



safe. For example, even sleeping for longer periods, like 10 hours, results apparently in a small increase of strokes and blood clots. In radiation matters, scientific committees recommend exposure guidelines that they judge will result in no greater risk after lifetime exposures at the maximum values than the risks for other serious injuries or illnesses in safer industries or occupations. These are experienced judgments that are always open to challenge; hence, controversy.

It is generally not appreciated how unique it was that radiation protection specialists felt that these small, undetectable health risks should be estimated and be used in setting standards. This was new for health protection—that is, to provide protection for levels of exposure that may produce potential effects or disease although these were not observable directly by scientific methods. In contrast, exposure regulations for other toxic materials were set at levels somewhat below those that produced acute or subacute effects, that is, recognizable symptoms or signs of toxicity. The concept of protecting against possible unrecognized injury, such as the small risk of induction of cancer years later, was new with radiation protection. In the past decade or so, this same philosophy of protection is beginning to be applied to regulations on exposure to toxic metals and chemicals in a manner similar to those used in radiation protection for more than 30 years. In effect, radiation protection specialists have led the way. As shown by the swirl of controversy, trail blazing is not an easy task. I believe radiation protection specialists in the formative years of the nuclear industries should be recognized for their foresight and concern.

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## PEDAGOGY IN REACTOR SAFETY

I have been giving a series of lectures for IAEA to a group of scientists and engineers from developing countries on the subject of PWR safety. For my main reference in discussing emergency core cooling I used your fine article, "Accident Simulation with TRAC," in the latest issue of *Los Alamos Science*. You provided a clear and vivid picture of the accident and recovery and I believe the students benefited greatly. I was much interested in the pedagogical virtue of your modeling of reactor components as variants on a pipe.

I'm working on a set of simple educational modules in nuclear engineering that include theory, calculation method, computer program, and illustrative example. They are intended to demonstrate concepts and allow the student to vary parameters and modify or expand the program. For the preparation of one on LOCA/ECCS I need to go one step further than the article, to the issue of the model used in TRAC. It would be too big a job for me to learn all the great detail that I know is involved in such a comprehensive code. Can you suggest a program of reading and study that would put me in good position to prepare such a module? Any written material would be helpful. Many thanks and best regards.

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*Editor's Note: In response to this letter, addressed to the authors, John C. Vigil sent the manual for the latest TRAC version to Professor Murray and recommended the references it contained as additional helpful material.*

I was delighted to receive a copy of *Los Alamos Science*, Volume 2, Number 2, on

Reactor Safety. This is a superb collection of articles on one of the most important technical issues we are faced with.

The timing couldn't have been better as my upper-level graduate course, Two-Phase Flow and Boiling Heat Transfer, is rapidly heading toward application topics which include thermal-hydraulic issues in nuclear reactor safety. I may use *Los Alamos Science* as class notes for this important part of my course.

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Distinguished Professor and Chairman  
Department of Mechanical Engineering  
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## THANKS FROM AGNEW

I'm finally getting around to thank you (Barb Mulkin) for the idea of the interview. In such articles one always wonders afterwards why one said this or that or why one didn't say something else. I believe that you did a great job and I appreciate your endeavors very much. Suggest if you reprint it that the picture on page 155 should carry the caption, "You mean I have to spend another year in San Diego?" Actually it isn't all that bad and each year Beverly and I have a harder time trying to decide what to do.

Keep up the good work and please tell Necia the magazine continues to be a smashing piece of work. Really impressive!

Harold M. Agnew  
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*Your comments on articles appearing in Los Alamos Science are welcome. Please address them to Editor, Los Alamos Science, Los Alamos National Laboratory, Mail Stop M708, Los Alamos, NM 87545.*