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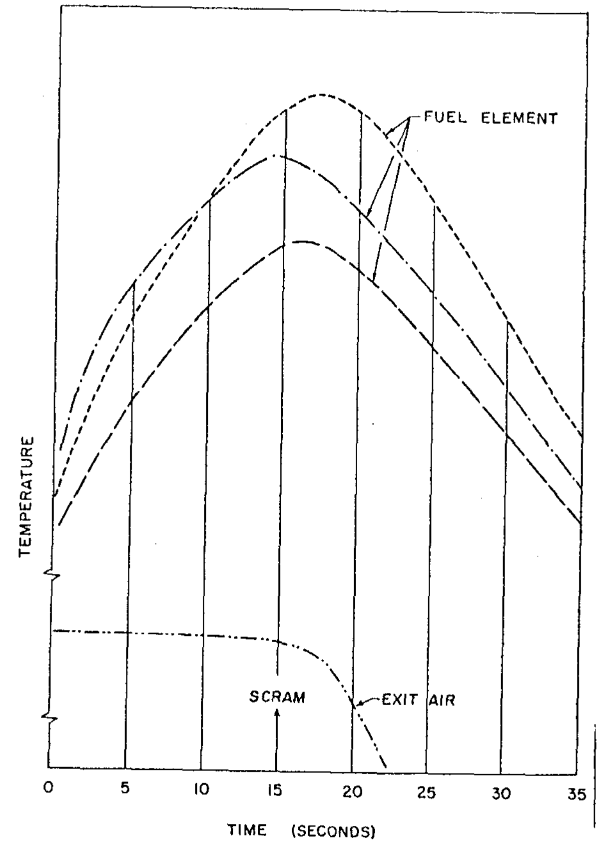

Temperature-Time Relationship During Melt.

residue indicated that melting and oxidation had taken place. Some fuel was redistributed in the test segment and some was swept along through the exhaust with fission products which were released as a consequence of the loss of element integrity.

The effluent was sampled before it left the stack, and a network of field sampling stations covering a sector 60° wide for 20,000 ft was used to determine dispersal patterns downwind of the release point. Fallout and airborne concentrations were established in the network but the activity was too low, under the existing meteorological condition, to determine the adequacy of diffusion theory in predicting concentrations at specific locations downwind.

25-2 A Summary of Experimental Results of the Spherical Core Investigations in the KEWB Program,* ***R.K. Stitt (AI).*** The Kinetic Experiments on Water Boilers (KEWB) Program examines the dynamic behavior of homogeneous research reactors. The experimental facility has been described in a previous publication.[1] Investigations have been made of the effect, on peak power, maximum pressure, and energy release, of the following operating parameters: (1) Amount of reactivity released; (2) Initial core pres-

*Sponsor: John W. Flora.

sure; (3) Void volume above the fu
power level; (6) Initial fuel temperat

The dynamic response of the reac
with stable reactor periods down to
ious initial pressures and fuel solutio
cm Hg, and solution volumes ranging
gated. Excursions run with the cor
slightly higher peak powers and max
full. In decreasing the core loading
volume for this type of reactor) a reg
developed during the transient beco
The maximum pressure developed
than that observed for fuel solution
power exhibited no dependence on th
insensitive to the initial system pr
cases where the periods were shor
maximum power results from incre

The response of the reactor to
ined for both the full and 85%-full c
until total reactivities of 4% Δk w
transients depended primarily on the
input result through minimum perio
burst from a ramp depends on the
nificant differences due to changes
ments. Ramp transients which wer
addition of 4% Δk, with the gas rec
inflammation in the core vessel dur
burst.

All transients described thus fa
than 1 mw. A series of step input t
1, 10, and 25 kw to determine the
activity releases near prompt cri
reactivity input is increased the t
initial power. In all cases the pe
activity release with initial power c

[1]M. E. Remley, J. W. Flora, D. L.
Boiler Reactor Kinetic Experimen

25-3 A Proposed Model of Bubble
D. P. Gamble (AI). Experimental
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period transients (20- to 2-msec p
tion.[1] Also evident is the fact that
as the period decreases. The occ
transients has an imperceptible ef
internal pressure of the gas in th
pressure. Moreover the inerti
saturation pressure, as computed
lead to the conclusion that the b
originally small subcritical bubb
bubbles required to produce the o
basis of thermodynamics. There
growth of small bubbles has been
are most promising since the di
volume. The time in which the th
volume in the charged particle
is short compared to the time

sure; (3) Void volume above the fuel solution; (4) Rate of reactivity release; (5) Initial power level; (6) Initial fuel temperature.

The dynamic response of the reactor to reactivity inputs which give rise to transients with stable reactor periods down to 2 msec has been examined under conditions of various initial pressures and fuel solution volumes. Initial core pressures of 15, 45, and 70 cm Hg, and solution volumes ranging from 85 to 100% of the core capacity were investigated. Excursions run with the core completely filled with fuel solution gave rise to slightly higher peak powers and maximum pressures than observed with the core underfull. In decreasing the core loading from 100 to 85% full (11.5 liters is the normal fuel volume for this type of reactor) a region was found wherein the magnitude of the pressure developed during the transient becomes a sharply varying function of the fuel volume. The maximum pressure developed at a loading of 12.6 liters was higher by a factor of 3 than that observed for fuel solution volumes differing from this amount by 1%. Peak power exhibited no dependence on these higher pressures. The assembly was also found insensitive to the initial system pressure over the range from 15 to 70 cm Hg for all cases where the periods were shorter than about 150 msec. For longer periods higher maximum power results from increased initial pressure.

The response of the reactor to linearly increasing reactivity inputs has been examined for both the full and 85%-full case. Ramp rates up to 0.12% Δk/sec were maintained until total reactivities of 4% Δk were installed. The peak powers observed for these transients depended primarily on the ramp rate and could be well correlated with the step input result through minimum period. The equilibrium power established after the initial burst from a ramp depends on the total reactivity input and heat removal rate. No significant differences due to changes in initial fuel volume were observed in these experiments. Ramp transients which were run at the maximum reactivity input rate and a total addition of 4% Δk, with the gas recombiner in operation, gave rise to hydrogen-oxygen inflammation in the core vessel during the period of stable power operation following the burst.

All transients described thus far were conducted with an initial power level of less than 1 mw. A series of step input transients were run with initial stable power levels of 1, 10, and 25 kw to determine the effect of initial power level on peak power. For reactivity releases near prompt critical the peak power is markedly decreased. As the reactivity input is increased the transients become similar to those observed with low initial power. In all cases the peak power is less than that observed for the same reactivity release with initial power of less than 1 mw.

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[1]M. E. Remley, J. W. Flora, D. L. Hetrick, L. P. Inglis, "Program Review of the Water Boiler Reactor Kinetic Experiments", NAA-SR-1525, (1956).

25-3 A Proposed Model of Bubble Growth During Fast Transients in the KEWB Reactor, *D. P. Gamble (AI).* Experimental evidence indicates that the dominant shutdown mechanism operating in the Kinetic Experiment Water Boiler Reactor (KEWB) during short-period transients (20- to 2-msec periods) is void production from radiolytic gas evolution.[1] Also evident is the fact that the time required to produce these voids is shortened as the period decreases. The occurrence of inertial pressures up to 30 atm during fast transients has an imperceptible effect on the gas-generated void volume. Therefore, the internal pressure of the gas in the bubbles must be significantly larger than the inertial pressure. Moreover the inertial pressures are comparable to the observed gas-saturation pressure, as computed by Henry's Law from the energy release. These data lead to the conclusion that the bubbles responsible for shutdown in fast transients are originally small subcritical bubbles which have high internal pressure. Growth of such bubbles required to produce the observed reactivity changes appears inexplainable on the basis of thermodynamics. Therefore, a search for a mechanism which will force the growth of small bubbles has been conducted. Processes which involve fission fragments are most promising since the dissipation of large amounts of energy occurs in a small volume. The time in which the thermal spike and ionization associated with the disturbed volume in the charged particle wake are dissipated[2] is of the order of 10^{-10} sec, which is short compared to the time required, 10^{-7} sec, for completion of the chemical re-