LETTER TO THE EDITOR

HTGR CONCERN CLARIFIED

Dear Sir:

In a recent *Nuclear Applications* article,[1] T. R. Billeter and co-workers describe a promising method for measuring coolant temperatures and impurities in high temperature gas-cooled reactors (HTGR's). However, as an example of an abnormal coolant condition where fast detection is beneficial in avoiding damage to the components, the authors cite a capability in this reactor type for producing "potentially dangerous amounts" of hydrogen and carbon monoxide if water vapor occurs in the coolant. Lest an unwary reader conclude, without checking the supporting reference[2] for further details, that the generation of an explosive gas mixture within the primary vessel is a significant hazard in an HTGR, I feel that some clarification is appropriate.

The reaction of water vapor with graphite at HTGR fuel temperatures will indeed produce H_2 and CO. At low moisture concentration, long exposure times, and reducing conditions, a catalytic decomposition of CO at cooled internal surfaces, such as the steam generator tubes, could produce an undesirable deposition of carbon. The possible concern in such an occurrence is that this active carbon layer could concentrate radioactive fission products by absorption from the small quantities circulating in the coolant gas. The remote and indirect safety consequence of this occurrence would ensue if a rupture of the vessel should ever occur: part of this radioactive deposit could be blown from the vessel by the escaping gas, to aggravate the consequences of the accident.

A category of accident where the fast response characteristics of the microwave technique described could be most useful postulates the rapid injection of steam into an HTGR from a broken steam generator tube. Upon detection of such an accident, automatic remedial action involves dumping the leaking steam loop to a pressure relief tank and, of course, reactor shutdown. The realistic operating concern in such a water injection accident is to minimize corrosion of the core by the steam, with its attendant possibility of damage to the fuel, and prompt remedial action would indeed be beneficial. Production of an inherently dangerous (i.e., inflammable) amount of hydrogen and CO would require reacting several thousand pounds of water with the core; in addition, a means of uncontrolled escape to an oxygen-bearing atmosphere would be needed to support combustion. Thus, normal safety system action would halt the progress of the accident long before the condition invoked would occur.

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REFERENCES

1. T. R. BILLETER, D. P. BROWN, and W. G. SPEAR, "Microwave Techniques for Measuring High Temperatures and Coolant Impurities," *Nucl. Appl.*, **6**, 73 (1969).

2. S. I. KAPLAN, "Safety in High-Temperature Gas-Cooled Reactors," *Nucl. Safety*, **9**, 4 (1968).