

Monsanto

FROM (NAME & LOCATION)

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DATE : February 1, 1974

SUBJECT : IEEE Meeting - New York - 1/31/74

REFERENCE :

TO : C. Paton

cc: H.S. Bergen
J.G. Bryant - 1650
T.L. Gossage
R.H. Munch - T1B (Atts. only)
W.R. Richard - T3A
P.L. Slayton - 1650
E.S. Tucker - T2F

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Meeting attended by Dr. Scott Tucker and the writer.

Subject: Suggested Dielectric Fluids Replacements

Attached are the four papers given at the IEEE meeting:

- A. The Dielectric Properties of Silicone Fluids
R.M. Hakim, Institute of Research
Hydro-Quebec
- B. Silicone Fluids vs. Hydrocarbon Oils
R.F. Burow & G.A. Vincent, Dow Corning Corp.
- C. Silicone Dielectric Fluids for Liquid Dielectrics
J.S. Hurleg & Dr. A. Torkelson, G.E. Co.
- D. Industrial Organic Chemicals vs. Alternative
Dielectric Fluids
Dr. Larry L. Jackson, The Dow Chemical Co.

I. Silicone Oil:

- A. Silicone oil appears to be the only known substance purported to coming down in price (these days). At roughly \$1.00 a pound, it was said, that they are getting into the range of askarels, which have advanced in price, markedly.
- B. Addressed primarily to transformers, the announcements by Dow Corning and General Electric people, at this time, do not recommend nor guarantee that askarel be directly replaced by silicone oil -- but they emphasize that electrical engineers should indeed try such conversion because it should prove satisfactory.

DSW 197219

While admittedly a good deal more compatibility data is desired, nevertheless, it is pointed out that the Japanese, who no longer like askarel, have already replaced it with silicone oil in some of their railroad transformers. This is a good place to start, but also a 2-year satisfactory operation of a 2,500 KVA transformer filled with silicone oil was mentioned.

- C. While much needs to be probed and established before silicone oil can attain wide commercial acceptance as replacement for askarel, Dow Corning and G.E. now have a respectable staff assigned to this effort.
- D. Still today, Dr. Sloat, who was chairman of this meeting, said that Westinghouse could not take silicone oil and use it to replace either mineral oil nor askarel in a transformer. But he added that given time and experience they could probably design a transformer to operate with silicone oil.
- E. This meeting was not the place to raise "in-depth" questions about the operating performance of silicone oil. However, there was a little discussion of the apparent lack of "self healing" of silicone oil and the fact that no one knew how impregnated press board, etc. behaves under impulse.
- F. Both Dow Corning and G.E. people said they are now getting many inquiries from people asking whether silicone oil can be used to replace askarel and also mineral oil.

II. Industrial Organic Chemical vs. Alternative Dielectric Fluids:

This paper discussed by Dr. Jackson of Dow Chemical also reflects concerted effort and a sizeable program of going on at the research laboratory levels, but lacking practical commercial appraisal and experience.

- A. From a price point of view Dr. Jackson said that he was talking about fluids under \$1.00 a pound and not multi-dollar a pound exotic materials.
- B. By way of most proper and polite questioning, Dr. Tucker brought out a number of aberrations resident in Dow's approach to comparing askarels with Dow's biphenyl oxide derivatives regards biological and toxicological behavior. At least Dow got a preview that a good deal of their thoughts are subject to debate.

DSW 197220

- C. It is also apparent on noting that the Dow material lacks fire resistance, that this leads them to assume that fire-resistance either is not needed or that it does virtually no good.
- D. Doing what they can with halogenated biphenyl oxide to take advantage of our unfortunate environmental position with halogenated biphenyl is so obvious that there is really no need for me to discuss details. They add chlorine to biphenyl oxide to increase its dielectric constant, but limit this to one chlorine to maintain biodegradeability. Doing this with biphenyl oxide allows a low enough pour point and avoids crystallinity, whereas monochlorobiphenyl would be unacceptable on both of these properties. Dow pointed out that they achieve a DK of near 5 which is desirable for capacitors, but of no real interest for transformers, especially as this relatively high capacitance, coupled with the relatively low viscosity, may intensify compatibility problems beyond what we already have with askarels, Additionally giving up fire-resistance. Dow rationalize and assume that it is not needed for capacitors other than their providing a flash point high enough to guard against fire while the capacitor is being impregnated. Then Dow suggest this same fluid to replace transformer askarel which, at a premium price, has combustion resistance in both the liquid form and arc-formed gas as its prime (if not sole) reason for being in use. Here Dow rationalize that need for non-combustibility of the arc-formed gas appears largely as a myth as indeed it does not prevent primary explosion.

CONCLUSIONS:

Dow's approach leaves the audience in confusion about really what are their specific objectives in the end use of the fluid, as they speak of capacitors and transformers in the same "breath".

1. Dow's views of not much need for fire-resistance needs to be challenged and probed.
2. Their inequitable comparison of monochlorobiphenyl oxide against askarels relative to various biological and toxicological considerations are subject to challenge and debate. They show no restraint to advocate even the worst misconceptions about askarels.

DSW 197221

3. As unquestionably Dow is going forward with their replacement approach they will have opportunity for more realistic orientation and guidance as they encounter practical problems in the end use of askarel type capacitors and transformers.

Either their assumptions about little value or need for fire-resistance will be challenged or the anticipated relatively high price of monochlorobiphenyl oxide (even though not over \$1.00/pound) will thwart it. Most likely less costly materials can do what Dow's proposals offer. In fact, we are getting on quite well on this in the capacitor area.

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DSW 197222