

## PCB DECONTAMINATION UNIT - ENERVAC MPU

The MPU series is designed for the decontamination of electrical insulating oils that have been contaminated with low levels of polychlorinated biphenyls (PCBs - also known as "Askarels"). PCBs were first synthesised in 1881 and have excellent properties for use in transformers; they are very stable, fire-resistant, insulating and have a low volatility. Unfortunately, because they are stable organic compounds that can remain indefinitely in the environment, they accumulate in the fatty tissue of most living organisms. The pollutants are so toxic that even one gram can contaminate up to one billion litres of water. Approximately 635,000,000 kg of Askarels were produced in North America before production was banned in 1977.

Oils containing up to 5,000 parts per million (PPM) of PCBs can be processed in the ENERVAC MPU, lowering the PCB level to below the detectable limit.



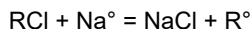
The chemical process employed in the MPU reverses the process by which PCBs were originally developed. A small amount of sodium dispersion is added to dehydrated and degassed insulating oil in a reaction vessel. The sodium reacts with the chlorine in the PCB and converts it to harmless compounds, common salt and a few hydrocarbon residues. These reaction byproducts are removed from the now PCB-free oil either by an optional centrifuge or in a settling tank. The sludge is non-PCB and can be disposed of in any industrial waste disposal facility.

The decontaminated oil can be reused once it has been through a further upgrade with an ENERVAC Fullers Earth system (E575A) and Vacuum Oil Purifier (E865A) or a Transformer Oil Regeneration system (E575R). This upgraded oil meets the ASTM and IEC standards of new oils.

The technology used in the MPU was developed by BC Hydro and Ontario Hydro in the early 1980's, both of these utilities have been using the ENERVAC MPU for over 30 years and have reclaimed tens of millions of litres of contaminated oil.

### DESCRIPTION OF PROCESS

The dechlorination of insulating oils contaminated with low levels of PCBs depends on the reaction of active sodium with chlorine in the PCB molecule, under controlled conditions. This reaction forms sodium chloride and hydrocarbon residues. The principal reaction in the process is the direct removal of the chlorine atoms from the PCB:



where

RCI is a PCB molecule with up to 10 chlorine atoms

Na<sup>°</sup> is a reactive sodium atom

R<sup>°</sup> is a PCB molecule with 1 Cl atom removed

Now, R<sup>°</sup> is reactive and will combine with H<sup>°</sup> formed by the reaction of sodium with residual water in the oil. This will form a neutral RH molecule. If the RH still contains chlorine then it will react again with the sodium until all the chlorine atoms have been removed and replaced by hydrogen atoms. At this reaction endpoint the PCB has been converted to a biphenyl molecule and all the chlorine has combined with the sodium to form salt.



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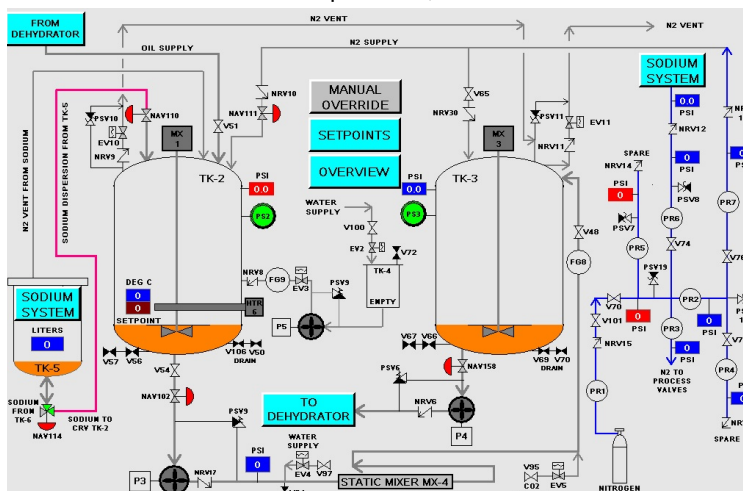
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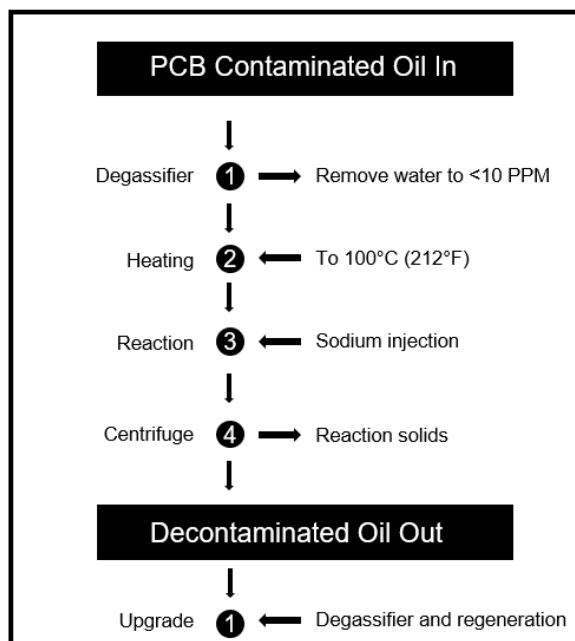
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## Safety & Features

- The process does not produce any emissions
- There is no discharge into the environment
- Integral steel bund holds more than the system total oil capacity
- Process is PLC controlled from an air-conditioned office/laboratory
- All piping is Schedule 40, rated for 1000 psi, actual operating pressure is 15 psi or less.
- Operates at lower temperature than alternative techniques
- All processes operate under an inert gas atmosphere, sodium dispersion is moved around the system by nitrogen gas
- Optional centrifuge for rapid return of oil to use
- Batch sizes from 500 litre to 4,000 litre
- Batch processing time approximately 45 minutes
- Optional onboard sodium dispersion manufacturing system ensures the best results
- Eliminates over-the-road transportation of PCBs
- System is available to be mounted for in-plant use, or mobile units in trailers or custom containers



## Process Oil Flow



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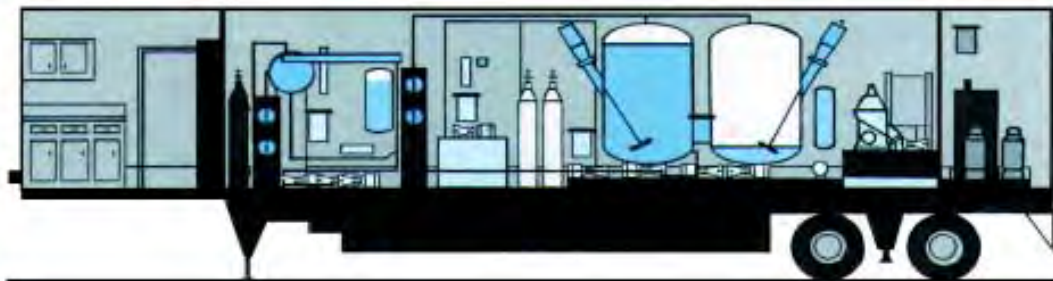


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## Comments

New or dechlorinated oils introduced into a transformer that was previously contaminated with PCBs will experience a leaching effect from the core and coil that was impregnated with contaminated oil. Consequently, the new or dechlorinated oil will take on PCBs and the contamination level will increase. It will not reach the level of PCB contamination that existed prior to the change out or dechlorination. Benchmarks vary globally but most country regulations imply that a transformer that has been retrofilled or dechlorinated must contain less than 50 PPM of PCB 90 days after treatment in order to be classified as successfully decontaminated. Some countries have lowered this limit to no more than 2 PPM, which is considered PCB free or non-detectable. Transformers that have been dechlorinated in situ must contain no more than 2 PPM at the time of treatment.



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