dria. It's a large flattish cylinder stood on its side—not the way you see it on the truck (p.14): that's just to transport it. In a CANDU nuclear reactor, the calandria is full of tubes which hold the fuel bundles. There are 306 horizontal fuel channels in RAPP I, each containing 12 fuel bundles. The whole thing is sealed up at both ends. To produce a chain reaction, you then flood the calandria with heavy water. As the level of the heavy water climbs, more and more fuel channels are immersed—just as many as the operating crew wants.

How hot does it get inside a fuel channel?

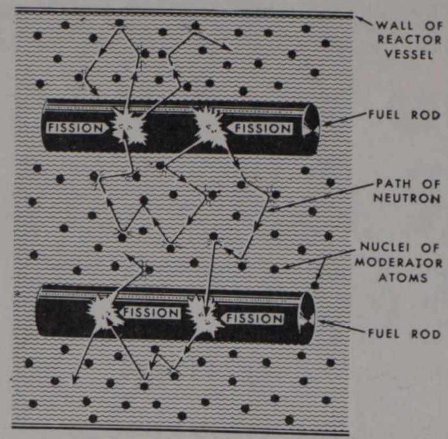
Maximum 3,500 degrees Fahrenheit (1,930 degrees Centigrade).

Why doesn't the whole thing just melt?

Because the heat is carried off as fast as it's produced. It's one thing to produce a controlled nuclear reaction. It's another to harness the heat, in this case to make steam to turn a turbine-generator. To take off the heat there is a separate system known as the heat transport system which in turn produces steam to drive the turbine-generator direct.

So there are two different lots of heavy water?

Correct. One, the moderator, is stored in the dump tank under the calandria and pumped up into the calandria as needed. The other, called the coolant, is



forced through the zircaloy tubes past the fuel bundles and round to the exchange boilers to heat ordinary water for the turbine generator. When it leaves the fuel channel the coolant is at 560 degrees F. By the time it completes the circuit it has cooled to 480 degrees F. That much heat has been passed on. Of course, the coolant operates under high pressure (1,500 pounds per square inch at the entry to the fuel channel).

Fresh uranium fuel is harmless, but spent fuel is highly radioactive. Hence refuelling is done by sophisticated machines behind steel and concrete doors. Personnel who enter the reactor building wear special clothes and carry radiation badges. There are strict decontamination drills.

Spent fuel is buried for years under 20 feet of water in a concrete-lined pit. Then there's tritium—a radioactive toxic gas readily absorbed by the lungs and the skin. Tritium is hydrogen's other isotope. When heavy water passes through a functioning reactor some of the deuterium atoms capture neutrons released by the fission process.

Tritium gets out when there's a leak in one of the heavy water systems. To localize the threat it poses, areas prone to contamination are kept at lower atmospheric pressure than the rest of the plant. Otherwise a draft might sweep the tritium into the other buildings.

There are other safety devices. The calandria can be emptied of heavy water in seconds. Normally the head of heavy water is stablized with helium. The moderator circulates to carry off waste heat from the calandria. If the control room wants to it can stop the reaction by rapidly emptying all the heavy water from the calandria.

The worst thing that could happen would be a major rupture of the heat transport system. This could fill the reactor building with heavy water vapour at high pressure. In case that ever happens, there is a dousing tank in the dome of the reactor building which can deluge the interior with water to condense the steam and prevent the pressure building up.

The plant contains sophisticated safety devices. Before the operator can throw the switch unleashing the fission process he must unlock the equipment with keys taken from the doors of the reactor building. If the keys aren't in place it may mean someone is inside the building, or didn't close the door when he left. ■