minum siding, rubber, and other materials. The nozzle of this instrument is made of artificial sapphire, looks like a tiny glass bead, and measures less than 0.076 mm in diameter. Vijay says the stream of water shooting out of this nozzle can cut most materials as well as a knife can, but without many of the problems encountered in mechanical cutting. (There are no blades to dull in waterjets).

There is a growing demand for this type of precision instrument in the manufacturing sector, and the NRC has licensed a Canadian firm, Indescor Hydrodynamic Inc., to produce it commercially. "This company also produces two other kinds of waterjets," says Vijay. "Their prospects are good, and already they have quite a few customers, especially from the cleaning industry."

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A Pond Full of Fluoride

A pond in France is helping Canadian scientists learn more about fluoride pollution. Fluorides, or compounds of the element fluorine, find wide use in today's society: we use various forms of them to prevent tooth decay, power aerosol cans, smelt aluminum, and make synthetic carpets. What happens to all these fluorides once they're disposed of, however, is still largely unknown.

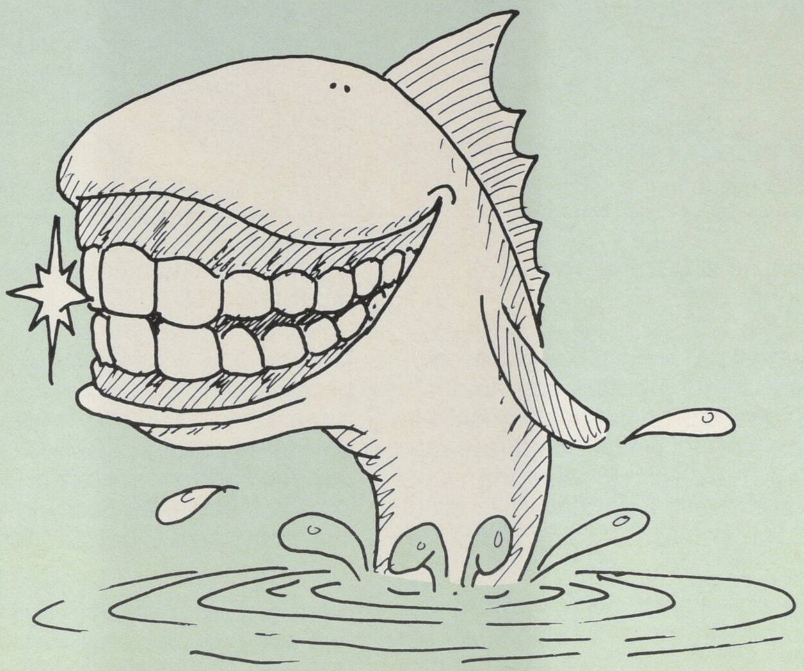
Most industrial fluorides go into the atmosphere and eventually fall back to Earth in rain. They then combine and recombine with other elements and compounds, ending up in the water table. But simple measurement of fluoride levels in drinking water can be misleading: fluoride also occurs naturally in certain rocks, and continually leaches into groundwater.

On average, the fluoride content of unpolluted water is around one part in 10 million (0.1 ppm). But levels 35 times higher have been recorded in industrialized areas. What might this do to plant and animal life in the food chain?

NRC researcher Akira Kudo, on loan to the Plant Biology Laboratory of the Nuclear Studies Centre in Grenoble, France, and Jean-Pierre Garrec, one of that Centre's researchers, have simulated the fluoride pollution of a pond. They dumped a massive load of ammonium fluoride into a 12-m-square pond with well-established plant and animal life, recording toxic effects of the chemical as well as its distribution and transport over 30 days. Kudo and Garrec say the pond was large enough for good experimental results, yet small enough to be observed thoroughly.

Just after the fluoride dump, the two researchers recorded a white, gelatinous substance in the pond. This could have been calcium fluoride (CaF_2), one of the products of rapid chemical reactions which occur soon after many fluorides dissolve in groundwater. Such altered fluorides might well prove less toxic than the fluorides first dumped, because 30-day observation showed surprisingly little effect on pond life. Despite fluoride concentrations of up to 5 000 ppm (one part in 200) in the pond, fluorides were not taken up by organisms throughout the food chain. Fluoride penetration, in fact, was superficial more than internal. And contrary to what happens with other pollutants such as heavy metals, fluoride accumulated more in plants and green algae than in higher organisms like molluscs and fish. Twenty-four hours after the fluoride dump, with 99.8 per cent of the chemical suspended in the water or mixed with bottom sediments, only 0.2 per cent had been taken up by living creatures.

These results contradict other findings, which show greater, faster fluoride uptake in aquatic systems. Kudo and Garrec point out, however, that the study was done at the end of winter, when biological activity in the pond was at its lowest ebb. At such times, resistance to fluoride pollution might be high. If this is the case, then other times in the year would be more critical for the ecosystem than others. Kudo and Garrec suggest that further studies along this line could result in safe, low-cost methods of fluoride-pollution control.



Cartoons by John Bianchi