Re: fission question

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From: Steve Harris sbharris_at_ROMAN9.netcom.com (*sbharris_at_ix.netcom.com*)
Date: 07/26/04

Date: 26 Jul 2004 13:00:34 −0700

puppet_sock@hotmail.com wrote in message
news:<c7976c46.0407260611.62276699@posting.google.com>...
> sharp@cadence.com (Steven Sharp) wrote in message
news:<3a8e124e.0407231355.15f66c0c@posting.google.com>...
> [snip]
> > Are you sure that radiation is the dominant heat loss mechanism from
> > the core in that timeframe? These cores were sitting inside
> > hemispherical hollows in metal reflectors. The thermal contact may not
> > have been great, but there would be some conduction into that larger
> > metallic mass, delaying meltdown.
>
> Horseback feeling from experience with commercial nuclear fuel:
> A core such as this, in five seconds, would be fairly accurately
> treated as adiabatic. That is, practically speaking no energy
> would conduct out thermally in that time. I certainly have not
> run any numbers on it. Certainly a power pulse in the 10's of
> kilowatts range would be very little affected by conduction during
> the first few seconds.

COMMENT:

Agreed. This is a little 2 inch ball of metal into which we're dumping 60 kw. It doesn't matter what solid it's in contact with−− it's gunno go over 500 C and melt.

> Probably thermal radiation during the first few seconds would be
> nearly negligable as well. Just not time for the heat to move around
> very much.

Well, the heat doesn't have to move inside the metal because it's generated uniformly in place. The interior will certainly melt. IR at best would keep an external shell intact, which would depend on a thin rind of solid Pu−239 cooled by radiative surface loss. However, we calculated that at the melting point of Pu, and it's less than 300 watts at the melting point, so no help there.

>
> I'm thinking, though, that a significant fraction of the energy

> *would have gone away as neutrons that didn't interact with the*
> *core. The fact that this thing is just barely over prompt would*
> *tend to say that there are still a goodly fraction going away,*
> *winding up in lab gear, lab personnel, etc. So, the lack of a*
> *melt may not be all that surprising, as long as the event is*
> *terminated in a few seconds. The lab equipment probably got warm*
> *(thermally as well as by induced radiation) fairly quickly.*
> *Socks*

Nah, you're wrong there. Fission neutrons have a median (most probably) energy of maybe 0.7 Mev and average maybe 2 Mev. We use the average. Figure 2.5 neutrons per fission and you get 5 MeV in neutrons per 200 MeV fission. That's only 2.5% of the energy in neutrons. Sorry. 97% or more of fission thermal power comes from fission fragments smacking into surroundings. And most don't get far.

SBH