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Mystery lingers: What's causing brain cancer among chemical workers?

by Stephen G. Crapnell

WHEN occupational disease problems are probed, industry and government often eye each other with suspicion, and the heel-dragging begins. This was most emphatically not the case during NIOSH's investigation of brain cancer deaths at Union Carbide Corp.'s Texas City petrochemical plant.

The two parties met frequently, a protocol was hammered out and made available to all concerned, and parallel studies were initiated using a common data base. But as findings and interpretations from the separate studies have begun to emerge, it appears that the cooperative thread has begun to fray.

Last November, Union Carbide officials held a news conference and announced that their investigation had shown 12 deaths due to primary malignant brain cancer, an excess of four or five cases for the population studied. Plant Manager Damon L. Engle and Plant Physician Dr. David H. Glenn stated that they believed the four to five cases of brain cancer "may represent a chance occurrence and that these cases are not due to chemical exposure at our plant." The company said it expected NIOSH's report to "reflect similar conclusions as those of Union Carbide."

NIOSH, however, said it had found 23, not 13, brain cancer deaths and disputed the reasons Union Carbide had given for believing the deaths were not job-related. Using the same data base, how had the two parties come to such seemingly dissimilar conclusions? Apparently, after long

months of successful cooperation, communications between NIOSH and Union Carbide began to break down.

The first act of the drama unfolded in November 1978 when an employee of Union Carbide's Texas City plant, who was out on sick leave, called OSHA and told them he believed there was an excess of brain tumors in the shipping department. His doctor had diagnosed him as having a metastatic brain tumor (one that arises in one part of the body and moves through the bloodstream to another) and he remembered that two co-workers had died in the recent past from brain tumors. Both OSHA and NIOSH investigated.

In February 1979, according to Dr. Philip Landrigan, director of NIOSH's Division of Surveillance, Hazard Evaluations, and Field Studies, NIOSH and OSHA developed a joint protocol reflecting some suggestions from Union Carbide and the Texas City Metal Trades Council, the union representing workers at the plant. Then began the tedious process of tracing the thousands of employees who had worked at the plant and obtaining death certificates for deceased employees in order to determine who had suffered brain tumors. Landrigan said Union Carbide was "enormously helpful" in the data gathering. In August 1981, NIOSH made the computer tapes of its data available to Union Carbide researchers. According to Landrigan, when the company made its results known in November 1981, it "presented us

with a *fait accompli*" in that the parameters of the company study were not communicated to NIOSH. But according to UC Plant Manager Engle, "When we agreed on a protocol in early 1979, it was our understanding that the analysis would be limited to data through 1977 and to white males. Their judgment was that the number of black males in the plant population was small and that the comparative national data was not good."

Acting on that understanding, UC unveiled its results in November 1981. The company collected health and work histories of 6,588 employees who are working or have worked at the Texas City plant from its start-up in 1941 through 1977. UC found:

- The overall mortality of Texas City employees working since 1941 was "significantly less" than the national average (765 observed v. 923.82 expected).
- Of the 765 deaths, 12 were due to primary malignant brain cancer v. 7.42 expected.
- No correlation could be found between brain cancer cases and employee exposure to chemicals used or manufactured at the plant.

In a letter to plant employees, Engle and Dr. Glenn listed three reasons for believing the excess brain cancer cases might represent a "chance occurrence" not connected with any workplace exposures: "First, we have not been able to associate these brain cancer cases with any particular chemical exposure. Second, the types

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of brain cancer are present in the same percentages as that seen in the general population. Ordinarily, chemically caused cancer is a specific and often unusual type, different than those seen in the general population. Finally, excessive brain cancer has not been confirmed in chemical plants similar to ours in other parts of the country," Engle added that the "present standards and practices" of industrial hygiene at the plant "provide adequate protection from known health hazards. In the unlikely event we learn of a hazardous exposure, we will take whatever action necessary to further protect the health of our employees."

NIOSH reply

By extending its study period through 1979 and including black males, NIOSH found approximately a two-fold increase in brain cancer deaths — 23 versus the expected 11. NIOSH also found in a separate analysis of workers with 20 years or more of employment that they had an even greater risk of brain cancer. In other words, the longer he was employed, the more likely the employee was to have contracted the disease.

NIOSH's Landrigan disputed UC's three reasons for believing the brain cancers might not be work-related, beginning with the lack of causal agent: "I think that's a rather weak explanation. There are at least 13 known carcinogens in that plant, and we're carefully reviewing the exposures of workers to each of those known carcinogens to see if there are links between them and cancers that occurred. Given the vast number of chemicals in that plant, it's a certainty that there are other carcinogens in addition to the 13 well-established ones. It just seems to me a bit foolhardy to dismiss those cancers as being due to chance," Landrigan said. He added that the case control study NIOSH has undertaken in an attempt to establish a causal agent was "several months from completion."

At press time, UC had completed its own case control study, but would not release a copy of the report until it has been published by the *Journal of Occupational Medicine* in a forthcoming issue. However, a company spokesman did reveal that the study



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examined chemical exposures to 35 chemicals, including five known or suspected carcinogens — benzene, ethylene dichloride, ethylene oxide, diethyl sulfate, and vinyl chloride (UC said recent tests have removed ethylene dichloride from the "suspected carcinogen" list). The study compared exposure histories of the brain cancer victims with two control groups of workers randomly selected from the 450 deceased plant workers known to the company in June 1979. UC researchers found no cause for the cancers.

NIOSH disagreed with UC's reasoning that because the types of brain cancer found mirrored those of the general population, the cancer was not chemically caused. NIOSH's Landrigan admitted that it was true some chemicals attack specific organs; he gave as an example vinyl chloride and angiosarcoma of the liver, a rare cancer. "But there are many tumors that are caused by occupational and environmental agents that are not of some highly specific cell type," he added. "One good example is lung cancer and cigarette smoking. Cigarette smoking induces a half-dozen different types of lung cancer . . . Asbestos causes all types of lung cancer as well as mesothelioma, and possibly cancers of the gastrointestinal tract." Landrigan said that finding one particular type of tumor

in these brain cancer cases would have been a "very strong finding," but "the absence of such an association certainly doesn't preclude the possibility of a connection between occupational exposure and the resulting tumor." He also pointed out that a "mixture of exposures" could account for the variety of types of brain tumors.

Landrigan also took issue with UC's statement that brain cancer excesses had not been confirmed in similar petrochemical plants. He noted that one researcher had found excesses of brain, kidney, and pancreatic cancer in UC's Kanawha Valley chemical plants. The findings formed a "similar pattern of tumors" as those found at the Texas City plant, Landrigan said, and he added that NIOSH was investigating "clusters of brain cancers" in Texas petrochemical and refining plants operated by Dow Chemical, Amoco, and Gulf.

While NIOSH and UC debate whether the excess of brain cancer deaths in the plant population are due to chance or to a chemical or group of chemicals, the fact remains that no causal agent has been found to either confirm or deny either party's theories. Plant Manager Engle maintains that plant safety and health standards "are completely adequate protection for any known health hazards." But what about as yet undiscovered hazards, if they exist? "I've consistently said if we've got any problems, tell me what they are. We'll find some way to deal with them," Engle said. "We're looking for clues. We go beyond regulatory compliance. Our exposure levels are already well below the Federal regs on a number of substances." He gave benzene and ethylene oxide as examples.

According to Engle, all of the workers stricken with brain cancer were hired by UC after the mid-1950's. May the answer to the brain cancer puzzle lie in plant conditions that have not existed for two or three decades? No one is really sure. Engle said UC has not been able to determine any "technical situation" that would account for the change, and he admits that exposure records from that period are not good.

NIOSH's Landrigan commented that plants such as Texas City have generally been increasingly well-controlled over the years, but he would



Union Carbide's Texas City plant: Are excess brain cancer deaths result of "chance occurrence" or chemical exposure?

not rule out the possibility that present plant conditions could still lead to problems. "All of these plants are pretty good most of the time," he observed. "They employ a lot of closed systems where chemicals move through pipes from tank to tank. During normal operations, often no human contact is necessary. But the time when exposures occur is when things go wrong. If a pipe clogs or a pump fails, then a couple of guys have to climb in a tank to do repairs, and even though their exposures only account for, say, three percent of the total exposures to that tank that occur that year, they're heavy exposures. In other words, it's a situation where averages are misleading and the exceptions are really what govern the exposure."

Al Goodson, a spokesman for the Texas City Metal Trades Council, agreed with UC officials that the plant is generally well-regulated, but said workers were not qualified to assess the situation. "Those employees

are just like I am; we're novices. Hell, we don't understand the chemicals involved. It takes an expert to unravel all that. I think the facts are there that the cancer rate is above normal. What the cause is I don't know, and I don't know that anybody knows. We're waiting to see what NIOSH has to say," Goodson said.

Goodson was asked how plant workers were reacting to the stream of letters and other communications from UC (20 written reports from February 1979 through November 1981) discussing the brain cancer deaths. "The truth is they're not as upset as you might think," he replied. "People always think misfortunes are going to happen to someone else. Certainly, people are concerned, but I would not say they are alarmed."

On the forefront

Health researchers' inability to find a cause for the elevated brain cancer death rates at the Texas City

plant undoubtedly has kept lawsuits against UC from proliferating, but a company spokesman acknowledged that "seven or eight lawsuits" have been filed by workers and their families.

Indeed, occupational and environmental litigation has become a growth industry in the Texas Gulf area. Commented Walter Umphrey, a Port Arthur plaintiff's attorney: "Environmental law is the wave of the future for lawyers in this area."

Umphrey, who said environmental law now comprises 70 percent of his caseload, currently is handling brain cancer cases involving Texaco and Mobil Chemical employees as well as a number of asbestosis, leukemia, and bladder cancer cases. He said most of his product liability suits are being brought against chemical suppliers and patent holders on various chemical processing units.

Herschel Hubson, a former supervisor of industrial hygiene and epidemiology for Texaco who now serves

as a consultant to Umphrey, said the chemical industry has not "felt the brunt of the blow yet" regarding litigation, and added that the potential for widespread industry litigation "undoubtedly" exists. Hobson said little had been done in the past to establish a connection between cancer and occupational exposures. Recognition was increasing among workers and others, he added, but few physicians had the training to associate chronic diseases with the workplace. "We just encountered a physician in a case yesterday who wouldn't know the chemical exposure of his patients if someone told him. This physician is associated with a major medical center in the United States. He's a premier oncologist. There's no doubt that he is an accomplished practitioner able to treat various kinds of tumors, but his ability to associate those tumors with any type of occupational or personal exposure history is minimal," Hobson said.

Will workers have to pinpoint a causal agent in order to validate workers' compensation and product liability claims? Hobson said case law is being developed in that area right now. "This varies from state to state, but in Texas, you must have a physician state that within a reasonable medical probability the claimant came down with the disease from his employment. Whether that means that you must trace the cause to one particular chemical agent or not is a question that remains to be answered," he opined.

Mixed results

The conflicting conclusions of NIOSH and Union Carbide regarding their Texas City plant investigations reflect a generally mixed picture of whether petrochemical workers are subject to an increased risk of various types of cancer. For instance, at a 1980 workshop on brain tumors in the chemical industry, NIOSH and OSHA investigators reported that the 25 brain cancer deaths at Dow Chemical U.S.A.'s Freeport, Texas, plant, registered over a 40-year period, represented an excess risk of death due to brain cancer of approximately 2½-fold. However, a case-control study by Dow Chemical investigators found that "preliminary calculations of expected deaths from

No time for reticence

WHAT if you awoke one morning to find your plant at center stage in a controversy over a disease that may have stemmed from plant exposure? In this era of heightened occupational health consciousness, it's a distinct possibility.

We asked Damon Engle, plant manager at Union Carbide's Texas City petrochemical plant, what advice he might have for plant management and safety officials facing this kind of situation.

"I think the most useful thing we did in this entire episode was to communicate with our employees early and often, to the point where some of them are almost bored now," said Engle, who has managed the plant since 1974. Before OSHA conducted its initial meeting with union representatives, Engle had already told employees that OSHA would be investigating and that Union Carbide intended to cooperate fully with the investigation.

Letters were sent to employees, Engle recalled, "telling them everything we knew at that point."

Next, Engle said the company acted to limit the number of contacts who would communicate with the media, and to shorten the "approval chain" for external communication. Finally, Engle and other Union Carbide personnel received training in handling "adversary interviewing." Engle said he learned that there "is no such thing as off-the-record. If you don't want it on the record, don't say it. If it wouldn't look good on the six-o'clock news, don't do it in the first place." In other words, designate who will deal with the press and train them to do the task effectively.

"I think the openness of our communication with our employees and with the community and our willingness to talk to the press has spelled the principal difference between our situation and that of some others found around the country," Engle observed. ■

primary intracranial neoplasms (brain tumors) among the employee cohort suggested there was no excessive risk." At the same workshop, a Gulf researcher reported no increased risk of brain tumors among over 17,000 employees of a Texas refinery employed between 1935 and 1979. But a NCI/NIOSH/OCAW study of workers at Texaco, Mobil, and Gulf refineries suggested that workers might be suffering a brain cancer mortality risk twice what would be expected.

Is the Texas Gulf area an unhealthy place to live because of the concentration of industry? UC's Engle noted that the area is the focus of a large number of studies. He speculated that this may be because the chemical industry in the region has accumulated medical records that are among the best of any employer group and the

Galveston-Houston axis features some of the best cancer research and treatment centers in the country. The result, he suggested, might be not that the industry is producing an unhealthy environment, but that the "concentration of attention" is revealing more about the area than is normal. "In Nigeria, primary brain tumors are reported to number one per 100,000 per year. In Rochester, Minnesota, the number is 15 per 100,000 per year. Neither place has any petrochemical industry. The only cause that has been attributed to the striking contrast revealed by the statistics is that the Mayo Clinic is in Rochester and the cause of death is better diagnosed there," said Engle. His conclusion: "The jury is still out on whether this area is healthier or less healthy than any other in the country." ■