Desperately Seeking Salmonella In Illinois

Salmonella in milk causes massive epidemic; how it happened baffles investigators

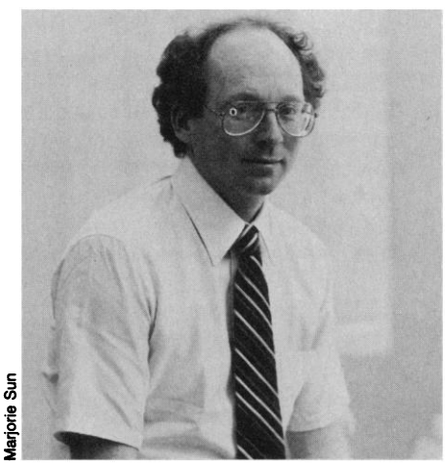
Chicago. For the past 18 years, Jewel Food Stores' enormous Hillfarm Dairy has safely produced billions of gallons of milk. It has been hailed as a state-of-the-art milk processing plant: the production system is completely closed, computerized, and capable of producing 175,000 gallons a day. But in March, milk produced by this model dairy became contaminated, causing the nation's worst epidemic of salmonella poisoning in memory. State officials confirm that more than 14,000 people in a six-state area have been stricken with diarrhea, nausea, vomiting, and fever. Five individuals who were already sick died as a result of further complication by salmonella poisoning.

Now, after more than a month of intensive investigation by local, state, and federal public health authorities, the source of the massive contamination still remains a mystery. The obvious theory is that the milk was not adequately pasteurized, but no conspicuous malfunction in the plant has been found. Another possibility is that an ill worker contaminated the milk. Officials discount this idea even though a couple dozen workers did become ill because employees receive free milk at the dairy and the processing system is closed.

Now investigators are literally dissecting and dismantling the plant, located in the suburb Melrose Park. They have uncovered bits and pieces of information that are intriguing, but nothing discovered as yet adds up to a plausible explanation for the contamination. Officials are increasingly frustrated because, if they cannot nail down the cause, they will not learn how to prevent the problem from possibly happening again. Bernard Turnock, the newly appointed director of the Illinois State Health Department, said in an interview, "If we don't find the cause, that's a problem in and of itself as serious as the outbreak."

Public health officials are also trying to track down the original source of the bacteria. It is unclear how prevalent the offending microbe, *Salmonella typhimurium*, is in raw cow's milk. In any event, this particular strain is unusual because it is resistant to several common antibiotics and, to some scientists, suggests that feeding antibiotics to livestock may pose health risks to humans. The antibiotic resistance of *S. typhimurium* "is an added dimension in this case and it is an issue we ought to be addressing [in this investigation] because of the potential public health problem," Turnock said. (The working assumption is that salmonella were transferred from beef cattle or other livestock to the cows, although there is no hard evidence. Government rules bar the feeding of antibiotics to dairy cows ready to be milked.)

With these two concerns in mind, the investigation is stretching from "cow to consumer," government authorities say, and the task is huge. Milk supplied to Hillfarm Dairy comes originally from hundreds of Wisconsin dairy farms. The milk from individual dairies is trucked to one of a dozen transfer stations, combined with milk from other farms, and then transported to Hillfarm. The plant



Marjorie Sun

State health director Bernard Turnock

The investigation is stretching from "cow to consumer."

itself sprawls over a city block. According to Illinois state dairy official Lewis Schultz, the plant pumps milk through a maze of 400 miles of stainless steel pipes, 638 air valves, a giant holding tank, and more than 600 large metal plates, which heat and cool milk during pasteurization.

There are several facts that are baffling in the chronology of events and from the data gathered so far. Hillfarm normally produces milk on a daily basis, except when it shuts down 2 days a week for cleaning and maintenance. Since the outbreak was identified, contamination has been identified in only three batches of milk processed 20 March, 30 March, and 8 April. (Milk produced on 8 April was never sold. The plant shut down 9 April.) What happened on these 3 days that was different from the others?

If the contamination did occur at the plant, it apparently happened under the noses of state officials. Since last summer, Hillfarm has been under particular scrutiny by state health inspectors. Last August, an outbreak of about 200 confirmed cases of *S. typhimurium* occurred in the outlying Chicago area, and Hillfarm dairy products were considered a possible source of contamination. State officials concede, however, that the evidence was very slim. They note that out of many cartons analyzed, only one Hillfarm dairy drink was positive for *S. typhimurium* and that the carton was retrieved from a household of children sick with salmonellosis and had already been opened. Investigators failed to find any salmonella at the dairy plant.

Nevertheless, state inspectors began inspecting the plant more often, Schultz says. In fact, on 26 March, in between the time the first and second batches of contaminated milk were processed, authorities from the state public health department visited Hillfarm to train three new dairy inspectors. During the training exercise, the equipment was tested and everything was in order.

Investigators thought they might have found the problem early on. By March 29, the state health department called the Centers for Disease Control (CDC) to report 20 confirmed cases due to *S. typhimurium* and another 40 unconfirmed cases, and asked for assistance to investigate. On 2 April, a cross-connection was discovered in the plant piping that in theory could have linked raw milk with pasteurized milk in the unlikely event that a series of three valves and the air pressure system failed. The cross-connection was removed. Even so, a third batch of milk became contaminated on 9 April. By this time, reports confirmed that more than 1500 people had been sickened.

The sampling of the milk has also uncovered puzzling information. Pasteurization kills salmonella and also destroys the enzyme phosphatase. Although the bacteria have been found in the milk, phosphatase has not yet been detected in these samples from the three batches. Scientists are not quite sure what to make of this. Turnock suggests

that the concentrations may be below the level of detection. Investigators even went so far as to test the unlikely possibility that this strain of *Salmonella* is resistant to heat. It was not.

Moreover, not all the milk processed on the 3 days has showed bacterial contamination. Some samples produced both positive and negative results and there has been a wide range of salmonella concentrations, says Jeremy Margolis, who is the Illinois inspector general and was acting state director of public health prior to Turnock's appointment.

Margolis also says that investigators have swabbed "every nook and cranny in the plant" in search of salmonella, but to no avail. All the tests to date have been negative. Of the thousands of cultures taken, "not a single salmonella has been found," he said in an interview. Sabotage has been considered, but minimized as a possibility because the processing system is closed, Margolis notes. "To my knowledge, nothing whatsoever suggests sabotage," he said. Even the paper cartons and plastic bottles to package the milk have been examined as a source, but, again, the tests are negative.

Scientists from the Food and Drug Administration, CDC, the state health department, Jewel, and other experts are now probing the vast plant, piece by piece. Margolis and Schultz say that the equipment has been subjected to dye testing to detect possible cracks and leaks, and pressure testing to trace the flow of milk. Each valve is being disassembled.

So far, the investigation has uncovered 13 minor violations. The dye tests have revealed a number of pinhole leaks among a few of the pasteurization plates and a small crack in one of the 25,000-gallon holding tanks. Investigators cut a 1-foot-square piece out of the tank, but failed to find any salmonella in the insulation where the red dye had leached.

Margolis says that the probe of the plant has become so complex that the state is now relying on a management technique used by the National Aeronautics and Space Administration to solve problems. "Every conceivable possibility is being considered," he says. Turnock says, "This may be an absolute quirk of circumstances or it may be that the conceptualization of the design of the plant failed to take into account a rare but possible event." Some officials, like Schultz, are increasingly skeptical that the problem will ever be found as the investigation continues. He says, "Every day, the mystery gets deeper."

—MARJORIE SUN

HHS Revises Rules on Animal Research

The Public Health Service (PHS) on 1 May released long-awaited revisions of its policy on laboratory animals, which are applicable to all institutions receiving PHS funds for research involving animals.

The changes, made partially in response to pressure from the animal welfare movement, shift responsibility more to the institutional level and require more detailed justifications for animal use in research proposals.

The principal requirements are as follows: every institution must have an "animal care and use committee." Formerly known as Animal Review Committees, these bodies, in which lay members are required, will have enhanced responsibilities for reviewing research plans and monitoring compliance. All animal facilities must be accredited by the American Association of Laboratory Animal Accreditation, or must conduct a self-assessment based on the updated NIH Guide for the Care and Use of Laboratory Animals. Institutions must designate clear lines of authority for those involved in animal care and use, and must furnish information to the federal government in great detail not only on the care and use of animals but on the facilities, staffing, and staff training.

The new policy, which goes into effect next November, "tells the world the standards are pretty high," says Charles McCarthy of the Office of Protection from Research Risks of the National Institutes of Health. He adds that the standards were already pretty high, but people are "not always getting credit."

The new PHS rules are not the only development on the animal front. In late April, the American Psychological Association came forth with a detailed set of guidelines for research psychologists. Designed by its Committee on Animal Research and Experimentation, they furnish a prototype of sorts, covering not only animal care but research procedures, surgery, fieldwork, and the use of animals in education. Review of proposed research by a local institutional committee is also required.

Meanwhile, the Office of Technology Assessment is completing a report on "Alternatives to Animal Use in Testing, Research and Education," requested in late 1983 by Senator Orrin Hatch (R–Utah), chairman of the Senate Committee on Labor and Human Resources.

In yet another project, the National Research Council's Board on Basic Biology is seeking money for a $1-million study on the "The Use of Laboratory Animals in Biomedical and Behavioral Research." This will include an update of the 1978 survey of animal use by NRC's Institute for Laboratory Animal Research (ILAR), which sent questionnaires to more than 2000 institutions. The study will also discuss future research requirements, regulations, and scientific policy issues.

Taken together, these initiatives are likely to further the downward trend in consumption of vertebrates. According to the ILAR's 1978 survey, the number of mammals used in research had declined from 33 million to 20 million in the prior decade.

—CONSTANCE HOLDEN

Congress Rearranges NRC's Priorities

The budget priorities of Nuclear Regulatory Commission (NRC) Chairman Nunzio J. Palladino have been largely rejected by House and Senate authorizing committees. The committees instead have mostly followed recommendations made by NRC Commissioner James K. Asselstine.

In testimony presented to Congress in April, Asselstine charged that the commission's recommendations for trimming back reactor regulation, inspection, and enforcement programs were unsound. The Administration had recommended that NRC's budget be cut from $449.6 million this year to $429 million in fiscal year 1986, and that the emphasis should be shifted toward "regulatory" research programs.

"We ought to reallocate that money and aim more at some of the real safety problems that exist in the plants," Asselstine advised the House Energy and Commerce subcommittee on energy conservation and power on 17 April. Although the energy committee has yet to issue its report, it is