

PCB MANAGEMENT AND CONTROL

Condition Monitoring Manager

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Date: July 2019

Points of Discussions

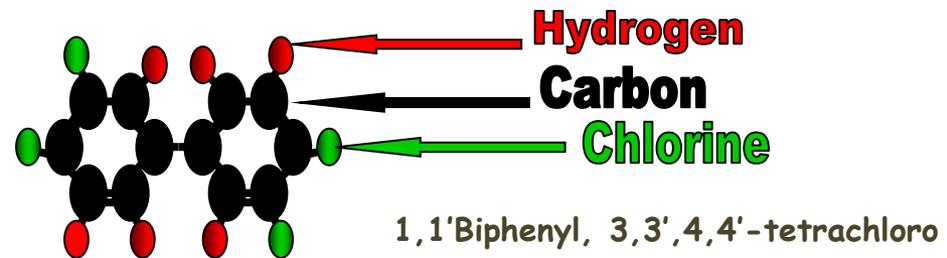
- History of the PCB and its usage
- Health Effects
- Detections of PCB
- Global Position on the PCB
- RSA Legislations
- PCB Management

History of the PCB

- 1929 - 1979 Production in United States
- 1968 - 1977 PCB found in Herring
- 1968 - 1976 Many More incidents followed
- 1976 - Worldwide ban – bioaccumulation and toxicity
- 1977 - Eskom Trade ban – Policy
- 1992 - Eskom Standard, Testing and Inventory
- 2002 - RSA – Stockholm Ratification
- 2007 - SANS 290 – PCB Management Standard
- 2014 - RSA PCB Phase-Out Regulation
- 2023 - RSA Compliance

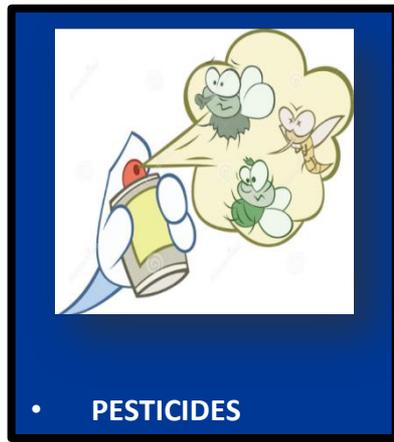
WHAT IS PCB?

- Synthetic chemical fluids and don't easily degrade or break
- 209 Congeners (possible combinations as per example below)
- Monsanto was the largest producer with the brand Arochlor
- Arochlor 1260, 1254, 1242 were used in electrical industry in South Africa
- Commercial production 1929 – 1976



WHY WAS PCB USED?

- Chemically & Thermally Stable
- Flash Point < 330 °C
- Many uses other than Insulating Fluid



APPLICATION OF PCB

In South Africa, PCBs are mainly used in Transformers, Switchgear and Capacitors in electrical equipment as:

- Insulant
- Coolant
- Fire retardant



APPLICATION OF PCB

We operate
30 POWER STATIONS
 Total nominal capacity of **45 561MW**



Our business and strategy

37 868MW
 of coal-fired
 stations

1 860MW
 of nuclear
 power

Base-load stations

2 724MW
 pumped
 storage

600MW
 hydro
 stations

2 409MW
 of gas-fired
 stations

Mid-merit/peaking stations

100MW
 Sere Wind
 Farm

Self-dispatching

Our network consists of

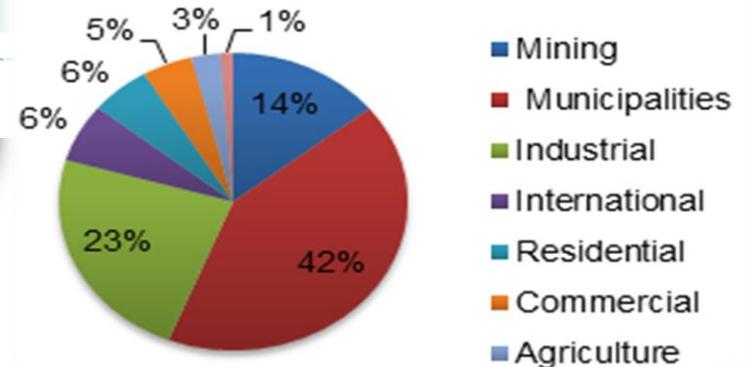
381 594km

of high-, medium- and low-voltage power lines

285 737MVA

Cumulative
 substation capacity

Electricity Distribution per consumer group (%)



Eskom generates 95% of SA electricity and 45% in Africa

EXPOSURE TO PCB

Humans may be exposed to the PCB through:

- Fish, chicken, dairy products and eggs consumption
- Inhalation PCB's in air (living near hazardous waste sites)
- Drinking PCB-contaminated water
- Leakages and spillage to surface from Electrical Equipments
- Contact and handling PCB materials during repairs and maintenance activities

Humans are exposed through contaminated meat, fish, and poultry



HEALTH EFFECTS

Excessive exposure of PCB may have the following effects on humans:

- Carcinogenic
- Skin conditions – chloracne & rashes
- Neurological and immune systems
- Increase risk for type 2 diabetes



GLOBAL REGULATIONS - PROTECT PUBLIC HEALTH

- USA Federal Government developed regulations, guidelines, and standards to protect people from the possible HEALTH EFFECTS of exposure to toxic substances.
- Food and Drug Administration (FDA) regulations and recommended PCB limits in various foods are:

FDA PCB Limits`

Type	PCB Limit
Eggs	0.33 ppm
Infant & Junior	0.2 ppm
Milk & other dairy products	1.5 ppm
Fish & shellfish (edible portions)	2 ppm
Poultry & red meat (fat basis)	3ppm

Source: US EPA Achieve Document

GLOBAL REGULATIONS - PROTECT PUBLIC HEALTH

Occupational Safety and Health Administration (OHSA)

- states that workers not be exposed of 8hrs for 5 days per week to more than 1 milligram per cubic meter of air (mg/m³) for 42% chlorine PCBs to 0.5 mg/m³ for 54% chlorine PCBs.

National Institute for Occupational Safety and Health (NIOSH)

- states that workers not breathe air containing 42 or 54% chlorine PCB levels higher than 1 microgram per cubic meter of air (ug/m³) for 10-hour workday,40-hour

GLOBAL POSITION ON THE PCB

Stockholm Convention

- More 180 countries are signatories including Republic of South Africa (RSA)
- Identify, label & remove from use Oils & Equipments PCB >500 ppm by (2025)
- Endeavour to remove from use oil & equipment >50 ppm (no later than 2028)
- Shall not trade in PCB
- Shall not allow recovery of PCB for purposes of reuse
- Shall ensure environmentally sound management & disposal
- Provide a status report to government every 5 years



Basel Convention

- Regulates trans-boundary movement of hazardous waste

LEGAL ASPECTS - RSA

- South Africa Constitution (1996)

“All persons have the right to an environment that is not harmful to their health and well-being, and to an environment that is protected for the current and future generations”

- Hazardous Substances Act (1973)

- National Environmental Management Act (1998)

- Occupational Health and Safety Act (1993)

- National Water Act (1998)

- National Traffic Act (1996)

- National Policy “Minimum Requirement for the Handling, Classification and Disposal of Hazardous Waste” (1998)

RSA REGULATIONS

STAATSKOERANT, 2 MEI 2014

No. 37603 3

GOVERNMENT NOTICE

DEPARTMENT OF ENVIRONMENTAL AFFAIRS

No. 331

2 May 2014

NATIONAL ENVIRONMENTAL MANAGEMENT: WASTE ACT, 2008
(ACT NO. 59 OF 2008)

NATIONAL NORMS AND STANDARDS FOR THE REMEDIATION OF CONTAMINATED LAND AND
SOIL QUALITY

SA REGULATIONS 2014

STAATSKOERANT, 10 JULIE 2014

No. 37818 3

GOVERNMENT NOTICE

DEPARTMENT OF ENVIRONMENTAL AFFAIRS

No. R. 549

10 July 2014

NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998
(ACT NO. 107 OF 1998)

REGULATIONS TO PHASE-OUT THE USE OF POLYCHLORINATED BIPHENYLS (PCBs)
MATERIALS AND POLYCHLORINATED BIPHENYL (PCBs) CONTAMINATED MATERIALS



RSA REGULATIONS

Registration

Government Gazette no 37818 July 2014

5. (1) Any person who possesses articles must register with the Director-General within 90 days of promulgation of these Regulations.

“articles” means dielectric fluid, dielectric fluid containers, electrical equipment or other equipment or materials that contain PCBs or came into contact with materials that contain PCBs;

Testing and labelling

7. (1) Any person who possesses articles must draw samples from all their articles, excluding sealed units and have them tested for PCB content by an Accredited Laboratory the results of which must be kept until the year 2023.
- (2) A person contemplated in sub-regulation (1) must conduct the sampling and testing of the articles in accordance with SANS 290.
- (3) PCB Holders must label their articles in accordance with SANS 290.



RSA REGULATIONS

This standard may only be used and printed by approved subscription and freemailing clients of the SABS.

ISBN 978-0-626-20274-3

SANS 290:2007

Edition 1

SOUTH AFRICAN NATIONAL STANDARD

**Mineral insulating oils — Management of
polychlorinated biphenyls (PCBs)**



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ISBN 978-0-626-33529-8

SANS 290:2016

Edition 2

SOUTH AFRICAN NATIONAL STANDARD

**Mineral insulating oils — Management of
polychlorinated biphenyls (PCBs)**

WARNING
This document references other
documents normatively.

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RSA REGULATIONS

1	2	3
PCB content levels mg/kg	PCB level	PCB levels, common names
Undetectable	0	PCB free materials
1 - 10	1	Non PCB materials
11 - 20	2	
21 – 50	3	
51 - 500	4	<i>PCB contaminated materials</i>
> 500	5	<i>PCB materials</i>

RSA REGULATIONS



PCB LEVEL 0

The dielectric fluid in this equipment has been tested to determine the amount of polychlorinated biphenyls (PCB content). We certify that, based on the test sample, the PCB concentration of the fluid is below 1 mg/kg.

Date: _____

Sample No.: _____

Laboratory: SANAS LAB T005

Test method: EPA8004-81-045

Equip serial No.: _____



PCB LEVEL 2

Warning
PCB-contaminated electrical equipment

The dielectric fluid in this equipment has been tested to determine the amount of polychlorinated biphenyls (PCB content). We certify that, based on the test sample, the fluid contains between 11 mg/kg and 20 mg/kg of PCB.

PCB content: _____ mg/kg

Date: _____

Sample No.: _____

Laboratory: SANAS LAB T0055 (Eskom)

Test method: EPA8004-81-045

Equip serial No.: _____



PCB LEVEL 4

Warning
PCB-contaminated electrical equipment

The dielectric fluid in this equipment has been tested to determine the amount of polychlorinated biphenyls (PCB content). We certify that, based on the test sample, the fluid contains between 51 mg/kg and 500 mg/kg of PCB.

PCB content: _____ mg/kg

Date: _____

Sample No.: _____

Laboratory: SANAS LAB T0055 (Eskom)

Test method: EPA8004-81-045

Equip serial No.: _____



PCB LEVEL 1

The dielectric fluid in this equipment has been tested to determine the amount of polychlorinated biphenyls (PCB content). We certify that, based on the test sample, the PCB concentration of the fluid is below 10 mg/kg.

PCB content: _____ mg/kg

Date: _____

Sample No.: _____

Laboratory: SANAS LAB T0055 (Eskom)

Test method: EPA8004-81-045

Equip serial No.: _____



PCB LEVEL 3

Warning
PCB-contaminated electrical equipment

The dielectric fluid in this equipment has been tested to determine the amount of polychlorinated biphenyls (PCB content). We certify that, based on the test sample, the fluid contains between 21 mg/kg and 50 mg/kg of PCB.

PCB content: _____ mg/kg

Date: _____

Sample No.: _____

Laboratory: SANAS LAB T0055 (Eskom)

Test method: EPA8004-81-045

Equip serial No.: _____



PCB LEVEL 5

Warning
PCB-contaminated electrical equipment

The dielectric fluid in this equipment has been tested to determine the amount of polychlorinated biphenyls (PCB content). We certify that, based on the test sample, the fluid contains 501 mg/kg and above of PCB.

PCB content: _____ mg/kg

Date: _____

Sample No.: _____

Laboratory: SANAS LAB T0055 (Eskom)

Test method: EPA8004-81-045

Equip serial No.: _____

RSA REGULATIONS



PCB LEVEL 0

The dielectric fluid in this equipment has been tested to determine the amount of polychlorinated biphenyls (PCB content). We certify that, based on the test sample, the PCB concentration of the fluid is below 1 mg/kg.

Date: _____
 Sample No.: _____
 Laboratory: SANAS LAB T001
 Test method: EPA8004-81-045
 Equip serial No.: _____



PCB LEVEL 1

The dielectric fluid in this equipment has been tested to determine the amount of polychlorinated biphenyls (PCB content). We certify that, based on the test sample, the PCB concentration of the fluid is below 10 mg/kg.

PCB content: _____ mg/kg
 Date: _____
 Sample No.: _____
 Laboratory: SANAS LAB T0055 (Eskom)
 Test method: EPA8004-81-045
 Equip serial No.: _____



PCB LEVEL 2

Warning
 PCB-contaminated electrical equipment

The dielectric fluid in this equipment has been tested to determine the amount of polychlorinated biphenyls (PCB content). We certify that, based on the test sample, the fluid contains between 11 mg/kg and 30 mg/kg of PCBs.

PCB content: _____ mg/kg
 Date: _____
 Sample No.: _____
 Laboratory: SANAS LAB T0055 (Eskom)
 Test method: EPA8004-81-045
 Equip serial No.: _____

Why 11ppm not > 50ppm

Chiwaya chicken and chips fried in transformer oil

Chiwaya chicken and chips fried in transformer oil

Posted on [January 3, 2010](#) by [muza2009](#)

3rd January 2010



Chiwayas street food vendors along the roadside in Malawi

It is Malawi's favourite snack with fast service, convenient locations, and value for money. Those with extra notes in their pocket will line up at Hungry Lion, while others will take a short walk to their local chiwaya for probably Malawi's most popular dish – chicken and chips. A chiwaya is a portable makeshift stove – for placing charcoal, and long metal stilt for legs. They are mobile and fit right at discos and bars. On the menu for the cheap price of anything from a cooking oil, a threadbare, hard (but tasty) piece of chicken and coleslaw (time its blue).

Don't buy chips fried in transformer oil, warns Zim's energy minister

2016-09-06 10:29

News24 Correspondent

Harare - Zimbabwe's energy minister Samuel Undenge has complained that people are stealing oil from electricity transformers and selling it on to food vendors who use it to fry chips, the state Zimbabwe Broadcasting Corporation reported on Monday.

In an accusation that's been trotted out before in this southern African country, Undenge was reported as saying the oil stolen from vandalised transformers was being sold to fast food outlets.

Anyone thinking of buying those chips should be careful, the minister said.

"This is a cause for concern for the government because the oil is not for human consumption," Undenge said.



Zimbabwe 2016

Don't buy chips fried in transformer oil, warns Zim's energy minister



PCB MANAGEMENT – SANS 290 STANDARD

Testing of PCB



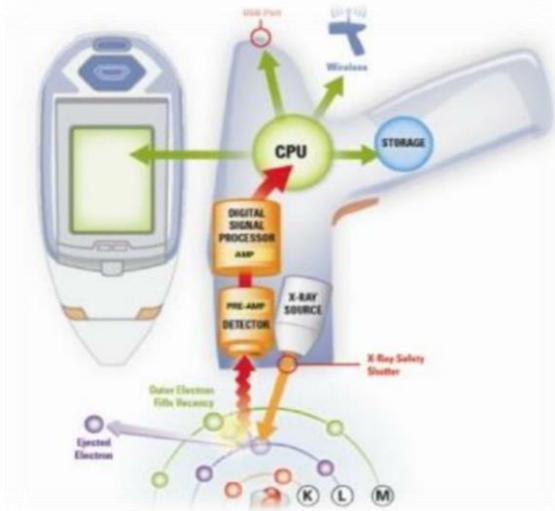
1. PCB DETECTION USING GC ANALYSER

- Oil sample is taken from transformer
- Submit to an accredited laboratory for quantitative analysis
- Currently only Eskom laboratory complies



PCB MANAGEMENT – OIL SCREENING

2. Screening Testing of PCB:



X-RAY FLUORESENE (XRF)



FIELD TEST KITS



PCB MANAGEMENT – OIL SCREENING

Title	Analytical chemistry of PCBs
Author	Mitchell D. Erickson

- Screening sacrifice confidence of analysis for speed/simplicity
- Provides yes/no answer (positive/negative)
- Segregate samples – for further testing
- EPA defines quantitative screening as setting a quantitative action level (50 ppm), where positive response means analyte is present and negative means it is absent

PCB DISPOSAL OPTIONS IN RSA

Various acceptable PCB Management available:
Retro-filling & Reclassification

Oil Dechlorination



Oil and Solid Incineration

RISK MANAGEMENT & MITIGATIONS

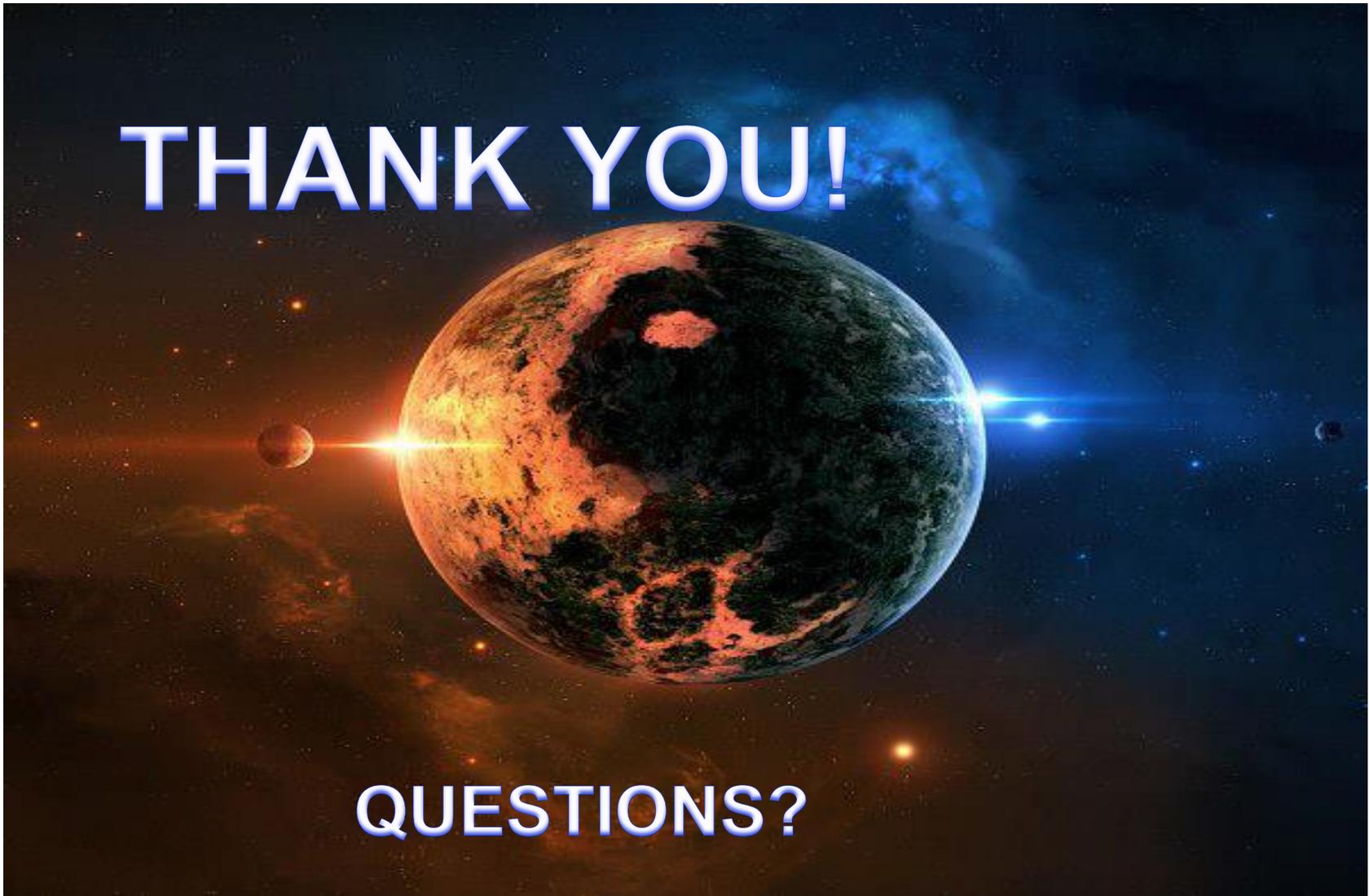
Compliance to the Occupational Health and Safety Act (1993) of the RSA when PCBs are handled at all times is required.

- Eyes, Hands, Feet, Hearing, Head, Body, Breathing maybe affected when exposed to PCBs
- Enforcement of correct use of PPEs
- HIRA Assessment should be in place
- Operating Permit
- Waste Disposal License
- SANS Accredited Laboratory



CHALLENGES FACING RSA

- Limited testing facilities
- Vast numbers of untested equipment
- Lack of knowledge
- Owners are not aware of legislation
- Disposal options and expertise are limited
- Doing the wrong thing is easier - blending
- COSTS - COSTS – COSTS



THANK YOU!

QUESTIONS?