

# Dioxin Digest

As Times Beach residents celebrate a delayed Christmas, the dioxin debate—and dioxin contamination—continues

By LINDA GARMON

Former Times Beach, Mo., residents recently gathered just outside of their onetime Meramec River town for a summer yule party — complete with a Santa Claus, Christmas tree and presents. The discovery last year that the town is contaminated with a dioxin called 2,3,7,8-TCDD, due to the spraying of dioxin-contaminated waste oil in the early 1970s to control dust on the town's unpaved roads, had prevented those residents from celebrating the holiday in December (SN: 1/22/83, p. 61).

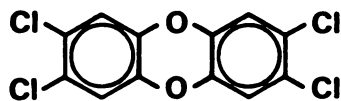
Since then, the federal government has offered to buy out homeowners and business proprietors of the town (SN: 2/26/83, p. 132); federal and state officials have wrangled over and finally ironed out who should take title to the land (SN: 4/23/83, p. 270); Federal Emergency Management Agency officials have begun assessing property values; and the Environmental Protection Agency has started considering suggestions of what to do with Times Beach (including a proposal by the St. Louis Metropolitan Airport Authority to convert it into an extra airport field). Clearly, the Times Beach party symbolized the end of a chapter in the dioxin story.

But it far from closed the book on the topic. The possible health effects of dioxin exposure on former Times Beach residents — and on others who have come in contact with the substance in, for example, industrial settings — are still unclear and being intensely debated. In addition, dioxin contamination recently has been discovered in several other areas across the country such as in Midland, Mich., and Newark, N.J. In New Jersey, hazardous levels of 2,3,7,8-TCDD have been found at the former home of Diamond Alkali, which manufactured the dioxin-contaminated herbicide 2,4,5-T, a component of Agent Orange. Also, certain details of one of the most well-known cases of dioxin contamination — that resulting from the 1976 explosion of a Seveso, Italy, chemical plant — are just now beginning to unfold: A long-term morbidity study of potentially exposed area residents is underway, and forty-one barrels of the long-missing dioxin-contaminated material from that explosion recently mysteriously turned up in an abandoned slaughterhouse in a tiny village north of Paris.

Also among recent developments in the continuing dioxin tale are the following:

- A panel of the U.S. House of Representatives' Veterans' Affairs Committee

recently approved a bill that would make Vietnam veterans who are disabled by any of three relatively rare diseases, presumably due to exposure to the 2,3,7,8-TCDD-contaminated Agent Orange, eligible for compensation. During the Vietnam War, the United States sprayed about 72 million liters of herbicides, mostly Agent Orange, to defoliate some 1.7 million hectares of rural South Vietnam. The recently proposed bill would make veterans eligible for disability compensation if they contract soft-tissue sarcoma, a cancer, within 20 years of their departure from that area or if they showed signs of the skin disorder chloracne or the liver disorder porphyria cutanea tarda within a year after leaving. Such compensation would be the first benefits given to veterans for maladies thought to be linked to Agent Orange.



2,3,7,8-Tetrachlorodibenzo-p-dioxin

2,3,7,8-TCDD is inadvertently formed as a byproduct in the manufacture of several products, including the herbicide 2,4,5-T (a component of Agent Orange).

But the bill still has "many obstacles to clear," says an aide to its chief proponent, U.S. Rep. Thomas A. Daschle (D-S.D.). It must be approved next by the full Veterans' Affairs Committee, then by the entire House and finally by the Senate. And officials of the Veterans Administration (VA) already have expressed strong opposition to the bill. At an April 26 House hearing, the VA's Harry N. Walters said, "There is presently not a consensus within the medical community that a causal connection between [exposure to Agent Orange and related herbicides] and long-term health consequences in humans exists." The proposed bill, he says, is based on what he terms theories and hypotheses; "I do not believe that Congress should base its decisions on hypotheses."

- A health survey of 85,000 Vietnam veterans who were concerned about exposure to Agent Orange turned up "a wide variety of health problems, but nothing stands out as specifically related to dioxin and Agent Orange exposure," says Alvin L. Young of the Veterans Administration in Washington, D.C. The results of the survey were reported Aug. 29 at the American Chemical Society (ACS) meeting in Wash-

ington. The study showed a slightly elevated incidence of one cancer, lymphoma, but no increase in soft-tissue sarcomas. Critics charge that VA exams may not be thorough enough (SN: 11/6/82, p. 301). Young says it may still be too soon to see cancers caused by Agent Orange exposure.

- During a House environment subcommittee hearing in July on dioxin, Philip Landrigan of the National Institute for Occupational Safety and Health in Cincinnati reported findings of a statistically significant excess of soft-tissue sarcoma cases among U.S. workers exposed to TCDD-contaminated chemicals. (While the data were first reported in the Jan. 31, 1981, issue of THE LANCET, they only recently entered Congressional records.) "There's been a lot of loose talk in the past few months that dioxin causes nothing but chloracne," Landrigan later told SCIENCE NEWS; "we at the Public Health Service consider that talk to be imprudent."

- Earlier this year, "important connections" were made between Eastern and Western Hemisphere dioxin researchers at the International Symposium on Herbicides and Defoliants in War held in Ho Chi Minh City, Vietnam, says meeting participant Maureen Hatch of Columbia University in New York City. For example, U.S. researchers learned of a study linking post-Vietnam War cases of birth defects with paternal exposure to Agent Orange. The study found that North Vietnamese children born with birth defects were 3.5 times as likely to have fathers who had served in South Vietnam during the war — and who presumably were exposed to dioxin-tainted Agent Orange. Vietnamese scientists also report increased chromosome damage among people exposed to Agent Orange, Alastair Hay of the University of Leeds in England said at the ACS meeting.

- Measurement of dioxin in human fat, a still controversial technique, has indicated the presence of the chemical in people not known to have been exposed, several scientists reported at the ACS meeting. A. Schechter of State University of New York at Binghamton measured high levels of dioxins and related compounds both in some persons exposed to the chemicals during a transformer fire in a Binghamton office building and in some control subjects. The fat of 22 of 23 Canadians tested in eastern Ontario contained detectable levels of 2,3,7,8-TCDD, reports John J. Ryan of Canada's Health Protection Branch in

## TOXICITIES OF SELECTED POISONS<sup>a</sup>

Substance	Minimum lethal dose (moles/kg) <sup>d</sup>
Botulinum toxin A	$3.3 \times 10^{-17}$
Tetanus toxin	$1.0 \times 10^{-15}$
Diphtheria toxin	$4.2 \times 10^{-12}$
2,3,7,8-TCDD <sup>b</sup>	$3.1 \times 10^{-9}$
Saxitoxin	$2.4 \times 10^{-8}$
Tetrodotoxin	$2.5 \times 10^{-8}$
Bufotoxin <sup>c</sup>	$5.2 \times 10^{-7}$
Curare	$7.2 \times 10^{-7}$
Strychnine	$1.5 \times 10^{-6}$
Muscarin <sup>c</sup>	$5.2 \times 10^{-6}$
Diisopropylfluorophosphate	$1.6 \times 10^{-5}$
Sodium cyanide	$2.0 \times 10^{-4}$

a—Source: Poland and Kende 1976. These data were compiled by Mosher et al., and the values indicate only relative toxicity. It should be noted that the values deal with different species, routes of administration, survival times, and in one case the mean lethal dose rather than the minimum lethal dose. Except where noted, administration was by the intraperitoneal route in mice.  
b—LD<sub>50</sub> upon oral administration in the guinea pig.  
c—Intravenous injection in the cat.  
d—A mole is the gram-weight of a substance that contains  $6.02 \times 10^{23}$  units—molecules, atoms or ions, for example—of that substance.

Ottawa. The source of the chemical in these cases might be herbicide contaminated with traces of dioxin or combustion processes that emit small amounts of dioxin, Ryan suggests.

A VA study also indicates a background level of 2,3,7,8-TCDD in human fat, Young says. Dioxin was detected in about half the subjects among 35 Vietnam veterans,

### Continued from page 153

conditions. "This is precisely what one would expect if the Universe is to be explained as a spontaneous random quantum fluctuation from nothing," he writes. The rules governing quantum mechanical fluctuations allow nothing to become something if it does it for a short enough time: Dust thou wert and to dust shalt thou return, but in the meantime things can happen. The universe has had something like 20 billion years of history (or 10 billion if you believe more conservative astronomers). To us that's a long time, but on the cosmic scale it may be just the briefest flicker.

This is the quantum mechanical universe to an extreme. For Guth it is a free lunch prepared in a sudden phase change. To Davies it's a flash in the pan. To John William Moffatt of the University of Toronto, it's the result of another kind of quantum mechanical fluctuation: tunneling.

Tunneling occurs when a particle, an electron, for example, meets a barrier that it does not have the energy to surmount. Nevertheless, the wave equations of quantum mechanics give a certain probability of finding the particle on the other side of the insurmountable barrier, and occasionally an electron satisfies the prediction by "tunneling" through. The phenomenon is exploited in electronics, in tunneling junctions and other devices.

whether or not they said they had been exposed to Agent Orange. The scientists say that until there are reliable methods of determining who has been exposed to dioxin, for example by accurately measuring dioxin content in fat, it will be difficult to determine epidemiologically whether dioxin has important health effects.

• In regulations published in the April 4

There is a large barrier between being nothing and being something, and Moffatt proposes that the universe tunneled through it.

Moffatt has been working on a theory he calls nonsymmetric gravitational theory (NGT), which differs from Einstein's general relativity, but which now seems to answer a couple of questions raised by recent observations (SN: 5/8/82, p. 313). Mathematically, Moffatt's theory has two field components, one related to a particle of spin 2, one related to a particle of spin 0. Einstein's has only the spin 2 field. Moffatt's theory makes an explicit connection to particle physics in that the number of fermions (subatomic particles with half-integral amounts of spin) in the universe affects the gravitational field. There is nothing like that in Einstein. The cosmological implications of NGT have some important differences from cosmologies based on general relativity as well as some important agreements.

One of the most striking differences is that in NGT cosmology there is no big bang. The universe comes into being by quantum mechanical tunneling from nothing. It has a minimum radius at which, if it should collapse, it will bounce. It has an early inflationary period that follows a phase transition occurring at about  $10^{-34}$  seconds.

There is no horizon problem in NGT cosmology; different parts of the universe

Is 2,3,7,8-TCDD perhaps the most poisonous man-made chemical—as accounts on dioxin often claim? As the table at left indicates, only toxins produced in nature by certain bacteria are more potent poisons, so the statement appears to be correct. But several important caveats should be included.

First, the statement refers only to the acute LD<sub>50</sub> (the minimum dose that kills half of the test animals in a relatively short time period) of 2,3,7,8-TCDD in guinea pigs—the test species now known to be the most sensitive to dioxin. And, "There is great species variability in the acute toxicity of dioxin," notes Paul Stehr of the Centers for Disease Control in Atlanta.

Second, it should be noted that the position of a chemical on an acute toxicity list does not necessarily correspond to its total risk (which includes its long-term health effects). For example, exposure to plutonium is a known cancer risk, but that substance would rank second to last on the table at left.

FEDERAL REGISTER, EPA proposes to allow the disposal of dioxin-contaminated wastes only in specially approved landfills. If finalized, the regulations would, for the first time ever, make it illegal under federal law to spray roads with dioxin-contaminated oil—the activity that was a significant link in the chain of events that led to the Times Beach incident. □

do not get out of touch with one another. The universe starts out chaotic and highly anisotropic but ends up looking isotropic (as it should to match observations). Moffatt can get galaxies of the right size to form by putting in primordial density perturbations of the right kind, a problem that has baffled some other theories.

Moffatt has already suggested using the oblateness of the sun that seems to appear in some observations reported by Henry A. Hill of the University of Arizona in Tucson at the New Orleans meeting and elsewhere (SN: 4/7/82, p. 260), in conjunction with motions of the planets, as a test of his theory (SN: 3/19/83, p. 182). Black holes, which can exist in NGT, might be another test. In NGT, black holes would emit very strong radiation of the type predicted by Stephen Hawking of Cambridge University in England. This would come to us as gamma rays.

Attempts to see things in the present day universe that would tell us about conditions in the first fraction of a second are also underway. Demianski's question whether we can see into that time is for the future to answer. In spite of much theoretical progress the basic questions remain open: how to mate quantum physics with gravity and cosmology and whether it can be done through Einstein's theory or needs some serious modification of it. The future, cosmologists hope, will have answers. □



The Weekly Newsmagazine of Science

# SCIENCE NEWS

September 3, 1983  
Vol. 124, No. 10  
Pages 145-160

## Dioxin Update

