



Palisades' Leaking SIRWT

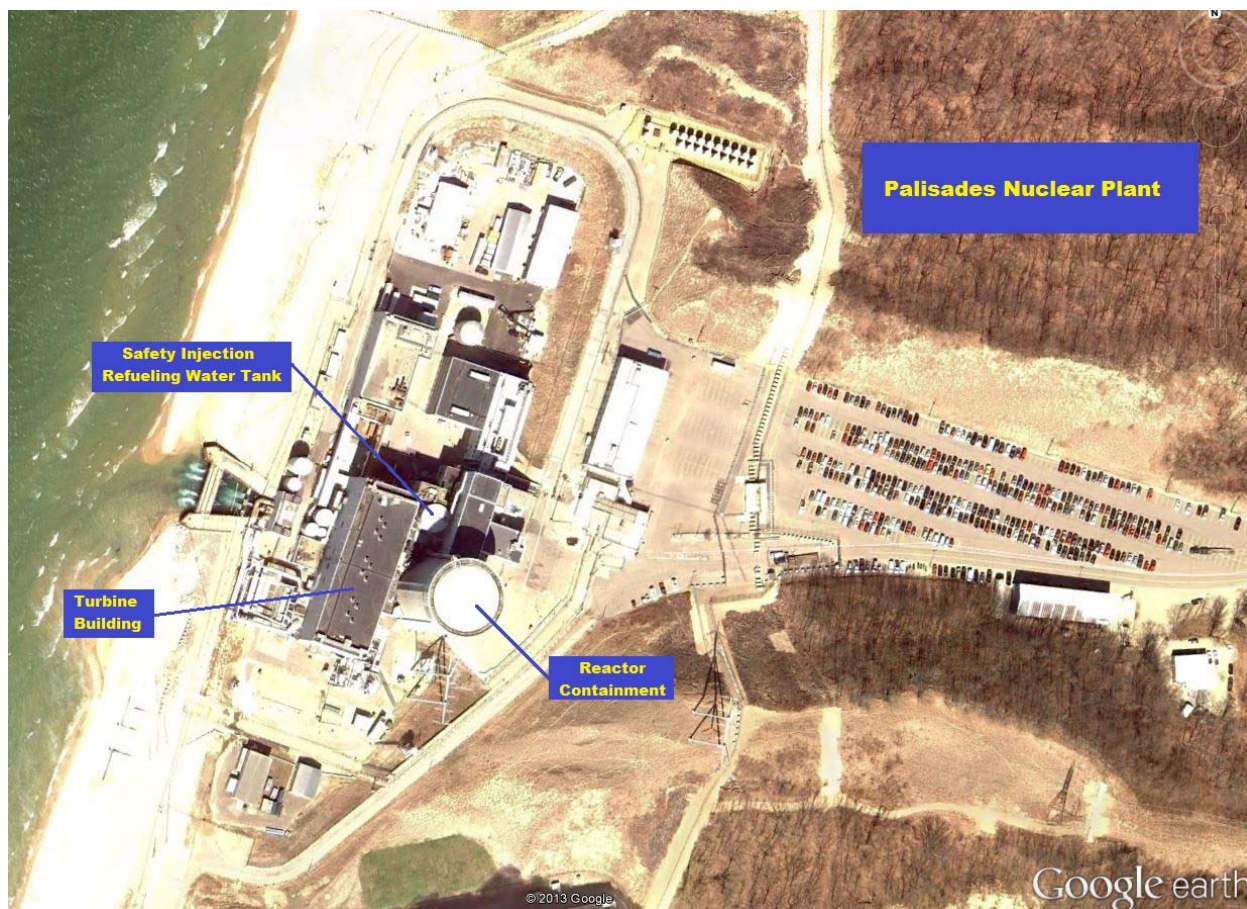
The Nuclear Regulatory Commission (NRC) was notified by the owner of the Palisades nuclear plant near South Haven, Michigan that operators began shutting down the reactor on May 5, 2013, because about 90 gallons per day was leaking from the SIRWT.

What is the SIRWT?

The SIRWT is an acronym for the safety injection refueling water tank. It is an aluminum tank 24 feet tall, 46 feet in diameter, holding a minimum of 250,000 gallons of borated water when the reactor is operating.

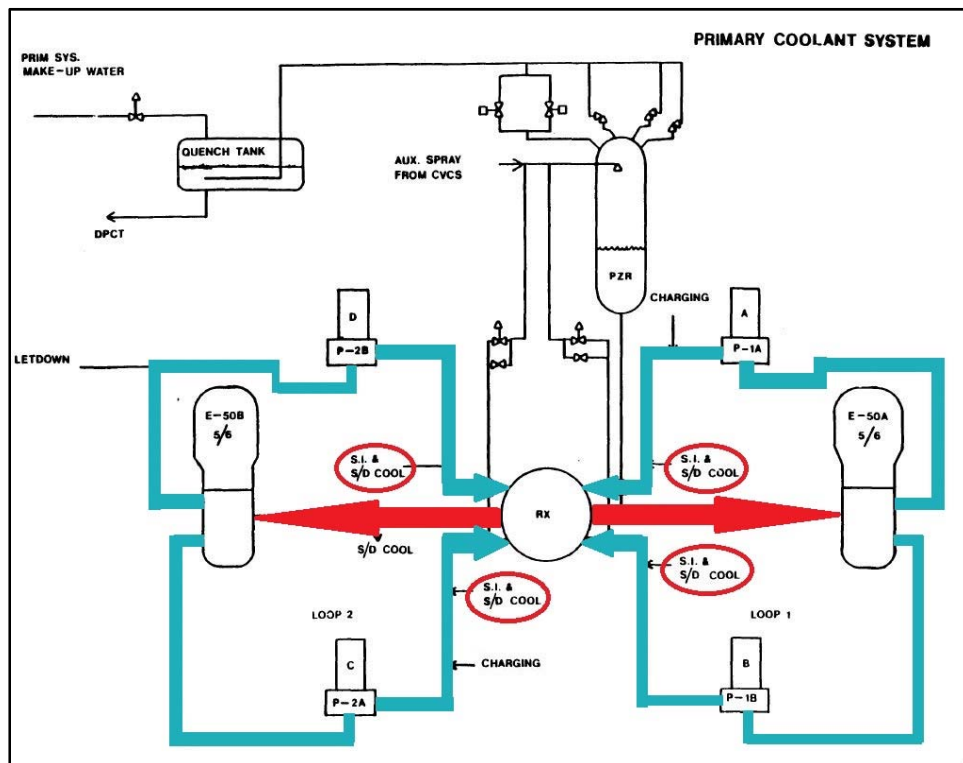
Where is the SIRWT?

As shown in the Google earth photograph, the SIRWT is located east of the turbine building and northwest of the reactor containment building. It is located directly above the plant's control room.



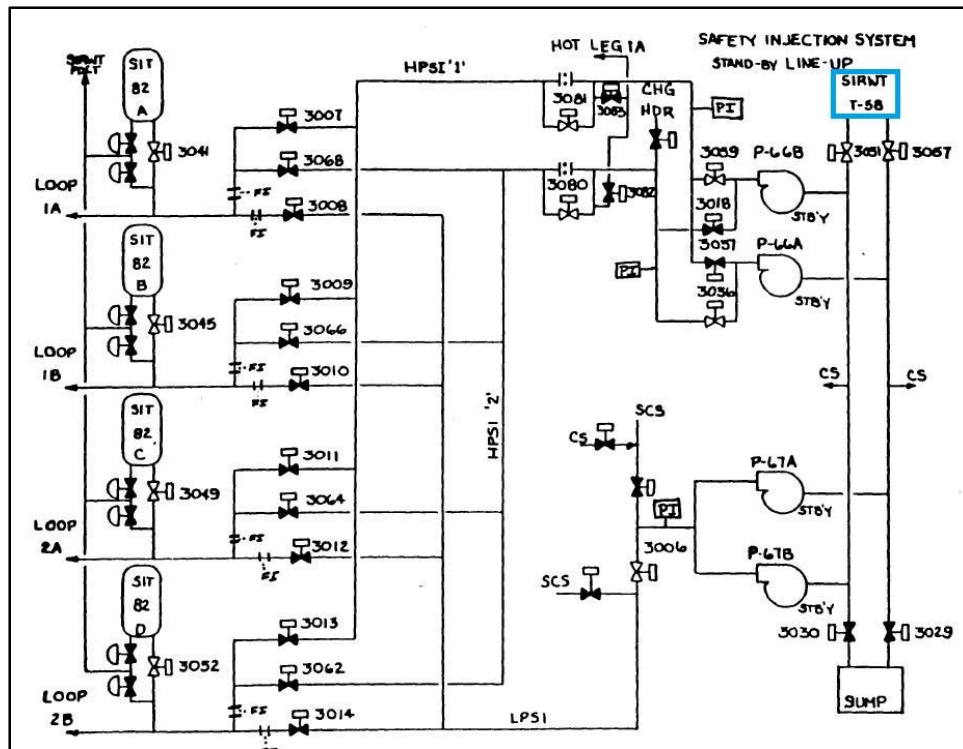
What is the function of the SIRWT?

The SIRWT is a water warehouse during routine plant operations and in event of accidents. It supports refueling outages by providing water needed to flood up the space above the reactor vessel so that irradiated fuel assemblies can be safely removed from the reactor core and replaced with new assemblies. It also receives water as the space above the reactor vessel is drained near the end of a refueling outage.



Schematic of the primary coolant system at Palisades showing the reactor vessel (RX), the two steam generator (S/G) loops, the four reactor coolant pumps (P-1A, P-1B, P-2A, and P-2B), the pressurizer (PZR), and the four connection points for the safety injection (S.I.) system.

During normal operation, water heated by passing through the reactor core flows from the reactor vessel to the steam generators via the red paths. This water flows through thousands of metal tubes inside the steam generators. Heat conducted through the tubes walls boils water used to spin the turbine/generator to make electricity. “Cool” water exits the steam generator tubes and gets pumped back to the reactor vessel via the light blue paths. The safety injection connections are passive in a standby mode during normal operation.



Schematic of the safety injection system at Palisades showing the safety injection tanks (SIT), the SIRWT, and two high pressure safety injection (HPSI) pumps (P-66A and P-66B), the two low pressure safety injection (LPSI) pumps (P-67A and P-67B), and the four lines connecting to the primary coolant system.

If water drains from the primary coolant system, the safety injection system responds as needed. In event a large rupture causes a rapid loss of water inventory, the four safety injection tanks collectively supply 30,000 gallons of makeup water. The SITs are partially filled with water and topped by nitrogen gas under pressure. If the pressure inside the reactor vessel drops low enough, the nitrogen pressure inside the SITs automatically “pushes” their water into the reactor vessel.

The LPSI pumps back up the SITs. The flow from the SITs provides time for the LPSI pumps to start transferring water to the reactor vessel from the SIRWT. The LPSI take over when the SITs are emptied.

The HPSI pumps handle smaller losses of water from the primary coolant system; ones that rob cooling water but keep pressure inside the reactor vessel too high for the SITs and LPSI pumps to do their thing.

Before the SIRWT empties, the HPSI and LPSI pumps swap over to take water from the containment sump instead. If water is lost from the primary coolant system, it winds up in the basement of the reactor containment building in its sump, a concrete pit. The HPSI and LPSI pumps recirculate water from the sump to the reactor vessel. After cooling the reactor core, the water pours out the ruptured pipe or component into containment where it returns to the sumps for re-use.

The SIRWT and sump also supply water to the pumps that spray water from carwash-styled nozzles inside containment if necessary to cool down the containment’s atmosphere during an accident.

What's wrong with a leaking SIRWT?

Because of past problems with SIRWT leaks, the NRC and Palisades' owner agreed last year that the reactor would be shut down when indicated leakage exceeded 38 gallons per day – a relatively small amount from a tank holding a minimum of 250,000 gallons. It would take 18 years for that amount of water to drain from the tank at 38 gallons per day.

But two factors require that the reactor be shut down for such a modest leak rate: (1) gravity, and (2) LBB. The SIRWT is physically located above the control room. In the past, gravity helped some of the leaked water find its way into the control room. As Fukushima reminded us, electrical equipment does not work well underwater and there's plenty of electrical equipment inside the control room. LBB is nukespeak for "leak before break." Pipes and tanks are designed to hold water. Leakage from pipes and tanks indicates a breach in their integrity. Depending on the pathway, the breach could be early signs of a degrading condition that can only get worse with time. The mission time for vital emergency equipment such as the safety injection system – or the duration that it is assumed to function following an accident – is commonly 30 days. A small leak today left unattended could become a large leak tomorrow. The SIRWT could rupture and be drained of water before the safety injection and containment spray pumps do their things.

The sump steps in to take over as the source of water for the safety injection and containment spray pumps. But this pool of water is only deep enough when the SIRWT has been emptied into it. If the SIRWT water flowed into the control room or elsewhere, the sump may not contain enough water.

What must be done about the leaking SIRWT?

Palisades has had recurring problems with SIRWT leaks. Federal regulations, specifically Appendix B to 10 CFR Part 50 (online at <http://www.nrc.gov/reading-rm/doc-collections/cfr/part050/part050-appb.html>), mandate that owners have effective programs to find and fix safety problems. Applying band-aid fixes every few months is not complying with this federal regulation. The NRC must take steps to ensure that a federal regulation developed to protect public health and safety is consistently being met rather than consistently being violated. "Patch and restart" may be great for generating revenue, but it is very bad for public safety. The community does not deserve another Palisades patch. It deserves an effective repair.

Prepared by: David Lochbaum
Director, Nuclear Safety Project

Source: NRC Preliminary Notification of Event or Unusual Occurrence – PNO-III-13-004, May 6, 2013 (available online at <http://pbadupws.nrc.gov/docs/ML1312/ML13126A270.pdf>)