even may not be in the best interest of the physics community.

HANS MEISSNER
11/92 *Leonia, New Jersey*

THE AUTHORS OF THE TWO ARTICLES REPLY: All energy sources involve materials or processes that, if not properly controlled, can be hazardous to humans or the environment. When the magnitudes of the risks and the means of controlling them are considered, we believe that inertial fusion indeed does have the potential to be safer and cleaner than today's fossil and fission power plants. Our articles clearly point out the magnitude of the design and development tasks that must be done to assure this. Hans Meissner has not identified any new mechanisms that would affect safety or cleanliness. The specific reactor studies referred to in our second article (references 4, 5 and 12) do not ignore the possibility of tritium leaks into the cooling fluid or any other identified source of leakage. Our "calculated" total radioactivity estimates are based on a very large number of measured cross sections, and the neutronics codes used have been used in current fission reactors to estimate other integral results that have in turn been verified by experiments. It is not likely that integral experiments done when fusion facilities are available will find that the calculated results are in error by the several orders of magnitude that would be required to reverse our conclusions.

Regarding the issue of optics damage, the ten-beam Nova system, which was originally designed in the late 1970s using the then current technology and began operation in 1984, operates at about 3–4 kJ per beam in the blue (0.35 μm) and provides about 1400 system shots per year on a two-shift-per-day, five-day-a-week schedule. In addition, high-power laser and optical materials technology has made significant and in some cases revolutionary progress in the past 15 years. Based on these advances, a National Academy of Sciences review group (reference 1 of our first article) concluded in 1990 that a megajoule-class solid-state laser was technically feasible with present technology.

Finally, we do not apologize for the fact that we are advocates of inertial fusion energy. We believe it is in the best interest of the physics community that advocates be as enthusiastic as they can be so long as they do not ignore the difficulties that must be overcome to realize the benefits of their ideas. We are certainly not alone in our assessment of the promise of fusion. DOE's Fusion Policy Advisory Committee[1] found that "fusion reactors will have substantial advantages over fission reactors with respect to the consequences of severe accidents and the magnitude of radioactive-waste burdens. This is true even in the unfavorable case of fusion blankets that use nonoptimal structural materials such as stainless steel, which becomes highly radioactive under neutron bombardment. The volume of waste produced by a 1200-MW_e fusion reactor, if diluted to the levels required for shallow land burial under US Federal Regulations, is at least a factor of one million lower than that produced by a fission reactor of the same size. The maximum plausible critical dose at the site boundary for a severe fusion accident is two to three orders of magnitude less than that for a severe fission accident."

Reference

1. Fusion Policy Advisory Committee final report, September 1990, NTIS-PR-360, available from Natl. Technical Inf. Service, US Dept. of Commerce, Springfield VA 22161.

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News from the Nuclear-Pumped Laser Forefront

The Russian Institute of Physics and Power Engineering (IPPE) hosted NPL-92, an international conference on nuclear-pumped lasers, in Obninsk during the last week of May 1992. Scientists from the former Soviet Union, the United States, Germany, China and South Africa attended, including scientists from American and Russian nuclear weapons laboratories. The openness of the FSU participants was remarkable, considering the relationship of the conference topic to nuclear directed-energy weapons programs. The changing political climate allowed the Russian organizers to welcome foreign participation; previous NPL conferences had been

held in secret.

Most of the nearly one hundred papers at NPL-92 were presented by Russian authors and discussed a variety of lasers powered by nuclear reactors. The Russian reactor-powered-laser research programs were remarkable for their breadth and sophistication. Two new lasers were reported, and the performance of existing lasers was characterized in new parameter ranges. Numerous other papers reported on fission-fragment excitation cross sections, excitation of liquid laser media, a neutronic mockup of a reactor-pumped laser system, calculations and measurements of laser beam quality, uranium coating integrity and specialized nuclear reactor facilities. Key Russian scientists stated that their research programs had achieved great success before the first US reports of reactor-pumped lasers, in 1975.

NPL-92 provides evidence of a new orientation toward peaceful applications of weapons science. Russian scientists suggested various uses for nuclear lasers and even proposed Earth-orbiting reactor-powered lasers that would produce powerful beams to vaporize space junk that is becoming a serious navigational menace to satellites.

Two Russian papers presented at the conference described two underground experiments on nuclear-explosive-driven optical lasers conducted in the early 1980s. Technical details of the laser configuration such as the hardware geometry, nuclear pumping mechanisms, lasant composition and beam energy output were discussed. The purpose of these experiments, according to the Russians, was to develop an alternative source of beam energy for research on inertial confinement fusion.

One day of the conference was devoted to touring several laboratories in the vicinity of Moscow that until recently had been closed to foreigners. At IPPE, Russian scientists demonstrated research facilities for developing reactor-powered lasers: a new pulsed reactor facility (BARS-6), the aforementioned neutronic mockup of an RPL system (VKS-1M) and facilities for studying degradation of laser gas and for measuring laser level properties. Visitors to the Troitsk Institute for Innovation and Thermonuclear Studies toured several important experimental facilities for ICF research: the TIR-1 CO_2 laser, the MISHEN-II Nd–glass laser and the ANGARA-V pulsed-power particle-beam accelerator. Visitors to the Obninsk technology center for the production of nonmetallic materials viewed parts such as ceramic tiles and windows produced for the Buran space shuttle, ceramic turbine blades, crushable hexcell and a variety of specialty consumer products.

One US participant was shown through the Institute of Experimental Meteorology at Obninsk by an acquaintance who is now the director. The tour revealed a wide array of unique capabilities, including a 3000-m^3 state-of-the-art cloud chamber for optical studies of droplet and crystalline fogs. Significant achievements at the institute include successful cloud-clearing experiments using CO_2 lasers.

The American contribution to the body of information presented at NPL-92 was small; most of the presentations were given by Americans from nongovernment organizations. Although scientists affiliated with the US Departments of Energy and Defense attended the conference, only two papers were presented from those organizations. This clearly disappointed the Russians, who complained that they had opened their laboratories to Western scientists and had released closely held information on both reactor-driven and nuclear-explosive-pumped lasers but had received relatively little information in return.

The next NPL conference is tentatively scheduled for 1994—as an open meeting at Arzamas-16, the Russian Scientific Research Institute for Experimental Physics.

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Hold Recommendation Letters for Later

I am writing about a concern I have with the job listings in PHYSICS TODAY. For almost all of the faculty positions advertised three letters of recommendation are requested. For the job applicant, who may literally apply for over a hundred positions, this means asking references to send out a lot of letters. Given the current employment climate even small schools can receive hundreds of applications. Since most candidates will be eliminated simply on the basis of their resumes and research interests, is there really a need for a letter of recommendation in the early stages?

Although word processors and secretaries can lighten the burden for some, this requirement still represents quite a bit of work. Additionally, the applicant is placed in the awkward position of repeatedly asking for a letter of recommendation, and in most cases this will be for a job for which the applicant will not be seriously considered.

I ask that prospective employers hold off asking for recommendation letters until they have narrowed the field to serious candidates. (They can still require names and addresses of references.) This would cut down on the paperwork employers have to wade through, and it would make things easier for those searching for positions.

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O_3 Hole: No More than the Sum of Its Past?

I believe Barbara Goss Levi's news story on Arctic ozone depletion (July 1992, page 17) should have appeared in another department, perhaps Opinion. Historically, knowledge of the Arctic gap, hole, crack or cavity dates back about three-quarters of a century.[1] And the Antarctic ozone hole, which has been featured in the popular press as a recent discovery, was detected over Halley Bay during the International Geophysical Year (1957–58).[2]

If there was already an annual drop in the ozone over both polar regions before humans introduced chlorofluorocarbons into the atmosphere, what caused the annual variation (or hole or gap or cavity or crack)? Isn't it more likely that the recent introduction of CFCs only amplified a naturally occurring event and does not deserve to have been treated as a "cause célèbre" by writer after writer?

References

1. F. W. P. Gotz, in *Compendium of Meteorology*, T. F. Malone, ed., Am. Meteorological Soc., Boston (1951), p. 275.
2. "Dobson on the Ozone," Eos, 28 February 1989.

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LEVI REPLIES: True enough, ground-based and satellite data taken since the early 1960s have established that