Cutting refrigerant emissions

Annual member Plenary Meeting (online)

Policy and technology session:
Overcoming barriers to transboundary movement, lessons learned from A-Thermal in South Africa and Zimbabwe

A-THERMAL
for the environment

Destruction of R12 gas cylinders

Mr. Martin Botha
MScEng, *PrEng*
2 July 2025

INTRODUCTION

- Refrigerant stock identified – need for responsible management
- Co-ordination between parties: owner (generator), service provider, financer, regulator
- Zimbabwe: 6x 1 ton cylinders R12 at 3 locations
- A-Thermal was awarded the contract from GIZ for the *collection* and *safe destruction* of these cylinders

A-Thermal operates a thermal treatment facility for hazardous and general wastes in Olifantsfontein since 2004

STAKEHOLDERS

- Zimbabwe National Ozone Unit (NOU): Refrigerant owners (“generator”)
- GIZ GmbH: project management and funding
- South Africa NOU and Department of Forestry, Fisheries and Environmental (DFFE): transborder movement and permit
- A-Thermal Retort Technologies (Pty) Ltd: hazardous waste treatment facility

Challenge #1: Co-ordination and agreements

Resolution: Clear structure needed and contracting

Challenge #2: Documentation submission and timeframes for permits

Resolution: Stick to established regulations, communication to update on progress

FRAMEWORK

UNEP

- 2022: UNEP Technology and Economic Assessment Panel (TEAP)

Table 4-1: *Recommended Technologies and Their Applicability*

Technology	Applicability	
	Concentrated CFCs and HCFCs	Concentrated Halons
Cement Kilns	Recommended	
Liquid Injection Incineration	Recommended	Recommended
Gaseous/Fume Oxidation	Recommended	Recommended
Reactor Cracking	Recommended	
Rotary Kiln Incineration	Recommended	Recommended
Argon Plasma Arc	Recommended	Recommended
Inductively-Coupled Radio-Frequency Plasma	Recommended	Recommended
Nitrogen Plasma Ar		
Microwave Plasma		
Gas Phase Catalytic		
Super-Heated Steam		

A-Thermal thermal oxidiser (secondary chamber / afterburner)

A-Thermal rotary kiln (primary chamber)

the ODS incineration capacity. Liquid wastes such as CFCs, halons and other ODS can be fed into the rotary kiln or directly into the afterburner.

Rotary kilns are widely used in developed countries for the incineration of hazardous wastes, including chlorinated solvents (CCl_4, $CHCl_3$, CH_3Cl, CH_3CCl_3), and toxic waste, such as PCBs. In Europe and Japan they have been

SAFE DESTRUCTION

Challenge #2: Demonstration of capability, readiness and compliance

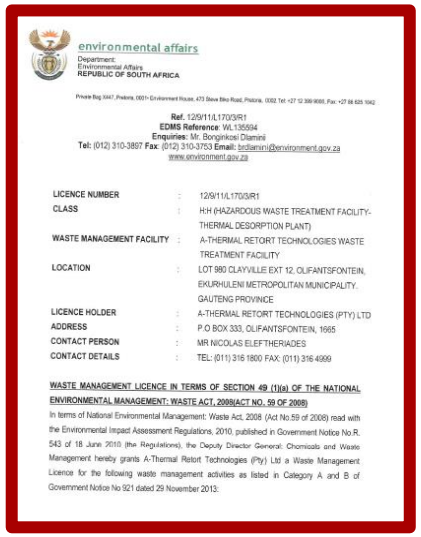
Resolution:: Licensing, audits, site visit, subject matter experts

- A-Thermal operating permits:
  - Waste Management Licence (WML) – DFFE
    - Includes ODS and POPs
  - Air Emission Licence (AEL) – City of Ekurhuleni

- Engagement with experts:

SENIOR EXPERT SERVICE SES

FUTURE THROUGH EXPERIENCE



environmental affairs
Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

Ref. 12/9/11/L170/3/R1
EDMS Reference: WL135594
Enquiries: Mr. Bonginkosi Dlamini
Tel: (012) 310-3897 Fax: (012) 310-3753 Email: bdlamini@environment.gov.za
www.environment.gov.za

LICENCE NUMBER	:	12/9/11/L170/3/R1
CLASS	:	H:H (HAZARDOUS WASTE TREATMENT FACILITY-THERMAL DESORPTION PLANT)
WASTE MANAGEMENT FACILITY	:	A-THERMAL RETORT TECHNOLOGIES WASTE TREATMENT FACILITY
LOCATION	:	LOT 980 CLAYVILLE EXT 12, OLIFANTSFONTEIN, EKURHULENI METROPOLITAN MUNICIPALITY, GAUTENG PROVINCE
LICENCE HOLDER	:	A-THERMAL RETORT TECHNOLOGIES (PTY) LTD
ADDRESS	:	P.O BOX 333, OLIFANTSFONTEIN, 1665
CONTACT PERSON	:	MR NICOLAS ELEFTHERIADES
CONTACT DETAILS	:	TEL: (011) 316 1800 FAX: (011) 316 4999

WASTE MANAGEMENT LICENCE IN TERMS OF SECTION 49 (1)(a) OF THE NATIONAL ENVIRONMENTAL MANAGEMENT: WASTE ACT, 2008(ACT NO. 59 OF 2008)

In terms of National Environmental Management: Waste Act, 2008 (Act No.59 of 2008) read with the Environmental Impact Assessment Regulations, 2010, published in Government Notice No.R. 543 of 18 June 2010 (the Regulations), the Deputy Director General: Chemicals and Waste Management hereby grants A-Thermal Retort Technologies (Pty) Ltd a Waste Management Licence for the following waste management activities as listed in Category A and B of Government Notice No 921 dated 29 November 2013:

CITY OF EKURHULENI
HEALTH AND SOCIAL DEVELOPMENT DEPARTMENT
ENVIRONMENTAL HEALTH DIVISION

Ekurhuleni Air Quality Officer
Department of Health and Social Development
P O Box 13
Kempton Park
1620

Tel: (011) 999 3525
Fax: (011) 999 4581
Email: Bamukelo.Shongwe@ekurhuleni.gov.za

THE ATMOSPHERIC EMISSION LICENCE AS CONTEMPLATED IN SECTION 47 OF THE NATIONAL ENVIRONMENTAL MANAGEMENT: AIR QUALITY ACT, 2004, (ACT NO. 39 OF 2004)

This Atmospheric Emission Licence issued to **A- Thermal Retort Technologies (Pty) Ltd** in terms of section 41(1) (a) of the National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004), in respect of Listed Activity, **No. 7.4 Inorganic Chemical Industry, No. 8 Disposal of Hazardous and general waste and Subcategory No. 4.21 Metal Recovery**. The Atmospheric Emission Licence has been issued on the basis of information provided in the company's application dated **7 July 2017** and information that became available during processing of the application and the processing fee payment made on **14 February 2018.**

The Atmospheric Emission Licence is valid until **30 May 2023**

The reason issuance of the current licence is the **Renewal application.**

The Atmospheric Emission Licence is issued subject to the conditions and requirements set out below which form part of the Atmospheric Emission Licence and which are binding on the holder of the Atmospheric Emission Licence to **A- Thermal Retort Technologies (Pty) Ltd**

1. **ATMOSPHERIC EMISSION LICENCE ADMINISTRATION**

Name of the Licensing Authority	Ekurhuleni Metropolitan Municipality
Atmospheric Emission Licence Number	14/1/1/7/16/Thermo/Kemp
Atmospheric Emission Licence Issue Date	18 MAY 2018
Atmospheric Emission Licence Type	Final
Review Date, not later than	30 January 2023

Air Quality Officer: Date: 18/05/2018
Mr. Jerry Chaka
Divisional Head: Environmental Health
Health and Social Development Department

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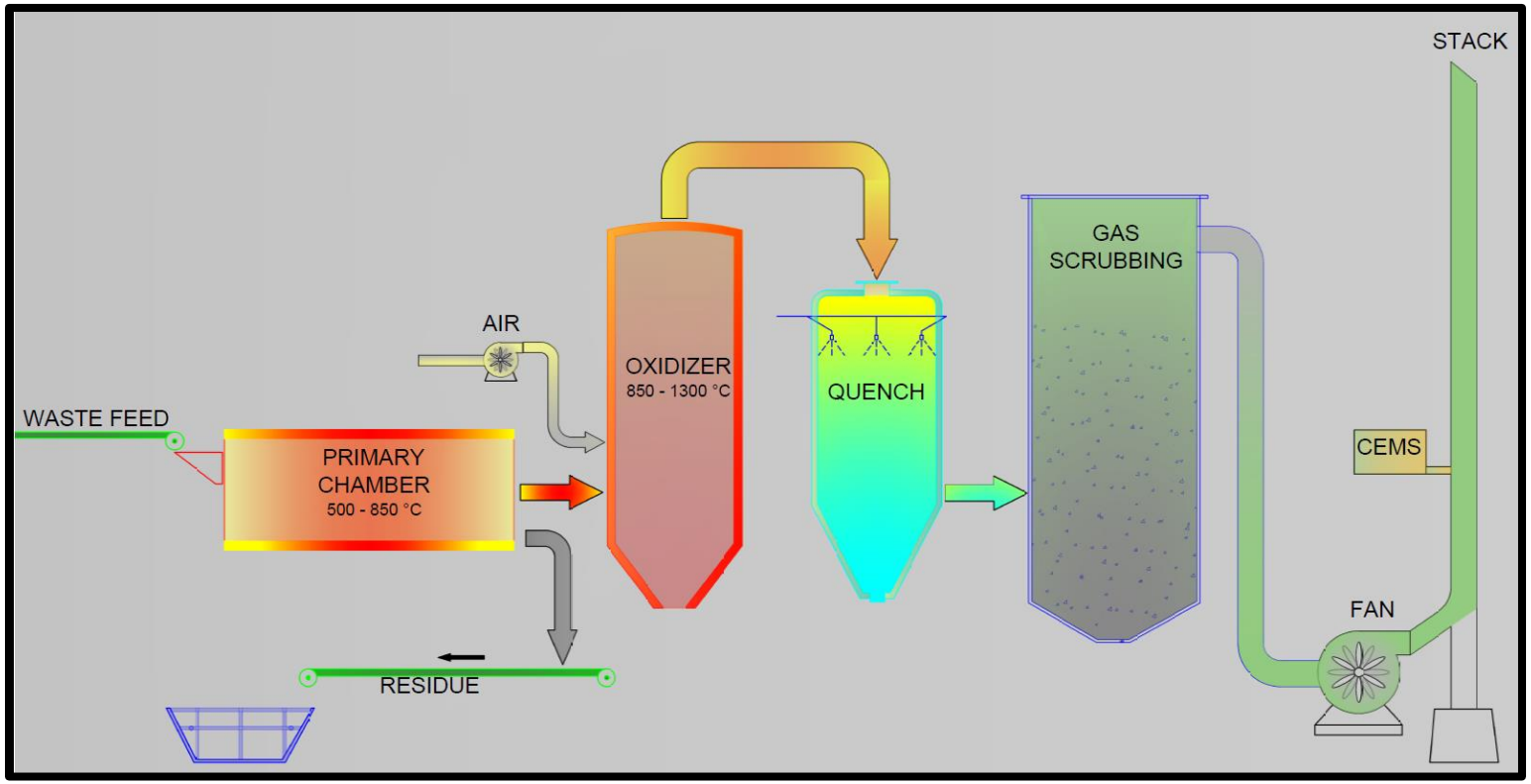
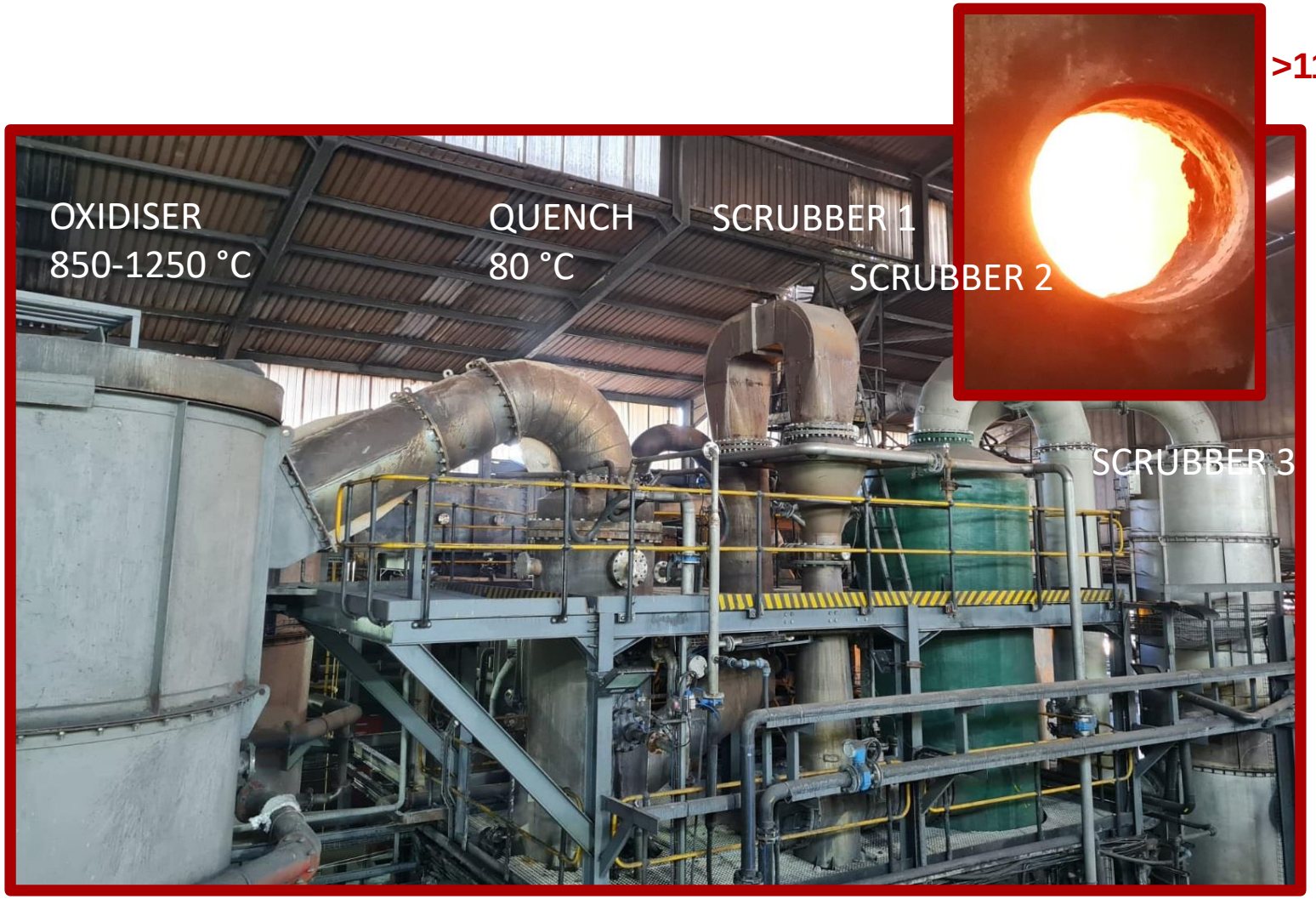
PROCESS OVERVIEW

Challenge #3: Correct plant design and operation



Resolution: Purpose built for hazardous waste treatment

GAS TREATMENT



SPECIFIC CONDITIONS

Completed by A-Thermal

Process validation

✓ Destruction Removal Test (DRE) by independent expert

Equipment

✓ Minimum operating temperature of 1100 °C

✓ Residence time of 2 seconds

✓ Calibrated scales / weighbridges for before/after weights

✓ Feeding, metering and interlocks of material flow into oxidiser

Monitoring and reporting

✓ Chain of custody of material

✓ Sampling and analysis requirements

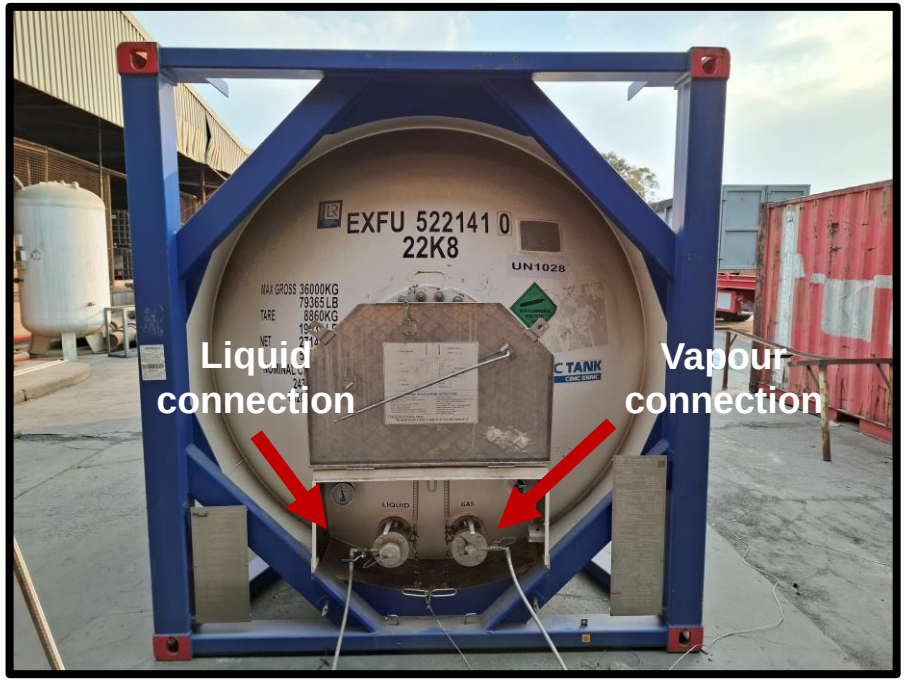
✓ Process conditions (temperatures, emission concentrations)

EXPERIENCE

Year: 2024

- R11 9 660 kg: destroyed
- R12 13 760 kg: destroyed

100 year GWP (kg CO_2e / kg ODS)			
R11	4 750	**45 855**	**ton CO_2e**
R12	10 900	**149 984**	**ton CO_2e**
Total:		**195 869**	**ton CO_2e**



EQUIPMENT

- Leak checks and interlocks
- Emission monitoring (12 species)

Capable to treat liquid and gas containers

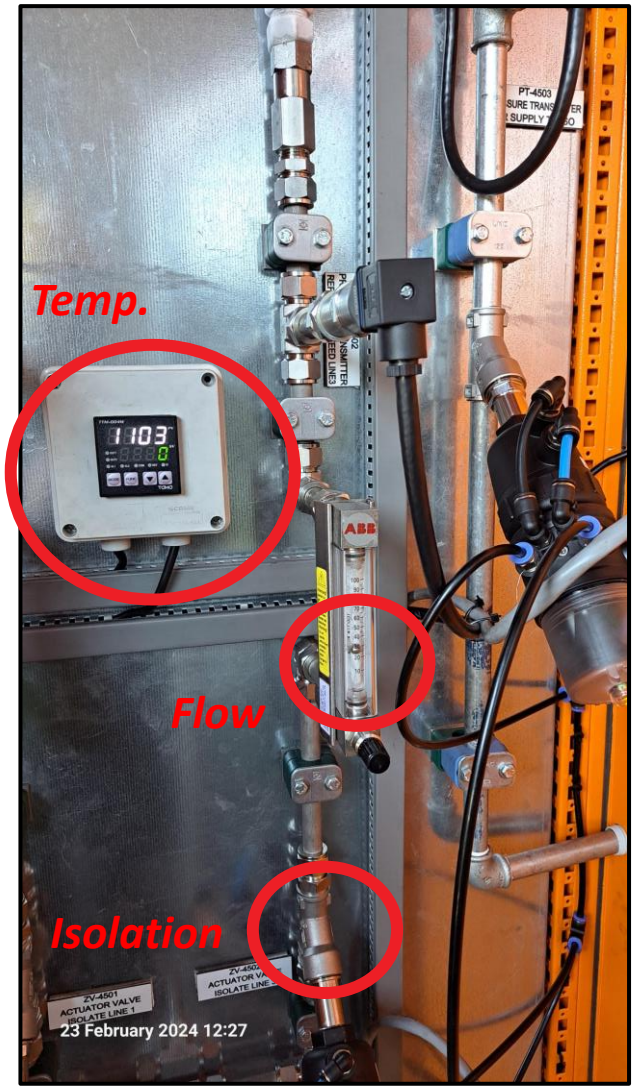
Challenge #4:

Condition of cylinders / containers

Resolution:

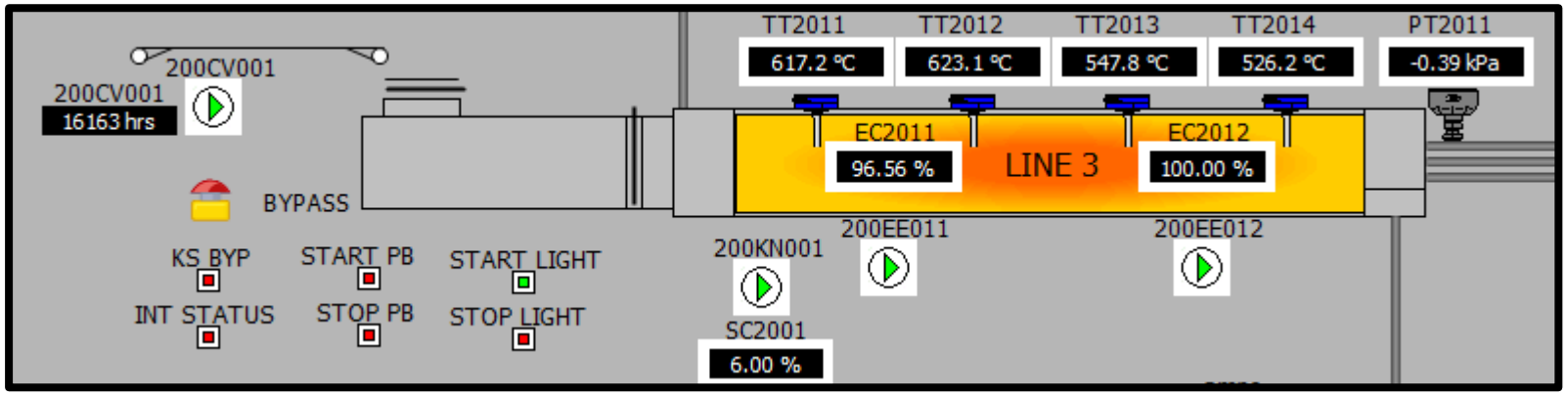
Upfront communication regarding connections and integrity.

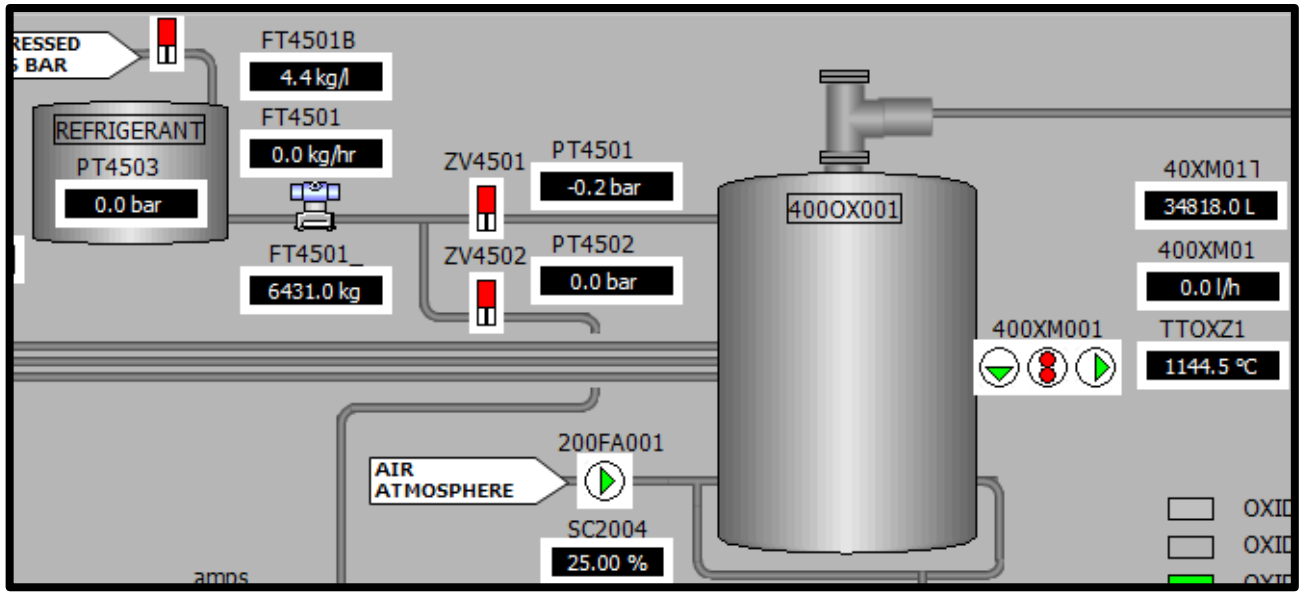
Local suppliers for piping connectors



Precise metering and interlock station

EQUIPMENT


TT2011
617.2 °C
TT2012
623.1 °C
TT2013
547.8 °C
TT2014
526.2 °C
PT2011
-0.39 kPa
200CV001
200CV001
16163 hrs
BYPASS
EC2011
96.56 %
LINE 3
EC2012
100.00 %
200EE011
200EE012
KS BYP
START PB
START LIGHT
200KN001
INT STATUS
STOP PB
STOP LIGHT
SC2001
6.00 %


FT4501B
4.4 kg/l
REFRIGERANT
FT4501
0.0 kg/hr
PT4503
0.0 bar
ZV4501
PT4501
-0.2 bar
400OX001
40XM011
34818.0 L
400XM01
0.0 l/h
FT4501_
6431.0 kg
ZV4502
PT4502
0.0 bar
400XM001
TTOXZ1
1144.5 °C
200FA001
AIR
ATMOSPHERE
SC2004
25.00 %
amps

PROJECT: OBJECTIVES

- Obtain necessary permits and authorization for movement of refrigerant cylinders
- Collect of 6x 1 ton R12 refrigerant from in Zimbabwe
- Transport to A-Thermal's plant at 28 Keramiek Street, South Africa
- Analysis of cylinders
- Destruction at A-Thermal's plant
- Accurate quantification of the destruction based on calibrated scales
- Engineering report

Challenge #5:
Analysis of refrigerant in South Africa

Resolution:
(a) Use of screening analyzer to verify contents
(b) International laboratory e.g. AHRI Standard 700 – challenges as well

DOCUMENTATION

Challenge #6: Clear documentation

Resolution: Reporting requirements defined and submitted Report:

- The engineering report gives a summary of the steps taken for the destruction;
- Photographs, analysis results, calibration certificates.

A-THERMAL
for the environment

Certificate Number A-0006600

THERMAL DESTRUCTION CERTIFICATE

Description	Quantity	UOM
REFRIGERANT: R-12:	9520	KG
Total:	9520	KG

STARTING DATE: 18 MARCH 2025

ENDING DATE:

CLIENT:

WASTE GENERATOR:

SIGNED: DATE OF ISSUE: 29/05/2025

Sherwin Naicker
BSc. Chemical Engineering

Responsible Care®

28 Keramiek Street, Clayville,
Olifantsfontein, South Africa, 1666

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Table 2.3.2 List of SCADA tags and descriptions

Parameter	Description	Unit
PID-001-TTOXZ1-PV ValueY	Line 1 furnace (oxidiser) temperature	°C
PID-001-TT-OXZ2-PV ValueY	Line 3 furnace (oxidiser) temperature	°C
PID-001-FT4501-PV ValueY	Flow transmitter: refrigerant feed	kg/hr
PID-004-AIT-CO-PV ValueY	Carbon monoxide concentration at stack	mg/Nm³
PID-004-AIT-O2-PV ValueY	Oxygen concentration at stack	vol %

Table 2.3.3 Average plant readings

Description	March 2025	April 2025	May 2025	Average	Unit
Line 1 furnace temperature	1149	n/a	1158	1153	°C
Line 3 furnace temperature	1168	1158	1164	1163	°C
Flow transmitter: refrigerant	28.48	20.73	52.96	34.05	kg/hr
CO concentration at stack	4	5	9	6	mg/Nm³

CONCLUSIONS

- Correct application of Best Available Technology (BAT) processing
- Compliance to current best practice activities and country laws
- Ensures protection of environment and sustainable operations
- **Co-operation, communication, following regulation structures**

Maloti-Drakensberg Park
UNESCO World Heritage Site

THANK YOU

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