ment calculation shows that a person ingests 0.5 μg of DMN if he eats four slices of cooked bacon (with the nitrite level permitted by the old standard). He inhales 0.8 μg after smoking a pack of cigarettes (it is well established that nitrosamines form in cigarette smoke). Fine has calculated that, by comparison, a person breathing air containing 1 $\mu g/m^3$ of DMN for 24 hours will inhale 10 to 14 μg of DMN.

On a clear day in Belle, West Virginia, where DMN levels of 0.1 $\mu g/m^3$ were measured, a person would inhale 1 to 1.4 μg of DMN—still more than the amount he would have taken in after eating the bacon or smoking the pack of cigarettes. James Smith, an EPA scientist who has reviewed calculations of relative exposures to nitrosamines, says that exposures of humans to atmospheric nitrosamines are probably "in the same ball park" as exposures from food and cigarettes.

An important missing piece of information, however, is how nitrosamines behave in the human respiratory system. Jean French, an EPA epidemiologist, says that while nitrosamines have been shown to form from precursors in the digestive system, "a counterpart of such a demonstration in the respiratory system hasn't been tried.... This is a bad void in the research." If indeed they form there, nitrosamine exposure in the population may be more than that even now supposed.

Cancer researchers have tested nitrosamines on dogs, monkeys, parakeets, rats, mice, hamsters, guinea pigs, and even on rainbow trout. Each group has contracted a significant number of cancers. Moreover, each has developed a variety of kinds of cancer—suggesting that nitrosamines do not limit their harmful effects to one organ.

Animal studies have also shown that, in low doses, nitrosamines seem to activate other, weak carcinogens, such as benzo(*a*)pyrene, to act more potently. Reviewing this and the other evidence of its harmfulness, an EPA report in 1974 concluded, "as a family of carcinogens, the nitrosamines have no equals."

But relating all this evidence in animals to the likely human experience is another matter. At present there is no data linking nitrosamines to cancer in humans. Establishing that it does or does not cause human cancers would be a formidable research task. Nonetheless, some researchers say they should be considered a public health menace on the basis of animal data alone. Says one:

> There is no evidence linking nitrosamines to cancer in man, but that may be because the cancers they produce are so common that they don't stand out as unusual. Vinyl chloride was easy to track down because it produces such an odd cancer. With the nitrosamines, however, it is reasonable to assume that man is not a god

ERDA Gives Boost to Breeder Program

The Energy Research and Development Administration (ERDA) has decided to continue a "strong research effort" to develop a liquid metal fast breeder reactor that might become a key factor in supplying nuclear energy in the next century. The renewed commitment to the controversial breeder program appears to belie hints that surfaced last summer that the agency's zeal for the breeder might be waning.

The new commitment was signified in two events that occurred late last month. On 20 December, ERDA announced an internal reorganization aimed at putting "particular emphasis on the Liquid Metal Fast Breeder Reactor (LMFBR) program." A new Division of Reactor Development and Demonstration was formed that will be devoted exclusively to LMFBR activities, while other activities that had formerly been handled in the same administrative unit were spun off into a second new division. Richard W. Roberts, ERDA's assistant administrator for nuclear energy, said the reorganization will give the LMFBR the "dedicated attention it requires."

Then, on 31 December, Robert C. Seamans, Jr., ERDA administrator, announced his findings after reviewing the LMFBR program's final environmental impact statement, which analyzed the various environmental, economic, technological, and social issues involved in widespread deployment of breeders. Seamans concluded, in essence, that the impact statement supported the need for a vigorous research and development program to determine whether the breeder is a viable energy option, but that at least one more impact statement should be prepared and considered before ERDA decides—probably by 1986—whether the breeder is acceptable for widespread commercial deployment. Should ERDA decide in the affirmative, it would then be up to industry to decide whether to invest in the breeder option or use some alternative source of energy, and it would be up to the Nuclear Regulatory Commission to decide whether to license such breeders.

These latest steps by ERDA reverse the impression which emerged last summer that the agency was backing slowly away from its commitment to the breeder, a reactor that produces more nuclear fuel than it consumes. One event which gave that impression was the publication of ERDA's national plan for energy R & D. That plan seemed to treat solar energy and fusion on a par with the breeder as potential long-range energy options, a scenario that caused dismay in the nuclear industry. "They acted as if all three horses came out of the gate at the same time and were running in the same race," complained a spokesman for the Atomic Industrial Forum, the industry trade group. "That was not a realistic appraisal. We have the breeder technology fairly well in hand, but we've never built a solar generating station or a fusion reactor." A second event that reinforced the impression was ERDA's announcement that it was reducing its fiscal year 1976 budget for the breeder by $60 million. But much of that money could not have been spent anyway because of delays in the program. Some observers believe ERDA made the announcement to defuse opposition in Congress, where the breeder budget for long-range items subsequently survived a major attack by votes of 227 to 136 in the House and 66 to 30 in the Senate.

The latest plan as approved by Seamans calls for construction of a demonstration plant (the Clinch River Breeder Reactor Plant); a prototype large breeder reactor; and a commercial reactor that would go critical in 1993. Seamans said a decision on commercialization could be made in 1986, and that carrying out the R & D program would not constitute "an irreversible commitment to widespread commercial use." But J. Gustave Speth, of the Natural Resources Defense Council, an opponent of the breeder, calls such an assertion "nonsense." He argues that, after billions of dollars have been spent on the breeder and a large private and public bureaucracy has been built up in support of the breeder, the decision on commercialization will be "foreclosed." The total cost of the breeder program through 1986 is projected at about $10 billion.

Opponents of the breeder argue that it will be beset by technologic and economic uncertainties and that it is environmentally dangerous, since it is based on highly toxic plutonium, the stuff of which bombs are made. But proponents contend that the problems can be overcome and that the breeder will be essential to meet future energy demands.—PHILIP M. BOFFEY