A new step toward controlled fusion

Physicists at Princeton University have demonstrated a new technique for heating a plasma, the hot, fluid-like, conductive mass of ions from which scientists hope someday to obtain useful amounts of fusion energy. The development makes possible a new round of experiments in the long process of creating a thermonuclear reactor.

The new heating technique involves accelerating deuterium ions to high energies before injecting them into Princeton's Adiabatic Toroidal Compressor (ATC), a doughnut-shaped plasma machine of the tokamak variety. Raising the temperature of the magnetically suspended plasma has been one of the three main problems facing fusion researchers. To get more energy out of a plasma than is put into it, a mixture of deuterium and tritium ions must be heated to roughly 100 million degrees C., and a high density must be achieved without letting the plasma spread. The ATC last year became the first tokamak device to achieve the minimum density believed necessary for an operating fusion reactor (SN: 11/25/72, p. 341), allowing scientists to concentrate on improving temperature and confinement time.

The latest achievement was announced last week by the Atomic Energy Commission.

H. P. Furth, who originated the ATC experiment, says the importance of hot-ion injection is that it can immediately be applied to much larger machines. In the ATC, plasma is first heated to 2 million degrees by running electrons through it. Next it is compressed magnetically until a temperature of 6 million degrees is reached. Then, in the new technique, positively charged deuterium ions are accelerated to high energy, passed through a gas to pick up electrons that neutralize their charge, and shot into the waiting plasma, heating it to 7 million degrees C. (Neutral particles cannot be accelerated; charged particles cannot pass directly through a magnetic field.) "The charming part," Furth told SCIENCE NEWS, is that very little acceleration was necessary to demonstrate the heating effect, which can now be very greatly increased for larger machines.

The first large fusion device to use neutral-beam heating will probably be the Princeton Large Torus (PLT), scheduled for completion in 1975. By increasing the size of the plasma ring from ATC's 21-centimeter radius to one meter, and adding the accelerated deuterium beam, the new machine may reach the half-way mark toward the 100-million-degree goal.

AMA? "I think that we are slowly bringing these people into the real world," replied Assistant Secretary Charles Edwards, "which recognizes that we all . . . have a hell of a lot of people looking over our shoulder and providing a certain amount of quality control."

Still, many of the medical writers remained openly skeptical, noting that many of the HEW proposals had yet to run the gauntlet of White House staffers, including the Office of Management and Budget, which trimmed so many of last year's medical programs. "I'll believe it when I see it," sighed one veteran reporter. □

The 4 choices in EPA's 'other great debate'

The Environmental Protection Agency last week announced a series of public hearings on four new pollution-control proposals, drafted in response to recent court decisions (SN: 6/16/73, p. 384) and designed to protect pristine areas of the country from "significant deterioration" of air quality.

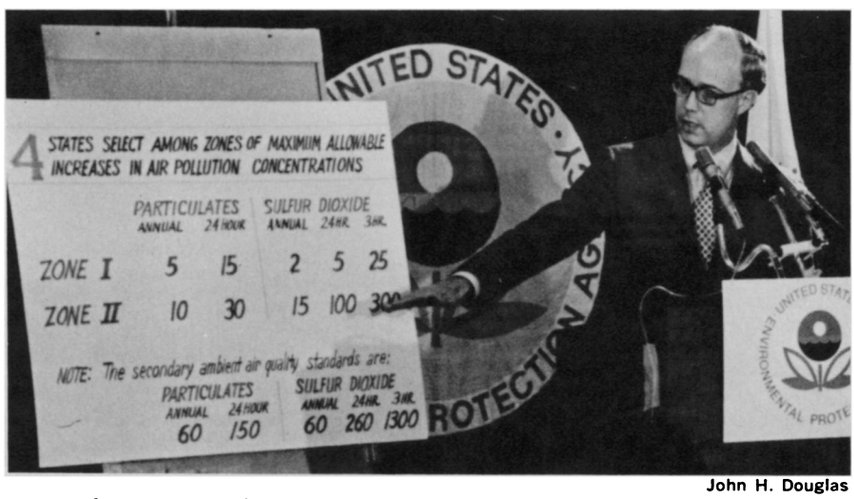
The hearings to help determine which of the four proposals should finally be adopted will form part of what acting EPA Administrator Robert W. Fri calls the "two great debates" over environmental quality: the transportation debate to decide the limits of personal vehicle traffic and the land-use debate to decide the limits of economic growth in the nation's cleanest regions.

The four proposals offer different methods of minimizing emissions from new sources of air pollutants and for determining where to build them.

- The first proposal would classify all affected regions as zone II (see chart) by limiting the increase of ambient pollutant concentrations to the specified values. The effect, Fri said, would be to discourage new development so much as to force industries to concentrate even further in urban areas.
- The second proposal would limit emission increases rather than ambient air pollution increases. Sulfur dioxide emissions could increase by only 20 percent per year above 1972 levels in a region, or by 10 tons per year per square mile, whichever was greater. Particulate emissions would be similarly limited to 20 percent or 3 tons. This plan would provide greater flexibility in locating new industrial plants, but might lead to clustering of plants, resulting in higher local pollution.
- The third proposal would turn the whole matter over to the states, giving local authorities the power to decide, within limits, what to do about new development in "clean" areas, but raising the possibility of widely varying standards and the application of high-pressure salesmanship.
- The fourth proposal would allow states to divide their territory into zones I or II (see chart). Almost no new development could take place under the restrictions of zone I; limited development could proceed in zone II regions.

The effect of zone II standards would be to limit such regions to development at the level of "light industrial and residential complexes." A large, well-controlled coal burning electrical power plant could be built in such areas, for example, if wind and terrain would allow sufficient dissipation of its emissions.

The Sierra Club, which initiated the original suit to forbid any significant deterioration of already clean air, called the proposals "flagrant violation" of the law and of the court decision. It announced plans to begin new litigation in the matter immediately. □



John H. Douglas

Fri explains proposed standards for clean areas (micrograms/cubic meter).