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CHEMICALS AND PIGMENTS DEPARTMENT
JACKSON LABORATORY

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1984 TECHNOLOGY SUMMARY

Attached is the draft of the Colored Pigment Summary. This is very similar in content to the previous summary, with changes reflecting CR&DD's changed format, as well as new information on R&D programs. The Business Center has reviewed the write-up.

A note of explanation on the data presented in Table I. The R&D expense for 1979, 80 and 81 includes actual IEB expense plus ~36% of the MTE expense for those years. The 36% figure is an estimate of programs that could have been classified MDV; 1982 numbers are actual expense.

Manpower this year includes all allocations. The big change in manpower in 1981 reflects a jump in allocated manpower from 5 in 1980 to 13 in 1981.

I feel that use of total manpower distorts the manpower trends picture, but that's the way CR&DD wants it.

P. A. WRIEDE

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Business Mission - Harvest

Manage quinacridone in a strengthen mode and Krolor® in a sustain mode, while managing remaining products in a harvest mode. Improve cash flow by reducing costs and maintain an assured supply of quality pigment to F&FP.

Role of Technology

Superior quinacridone process and product technology is the key factor in maintaining Du Pont's competitive leadership in quinacridones. The quinacridone segment is Du Pont's strength in Colored Pigments.

Evaluation

	Technology Position Opposite Competition			<u>Summary</u>
	<u>1983</u>	<u>1988</u>	<u>1993</u>	
Product				
Quinacridones	+	+	+	Superior products for automotive finishes and plastics.
Inorganics	0	0	0	Conventional inorganics competitive in all areas. Krolor® superior for plastics applications.
Copper Phthalocyanine	0	0	0	CPC blues are generally equal to competition.
Other Organics	0	0	0	Competitive products for ink and consumer paints, but product line is narrower than competition's.
Process	0	0	0	Low cost producer of quinacridone crude. Some copper phthalocyanine and other organic processes are not cost competitive.

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Patent Position

Du Pont's current competitive advantage in the quinacridone business is a direct result of past strong patent position on process and product technology.

Critical quinacridone patents on crude synthesis and solid solution products have expired in the last several years, allowing competition, especially Bayer, to introduce products that had been unique to Du Pont. Patent protection continues through the late 1980's on important treating agents and quinacridone gold products. No strong patent protection exists for other product lines with the exception of silica coated lead chromates (Krolor®) where product and process patent protection exists through the mid-80's. Competition is marketing Krolor®-type products, which we feel infringe our basic patents.

Key Technologies

Quinacridone

	Business Impact	Life Cycle	Du Pont	Hoechst	Bayer	Sun
• Crude Synthesis	MI	M	▲			
• Finishing Technology	MO	M	△	▲	▲	▲
• Product Properties	MO	M	▲			

Competitive Technical Activity

State of the Art

Research in Colored Pigments at Du Pont and major competition is generally aimed at modifying and improving existing products to meet the performance needs of changing end-use industries. European pigments manufacturers have also been successful in research aimed at developing completely new pigment chemical types (as judged by patent activity) especially in the yellow, orange, red color areas. Du Pont currently does not have a major technical effort aimed at new pigment development.

Major Activity

- Bayer has developed a production unit (Bushey Park, S.C.) utilizing Du Pont quinacridone synthesis technology to produce unique red products.
- Bayer and Sun are actively developing quinacridone solid solution products which had previously been unique to Du Pont.

Du Pont Assessment

- Du Pont production scale should continue to yield better economics.
- Du Pont technical expertise in quinacridone product development and strong ties with Fabrics & Finishes Department will maintain our lead in new product development.

Conclusion

Du Pont's strength in Colored Pigments resides in the quinacridone segment of the business. Our large scale production facility based on intermediate synthesis of dihydroquinacridone and our backward integration to dimethylsuccinate (a Petrochemicals Department by-product) combine to make us the low cost producer of crude quinacridone. The requirement for high temperature operation and sophisticated solvent recovery make it difficult for competitors to duplicate our economics without significant investment. Bayer has installed a production facility based on our technology to produce products formerly unique to Du Pont.

Improved product introductions are key to maintaining a competitive advantage. Our technical expertise in quinacridone product development and our close ties to the critical automotive industry through Fabrics & Finishes Department should allow us to continue our product superiority.

Du Pont is generally equal to competition in product technology in nonquinacridone segments of the business. However, our multiplant configuration and low capacity utilization result in process cost disadvantages in these segments vs. competition.

Research Strategy and Programs (1982)

Research emphasis will be placed on maintenance of our quinacridone competitive position through improved product development to respond to new automotive finishes technology and to expand quinacridone penetration into high value plastics markets. Development of improved products in nonquinacridone business segments will be minimized over the next several years.

Manufacturing technical programs are aimed at upgrading existing product technology to improve operating reliability and product quality and reproducibility. Success in these programs will allow future operation of the Colored Pigments business in a more cost effective manner to improve profitability and competitive position.

Key Issues

- Can we be successful in process improvement program to achieve cost reduction goals of Colored Pigments business?
- Will we successfully maintain our quinacridone competitive position through new product development programs?

Summary Data

	<u>1983 (F)</u>		<u>1984 (F)</u>	
	<u>MP</u>	<u>\$MM</u>	<u>MP</u>	<u>\$MM</u>
R&D	15	2.9	14	2.7
MT	<u>9</u>	<u>1.6</u>	<u>8</u>	<u>1.4</u>
Total	24	4.5	22	4.1
R&D % S+T		2.5		2.1
Total % S+T		3.8		3.2

Research Objectives (%)

	<u>1982 (A)</u>	<u>1983 (F)</u>	<u>1984 (F)</u>
Cost Reduction			
Existing Process	17	29	34
New Process	-	-	-
Capacity	-	-	-
Existing Product Improvement	72	71	66
New Product	11	-	-
Regulations	-	-	-

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Programs

	1983		1984		<u>Incentive</u>
	<u>Expenditures</u> <u>MP*</u>	<u>\$M</u>	<u>Expenditures</u> <u>MP*</u>	<u>\$M</u>	
<u>Tactical Research</u>					
• Develop new, improved QA products to meet changing automotive end-use technology and maintain our competitive position.	4.0	1250	4.7	1220	• 1.3MM lbs. new business during 1985-1988 resulting in a profit contribution of \$18MM.
• Develop new non-QA product forms that improve value-in-use in critical paint and plastics applications.	2.5	810	1.7	550	• Protection of our QA competitive position. • 800 M lbs. new business during 1985-1988; resulting in a profit contribution of \$1.2MM.
• Improve operating technology and facilities to reduce cost and allow more reliable operation of manufacturing processes.	3.8	840	4.9	920	• \$1.4MM in 1984 cost reduction. • Allows operation of Colored Pigments business at zero base levels.

*Direct manpower only.

TABLE I

EXPENSE AND MANPOWER*COLORED PIGMENTS

	<u>ACTUAL</u>				<u>FORECAST</u>					
	<u>1978</u>	<u>1979</u>	<u>1980</u>	<u>1981</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>	<u>1986</u>	<u>1987</u>
Res. & Dev.										
Expense, \$M		3810	4660	4620	2660	2910	2690	2920	3090	3290
Exempt Manpower (Jan. 1)		29	30	38	22	21	14	14	14	14
Mfg. Tech.										
Expense, \$M		1845	2210	2145	3160	1570	1435	1500	1580	1655
Exempt Manpower (Jan. 1)		20	20	21	26	9	8	8	8	8
Sales Tech.										
Expense, \$M	-									
Exempt Manpower (Jan. 1)	-									
<u>Distribution of R&D Objectives</u>										
Cost Reduction										
- Existing Process	53%	53%		34	17	29	34	34	34	34
- New Process										
Capacity										
Existing Product Improvement		30	37	39	72	71	66	66	66	66
New Products		16	10	27	11	-	-	-	-	-
Regulation**		1	-	-	-	-	-	-	-	-