

Clarington Transformer Station

SAFETY BY DESIGN

HOW DOES HYDRO ONE ENSURE ITS EQUIPMENT OPERATES SAFELY?

Hydro One invests in a robust proactive maintenance approach to ensure its equipment operates safely and reliably. All transformer stations are operated remotely from Hydro One's grid control centre where they are monitored by technology and Hydro One employees on a 24/7 basis. Hydro One employees will also conduct site visits and inspect the oil water separator and containment systems at the Clarington Transformer Station on a monthly basis.

Each of the 500/230 kilovolt transformers at the Clarington Transformer Station (TS) will be equipped with more than 30 automatic early warnings and alarms that will communicate with the province's Grid Control Centre on a sub-second basis. If an alarm is triggered at Clarington TS for any reason, a Hydro One employee will be dispatched immediately to investigate the cause.

WILL THERE BE ANY PCBs USED ONSITE?

The construction and operation of Clarington TS will not include the use of any PCBs, cadmium or mercury. Today, all of Hydro One's transformers use mineral insulating oil, which is the same category of oil used in food packaging, cosmetics and pharmaceuticals*. Each transformer will hold up to 165,000 litres of mineral oil.

At Clarington TS, the type of mineral oil utilized, will be Luminol transformer fluid which through testing have been determined as inherently biodegradable in natural environments according to OECD 301 B - Biodegradation Test and are not considered hazardous according to the Material Safety Data Sheet (MSDS).

WHAT PROTECTIONS ARE BUILT INTO THE TRANSFORMERS?

The 500/230 kilovolt transformers that will be installed at Clarington TS contain several levels of protection to ensure the environment will remain protected throughout the operation of the station. All containment systems must meet Ministry of Environment and Climate Change requirements.

The first level of protection is the 24-7 monitoring system with automatic early warnings and alarms as described above.

The second level of protection is a self-containment system located on each of the transformers themselves, which includes a state-of-the-art Transformer Pressure Relief Plate (TPRS) system. In the unlikely event that the transformer experiences excessive pressure, the pressure is relieved and the oil is directed internally within the sealed containment of the transformer.

The transformers are also situated inside impermeable spill containment pits. Each pit is capable of holding up to 260,000 litres of mineral oil stored within a transformer. The transformers themselves are placed on foundations which are separate structures from the pits. The specified concrete, the steel reinforcement and the manner in which it is detailed provide adequate resistance to transformer vibration.

Any liquids entering these containment pits are directed toward the third level of protection which is the holding tank oil-water separators. The oil water separator system has the capacity of holding

220,000 litres of fluid. These are designed to ensure mineral oil from the transformers remains contained within the separators and ultimately remain safely stored within the station allowing for collection and removal for safe disposal.

WHAT ARE THE DESIGN SPECIFICATIONS FOR THE CONTAINMENT SYSTEM?

The containment pits are 32.65 metres (m) long by 19.76 m wide and 0.6 m deep. The floor and the walls of these units are 200 millimetre (mm) thick and are reinforced with double layer 15M (16mm in diameter) rebars spaced at 300 mm intervals. The concrete will be 35 MPa with maximum water cement ratio of no more than 0.5 and air entrainment of 5 – 8 per cent and is similar or identical to a Ministry of Transportation specification for concrete bridges. Concrete samples are taken as the spill pits are cast and tests are performed to ensure that specifications are met.

The holding tank oil water separator is a double tank system which sits side by side with each one measuring 8.59 m long by 3.24 m wide by 4.10 m deep. The concrete for the oil water separator tanks is pre-cast and manufactured in a temperature controlled environment to ensure a high quality product. The thickness of the floor and the walls of these units ranges from 230 mm to 250 mm and are reinforced with double layer 25M rebars spaced at 200 mm intervals. All concrete used for the containment system will meet the Canadian Standards Association requirements.

WHAT IF A TRANSFORMER DISCHARGES MINERAL OIL BEYOND THE STATION FENCE?

Hydro One recognizes the importance of protecting the natural environment and preserving the groundwater. Hydro One has conducted extensive study at the site and remains confident that the soil, surface water and groundwater will remain protected throughout the construction and operation of the Clarington TS.

Our research and site monitoring demonstrates that beneath the site is a very dense silt till layer (referred to as Newmarket Till) that serves as an aquitard (a geologic layer that restricts groundwater flow). The Newmarket Till is estimated to be 50 to 100 metres (m) thick beneath the site. The very nature of the surficial dense silt till would significantly slow mineral oil from spreading into the shallow groundwater system and from migrating toward water supply wells.

In the very rare and unlikely event that mineral oil travels outside of the station's three-level containment system, the very dense sandy silt till (Newmarket Till) beneath the site would work to naturally restrict mineral oil from migrating downward away from the source, and allow for rapid and complete clean up and recovery of discharged mineral oil at the source.

HOW DOES HYDRO ONE RESPOND TO ON-SITE EQUIPMENT FAILURES?

Between Hydro One's proactive maintenance program and multi-level containment system, Hydro One takes every necessary precaution to prevent equipment failures.

In the event an equipment failure occurs at the station, Hydro One has also developed an Emergency Response Plan (ERP) for the Clarington TS, as it does with all of its transformer stations. The purpose of the ERP is to provide Hydro one employees with quick access to critical information in the initial stages (first 24 hours) of an emergency situation. The ERP will be shared with local emergency responders including Durham Regional Police Service and Clarington Emergency and Fire Services.

For more information on Hydro One's transformers and spill containment systems, please visit:

<http://www.hydroone.com/Projects/Clarington/Pages/ProjectResources.aspx>

Source: Insulating Oil Characteristics – Volume 1 Characterization Results, Electric Power Research Institute, TR-106898-V1 4168, 9087, Final Report, December 1996