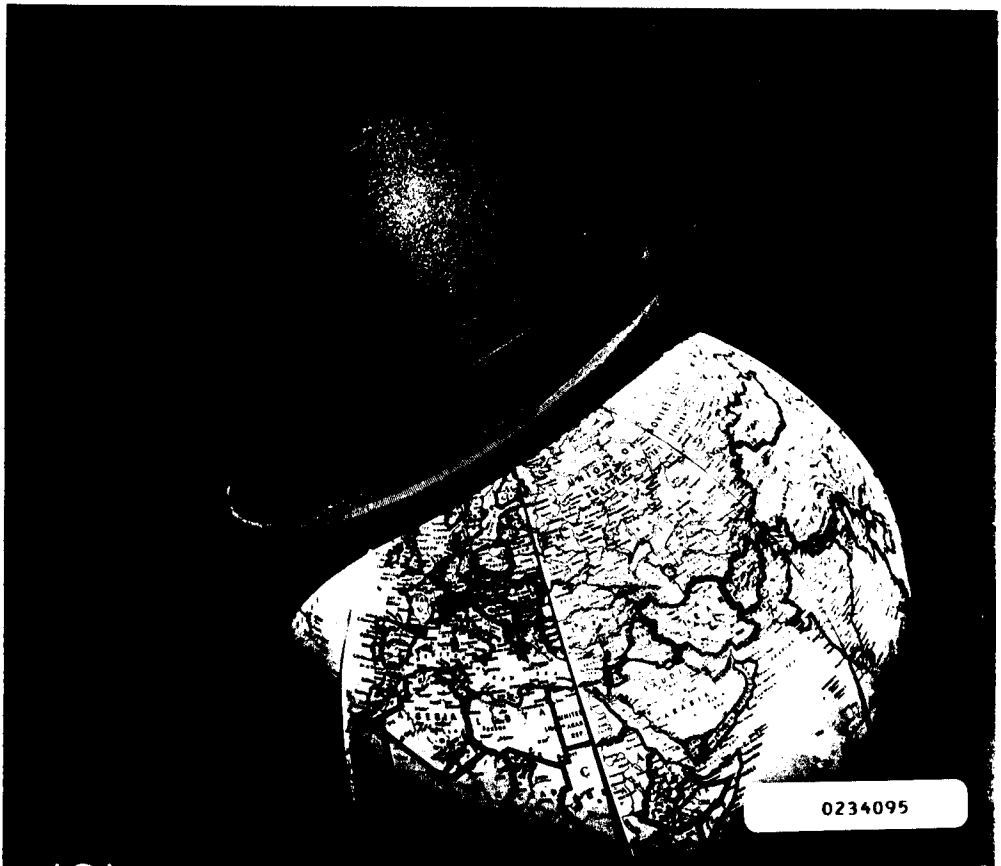
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Chemical Week

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Corfam hasn't soured Du Pont on venture analysis
Monsanto plays policeman to solve environmental problem



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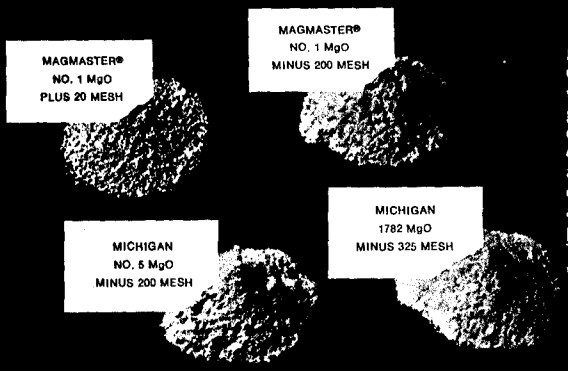
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April 21, 1971 Vol. 108, No. 16

Chemical Week

Departments

Business Newsletter 5
CW Business Index 12
Engineering 39
Environment 35
International 15
International Newsletter 14
Key Changes 45
Management Science 19
Market Newsletter 27
New Products 29
People 46
Research 41
Stock Market Report 12
Technology Newsletter 42
Top of the News 6
Viewpoint 4
Washington Newsletter 13

Coming in CW

The top 300 CPI companies: How well have they performed in a tough year? CW, Apr. 28

Detergent makers gird for fight: scores of nonphosphate newcomers grab 10% of heavy-duty powder market. CW, Apr. 28

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VIEWPOINT

4 A plea for reasonable pollution regulations free of harassment.

TOP OF THE NEWS

8 Du Pont and Reichhold predict strong '71 finish after weak start.

9 More states whip up rigid bans against phosphate detergents.

9 Pickup in housing, borrowing, new orders buoys hopes of buyers.

9 GAF reports earnings gain, but dissidents say it proves little.

9 Chemical warfare projects may be revived with new labels.

10 Spain's petrochemical investment will reach $485 million by '73.

10 First-quarter chemical reports: the profit squeeze is still on.

11 Chemway lost $2.2 million last year; earned $632,500 in '69.

11 U.S. rules governing potential cancer chemicals may be tightened.

11 Du Pont's 192-day strike at Niagara Falls, N.Y., plant settled.

INTERNATIONAL

15 ICI looks abroad for new ventures to beef up profits.

46 Jack Callard, first engineer to head ICI, aids classless image.

MANAGEMENT SCIENCE

19 Despite Corfam, Du Pont remains high on its "answer machine."

TECHNOLOGY

35 PCB: Monsanto's $2-million environmental pollution headache.

39 Heat-transfer fluids are pushing into a host of new CPI jobs.

41 Few takers for Agriculture's offer of exclusive technology rights.

MARKETS

6 Spring fertilizer sales will be record breaker—weather permitting.

0234099

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Time for a collision with reality

It isn't often that we yield our cherished prerogative of sounding off in this space. But this week we do it gladly. What follows are the remarks of Henri Wolbrette II, executive vice-president of the Louisiana Chemical Assn., at the recent New Orleans meeting of the Manufacturing Chemists Assn.'s board of directors. Subject: capital investment and pollution control. We couldn't have said it better. We quote Mr. Wolbrette:

"Even though you might be in compliance with existing water quality standards, you still could be stopped or delayed at any of four or five points from obtaining a permit for a new plant. Since there is no time limitation on how long each of the stopping places could take, it could take you one, two, three years, or maybe forever, to obtain a permit, even though you are in compliance with existing quality standards.

"You might be forced to go through a public hearing for a permit from a state agency; a second public hearing to obtain certification of your 1899 permit from a state agency; a public hearing if any other state objects to your application; another hearing if enough persons—ecologists, conservationists, etc.—raise substantial objections to the Corps of Engineers; another hearing if the Corps feels that navigation might be obstructed or if the Interior Dept. thinks wildlife and fish might be endangered—and don't forget there is no time limit for a determination of any of these hearings.

"If you get through all these hearings, then the Secretary of the Army gives your application to the Environmental Protection Agency administrator, who has from now to eternity to determine where the forces of technology are taking us—and again don't forget, during this entire time, you're liable to suits by the federal government for depositing refuse in any navigable stream.

"What makes this nearly impossible situation more ludicrous is that President Nixon is calling for the economy to be stimulated. He wants increased capital investment. He wants more construction jobs, more production jobs, more white-collar jobs. How can you put investment dollars to work if you can't get a permit for the first spadeful of dirt to be turned?

"What I am suggesting is that the time has come for a collision with reality in environmental matters. We are at a crossroads. Either there will be economic development or there will not be. We are not saying industry cannot expand unless it is at the expense of the environment. We are not saying repeal any of the present laws. We are not saying we want a license to pollute.

"We are saying to government leaders that you must remove this as a political football. That you should stop, take an inventory of what we have, codify and simplify the existing laws and the administrative procedures. We must have clearly understood laws, we must have attainable goals and standards, we must know exactly how long it will take to get permission and permits in order to begin our capital construction, and we must be allowed to operate our businesses, subject to reasonable governmental regulation, but free of harassment of citizens' suits under new litigious rights which you are encouraging."

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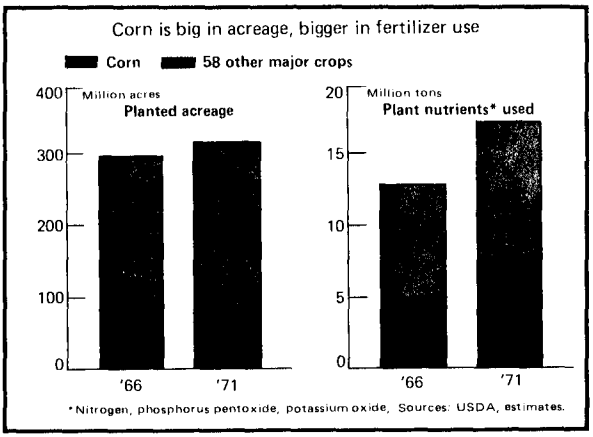
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trate. But urea is weak, commonly discounted from the $52-55/ton tab, mostly because of lower export demand and continuing imports of cheap urea from Europe.

Coast Consumption Up: West Coast farmers are using more fertilizer this year. California, which accounts for the bulk of the area's fertilizer consumption, will take about 10% more than last year. And although cold wet weather has delayed marketing in the Pacific Northwest, full-year sales in that area will probably top last year's by 5%.

Moreover, Canadian imports, which came into the Northwestern states in volume last year, may not be so much of a problem this year. Canadian wheat growers are expected to boost their acreage about 40% from last year. That will provide a much larger market for Canadian fertilizer, help marketers on both sides of the border.

But there are still some problems on the West Coast. There's an oversupply of urea, largely because Collier's big Alaskan plant isn't selling as much to Japanese markets as anticipated. And there's some price cutting on ammonium nitrate by an Eastern producer that has shipped substantial tonnage into the area.

Now, the Main Event: All the action in these lesser markets around the country has been only a prelude to the main attraction. That's the Corn Belt fertilizer season, now approaching its peak. And it promises to be the most hectic ever.

Corn is the key to the Midwest fertilizer market. It's the biggest single user of plant nutrients, takes about 40% of the nationwide total.

Moreover, corn this year should take more fertilizer per acre than usual. Farmers didn't fertilize some corn land last fall because they were uncertain how much to plant to corn and how much to soybeans and other crops. Now that they've decided on corn, they'll put on more fertilizer than they normally would in the spring.

And to minimize the danger of corn blight infection from old fields, farmers will try to plant as much corn as possible on land that wasn't used for corn last year. Land that was idle or planted to other crops last year wasn't as heavily fertilized as land used for corn, thus won't have as big a store of residual nutrients. So that land too will get heavier-than-usual applications of fertilizer to make sure of a good crop.

When warmer weather comes in the Midwest, the industry will have to move fast to meet the accumulated demand. One "plus": despite last fall's near-record snowfalls in the upper Midwest, there's little fear of massive floods like those that disrupted the fertilizer market two years ago (*CW, Apr. 26, '69, p. 25*). Warm days and cool nights have worked together to melt the snow at a rate the rivers can handle, and so far the spring rains have not been heavy.

But there will still be transportation problems, and they'll be compounded by the shortness of the remaining season. More fertilizer will have to be moved in a shorter time than ever before. There's more fertilizer in storage close to farms this year, and that will help. But a shortage of boxcars (caused in part by a heavy movement of grain for export) will make it difficult for the industry to meet the peak demand.

Clearing this hurdle could bring the industry into a new era of rising earnings. Would this induce another round of overexpansion, like that of the early '60s? No, say executives of W. R. Grace & Co.: "It's pretty hard to get a cat to sit on a hot griddle again."

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Du Pont President C. B. McCoy reports to shareholders, Chairman Lammot Copeland listens.

Stockholders get the word

The chemical industry's annual meeting season is in full swing. At the rash of shareholders' get-togethers this week and last, the consensus of top executives was that first-quarter performances are nothing to brag about, but that full-year '71 may not be too bad.

Du Pont's first-quarter '71 earnings were about $73.9 million, down a whopping 21% from last year's first-quarter figure of nearly $93.5 million. Sales in the first three months by the country's largest chemical company totaled about $919 million, down 2% from $937 million in last year's comparable period.

At the company's annual meeting in Wilmington, Del., last week, attended by approximately 1,300 shareholders, President Charles (Brel) McCoy labeled the company's business outlook for the remainder of the year as "cautiously hopeful." He noted that first-quarter earnings were about 17% above fourth-quarter '70's.

In response to several shareholders' queries, McCoy and Chairman Lammot du Pont Copeland, Sr., explained that the company was pulling out of the Corfam business (after investing $80-100 million in its development) because the poromeric shoe material was not able to generate sufficient sales (*see also p. 36*). They also said Du Pont's new Qiana was still in the development stage and was not making a profit.

Celanese in New York: Celanese treated stockholders to both fact and fashion at its annual meeting last week in New York. President John Brooks outlined some basic short-term goals for the company, including financing of new product lines. And the creative services department staged a show that featured textured polyester garments.

Brooks told shareholders that first-quarter '71 earnings of $13.1 million were 17% below the year-ago figure. Fiber sales, he added, are showing some pickup following a disastrous January and February.

Celanese's three-year-old divestment program came in for some shareholders' fire. But Brooks contended that the write-offs and shutdowns were necessary to put the company on a firm profit footing. Divestment is complete except for Celanese's Canadian subsidiary, Columbia Cellulose, which is slated to be sold, he said.

Big Month for RCI: March was "the biggest month in the history of Reichhold Chemicals," Henry Reichhold, chairman and chief executive officer, told company shareholders in White Plains, N.Y. Despite extreme slowness in sales earlier in the quarter, Reichhold expects better sales and earnings this year. First-quarter earnings will be about 10¢/share, compared with about 20¢/share last year.

For '71, sales will total at least $187 million, compared with $178 million in '70, says Stefan Baum, president. He predicts earnings will recover to $4.5 million this year after a drop to $3.2 million in '70. The company's capital expenditures, Baum adds, are expected to be about $20.3 million in '71, down from the record $22.6 million in '70.

Reichhold is pinning its hopes on several new plants and expansions and to the company's shutdown of unprofitable phthalic anhydride operations at Elizabeth, N.J. The company expects to be onstream within two months with its new polyol plant at Carteret, N.J. Its new, 60-million-lbs./year maleic anhydride unit at Morris, Ill., is expected to be onstream by mid-'72.

The company is also expanding formaldehyde operations at Houston (onstream late May) and Moncure, N.C. Its optimism on formaldehyde stems from growth in its use in particleboard plants in the Southeast and Texas.

Net Down, Sales Up: Net income of American Petrofina in the first quarter dropped to $2.26 million, compared with $4.3 million in '70. But sales increased to $65.4 million from $61.3 million in '70, President Richard Galland told stockholders in Wilmington.

Reasons for the earnings drop, said Galland, include higher costs of crude oil and labor, and depressed prices of gasoline, petrochemicals and styrene plastics. "There was, however, an improved demand for polystyrene products in March," he added.

Same for Alcoa: Alcoa's net income in the first quarter plunged to $17.6 million from $30.7 million in '70's first period, Chairman John Harper told shareholders in Pittsburgh. The company's sales were $362.8 million, down from $394.3 million in '70. Shipments in the quarter were below anticipated volume, Harper said, although the rate increased through the quarter as hedge buying began taking place.

Harper said the outlook for an aluminum strike when current contracts expire May 31 is uncertain. He declined to say whether aluminum producers could afford the 9% wage increase given by can makers. The company is "cautiously optimistic" about over-all '71 results, partly because of its diversification into

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other metals. Alcoa has no plans to cut aluminum production, said President Krome George. Prices, he added, should firm.

PPG Bucks: Bucking the lethargic first-quarter trend was PPG Industries. Its earnings, Board Chairman Robinson Barker told shareholders in Pittsburgh, rose about 25%, to $9.2 million, from $7.4 million in '70. Sales were a record $285.2 million, up 8.4% from the $263.1 million in '70.

Barker attributed much of the improvement to strength in the automotive and residential construction sectors. Sales of glass, glass fiber, and coatings and resins products benefited from this, although gains in glass fiber were hurt by continued weakness in the textile market.

Phosphates going out

Indiana will be the first state to ban nearly all phosphate detergents. Governor Edgar Whitcomb signed a bill last week permitting only laundry and industrial detergents with less than 3% phosphate by weight to be sold in the state after Jan. 1, '73. All detergents with more than 12% phosphate will be banned on Jan. 1, '72.

Violaters are subject to a fine of up to $1,000. Senator Donald Park, a sponsor of the bill, said, "The law will effectively ban all but a few laundry detergents."

It may not be long before Indiana is joined by other states. Legislatures in California, New Hampshire, Pennsylvania, Nevada and Wisconsin are considering statewide bans on phosphates. A measure passed by the Nevada assembly and awaiting action by the senate, would make it illegal to sell detergents with more than 8.7% phosphate content.

Other Bans: Measures similar to Indiana's are already in effect in Chicago and its suburb, Hillside, while Akron's recent ban on phosphates is being debated in court. And the Canadian government hopes to ban phosphates by the end of '72.

Federal legislation in the U.S. is not as specific, though. The Administration favors a bill that would give the Environmental Protection Agency (EPA) power to review and set standards for all toxic substances, including phosphates. At one time a move to limit the amount of phosphates used in detergents nationwide was proposed by EPA but it never got past the White House.

In contrast, Soap and Detergent Association (SDA) spokesmen contend that it will be impossible to totally replace phosphates by '72 or '73. Instead, the association would prefer to see phosphates removed at municipal waste treatment plants.

Hedge-buying pickup

Hedge buying of basic materials and a rebound in housing are helping the U.S. economy stage a mild upturn. That's the view of purchasing managers who participated in a March survey conducted by the National Assn. of Purchasing Management (NAPM).

Allegheny Ludlum's E.F. Andrews, chairman of NAPM's business survey committee, says members credited inventory accumulation for extending the upturn in new orders during the first three months of '71.

Stocks Rising: Purchasing men report that inventories were up in March for the first time in a year. Moreover, stocks are rising sooner and faster than they did in '65 and '68, when strike hedge buying of steel helped boost inventories.

Good news amid bad

Amid the welter of charges and countercharges in the bitter proxy fight for control of GAF, the company had some good news for shareholders last week. Earnings in the first quarter, says GAF's management, were up 34% (to $3,263,000 or 17¢/share) from the '69 period's $2,433,000 (11¢/share).

Net sales climbed 11%, to a shade over $152.3 million, compared with last year's $136.9 million. The company, says Chairman and President Jesse Werner, "especially benefited from increased activity in construction and housing, which GAF serves through its building and floor products divisions."

The dissident shareholders' group, the GAF Stockholders Protective Committee, was quick to point out that the company's first-quarter earnings, "released within 12 days of the end of the quarter, a week before the annual meeting in Shelby, O.," were the "second worst for any first quarter in five years."

A GAF spokesman, though, indicates that the first quarter's net sales and net income were the best in the past six quarters, despite the general recession.

Chemical warfare R&D: Off or on?

While ceremonies last week marked the conversion of an Army biological warfare plant at Pine Bluffs, Ark., to toxicological research, Congressional and other critics continued to charge the Army with persisting in research on chemical and biological warfare under the guise of working on defensive applications.

Although chemical companies, the Army and federal government officials deny any biological or chemical warfare activities (President Nixon pledged to stop them in Nov. '69), a recent article in the *Wall St. Journal* indicated that many people believe otherwise. For example, Richard McCarthy, who led the antichemical warfare fight when he was a congressman, charges that the President's policy is being evaded under a "semantic cloak."

Critics cite alleged expansion of germ-warfare research at Dugway Proving Ground, Utah, and a list of biological materials the Pentagon concedes it is studying. Also alleged: biological warfare materials are being stored near Dugway, and animals in the area have died from exposure to such agents.

No Laws in Sight. Despite the criticism, there is no pending Congressional legislation dealing with the situation. An assistant to Representative Sherman Lloyd (R., Utah), whose district includes Dugway, says, "We've seen no evidence they are continuing offensive biological and chemical research there, but we'll keep checking."

Chemical companies queried by *Chemical Week* disavow any chemical warfare activities and won't hazard guesses on the outlook for defoliants, nerve gas or riot control gases. Hercules says it has been out of the market since it dropped 2,4,5-T several years ago. Pesticides producers Atlas Chemical, Pennwalt and PPG declare they are not involved, and Rohm and Haas reports it has no government contracts for herbicides it makes.

Millmaster Onyx has had no chemical warfare projects since the early '60s, when it was involved in a classified research project. Dow Chemical says it is doing no work on lethal or incapacitating agents. It does make 2,4,5-T, but asserts it doesn't sell any to the Army.

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Dollar figures in millions	SALES Latest period	SALES Change from '70	EARNINGS Latest period	EARNINGS Change from '70	Profit margin
Three-month results					
Alcolac	$ 2.8	+ 6.0%	$0.12	+37.7%	4.41
Allied Chemical	310.3	+ 5.3	11.10	+49.4	3.58
Celanese	268.5	+ 3.5	13.10	- 16.6	4.88
Cook Paint & Varnish	12.5*	- 0.3	0.22	- 33.6	1.79
Crown Zellerbach	231.0	+ 2.8	10.63	- 4.1	4.60
GAF	152.3	+11.3	3.26	+34.1	2.14
General Tire & Rubber	229.8	- 0.4	6.94	+26.7	2.34
International Paper	458.5	+ 4.3	15.64	- 39.1	3.41
Kaiser Aluminum	222.2	+ 2.4	5.69	- 59.7	3.01
Michigan Chemical	3.7	- 11.2	0.15	- 56.1	4.02
Monsanto	542.3	+ 5.8	30.50	- 7.6	5.62
Owens-Corning	117.0	+ 0.5	3.38	- 36.7	2.89
Scott Paper	189.8	+ 3.4	9.38	- 32.3	4.94
U.S. Industries	322.3	+12.2	16.56	+ 0.2	5.14

*Excludes extraordinary gain of $1.88 million.

Good for some, bad for most

Although some chemical companies reported a pickup in sales and earnings in the first three months of this year, most are still hurting. That's evident as first-quarter reports trickle in.

Pharmaceutical firms had a good first quarter, but paper companies suffered some of their worst declines in years (*see table*).

Allied Chemical, for example, had a good first three months, reporting earnings of $11.10 million, up 49% from the year-ago figure. The gains came from the energy sector, including gas, coal and oil. Allied said chemical showings were below last year's performance, while fiber results were "encouraging." First-quarter '71 profits were well below those recorded by the company in fourth-quarter '70.

Monsanto reported a year-to-year increase—$512.7 million to $542.3 million—in first-quarter sales. But profits continued to slip—down 7.6%. Likewise, Sun Chemical's earnings dropped 20%, to $460,000 in the first quarter, while sales were slightly higher. Diamond Shamrock predicted earnings improvements in '71, saying chemical sales will depend on the economy.

Paper in Bind: Particularly hard hit by the lack of consumer confidence and the pollution control quandary were the paper companies. St. Regis saw its first-quarter earnings fall almost 50% from last year's figure. International Paper, Kimberly-Clark and Scott are in the same boat. International Paper's profits plummeted 39%, to $15.6 million, while Scott saw earnings decline 32% from the year-ago figure.

Per-share earnings at Riegel Paper fell to 9¢ for the first quarter from 41¢ last year.

Industry, stay 'way from our shore

No oil refineries, pulp and paper mills, steel mills or other process plants that are likely to pollute or adversely affect the environment will be permitted to operate on Delaware's coast. That's the main thrust of the policy proposed in the long-awaited report of Delaware Governor Russell Peterson's task force on marine and coastal affairs.

The chief conclusion of the report parallels the stand Governor Peterson has taken since Shell Oil disclosed plans for a $200-million refinery and petrochemical complex it wants to build on a 5,000-acre tract it owns near Smyrna (*CW, Mar. 24, p. 13*).

The task force would also ban construction of an offshore artificial island that would be used as a terminal for coal and iron ore exports and as an offloading point for imported oil.

More to Come: The preliminary report of the committee, headed by James Wakelin, Jr., also recommends that the moratorium on coastal development be continued until the state legislature comes up with "adequate" laws on use of the state's land and waters. A final report, more detailed but not expected to vary much in policy recommendations, will be released in four to six months.

Adequate controls, accomplished by legislation, says the committee, would include zoning, issuing of state permits, cease-and-desist authority and environmental rulings.

Investment in Spain

Spain's petrochemical investments will increase 30%, to $485 million, between '70 and '73, according to Eduardo Angulo, president of the Spanish government's petrochemical company, Calvo Sotelo. He adds that petrochemical output will climb a whopping 86%, to about $400 million.

Angulo, in a talk prepared for the American Section of Soc. de Chimie Industrielle in New York this week, says over-all Spanish chemical industry value of production was $2,091 billion at the end of '70. By '73 it should reach $2.5 billion. Petrochemicals' share of total chemical investment, he adds, will rise from 16% in '70 to 20% in '73.

Angulo says Spain's petrochemical industry is still relatively underinvested, despite several projects under way.

Big Buildup: At Puertollano, for example, there are these projects:

(1) An 80,000-tons/year benzene plant and a 33,000-tons/year butadiene unit to be built by Calvo Sotelo.

(2) An 80,000-tons/year styrene unit and 32,000-tons/year propylene oxide plant, now being built by Montoro, owned jointly by Calvo, Atlantic Richfield and Halcon.

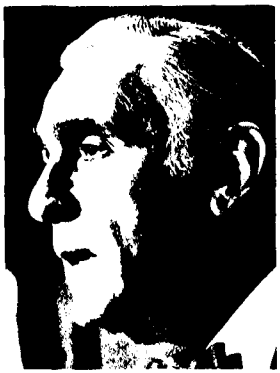
(3) Plans by Alcudia (owned 48.5% each by Calvo and ICI, 3% by Foret) for a 25,000-tons/year polyethers unit, getting propylene oxide from Montoro.

(4) An 80,000-tons/year vinyl chloride plant and 77,000-tons/year PVC unit to be built by Cros.

(5) Paular's (joint venture of Calvo and Montedison) plans for a 40,000-60,000-tons/year acrylonitrile unit.

At Tarragona, Dow-Unquinesa has three projects under review: expanding low-density polyethylene capacity from 25,000 tons/year to 122,000 tons by '75; a new, 25,000 high-density PE unit (expandable to 40,000 tons); and a new, 14,000-tons/year polyethers plant.

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Senator Ribicoff: Only one-third of food additives are now being tested.

Food chemicals scored

A new assault against chemicals that may cause cancer is being launched in several quarters. A Senate subcommittee on research is reviewing a proposal that would require industry to test all chemicals for food or industrial use to determine whether they can cause cancer. And George Bryan, the Wisconsin scientist instrumental in getting cyclamates banned, has leveled a new blast at saccharin, which he terms potentially as carcinogenic as cyclamates.

Last week Representative Joseph Minish (D., N.J.) added to the attacks by terming the present federal system of monitoring food substances "inadequate, inept and possibly injurious." He has introduced a measure that would require that food additives that don't meet rigorous standards be eliminated from public sale.

Senator Abraham Ribicoff (D., Conn.) had earlier launched Senate hearings by saying that only about one-third of all chemical additives in processed foods have been tested for possible harmful effects. The hearing's first witness, Boston toxicologist Samuel Epstein, criticized the Food and Drug Administration for not requiring testing of additives for mutation capability.

Sock at Saccharin: Bryan, in criticizing lack of regulatory action against saccharin, says his animal studies have proved its cancer-causing potential. He wants saccharin use to be limited to "diabetics, the severely obese and others with specific medical need." FDA is now considering new guidelines for regulating food additives. Although saccharin use is not now regulated, there are several federal studies of it under way.

Leading saccharin producer Monsanto says these studies will give FDA a valid basis for recommendations, but they won't be completed until '72. Monsanto has a saccharin production capacity of 2 million lbs./year and sales of more than $3 million.

Peaceful labor week

It was a week of peace-making in process industries' labor bargaining. Two strikes were settled; the year's first cement industry contract was signed; and workers at a paper mill accepted a 10% pay cut so the mill could continue operating.

Workers are back at Du Pont's Niagara Falls, N.Y., sodium plant; they had been out 192 days. The independent Niagara Plant Employees Union voted 571-273 to accept a one-year contract that features fringe benefits and changes in work rules. Talks are continuing, however, on the size of a wage increase.

A strike against Engelhard Minerals & Chemicals at Newark, N.J., ended last week with the signing of a three-year contract that provides an annual wage increase of 6.6%. The strike, affecting 1,100 members of United Auto Workers, started Mar. 15.

Cement Contract: Medusa Portland Cement signed a two-year pact with United Cement, Lime and Gypsum Workers International Union. Medusa says the contract will increase employment costs 18% over the two years, to an average of more than $7/hour.

Medusa's settlement, expected to be the industry's pattern-setter, provides wage boosts of 60¢/hour during the two years and an additional 36¢/hour for skilled workers, increased pensions and insurance; and longer vacations. The contract also provides full pensions for employees whose age plus years of service equal 65 when their jobs are lost in plant shutdowns.

A plant shutdown possibility was a prime consideration when the 550-member local of United Pulp and Paperworkers voted to take a 10% pay cut to keep Westvaco's Mechanicville, N.Y., mill open after June 1 under new ownership -a group of middle-management employees.

Chemway: down, out

Chemway Corp. (Wayne, N.J.), which plans to sell its assets to Cooper Laboratories this month, reports operating income last year plunged 92%, to $51,000, from $617,000 in '69. Counting extraordinary items, Chemway posted a $2.2-million net loss in '70, compared with $632,000 net income in '69. Sales in '70 declined to $26.7 million from a restated $29.9 million in '69.

Cooper Laboratories, a producer of specialty pharmaceuticals, owns 15% of Chemway's stock. If Chemway shareholders approve sale of the remaining assets at a meeting Apr. 30, Cooper would shell out, for each Chemway share, $2 cash, one-fifth of a share of Cooper stock and $4 in debentures. Since Cooper retains all earnings, dividends would not be paid.

Cooper's sales totaled $18.6 million in fiscal year ended Oct. 31, '70. Sales in the previous year were $13.5 million. Net earnings rose to $2.3 million in '70 from $1.9 million in '69.

O.A. Wilkerson, Cooper's manager of corporate development, says his company intends to further develop Chemway's ethical dental and medical products business, which complement its own product lines.

Rapid wrap-up

Shulton stockholders voted approval of merger with **American Cyanamid.** The agreement provides for the exchange of 0.96 of a share of Cyanamid for every share of Shulton. . . . The annual meeting of beleaguered **Pan American Sulphur,** set for Apr. 23, has been postponed indefinitely, as has been the meeting of its parent company, **Susquehanna Corp.** . . . A chemical merger clearinghouse for smaller firms (sales of $1 million or less) has been formed by **WEH Corp.** (New York). . . . Merger negotiations between **G.D. Searle** and **Howmedica** (New York) were terminated by mutual agreement.

Georgia-Pacific's plywood plant near Emporia, Va., was destroyed by fire. Damage: $9 million. . . . **Jefferson Lake Petrochemicals** (Canada) will combine with **Occidental Petroleum's** Canadian oil, gas and chemical operations. . . . **Natural Gas Pipeline Co. of America** will build a 53-mile pipeline from the Louisiana Coast into the Gulf of Mexico. Cost: $25 million.

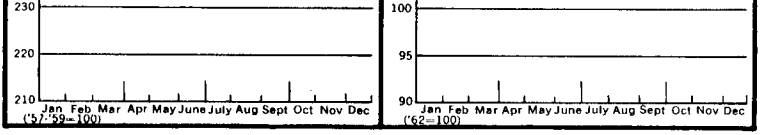
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CW's stock prices and index

YEAR HIGH	YEAR LOW	COMPANY NAME	E X	VOL	PERIOD HIGH	PERIOD LOW	LAST 4/14	NET CHG	DIV	YLD	ERN	P/E
57.6	44.7	AIR PRODUCTS	N	439	57.6	56.0	57.1	+0.7	0.20	0.4	2.56	22
25.0	20.5	AIR REDUCTION	N	1482	23.7	22.5	23.6	+0.7	0.80	3.4	1.60	15
29.6	23.3	ALLIED CHEMICAL	N	1333	29.6	27.0	29.5	+2.4	1.20	4.1	1.56	19
37.7	32.0	AMER CYANAMID	N	3281	35.1	33.2	34.0	-1.1	1.25	3.7	1.93	18
13.6	8.5	ANSUL	A	28	13.0	12.3	12.5	-0.2	0.00	0.0	0.90	14
33.0	22.1	ATLAS CHEM	N	674	33.0	23.0	33.0	+9.0	1.00	3.0	1.54	21
50.2	40.6	CABOT CORP	N	114	46.7	46.0	46.6	+0.4	0.70	1.5	3.35	14
76.4	62.1	CELANESE	N	553	76.4	73.0	76.0	+2.7	2.00	2.6	3.51	22
30.7	25.2	CHEMETRON	N	168	27.5	26.6	27.4	+0.3	1.00	3.6	1.97	14
23.5	17.0	COMM SOLVENTS	N	739	23.5	21.0	23.5	+2.2	0.40	1.7	0.25	95
40.2	35.1	DART INDUSTRIES	N	305	39.7	39.0	39.1	-0.1	0.30	0.8	1.90	21
25.2	20.4	DIA SHAMROCK	N	724	23.4	22.4	23.1	+0.5	1.00	4.3	1.49	16
90.6	72.2	DOW CHEMICAL	N	560	90.6	88.6	90.0	+0.6	2.60	2.9	4.38	21
148.0	129.4	DU PONT	N	723	145.4	143.0	144.0	+0.2	5.00	3.5	6.76	21
15.4	11.7	EMERY INDUSTRIES	A	90	14.1	12.7	13.1	-0.7	0.30	2.3	0.61	22
35.1	26.2	ENGELHARD	N	2657	35.1	33.0	33.3	-1.3	0.40	1.2	1.30	26
30.0	23.0	ETHYL CORP	N	1147	28.4	25.5	26.4	-1.2	0.84	3.2	3.06	9
30.0	23.6	FMC CORP	N	1080	28.3	27.2	27.6	-0.1	0.85	3.1	1.76	16
18.0	12.0	FOOTE MINERALS	N	237	18.0	17.1	18.0	+0.6	0.00	0.0	0.49	37
25.2	16.5	FREEPORT SULPHUR	N	1232	25.2	22.4	24.3	+1.4	0.80	3.3	1.02	24
15.7	12.3	GAF CORP	N	1129	15.0	13.2	15.0	+1.3	0.40	2.7	0.34	44
35.1	27.5	GRACE W R	N	989	32.4	30.1	32.0	+1.0	1.50	4.7	1.96	16
11.4	8.1	GREAT LAKES CHEM	A	516	9.5	9.0	9.1	-0.2	0.00	0.0	0.40	23
14.0	8.7	GULF RES +CHEM	N	1006	14.0	12.6	13.4	-0.3	0.00	0.0	0.80	17
46.2	40.4	HERCULES	N	1151	45.2	43.0	45.2	+2.2	1.20	2.7	2.51	18
12.7	10.1	INMONT CORP	N	673	12.4	11.2	12.4	+1.0	0.00	0.0	0.00	32
18.0	13.6	INTL MIN +CHEM	N	2576	17.4	16.3	16.6	-0.1	0.00	0.0	0.53	32
37.0	31.3	KOPPERS	N	43	36.0	35.3	36.0	+0.4	1.60	4.4	2.16	17
91.0	72.4	LUBRIZOL	N	183	90.6	88.0	88.6	+0.7	0.70	0.8	2.17	41
103.2	94.3	MERCK	N	530	102.4	98.0	102.2	+1.7	2.20	2.2	3.11	33
15.4	12.3	MILLMASTER ONYX	A	127	14.2	13.5	14.1	+0.3	0.00	0.0	1.08	13
43.5	32.7	MONSANTO	N	1224	43.5	41.7	43.3	+1.4	1.80	4.1	2.17	20
54.2	42.1	NALCO CHEMICAL	N	144	54.2	50.4	53.4	+3.4	0.70	1.3	1.36	39
19.3	15.4	NATL DIST &CHEM	N	425	18.4	18.0	18.1	0.0	0.90	5.0	1.18	15
22.7	18.1	NATIONAL LEAD	N	1767	22.7	21.4	22.7	+1.3	1.00	4.4	1.60	14
34.0	25.4	NAT STARCH &CHEM	N	94	34.0	33.2	34.0	+0.6	0.64	1.9	1.54	22
22.6	16.5	OCCIDENTAL PET	N	4760	21.7	20.5	21.1	+0.4	1.00	4.7	2.92	7
25.2	17.4	OLIN	N	1950	25.2	21.6	25.0	+3.2	0.88	3.5	1.12	22
37.0	32.3	PPG INDUSTRIES	N	198	37.0	36.2	37.0	+0.1	1.40	3.8	1.51	25
33.6	26.1	PENNWALT CORP	N	452	31.4	29.5	30.6	+0.1	1.20	3.9	1.20	26
39.7	34.5	PFIZER INC	N	1401	39.7	37.1	38.7	+1.4	0.65	1.7	1.28	30
9.2	6.6	PUBLICKER INDUST	N	180	8.1	7.4	8.1	+0.4	0.00	0.0	0.00	0
12.4	9.6	REICHHOLD CHEM	N	703	12.2	11.0	12.0	+0.7	0.20	1.7	0.47	26
99.0	85.2	ROHM AND HAAS	N	111	99.0	95.2	99.0	+3.6	1.60	1.6	4.05	24
50.4	44.0	SHERWIN WILLIAMS	N	678	50.3	49.0	50.1	+0.3	2.00	4.0	2.56	20
44.0	35.0	STAUFFER CHEM	N	1679	42.1	41.3	41.5	+0.4	1.80	4.3	2.60	16
30.5	21.2	STEPAN CHEMICAL	A	13	30.5	30.0	30.0	-0.1	0.52	1.7	2.03	15
24.3	17.4	SUN CHEMICAL	N	265	23.1	22.0	22.7	+0.5	0.40	1.7	1.76	13
24.3	15.7	TEXAS GULF SULPH	N	2368	23.3	22.1	23.1	+0.1	0.60	2.6	1.51	15
49.6	39.5	UNION CARBIDE	N	3822	49.6	45.5	49.4	+4.0	2.00	4.0	2.64	19
28.7	21.2	UNIV OIL PRD	N	1309	28.4	27.4	27.7	+0.1	0.40	1.4	0.50	56
23.3	20.5	VULCAN MATERIALS	N	78	22.3	21.3	22.3	+0.7	1.00	4.5	1.80	12
29.4	24.3	WITCO CHEMICAL	N	95	28.2	27.1	27.3	-0.5	0.92	3.4	1.84	15

Last Wednesday closing prices of 53 key chemical stocks. Computed for CW by Investors Management Sciences, Inc., subsidiary of Standard & Poor's. Closing prices, high, lows and net change expressed in dollars and eighths (e.g., 12.3 is 12⅜ in market terms, $12.375 in conventional terms). High/low range period is for current year, except in first quarter, when preceding year is included. N, New York exchange; A, American; O, over-the-counter. Volume in hundreds of shares. Net change is last reported Wednesday price vs. previous Wednesday close. Dividends (indicated for current year) and earnings (for last 12 months) expressed in dollars and cents. Yield determined by dividing by last sales price; price/earning ratio, last price divided by last earnings. P/E ratio not shown if earnings are negative.



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Most U.S. petroleum prices need not necessarily be affected by new royalty agreements between international oil companies and oil-producing countries. So says President Nixon's Council of Economic Advisers in its third and most pointed inflation alert. The advisory, though, stops just short of making specific threats while repeating the Administration's beliefs concerning the oil agreements. The council did say, however, that prices of heavy fuel oil (which accounts for about 11% of total U.S. oil consumption) could climb as world tags rise.

The alert also made clear that steel is shaping up as the next big test of Nixon's modified incomes policy. White House intervention in upcoming price decisions in the problem-plagued steel industry is a real possibility. Contract negotiations between steelmakers and the United Steelworkers get under way next month.

The rubber and plastics products industries will be among the first hit by rigid new rules regarding job safety and health. Under the Occupational Safety and Health Act, which goes into effect next week (Apr. 28), Labor Dept. safety experts are initiating a target industry program (TIP) to begin enforcement efforts. Labor Secretary James Hodgson says this means that the government will go after the "worst first," that is, industries with accident records above the national average. The average is 8.08 disabling accidents/million man-hours.

According to the Bureau of Labor Statistics, the worst offenders include rubber and plastics producers, paper and allied products industry, contract construction, fabricated metals and stone, clay and glass industries. Enforcement officials will concentrate on developing broad standards to cover a wide range of industries. "Horizontal" standards are being drafted now that will deal with noise levels, illumination, ventilation and clutter.

The Food and Drug Administration is studying Japanese reports that Clioquinol, sold as Entero-vioform by Ciba-Geigy, might be the cause of severe nerve disorders that have stricken 10,000 Japanese in the past 15 years. The drug, widely used in Japan, has been available there without prescription as a treatment for diarrhea and dysentery. It is temporarily banned in Japan, but no such action appears likely in the U.S. An FDA spokesman says the drug is sold only by prescription here, usually for persons going abroad. Investigations so far show no cases of nerve disorder in the U.S. traceable to use of the drug. Although FDA has not decided on a course of action, it will likely require relabeling of the drug, advising doctors to warn patients about its powerful, possibly adverse effects.

President Nixon has high hopes for the three-day White House conference on the "Industrial world ahead; a look at business in '90" that will be held in Washington in November. About 1,500-2,000 blue-chip company executives will attend. Long-term, Nixon is counting on business to cope with the tough economic problems foreseeable in this century. Short-term, it's expected the conference will solidify business support for the President in '72.

TOWOLDMON0054202

International newsletter

It's up to the Italian government to determine whether Montedison reverts to private hands or is run by the state. If Prime Minister Emilio Colombo decides on a stronger government voice in the company, Montedison's next president will probably be Eugenio Cefis, head of the government oil company, ENI. He would succeed Pietro Campilli, 79, the third president of the beleaguered company to resign in the past two years. Montedison has been battered by a struggle for control between the government and private investors. Earlier this month Raffaele Girotti, vice-president of ENI, resigned as vice-president of Montedison in an attempt to disassociate ENI from the Montedison management.

French officials have asked the U.S. to delay approval of El Paso Natural Gas' deal for liquefied natural gas (LNG) with Algeria. Reason: the French want time to work out some kind of compensation agreement for recently seized oil properties in Algeria. Despite French efforts, El Paso is confident it will receive Federal Power Commission approval to consummate the $220-million/year deal. Meanwhile, Algerian President Houari Boumediene has offered French oil companies $100 million for the 51% interest in the oil ventures taken over by his government. That's only about 14% of what the French are asking for.

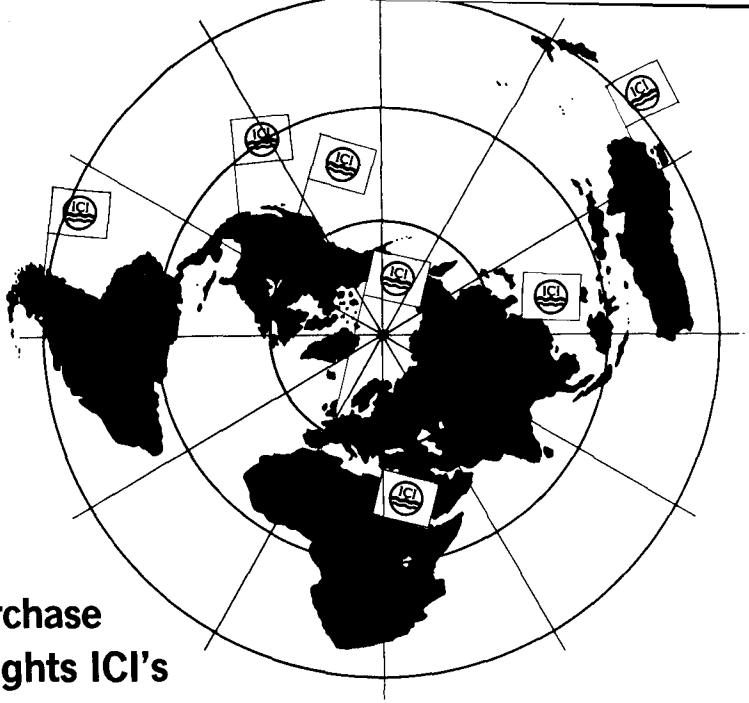
Venezuela has finally obtained some financial backing for its proposed petrochemical buildup. IVP, the government's petrochemical company, last week borrowed $70 million from a group of international banks. The funds are earmarked for the petrochemical complex at El Tablazo. Included: a liquid gas plant that will supply IVP with propane, butane, ethane, residual gas and natural gas; a 150,000-metric-tons/year ethylene unit and plants to turn out 65,000 m.t./year of chlorine and 39,000 m.t./year of caustic soda.

Red China wants to buy another ammonia plant. Yosomatsu Matsubara, board chairman of Japan's Hitachi, says he has received an inquiry from Peking about building "a large-size ammonia plant in mainland China." To clinch the deal, Matsubara may join a group of Japanese businessmen going to mainland China this fall. If Hitachi reaches agreement with Peking, it would be the third ammonia plant purchased by the Chinese abroad, according to Japanese observers. They bought two $8.4-million, 100,000-metric-tons/year units from Britain's Humphrey's & Glasgow in '63 and '65. Tokyo China-watchers believe Peking is considering switching its feedstock for fertilizers from coal to natural gas or naphtha and boosting the size of its ammonia units to the 1,000-tons/day level.

Naphtha deals in Europe and Asia: Japan's Mitsui has purchased 20,000 tons of naphtha from Burma's government-owned Mya Ma refinery. It will be used to produce aromatics in Japan. . . . New pumping stations in the naphtha pipeline between Rotterdam and Geleen will enable DSM to boost its naphtha supply from 800,000 tons/year to 1.3 million this spring and to 1.6 million later.

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Sluggish growth at home forces British chemical giant to invade foreign shores

Atlas purchase highlights ICI's global push for greener pastures

Imperial Chemical Industries, which is counting heavily on overseas expansion for growth, made its biggest move in the Western Hemisphere last week: it agreed to acquire Atlas Chemical Industries (Wilmington, Del.) for an estimated $163 million.

Expansion abroad is essential for ICI, since the United Kingdom is neither large enough nor economically strong enough to provide Britain's biggest chemical maker with a satisfactory earnings base or capital for new investment.

If Atlas' shareholders agree, the company will be merged into ICI America. ICI will pay $40/share for Atlas common—about 26 times earnings.

Atlas' stock jumped $9.25, to $33/share, on the New York Stock Exchange last week following disclosure of the deal with ICI.

Atlas' sales increased last year 7%, to $155.2 million, while net profit slipped 4%, to $6.3 million. The company has two highly profitable divisions—Stuart Pharmaceutical and International—which fit neatly into ICI's plans. Atlas' fine chemicals business was another attraction.

Expansion Base: There is little overlap in the products of the two companies. "It's a synergistic mix," says Jack Callard, ICI's new chairman (*see p. 46*). The acquisition will give the company a broader base on which to expand in the U.S., he adds.

John Dick, vice-president of ICI North America, says that the Atlas purchase could be the springboard for ICI's entry into areas such as plastics, foams and textiles.

ICI expects no trouble from the U.S. Justice Dept. Says Callard: "The proposition is wholly within U.S. law." The British giant will raise the cash for the deal from nonsterling sources, mainly in the U.S.

One result of the acquisitions: ICI expects to export more to the U.S. This will help the British company because business in the U.K. is in the doldrums. A big chunk of ICI's output is consumed by British industry, but last year industrial growth in the U.K. was less than 2%.

"We are profit-hungry now," Callard tells *Chemical Week*. "We have got to go out and improve ourselves. The emphasis is on 'up with profit' and from there a stronger and stronger base on which to grow internationally."

Slump in '71: The new chairman's view is understandable. ICI's net profit fell 7.5% last year, to $238 million, and the prospects for much improvement this year are dim.

However, sales were up 9%, to $3.5 billion, as ICI closed the gap with the world's leading chemical volume producer, Du Pont (*see table*). The British company has been creeping up on Du Pont in the past decade. Its sales have increased 166% since '61, compared with Du Pont's 65%.

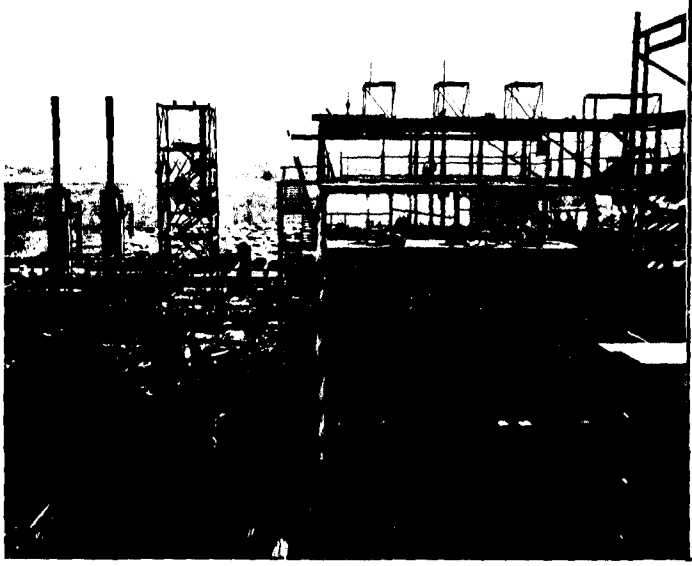
ICI's net profit has soared 190% since '61, to $238 million, while Du Pont boosted net profits 27%, to $329 million, in the same period. But ICI has a long way to go in profitability. Its net profit on sales was 6.8%, compared with 9.1% for Du Pont.

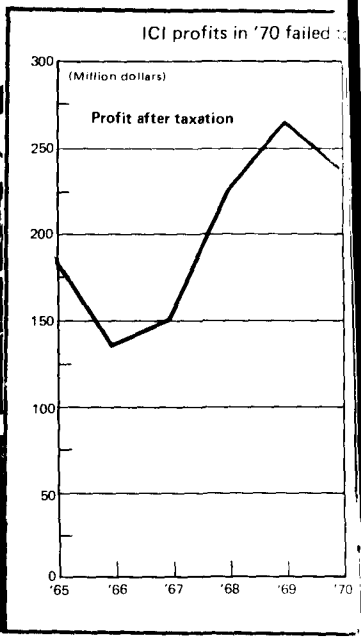
ICI's overseas sales have been growing at a faster pace than its domestic

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A $50-million polyester polymer and film plant is taking shape in Hopewell, Va., ICI's biggest investment in the U.S.





sales. They now account for almost 53% of the company's total. Although the German chemical giants particularly Bayer have a higher percentage of sales overseas, ICI's overseas total of $1.85 billion is the biggest in the world.

Europe Is Target: ICI aims to boost sales on the European continent to a point where they will be higher than the $1.7 billion in the U.K. Sales on the Continent reached $540 million in '70. Callard would like to see the volume pass the U.K. total before he retires (he has a four-year, renewable contract).

ICI figures the European Economic Community (EEC) chemical market was $22.7 billion in '68 and growing at 11.5%/year. Britain's chemical market was $6.5 billion, growing at 6.9%/year. Little wonder Callard wants Britain in the Common Market.

"We have so far gone into Europe in only fibers and plastics, and our proportion of the market in those products in Europe is much higher than our share of the total chemical market–10% vs. 1 to 2%," says Callard.

ICI has roughly 30% of total chemical sales, 40% of plastics business and 60-80% of fibers volume in the U.K.

The company's $240-million investment in Europe is concentrated in Rozenburg, Holland, and Oestringen, West Germany. At Rozenburg, it produces about 120,000 long tons/year of polyethylene, 7,000 l.t./year of polyester film and nylon and polyester polymer. The latter is shipped to Oestringen, where ICI makes 35,000 l.t./year of nylon and 15,000 l.t./year of polyester.

ICI is also building nylon and polyester spinning facilities at Offenbach, West Germany. Due onstream about midyear, the units will add 10,000 l.t./year of each fiber to the company's European capacity.

Missing Leg: "We call this act our two-legged stool (Holland and Germany), and we must develop a third leg to create greater stability," says Callard. "We are now developing quite a bit in pharmaceuticals in Europe. I think we shall develop into the foams. We have interesting prospects in films for packaging and reprographic use."

The company may add its third leg in southern France, where it plans to build a 60,000-tons/year polyethylene plant at Fos, near Marseilles, by '72, on a site that will include ICI's second petrochemical complex on the mainland.

The Fos location gives ICI a base from which to tackle Mediterranean markets as well as those of EEC.

Twice as Much: ICI plans to more than double its investment in continental Europe to at least $500 million by '75. This year the company will spend about $72 million there, compared with $65 million last year. ICI's total overseas investments this year will be twice those of '70–$216 million, with U.S. and Australian operations sharing in the budget with Europe. In '70 the company spent $26.4 million in North America, $21.6 million in Australasia.

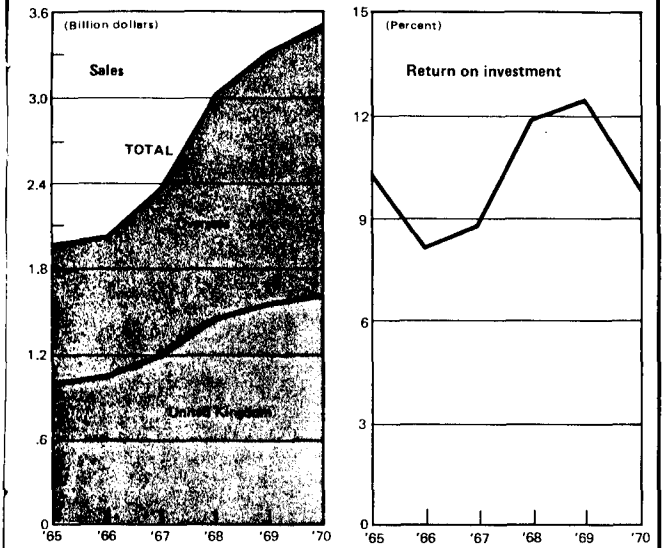
While overseas investments are going up more than 100%, ICI is holding the level of its U.K. outlays at about $283 million this year.

In the U.S., ICI's biggest investment before Atlas is a $50-million polyester polymer and film plant being built at Hopewell, Va. Completion target: Dec. '71. The company also has a 37.5% interest in Fiber Industries (Celanese has the rest). Fiber Industries had sales of

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keep pace with sales growth; return on investment fluctuates



about $300 million last year.

ICI America had '70 sales of $67 million, expects about $75-million volume this year. ICI group sales in North America totaled about $400 million in '70, up 6% from '69.

Mining Interests: In Australia and Canada, both of which have limited chemical markets, ICI affiliates are digging deeper into mining. Canada's CIL has acquired Jarvis Clark Co. (North Bay, Ont.), a leading supplier of mechanical equipment to the mining industry, and McPhar Geophysics Ltd. (Toronto), a supplier of geophysical instruments and services to the mining industry. McPhar has subsidiaries in the U.S. and Australia.

In Australia, ICIANZ plans to become a major force in the booming mining industry in the next decade. The company is prospecting for base metals in Queensland and is a partner in Newaim, a minerals exploration company testing lateritic nickel deposits on the island of New Caledonia.

The mining industry has always been a market for ICI's explosives, and Callard says the company will offer mining companies assistance in refining ore more cheaply by chemical extraction processes. And he doesn't rule out a bigger role in oil exploration.

Whereas Australia's market is limited (population is only 13 million), Indonesia has considerable potential, says Callard, adding: "There are a lot of people in Indonesia, and we've started some small ventures there.

"In Malaya we started with paint activity, and now are in fertilizers, chlorine and caustic soda and can move from there. We can do a lot of business in crop-protection products. In Thailand we've got a paint activity and I don't see why we shouldn't introduce other products."

Flanking Japan: Some see ICI's buildup in these Japan-oriented markets as an attack on Tokyo's stringent restrictions on foreign investment. ICI's only real presence in Japan is through 30-40 licensees.

"We are very pleased to receive the royalties," says Callard, "but as far as we can see they have a long way to go to come to the point where investment there can be undertaken in the same way as in any other industrial country."

ICI's sales to Japan: about $12 million/year.

As it moves more deeply into overseas areas, ICI is reorganizing and rationalizing in the U.K. It recently realigned its divisions (*CW, Mar. 10, p. 14*), squeezed 1,500 jobs out of its organization. The company is expected to spin off its fertilizer interests, which are likely to be merged with other U.K. fertilizer units to form a state company.

Since the demand for explosives is decreasing in Britain, ICI has put its explosives operations (formerly in the Nobel Division) into a subsidiary company. "That," explains Callard, "should allow it to streamline."

Strong Suits: ICI expects ultimately to be in fewer but stronger products — plastics, fibers, paints, pharmaceuticals, color chemicals, possibly food chemicals.

"And never forget the huge bread-and-butter production of chlorine, caustic soda, alkali—tremendously large-volume stuff," says Callard.

Because of the enormous resources

ICI moves up on No. 1

(million dollars)	'70 Sales	% Change from '69	'70 Net profit	% Change from '69
Du Pont	$3,618	- 0.4	$329.0	- 7.8
ICI	**3,509**	**+ 8.0**	**238.0**	**- 7.5**
Union Carbide	3,026	+ 3.1	157.3	- 15.6
Hoechst	2,884	+18.5	N.A.	N.A.
BASF	2,872	+18.3	83.8*	- 13.3
Bayer	2,603	+ 8.7	80.6*	- 25.6
Akzo**	1,987	+13.0	68.5*	- 19.4
Rhone-Poulenc	1,985	+ 8.6	36.6*	+16.0
Monsanto	1,972	+ 1.7	78.0	- 28.8
Dow	1,911	+ 6.3	132.0	- 11.1

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needed to introduce new products. ICI intends instead to develop improved grades of and new applications for existing products. "The demand for plastic films—for packaging and other uses—is going to grow quite rapidly," Callard continues, "so I can see advances down the films road."

The ICI chairman says the company is expanding its research in pharmaceuticals. "I think we shall certainly grow in that area," he adds. And he has high hopes for a new synthetic cellulosic material the company is developing as a tobacco substitute.

In addition to regrouping its product lines and shifting its priorities, ICI will be paying more attention to pricing. Callard says he is not satisfied with his company's prices and expects increases to be greater this year than in '70.

This may be easier said than done. There is still overcapacity in many chemical products, and competition from U.S., European and Japanese companies is expected to be rougher.

Productivity Push: As it fights the cost-price squeeze, ICI is placing greater emphasis on efficiency and productivity. A unique labor contract calling for weekly instead of hourly pay is boosting productivity at least 15% in some plants.

But British labor is not easily mollified. Henry Ford II recently aroused labor's ire by threatening to close a British auto plant during a lengthy strike. And Callard had hardly warmed his seat in his new office when he was hit with hefty wage and benefit demands.

In addition to a 30% wage hike, cost-of-living escalator clauses and lump-sum payments to compensate for loss of purchasing power, Britain's chemical union is asking for greater access to company books and information, a study of the possibility of getting worker directors on the board and increased participation in the company's productivity agreement.

So Callard has a tough row to hoe. Though he is comforted by ICI's results last year—they were not as bad as those of other chemical giants (*see table*)—he feels that the company's 9.8% return on funds invested must be improved.

The first engineer to head ICI, Callard will probably see the company move into the No. 1 spot in worldwide chemical sales this year. But whether he will be able to "engineer" improved profits remains to be seen.

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Pollution cop's lot not 'appy

Despite complaints from government and customers, Monsanto is pushing ahead with $2-million plan to curb pollution by PCB

William Papageorge, manager of environmental control for Monsanto's organic chemicals division, is in a spot few would envy. He has the ticklish job of guiding the company's $2-million research and control program aimed at halting pollution of the environment by its polychlorinated biphenyls (PCBs).

The trouble is, the government doesn't think the program goes far enough—but some of Monsanto's PCB customers (who have been asked to pitch in and help) think the company has overreacted.

Despite the headaches, Monsanto is pushing ahead with its program, which has four main objectives: (1) eliminating open-system applications of PCBs, such as in coatings and plasticizers; (2) controlling spillage or other loss from closed-system operations; (3) developing a less-persistent type of PCB; (4) eliminating loss or contamination during manufacture.

Latest step: next month at Monsanto's Sauget, Ill., plant a new, $500,000 incinerator will begin complete destruction of more than 500,000 lbs. of contaminated Aroclor, the company's tradename for PCB used as an insulating and heat-transfer fluid. The material, recalled from customers, is now being stored in several 10,000-gal. tanks at the plant.

Sole Supplier: As the lone U.S. manufacturer of PCBs (at Anniston, Ala., as well as Sauget), Monsanto was the only company that had to respond to evidence presented early in '70 that these materials are in the family of persistent chlorinated hydrocarbons that build up in animals and affect their reproductive cycles. (Among other things, PCBs were linked with thinning of peregrine falcon egg shells.)

Papageorge says: "We don't know how serious a hazard PCB is to the environment—no one really does." But he adds that the company recognizes that PCBs are turning up in the environment and has decided to do something about it.

Long History. PCBs were originated by Swan Chemical in '29 in response to the electrical industry's need for an explosionproof insulating fluid for transformers. Mineral oils (still used in more than 85% of electrical insulating applications) have a stability problem that makes them potentially hazardous.

Power surges in electrical equipment causes arcs—and enough of them can vaporize mineral oil so that the next arc can ignite the vapor. It's not a big risk, but it is enough to warrant use of stable PCBs (which can withstand temperatures up to 1,600 F) in substations located in populated areas and around expensive industrial equipment.

Monsanto, which makes biphenyls as a basic commodity, took over Swan in the early '30s, now is sole supplier for the U.S., England and Canada. PCBs are also made in France, Germany, Italy, Japan and the Soviet Union.

Soon after Monsanto took over, new applications opened up for PCBs as industrial heat-transfer media. The next major push for new markets was in '60, when a Monsanto technical bulletin was published to promote the use of PCBs in sealants, chlorinated rubber, adhesives, printing inks and insecticides.

The insecticide use has drawn fire in recent years, but Monsanto says the U.S. Agriculture Dept. originally suggested that PCBs could be used to extend the life of some pesticides if added as inert material.

Pulling out of the open-system market does not appear to be a big loss for PCBs. Some 200,000 lbs. of material destined for such use has been bought back by the company, will be shipped for use in closed systems. As a service to former open-system customers, Monsanto has prepared a list of suggested replacements for PCBs in adhesives and coatings—some more expensive, some cheaper. The PCB insulator market, though limited, seems secure. But as heat-transfer media, PCBs are being challenged by several new competitors, who are stressing environmental safety (*see, p. 39*).

Early Concern: The first signs of trouble for PCBs turned up in '66, when a Swedish biologist, Soren Jensen, identified these materials in the bodies of fish.

In '68 Monsanto began studying the Swedish work. One problem: separating



Monsanto's Papageorge makes inspections to help check loss of PCB to environment

PCB from the other chlorinated hydrocarbons like DDT and DDE that were known to be prevalent in the environment. To identify PCB (present in parts per billion quantities) gas chromatography, electron capture and mass spectrophotometry methods had to be refined.

Robert Risebrough, marine biologist at the University of California (Berkeley), identified PCB in San Francisco Bay area birds in '69. Risebrough's work received wide circulation in *Environment* (Jan/Feb, '70) just one month after Monsanto began its control program. The company ran into more trouble when Representative William Ryan (D., N.Y.) called for a ban on the product (*CW, Apr. 22, '70, p. 1*).

Says Risebrough: "There is no evi-

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dence to indicate that PCBs in the environment are likely to reach levels that would cause severe injury or death from short-term exposure. The possible PCB hazard, like so many environmental hazards, is one of long-term, low-level exposure."

Even though Monsanto has stepped up the program to control escape of PCBs into the environment, Ryan says further measures are necessary. To encourage government supervision of Monsanto's controls, which he says is the only way to assure their success, Ryan is preparing a report on PCBs in the environment, which is expected out around May 1.

Clamping Down: Nevertheless, Monsanto insists it is taking vigorous steps to stop accidental distribution of PCBs into the environment—so vigorous that some customers have complained.

"Some of our customers have accused us of overreacting to the dangers," Papageorge says, "but we're intent on following through on any possible loss of PCBs to the environment."

First step in Monsanto's crackdown was to halt sales for any application where entry into the environment could not be controlled. In most cases the company was able to spot orders for such uses by the quantity requested. It also has stopped selling Aroclor through distributors.



At Sauget, Ill., plant, $500,000 incinerator will destroy waste PCB at 3,000 F.

Order size also is the tip-off on potentially polluting heat-transfer applications of PCBs. Papageorge points out that new material bought in small quantities invariably is for makeup in systems to replace what is lost when samples of the liquid are taken periodically during operation. Monsanto has shut off sales for such use in the food industry because of the risk of direct contamination if any of the PCB escaped into the food.

Educating Customers: To back up its policy, Monsanto has set up an education program for its customers, showing how to avoid losses during use and handling of PCBs. Papageorge says he has found the best way to get cooperation from a user is to go directly to the company's president or vice-president.

"In every case we've gotten a good response," he says, "because there is no substitute for PCB, or at least no economical substitute." (The material sells for 20-25¢/lb.)

"We tell our customers that if they ignore us, we may be forced to stop selling them PCBs . . . and the message usually gets through," adds Papageorge. To back up the message, Papageorge makes personal inspections of customers' unloading facilities to make sure spill-prevention programs are working.

Recover or Destroy: One of the main objectives of Monsanto's program is to keep PCBs away from water supplies. Papageorge notes that once the material gets into the water, it spreads out, leading to widespread effects.

To prevent this, Monsanto is buying back at full price materials sold to customers for other than closed-system use. The company also reprocesses PCBs contaminated by arcing or other means. PCBs are recovered by passing contaminated material through a series of clay filters.

The new incinerator at Sauget will give Monsanto a way of handling PCBs that cannot be recovered or reused. It will charge 3¢/lb. for destroying spent material.

One complaint against PCBs has been that when plastics coated with these materials are placed in incinerators at relatively low temperatures the PCBs are not destroyed. But the new, 10-million-lbs./year incinerator built for Monsanto by John Zink (Tulsa) will operate at 3,000 F., reduce PCBs to carbon dioxide and water.

Hydrochloric acid formation will be prevented by use of a scrubber and by neutralization of the resulting fluid.

Plant Practice: Monsanto's PCB manufacturing operations have experienced an equal tightening of standards. "You get a feeling of bone dryness in the plant," says Papageorge. "There is none of the hosing down you find in most chemical plants."

Other measures include complete monitoring of all vents and traps for leaks at all sample points. All tanks are "buttoned up" so that operators don't have to look in. And all of the air and gas that escapes the plant is passed through a Brink mist eliminator. In addition, process temperatures were lowered to prevent vaporization.

Monsanto even provides clothing for all the workers, and after the clothes are cleaned all the cleaning fluid is collected for destruction in the incinerator.

For PCBs used in capacitors, the little boxes on poles that boost electrical power, Monsanto is installing a distillation column, scheduled to go on-stream in June, to produce a PCB without the persistent isomers. The material can then be further chlorinated for transformer use. The problem with capacitors is that they are small, hard to collect after they have been replaced. They could easily end up in a land fill, crushed so that the material inside leaks onto the ground.

Seeking Substitutes: Monsanto admits to looking for some substitutes for PCB. What the company has primarily gained from the PCB furor was an awareness that it must test all new products for environmental effects.

"We don't yet know what tests will be required, what data will be acceptable, or even what animals to test on," says Papageorge, "but we have worked out a checklist approach for all new chemicals. We hope we'll be batting 1.000 when the federal government details its toxic substances act."

Meanwhile, Monsanto feels it is well on its way to providing an effective program for controlling PCB. It still questions some of the identification procedures under which PCB has been indicted. But the company is betting that closing the open-system market will end the threat.

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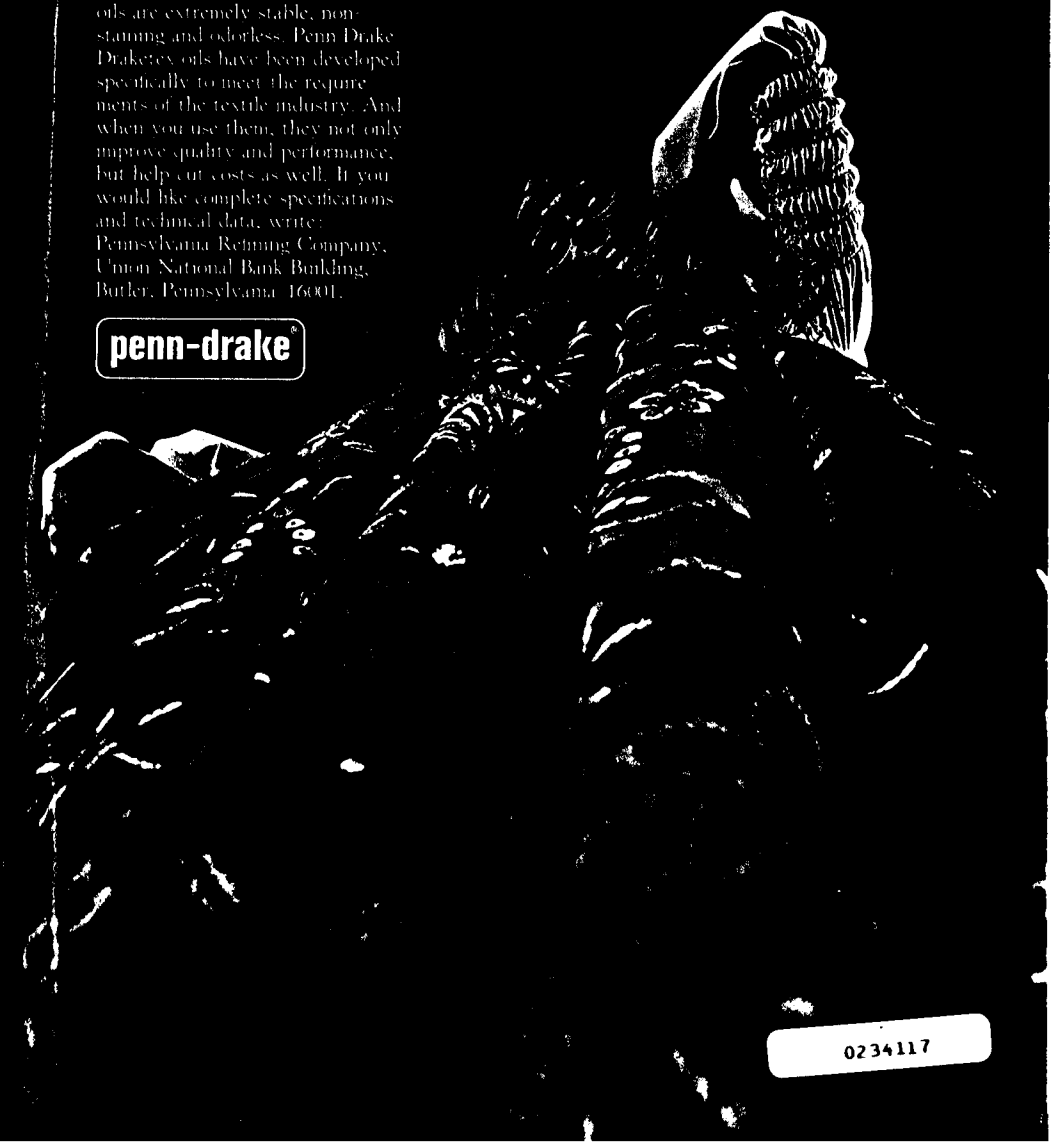
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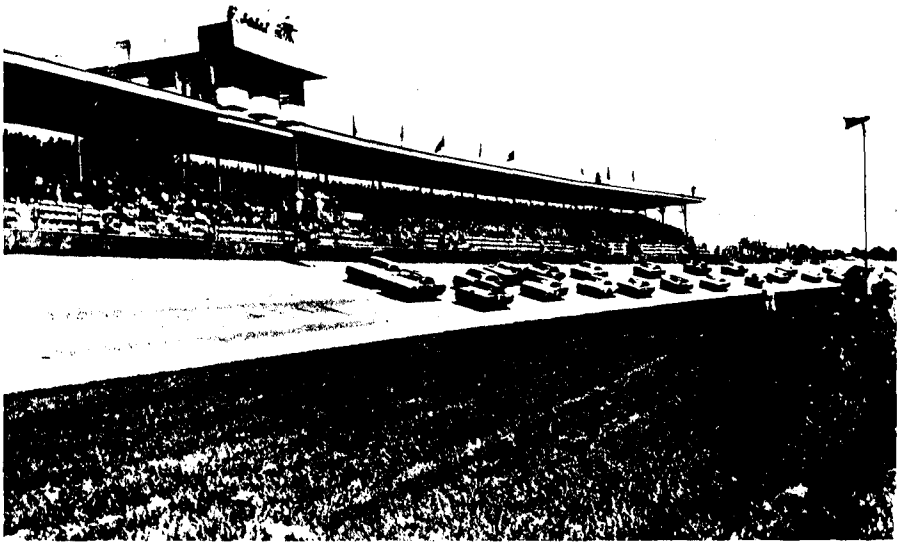
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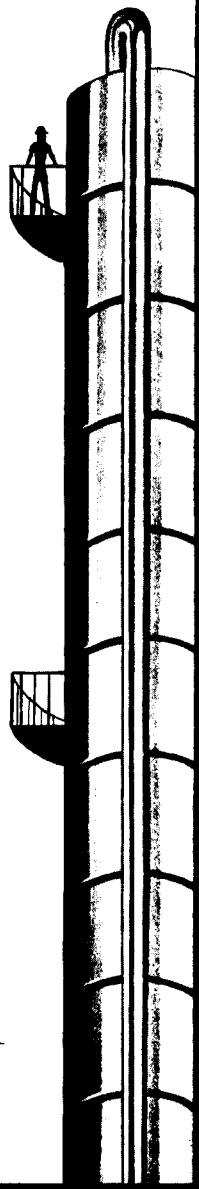
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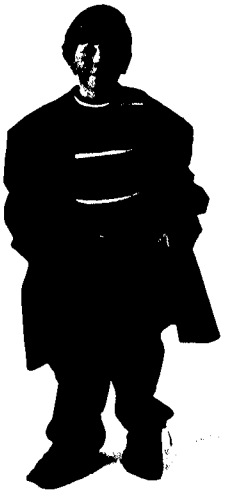
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TOWOLDMON0054215

Fertilizer makers posted a big improvement in calendar '70. The Fertilizer Institute says the industry's four major groups—potash producers, fertilizer producers and marketers, mixed fertilizer manufacturers and independent retailers—showed gains. The spotlight, of course, is on the 33 basic producers and marketers who lost $70 million in '69. That loss was trimmed to $33 million in the fertilizer season ended last June 30, and in calendar year '70 they cut costs and boosted sales enough to earn $15.4 million. Fertilizer makers expect to do better this year. They have chopped expenses drastically—the R&D budget is down to 0.2% of sales—and are set to take full advantage of any sales upturn.

Sulfur stocks at the end of February were 4.09 million l.t., down less than 1% from January's 4.11 million l.t. The Bureau of Mines says that inventories were 4.04 million l.t. at the end of '70, 3.46 million at the end of '69 and 2.79 million at the end of '68. A 4% increase in sulfur shipments in the first two months of '71 was mildly encouraging to producers. Shipments are now running at the rate of 8.19 million l.t./year, compared with 7.89 million l.t./year recorded during '70's first two months.

But imports may be a problem again for domestic producers. February imports rose 9%. And while the year's total so far is down about 44% from '70, import prices are sliding. The average value of a long ton of imported sulfur was $14.74 in February, compared with $17.23 in January and an average of $22.20 in '70.

Celanese has boosted prices of a number of coatings sold to automotive and industrial markets. Among the increases: 5% on selected automotive finishes; 6-8% on epoxy can linings; 8% on thermosetting and lacquer clears used in coating paper, film and foil; 5% on epoxy coil-coating primers.

Dow Corning has raised prices of some silicone rubbers, effective May 3. The products, all high-performance materials, are Silastic 35U, 55U and 75U, which went from $3.10/lb. to $3.46; and Silastic 235U, from $3.40/lb. to $3.58.

Dutch petroleum product users dispute oil company claims that the new $3.45/bbl. tab on Libyan crude justifies higher prices in the Netherlands. The users contend that recent declines in oil tanker rates more than offset the 90¢/bbl. price increase on crude. Both parties have taken the dispute to the Dutch Minister of Economic Affairs. At issue: not only fuel prices but also the costs of heavy petroleum feedstocks for the petrochemical industry.

Benzene production is declining. Tar distillers and petroleum operators turned out 152 million gal. during January and February, 24% below last year's 200 million gal. Other production drops reported by the U.S. Tariff Commission for the period: synthetic phenol, 260 million lbs., 3.6%; cyclohexane, 265 million lbs., 18.3%; acetic anhydride, 244 million lbs., 13%; butadiene, 174 million lbs.,

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7.1%; formaldehyde, 615 million lbs., 3.9%; vinyl chloride monomer, 576 million lbs., 11.9%; urea, 931 million lbs., 4.5%.

Output of these materials was up: dodecylbenzene, 96.6 million lbs., 8.3%; acetone, 236 million lbs., 3.3%; acrylonitrile, 174 million lbs., 3.3%; ethylene oxide, 546 million lbs., 8.9%; methanol 776 million lbs., 10.4%. Ethylene and propylene production (not reported last year) was 2.9 billion and 959 million lbs.

Prices of fine-denier nylon filament for apparel are moving up. Allied boosted tabs an average of 8% across the board, effective Apr. 15, and other major producers of the yarn have already made similar moves, or intend to do so soon. This is the third round of increases since Oct. 15, making a total advance of 15-20% from the severely depressed prices of mid-'70. The most important item included is beamed nylon, used to make warp knits for underwear. Demand for warp knits, which account for about 45% of nylon's apparel market, has been especially strong. Other apparel markets that use products covered by the increase include hosiery and bonded outerwear. Nonapparel markets for nylon have generally had flat or weak demand. Carpet markets, for example, have been depressed for more than a year. A move to raise prices of carpet nylon last fall failed. Tire-cord demand is reported to be steady.

Casein quotes are continuing to move up. The latest tabs for bagged carloads (ex-dock, Eastern seaport) are 39.2-39.7¢/lb. for Argentine inedible material vs. a January quote of 35.5¢/lb. Australian edible material is 40-43¢/lb. on the same basis, and the tab on New Zealand edible is 39.5-40¢/lb. Four months ago they were 35.4¢/lb. and 33-34¢/lb., respectively.

Reichhold has posted a price boost on pigments, effective May 3. Items included: molybdate orange, up 2¢/lb., to 59.5¢/lb., chrome green, up 2¢/lb., to 54-59¢/lb.; chrome yellow, up 1.5¢/lb., to 44¢/lb.; zinc chromate, up 2¢/lb., to 37¢/lb. The move follows boosts by other producers and confirms the stronger trend of the paint and coatings industry. Latest U.S. Census statistics show sales of paint, varnish and lacquer are starting to move up after nine months in the doldrums. Trade sales are showing more zip than industrial sales.

Synthetic rubber markets are starting to pick up. The Rubber Manufacturers' Assn. reports that 167,578 long tons were used in January, up 13.7% from Dec. '70. But that's still 0.9% below the 169,074 l.t. used in Jan. '70.

Prices of gum naval stores are still strong. The average charge for commercial pine gum was $44.80/bbl. in March, says the U.S. Agriculture Dept. That compares with $43.70/bbl. in February and $34.60 in Mar. '70. The gum turpentine price is still firm at the $1.20/gal. tab in effect since April of last year.

British prices of expandable polystyrene bead will rise 5% on May 1. Monsanto Chemicals set the new price at about $24/long ton.

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For additional information on these new products, please circle key numbers on Management Information Service postcard inside back cover.

Chemicals

Diene intermediates: Union Carbide has brought out three diene intermediates for production of resins and specialty chemicals: bis-(2-cyclopentenyl)ether, 3-cyclohexenyl-3-cyclohexenecarboxylate, and bis-(6-methyl-3-cyclohexene-1-methyl) adipate. **Circle 150**

Reagent chemicals: Highly pure grades of *para*-dimethylaminobenzaldehyde (Ehrlich's reagent) and ammonium pyrrolidinedithiocarbamate (APDC) are offered by J. T. Baker. **Circle 151**

Strontium compounds: Twenty-seven strontium compounds, including hydroxide, chloride, acetate and sulfate, have been introduced by Tenomer Industries, Inc. **Circle 152**

Alkyl phosphorus intermediates: Ethyl Corp. has added n-propyl-phosphonous dichloride (PPD) and n-propylphosphonic dichloride (PPOD) to its line of alkyl phosphorus intermediates for making pesticides, pharmaceuticals and flame retardants. **Circle 153**

NMR shift reagents: Euroshift-F and Prashift-F are partly fluorinated chelates of europium and praseodymium, offered by Pierce Chemical for nuclear magnetic spectra analysis. **Circle 154**

Epoxy resins: Dow Chemical has developed two epoxy resins for intermediates in formulating adhesives, coatings, castings, powder coatings. **Circle 155**

Equipment

Radiometer: Infrared instrument from Williamson optically measures surface temperature of tubes in gas or oil-fired furnaces to 3,000 F. **Circle 156**

Control system: A new solid-state direct-current logic system for process control is available from Gulf + Western's Eagle Signal Division. The unit will provide load relay, control relay and timer functions, depending on modules selected. **Circle 157**

Thermoswitch: Scientific Engineering and Manufacturing has a solid-state device that warns of overtemperature. The instrument also has an independent analog signal for remote temperature display. **Circle 158**

Air lock: A rotary dust valve from Joy Manufacturing's Western Precipitation Division has a cast-iron body that can handle dust and free-flowing solids at temperatures to 300 F. **Circle 159**

Couplings: Garlock is marketing a new line of TFE fluorocarbon expansion joints and couplings. **Circle 160**

Temperature control: Protective Closures' Mokon Division has an expanded line of circulating liquid temperature contol systems. **Circle 161**

Lighting unit: ESB Inc's Exide Power Systems Division is offering a new 12-volt emergency lighting unit. **Circle 162**

View port: Terriss-Consolidated has a polished, stainless-steel view port for single-wall vessels. **Circle 163**

Level gauge: Both transparent and reflex heated liquid-level units are by Jerguson Gage & Valve. **Circle 164**

Condenser: Frick has a new series of evaporative condensers of the blow-through design for process cooling applications. **Circle 165**

Nozzle: Wellco Chemical offers a new stainless-steel high-pressure automatic tank-cleaning nozzle. **Circle 166**

Motor: A 700-hp., 3,600-r.p.m. motor designed by General Dynamics' Electro Dynamic Division for centrifugal compressor drives is said to set new standards in lower noise levels. **Circle 167**

Filter: A swinging-barrel air filter offered by Sonair needs only 15 seconds for replacement of moisture and oil-adsorbent cartridges. **Circle 168**

Valve manifold: Hoke is offering a new heavy-duty three-valve manifold that saves installation space. **Circle 169**

Motor driver: A new integrated circuit

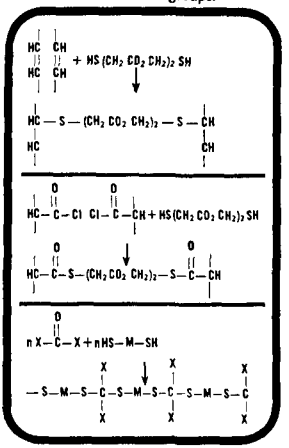
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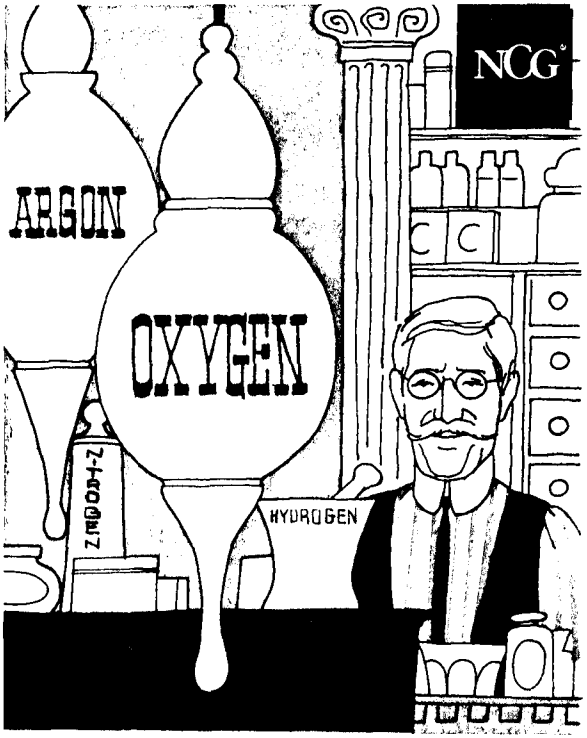
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New products

For additional information on these new products, please circle key numbers on Management Information Service postcard inside back cover.

stepper motor driver marketed by A. O. Smith is designed for applications where amplified, buffered signal output from a meter is needed to drive high-torque mechanical drives. **Circle 170**

Filter press: Netzsch Brothers' press system has up to 110 chambers, 1,200 x 1,200-mm. size, filtration area up to 250 square meters. **Circle 171**

Drum plug: A 2-in. drum plug on which standard drum wrenches or square or hexagonal socket wrenches may be used is offered by Rieke. **Circle 172**

Level Control: Bin-Dicator's point level indicator has a computer-compatible output signal. **Circle 173**

Flash dryer: Now being introduced by Wyssmont is an automatic unit for drying crystalline, granular, pasty, powdery and slurry materials. **Circle 174**

Chromatograph: Hewlett-Packard offers a new U-tube gas chromatograph for use with four columns and five detectors. **Circle 175**

Oxygen meter: A portable instrument by Fincher Engineering is designed to measure oxygen content in both liquid and gaseous mixtures. **Circle 176**

Valve: A solid ceramic gate and seat are the main features of a new Type RS valve offered by Mohawk Valve in size range from ½ in. through 2 in. **Circle 177**

Sound meter: General Scientific Equipment's self-contained sound-level meter that determines noise levels is ready for distribution. **Circle 178**

Pressure regulator: A compact 1.5-lb. back pressure regulator has been introduced by Circle Seal's Victor Controls Division. Units maintain preset pressures in either corrosive or non-corrosive fluids. They are available in pressure ranges from 80 to 1,000 psig. **Circle 179**

Flow switch: McDonnell & Miller has a new series of switches that make or break two separate electrical circuits

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when flow in a pipe starts or stops. **Circle 180**

Descaling unit: A new electrostatic device for descaling water systems is available from Worthington. **Circle 181**

Mixer: McCarter has a new line of mixers for pastes, liquids, dry powders or heavy granular materials. **Circle 182**

Filter tube: A new line of high-efficiency filter tubes composed of borosilicate glass microfibers bonded with epoxy resin is offered by W. & R. Balston Ltd. **Circle 183**

Valve isolator: Relief valve isolators said to reduce maintenance up to 75% and to eliminate product loss and air pollution have been developed by Ametek/Calmec. **Circle 184**

Turbidimeter: Gam Rad has a new analyzer for suspended-solids monitoring. **Circle 185**

Sight glass: A pipeline sight glass developed by Gala Industries is made of cast acrylic pipe, has quick-disconnect couplings. **Circle 186**

Analyzer: Leigh Instruments' Resource Electronics Division offers a new fluoride analyzer and satellite sensing unit. **Circle 187**

Data terminal: A portable data terminal designed for time-sharing users is being introduced by Texas Instruments. The device features a built-in acoustic coupler. **Circle 188**

Computer: Digital Equipment has a new family of small functional computers designed to user specifications. They are designated PDP-16, are priced at $800-3,000 in volume. **Circle 189**

Valve: A horizontal slide-roller-mounted gate valve for use in the handling of dry bulk materials is offered by Research-Cottrell's Cleveland Armstrong subsidiary. **Circle 190**

Valve: Dezurik has a new line of knife gate valves for highly corrosive applications. Sizes range 2 to 36 in., inclusive. **Circle 191**

Light: A new mercury vapor fixture for industrial use, developed by Killark Electric, is suitable for Class I, Division 2, and Class II and III, Division 1 and 2 hazardous locations. **Circle 192**

Specialties

Bonding liquid: Zipbond is a one-system alpha-cyanoacrylate adhesive for bonding synthetic materials. It's marketed by Tescom Corp.'s Instrument Division. **Circle 193**

Metal cleaner: Lubrizol Corp.'s Metal Finishing Chemicals Dept. offers Irco 51020, a phosphate-free alkaline spray cleaner for hot- or cold-rolled and galvanized steels. **Circle 194**

Black masterbatch: Polysar Inc. has introduced Krymix 7266, a black masterbatch containing a high-structure grade of carbon black that imparts improved abrasion resistance. **Circle 195**

Heat-resistant ABS: Lustran HR-850, Monsanto's new ABS entry, is high-heat resistant, for use in injection molding of engineered parts. **Circle 196**

Mining frother: Union Carbide has developed Ucon Frother 130, a biodegradable high-molecular-weight alcohol, for use in flotation of sulfides of copper, molybdenum and zinc, other ores. **Circle 197**

Flame retardant: Fallek Products Co. is marketing decachlorobiphenyl, a flame retardant for polyesters, phenolics, polyolefins, epoxies and elastomers. **Circle 198**

Glass filler: The 3M Co. has developed its Type B25B Glass Bubble for use as a low-density filler in synthetic resins. **Circle 199**

Ethylene homopolymer: Bareco Polywax 2000 is a low-molecular-weight homopolymer of ethylene for hot-melt coatings and adhesives. It's being introduced by Bareco Division of Petrolite Corp. **Circle 200**

Floor polish polymer: A metal cross-linked polymer, dubbed Richamer R-747, has been developed by the Richardson Co. for long-wearing floor polish formulations. **Circle 201**

Flocculants: DuBois Chemicals has introduced five long-chain polyelec-

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New products

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trolytes, called Floculites 534, 535, 545, 550, 551, for use in air and water pollution control. **Circle 202**

Adhesive emulsion: Multipurpose Emulsion Adhesive (MPA) is an aqueous-emulsion elastomer for laminating, packaging, luggage- and shoe-manufacturing and textile industries. **Circle 203**

Substituted aldehyde: Rhodia Inc.'s Satinaldehyde, a substitute aromatic aldehyde for fragrance formulations, offers an outdoor top-note with a spicy floral undertone. **Circle 204**

Pool waterproofer: Liquid Bondex, from Reardon Co., is a paint for waterproofing masonry swimming pools. **Circle 205**

Lubricant softener: Scholler Brothers has Trisco Tex SL, a nonionic lubricant softener for textile finishing plants, and Esterlube S, a softener for polyester knits. **Circle 206**

Butyltin stabilizer: Thermolite 31 Super, a butyltin stabilizer for rigid PVC, is now being marketed by M & T Chemicals. **Circle 207**

Spray oil emulsifier: Atlas Chemical offers Atlox 775, an emulsifier for citrus fruit and vegetable sprays, and Atlox 3421 F and 3422 F, emulsifiers for organophosphate pesticides. **Circle 208**

Glass coating: A shatterproof coating for laboratory and industrial glass, called Shatr/Pruf is being introduced by Polysciences, Inc. **Circle 209**

PVC stabilizer: Advastab F-454 is a calcium-zinc stabilizer for PVC homopolymer and copolymer resins for food packaging. It's marketed by Cincinnati Milicron Chemicals. **Circle 210**

Seamless system: General Mills Chemicals has a condensed water emulsion base-chip coat system for seamless flooring formulations. **Circle 211**

Cosmetic ester: Emery 3978-D propylene glycol dipelargonate is Emery

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Industries' new ester for cosmetics formulations. **Circle 212**

Research enzymes: Eighteen high-purity enzymes for biochemical research are by Worthington Biochemical Corp. **Circle 213**

Instrumentation inks: Esterline Corp.'s Esterline Angus Division offers 16 new instrumentation inks that dry at varying speeds at −60 F to 180 F. **Circle 214**

Conductive paint: Isochem Resins offers a silver-coated conductive paint for metals, glass, ceramics and plastics. **Circle 215**

Electrostatic toners: Day-Glo Color Corp. has an experimental line of color electrostatic toners for the graphic arts industry. **Circle 216**

Plastisol extender resin: A bulk-polymerized PVC resin, Rucon B-24S, is available from Hooker Chemical's Ruco Division. **Circle 217**

Literature

Pumps: Standard and self-priming types for handling severe corrosives are featured in Duriron's 36-page bulletin covering technical data, applications, performance curves, materials choices. **Circle 218**

Oily waste control: Control at the source is main point of an article reprint that discusses types of oil and advantages of treatment before wastes mix and dilute. It's from Nalco Chemical. **Circle 219**

Plasticizers: Coating Chemicals Division, Eastman Chemical Products, has data sheets on two glyceryl types, plus booklets on three other types that are said to have flexibility at low temperatures and stability under heat and ultraviolet light. **Circle 220**

Quick-disconnect applications: Advantages, operating data, illustrations and selection are covered in Snap-Tite 20-page guide on couplings. **Circle 221**

Professional TV: Low- and medium-priced monochrome and color cameras and related equipment are illustrated and described in a 20-page RCA booklet. **Circle 222**

Gear drives: Technology advances, application flexibility and other features of Motogears, Gearmotors, and Fluid Gear Drives are outlined in FMC Link Belt Enclosed Drive Division's 56-page book. **Circle 223**

Specialty gases: Revised 114-page catalog from Air Products and Chemicals lists details on more than 170 different compressed gases and standard gas mixtures plus more than 80 equipment items. **Circle 224**

Control systems: Circulating liquid temperature units for machines and processes in plastics, rubber, carbon, paper, chemical and other industries are detailed in a 20-page bulletin published by Mokon Division, Protective Closures Co. **Circle 225**

Plastic-lined piping: First of five booklets on products being made by Dow and distributed by Saran Lined Pipe includes line drawings, cutaways, graphs. **Circle 226**

Solid-state switches: Procedures and possibilities of magnetically operated units from Micro Switch Division of Honeywell are featured in a 20-page publication. **Circle 227**

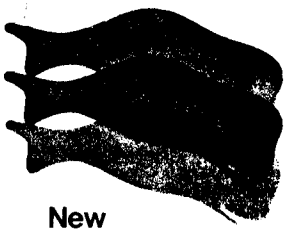
Box-car load plans: Three-color wall chart shows best loading configurations for palletizing 100-lb.-net bags of Trona chemicals in 50-ft. cars. **Circle 228**

Real-time computer: How capabilities of basic Systems 810B can be expanded with workload is the subject of a 16-page brochure from Systems Engineering Laboratories. **Circle 229**

Lasers: Several types and applications are discussed in series of product literature from Avco Everett Research Laboratory. **Circle 230**

Laboratory furnace controllers: Performance data, dimensions and power requirements are given in an eight-page bulletin distributed by Lindberg Hevi-Duty. **Circle 231**

Ultraviolet spectrophotometers: Performance, specifications, construction and special features of ACTA II, III and V are featured in a 22-page illustrated bulletin from Beckman Instruments. **Circle 232**



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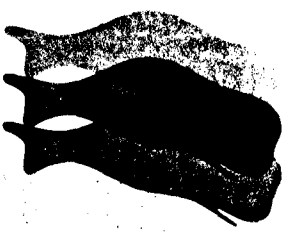
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Du Pont is watching a flock of its investment dollars fly away with Corfam footwear, but . . .

Despite Corfam

Du Pont is still high on venture analysis

Du Pont's decision to drop Corfam hit the company hard in the pocketbook ($80-100 million before taxes) and also raised some serious questions about the effectiveness of venture analysis (VA) as a decision-making tool.

But as far as Du Pont is concerned, the trouble was in the way the venture-analysis model was used in the Corfam case, not in VA itself. The company is using venture analysis on a fistful of other projects, is satisfied with the results and is counting on the method to help it come up with the profitable new products it will need to meet its growth aims.

Early Entry: A computerized mathematical model for Corfam was cited as a major factor in management's decision to enter the shoe market in '64. Models are the key to Du Pont's VA system, and Corfam was one of the company's first products to go through the mill.

"We feel the model worked well in telling us what we wanted to know before we decided to market Corfam," notes one Du Pont spokesman, who worked on the original model. He adds that the model showed there were some uncertainties and helped pinpoint some areas where additional planning was needed. "We definitely have not gone sour on VA, and we're not blaming it for what happened to Corfam," he says.

Some Mistakes: "Sure, we made some mistakes in working with the model and in selecting some of the inputs," this spokesman continues.

Any model is only as good as the input fed to it. The Corfam model obviously contained some wrong assumptions about the domestic shoe market, domestic and foreign competition and customers' preferences in shoe materials. Says one model specialist: "Du Pont had the research and the manufacturing strengths. Where it missed was in its understanding of the market—which was brand new to the company." (Price problems and a decline in the shoe market were big factors in Du Pont's decision to call it quits.)

Another mistake, Du Pont concedes, was the company's failure to keep the model up to date. It was updated through '66, notes a company spokesman, but after that the model began to fall behind—and it wasn't updated at all in the past two and a half years.

"Once Corfam was a going business, the company determined that the expenditure and manpower that would be needed to update the model after it had lapsed was too great and that costs and people could be better applied elsewhere," he says.

While Du Pont isn't saying so, it would appear likely the decision not to update the model was influenced by Corfam's market performance—by '67-'68 it already was experiencing difficulties. Rival products were starting to take hold and prices dropped. As a result, Du Pont decided it didn't need the model to tell it Corfam was in trouble.

Management science pros agree that venture analysis is a continuing tool that must be kept up to date. Says one: "We've made some horrendous mistakes by letting models lapse."

Others Working Well: The Corfam model was only one of about 40-50 VA models constructed by Du Pont from '64 to '70. The company says the others are saving it a lot of money. One example: providing readings on potential return on investment (ROI) early enough to avoid costly research and development work on products whose potential ROI isn't up to corporate standards.

Du Pont puts heavy emphasis on ROI in evaluating new projects. And Du Pont managers, who have seen the computerized model grind out low ROI forecasts, dryly refer to VA as "venture annihilation."

Setting up a VA model takes anywhere from a couple of months to more than two years, but even in the case of complicated projects that take long to set up, models are ready well ahead of the products whose development they are evaluating. Sometimes, models are built even before a proposed product ever gets out of the laboratory.

Savings by weeding out losers early

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don't make headlines, but Du Pont is well aware of their value, nonetheless. Typical of the "quiet savings" VA has been chalking up is the case of a new opacifier (brightener) developed by Du Pont's Pigments Dept. for the paper industry.

While the "product" was still in the lab, VA people and Pigments Dept. managers started taking a close look at the potential market and ROI for the opacifier, whose major application would be as a new wet-end additive to fine paper and printing paper.

"VA models were built to determine if the material we had in the test tube could be marketed economically in the paper industry," explains John Dickinson, research supervisor, Research Division, Pigments Dept. Dickinson, who spent a year and a half constructing the model, says that VA helped determine the business opportunities for the new product and showed Du Pont technical people how to modify the product to better serve the paper industry's requirements.

No Dice: "After setting up the model and determining the possible market and return for the opacifier, we decided to stop development," Dickinson says. "In the long run, we would have taken a beating; VA allowed us to run experiments without running the risk of trial-and-error in the marketplace."

VA models are saving Du Pont money on new-product development by telling early whether a project that looks good in the lab will be a hit in the marketplace

The Pigments Dept. model, typical of many used in VA, was constructed to push the opacifier through three types of examinations: (1) a technical screen to see if it could do the job; (2) use-cost check to see if the Du Pont product could fill the bill for a cost to the customer no higher than that with competitors' products; (3) opportunity determination to see if Du Pont could find a big enough market for the product to justify commercialization.

Dickinson explains that the technical screen evaluates the product's performance without regard for costs. With the opacifier, Du Pont fed the model data on existing products (Du Pont's and competitors') covering such details as particle size, dispersion in water, bulking properties, dry brightness, grit level, abrasiveness, dusting. Also added were details on properties of finished sheets and how well they could be prepared by machines.

The new opacifier passed the technical test, so the next step was to see how much of a market there was for a product with these properties and if its price would be competitive.

Calculating Costs: The check of customers' use cost involved taking a look at the economics of the entire operation in which the opacifier would be used. For starters, Dickinson explains, the model determined what it costs the customer to produce his product. Next step was to see if there might be some ways in which the customer could cut this cost (e.g., using less titanium dioxide or changing machine operating speed.

"When we feel we have his lowest cost alternative (called the user's cost), we can calculate the 'value in use' (VIU) of our product," Dickinson says. VIU is the price a customer could pay for the new Du Pont product and still maintain his lowest use cost.

In this step, the model was given data on pulp, filler and machine costs, plus pigment, additives and finishing costs from which it came up with estimates of the use costs in dollars per ton.

Will It Sell? In the final test, the VA model determines the opportunity and potential for the product. "We have to determine the size of the market for which the product is both technically and economically adequate," Dickinson says. "You have a competitive position when your VIU equals or exceeds the selling price."

The VA model analyzes the dollar potential for a new product based on inputs of explicit information about various potential end-uses. It estimates how much return Du Pont figures to get with its new product in each of these end-use areas and then sums up the totals to give an idea of potential over-all return.

Handling Uncertainties: Dickinson explains that much of the data fed to the VA model consisted of estimates each involving a degree of uncertainty. To minimize the risk involved in these uncertainties, it is necessary to find out how much such key factors as ROI, earnings and cash flow would be affected by changes in such key inputs as estimated industry potential, product performance and market penetration. "We do this by a series of 'what if' questions," Dickinson points out, "and the answers give us an indication of which factors are the most sensitive." These sensitive variables are then given further study, including risk analysis, and an over-all range of uncertainty for the project as a whole is determined.

No Total Loss: The new opacifier was dropped before the model had been fully completed, but the completed parts of the model have not been destroyed. "The data we compiled about our customers, products and industry have proved useful for other purposes," says Paul Linsen, research supervisor, Research Division, Pigments Dept. "But more important, there could be some new developments or processes in the paper industry that could warrant taking another look, through VA, at this same product."

Linsen, who compiled the industry and technical data for the opacifier model, says the VA model, by giving quick evaluations, can help boost morale of researchers. "There's nothing more frustrating than spending years on a new product or process development, only to find out that commercialization is out of the question," he notes. "In the case of the opacifier, the model showed that the project would die in the marketplace . . . and we saved years of work that might otherwise have been necessary before finding out the project would go down the drain."

In addition, the closer communications between researchers and VA men leads to more meaningful inputs for models. The more a manager knows the more he can reduce uncertainties, close in on a decision.

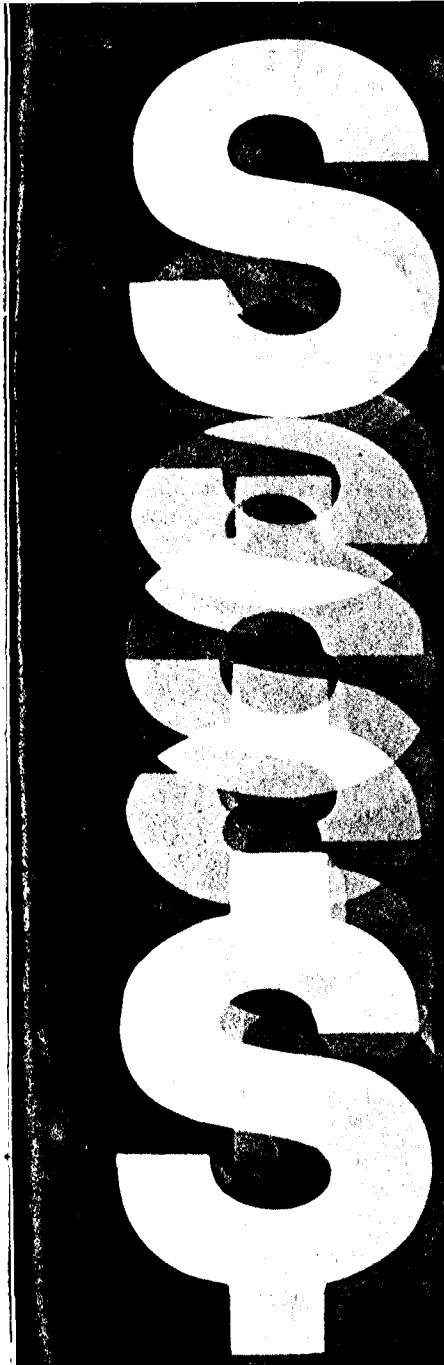
Adds Linsen: "Usually, a VA model is ahead of research work being done."

Outlook: Du Pont is counting on VA to play a significant role over the longer term, Corfam notwithstanding.

When President Charles McCoy first predicted that the company's earnings would grow an average 6-10%/year he noted that half of that improvement would be generated from products not yet on the market.

And Du Pont plans to use venture analysis to determine which of its new-product hopefuls have the best chance to offer the biggest payoffs in the shortest possible time.

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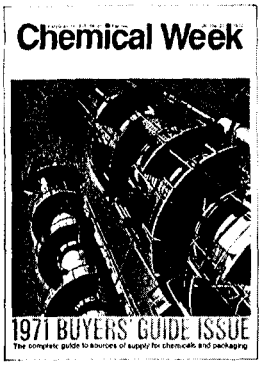
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Heat-transfer competition boils

New products hitting the market are out to win range of industrial heating jobs. Latest entry: MSA Research's NaK

NaK, a liquid heat-transfer system supplied by MSA Research Corp. (Evans City, Pa.), is out to win new friends. For years NaK—sodium-potassium alloy—has been used in nuclear plants to remove heat from reactor cores. Now MSA is promoting it for industrial jobs.

It's one of a dozen systems competing for the heat-transfer business in temperature ranges beyond water's capacity to serve.

MSA is bucking a number of established products. This month Dow will add two new items to its Dowtherm line, designed to extend range of application. And Monsanto is selling Therminol to oil installations on Alaska's North Slope. American Hydrotherm has developed a packaged system for pilot plants that provides heating up to 1,000 F. Among the other suppliers are Humble, Mobil, Union Carbide and Du Pont.

"Heat-transfer problems are the same as they always were," says Walt Seifert, marketing manager for the Dowtherm line, "but the applications are different." In fact, marketers are pushing heat-transfer fluids into a host of new industrial applications.

For example, they are used in resin cooking to overcome the hazard of hot spots in direct-fired equipment, and on ethylene condensers where temperatures must be controlled within a close range.

The systems are widely used in the polyester and nylon fiber industry to transfer heat during the production of the monomer and during the extrusion and drawing processes.

Steam Replacement? Donald Roush, product specialist for Monsanto (St. Louis), points out that some chemical producers are even considering heat-transfer systems as a replacement for steam.

And newer refining units, says Roush, are installing central systems that employ a heat-transfer medium, making the individual refining sections more independent of each other.

Monsanto is also promoting its fire-resistant fluids in supplying heat for tankers and barges that carry high-pour-point oil products, for offshore platforms in separating and treating oil and gas, and for oil installations in the Arctic subzero temperatures.

MSR Research sees a growing market for NaK in high-temperature applications involving molten metal and for adding or removing heat from chemical reactors such as those used in production of phthalic anhydride. Advantages: the material is a liquid at high temperatures and won't decompose.

Subbing for Water: Water is the cheapest and most readily available heat-transfer agent, but at high temperatures (600 F) its vapor pressure is so high (1,548 psig.) that expensive heavy construction is needed to contain it.

Heat-transfer media, on the other hand, such as petroleum oils, synthetic organic fluids, molten salts and fused metals, can tolerate a wider range of temperatures.

According to Monsanto's Charles Staub, petroleum oils (Humbletherm and Mobiltherm) are stable at temperatures to 500-600 F; organic fluids such as Dow's Dowtherm or Monsanto's Therminol, to 700-800 F; molten salts such as mixtures of sodium nitrate and nitrite, to 850 F; and metals such as NaK and sodium, to 1,300-1,500 F.

Petroleum oils are the cheapest, sell for about $1/gal., while the organic fluids cost $2.50-3/gal.

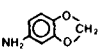
The choice of a system is complicated, depends on its thermal stability, safety, whether it's used for heating, cooling or both, and on its environmental characteristics, as well as capital and operating costs. Monsanto's chlorinated polyphenyl derivatives, for example, which are used in some of the company's heat-transfer products, have been under fire for leaving a persistent residue (*see p. 19*). And the reaction of alkali metals with water is well known. Both Monsanto and MSA Research contend that these products cause no problems when they are maintained in a closed system.

What new jobs NaK will win in chemical process plants is not yet clear. But MSA is betting it will carve out a niche in those systems that operate above 800 F.

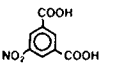
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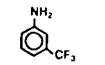
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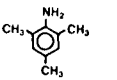
3,4-Methylenedioxyaniline



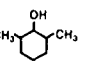
5-Nitroisophthalic acid



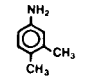
α,α,α-Trifluoro-m-toluidine
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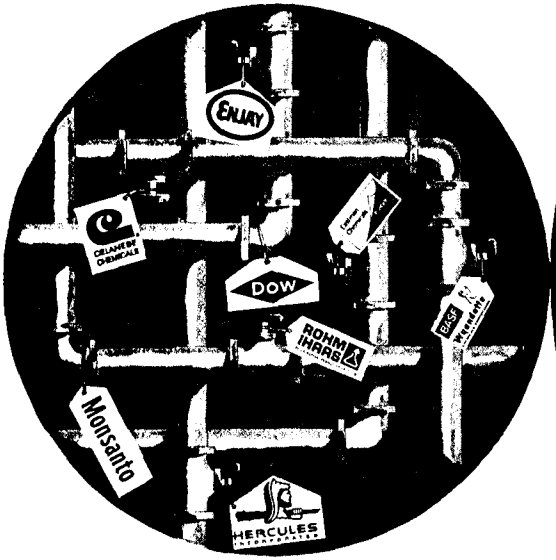
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Exclusive rights are poor lure

USDA hoped industry would pick up offers of patent rights on government research, but just two firms took first bait

The government's first offer of exclusive licenses to get technology out of its laboratories and into industry for further development has had few takers: two.

The U.S. Agriculture Dept. kicked off the new policy earlier this year when it published a list of 14 patented processes it was willing to turn over to industry, plus one technique on which a patent has not yet been granted. Included were processes for such things as making powdered fruit juices and producing confectionery fats.

Industry was given until Apr. 3 to file for exclusive rights.

Franklin Laboratories (Denver, Colo.) put in a bid for a patent on phosphoramides and thiophosphoramides used as insect chemosterilants, and Upjohn Co. applied for exclusive rights to the use of cycloheximide as an aid in mechanical harvesting. Upjohn makes cycloheximide but has no patent for its use in harvesting citrus fruits.

In this method, the one technique offered by USDA on which it does not have a patent, cycloheximide is sprayed on citrus fruits four to seven days before harvesting. The chemical starts a reaction that weakens the attachment of fruit to the tree, greatly simplifying mechanical harvesting.

Under Pressure? Some USDA officials claim that cycloheximide technology was included in the list to accommodate Upjohn—even though the method has not yet been patented and may not be patentable.

USDA applied for a patent in Oct. '69, and the Patent Office has informed the agency that chances are less than 50-50 that this use of cycloheximide can be patented.

One USDA staff member says: "It will be poetic justice if the patent application is turned down." Reason: some staffers believe the whole licensing program was pushed up by as much as a year or two in response to Upjohn's interest in getting exclusive rights to cycloheximide technology.

Fred Senti, head of the licensing program, concedes: "Perhaps the citrus industry's interest in developing mechanical harvesting and Upjohn's interest in the fruit abscission patent may have encouraged faster policy enactment."

Upjohn denies putting any pressure on USDA and claims that the cycloheximide technology was probably included in USDA's offering, since it was one bit of technology that was sure to attract industrial interest.

But there are indications that USDA did move hastily to set up the program. Agency officials left up to regional labs the job of picking the patents to offer. Some observers say there would have been more industry interest had USDA's staff in Washington taken stronger steps to make sure that items of high commercial potential were on the list. USDA has about 1,300 patents from which it could have drawn.

Incentive Needed: Despite the poor response to the first offering in the licensing program, USDA plans to make more patents available to industry. Senti says there's a chance that some day almost all government-held patents will be offered on some sort of exclusive basis. Other agencies are watching the program to see how it works out.

The whole idea of offering the exclusive licenses to industry goes back to a govenment-funded study by Harbridge House, Inc. (Cambridge, Mass.), in '66. Harbridge concluded that such licensing could increase the flow of technology from government labs into industry.

The report pointed out that lack of full technical development was one reason industry often cited to explain its lack of interest in government technology—the ideas often were promising, but industry was not willing to shell out the extra funds needed to finish the job if it would not end up with exclusive rights to the results.

USDA became the first government agency to act on the Harbridge findings when it changed its licensing policy in May '70. The agency had been granting 20-30 licenses a year on a nonexclusive basis, and it was hoped that the new policy would attract more takers.

If continuation of the policy meets with more success, the Atomic Energy Commission, Defense Dept. and NASA could possibly follow suit.

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Technology newsletter

CHEMICAL WEEK April 21, 1971

Sodium hypochlorite can be produced on site in a small unit that Pacific Manufacturing and Production Co. of Nevada (Henderson, Nev.) is making. Heart of the system, called PEP-CLOR, is an unidentified metal oxide anode said to have all the properties required in commercial applications—e.g., hardness, durability, impermeability and corrosion resistance. Sodium hypochlorite is generated electrochemically, using either a solution of common salt or sea water. Recycling this solution through the cells optimizes salt and power use.

A new process for the production of plastic paper has been developed by a German and French joint venture. The technique, based on polystyrene, includes biaxial orientation of the primary film, followed by a special chemical treatment to "paperize" the material. The process was developed by CDF Chimie (Paris) and Brueckner Maschinenbau (Siegsdorf, Germany). U.S. representative is Bruckner Inc. (Cedar Grove, N.J.).

A ceramic exhaust purifier for cars is being touted by an independent Swedish developer, Allan Inovius. The system is said to slice carbon monoxide emissions to 0.1%. Inovius, of Stockholm, will demonstrate the system next month to the Los Angeles Chamber of Commerce.

The 24-hour cold cure proclaimed last week has met with skeptical response from some researchers. The drug, revealed by Dr. Paul Gordon of Chicago Medical School, is an inosine-dimethylamino isopropanol complex. Gordon says clinical trials in Argentina showed it can stop cold symptoms in 24 hours. The Argentine government has approved its use. But one researcher points out that 89 viral strains can cause a cold, and the new drug would have to be effective against all to be billed as a cure. Antiviral agents in use today attack only specific strains. Newport Pharmaceuticals (Newport Beach, Calif.) is making the drug, and clinical tests in the U.S. and abroad are in progress.

Shameful squandering of funds and ineffectual administration are the charges inventor William Lear has leveled against the Urban Mass Transportation Administration's effort to develop a low-pollution passenger bus. In a letter to President Nixon and telegrams to all congressmen, Lear claims that his own $8-million investment has led to a vapor turbine external combustion engine (*CW, Dec. 16, '70, p. 60*) that is now ready for full-scale testing. Instead, he says, UMTA (component of the Dept. of Transportation) has excluded his firm from its $4-million bus program.

ICI may soon be offering a catalyst to replace platinum in nitric acid production. The unidentified catalyst, the British firm claims, can cut production cost by $2.50/ton—roughly 15% of total production cost. Nitric acid output accounts for about 10% of the Western world's platinum consumption.

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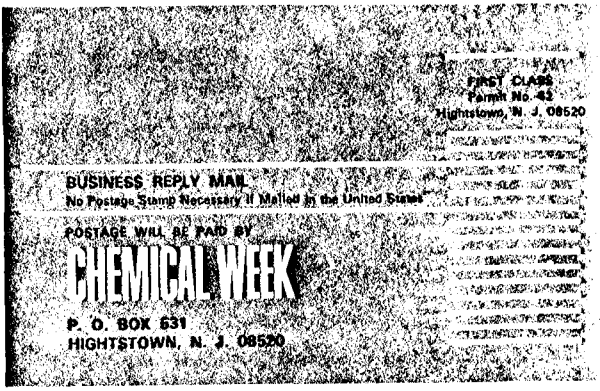
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Advertisers' index

CHEMICAL WEEK, APRIL 21, 1971

★ARCO CHEMICAL CO. Agency-Lennen & Newell, Inc. ..... 2nd Cover
CHEMETRON CORP. Agency-Buchen Adv., Inc. 30
CHEMICAL DESIGN, INC. Agency-Stahlka, Faller & Klenk 32
CHEMICAL WEEK 24, 38
CINCINNATI MILACRON CHEMICALS, INC. Agency-Keyes, Martin & Co. 33
C&O/B&O RAILROADS Agency-The Marschalk Co., Inc. 2
*COPPEE-RUST Agency-Hamil-Toms 42A
★EVANS CHEMETICS, INC. Agency-Daniel H. Price, Inc. 29
FABRIQUE SUISSE D'EXPLOSIFS SA Agency-Publicitas 39
★FINE ORGANICS INC. Agency-Cooper Communication Group 22
FOSTER WHEELER CORP. Agency-Muller, Jordan & Herrick, Inc. 26
GRIEF BROS. CORP. Agency-The Jay H. Maish Co. 32
GIFFORD-WOOD, INC. Agency-Harris D. McKinney, Inc. 43
★GULF OIL CO., PETROCHEMICALS Agency-Ketchum, MacLeod & Grove, Inc. ..... 3rd Cover
★HERCULES, INC. Agency-Fuller & Smith & Ross, Inc. 34
★HOUDRY PROCESS & CHEMICALS CO., DIV. OF AIR PRODUCTS & CHEMICALS Agency-Rumrill-Hoyt, Inc. 32
*MANNESMANNROHREN-WERKE Agency-Mannesmann-Werbe-Gesellschaft 4B-4C
*MELLE BEZONS Agency-Eplac 4D
MICHIGAN CHEMICAL CORP. Agency-Sander Allen Adv., Inc. 1
*OXIRANE CHEMIE (NEDERLAND) Agency-N.W. Ayer & Son, ... 42D
★PENNSYLVANIA REFINING CO. Agency-Fahlgren & Assoc., Inc. 21
PENNWALT CORP., INDUSTRIAL CHEMICAL DIV. Agency-The Aitkin-Kynett Co., Inc. 37
REPUBLIC CARBON PRODUCTS CO. Agency-Beldone Nyder Assoc. 18
*SAIPEM Agency-L.S.P.N. 42C
SCIENTIFIC DESIGN CO. Agency-Michel-Cather, Inc. ..... 4th Cover
*★SHELL INTERNATIONAL CHEMICAL CO. Agency-Leo Burnett-L.P.E Ltd. 42B
*SNAM PROGETTI Agency-L.S.P.N. 4A
★SOLVENTS & CHEMICALS CO. Agency-The Wittleder Co., Inc. 40-41
TIDEWATER VIRGINIA DEVELOPMENT COUNCIL Agency-McCurry, Henderson, Enright, Inc. 18
★VELSICOL CHEMICAL CORP. Agency-Sander Allen Adv., Inc. 25

★ Additional information in 1971 Chemical Week Buyers' Guide.

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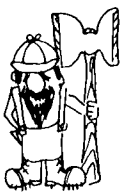
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Wyman Taylor to vice-president and general manager, Stauffer Chemical's Plastic Division.

J. Edwin Carter to executive vice-president, International Nickel.

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J. E. Hesse to vice-president, production and engineering, Johns-Manville.

Gorden MacDonald to vice-president, finance, General Dynamics.

Francis L. Brody to vice-president, National Distillers and Chemical.

Marvin Chertkoff to vice-president, marketing and sales, Aroma Chemical and Fragrance; **William Iwaskow** to vice-president, product development, Esrolko Fragrance; Givaudan.

Aber Salant to vice-president, **David Peterson** to director, marketing, George Lueders & Co., Monsanto subsidiary.

Traynham Houston, Thomas Arnold and **James Miller** to assistant treasurers, Akzona.

Henry Clancy to manufacturing manager, Pesticides Division, American Cyanamid.

Richard Zehe to director, marketing, Apex Smelting.

John Barden to manager, marketing; **John Gburek** to technical manager; **S. Clark Murray Jr.** to technical service; Hooker Chemical's Durez Division.

Richard Smith to manager of Barex resins, Vistron.

Harvey Bonafield to director, labor relations, Uniroyal.

Allan Varian to director, corporate communications; **Calvin Green** to assistant, communications; Sun Chemical.

TOWOLDMON0054236



He left the family baking business to become an engineer —and head of the U.K.'s biggest chemical maker

ICI's Jack Callard

Can he put icing on ICI profits?

The odds were that Eric John Callard would become a master baker—like his brother, father, grandfather and great-grandfather.

But the family's success in bread permitted Callard to leave his Torquay, Devon, home and go to St. John's College in Cambridge, where he earned a B.A. in mechanical sciences in '35.

At home, he says, "no one ever thought about engineering, except perhaps when the Navy sailed in."

But Imperial Chemical Industries, which he joined upon graduation, thought enough about engineering—and Callard—to move him around from one key position to another until he became chairman of the multibillion-dollar company this month, the first engineer to occupy the top slot.

In his spacious, uncluttered office overlooking the Thames, Callard (he insists on being called Jack) talks sparingly about himself and his family. "I prefer to leave the family out of this (interview)," he says.

The Callards have three daughters and live in the small Buckinghamshire village of Jordans, where he grows roses.

Tall (over 6 ft.) and lean, with thinning gray hair and a ruddy complexion, the 58-year-old Callard wears horn-rimmed glasses. A quiet dresser, he usually favors gray or black suits, which are well-cut but not Saville Row. For the *Chemical Week* interview he wore a pale-pink shirt and a wide red tie with bright-pink spots.

Not much of a sportsman, Callard says, "I fiddle with tennis, but haven't got the hang of golf."

This year, he took a winter holiday in the Mediterranean but usually spends his vacations scrambling about the hills of England's damp but beautiful Lake District. Water colors of the area are among the few decorations in his office.

Career Talk: Callard loosens up a bit when the discussion shifts to his work.

An ICI recruiter hired only one man from Cambridge after he came to visit in '34, Callard says.

"I think I was the lucky one that year," he adds.

"The company sent me to Vickers-Armstrong's Barrow Works for a year's apprenticeship, then to Billingham to turn coal into petrol. That was the foundation of ICI's stake in petrochemicals today."

Then, "as the war blew holes in Europe in '42," Callard moved to a Ministry of Aviation plant in Lancashire to help design an aviation production factory and make aviation fuel.

Back at ICI in '47, he was made chief engineer of the paint division. He stayed there for 17 years, becoming managing director and chairman in '59.

In the paint division, Callard developed a reputation for shrewd decision making, expanding the division's consumer paint business and diversifying into wall coverings.

In '64, Callard moved up to the ICI board and the following year was given the task of setting up and running ICI (Europa), the company's Brussels-based subsidiary. He fought hard (even banging his shoe on the table, according to an undisputed account) to move the subsidiary's base from London to the Belgian capital.

After that, as the board member responsible for heavy chemicals, Callard brought to the consumer market a spray for putting out auto fires—a product that is earning well for ICI.

Callard was named deputy chairman of the company in '67.

Classless Image: Callard's modest personal background is expected to help him project the classless image that ICI is pushing.

The chairman speaks highly of an ICI labor productivity plan that attempts to break down class lines between employees. He explains: "The general philosophical, behavioral, sociological principle behind it is that a chap basically likes to use to maximum advantage the ability and ideas that he has—and I think that's a damn good principle."

Labor is now asking for greater participation in ICI management, and Callard is expected to support some of these demands.

Callard's outlook has broadened to cover the "total business complex," but he remains an engineer at heart:

"I'm proud to have been an engineer, but those days have become submerged. Still, when I get the chance to go and look at an ironmongery, I can feel the old excitement."

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001	026	051	076	101	126	151	176	201	226
002	027	052	077	102	127	152	177	202	227
003	028	053	078	103	128	153	178	203	228
004	029	054	079	104	129	154	179	204	229
005	030	055	080	105	130	155	180	205	230
006	031	056	081	106	131	156	181	206	231
007	032	057	082	107	132	157	182	207	232
008	033	058	083	108	133	158	183	208	233
009	034	059	084	109	134	159	184	209	234
010	035	060	085	110	135	160	185	210	235
011	036	061	086	111	136	161	186	211	236
012	037	062	087	112	137	162	187	212	237
013	038	063	088	113	138	163	188	213	238
014	039	064	089	114	139	164	189	214	239
015	040	065	090	115	140	165	190	215	240
016	041	066	091	116	141	166	191	216	241
017	042	067	092	117	142	167	192	217	242
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019	044	069	094	119	144	169	194	219	244
020	045	070	095	120	145	170	195	220	245
021	046	071	096	121	146	171	196	221	246
022	047	072	097	122	147	172	197	222	247
023	048	073	098	123	148	173	198	223	248
024	049	074	099	124	149	174	199	224	249
025	050	075	100	125	150	175	200	225	250

0234145

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TOWOLDMON0054238

Please print: April 21, 1971

Name_____ Title_____

Company_____

Address_____

City_____ State_____ Zip_____

Area Code_____ Phone_____ Ext._____

Your Primary Management Function (check one):

☐ Administration ☐ Research & Development
☐ Production & Plant Operations ☐ Purchasing & Procurement
☐ Design & Construction ☐ Sales & Marketing

001	026	051	076	101	126	151	176	201	226
002	027	052	077	102	127	152	177	202	227
003	028	053	078	103	128	153	178	203	228
004	029	054	079	104	129	154	179	204	229
005	030	055	080	105	130	155	180	205	230
006	031	056	081	106	131	156	181	206	231
007	032	057	082	107	132	157	182	207	232
008	033	058	083	108	133	158	183	208	233
009	034	059	084	109	134	159	184	209	234
010	035	060	085	110	135	160	185	210	235
011	036	061	086	111	136	161	186	211	236
012	037	062	087	112	137	162	187	212	237
013	038	063	088	113	138	163	188	213	238
014	039	064	089	114	139	164	189	214	239
015	040	065	090	115	140	165	190	215	240
016	041	066	091	116	141	166	191	216	241
017	042	067	092	117	142	167	192	217	242
018	043	068	093	118	143	168	193	218	243
019	044	069	094	119	144	169	194	219	244
020	045	070	095	120	145	170	195	220	245
021	046	071	096	121	146	171	196	221	246
022	047	072	097	122	147	172	197	222	247
023	048	073	098	123	148	173	198	223	248
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FIRST CLASS

Permit No. 25682

Philadelphia, Pa.

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You can use both post cards over a six-week period. Expiration date is June 2, 1971. Should your supply of post cards be depleted prior to expiration date, please write for an additional supply to the following address:

CHEMICAL WEEK

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New York, New York 10036

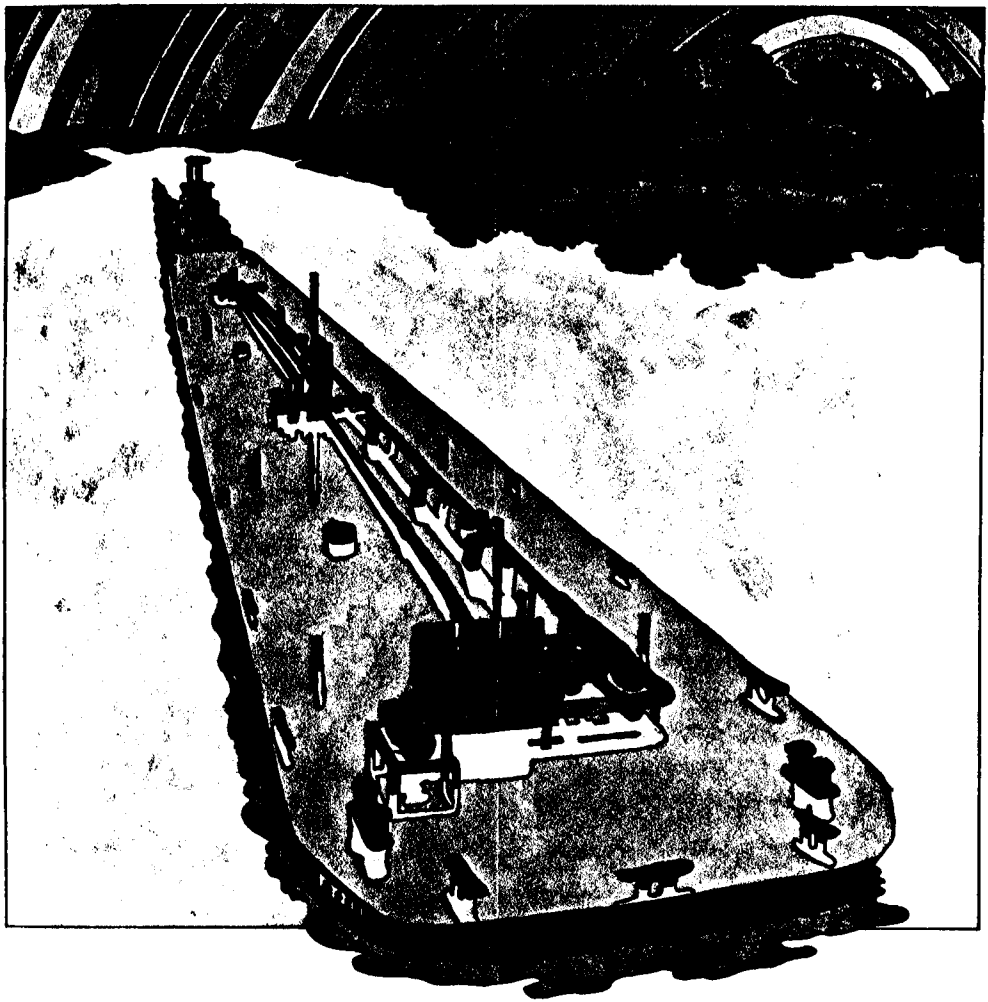
Attention: Management Information Service Dept.

CHEMICAL WEEK'S MANAGEMENT INFORMATION SERVICE POST CARDS ARE DEPENDABLE, FAST, EASY TO USE. SIMPLY CIRCLE APPROPRIATE CODES —AND MAIL. NO STAMP REQUIRED.

Write to the manufacturer directly should you wish to obtain specific information on a multi-product advertisement (e.g. on a certain pump or valve in an ad which features a broad and diversified line of equipment). Should you wish to obtain general information on a multi-product advertisement, just circle the appropriate code (noted at the bottom of the advertisement) on the Management Information Service post card.

0234146

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0234147

We're ready to barge in with a fresh load of styrene.

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The same quality performance you expect in benzene, cumene, xylenes, toluene, cyclohexane and our other petrochemicals.

Write or call today and let us arrange to barge in with our styrene. Rail delivery too.

Call Gulf Petrochemicals at (713) 226-1516. Or write us at P. O. Box 2100, Houston, Texas 77001.

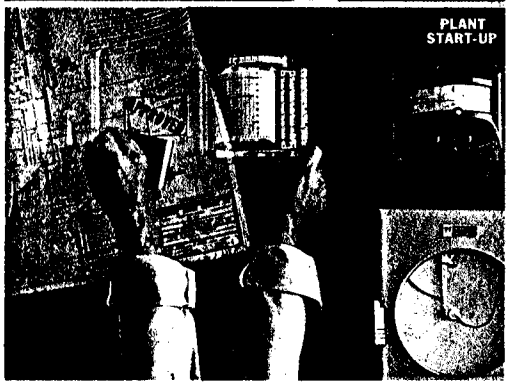
Circle 002 on Mgt. Info. Service Card

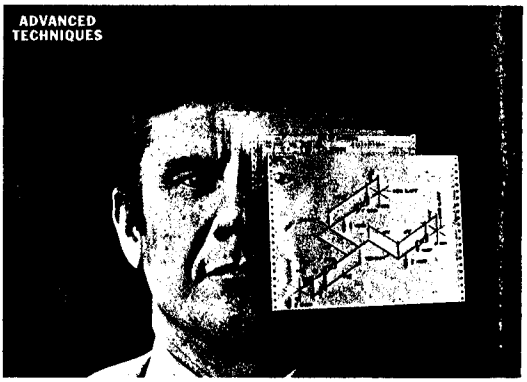
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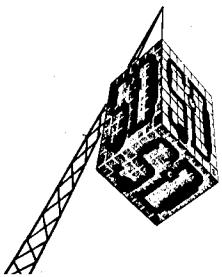




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