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# GLOBAL ELECTRONICS

# INFORMATION NEWSLETTER

#2

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## CLEAN IMAGE--DIRTY WORK

The electronics industry has a clean image, because its plants don't have belching smokestacks and its products have a futuristic gleam. But semiconductor production is a series of sophisticated chemical reactions, involving a vast array of solvents, acids, and gases. Very little research has been done on the effects of these chemicals on the human body or their impact on the environment. What little is known gives cause for alarm. Recently California health officials discovered the presence of trichloroethylene (TCE), a known carcinogen, in the water supply of Santa Clara County, heart of Northern California's semiconductor industry. TCE is just one of the chemicals used in semiconductor production. Workers exposed to these chemicals on the job--both in wafer fabrication and in assembly--have complained of symptoms ranging from nausea, skin rashes, and respiratory disorders to liver and kidney damage.

The Project on Health and Safety in Electronics (PHASE) in Mountain View, California, has been collecting information on worker complaints, and it has pulled together the information that is available on the known health hazards of chemicals used in the semiconductor industry. PHASE is publishing

free factsheets on these chemicals and their hazards. The following ones are currently available:

1. TCE (also available in Tagalog)
2. Reproductive Hazards
3. 1,1,1-Trichloroethane
4. Solders and Fluxes
5. Epoxy Resins

In addition, PHASE will soon publish a comprehensive listing of chemicals and their hazards, entitled "A Guide to the Health Effects of Chemicals Used in Electronics Manufacturing," which will be available for a small fee.

To obtain these materials, write to PHASE, 655 Castro St., # 3, Mountain View, CA, 94041, USA.

## SUBSCRIPTIONS

For those who can afford them, one-year subscriptions to the newsletter are US\$5.00 (US\$15.00 international airmail).

## PRODUCTION COST ESTIMATES

Because semiconductor production is so complicated, it has always been difficult for outsiders to estimate production costs. Figures presented by Howard Dickens, however, provide valuable insights into the factors involved in the manufacture of integrated circuits ("How to Determine Fair Market Prices for Integrated Circuits," *Defense Electronics*, June, 1980).

Among other, more technical points, Dickens points out that market prices range from 2 to 3.5 times the production cost for integrated circuits. He also reports that contract assembly costs are about twice the expense of assembling in a wholly owned offshore subsidiary.

Like other observers of semiconductor manufacturing, Dickens highlights the importance of yield, the percentage of dice (chips during processing) that actually function properly. He points out, "Final yield loss is the most expensive, since it includes all the processing, assembly, and packaging costs that have been expended on each unit up to this point."

Most significant, Dickens demonstrates the cost-savings likely to result from new processing technology, particularly the improvement of photolithographic resolution during wafer fabrication, from 4 microns resolution in 1979 to a projected 1.5 microns in 1981. This sharper resolution will reduce the typical die size for a 16-K RAM (16,000 bit random access memory) chip from .03 square inches to about .006 square inches, increasing the number of dice on a 4-inch wafer from 323 to 2,142. He suggests that improved resolution will also improve wafer fabrication yields substantially, producing 1,392 good die per wafer compared to a present 64.

Thus, despite the additional capital costs of producing a four-inch wafer with the new techniques, the cost per good die will fall from

\$1.17 to \$.13. This will not only lead to lower final prices, but it raises the relative importance of assembly (\$.08 per die) and testing (\$.50 per die) in the combined production process.

## MILITARY CIRCUITS

If the Pentagon has its way, the U.S. military will increase its utilization of semiconductor products over the next few years, and it will re-assert its influence over the industry. Pentagon production rules prevent, at least in theory, certain types of "milspec" components from being assembled outside the U.S., despite lower labor costs. In fact, Pentagon security needs may limit domestic design and production as well.

John Callahan ("Is DOD a Competitive Force in the Semiconductor Market?" *Armed Forces Journal*, June, 1980) points out:

Security requirements can present a serious problem to the traditional semiconductor manufacturer. Ignoring the fact that several of the top companies in the industry are foreign owned, all companies have a significant number of non-U.S. citizens in key technical and managerial positions. On the production line, the situation is much worse. It is not unusual for a third of the production workers on any given shift to be non-U.S. citizens. The situation would require virtually shutting down successive areas in the fabrication, assembly and processing areas as a run of confidential devices is handwalked through the flow.

## PUERTO RICO

In the past three years, Puerto Rico has convinced about 30 U.S. electrical equipment manufacturers to open up shop on the island. Its 1978 Industrial Incentives Program, described as "the most attractive industrial incentives to be found under the American flag," offers companies exemption from U.S. federal taxes, tax-free repatriation of profits, and 90% exemption from Puerto Rican taxes for the first five years. Still, despite all its lobbying in the semiconductor community, including a promotional tour this spring in Silicon Valley, it has been unable to convince any firm to located an integrated circuit assembly plant in Puerto Rico. Hewlett-Packard and Intel, two Silicon Valley corporations that do semiconductor work, have both recently decided to build plants in Puerto Rico, but they will not be assembling integrated circuits there. Instead, H-P will manufacturer computer peripheral equipment in Aguadilla, and Intel will put together systems products in Las Piedras.

It appears that for semiconductor manufacturing, where shipping costs are negligible, wage levels are a more significant factor than proximity to the U.S. mainland in siting plants. Wage levels in Puerto Rico, while lower than in the U.S., are still higher than in Asian countries. Thus Puerto Rico has served mainly as a nearby offshore base for the assembly of larger electrical products.

## IRELAND

Ireland too has attracted foreign electronic companies with appealing investment incentives and a reputation for the highest rate of return on investment in Europe (29.9%). It now has some 70 companies, 50 of which have arrived in the last five years. These companies, including Amdahl, Memorex, Digital Equipment, and Prime Computer, are primarily engaged in

computer or peripheral manufacture for the European market. But a small number of companies, such as Analog Devices, Nippon Electric, and now Mostek, have recently established semiconductor plants in Ireland. Some reports say that these companies carry out assembly, as well as wafer fabrication, at these sites. While wages in Ireland are higher than in Asia, they are among the lowest in Western Europe, and Ireland's membership in the Common Market gives manufacturers tariff-free access to the fast-growing European semiconductor market.

## INFORMATION EXCHANGE

The Pacific Studies Center considers the Global Electronics Information Newsletter to be a vehicle linking together activists and researchers throughout the world. Here are some ways we can help eachother.

1. If you have data, bibliographical information, or organizing reports that would be useful to others, send it in and we'll publish it.
2. If you need information and would like to get in touch with others working in the industry, we can publish your request for information. Please consider whether you wish your contacts to remain confidential.
3. If your group is providing services that might benefit others in the industry, send us a brief description of your work for inclusion.

## COMPANIES ON THE MOVE

**SYNERTEK**, a wholly owned subsidiary of **HONEYWELL**, is expanding in both **THAILAND** and **CALIFORNIA**. The company broke ground in June for a new \$40 million plant in Santa Cruz, a short drive from its present base in Silicon Valley. It plans to produce very large scale integrated (VLSI) circuits in a 170,000 square-foot building on a 22-acre site which will include tennis courts and a jogging Par Course, and expects to eventually employ 375 people. Local environmentalists have opposed the project, however, arguing that the plant's gaseous emissions will have an adverse effect on the Monarch butterflies that winter at nearby Natural Bridges State Park. In addition, the company may have already completed its new 21,000 square foot, \$7 million assembly plant at Nava Nakorn. Synertek already operates an assembly facility in Singapore.

**KULICKE & SOFFA**, the U.S.-based manufacturer of semiconductor production equipment, has expanded its **HONG KONG** operations for the second time in recent months. Kulicke & Soffa (Asia), Ltd., replaced an older 9,000 square foot facility with a new, 22,000 square-foot operation, and it plans to increase employment from 86 to 100 by the end of 1980.

**Signetics Filipinas**, a subsidiary of California-based **SIGNETICS**, which in turn is owned by the Dutch multinational, **PHILIPS**, has received permission from the **PHILIPPINE** Board of Investment to expand its integrated circuits production. The company will spend 8 million pesos of its own funds to finance the 45 million peso project. (1 pesoUS\$.13)

**P.T. NATIONAL SEMICONDUCTOR Electronics Indonesia** has gained approval from the **INDONESIAN** Capital Investment Coordinating Board to expand its Bandung facility.

address correction requested

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