Monsanto

FROM (NAME & LOCATION) D.E. Roush - St. Louis General Office

DATE November 30, 1970 CC:

SUBJECT STATUS REPORT
CABLE OIL

REFERENCE

TO :

DISTRIBUTION LIST

M.F. Baber - MBABE
H.S. Bergen - HBERG
P.G. Benignus - PBENI
J.G. Bryant - JBRYA
R. Davis - RDAVI
J.R. Fallon - JFALL
T.L. Gossage - TGOSS
R.H. Munch - RMUNC - JFQ
J.R. Pullman - New York
W.R. Richard - WRICH
R. Weiss - RWEIS
J.J. Roder - Chicago

DSW 201796

STLCOPCB4059863

STATUS REPORT

CABLE OIL

Our efforts to date to establish an existing product as an electrical transmission cable coolant and dielectric indicate an opportunistic market exists.

Cable manufacturers and utilities have expressed interest in our candidate fluids and our expertise in heat transfer and dielectrics.

Additional actions to achieve our stated objectives are included in the attached details.

Please review these actions and note initiate where indicated.

D. E. Roush

lb

DSW 201797

STLCOPCB4059864

STATUS REPORT

CABLE OIL

Background

The use of underground power transmission cables is increasing in the U. S. Availability and cost of right-of-ways and a growing list of restrictions against overhead utilities are given as the reasons.

Insulated cable is buried in pipe to transmit power and costs are as much as 30:1 over conventional pole-type installations. Economics have forced the utilities toward greater electrical carrier capacity in 6 and 8 inch diameter pipe (larger sizes greatly escalate costs) and to achieve greater capacities, it becomes necessary to cool as well as electrically insulate the conductors.

It is in the cooled pipe-type power transmission cables that we find a significant market for heat transfer fluids with dielectric capability.

Polybutene and refined mineral oils are now used but these fluids have not performed as expected. Therminol 55 as MCS 1072 (primarily alkyl benzene) appears to be the best fluid to fit this growing market.

Project Objective

Determine viability of market for heat transfer/dielectric fluids in pipe contained power transmission cables and sell this market on our existing fluids (alkylate H 230 high boiler and ethyl benzenes).

References: J. J. Roder memo to J. R. Fallon, October 12, 1970 and minutes of October 19, 1970 meeting by J. G. Bryant.

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Status

The actions listed in the October 19 minutes are either completed or near completion.

1) AEIC contact made by M. Baber. Two fluid specifications and application guide for insulation temperatures of impregnated-paper insulated cables forwarded to W. R. Richard and R. Munch. J. Roder and D. Roush have obtained Commonwealth Edison's specifications for cable insulating and taping oils--these are attached.

2) Samples of light and heavy polybutene are promised from Zanona at Commonwealth Edison in Chicago. J. Roder to pick up fluid when it arrives at Commonwealth.

   A sample of Amoco polybutene was obtained by Roder from Union Carbide and forwarded to St. Louis.

   A look at compatibility with alkylate benzenes and the dielectric properties has been initiated by R. Weiss.

3) J. Bryant has obtained the following MCS designations for candidate products for cable application:

MCS 1072	alkylate H 230 L
MCS 1072	alkylate H 230 H

4) A 5 gallon sample of MCS 1072 will be adsorptive refined to improve the dielectric properties and will be sent to Zanona at Commonwealth Edison for aging tests. Aging tests are carried out at 95°C. for 100 hours in air environment with and without copper metal. Measurements of power factor change and oxidation of the fluid are tabulated.

5) J. Pullman in New York City has contacted the following cable manufacturers:

   General Cable Company - New York, New York
   Mr. Steve Turner

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Phelps-Dodge - Yonkers, New York
Mr. Jim Moran
Mr. Frank Teti

The Okonite Company
Mr. Dick Waldron

Anaconda Wire & Cable - Hastings on the Hudson, N. Y.
Mr. Ed Eich

Pullman reports the following:

--The cable companies are interested. General Cable and Phelps Dodge are ready to test our fluid on receipt of samples and data. Tests will be similar to aging tests described in #4 plus compatibility with cable impregnants being used. Impregnants will not be changed to accommodate cable coolind fluid-rather cooling fluid must be compatible with impregnant fluid and insulation system.

--The heat transfer problem in fluid filled cables is of equal importance to the dielectric and service-life properties of the fluid. The cable manufacturers request help in the cooled cable installations. We have offered to consult on the heat transfer application of our fluids.

--Use of oil filled cables is just beginning in terms of the cooled cable applications which are required to accommodate higher electrical energy rates transferred. (See M. Baber report October 13, 1970, "Fluids for Power Cables") Oil filled cables have been in use for years in Europe. The primary fluid used in alkyl benzene chemistry but energy rates are lower and do not require cooling.

--Installed filled cables can be converted to cooled filled systems. Phelps-Dodge is working with General Electric on cryogenic cooling techniques.

--Present fluid filled cables are 90% static and 10% cooled. This ratio will reverse within 10 years according to cable manufacturers.

--General Cable is adding 10-15% dodecyl and tridecyl benzene to polybutene to improve heat transfer properties to get better cooling.

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--Price of cable oil (polybutene) confirmed at 50 1/2¢/gallon for refined but untreated product. Treatment consists of degassing without removal of low boilers, demoisturizing, deaerate and blanket shipment with N_2. Treatment adds 10¢/gallon to the cost or 60.5¢/gallon for treated oil. Quality and clean-up of the oil are major problems, particularly at the job site. The installation and/or utility company has clean up equipment for maintaining fluid quality. Even N_2 pressure is important on fluid, as too much pressure saturates oil with gas creating voids in the insulation system and possible cable failure.

--Miscellaneous—Steve Turner of Anaconda lives one door from Pullman and Ed Eich of General Cable lives within a mile and is a ski buff. Jay is confident Turner and Eich will cooperate with our effort.

Miscellaneous Information

Cable System Many different arrangements of conductor and insulation exist in cable systems and not all cable systems are liquid filled.

Solid cross-linked polyethylene has been extruded to form an insulating core and outer shield on cable rated to 230 KV. Kaiser has extruded cable of this type. General Electric's clay-filled Vulkene has been extruded to 230 KV rating also but these systems are still being evaluated. The cross-linked PPE insulating systems are used more routinely to 135 KV.

The preference at this point is the cooled, liquid filled cables.

Insulations & Coatings Coatings are required to protect buried pipe containing the cable. Epoxy and vinyl type coatings are used by Pipeline Service Company in Chicago for Commonwealth Edison.

Vinyl type - Endcor 382
Epoxy type - Endcor 745 available from Dearborn Chemical

Other insulation, conductor and sheathing materials are:

Mylar
Copper
Aluminum
Insulating paper
Stainless steel
Lead

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Cable Oils - Competitive Specified are polybutene, light and heavy grades, Socony Mobilect A and Sun Oil Company's Sun #6. Alkyl benzenes have been used in Europe.

Witco Chemical Corporation, Golden Bear Division, recently advertised a new product compatible with any saturant and with moisture <15 ppm and flash point of 425°F. Not identified chemically.

Further Action Required Through January 1971	Responsibility
1) Prepare tentative specification for cable oil based on low viscosity polybutene specifications and including data to date on our MCS 1072(mixed stream).	DER/JGB*
2) Obtain polybutene samples promised from Commonwealth Edison.	J.J. Roder*
3) Complete present evaluations of candidate fluids --ethylbenzene bottoms (SD4) --aromatic oil #1 --MCS 1072	R.W. Weiss*
4) Complete compatibility study of polybutene and MCS 1072	R.W. Weiss*
5) Evaluate test data and select candidate fluid	R.W. Weiss/ DER/JGB
6) Gain acceptance of tentative specifications by several OEMs and utilities and establish testing of candidate fluid. (Commonwealth Edison, General Cable and Phelps-Dodge have agreed to testing)	*DER/J.S. Pullman/ J.J. Roder
7) Prepare quantities of candidate fluid for testing	R.W. Weiss*
8) Investigate, in depth, electrical properties of candidate fluid.	R.W. Weiss*
9) Determine production requirements of MCS 1072 (mixed stream) to meet tentative specification	J.G. Bryant*
10) Define further the heat transfer demands of pipe-type cable systems.	J.S. Pullman* J.J. Roder D.E. Roush

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*Prime Responsibility

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11) Initiate market plan

* D. E. Roush
J. G. Bryant

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LOW VISCOSITY POLYBUTENE OIL FOR PIPE TYPE CABLE

1. SCOPE

1.1

The oil furnished in accordance with this specification will be used as the insulating, cooling and pressure medium in 69 and 138 kV high-pressure pipe type, forced-cooled, cable installations.

2. GENERAL

2.1

This oil shall be a butylene polymer oil suitable for use in pipe type installations as an insulating and cooling medium. It shall be chemically compatible with the cable impregnant, and shall be free from matter which might be injurious to cable installation, or be affected by Endcor 382 vinyl pipe coating or Endcor 745 epoxy pipe coating and/or other parts of the pipe type cable system.

This oil shall meet the following requirements when tested in accordance with applicable ASTM standards of latest issue as listed for the most part in ASTM Specification D117.

3. PROPERTIES

3.1 FLASH POINT

130°C or higher. 266° F
Test Method ASTM D92.

3.2 POUR POINT

Minus 45°C or lower. Test Method ASTM D97. -49° F

3.3 VISCOSITY

At 37.8°C: 115 to 140 Saybolt Universal sec. 29-30 cs
At 100°C: 38 to 44 Saybolt Universal sec. 3.6 to 5.5 cs
Test Method ASTM D88.

3.4 NEUTRALIZATION NUMBER

The neutralization number or amount of potassium hydroxide in milligrams to neutralize 1 gram of the oil shall be less than 0.02. Test Method ASTM D974.

3.5 FREE AND CORROSIVE SULPHUR

The oil shall not contain free sulphur nor corrosive sulphur compounds. Test Method ASTM D989, except that the copper strip shall be maintained in the oil at test temperature for 16 hours.

3.6 DIELECTRIC STRENGTH

The dielectric strength of the oil shall be 35 kV or higher.
Test Method ASTM D877.

3.7 POWER FACTOR

The power factor at 60 cycles shall be not more than 0.1 per cent at 100°C. Test Method ASTM D924.

3.8 RESISTIVITY

The dc resistivity, in ohms per cubic centimeter, shall be 100×10^{12} or more at 100°C.
Test Method ASTM D1169.

3.9 GAS CONTENT

The Vendor in his proposal shall state a guaranteed maximum gas content under standard conditions of 760 mm of mercury and 0°C, by ASTM D831, for the oil as shipped. The typical constituents of the gas on a volume percentage basis by gas chromatograph shall be included in the proposal.

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3.10 COLOR NUMBER

The color number shall not exceed 1 as determined by use of the ASTM Union Colorimeter. Test Method ASTM D155.

3.11 CHLORIDES

Organic chlorides as chlorine shall not exceed 30 ppm.

3.12 WATER

Water content shall not exceed 30 ppm. Test Method ASTM D1533.

4. METHODS OF SAMPLING AND TESTING

4.1 SAMPLING METHODS

The samples on which tests are made shall be obtained by Test Method ASTM D923, except that gas content samples shall be taken directly in the piston type sampling apparatus as covered in ASTM D831.

5. DETERMINATION OF QUANTITIES

5.1

Sixty degrees Fahrenheit (60°F) is established as the normal temperature for measurement of oil delivered under this specification. The temperature of the oil shall be determined at the time of volume measurement. The apparent quantity of oil shall be corrected to a 60°F basis in accordance with the Standard Abridged Volume Correction Table for Petroleum Oils; ASTM D1250 (Table 7).

6. SHIPMENT

6.1

The oil shall be shipped in clean tank cars or tank trucks with a positive regulated nitrogen blanket at 2 psi maximum over the oil.

7. REPORT TO BE FURNISHED BY VENDOR

7.1

Proposals shall include a statement indicating that the oil supplied will be in accordance with this specification except for specifically stated exceptions. Any exceptions shall be clearly listed in the proposal.

7.2

At the time of shipment, liquid samples shall be taken from each tank car or tank truck. The reported inspection results shall include measured values of the properties listed in the Specification.

In addition the amount of water in top and bottom tank oil samples shall be reported.

8. SUPPLEMENTARY SPECIFICATIONS

8.1

ASTM Specifications D88, D92, D97, D117, D155, D877, D923, D924, D974, D989, D1169, D1250, D1533, all of latest revision.

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INSULATING OIL FOR PIPE TYPE CABLE

1. SCOPE

1.1

The oil furnished in accordance with this specification will be used as the insulating, cooling and pressure medium in 69 and 138 KV high-pressure pipe type cable installations.

2. GENERAL

2.1

This oil shall be a pure mineral oil specially prepared and refined for use in pipe type installations as an insulating and cooling medium. It shall be chemically compatible with the cable impregnant, and shall be free from matter which might be injurious to insulation, No-ox-id #260 pipe coating and/or other parts of the pipe type cable system. Sun Oil Company Sun #6 Electrical Oil is an approved oil.

This oil shall meet the following requirements when tested in accordance with applicable ASTM standards of latest issue as listed in ASTM Specification D117-54T.

3. PROPERTIES

3.1 FLASH POINT

190C or higher. Test Method ASTM D92-52, or latest revision.

3.2 POUR POINT

Minus 21C or lower. Test Method ASTM D97-47, or latest revision.

3.3 VISCOSITY

At 37.8C between the limits of 750 to 850 Saybolt Universal sec.
At 100.0C between the limits of 55 to 65 Saybolt Universal sec.
Test Method ASTM D88-53, or latest revision.

3.4 NEUTRALIZATION NUMBER

The neutralization number or amount of potassium hydroxide in milligrams to neutralize 1 gram of the oil shall be less than 0.02. Test Method ASTM D974-54T, or latest revision.

3.5 FREE AND CORROSIVE SULPHUR

The oil shall not contain free sulphur nor corrosive sulphur compounds. Test Method ASTM D989-51, or latest revision. The copper strip shall be maintained in the oil at test temperature for 16 hours.

3.6 DIELECTRIC STRENGTH

The dielectric strength of the oil shall be 25 KV or higher. Test Method ASTM D877-49, or latest revision.

3.7 POWER FACTOR

The power factor at 60 cycles shall be not more than 1.0 per cent at 100C. Test Method ASTM D924-49, or latest revision.

3.8 RESISTIVITY

The d-c resistivity in ohms per cubic centimeter shall be 2.0×10^{12} or more at 100C. Test Method ASTM D1169-54T, or latest revision.

3.9 GAS CONTENT

The oil need not be degassed by the vendor.

NOTE: After degassing, the gas content shall be less than 1.0 percent under standard conditions of 760 m.m. of mercury and 0C. Test Method ASTM D831-48, or latest revision.

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3.10 COLOR NUMBER

The color number shall not exceed 2 as determined by use of ASTM Union Colorimeter. Test Method ASTM D155-45T, or latest revision.

4. METHODS OF SAMPLING AND TESTING

4.1 SAMPLING METHODS

The samples on which tests are made shall be obtained by Test Method ASTM D923-49, or latest revision, except that gas content samples shall be taken directly in the piston type sampling apparatus as covered in ASTM D831-48.

5. DETERMINATION OF QUANTITIES

5.1

Sixty degrees Fahrenheit (60F) is established as the normal temperature for measurement of oil delivered under this specification. The temperature of the oil shall be determined at the time of volume measurement. The apparent quantity of oil shall be corrected to a 60F basis in accordance with the Standard Abridged Volume Correction Table for Petroleum Oils; ASTM D1250-53 (Table 7).

6. SHIPMENT

6.1

Insulating oil supplied under this specification shall be shipped in clean tank cars with nitrogen gas in the space over the oil.

7. SUPPLEMENTARY SPECIFICATIONS

7.1

ASTM Specifications D88-53, D92-52, D97-47, D117-54T, D155-45T, D831-48, D877-49, D923-49, D-924-49, D974-54T, D989-51, D1169-54T, D1250-53, all of latest revision.

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CABLE INSULATING OIL

1. SCOPE

1.1

The oil furnished in accordance with this specification will be used as an insulating medium in cables and accessories for 34.5, 69 and 138 kv solid type and low-pressure oil-filled cables. It shall be a pure mineral oil approved by the purchaser, and conforming to the following requirements, as determined by the stated method of testing.

2. GENERAL

2.1

A one gallon sample of the kind of oil that is proposed to be furnished shall be submitted in a clear glass container for the purchaser's approval. If the sample meets the specifications, and is approved by the purchaser, oil of equivalent quality can be shipped as instructed. This does not require that the oil supplied be of the same lot as the original sample, but it does require that it be in accordance with the same specifications and have characteristics equal to those of the original sample when subjected to the same tests and inspection. Socony Mobil Mobilect A is an approved oil.

2.2

Each shipment of oil will also be sampled and tested by the purchaser and shipments not meeting these specifications will be rejected.

3. PROPERTIES

3.1 FLASH POINT

150C or higher. Test Method ASTM D92-52, or latest revision.

3.2 POUR POINT

Minus 40C or lower. Test Method ASTM D97-47, or latest revision.

3.3 VISCOSITY

At 37.8C between the limits of 92 to 125 Saybolt Universal sec. 184 to 245
At 54.4C between the limits of 60 to 72 Saybolt Universal sec.
At 100.0C between the limits of 38 to 40 Saybolt Universal sec.
Test Method ASTM D88-53, or latest revision.

3.4 NEUTRALIZATION NUMBER

The neutralization number or amount of potassium hydroxide in milligrams to neutralize 1 gram of the oil shall be less than 0.02. Test Method ASTM D974-54T, or latest revision.

3.5 FREE AND CORROSIVE SULPHUR

The oil shall not contain free sulphur nor corrosive sulphur compounds. Test Method ASTM D989-51, or latest revision. The copper strip shall be maintained in the oil at test temperature for 16 hours.

3.6 DIELECTRIC STRENGTH

The dielectric strength of the oil shall be 25 KV or higher. Test Method ASTM D877-49, or latest revision.

3.7 POWER FACTOR

The power factor at 60 cycles shall be not more than 0.50 per cent at 100C. Test Method ASTM D924-49, or latest revision.

3.8 RESISTIVITY

The d-c resistivity in ohms per cubic centimeter shall be 15×10^{12} or more at 100C. Test Method ASTM D1169-54T, or latest revision.

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3.9 GAS CONTENT

The oil need not be degassed by the vendor.

3.10 COLOR NUMBER

The color number shall be less than 1 as determined by use of ASTM Union Colorimeter. Test Method ASTM D155-45T, or latest revision.

4. METHODS OF SAMPLING AND TESTING

4.1 SAMPLING METHODS

The samples on which tests are made shall be obtained by Test Method ASTM D923-49, or latest revision.

5. DETERMINATION OF QUANTITIES

5.1

Sixty degrees (60F) is established as the normal temperature for measurement of oil delivered under this specification. The temperature of the oil shall be determined at the time of volume measurement. The apparent quantity of oil shall be corrected to a 60 degree basis in accordance with the Standard Abridged Volume Correction Table for Petroleum Oils; ASTM D1250-53 (Table 7).

6. SHIPMENT

6.1

Cable oil shall be shipped in 55-gallon steel drums. Each container shall be oil-tight and sealed to prevent the entrance of moisture and shall be stencilled "Socony Mobil Mobilect A" The figures shall be at least one-half inch high and preferably one inch or more high.

7. SUPPLEMENTARY SPECIFICATIONS

7.1

ASTM Specifications D88-53, D92-52, D97-47, D115-45T, D877-49, D923-49, D924-49, D974-54T, D989-51, D1169-54T, D1250-53, all of latest revision.

DSW 201809

QUARTS - STOCK NO. 351.004
GALLONS - STOCK NO. 351.010

TAPING OIL

1. SCOPE

1.1

This specification covers oil used to fill joints of paper insulated solid type cable rated 34.5 kv and below. The oil may also be used in conjunction with varnished cloth tape application in cable joints and terminals, to test paper cable insulation for moisture at temperatures not exceeding 160C, and to wash filings from connectors.

2. GENERAL

2.1

Vendors initially quoting on this oil shall submit two one quart samples representative of the oil to be furnished under this specification. All subsequent shipments will be rejected if found inferior in any respect to the sample submitted, or not meeting the requirements of this specification.

3. PROPERTIES

3.1 FLASH POINT

The flash point shall not be less than 225C. Test method ASTM D-92.

3.2 POUR POINT

The pour point shall not be above 5C nor below -15C. Test method ASTM D-97.

3.3 VISCOSITY

The viscosity shall be within the following limits:

Temperature Degrees Centigrade	Viscosity Saybolt (Universal) Sec.
37.8	1300-5000
54.4	400-1500
100.0	60-175

The viscosity shall be determined by a Saybolt Universal Viscosimeter having a standard orifice 0.1765 inch in diameter. Test method ASTM D-88.

3.4 NEUTRALIZATION NUMBER

The neutralization number or amount of potassium hydroxide in milligrams to neutralize one gram of the oil shall be less than 0.03. Test method ASTM D-974.

3.5 FREE AND CORROSIVE SULPHUR

The oil shall not contain free sulphur or corrosive sulphur compounds. Test method ASTM D-989. The copper strip shall be maintained in the oil at test temperature for 16 hours.

3.6 DIELECTRIC STRENGTH

The dielectric strength shall be 25 kv or higher when tested in accordance with ASTM D-877.

3.7 POWER FACTOR

The power factor at 60 cycles shall not be more than 1.00 percent at 100C. Test method ASTM D-924.

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4. INSPECTION

4.1 TESTING

Each shipment received shall be tested for viscosity at 54.4 and 100C as per Par. 3.3, and for dielectric strength per Par. 3.6.

At the option of the inspector a complete test of all properties shown in Section 3 may be made on any shipment.

4.2 SAMPLING

If the shipment consists of 50 cans or less, 3 cans shall be selected at random for testing. If the shipment exceeds 50 cans, 4 samples shall be selected.

If any one sample is found defective, the shipment shall be rejected.

5. PACKING AND MARKING

5.1

Taping oil shall be shipped in quart or gallon cans as specified in the purchase order. The cans shall be of the sealed type and shall be packed in cartons containing approximately 10 quart cans, or 4 one gallon cans.

5.2

Each can and carton shall be marked with the name of the supplier, and "Taping Oil EM-27010". In addition each carton shall be marked with the purchase order number.

6. SUPPELEMENTARY SPECIFICATIONS

ASTM Specifications D-88, D-92, D-97, D-877, D-924 and D-989 all of latest revision.

DSW 201811

1.5 Cont.
.5 - dry
1.6 profit
.2 Hand
1.0 fixed
4.8

PROJECT PROFILE

I. THE PROJECT

36 ¢

TITLE: Formulated Fluids for Transformers, Switchgear and Power Cables - Replacement in Mineral Oil Applications.

TYPE: A - Extension of Product Line

Product Objective (Who are the customers and what are they trying to accomplish?):

Power and distribution transformers consume the bulk of the electrical mineral oil used in the electrical industry. Present consumption in transformers is estimated to be about 45 $\overline{M}$ gallons or \$11 $\overline{M}$. Consumption in switchgear and cables may be on the order of 4 $\overline{M}$ gallons.

Present mineral oil is felt to be satisfa tory in all these applications, and there is no great desire to change fluids. However, there are certain properties in which present mineral oils are somewhat deficient.

Fire resistance in transformers is one, thus the market for 1.4 $\overline{M}$ gallons of Askarel. A small market may exist for a blending agent which would make transformer oil more fire resistant and more resistant to the formation of arc-formed gases. Askarel might be used in switchgear except that non-explosive, but corrosive HCl is formed under the repeated arcing conditions.

Viscosity is important in transformers, the lower the better for fluid flow and good heat transfer. Historically, viscosity was unimportant in underground cables and viscous fluids are still normally used. More recently, designs for EHV underground cables required that the fluid be pumped and forced cooled. Lower viscosity fluids were needed and the slightly more expensive polybutenes were substituted for some straight mineral oils.

Fluids which will operate at higher temperatures in combination with paper are desired for some transformer applications, but mainly in cables. Above 75°C or so degradation products from the paper attack mineral oil. Both Askarels and mineral oils are more sensitive to contaminants, oxygen and water that is desirable.

Heat transfer is generally a prime function of an electrical fluid. A fluid or system which allowed faster heat transfer would be of interest to the industry.

Finally, if some way could be found to improve the dielectric strength of the fluid or the fluid and paper in combination, this would be considered a major advance by the industry and would be most desirable. It has been suggested that the formation of a jell in the paper might cause a significant increase in dielectric strength of the system.

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(What are the specifications of the products we propose to develop
ose customers?):

nsformer and switchgear applications, the product would have to impart
increase in desired properties (dielectric strength, low temperature
mance, oxidative stability, viscosity, non-flammability, etc.) to
y a higher price, even as a blending agent. Otherwise it must be
itive in price and superior to mineral oil in some respect. Therminol
n alkyl benzene high boiler available from the Inorganic Division may
bly be superior to mineral oil in some respects.

same is true in cables, but with some exceptions. Above 345 KV the
of present fluids and materials causes the need for pumping stations
forced cooling, which is expensive. Forced cooling would not be
quired if fluid/solid dielectric (paper or film) systems could be designed
operate at higher temperatures, say 125°C. Higher temperature fluid/paper
stems should find limited applicability in transformers as well.

ome cables are designed to operate above 550 KV. It is possible that for
these neither cellulosic paper nor non-synthetic mineral oils will be
useable, and synthetic fluids will be required. Low dissipation factors
and low dielectric constants are important in higher voltage cable appli-
cations.

CONTRIBUTION TO SALES AND PROFITS

	Year	Total Market	Expected Market Share
Market Potential	1972	$13 M	$0 M
	1974	$15 M	$1 M
	1977	$18 M	$2 M

Basis of estimates:

10-12% of total use in transformers and switch gear. Chances of success are below 50% at these sales levels.

Estimated Profit Contribution (How much profit, when?):

20% on sales or $0.4 M in 1977

Estimated Capital Investment Required:

Minor plus working capital in early years, as this is a byproduct stream.

III. PROJECT APPROACH, RESPONSIBILITY AND CONTROL

R and D Program (brief statement of general approach)

As materials and approaches come to mind, these should be evaluated for possible R&D effort. The development of anti-oxidants could be considered. The following steps will be taken on the alkyl benzene high boiler:

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1) Determine how much by-product material we have available.

2) What its physical, chemical and electrical properties are.

3) Whether it would be of uniform quality or subject to variations at the whim of those operating the detergent alkyl benzene process.

4) Have it evaluated by the complete set of industry tests for transformer use by someone like Doble Engineering.

5) See how properties match industry needs.

6) Decide what treatment is needed.

7) Determine whether or not any additives are required or could be used if needed to improve cost/performance.

8) Evaluate to see if cost/performance is better than other materials.

R and D Expense: $10,000 on alkyl benzene high boiler.

Project Leaders - Marketing or Development J. Bryant on alkyl benzene, M. Baber on others

Research R. H. Munch

Action Plan: Electrical/Electronic Industry Diversification Plan, Initial Draft, M. F. Baber, 8/28/70

IV. PROJECT STATUS REVIEW

Status:

Achievement Targets (minimum)	Dates
Samples of alkyl benzene streams obtained	2/1/71
Properties of streams measured	3/15/71
Additives research completed	6/1/71
Samples of product to G.E. and Westinghouse	7/1/71

Possible Road Blocks and Alternatives:

Utilities prefer only one general purpose fluid for transformers. The new fluid may not be enough superior to mineral oil to justify use of a second fluid.

We could consider reselling mineral oil for Lion Oil or another oil company, perhaps one presently in the business and doing poorly.

DSW 201814

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