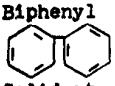
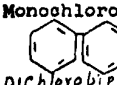
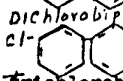
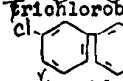
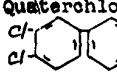
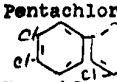
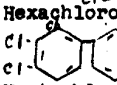
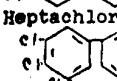
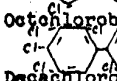
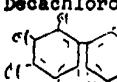
PCB ENVIRONMENTAL POLLUTION ABATEMENT PLAN

Introduction

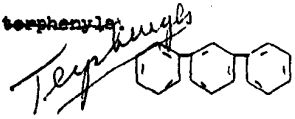
On 15 October the "AD HOC" Committee consisting of Messrs. M. Farrar, P. Hodges, E. John, W. Richard, and E. Wheeler issued a report summarizing the polychlorinated biphenyl (PCB) pollution problems from the known available information to date. Out of this report came considerable information, conclusions, and recommendations which we have attempted to tie together into a plan of action in this document. Our objective has been to take a reasonable and responsible approach to the entire problem. Before we get into the problem, we should clarify the meaning of PCB, the nature of the entire line, and how these tie into our product line of Aroclors.

Monsanto entered the Aroclor market in 1930 by acquiring Swann Chemical ~~Electrical~~ Company or known today as our Anniston, Alabama plant. The first load of Aroclor which incidentally was Aroclor 1254 -- went out of Anniston, Alabama to GE in 1931: Since that time the market has grown to 170 to 200M# worldwide.

Chemical	Monsanto Product Line	Nature of Material at Ambient
Biphenyl  ~~Solid at~~ ~~Sublimes at~~		Solid
Monochlorobiphenyl 	Aroclor 1221	thin liquid (oil)
Dichlorobiphenyl 	Aroclor 1232	thin flush water
Trichlorobiphenyl 	Aroclor 1242	oily type fluid material
Quaterchlorobiphenyl 	Aroclor 1248	Thicker - transmission oil
Pentachlorobiphenyl 	Aroclor 1254	Heavy-Molasses
Hexachlorobiphenyl 	Aroclor 1260	Thick - tar
Heptachlorobiphenyl 	Aroclor 1262	Very thick - liquid
Octochlorobiphenyl 	Aroclor 1268	Solid
Decachlorobiphenyl 	Aroclor 12715	Solid

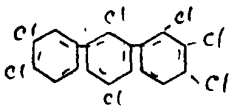
Total possibility are 210 theoretically possible chlorinated biphenyls

~~terphenyls~~ Terphenyls



Santowax or terphenyl

Solid



Aroclor 5460

Solid

II. Problem

Damage to the ecological system by contamination from polychlorinated biphenyl (PCB).

III. Extensiveness

The problem involves the entire United States, Canada, and sections of Europe especially the United Kingdom and Sweden. As the investigation broadens other areas of Europe, Asia and Latin America will surely become involved. Evidence of contamination have been shown in some of the very remote parts of the world. The involvement could and most likely will follow the DDT investigations.

IV. Nature of the Problem

Professors Widmark and Jensen of the Institute of Analytical Chemistry at Stockholm, Sweden, in November 1966, announced and confirmed findings PCB in fish, birds, and eggs. Subsequent findings were made in 1967 in Great Britain. In February 1969, Professor Risebrough of the University of California published an article in the San Francisco Chronicle relaying his findings of PCB in the environment of the United States. Monsanto confirmed the presence of PCB's in mid-1969 and confirmed the adequacy of work by Widmark and Jensen and others; truly, the PCB's are a worldwide ecological problem.

Analysis indicates the environmental presence of the 5 and higher chlorinated biphenyls which take the appearance of Aroclor 1254 and Aroclor 1260. We have strong indications that Aroclor 1242 or at least part of it degrades biologically. Since the Aroclor 1242 contains around 7 percent of the 5 chlorine biphenyl or higher we cannot rule out the possibility that the observations may be a concentration affect of the higher chlorinated biphenyls of Aroclor 1242.

4

To date ~~there~~ we have ~~been~~ no confirmed reports of finding Aroclor 1242 present in the environment (except ~~outside~~ in the effluent of our plants ~~where we know Aroclor 1242 is present).~~ or in the streams and mud below our own plants at Anniston and Sauget

The seriousness of the problem can best be spelled out as follows:

1. Fish - Marine or aquatic species concentrate PCB in the fatty tissue. Toxic is small quantities (down to 5 ppb) to sensitive marin life such as shrimp.

comparison

2. Birds - Predatory species feeding on the marine or aquatic life can further concentrate PCB to possible harmful effects. Specifically in birds PCB can affect the calcium metabolism leading to egg shell imperfections which prevents proper hatch of the young. In fact, Monsanto has confirmed the eggshell by feeding chickens, a high order of the species, PCB's in controlled tests.

still protect 12/2

3. Man - There is no harmful effect known to man or other mammals after 40 years of production. Investigations are underway by various sources.

4. Political and Public Emotion - PCB's are falsely linked with DDT because PCB's show up in the analysis for DDT. PCB's are linked with other permanent type chlorinated hydrocarbon pesticides. This becomes particularly serious since about every article of food in the country is being examined for a trace of these materials.

5

More than 50 samples out to various lakes
Have corrected in random samples

MONS 035375

V. Effect on Monsanto

Business potential at stake on a worldwide basis:

Fluids	Plasticizers	Total/Year
70M lbs.	34M lbs.	104M lbs.
$16M	$6M	$22M
$6-8M G.P.	$2-3M G.P.	$8-11M G.P.

Already competition is using certain data against us in competitive situations.

A. Legal Liability

Direct lawsuits are possible. The materials are already present in nature having done their "alleged damage". All customers using these products have not been officially notified about known effects nor do our labels carry this information. These are only a few of the possible legal implications which would best be covered by the legal department.

B. Public Image

The corporate image of Monsanto as a responsible member of the business world genuinely concerned with the welfare of our environment will be adversely affected with increased publicity.

The evidence proving the persistence of these compounds and their universal presence as residues in the environment is beyond questioning. This combined with certain scare publications is certain to give an adverse image. Guilty association (with DDT) will prevail as the background while actual facts may be sparse.

C. Customer Relations

MONS 035376

Some customers who presently use these materials will be "scared off" to other competitive products. Products associated with the same name or "trademark" will be adversely affected ie., Therminol, Pydraul and Aroclor. Competitors will use the information for an

influence on Monsanto products.

Customers will seek other "outs" rather than become involved.

VI. Effect on Customers and Ultimate Consumers

One of the unique features of PCB's is their fire resistance. Here the basic decision whether to risk lives due to fire or risk extinction of, some species of birds. In this case the PCB would probably be accepted as a necessary pollutant and tolerated under controlled conditions.

A. Electrical Industry - Capacitors and Transformers use Aroclor because it is the best inexpensive dielectric fluid available.

B. Food Processing - Bulk "deep frying" units for potato chips, fish, and doughnuts use the fire resistance fluid as an indirect heating medium.

C. Die Caster -- and other hot metal working industries fire resistance fluids to protect the workers.

Affects a wide range of plastics and adhesives because the PCB serves as the plasticizer.

A wide range of paints and coatings are affected. The "Carbonless" carbon paper used so widely would disappear.

VII. Involvement With Other Producers

Although Monsanto is most probably responsible for the U.S. contamination and jointly responsible with MCL for the United Kingdom problem, we cannot accept responsibility for the world. There are five known producers in the free world, several possible producers behind the iron curtain and couple of additional companies making overtures about entering the business. Monsanto representatives have on one occasion discussed this problem with a couple of these producers but they expressed no great concern. In fact, it is highly possible that one of

these manufacturers is dumping his waste into the Rhine River. Certainly any action taken by one producer will most assuredly affect the other. It is entirely possible that a joint plan of action could be developed but will most probably have to be spearheaded by Monsanto. It is also likely that producers of other chlorinated products used with PCB's will be dragged into the investigation.

VIII. Sources of Contamination

Although there may be some soil and air contamination involved, by far the most critical problem at present is water contamination. To our knowledge to date the contamination can be broken down into two general categories, open and indirect pollution.

A. Open Pollution - Our manufacturing facilities sewered a sizeable quantity of PCB's in a years time.

1. Fluids

Fluids are probably the most open source of pollution because of their mobility. They also may be the least serious because they are generally the lower chlorinated materials.

2. Electrical

Electrical customers have in the past sewered their wastes.

3. Heat Transfer

Heat transfer customers have sewered their objectionable and their spilled material.

4. Industrial

These fluids have generally been sprayed into drains, washed down sewers and generally regarded as very harmless.

All of the fluids have had the "pink" constituent dumped on dirt roads as a "dedusting agent" which inadvertently found its way back to the stream.

5. Plastics

The plastics are not as mobile as the fluids so therefore they have not found and cannot find their way back to streams in open pollution.

B. Indirect

Shipping containers and the cleaning thereof for subsequent use a source of contamination.

1. Fluids

a. Electrical - Disposal of "burned out" transformer and capacitors may find its way back to streams. Scrap units (new) are generally disposed of in land fills but could possibly get back to the stream.

b. Heat Transfer - Leaks could contaminate.

c. Industrial - Cross product contamination carried out of an air compressor. Residual material carried on parts.

2. Plasticizers

a. Process Contamination from Washing

(1.) Environment Contamination

Swimming pool paints

Incineration of wax coatings

Traffic paints

(2.) Product Contamination

Coating for tank lining

Printing inks and paper coatings

Certain adhesives

MONS 035379

IX. Recent Technical Changes Which Have Bearing on the Contamination

A. Fluids

The sources of pollution were pointed out as they have been in the past because we are dealing with that quantity of material in the

environment today which was deposited over the past forty years. We mustmust state that responsible people throughout the industry have taken corrective action to reduce contamination in the last two years. There have also been technical advances which have brought about the use of lower chlorinated biphenyls which may be an advantage because to date the low chlorinated ones have not been identified present in nature.

1. Electrical - The large customers have established collect systems and the waste is recovered. Incinerators are being investigated and built for the disposal of the materials. There has been a shift away from the higher chlorinated types products and could probably shift almost entirely away from those products.
2. Heat Transfer - System have been tightened up and redesigned to confine the contents. Here, too, the trend has been to shift away from the higher chlorinated materials.
3. Industrial - Settling ponds have been built by the large manufacturers to catch the material and decant off the PCB for reprocessing. The trend here as the other fluid areas has been towards the lower chlorinated materials.
4. Plants - The plants effluent has been passed through limestone which provides surface to catch some of the material. But high concentrations can be found in our effluent (that is relative to those findings in nature causing the problem).

B. Plasticizer

Quite opposite to fluids the trend in plasticizer Aroclor has been to the higher chlorinated biphenyls. In plasticizers the lower chlorinated biphenyl will not be an acceptable solution however, the lower chlorinated terphenyl could offer a possible solution.

X. Courses of Action

A. Do Nothing

We cannot deny the findings and the acquisitions by the various agencies. If we took no action we would likely face numerous suits. We would let government tolerances be based on public and political pressure along with any experimental or developed data which they may generate. We would most likely be forced out of this business. Other product areas would be adversely affected. We would project an image as an irresponsible member of the business world. Project poor customer relations. The only advantage to this technique offers is it reduces the cost but this too must be weighed against potential loss of business.

B. Discontinue Manufacture of All Polychlorinated Biphenyls (PCB)

Although we all realize this could be an eventually unfortunately the solution is not this simple. Assuming we did stop manufacture immediately, the pollutants are present in the environment, the liability is present and possibly by the shifting to the lower chlorinated materials and the recovery techniques the contamination may already be reduced to an acceptable level. Obviously the entire business would be lost without any or very few substitutes to be offered. Other product areas would be affected. Financial loss could be considered due to raw material contracts, customer contracts, and royalty -- secrecy contracts. Competition would take advantage on all fronts. We would be admitting guilt by our actions. Loss of capitol investment in the plant, associated utilities, and associated processes. We would possibly gain a little public image on this action.

MONS 035381

C. Respond responsibly, admitting that there is growing evidence of environmental contamination by the higher chlorinated biphenyls and take action as new data is generated to correct the problem.

This approach would enable us to phase out the higher chlorinated materials in many applications where they are no longer necessary or really desired. Wecould maximize the corporate image by publicizing this act. We would reduce a known pollutant. Additionally we could gain precious time needed to develop new products and investigate further the lower chlorinated materials. As new research data is generated our course may be altered considerably. Certain limited actions may reduce or limit the problem.

XI. Recommended Course of Action

Based on the information available today the only recommendation we can honestly make is respond responsibly admitting that there is growing evidence of environmental contamination by the higher chlorinated biphenyls and take action as new data is generated to correct the problem.

XII. Implementation of the Recommended Course of Action

A. Immediate (By 12-1-69)

1. Set up a task force under a project manager or the equivalent responsible for initiating, directing and implementing all action that Monsanto decides to take. This includes sufficient budget necessary to cope with the immediate problems. This task force should include representatives from Medical, Legal, Research and the two involved Marketing Groups and Public Relations and must conduct liaison with MCL and other locations involved in the problem.

2. Decide on timing and content of any public and/or customer notification of PCB problem.

B. Interim (Within 3 months)

Fluids	Plasticizers
1. Confirm Aroclor 1254/Aroclor 1260 are found in the environment.	1. Announce differential between fluids/plasticizer uses.
2. Publicize the difficult anal. tasks.	2. Announce safety of other PCB's/ chlorinated terphenyl.
3. Protect other PCB/chl. terph.	3. Educate customers on control of effluent for all products.
4. Announce plans to reformulate certain Therminols and Pydraul where control of the product is difficult.	4. Initiate program to develop A/ 1254 & 1260 substitutes

5. Emphasize better control over other Aroclor 1254 & 1260 uses.

5. Investigate with manufacturer the feasibility of alternate products.

6. Initiate customer education or need for effluent control of all products.

6. ~~Analyze 1242~~

7. Determine composition of all PCB's.

Develop a comprehensive Program

C. Short Term (within the next 12 months)

1. Research - Expand program for more meaningful biodegradation studies and confirming analytical results. Expand toxicity studies. Follow developments concerning publicity and those developments covering political implications of PCB contamination. Medical

2. Marketing - Discontinue or substitute replacement products for those applications of Aroclors 1254 and 1260 where the Aroclor remains mobile.

Work with customers to clean up plants on other Aroclors. Report the habitual violators or "do nothings" to the product group.

Reclaim or safely dispose of fluids. MONS 035384

Consider renaming products that do not contain PCB. Follow and report market developments such as customer disposal systems. Follow and report any political or public feedback which may affect the contamination problems and must be coordinated with Medical, Research and Legal.

3. Production - Clean up plants and stop gross contamination.

4. Legal - Define our present position, recommend reasonable action that will not unduely alarm the market but reduce the exposure in terms of liability. Coordinate recommendations with Marketing.

5. Public Relations - Publicize actions where believed advantageous. Certainly discussions should be held with other producers within same period to determine their planned course of action, if any.

D. Long Range Tentative Outline (From 1 year to 3 years)

Realizing that the comprehensive program must be outlined the "Long Range Tentative Outline" is meant to serve as a guide: All aspects of this program should be reviewed quarterly by Organic Management.

1. Research-Medical

   Continue biodegradation studies and analytical support

   Isomer distribution

   Toxicity and metabolism studies

   Water soluble removal

   Incineration analytical support

   Confirmation analytical

   Contract academic research for reference

   Develop new and improved formulations

2. Manufacturing

   a. Process Research and Development

      (1.) Identification of typical Aroclor isomers

      (2.) Develop control for effluent composition

      (3.) Test substitute formulations, etc.

      (4.) Develop new processes

   b. Clean Up Plants

   c. Modify processes to meet market needs

3. Engineering

   a. Develop and set up on plant locations incineration systems

   b. Design new processing equipment as necessary

4. Marketing

   a. Specify alternates or changes

   b. Customer liaison

c. Set reclaim or disposal of fluids

d. Work on name association problems

5. Patent

Investigate trademarks registered

Cover with patents any work felt patentable

6. Environmental Control

Develop cheap disposal systems for customers

a. Incineration or pyrolysis

b. Biodegradation unit etc.

c. Consultants in pollution control

7. Legal

Investigate and define our position on Royalty secrecy agreements.

Contracts - Raw Material and Customer

8. Public Relations

Portray to public positive actions at correcting the contamination problem. Release periodical statements covering our position.

XIII. Probability of Success

XIV. Cost of Program

Neither the program nor the costs have been clearly defined at this time. However, a cost estimate of $220,000 for toxicological work alone has been presented. Tentative figures indicated under the worst conditions the entire program could run as high as $2.0-2.5M. At this stage it is very difficult if not impossible to develop a reasonable cost figure but one point is clear it will be larger than the normal research budget can handle. For this reason, assuming the approach is acceptable, we shall be forced to ask for additional appropriations to fund the program.

XV. Future

Follow developments on the problem as they unfold.

Develop an aggressive research program to confirm or deny findings and better understand the problem.

Develop costs for the duplementation of the Recommended course of action.

Develop specific actions with each department involved

Submit the actions with costs for approval

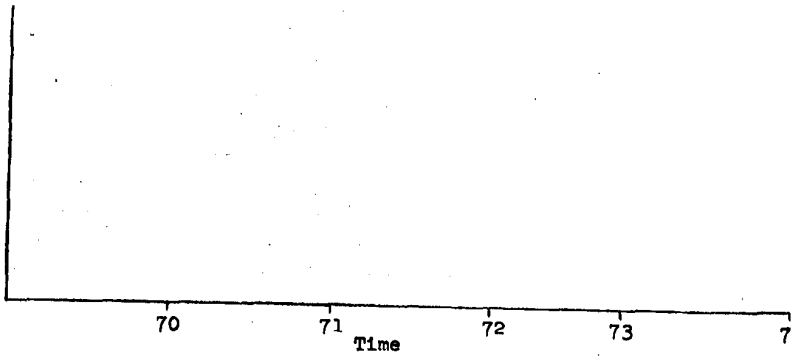
Develop a timetable to solve the overall problem.

Prepare for "precipitious pullout" or drastic legislative action although we do not feel this is a likely possibility.

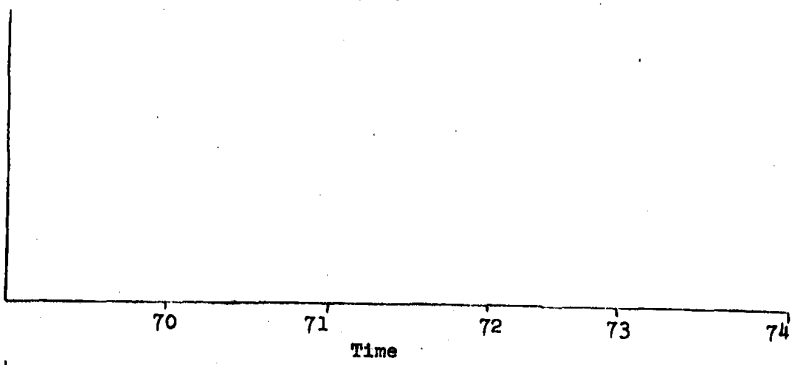
PROFIT AND LIABILITY VS. TIME

ACTION

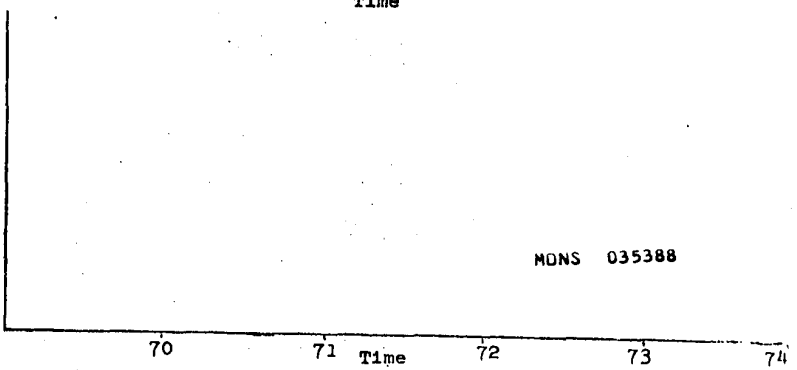
DO NOTHING



DISCONTINUE MANUFACTURE OF PCB

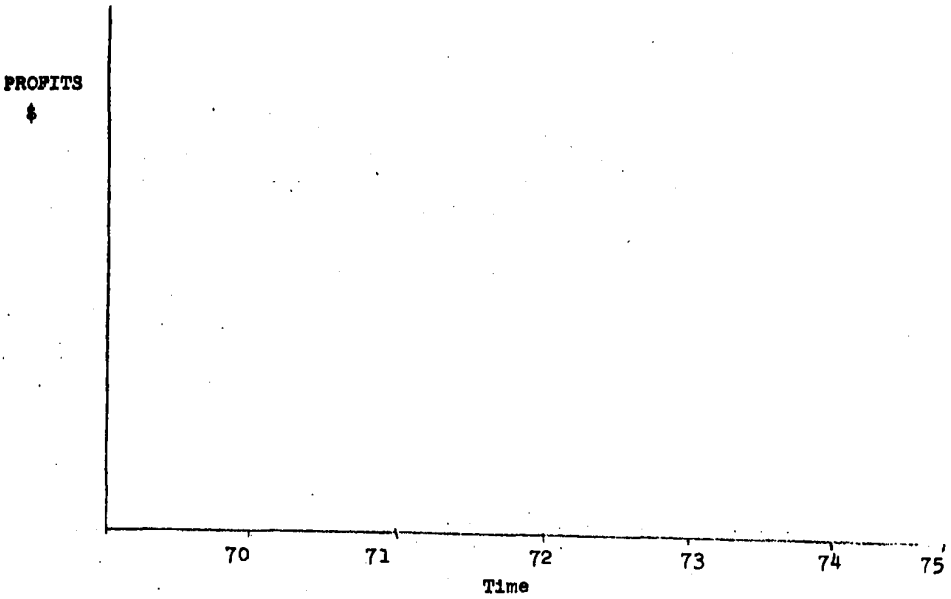


RESPONSIBLE APPROACH



MONS 035388

PROBABILITY OF SUCCESS —



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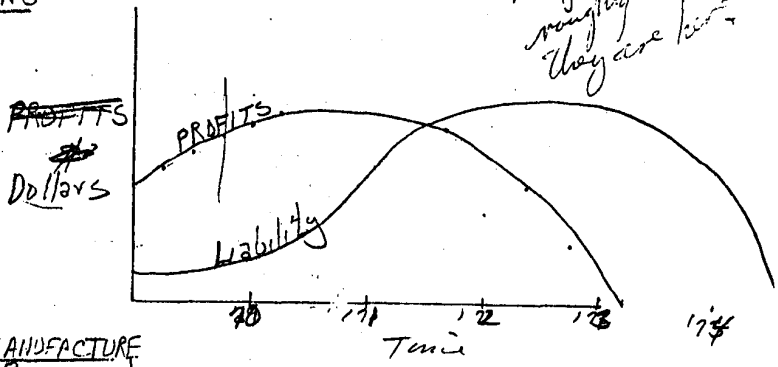
PROFIT AND LIABILITY VS TIME

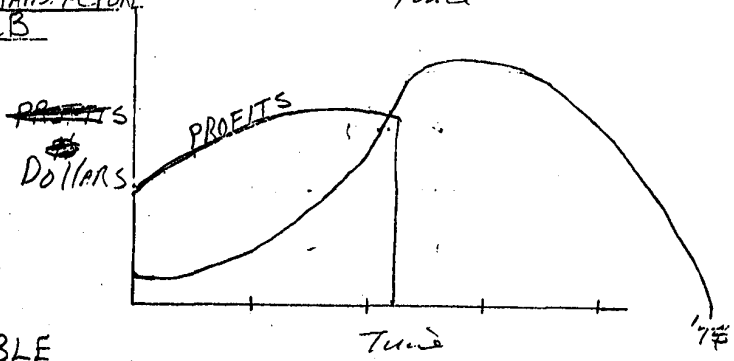
ACTION

Lay out graphs roughly like they are here

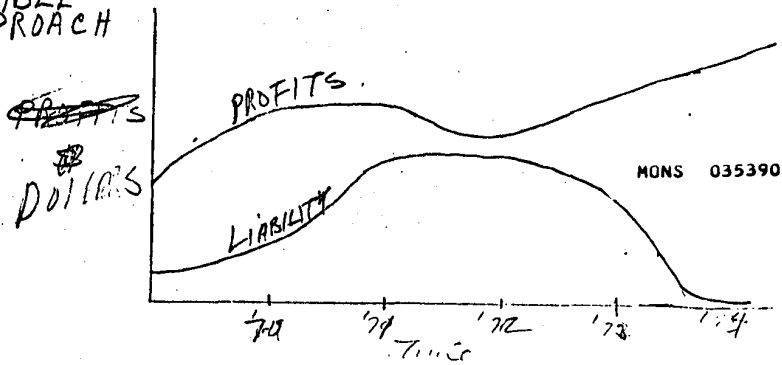
DO NOTHING



DISCONTINUE MANUFACTURE of PCB

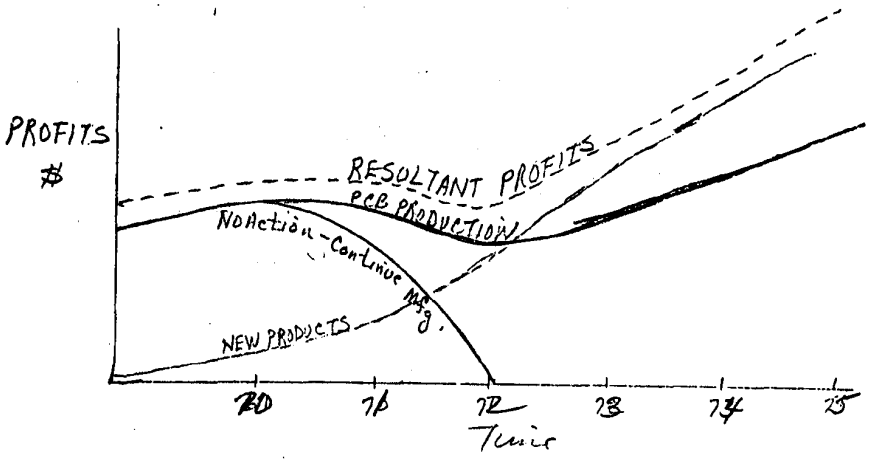


RESPONSIBLE APPROACH



MONS 035390

PROBABILITY OF SUCCESS



MONS 035391

XIII. Probability of Success

XIV. Cost of Program

$220,000 and bio with max. at $20-25M

XV. Future