Plutonium Pacemakers

Erkin Ötleş
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This is a reformatted version of a twitter thread I had put together nearly a year ago. In a former life I worked on designing the manufacturing system for cardiac pacemakers. I had done a bit of research on pacemakers at the time, but I had never come across the fact that some early pacemakers were designed and built with plutonium power sources.

Begin reformatted thread:

Fell down a history hole and came across the fact that we used to implant plutonium (!) powered cardiac pacemakers ❤️⚡☢️

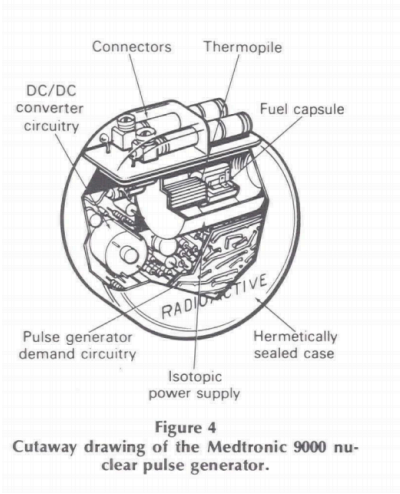
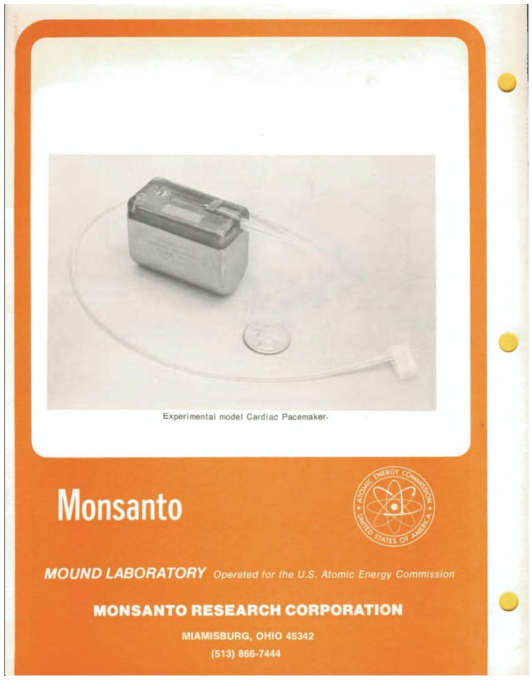


Figure 4
Cutaway drawing of the Medtronic 9000 nuclear pulse generator.

Above is a cutaway schematic - they used the heat generated from radioactive decay to generate electricity using thermocouples [1] Why nuclear power? In the early days if you wanted to pace a patient for a long time (i.e. a pediatric patient) you would need to replace the pacing device a lot because the batteries would die 🔋😦 [2]

clear power sources for implanted devices in the context of today's pacing innovations. Because the mercury-zinc cells used in the earliest implanted pacemakers lasted for such a short time, typically about 18 months, the need for a new power source was evident. Various manufacturers then worked on the development of radioiso-

In order to sell these in the US you needed sign-off from both @US_FDA and the @NRCgov (nuclear regulatory commission). of course @Medtronic made one, but apparently a bunch other folks got in the game as well - including monsanto! [3]



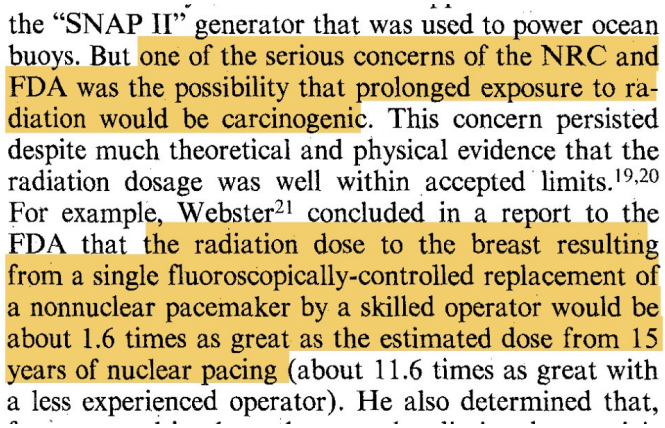
As weird as it sounds people were into the concept of having plutonium powered pacemakers at the time. [2]

Discussion

It will be many years before the true value and exact place of the nuclear pacemaker is established. However, it is clear, even at this early stage, that they are reliable. There is widespread public acceptance of these devices. The patients that have them are proud of their "unconventional" pacemakers and there are many disappointed patients who would like to have one but do not meet the current protocol criteria.

By January 1975, the AEC will have decided on the significance of the environmental impact of these devices following a detailed study that has been going on for years. A decision will be made at that time what restrictions if any — other than retrieval — will be imposed on the use of nuclear pacemakers.

Radiation exposure was a concern, although theoretically the devices were well shielded and risk would be minimal. theory was borne out in practice - after years of study it turned out that patients with these pacemakers did NOT have higher rates of cancer. [4]



the "SNAP II" generator that was used to power ocean buoys. But one of the serious concerns of the NRC and FDA was the possibility that prolonged exposure to radiation would be carcinogenic. This concern persisted despite much theoretical and physical evidence that the radiation dosage was well within accepted limits.[19,20] For example, Webster[21] concluded in a report to the FDA that the radiation dose to the breast resulting from a single fluoroscopically-controlled replacement of a nonnuclear pacemaker by a skilled operator would be about 1.6 times as great as the estimated dose from 15 years of nuclear pacing (about 11.6 times as great with a less experienced operator). He also determined that,

Thousands of these pacemakers were implanted in the 70s and it turns out that they lasted for a very long time. in 2007 a case report was written about a pacemaker that was still firing since its implantation in 1973! 😯 [5]

This crazy longevity wasn't necessarily a great thing - replacements = better features (i.e. interrogation and programming). plus end-of-life disposal issues made plutonium pacemakers a poor choice once better batteries came along.

On one hand the logic behind why you would design and implant these pacemakers makes total sense and on the other its totally wild because of the current stigma associated with everything nuclear.

Bibliography

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