[illegible]

FROM : J. J. Zeman - B2SK

DATE : January 22, 1976

SUBJECT : III. C. Transformer Action Plan
Retrofit Opportunity

MESSAGE :

TO : R. G. Potter

As part of the PCB Task Force planning exercise, we considered the possible opportunity of undertaking a program to retrofit askarel containing transformers. This was a natural item to consider as part of our planning. After due consideration, the Task Force has decided and will recommend that Monsanto not enter into such a program.

The reasons for this are that such a program would greatly increase Monsanto's liability and exposure to PCB contamination in the environment. Also, part of the transformer retrofit would be the re-rating of the transformer and the issuing of a new warranty. This obviously has to be the responsibility of the transformer manufacturer.

The only area we have decided Monsanto should enter would be to supply the fluids used for retrofitting. We also have decided and recommended that we not be involved in the incineration of askarel fluids. This was decided because it would require large quantities of PCB containing materials being handled within a Monsanto site, which would make it difficult for Monsanto to meet any forthcoming PCB discharge standards.

Obviously this does not preclude some other technology for destruction of PCB's, only that technology that we now possess for incineration. Also, in the case of incineration it may require building a unit much larger than the one we now have at Krummrich and on the surface this does not look like a business Monsanto should be involved in.

In the area of developing fluids for transformer retrofitting, we should be very careful not to dilute our R&D manpower and detract from our replacement programs or our own internal decontamination requirements. Such a development effort should evolve from our own program for internal decontamination.

Unless you advise otherwise, we are proceeding with our planning accordingly. Attached for your information is a document we used for analyzing the retrofitting matter.

J. J. Zeman

/rd
Attachment

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[redacted]

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PCB PLANNING TASK FORCE

TRANSFORMER FLUID RETROFIT OPPORTUNITY

There are some one hundred thousand askarel transformers in place in the United States containing a total of about three hundred million pounds of PCB base fluid. These transformers are valued at an estimated one billion dollars. Seventy percent of them are less than ten years old. Top up for these transformers represents about one million pounds per year of fluid. Replacement over ten years would represent a demand of thirty million pounds per year of dielectric fluid plus whatever flushing medium is needed.

If there is some broad national program to drain the PCB base fluids out of these transformers, and if Monsanto has a PCB replacement fluid program for new transformers, what should Monsanto's role be regarding the retrofit opportunity?

1. No participation;
2. Sell fluid to transformer manufacturers;
3. Sell fluid to transformer users;
4. Dispose of the PCB's if they are drained;
5. Involve in a service of retrofit?

These and other postures are possible. The following outlines the issues to be resolved to answer this question.

Product

1. Do we have a proved, environmentally qualified transformer fluid? Accepted as fire resistant by FM?

2. Is it compatible with askarel transformer (design insulation, sealants, etc.)? Some or all transformer models?

3. Is it suitable for top up in askarel transformers?

4. If not, is it suitable after a reasonable drain and flush procedure?

5. What would the flush fluid be?

6. How does our fluid compare to potential competition?

DSW 223785

Market Volume and Timing

1. Where are these (domestic) transformers? Type, size, user, location, age, fluid fill.

2. What is the total quantity of askarel in them?

3. What volume of fluid would be needed for top up or flush and replace? When?

4. What pressures or legislation are state and federal agencies likely to impose?

Procedure

1. Will transformer users have to dispose of their askarel because of a law or because of unavailability of a compatible top up fluid?

2. Will replacement fluids allow top up; or drain, flush and fill?

3. If top up, who supplies the fluid and instructions for retrofit to the transformer user:

   - transformer manufacturers (including Allis Chalmers and others who once made them),
   - fluid manufacturer or
   - service companies.

4. If drain, flush and replace, who performs the service?

5. What roles do the transformer manufacturers want to play?

Incineration

1. What incineration load will result? Volume, timing, storage.

2. What incineration capacity is needed in what locations? What is available (Monsanto, G.E., others)? How will capacity be increased sufficiently?

Manufacturing

1. How will we manufacture/purchase the needed volumes of flushing and replacement fluids?

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Law

1. Who is responsible for performance of each transformer retrofitted?

2. Who will be responsible for PCB entering the ecology during draining, flushing, transportation, storage and incineration of askarels?

Public Relations

1. What would be the risks to Monsanto's image if we were to handle and transport PCB's and concentrate volumes at incineration sites?

Economics

1. Sales of fluids for retrofit programs?

   Profit opportunity.

   New capital required.

III. D. Transformer Action Plan (Events Chart - Worldwide)

TIMING	ACTIONS	DECISIONS/APPROVALS
3rd Qtr '76	7/76 AR grade estimate prepared for interim manufacture. 7/76 Obtain GE/Westinghouse results on transformer model test program. 9/76 Check 1839 blends against emergent fire safety standard. 9/76 Results for 90-day feeding studies. 9/76 AR grade forecast to R.E. Beal 9/76 Complete MCS 1866 Review Report.	9/76 Interim approval of EC 202 including resolution of TCB issue. 9/76 Customer commitment to interim manufacture. 9/76 Decide GO/NO GO on transformer program.
IF GO 4th Qtr '76	10/76 AR for interim manufacture in existing facilities. 10/76 Begin 2-year feeding studies. 10/76 Initiate European planning process. 12/76 Alternate diluent found or search abandoned.	10/76 AR approval for interim manufacture.

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III-D Transformer Action Plan (Events Chart - Worldwide)

TIMING	ACTIONS	DECISIONS/APPROVALS
1st Qtr '77	1/77 Complete site study for economic evaluation for long-term manufacture	1/77 Site selected
2nd Qtr '77		
3rd Qtr '77		
4th Qtr '77	10/77 Begin interim manufacture 11/77 1-year results of 2-year feeding studies 12/77 PIR submission for permanent facilities	
1st Qtr '78		
2nd Qtr '78	AR submission for permanent facility	

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IV. Impact on Related Business

A.1 Economic Dependence - U.S.

While various other products have been developed using polyphenyls, Aroclor remains the dominant outlet in both pounds and dollars -- 50% of budgeted Anniston polyphenyl production for 1976 is biphenyl for Aroclor. Because we have dropped non-electrical uses of Aroclors, including all solid Aroclors (chlorinated terphenyl) in recent years, we already have twice the capacity needed. Total loss of dielectrics would reduce requirements to less than 25% of capacity. A "domino effect" would then begin, because the next largest volume, Santosol 340 (hydrogenated terphenyl), would no longer be cost competitive, and the remaining products including the now-profitable Therminol 66 could not support the investment.

Since MIPB is a biphenyl derivative and is functionally at least as good as other candidate hydrocarbons, it was chosen for the MCS 1238 blend. MCS 1238 relates only to the capacitor business, and our transformer candidate uses relatively little biphenyl, so the other derivatives will suffer somewhat even if the replacement program is completely successful.

Table I shows the impact of dielectrics on the flow sheet (based on volumes in the 10/31 Production Plan).

Use of biphenyl in dielectrics is not the only way to maintain a viable flow sheet, of course. Any profitable large volume use of either biphenyl or quaterphenyl would have the same therapeutic effect. Terphenyl volume would be less advantageous, due to flow sheet balance considerations. A quaterphenyl outlet must be profitable on a fully-costed basis, rather than the by-product accounting currently practiced.

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TABLE I

	Present Business	No Dielectrics	No Aroclor, 8M lbs., MCS 1238	No Aroclor 20M# MCS 1238
Aroclor/Pyranol Sales, M Lbs.	33,800	-0-	-0-	-0-
Santosol 340/Therminol 66, etc., Sales M Lbs.	14,450	14,450	14,450	14,450
MCS 1238 Sales, M Lbs.	200	-0-	8,000	20,000
Misc. Derivatives & Sales per se, M Lbs.	5,300	5,300	5,300	5,300
Total Polyphenyl Requirements, M Lbs.	37,200	18,600	23,200	30,300
Unit Cost, ¢/Lb.				
Biphenyl	19.2	27.3	24.0	20.8
Santosol 340, Therminol 66	23.6	33.1	29.5	25.7

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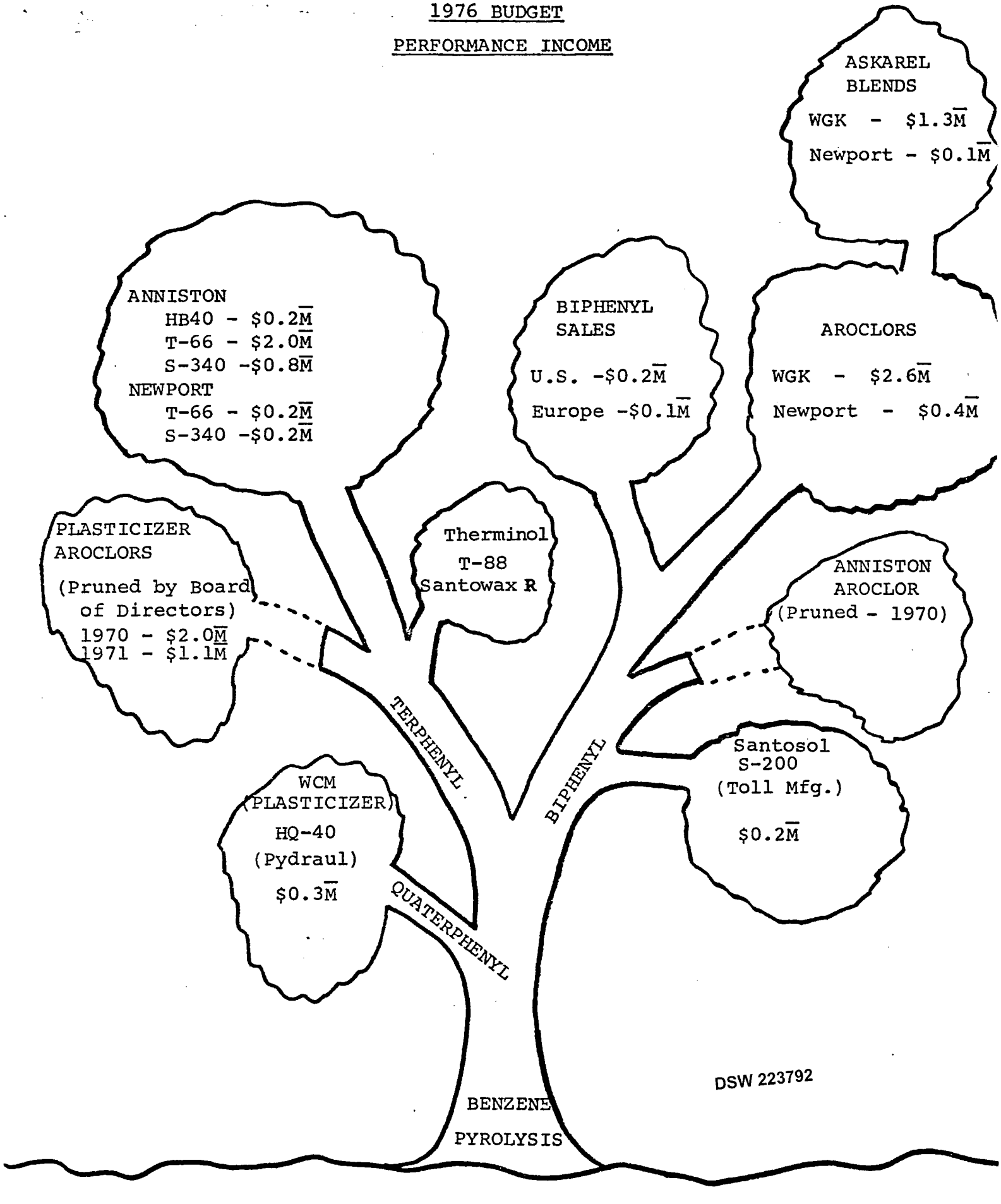

P O L Y P H E N Y L T R E E

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IV. Impact on Related Business

A.2 Economic Dependence - Europe

PCB's represent only 26% of our European polyphenyl output, but 54% of sales revenue. Immediate loss of PCB's would put the complex at a negative performance income, but there are more options available to correct the problem than in the U.S. In addition to the therapeutic effect of a successful MCS 1238 program, the following actions can be taken:

1. Increase merchant biphenyl volume.

2. Increase capacity for hydrogenation of terphenyl for Santosol 340 and/or Santotherm 66, either by debottlenecking from 1500 to 2000 tons/year or by a major expansion to 5000 tons/year, depending on the degree of customer commitment to the products. While these actions would have a negative effect on U.S. economics (by replacing U.S. exports) the worldwide effect would be positive because of the more favorable flowsheet balance in Europe, and reductions of freight and tariff.

3. Europe can also follow any U.S. lead on new polyphenyl derivatives.

Impact of MCS 1238 on our European business is illustrated in Table II (using a 2000 ton/year volume of hydrogenated terphenyl in 1978 as an example).

Except for the "1976 Budget" column, these figures are very rough and are only intended to indicate direction. More detailed analysis is to be completed during 1977. This study must answer the question of interdependence of the MCS 1238 program and a major HB-40 expansion.

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TABLE II

	1976 Budget with PCBs	1976 Without Dielectrics	1978 Without Dielectrics	1978 with 2600T MCS 1238
Sales Revenue $M	$ 5920	2705	4320	8740
Gross Profit $M	1510	459	1070	2557
%	25%	17%	25%	29%
Performance Income	916	(97)	519	1563
% on Gross Inv.	18%	(3%)	15%	29%

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V. Appendix

A. Potential Problem Analysis - Capacitors

The Task Force applied the Kepner-Tregoe type of analysis to our capacitor program to identify potential problems and determine preventive and contingency actions for those problems with a significant probability. The more significant of the preventive actions have been inserted in the Events Chart. The following is a Summary of the exercise.

Potential Problem:

Adverse medical information is received:

1. Legitimate adverse data from our own or outside studies.
2. Ill-founded accusations from environmentalists or competitors.
3. Inconclusive data after 2-year program.

Preventive Actions:

1. Publish our testing procedures and interim results (with appropriate disclaimer). Review progress with government agencies periodically.
2. Ensure that our own program is complete and timely; be ready with facts to refute accusations.

Contingency Actions:

1. PCB equipment should not be dismantled prematurely.
2. If competent adverse data is received:
   a. Recycle through EC 202 procedure and withdraw 1238 if "no go".
   b. Re-assess the dielectrics business.
   c. Consider extended timing if no viable competitor has emerged.

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Potential Problem:

Viable competition emerges to reduce our market share to an unacceptable level.

1. Dow fluid succeeds in power capacitors, perhaps with a sulfone boost.

2. Small capacitors switch to phthalates and/or "dry" technology.

Preventive Actions:

1. Consider further patent activities to block use of sulfones by others.

2. Tout the absence of halogen in 1238, look for weaknesses in competitive fluids.

3. Meet competitive prices on a cost/performance basis.

4. Begin aggressive promotion of 1238 as the PCB replacement during 2nd Quarter 1976 to preempt emergence of other competitors after 9/1/76 issuance of testing protocol.

5. Seek contractual commitments from major customers.

Contingency Actions:

1. If market share is clearly lost and competition has no serious weakness, re-assess continuing in the dielectrics business.

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Potential Problem:

Loss of G.E. support.

1. Due to pricing or timing of our capital commitment.

2. Due to more attractive alternatives.

3. Due to failure of 1238 in performance or environmental acceptability.

Preventive Actions:

1. Price 1238 at its proper level considering performance vs. potential competition.

2. Maintain Management contact with G.E. at all relevant levels.

3. Continue the Monsanto/G.E. Research Agreement.

4. Find an approach that would permit G.E. to continue to enjoy Magvar license revenue.

5. Move aggressively to permit G.E. to exploit their inherent technical leadership.

Contingency Actions:

1. Remain flexible on market needs for pricing and timing.

2. Possibly consider G.E. share in 1238 investment.

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Potential Problem:

Continuing unacceptable PCB contamination from WGK interim blending.

Preventive Actions:

1. Seek acceptance of a definition of "acceptable" that is not zero.

2. Seek acceptance of expected contamination level of first batches.

3. Consider sites other than WGK.

4. Do the best possible cleanout job.

   a. Test procedure beforehand.

Contingency Actions:

1. Suspend production and re-assess situation.

2. Consider crash project at another site.

DSW 223798

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Potential Problem:

Toll manufacture proves unreliable.

1. Meeting volume requirements on time.
2. Quality control.
3. Yield/cost control.
4. Force majeure event.
5. Security - confidential information, sales to competitors.

Preventive Actions:

1. Execute well-drawn secrecy agreements and contracts.
2. Inspect facilities re safety, OSHA and environmental control, and overall competence before signing contracts. Provide continuing technical support and surveillance.
3. Consider earlier manufacture "inside".
4. Carry engineering forward on "inside" manufacture to be ready for a potential crash project.

Contingency Actions:

1. Purchase MIPB from e.g. Tanatex.
2. Accelerate program for self-manufacture.

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POTENTIAL PROBLEM ANALYSIS WORK SHEETS TRANSCRIPT

*Indicates most significant problems

(1) (Irreversible)

Choice of 1238

* - Adverse Med. Data (outside/inside)

- MIPB } Degrees
- TXS }

- Appearance of Superior (sooner) Comp. } Someone avoids patent

* - Too many sources (M/I Problem) }

- R.M. Supply Deficiency
- R.M. Quality Deficiency
+ Best anyone knows of.
+ No Chlorine
- Dry capacitors prove more cost/eff.
- Timing -- we let it slide ⟶ 1016 accepted

* - Loss of G.E. support (for 1238)

- Pricing
- Alternatives
- Function
- Timing

- Demand for fire resistance

(2) Research Supply -- until interim S/U

- Violating Rule -- get dictate
- Demand > Supply
  - Possible rapid escalation
- R.M. Quality/Availability - MIPB
  TXS

DSW 223800

STLCOPCB4053592

(3) Interim Blending/Toll MIPB & TXS

* - Unacceptable PCB Contamination

* - Dependence on toll manufacture

- limited support resources } Force majeure items
- accident - strike

- loss of tech/security

- create MIPB capacity Ex 'M'

- Soon enough

- contract signing delayed
- WGK Construction
- Emergency need (ban)

- Supply to meet specs

- D.K.
- Moisture
- Biphenyl

- Can't get customer commitment - support contracts

+ Better site

- No contamination
- Sooner/Cheaper

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(4) Pricing (Economics)

- Adverse G.E. reaction

  - other

- Ultimate economics don't support pricing (Repl. cap.)

+ Better price/perf. than competitive

- Price too high vs. competitive

  - Dichlor Biphenyl in Europe

(5) Cease PCB by 1/1/78

± Gov't safety decree

  - image/publicity

- Customer suit

- Customers not ready to change

- Transformer PGM drags

(6) Activities leading to self manufacture of TXS & MIPB timed to delay capital commitment until after 2-year medical data available. PIR 6/77; A.R. 12/77

+ Don't need (already in business).

- Mgmt rejects PIR (Risk).

- Delay in medical program

  - Inconclusive result

- Outside accusation re 1238.

  - Synergistic environmental effect

OVERALL PLAN - Dielectrics Business

- Veto by Management

DSW 223802

STLCOPCB4053594

A. Adverse Medical Data - MIPB or TXS or Blend

- Inside --- clearly bad
  inconclusive 6/77

- Outside --- competent
  hysterical

- Preventive Actions

  - Publish procedures & results (with disclaimer).

  - Review with government as we progress.

  - Influence committee (R. Train/Industry Committee) protocol 9/76.

  - Be sure our program is complete.

    - Content & timing.

  - Ask NCR for MIPB data (if any) (after announcing 1238 compositions).

- Contingency Actions

  - Don't prematurely dismantle PCB equipment.

  - If competent adverse data

    - re-assess dielectrics business;

    - ask for time if no competitor has achieved credibility;

    - if one component only is implicated, consider replacing.

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B. M/I not adequate -- competitor(s) prove viable.

- Dow fluid gets power capacitors (with TXS?).
- Small ones go to DOP/DINP or Dry-type.

Preventive Actions

- Further patent action (?).
- Tout "non-halogenated" property of 1238.
- Looking for weakness in Dow fluid.
- Price consistent with performance.
- Begin aggressive promotion of 1238 as a PCB replacement during 2nd Quarter 1976.
- Alliance with G.E. (see item C).
- Contracts

Contingency Actions

- Re-assess dielectrics business.

C. Loss of G.E. Support

- Pricing
- Alternatives
- Functionality
- Timing of interim vs. long-term pricing

Preventive Actions

- Price consistent with performance.
- Maintain contacts at all relevant levels.
- Continue research agreements.
- Find support for continued Magvar licensing.
- Emphasize retention of lead time.

Contingency Actions

- Flexibility -- in pricing, timing, shared venture.

DSW 223804

STLCOPCB4053596

D. Continuing unacceptable PCB contamination of product from "interim" blending.

Preventive Actions

- Define acceptable level > 0
- Go elsewhere than WGK (Everett)
- Do good job on cleanup
  - Testing of Procedure
- Acceptance of expected level.

Contingency Actions

- Suspend production & re-assess.

E. Toll manufacture proves unreliable

- Meeting volume requirements on time
- Quality
- Yield/cost
- Force Majeure event
- Secrecy/technology/capability

Preventive Actions

- Good contracts/secrecy agreements
- Manufacture inside
- Provide technical/supervisor support
  - Monitor operation
- Develop engineering for inhouse manufacture (be ready).

Contingency Actions

- Accelerate self-manufacture
- Buy MIPB

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V.2 - Appendix

CHART 1

CAPACITOR DIELECTRIC FLUID POTENTIAL

(AS $\overline{M}$ LBS. AROCLOR)

WORLD AREA	CURRENT M/I %	'74	'75	'76	'77	'78	'79	'80
U.S.A.	100	22	13	16	17	18	19	20
West Europe	25	15	12	15	15	15	15	15
East Europe	40-50	6	5	5	5	6	6	6
ROW	50	7	7	7	7	8	9	9
TOTAL	58	50	37	43	46	47	49	50

Note 1: Japan uses approx. 8-10 $\overline{M}$ lbs. per year of non-PCB capacitor dielectrics having banned PCB in 1972.

Note 2: Monsanto non-PCB candidate MCS-1238 will have usage of .75 lbs. for each 1 lb. of Aroclor replaced because of difference in specific gravity.

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CHART 2
MONSANTO CAPACITOR FLUIDS SALES FORECAST

a) MCS-1238 Sales From U.S.A. ($\overline{M}$ Lbs.)

	Domestic	U.S. Export (excl. Europe)	Europe	Total
1976	1.3	-	-	1.3
1977	9.3	1.5	0.2	11.0
1978	13.5	2.0	1.0	16.5
1979	14.0	2.5	3.0	19.5
1980	14.5	3.0	-	17.5
1985	16.0	3.5	-	19.5

b) MCS-1238 Sales From U.K.

1976	-	-	-	-
1977	-	-	-	-
1978	-	-	-	-
1979	-	-	-	-
1980	-	-	3.0	3.0
1985	-	-	4.0	4.0

c) Aroclor Sales

	Domestic	U.S. Export	U.K. Produced	Total
1976	14.6	2.8	5.9	23.2
1977	5.2	1.0	6.0	12.2
1978	-	-	4.0	4.0
1979	-	-	-	-
1980	-	-	-	-
1985	-	-	-	-

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V.4 - Appendix

CHART 3

TRANSFORMER FLUID MARKET ($\bar{M}$ LBS. EXPRESSED AS AROCLOR/TCB BLEND)

WORLD AREA	M/I %	'74	'75	'76	'77	'78	'79	'80	'85
U.S.A.	100	14	14.5	10	5	12	14	15	18
West Europe	7-10	30	31.5	33	35	37	38	40	51
Canada	100	3	3	3	3	3	3	3	3
Miscellaneous	25	4	4	4	4	4	4	4	4
TOTAL	42	51	53	50	47	56	59	62	76

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V.5[1] Appendix

CAPACITOR FLUID SALES (U.S. Produced)

CHART 4a

	DOMESTIC				EXPORT				TOTAL D & E		
	SALES		GROSS		SALES		GROSS		SALES		GROSS
	M Lbs	$M	Profit	%	M Lbs	$M	Profit	%	M Lbs	$M	Profit
1970	27583	3872	1725	44	4717	699	255	36	32300	4571	1980
1971	17369	2748	978	35	3288	485	118	24	20657	3233	1096
1972	22654	4271	2108	49	3069	517	139	27	25723	4788	2247
1973	37742	7756	2259	29	4333	837	276	33	42075	8593	2535
1974	22098	6731	2753	40	2483	720	264	37	24581	7451	3017
1975	13468	5092	1957	38	2270	968	332	34	15738	6060	2289

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V.5[2] - Appendix

CAPACITOR FLUID SALES (U.K. Produced)

CHART 4b

Year	Sales M Lbs.	Sales $M	G.P. $M	G.P. %
1972	7142	1172	336	29
1973	7288	1437	403	28
1974	7861	2440	546	22
1975	5471	2168	362	17
1976B	5861	2383	636	27

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V.6[1] - Appendix

TRANSFORMER FLUID SALES (U.S. PRODUCED) CHART 5a

	DOMESTIC				EXPORT				TOTAL D & E		
	SALES		GROSS		SALES		GROSS		SALES		GROSS
	M Lbs	$M	PROFIT	%	M Lbs	$M	PROFIT	%	M Lbs	$M	PROFIT
1970	15902	2494	956	38	5454	853	259	30	21356	3347	1215
1971	14007	2571	879	34	5383	926	262	28	19390	3497	1141
1972	11384	2378	825	34	3673	686	172	25	15057	3064	997
1973	13415	2751	864	31	4014	802	202	25	17429	3553	1066
1974	13870	4522	1516	34	4093	1290	333	26	17963	5812	1849
1975	14202	5884	2326	40	4454	1791	532	30	18656	7675	2858

V-17

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V.6[2] - Appendix

TRANSFORMER FLUID SALES (U.K. Produced)

CHART 5b

Year	Sales M Lbs.	Sales $M	G.P. $M	G.P. %
1972	3193	643	166	26
1973	2518	546	139	25
1974	3422	1007	204	20
1975	2646	986	171	17
1976B	2205	832	215	26

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V. 7. Appendix - Toxicological Program

Study	Project #	Material (MCS #)	Projected Completion Date	Estimated Cost 1/76 Initiation	Estimated Cost 1/77 Initiation
Chick edema factor bioassay	BTL-76-4	1238	2/76	1000	
8-day LC 50 Bobwhite quail	TF-76-1	1045	3/76	750	
" " " " "	TF-76-2	1302	3/76	750	
" " " " "	TF-76-3	1238	3/76	750	
8-day LC 50 Mallard ducks	TF-76-1	1045	3/76	750	
" " " " "	TF-76-2	1302	3/76	750	
" " " " "	TF-76-3	1238	3/76	750	
Microbial mutagentic plate assay	BIO-76-5	1045	3/76	300	
" " " " " "	BIO-76-6	1302	3/76	250	
" " " " " "	BIO-76-7	1238	3/76	250	
Mouse Lymphoma mutagenicity	BIO-76-8	1238	3/76	2200	
Rat teratogenicity*	BTL-76-9	1238	3/76	4000	
Human skin patch test	SH-75-21	1045	3/76	900	
" " " "	SH-75-22	1302	3/76	900	
4-wk. Inhalation study	BTL-75-54	1045	4/76	5100 (pd.)	
" " " "	BTL-75-52	1302	4/76	5100 (pd.)	
14_C Metabolism Rat		1045	6/76*	7500	
" " " "		1302	6/76*	7500	
90-day Rat feeding		1045	Completed		
" " " "	BTL-76-10	1302	7/76	7500	
" " " "		1238	7/76	Part of 2-yr study	
14_C Fish Residue		1045	7/76*	10000	
" " "		1302	7/76*	10000	
Human skin patch test		1238	3/77		1000
6-month inhalation		1045	1/78		70000
" " "		1302	1/78		70000
2-yr. rat feeding	BTL-75-87	1045	4/78	24000 (12,000 pd.)	
" " "	BTL-75-85	1302	4/78	24000 (12,000 pd.)	
" " "		1238	7/78	75000	
96-hr. LC 50 Trout & Bluegill	BN-76-11	1045		680	
" " " " "	BN-76-12	1302		680	
" " " " "	BN-75-13	1238		680	

*Requires 14_C-labeled materials available 3/1/76.
Approximate cost $200,000 for MCS 1238 only.

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