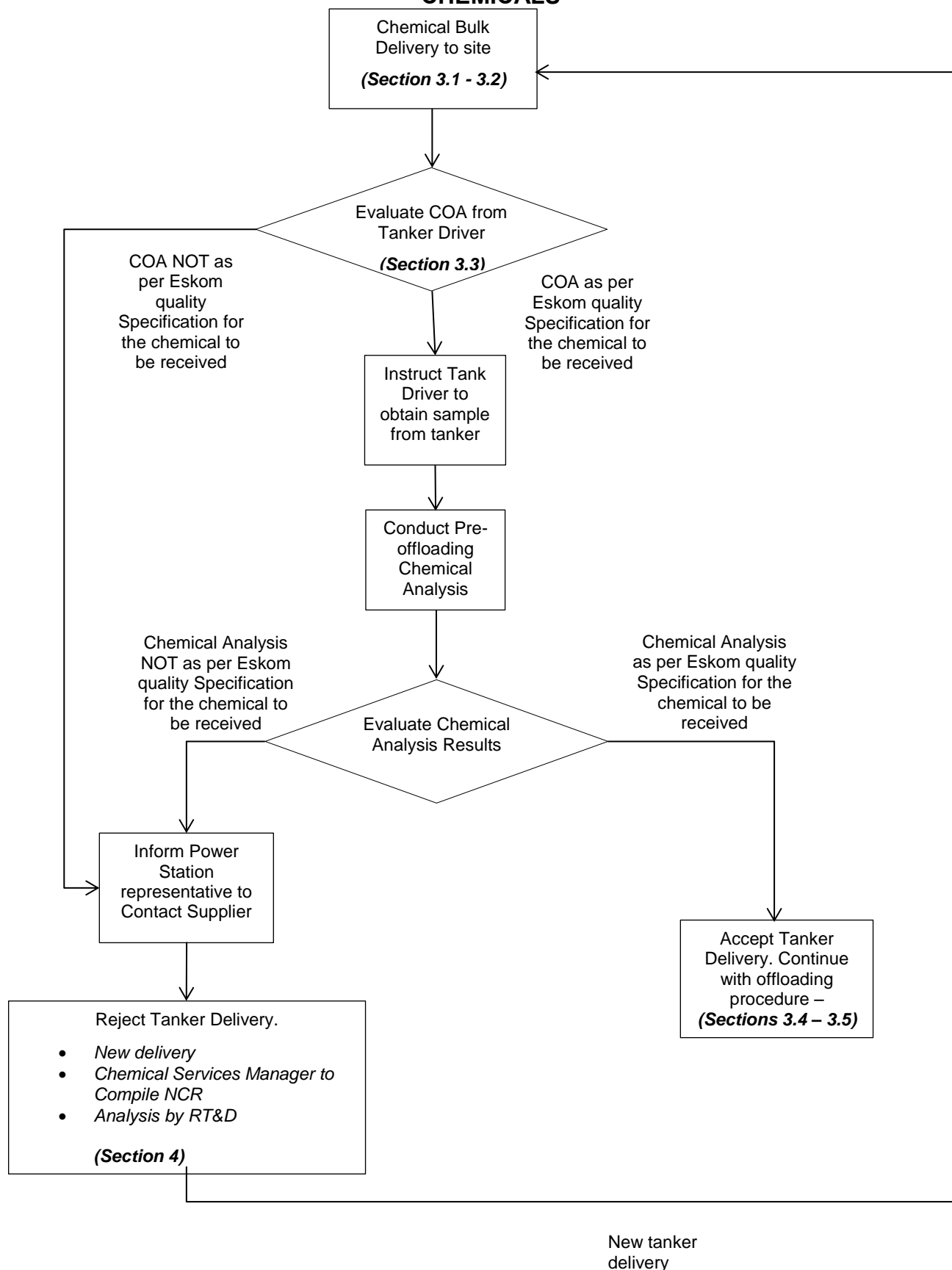
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## 8. ACKNOWLEDGEMENTS

Not applicable.

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**APPENDIX A: FLOW DIAGRAM OF ACTIONS REGARDING DELIVERY OF BULK CHEMICALS****CONTROLLED DISCLOSURE**

**APPENDIX B : MINIMUM ACCEPTANCE CRITERIA FOR BULK CHEMICALS****1. Ammonia****Table 1: Critical Parameters for Ammonia (liquid) prior to offloading**

Parameters	Units	Specification	Method
No sediment or visible impurities	-	Sediment or visible impurities	Visual check must verify no sediment or impurities
Concentration	%	25% minimum	Verify by Titration
Appearance	-	Clear colourless liquid ammonia solution	Visual check. Must verify a clear liquid
Sodium	ppm m/m as Na	1.0 (max)	Verify by AAS or ICP-OES

**Table 2: Contractual Quality Parameters for Ammonia to be confirmed post offloading**

Parameters	Units	Specification	Method
Chlorides	ppm m/m as Cl	0.5 (max)	Verify by Ion Chromatography
Sulphates	ppm m/m as SO <sub>4</sub>	4.0 (max)	Verify by Ion Chromatography
Iron	ppm m/m as Fe	0.2 (max)	
Lead	ppm m/m as Pb	1.0 (max)	
Arsenic	ppm m/m as As	0.05 (max)	
Non-volatile Matter	ppm m/m	25 (max)	
Reducing Substances	ppm m/m as O	8.0 (max)	

**2. Hydrated Lime****Table 3: Critical Parameters for Lime prior to offloading**

Parameters	Units	Specification	Method
Available Calcium as CaO	%	67% min	Verify as Ca from AAS or ICP-OES
Total Calcium	%	70% min	Verify by AAS or ICP-OES

**Table 4: Contractual Quality Parameters for Lime to be confirmed post offloading**

Parameters	Units	Specification	Method
Silica as SiO <sub>2</sub>	%	1.6% max	
Particle Size - % passing for 150um screen aperture	%	95%	Verify by sieving test

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### 3. Caustic Soda

**Table 5: Critical Parameters for Caustic Soda prior to offloading**

Parameters	Units	Specification	Method
Strength	% m/m as NaOH	47 (min) – 50(max)	Verify by titration <b>or</b> Check Specific Gravity - correlation to SG.
Specific Gravity at 20 degrees centigrade	-	1.50 (min)	Verify by Buoyant Force Transducer <b>or</b> Concentration

**Table 6: Contractual Quality Parameters for Caustic Soda to be confirmed post offloading**

Parameters	Units	Specification	Method
Chloride (Cl)	% m/m	0.03 (max)	Verify by titration. If possible to be done BEFORE Off Loading
Iron (Fe)	% m/m	0.001 (max)	
Sulphate (SO <sub>4</sub> )	% m/m	0.01 (max)	
Carbonate (CO <sub>3</sub> ):	% m/m	0.20 (max)	

### 4. Sulphuric Acid

**Table 7: Critical Parameters for Sulphuric Acid**

Parameters	Units	Specification	Method
Colour	-	Colourless to dark grey	Visual check
Density	-	1,831 (min) at 25 degrees Celsius	Verify by Buoyant Force Transducer <b>or</b> Concentration
Concentration	%	98 (min) - 99 (max)	Verify by correlation with Density
Iron	ppm as Fe	50 (max)	Verify by AAS of ICP-OES

**Table 8: Contractual Quality Parameters for Sulphuric Acid to be confirmed post offloading**

Parameters	Units	Specification	Method
Iron	ppm as Fe	50 (max)	Verify by AAS of ICP-OES
Chlorides	ppm as Cl	10 (max)	
Nitrates	ppm as NO <sub>3</sub>	100 (max)	
Lead	ppm as Pb	5 (max)	
Arsenic	ppm as As	5 (max)	
Oxidants	ppm as Cl <sub>2</sub>	10 (max)	
Insolubles		Nil	
Inhibitors	-	Acid must be free of any inhibitors	

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