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Flash reactors for Medical Research

1. We have been considering the relative merits of operating a reactor by the method of pulsing or flashing it, as opposed to the steady-state mode used in the existing MRR, for medical research applications.

2. The flash-type nuclear reactor is expected to have advantages in terms of:
   a. Achieving high intensity irradiations in time intervals short enough to preclude normal restorative processes in chemical and biological structures.
   b. Differential activation favoring reactions producing activities of short half-life.
   c. Low contamination of the slow neutron stream by other radiations, particularly fast neutrons and gamma rays.
   d. Simplicity of operation.
   e. Greater inherent safety.
   f. Less cumbersome biological shielding.

3. The special value of the flash reactor resides largely in the first two items above. Even though the time required for a flash may be long compared with the lifetimes of free radicals, the dose rate in a flash may be high enough to enhance the biological effect for a given amount of energy absorbed. The last four items are desirable features which we believe can be more readily achieved with a flash reactor than with a steady-state one, but which are not necessarily inherent in the flash concept and which would require further engineering to be accomplished.

4. Desirable output (at the treatment port) and operational requirements in a flash reactor specifically designed for medical research purposes are:
   a. Slow neutrons 10^{13} nvt per pulse.
   b. Exposure area adjustable from 1 cm x 1 cm to 20 cm x 20 cm.
   c. Fast neutrons (over 1 KeV) less than 10^{9} nvt per pulse.
   d. Gamma rays below 100 r per pulse.
   e. Length of pulse 10 milliseconds, preferably much less.
   f. Re-cycle time 20 minutes or less.

5. To evaluate the expected advantages and to determine to what degree it is feasible to meet the above output and operational requirements, it is suggested that a series of experiments be conducted with a prototype installation.

   Both the radiation effects and activation analysis applications might be investigated first with a program of limited extent, on a test-tube and small animal basis, using material suitable for transport to the site of the prototype assembly. Exploration of therapeutic application in humans could likewise be carried out there as soon as a practicable procedure is established. The advantages, once proved, would best be exploited with the reactor built as an integral part of the appropriate medical research center.