Termite gas and global methane

Termites do more than dine on the succulent wood of innumerable homes. They also may contribute as much as half of the atmospheric methane produced each year, scientists report in the Nov. 5 SCIENCE.

Methane, a long-lived trace gas, is one of the so-called greenhouse gases that can affect atmospheric chemistry and possibly warm the atmosphere by reducing the amount of heat the earth radiates back into space. Sources of methane are of growing interest because recent studies show that concentrations of the gas in the atmosphere are increasing by about 2 percent per year.

The methane is produced in the termites' guts by microorganisms that break cellulose down into compounds the insects can use. The scientists measured how much methane, carbon dioxide and other gas was emitted by two termite families. They also measured emissions from termite nests in Guatemala. The ratio of gas yield to wood consumption was then used to calculate the potential quantities of gases produced globally, based on previous estimates of carbon consumed by termites. The researchers found that the world's termites may emit as much as 165 million tons of methane and 55 billion tons of carbon dioxide.

"I would be the first to admit that those numbers are pretty rough," says Patrick Zimmerman of the National Center for Atmospheric Research in Boulder, Colo. Co-authors of the article are James P. Greenberg, also of NCAR, Paul J. Crutzen of the Max Planck Institute for Atmospheric Chemistry in Mainz, West Germany, and S. O. Wandiga of the University of Nairobi in Kenya.

The estimates are cushioned by a wide margin for error because global data on numbers of termites and how much methane comes from other sources are incomplete. The termites could contribute half or twice as much of the gas, the scientists note. Other sources of atmospheric methane are swamps (SN: 7/3/82, p. 5), rice paddies, leakage from natural gas reservoirs and pipelines, and cows and other ruminant animals that give off the gas as a by-product of digestion.

Only 1 percent of the wood ingested by termites is converted to methane, while 8 percent of carbon digested by cattle is converted to the gas, Zimmerman says. Termites contribute a greater percentage of the methane in the atmosphere, however, because they are so numerous. In fact, the authors write, termites may be increasing in number as humans clear tropical forests and create wet savannahs, a favored termite abode.

The termites convert about 90 percent of the carbon they digest to carbon dioxide but this simply speeds the natural recycling of carbon as plants decompose. While burning of fossil fuels adds only a third as much CO_2 to the atmosphere as termites may, the effect is more critical because the burned carbon, long bound into the earth, is essentially a new source of atmospheric CO_2.

Barbara L. Thorne, Harvard Univ

King, workers and soldiers tend larger termite queens in Central America.

Some other atmospheric chemists, while persuaded that termites produce methane, are reserving judgment on termites' potential as a major methane source until further measurements and calculations are done. Steven Wofsy of Harvard University says the speculation that the insects contribute as much as half of the atmospheric methane is "outrageous," adding that while he respects the work of the research team, "they're not being conservative about their estimates."

Barbara L. Thorne, a Harvard researcher who studies termites, says that while the insects may emit substantial amounts of methane, it is difficult to extrapolate their output to a global scale simply because "there is no way to get an accurate estimate of the number of termite colonies or the number of termites in the colonies."

Zimmerman says he and his colleagues plan more field observations through which they can refine their calculations.

—C. Simon

Markey elects to release reactor risks

There were political overtones in the timing of Rep. Edward J. Markey's (D-Mass.) unveiling last week of catastrophic nuclear-accident projections derived from a Nuclear Regulatory Commission study. At least that's how the Atomic Industrial Forum (representing 600 utilities and others favoring nuclear power) has interpreted the move. Releasing such emotion-rousing statistics the day before national elections—and three nuclear referenda in New England — was clearly "a scare tactic," according to AIF's Donald Winston.

In a press conference last Monday, Robert Bernero, director of the NRC's Division of Risk Analysis, attempted to dispel misinterpretations of the statistics. Developed by the House subcommittee on oversight and investigations (which Markey chairs), the statistics Markey used were derived from the draft form of a study examining the sensitivity of reactor-siting criteria to the potential consequences of very-low-probability accidents. At the press conference, NRC also released the formerly unpublished 454-page report from which Markey's data originated. Completed in July, the NRC study was performed by researchers at Sandia National Laboratories in Albuquerque, N.M.

In a statement issued Monday, Markey claimed that the Sandia data showed that projected consequences of the most serious accidents are much more severe than earlier estimates had suggested. "A 1975 study said a core meltdown could result in 3,200 early fatalities and some $14 billion in property damage," Markey said. "But the new figures . . . are as high as 100,000 early deaths for some sites and hundreds of billions of dollars in loss for many [sites]."

Bernero said he was "confused" by Markey's allegation that accident consequences depicted in the Sandia study were materially different than those in the 1975 WASH-1400 reactor-safety study. The only major difference was use of a hypothetical reactor site (embodying characteristics of actual sites) for modeling the 1975 data, versus use of real meteorological, population and plant data for 91 actual reactor sites in the Sandia report. And the new study confirms the basic estimate of individual reactor risk in WASH-1400, Bernero said.

Finally, Bernero attributed the higher early-deaths figure in the Sandia report to the lower-probability scenarios it examined. WASH-1400's authors cut off their analysis when risk projections suggested the possibility of scenarios yielding 3,500 early deaths. The newer study took probability calculations a couple "what if" steps further down the line, Bernero said, to determine possible consequences of even lower-probability events.

To generate the "worst-case" consequences projected in the Sandia study, Bernero said one would have to start with the worst type of "core-melt accident," where none of the plant's safety systems worked. Every safety system would have to fail immediately to create the worst radioactive plume. The weather would have to be calm enough that winds didn't "dilute" the radioactive plume, yet sufficiently active to drive the plume over a region of high population density. Then rain must fall, timed precisely to wash "all the radioactivity" onto the population.

The likelihood of this occurring is low, according to Bernero. "For any plant it would be roughly one in one billion per year of reactor operation," he said. For an average of 100 reactors operating over the next 20 years, he said there would be "two chances in a million" that this course of events could develop by the year 2000.

—J. Raloff