
Most of their mainline Protestant and Catholic counterparts were reluctant, and they were gradually squeezed off the airwaves after 1960, when the Federal Communications Commission dropped its requirement that public-service air time be provided free of charge to churches and others.

Technological advances soon strengthened televangelists: Videotape made it possible to air a program in hundreds of cities at the same time, and satellite transmission permitted live broadcasting. Televangelists created new religious networks—Pat Robertson's Christian Broadcasting Network, Paul Crouch's Trinity Broadcasting Network, and Jim Bakker's PTL Network. Between the late 1960s and the mid-'80s, the audience for syndicated religious TV shows soared, from an average of about five million per program to nearly 25 million. Related ventures, such as cathedrals, universities, and theme parks, also flourished.

Then, in 1987, with the revelation of Bakker's past tryst with a church secretary, came the fall. Scandal was only part of the reason for evangeli-

cal broadcasting's decline, Hadden argues. The market already had become saturated. Televangelist Rex Humbard, for example, left the air in 1985 after the number of stations on which he appeared fell by 36 percent over 10 years. The televangelists' forays into politics also hurt. In 1985, when talk of a presidential bid by Pat Robertson started to be heard in public, Robertson's TV audience began to shrink. Even before the Jim Bakker scandal broke in 1987, the audience for *The 700 Club* had fallen by 21 percent over two years.

But the nimble entrepreneurs of faith have readjusted. Robertson, for example, restructured his Christian Broadcasting Network to present family-entertainment programs along with religious broadcasts. He also exploited cable television. By the end of 1991, his Family Channel reached 92 percent of all cable households in the country. In addition, the number of *local* religious TV stations has steadily grown, from 25 in 1980 to 339 in 1990. All in all, Hadden concludes, it is much too early to conclude that televangelism's run is over.

SCIENCE, TECHNOLOGY & ENVIRONMENT

Superfund: The Continuing Calamity

"Stop Superfund Waste" by Bernard J. Reilly, in *Issues in Science and Technology* (Spring 1993), Univ. of Texas at Dallas, P.O. Box 830688, Mail Station AD13, Richardson, Texas 75083-0688; and "Environmental Policy and Equity: The Case of Superfund" by John A. Hird, in *Journal of Policy Analysis and Management* (Spring 1993), John Wiley & Sons, 605 Third Ave., New York, N.Y. 10158.

The federal Superfund program was created in 1980 in the aftermath of the Love Canal scare as a \$1.6-billion effort to clean up the nation's abandoned hazardous-waste sites. It has since evolved into "an open-ended and costly crusade" that wastes money and fails to target the sites that pose the greatest risks to public health or the environment, argues Reilly, cor-

porate counsel at DuPont.

There are more than 1,200 sites on the U.S. Environmental Protection Agency's (EPA) so-called national priority list, and more than 30,000 sites being considered for addition to the list. So far, fewer than 100 sites have been completely cleaned up. To do that for all of the 1,200 sites now on the priority list will cost an estimated \$32-\$60 billion, and much more if, as planned, the EPA adds 100 sites a year, at an average cost per site of \$27-\$50 million.

The legislation is intended to make the polluter pay the costs of cleanup, adds Hird, a University of Massachusetts political scientist. But that frequently fails to happen. The public often foots the bill. When a polluter is made to pay, moreover, it can be just a minor polluter. The courts have ruled that firms that contributed only a small portion of a dump's hazardous con-

tents nevertheless can be forced to bear the full costs of a cleanup. And not surprisingly, this prompts a lot of litigation—and delay.

There is no guarantee, moreover, that EPA is putting the riskiest dumps on its list. A 1991 report by a committee of the National Research Council, Reilly notes, “said that EPA has no comprehensive inventory of waste sites, no program for discovering new sites, insufficient data for determining safe exposure levels, and an inadequate system for identifying sites that require immediate action to protect public health.”

“The existence of toxic wastes at a site does not necessarily mean that they pose a threat to nearby residents,” Reilly notes. Recent research has shown, for example, that even at Times Beach, Missouri, where the whole community was evacuated, the potential health risks were relatively minor. The 1991 National Research Council report, however, said that while “current health burdens from hazardous-waste sites appear to be small,” prudence demands “a margin of safety.” The EPA’s failure to link costs with benefits, Reilly says, means that will not always happen. When Superfund comes up for reauthorization next year, Reilly says, Congress should direct EPA to end the “crusade” and “focus the program on practical risk reduction.”

A Venusian Catastrophe?

“Did Venus Hiccup or Just Run Down?” by Richard A. Kerr, in *Science* (March 5, 1993), American Assoc. for the Advancement of Science, 1333 H St. N.W., Washington, D.C. 20005.

Geophysicists have generally assumed that Earth and its companion “terrestrial” planets (Mercury, Venus, and Mars) share a basic design—a planetary geology shaped by the steady escape of heat from the interior, its amount only slowly diminishing over the eons. Radar images from the Magellan spacecraft, which has been orbiting Venus since 1990, reports *Science* writer Kerr, have upset this cozy image of the four rocky planets. Venus, it appears, may be a planetary black sheep, “a dramatic exception to the

rule of a smoothly running, steadily slowing planetary heat engine.”

By combining counts of the craters revealed by Magellan with estimates of how frequently meteorites have rained down on the surface, planetary geologists have calculated that the Venusian surface’s average age—the time since it was last wiped clean of craters—is about 500 million years. As an *average*, the figure is not in dispute. According to the controversial interpretation of the Magellan data by Gerald Schaber of the U.S. Geological Survey and Robert Strom of the University of Arizona, Kerr writes, a catastrophic “paroxysm of volcanic outpourings” wiped the face of the planet clean of landmarks some 500 million years ago. “Then, in less than 100 million years—abruptly, in geological terms—the planetary heat engine was throttled back, leaving a barely detectable trickle of lava.”

Many geophysicists remain skeptical. Roger Phillips of Washington University, Kerr notes, sees in the Magellan data not “one global episode of resurfacing [but] a patchwork, in which smaller regions were renewed at different times over Venusian history.” That would suggest that the planet’s internal heat engine kept working slowly and steadily.

Yet another explanation of the Magellan images has been offered by Sean Solomon of the Carnegie Institution of Washington. Like Phillips, he still thinks Venus’s heat engine is intact.

What sets Venus apart, according to his theory, is its blistering surface heat of 475 degrees C., caused by the greenhouse effect of the planet’s thick atmosphere. That heat, when combined with the additional heat flowing from a hotter interior in the distant past, Kerr writes, “could have kept near-surface rock soft well into Venus’ history.” The planet’s shifting surface would have remained smooth, without any catastrophic volcanic outburst. Eventually, perhaps 500 million years ago, as the planet’s interior slowly cooled, the temperature of the crust could have fallen enough to allow the rock to stiffen and resist stresses. No longer would new meteor craters be smoothed over. If that is what really happened, Kerr observes, “Venus could keep its flamboyant reputation—and still be pretty conventional at heart.”