



ON TRANSFORMERS IN INDONESIA

PCB

CONTAMINATION

TREND ANALYSIS ON
NATIONAL PCB
INVENTORY DATABASE

Rio Deswandi, PhD

#172137208



PCB IDENTIFICATION & INVENTORY

PCB MANAGEMENT PLAN

A ROADMAP TO SOUND
**MANAGEMENT
AND DISPOSAL**

PCB INVENTORY MUST BE ACCOMPLISHED
BY THE END OF 2025



WHAT ARE THEY?



WHERE ARE THEY?



HOW MUCH ARE THERE?



HOW DID PCB GET THERE?

PCB CONTAMINATION TREND

PATTERNS AND/OR LIKELINESS OF
PCB PRESENCE (PCC \geq 50 PPM) IN
TRANSFORMERS (AND CAPACITORS)....



BRAND OF DIELECTRIC OIL

YEAR OF PRODUCTION
COUNTRY OF ORIGIN



BRAND OF TRANSFORMERS

PCB-TRANSFORMER MANUFACTURERS

World's Known Producer:

USA: WESTINGHOUSE, GENERAL
ELECTRIC COMPANY, RESEARCH-COTTRELL,
KUHLMAN ELECTRIC CO
GERMANY: AEG, TRAFO UNION

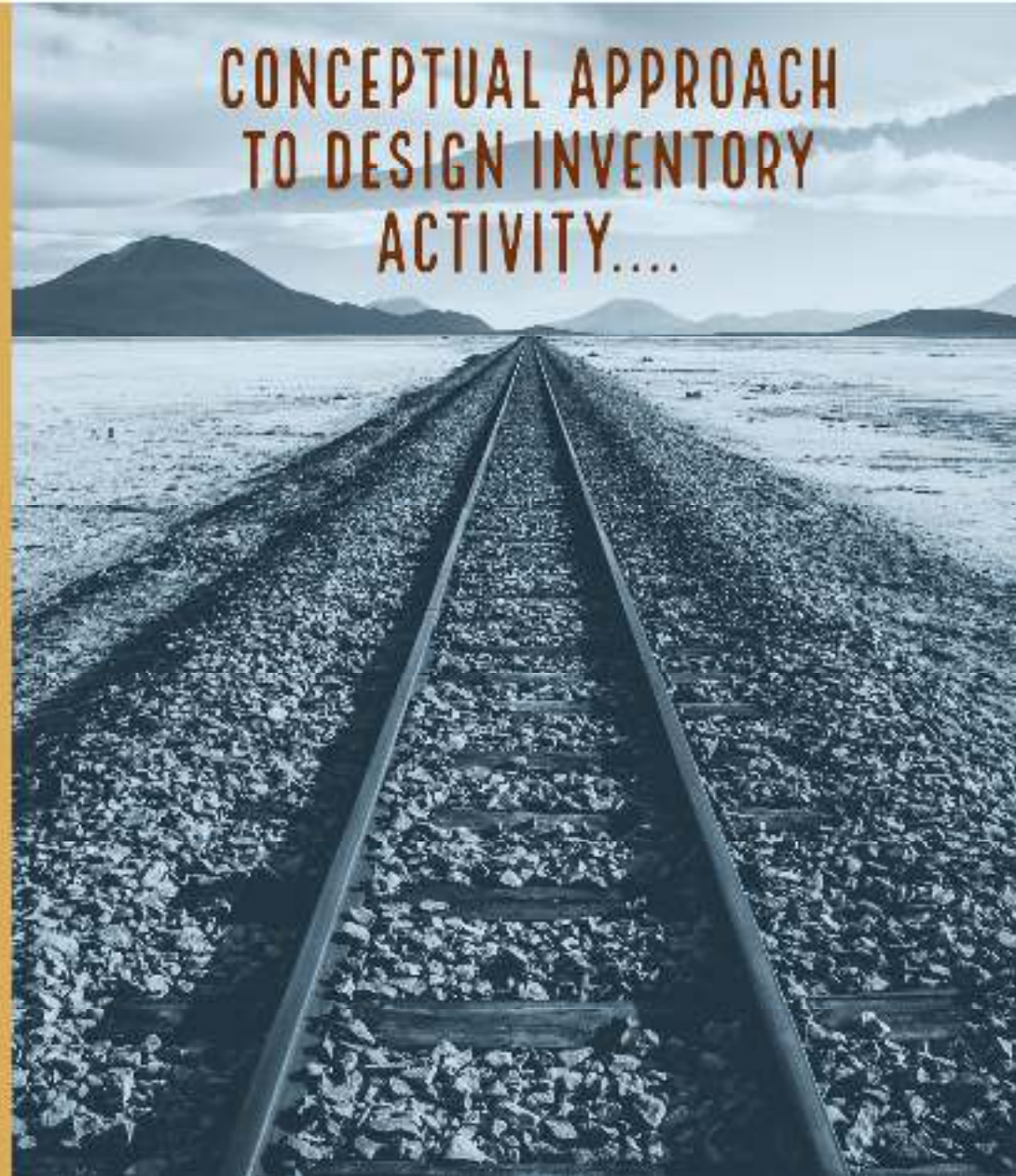


PCB MIXTURES

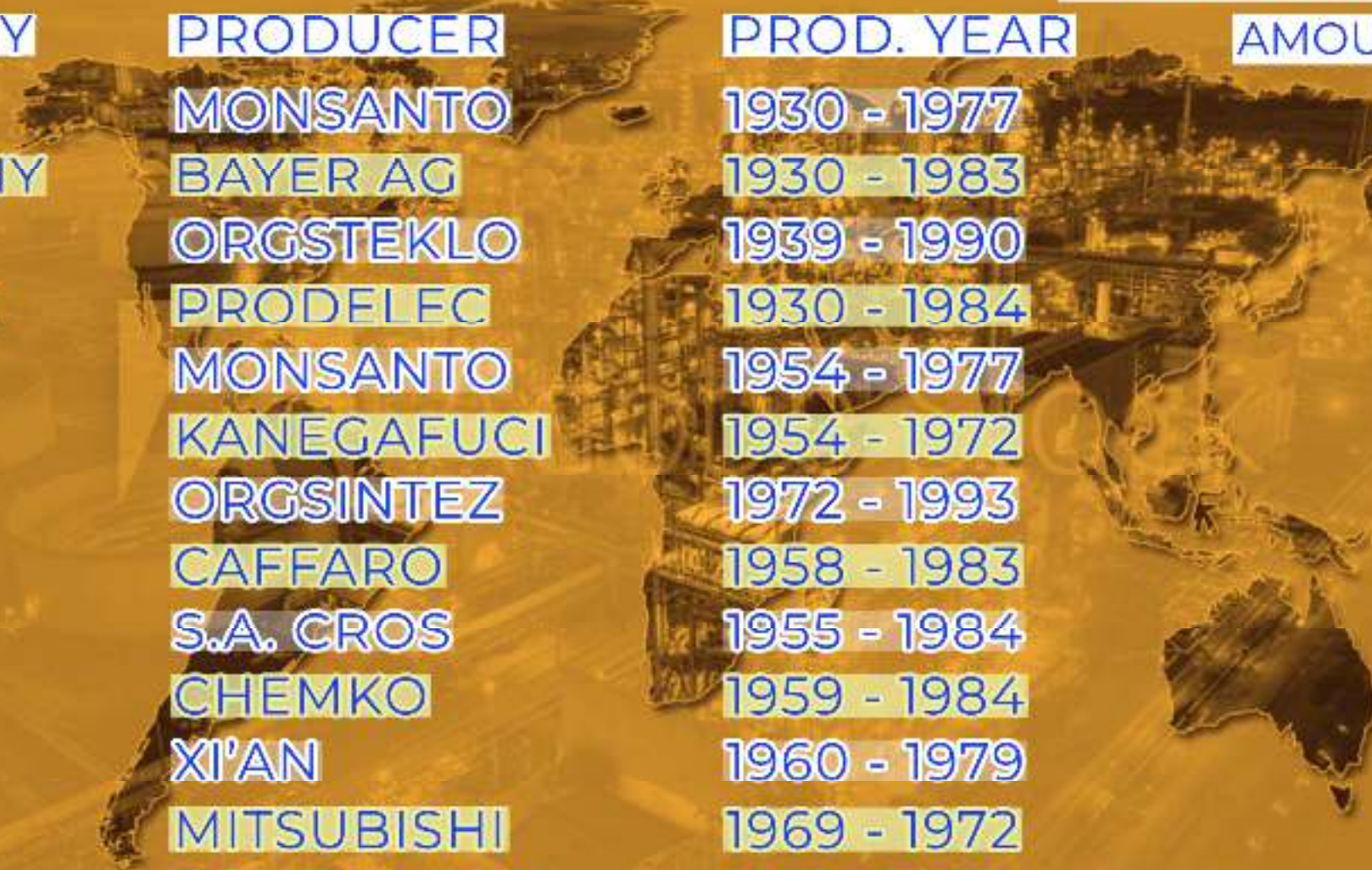
World's Known Brands:

ACECLOR, ADKAREL, BAKOLA, BICHLOR
CHLOREXTOL, CLOPHEN, DELOR, DIALOR
ELECTORPHENYL, ELEMEX....
SAFT-KUHL, SANTOVAC, TERMINOL, ETC....

CONCEPTUAL APPROACH TO DESIGN INVENTORY ACTIVITY....



GLOBAL PRODUCTION:
> 1,300,000 TONS



COUNTRY	PRODUCER	PROD. YEAR	AMOUNT (TONS)
USA	MONSANTO	1930 - 1977	641,246
GERMANY	BAYER AG	1930 - 1983	159,062
SOVIET	ORGSTEKLO	1939 - 1990	141,800
FRANCE	PRODELEC	1930 - 1984	134,654
UK	MONSANTO	1954 - 1977	66,542
JAPAN	KANEGAFUCI	1954 - 1972	56,326
SOVIET	ORGSINTEZ	1972 - 1993	32,000
ITALY	CAFFARO	1958 - 1983	31,092
SPAIN	S.A. CROS	1955 - 1984	29,012
CZECH	CHEMKO	1959 - 1984	21,482
CHINA	XI'AN	1960 - 1979	8,000
JAPAN	MITSUBISHI	1969 - 1972	2,461
USA	GENEVA IND.	1971 - 1973	#17280454

INVENTORY CARRIED OUT BY:
MINISTRY OF ENVIRONMENT AND FORESTRY, INDONESIA
UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

6 PROVINCES

**> 1,000
COMPANIES**

**> 3,000
TRANSFORMERS**

**365
DAYS**



RAPID TEST
POTENTIOMETRY (PPM)



5%
> 50 PPM

80%
CONSISTENT

82%
CONFIRMED

GC-ECD
IEC 61619

INDONESIA

CONTAMINATION TRENDS

3.7% OF TOTAL SAMPLES

50 - 400K PPM

POWER RATING > 100 KVA

27%
KNOWN
COUNTRIES

GERMANY

FRANCE

ITALY

USA

CHINA

JAPAN

73%
NON-PRODUCER
COUNTRIES

I.E. INDONESIA

2%
KNOWN OIL
BRANDS

CLOPHEN

98%
MINERAL
OIL

IEC 60296
IEC 60422

2%
KNOWN
TRANSFORMER
BRANDS

GENERAL ELEC. CO

TRAFO UNION

98%
NON-PCB
BRANDS

6%
"HISTORICAL"
PCB

YOM. BRANDS,
COUNTRIES,
MANUFACTURERS

94%
PCB
CONTAMINATED

PCB <
15,000 PPM



NUMBER OF TRANSFORMERS CROSS-CONTAMINATED BY PCB

"UNITED NATIONS ENVIRONMENTAL PROGRAMME.
2002. PCB TRANSFORMERS AND CAPACITORS
FROM MANAGEMENT TO RECLASSIFICATION AND DISPOSAL"

45%
IN EUROPE

THERE ARE TWO DIFFERENT REASONS WHY

A TRANSFORMER MAY CONTAIN PCB: (1) THE TRANSFORMER WAS DESIGNED AND BUILT TO BE USED WITH A PCB OIL AND (2) EXPERIENCE HAS SHOWN THAT MANY TRANSFORMERS SOLD, OR LABELLED, AS NON-PCB CONTAIN PCBS BECAUSE USING OIL CROSS-CONTAMINATED BY PCB.

"MAINTENANCE PRACTICES [....] TO REMOVE WATER & OTHER IMPURITIES. IF THE SAME MACHINES ARE USED [....] CROSS CONTAMINATION [....] WOULD OCCUR CAUSING THE CLEAN TRANSFORMER ALSO TO BECOME PCB-CONTAMINATED."

"LUCIANO GONZALES,
PHD - PCB ELIMINATION
NETWORK (PEN)
MAGAZINE IN 2010"

CROSS-
TAMINATION

Adobe St

TODAY

RETROFITTED
TRANSFORMERS



27%
YES



37%
NO



36%
N/A

YEAR OF
MANUFACTURE



73% > 1982



25% ≤ 1982



3% N/A

CONCLUSIONS

OF 3,000 SAMPLES 3.7% TRANSFORMERS CONTAINED PCB \geq 50 PPM

PCB LEVEL RANGED FROM 50 - 400,000 PPM

ALL PCB TRANSFORMERS WERE > 100 KVA

6% PCB TRANSFORMERS MATCHED "HISTORICAL PROFILES" OF PCB

94% PCB TRANSFORMERS WERE RELATIVELY RECENT BETWEEN 1983 - 2012

MAINTENANCE PROCESS MIGHT BE RESPONSIBLE FOR RECENT
CASES OF PCB CONTAMINATION



PCB

CONTAMINATION

**IN TRANSFORMERS
IN INDONESIA**

THANK YOU

FOR YOUR KIND ATTENTION

#172137208