UH Scientist Cites Acid Rain, Other Examples

Use of Fossil Fuels Endangering Man

By Helen Altonn
Star-Bulletin Writer

Damaging changes are occurring in the Earth's environment because of burning of fossil fuels and little is being done about it because it is "so political," says a University of Hawaii scientist.

An oceanography professor and geochemist, Fred Mackenzie has developed a set of research models to monitor what is happening on a global scale with the constant addition of chemicals in the atmosphere because of fossil-fuel burning and other societal activities.

The results include warming of temperatures, acid rain that destroys animal and plant life in freshwater lakes, possible depletion of the ozone layer that protects the Earth from ultraviolet light, and other threats to nature.

Concerned scientists around the world have warned repeatedly of the problems resulting from fossil-fuel burning emissions, Mackenzie said in a recent interview.

"I don't know how many meetings we have had in the last decade — U.S. scientists with Russian, Scandinavian and European scientists," he said. "Yet, from a practical standpoint, very little has been done about it. In fact, almost nothing."

MACKENZIE and his wife Jane, a geologist, joined the Hawaii Institute of Geophysics in 1981. He was formerly with the Bermuda Biological Station of Research, Shell Oil Co. and Northwestern University, where he was chairman of the department of geological sciences for seven years.

He is involved in several major research programs concerning the chemistry of sedimentary material from the sea floor but his main interest is the study of global cycles of elements, or compounds, circulating in the atmosphere.

Mackenzie has spent about 10 years examining how geochemical systems functioned over hundreds of millions of years in the past, what they're doing today and what they're likely to do in the future because of changes in society.

He has constructed models, or charts, of all major chemical elements and some trace metals, integrating available data on oceans, sediments and the atmosphere to see how they are affecting the Earth.

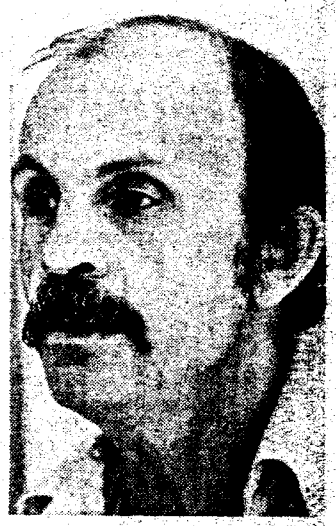
He shows how the substances are transferred across the Earth's surface, the processes that control them and their abundance and distribution in the atmosphere and ocean. Then he tries "to assess man's impact on those global circulation patterns."

THE CARBON cycle is one of great concern because carbon-dioxide gases play a large role in determining the Earth's heat balance and a gradual warming — known as the "greenhouse effect" — has been occurring.

"We know that burning of fossil fuels each year emits carbon in two forms — carbon dioxide and carbon monoxide," Mackenzie said. "Monoxide is rapidly altered to dioxide in the atmosphere, and some of it accumulates and stays there."

He said a potential doubling of the atmospheric content of carbon dioxide since the 1800s has been predicted by the years 2030 to 2050, causing an increase of 1

Turn to Page A-6, Col. 1



Fred Mackenzie
Man is changing his environment

Fossil Fuel Dangers Cited by Scientist

Continued from Page One

o 3 degrees Centigrade in the average temperature on the Earth's surface.

"What is even more dramatic," Mackenzie said, is that near freezing temperatures at the pole may rise to about 10 degrees Centigrade, which would have "lots of consequences."

Looking at the sulfur cycle, he noted that man is already adding a yearly supply of sulfur to the atmosphere through fossil-fuel burning that is comparable to the amount from natural processes such as volcanic emissions and biological decay.

HE SAID sulfur enters the atmosphere as sulfur dioxide and reacts with water to make a "rainout of sulfuric acid," which has led to the degradation of freshwater lakes in Canada, the northeastern United States and Scandinavian countries.

Despite a slowing down of fossil-fuel burning because of the economic crisis, Mackenzie said sulfur acidity is still increasing at a rate of about 2 percent a year from oil and coal pollutants in the atmosphere. Some sulfur is even showing up west of the Mississippi, he said.

Unlike carbon dioxide gas that "stays around a long time," Mackenzie said sulfur dioxide is short-lived and the atmosphere would be cleansed of it very quickly if fossil-fuel burning is halted.

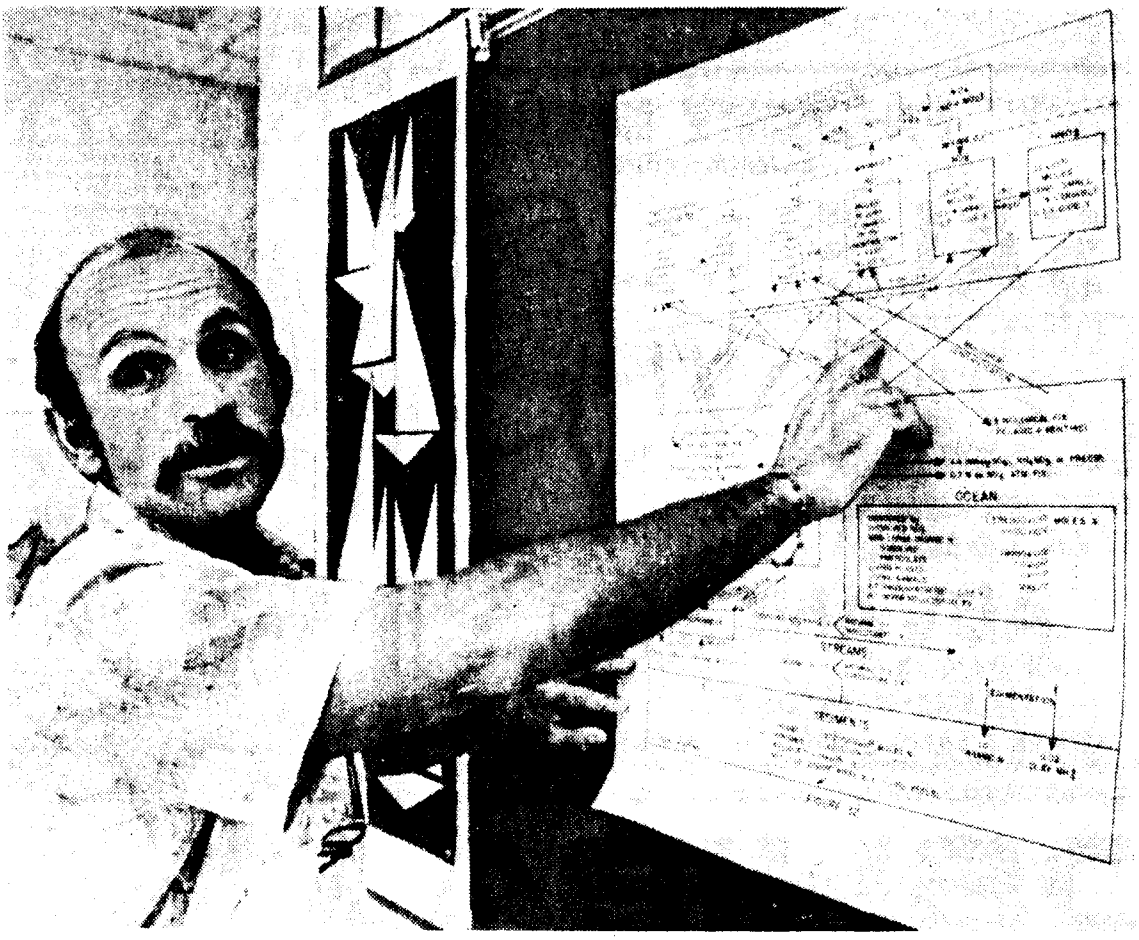
Combustion fuel burned in vehicles and power plants also adds nitrogen gases to the atmosphere that are responsible for smog and contribute to acid-rain problems, the scientist said.

"Indeed, it is likely that the nitrogen cycle is one that may be the most precarious because society's activities are affecting it in many ways," he said.

AMONG others, he said, man is adding nitrogen fertilizer on the Earth's surface and the run-off into aquatic and coastal marine systems "burdens the systems with plant productivity."

The increase in organic material depletes the oxygen in the systems and "everything starts to fall apart," Mackenzie said.

He said the fertilizer also releases nitrous oxide which will react with ozone in the stratosphere and lead to some depletion of the ozone layer.



PRECARIOUS CYCLE—University of Hawaii geochemist Fred Mackenzie describes the consequences of nitrogen gases added to the atmosphere by burning fossil fuels. —Star-Bulletin Photo by John Titchen.

"If we continue to combust fossil fuels at the present or an increased rate, and apply fertilizers to the Earth's surface, by 2020 there will be a few percent decrease of the ozone layer," he said, which means more ultraviolet light will reach the Earth and increase the danger of skin cancer.

He said there is "some argument in literature that we are already seeing some depletion of the ozone. It is based on a lot of 'ifs,' 'ands' and 'buts,' but it appears this way."

MACKENZIE said France and Belgium are committed to atomic energy because of the pollutants associated with fossil-fuel burning, although "there are a lot of concerns also with atomic energy."

He said he has "mixed emotions" about atomic energy as an energy source but expects society will end up with it "by default" because of inadequate research on all other sources except possibly solar.

"Probably by 2050, if not before, we're definitely going to see the impact of a lack of fossil-fuel resources on the economy," he said. "They are just not there."

He said "it's simply not true" that geologists haven't discovered all of the fossil-fuel resources as some people contend. "We know pretty well what the recoverable base is of coal, oil and gas, and definitely by the middle of the next century we're going to have problems. Not so much with coal, but it's the main culprit of the dirty problems — the acid rain."

"We have to look at alternate-energy sources," he said. "Unless we change our whole viewpoint on this business, by default we will end up with atomic energy. . ."

In addition to his research activities, Mackenzie is revising a book on chemical cycles and the global environment and has just finished editing a new volume on "Geological Cycling in Earth's History."