CONF-760439--1

LA-UR-76-887

TITLE: SUMMARY OF COMMENTS OFFERED AT THE MEETING ON RECRITICALITY ENERGETICS, ANL, APRIL 5 AND 6, 1976

AUTHOR(S): William R. Stratton

SUBMITTED TO: Proceedings of title meeting

los alamos
scientific laboratory
of the University of California
LOS ALAMOS, NEW MEXICO 87544

An Affirmative Action/Equal Opportunity Employer

Form No. 836
St. No. 2629
1/75

UNITED STATES
ENERGY RESEARCH AND
DEVELOPMENT ADMINISTRATION
CONTRACT W-7405-ENG. 36

Summary of Comments Offered at the
Meeting on Recriticality Energetics, ANL,
April 5 and 6, 1976

1. To start off I can do no better than to paraphrase Herb Kouts who, shortly after he accepted the position of director of Division of Reactor Safety Research of the AEC wrote that we (those interested in the technical matters of reactor safety) must convince the scientific community before we can hope to convince the public. In case of the Fast Breeder Reactor I believe that we must convince ourselves or at least arrive at a consensus, then convince the scientific community and then the public. It may be that what convinces us would convince the remainder of the scientific community, but this is not obvious.

2. My personal belief is that FBR'S cannot be caused to "violently disassemble" (for the moment I would rather defer a definition) without special assumptions. However, it is not easy to prove a negative and I admit that other opinions can and are held; this fact is certainly one of the reasons we are here. Most of <u>us</u> must be convinced of the safety of the FBR.

3. In defense of this personally held position, I note two points:

(a) a search has been going on for 20 or more years, to find a mechanistic sequence of events that would cause a reactor to fail sufficiently violently so as to cause the vessel and vessel head to fail. The search has been unsuccessful; every proposed problem, when examined closely, has vanished. I believe

that no such sequence of events now exists that has been proven to be a cause of a violent disassembly -- a couple such are postulated, but a close examination has not been yet completed.

(b) We insist upon postulating conditions that demand fuel melting. That is,- we postulate an industrial accident and then try to show that no threat to the health and safety of the public develops from a "violent disassembly". It is a fine line, but I believe that we can accept such conditions and come out wearing a white hat. Some motion is required to turn off such an industrial accident - the question is the amount of motion.

As side comments:

When discussing these matters with others in the scientific community we should make clear the assumptions we impose upon ourselves; this is not always understood.

Also, in the matter of terminology - and I confess to poor practice as much as anyone - we should insist upon precise meanings.

A TNT explosion implies pressures of up to 10^5 atmospheres, shock waves of velocities of $5\text{-}8\text{x}10^5$ cm/sec, and material velocities of 10^5 cm/sec = 1km/sec.

These conditions are not appropriate for the mild incidents we discuss.

We should stop the discussion to define terms whenever the notion of an explosion is introduced.

I do not especially like the term "disassembly" but I can't think of a better one.

We should be specific and quantitative, though. By quantitative I mean a measure of damage potential. The conditions

we postulate require some motion, either

- fuel taken out of the core, or
- redistribution of fuel in the core, or
- a small expansion of the core.

Any of these actions can be accomplished non-violently, and without any significant alteration in the potential for release of activity.

To remind ouselves again - we postulate an industrial mess and further motions (disassembly if you wish) need not be violent, may be peaceable, and may not threaten the public.

4. As you may expect, I propose that experiments be conducted that would involve more than one subassembly (1 + fraction of 6 + reflector to create a self-driven system).

The basic problem is the same as it was 10 years ago and 20 years ago, namely:

What is the course of events, given the melting of sizeable amounts of fuel, collapse and disassembly, or boiling and shut-down, or some combination of these?

In the last decade Dave Hall made the suggestion in 1967 and 1970, George Bell in 1972, and more recently, in ANL, by John Marchaterre and others. I lean to Bell's proposals as being the simplest and logically leading from one system to different, more complicated systems.

We could never do enough experiments to cover all variables, and calculations will be required for understanding of different cases and extrapolation to reactor size systems.

A strong computational program is needed, first to guide the experiments and later to extrapolate results to systems of major

interest.

Also, such experiments can provide guidance to smaller, in-pile experiments, as those conducted in Treat, and possibly later in Super-Treat and Phoebus (proposed for Los Alamos).

I can commit myself, personally, to such a program; I believe that the LASL would be interested in cooperating in such a program but I cannot commit the LASL at this time.

One's first thought for such experiments would be a remote site, Idaho or Nevada, and, indeed, John Marchaterre has inspected the Rover reactor test area in Nevada. The facilities are adequate for conducting the experiment he has in mind.

Within the LASL, we perform contained plutonium equation of state experiments with high explosives and the possibility exists that at least some reactor experiments might be conducted at Los Alamos. Spherical shells of diameter either three or six feet are used for this purpose.
Double containment is provided by a second larger spherical shell of diameter 10 feet or 12 feet.

5. Finally, my second proposal is less costly and has to do with exchange of information. We do it poorly.

I have talked to Bill Cottrell, editor of Nuclear Safety. His turnaround time on letters is 6-8 weeks, He would be delighted if the journal were used as a place for quick exchange of information.

I believe that we need to resolve differences quicker, new results should appear sooner, if a serious disassembly sequence is found, it should be reported so others can investigate the matter.

I understand, as a starter, this meeting will be reported in Nuclear Safety - I hope as a letter.

Later Comments on Integral Experiments, Second Day

I commented that reactivity excursion experiments with complete or nearly complete reactors would be a very expensive way to obtain information and recommended against such a program.

In regard to very short period, subassembly experiments that would involve an energetic disassembly, it seemed apparent that such a program was not needed because no reasonable sequence of events had been found that led to such a condition. The only qualification offered was if a margin between realistic conditions and disassembly conditions had to be evaluated.

The concept of simple experiments involving a few fuel subassemblies was proposed again as a means to provide convincing evidence to the scientific community that melting fuel did not lead to unacceptable conditions.