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September 9, 1964

Mr. Eugene F. Adiutori
President
Stability Consultants
P. O. Box 18062
Cincinnati, Ohio 45218

Dear Mr. Adiutori:

Enclosed is a copy of the Argonne letter which you had mentioned hearing about in a recent letter to Jerry Luntz. We have already sent the letter to other people in the field for comment. We also enclose one of the responses--namely, the short discourse by Tong. We have not included the other responses as we are still checking with the various persons involved to obtain their permission to use their remarks. In sum, however, the half dozen or so people we questioned supported the Argonne criticisms for the most part and took your side only on an occasional point.

Our plan at this point is to publish the Argonne letter in the version we enclose plus Tong's remarks and extremely brief excerpts from the other solicited letters.

We, of course, invite you to add your own comments although I'm sure you understand we must also ask you to be as brief as possible.

Sincerely yours,

Harold L. Davis
Managing Editor

HLD:cg
Enc.

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EDITOR . HO
ARTICLE NO. . LETTERS SHEET NO. . 1

Dear Sir:

The undersigned, having read "New Theory of Thermal Stability in Boiling Systems" (NUCLEONICS, May 1964, pp. 92-101), conclude that this article must be either a hoax, or that the paper reviewing procedures followed by NUCLEONICS are in need of reevaluation.

---H. K. Fauske/J. B. Heineman/B. M. Hoglund/P. A. Lottes/J. F. Marchaterre/
R. R. Rohde/R. P. Stein
Argonne National Laboratory
Argonne, Illinois

Dear Sir:

In reply to your request for more detailed criticism, a complete and critical review of Mr. Adiutori's article would, in this instance, require an effort much greater than and entirely inconsistent with the effort required to determine the article's lack of merit. However, some of us feel compelled to point out a few of the more obvious errors, not to imply that there are not more, equally important misleading statements.

1. The most consistent fundamental error throughout the paper treats temperature as an independent variable. In treating cases involving internal heat generation (the author's "fixed heat input" systems), temperature is always the dependent variable. In other words, one cannot postulate

a temperature change as the cause of thermal instability in such a system involving heat transfer from a solid surface to a fluid, whether boiling or not. In a "boiler", more properly an "evaporator", as used by the author, the wall temperature may be thought of as an independent variable, although, in practice, the change in temperature is actually dependent upon a change in fluid temperatures on the primary or high temperature side of an evaporative heat exchanger.

2. There is no recognition here of the fact that the flow and boiling heat transfer behavior of the fluid is the independent variable and is therefore the forcing function in a perturbation analysis of the systems considered in the article.

The preceding comments demonstrate the inherent difficulty in critically reviewing the article. Since the author's basic premises are wrong, any further corrections cannot necessarily validate any of the author's conclusions. However, once again, it may be worthwhile to present a partial list of erroneous statements.

3. The opening paragraph suggests a quantitative analysis; nearly the entire article is qualitative in nature. Also, it has been recognized for years that "boiling-heat-transfer coefficients are not very helpful ...", etc.

4. The general definition of thermal stability on p. 94 is not clear descriptively, and mathematically, almost preposterous; for example, under the stated perturbation, a condition such as,

$$T(t=\infty) = T(0) + \Delta T$$

could be just as "thermally stable" as any of the author's cases. Among ~~other things~~

other things on this page, along curves d and c in Fig. 3, dT/dt either changes sign in the interval $0 < t < \infty$ or the coordinate system is something that mathematicians ought to know about. Again, it should be emphasized that these traces are the results of a power or boiling phenomenon perturbation and cannot be justified as the cause of any instability considered here.

5. To be more specific, the statement at the top of the right hand column on p. 96," ... at burnout the temperature cannot increase without limit in a constant temperature system.", defies analysis in English.

6. The section on Reactor Instability (p. 98) is approximately the reverse of the actual behavior of a boiling reactor. The behavior of the spatial and time variation of void fraction constitutes the forcing function a boiling reactor.

7. It is very difficult to understand how the liquid superheat threshold (p. 99) has any influence on reactor stability. The quote from Ref. 8 by Anderson and Lottes refers to the fact that oxide fuel elements possess a much lower thermal diffusivity than metal fuels and therefore will dampen power feedbacks from temperature fluctuations to a greater degree. The stability referred to here is the per cent temperature difference oscillation when compared to the overall fuel temperature difference.

8. The discussion of liquid metal boilers (pp. 90-101) is full of confusion. A "once-through boiler" is by definition one which produces saturated vapor or, more probably, superheated vapor, so that a mention of "high quality" is meaningless. The remaining paragraphs do not touch upon the basic problems at all, because the discussion is based upon the

erroneous conclusions of the article's first few pages.

—J. B. Heineman/H. Fauske/P. A. Lottes/B. M. Hoglund
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