

THE ST. REGIS SYNDROME

Research is generating doubt about the safety of living in a rain of industrial fluoride

BY JANET RALOFF

Long before Canada or the United States existed, Mohawks fished, hunted, trapped and farmed those islands in the Gulf of St. Lawrence that are now known as the St. Regis Akwesasne Indian Reserve. But since 1959 a plague has fallen on their land, killing their livestock, destroying their agriculture, ripping apart the very fabric of their society. And with a growing body of scientific evidence, the Mohawk are building a strong case against airborne industrial fluoride as the cause of their cultural and economic destruction.

Pines—dead and dying from fluoride fallout—three miles from aluminum plant in Montana. Carlson and colleagues established that at air levels of 5 ppb, new needles show signs of damage within only 30 days. Gaseous fluoride emissions proved most harmful.



Clint Carlson, USDA Forest Service

George Maylin in a study they published in the *CORNELL VETERINARIAN* last year.

Because calves easily suckled their mothers dry, lactating cows were purchased from outside the island to provide enough milk for new calves. Many cows, however, never survived delivery and calf mortality was high. "If cows survived the third pregnancy, they were sold for slaughter," note Krook and Maylin; after three pregnancies, cows lacked the strength to carry another calf.

But the problem went beyond livestock. The island's bees disappeared. Crop yields fell. Partridges—for which the Akwesasne reserve was named—declined drastically. Tip necrosis (pine-needle browning and death) warned of coming forestry losses among white pines and other conifers.

"Being an Indian reserve where some-

further, to about 75 lbs/hr. And while conditions improved some on Cornwall Island, the problems didn't disappear.

Fed by several preliminary environmental studies, island residents began accusing Reynolds of poisoning their farms. A July 26, 1973, report, for example, noted fluorosis in white pines. Two years later a veterinarian with the Canadian government noted suspiciously high fluoride levels in cattle urine. Still, the Canadian government and New York State officials assured residents repeatedly that fluoride levels reaching the island were well within levels previously established by scientific studies as safe.

"But we noticed the cattle were still dying," Lickers said, "so we decided to do some independent research." After scanning the literature and consulting experts, the Band asked Cornell's Krook to take a look.

"For 17 years we allowed Reynolds Metals to come onto the island to look at the problem. And for 17 years they collected data ... never even insinuating there was anything wrong with our cattle," Lickers recalls. (In November 1975, for example, Lickers said the cattle of Angus Lazores were inspected by a veterinarian named Abbey sent by Reynolds. Abbey claimed internal and external parasites infected the Lazores herd, Lickers says, adding that there was no mention of fluoride testing.)

"Then Krook comes in," Lickers said, and runs extensive diagnostic and pathology tests on the St. Regis animals. Imagine the surprise, Lickers said in an interview, when Krook announced his finding: Owing to extensive and serious chronic fluoride poisoning, no cattle born on Cornwall Island are going to live more than five years.

Krook's and Maylin's findings appeared in the April 1979 *CORNELL VETERINARIAN*. "Stunted growth was the most obvious external sign in Cornwall Island cattle," they reported. "By use of the simple linear regression equations for height as a function of age, it can be shown that the height of normal, 12-month-old Hereford cattle, 115.4 cm, would not be reached in Cornwall Island cattle until age 41.5 months." And the Cornell scientists noted that "microradiographic, histologic and toxicologic examinations provided conclusive evidence that the stunted growth was the result of chronic fluorosis." The pair also found bone lesions, the severity of which correlated linearly with fluoride exposure, and signs of bone necrosis, or death.

Mottling (or pitting) of enamel and a brown discoloration of teeth are classic examples of fluorosis, with mottling occurring in only the more severe cases. Krook and Maylin found "great" mottling

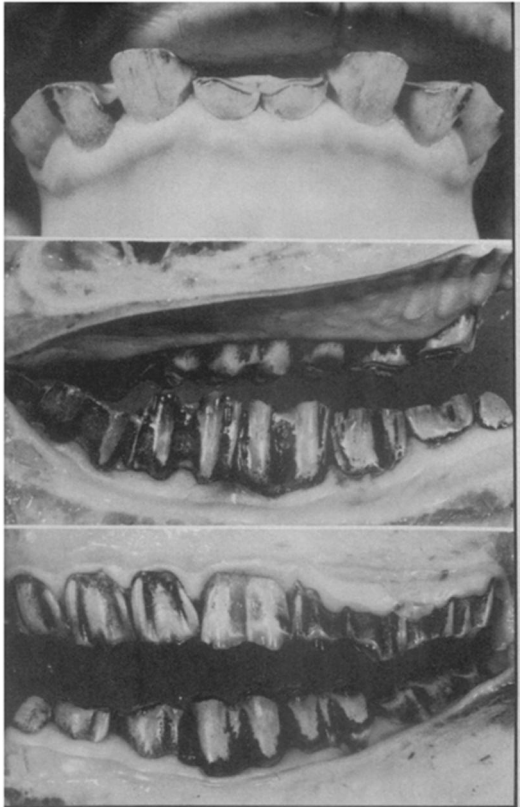
The St. Regis Mohawks are not the only ones affected by fluoride emissions from aluminum plants and other industrial sources. But they are perhaps the most striking and severely affected of such populations, and as such they exemplify the social and political edge of the fluoride controversy.

It started with cows. In 1959 there were 364 cattle — mostly dairy cattle — in 39 barns on Cornwall Island, a part of the St. Regis Reserve that straddles the borders of Quebec, Ontario, and upper New York State. Within three to five years the cattle started going lame and farmers noticed a swelling of the distal leg bones. In time, lameness became so severe that the animals had to lie down to graze and crawl from one place to another as the need to find new forage arose. Older animals had trouble drinking cold water supplied by the river or in the barns, and chewing proved painful. "[C]ows would grab hay but let it go after unsuccessful attempts at mastication," explain Cornell University veterinary scientists Lennart Krook and

thing like 70 to 80 percent of the people still speak Mohawk, it was very hard to find out what was causing the problem," explains F. Henry Lickers, director of the St. Regis Akwesasne Environmental Division and biological advisor to the St. Regis Mohawk Band council. Lickers said Cornwall Island residents suspected that the Reynolds Metals Co. aluminum processing plant might be implicated. Erected on the south bank of the St. Lawrence near Massena, N.Y., it began operation in 1959. Prevailing winds put the island downwind of the facility at least 60 percent of the time.

Between 1969 and 1971, at least two Canadian government agencies expressed concern over a possible link between island problems and the fluoride gases and particulates emitted by Reynolds's and, to a lesser extent, by Alcoa's aluminum plant upwind of Cornwall Island.

In 1973 Reynolds installed \$17.8 million worth of pollution-control equipment and reduced their emissions from more than 300 pounds per hour to 112 lbs/hr. Eventually, Reynolds lowered emissions still



Advanced fluorosis in 4- to 5-year-old Cornwall Island cow. Teeth show uneven wear, discoloration, chalky mottling, exposed dentin and extensive enamel defects.

in the permanent teeth of cattle they studied. They also noted delayed eruption of permanent teeth; for example, a delay of 2.5 years occurred in the teeth of one three-year-old cow. Fluoride, like calcium, settles in bone and teeth. Bone from slaughtered Cornwall Island animals, ashed overnight in a 600° C oven and then studied by Krook and Maylin using X-ray diffraction analysis, indicated high fluoride levels, with levels increasing with the age of the animal.

Based on these findings, the pair believe that the level of 40 parts per million fluoride in forage—recommended as safe in a 1974 National Academy of Sciences report (“Effects of Fluorides in Animals”)—is anything but safe. In fact, a follow-up study published by Krook and colleagues in April of this year reports severe fluorosis in New York cattle exposed to fluoride levels in forage ranging from only 13 to 25 ppm.

While Krook and his team studied cattle, Clancy Gordon of the University of Montana examined approximately 2,600 plant samples from Cornwall Island. “The very high levels of fluoride in vegetation and the pattern of damage measured by Dr. Gordon suggest that the [Reynolds aluminum] smelter is, indeed, the source of fluoride ... on the island,” according to University of Illinois investigators Bertram Carnow and Shirley Conibear in a 1978 report commissioned by the St. Regis Mohawk Band. They add that “the death of sensitive plants and trees, and disease of others, as shown by Gordon’s group, corroborate that high levels are present on the island.”

The Carnow-Conibear report was to examine whether there was any reason to suspect that islanders themselves may also suffer chronic fluoride-related problems. Based on two days of interviews at the Reserve and an extensive literature search, the Illinois team learned of “significant numbers of people with abnormalities of the muscular, skeletal, nervous and hematologic [blood] systems.” Island physicians noted high rates of anemia, irritability, rashes, diabetes, high blood pressure and thyroid disease.

Schoolteachers, according to the report, “stated that, in comparison with other children they had taught, the island children were more irritable and hyperactive and appeared to be suffering from a considerable amount of chronic fatigue.... Additionally, some had complained of aching in the legs, particularly the muscles. And in one case, the son of one of the teachers had so much pain in his feet that he frequently had difficulty sleeping.” The teachers also mentioned a high incidence of rashes, respiratory infections, poor handwriting that might be attributable to tremors, and at least one childhood goiter.

Not surprisingly, since they found signs of “unquestionably heavy exposure to fluorides” that “has affected all of the life forms studied,” Carnow and Conibear recommended both an “immediate” reduction in plant fluoride emissions and the commencement of a detailed epidemiological study of island residents.

It took more than two years, but approximately seven weeks ago that epidemiological study got underway. Headed and coordinated by Irving Selikoff, director of the Environmental Sciences Laboratory at the Mount Sinai School of Medicine in New York, its goal is a “detailed and definitive” examination of more than 3,000 Mohawks using unexposed Reserve Indians as a control population. Expected to last “as long as it takes,” and “certainly a year,” the list of researchers already recruited by Selikoff as either direct participants or consultants reads like a Who’s Who of environmental science and epidemiology. Their findings are important and could play a major factor as evidence supporting claims filed last February by the St. Regis Mohawk Band against Reynolds and Alcoa in a \$150 million class action lawsuit.

Perhaps even more important, however, are implications any finding of human health effects may have on federal regulations limiting fluoride emissions from U.S. industrial sources. According to the Environmental Protection Agency’s Dale Pahl, enforced new source performance standards limiting fluoride from aluminum plants went into effect for the first time June 30, 1980. Depending on the process regulated, allowed emissions vary from 0.1 lbs to 2.6 lbs per ton of product produced.

Pahl explained that the standards were based not on health-effects data but on availability of the “best technology”

proved cost effective by the industry. The reason health data were not included is because fluoride is considered a “welfare” pollutant, not a “hazardous” one. To be hazardous, there must be scientific indication that adverse health effects could occur following chronic exposure, and in EPA parlance the term “health effects” refers exclusively to humans. Pollutants adversely affecting plants, livestock or other property are welfare pollutants and controlled on the basis of balancing the cost of anticipated economic losses against the costs of reducing emissions.

Neither of the two persons described to SCIENCE NEWS as EPA’s “experts” on fluoride from aluminum plants was familiar with many of the studies published during the past decade documenting drastic plant and animal losses from chronic industrial fluoride emissions. (In fact, one of them explained that although anecdotal testimony about reduced productivity or death of livestock and crops was a decades-old complaint about neighboring industrial sources of airborne fluoride, he had never heard of scientific studies vindicating such charges.)

If EPA’s only standards for fluoride (there are no ambient air-quality standards for airborne fluoride) look at technology considerations alone, that may be understandable. But should notable correlations between fluoride exposure and adverse health effects be found in Selikoff’s epidemiological study of Cornwall Island residents major changes in the way EPA looks at fluoride could result, including its reclassification as hazardous.

That, however, offers little consolation to the Canadian Mohawks. “The nuances of our problem are immense,” Lickers says. Cornwall Island, long noted as an agricultural community with a tightly knit barter economy, is unraveling. Where there were 45 farmers and 40 cattle barns in 1959, there are 8 farmers and 8 barns left: “The cattle population was completely decimated,” Lickers laments. Trading crops for services, meat, fish and other goods has been disrupted by organic-chemical pollution of the fish (with PCB’s, mirex and mercury) and virtual destruction of the Band’s farming.

Even the diet has changed. Lickers says Band elders bemoan the recent switch from a diet high in protein—fish, meat and Indian corn—to one high in carbohydrates (potatoes, macaroni, gravies and bread).

“In other areas when you affect people there are alternatives,” Lickers explains. “Love Canal people can get compensation and move away. But the Indians here say, ‘Where are we to move?’ This is where they lived for 100 years. [Lickers is not a Mohawk himself, but a Seneca.] This is a place where they can be Mohawk, speak Mohawk, practice their religion. If you split us all up and distribute us all over North America, where is the continuity of our community?” □