Ongoing monitoring of transformer temperature and pressure, and regular preventative maintenance, is likely to find the rare leak when it is still small before it has a chance to leak much oil.

Figure 6. GSU Transformer with Secondary Containment to Capture any Leaked Oil

There was a time when most transformer oil was toxic. From 1929 to 1977 polychlorinated biphenyls ("PCBs"), a man-made alternative to mineral oil, was commonly used as transformer oil instead of mineral oil. However, the toxicity of PCBs was eventually understood, leading to PCBs being banned in the US in 1979. Today, transformers either use mineral oil or vegetable oil, both of which are free of PCBs. Mineral oil is non-toxic to humans, in fact "baby oil" that is commonly used to soothe an infant's skin is a scented mineral oil. Although non-toxic to humans, mineral oil is an environmental contaminate and harmful to aquatic ecosystems, so any release to the environment should be avoided. The potential for negative environmental impact from spilled vegetable oil is much less because these oils are biodegradable, so the time they impact the environment is short-lived. Federal regulations dating back to the Clean Water Act of 1973 require that facilities with significant quantities of oil prevent pollution of water.[15] The current EPA regulations require that facilities with over 1,320 gallons oil, and with the potential for spilled oil to impact surface water, develop and implement an oil spill prevention, control and countermeasure ("SPCC") plan. While the risk of negative environmental impact from a transformer oil spill/leak cannot be eliminated entirely, these regulations along with standard industry practices, result in a low probability for a substantial spill and a high probability for a quick clean-up response to minimize impact if a spill were to ever occur.

Toxicity: Operations & Maintenance

Unlike most other electricity generation facilities, PV systems do not produce any air emissions. The only way they could produce emissions is in the case of a fire. The potential human health impacts from contact with smoke from burning PV panels was studied by the IEA-PVPS in their first report on human health risk assessment. In that study they did not study ground-mounted PV, presumably because of the extremely low risk of significant fire, but they did investigate the potential health impacts of lead in silicon modules and cadmium in cadmium telluride modules dispersing in smoke from a fire in a building that is covered in rooftop PV modules. The study considered several worst-case scenarios for different size buildings and different environments and found no risk of harmful health impacts from the smoke from PV panels.[16]

The only other two aspects of O&M that have raised concerns about toxicity are the fluids used to wash panels and herbicides used to maintain vegetation.

- **Panel Washing** – Across GA there is ample rain to keep the panels clean. If the panels do need to be washed, it would occur infrequently and typically with use of deionized water and cleaning brushes.
- **Herbicides** – The industry standard practice for maintaining the vegetation at solar facilities is similar to how most cities maintain their parks, which is they primarily rely on mowing and string trimmers for vegetation and use herbicides along fences, on roads, and under some equipment. Parks and solar facilities also use herbicides to strategically remove problem weeds, especially woody weeds, to maintain a healthy cover of the desired species of grasses and other low-growing vegetation. This mode of herbicide use applies significantly less herbicide volume than is commonly applied in GA agriculture. For example, Round-Up-Ready crops are common row crops that have been engineered for the entire field to be sprayed with Round-Up (glyphosate) several times each season. Additionally, farmers applying most types of herbicides to their fields are not required to be certified or licensed, but a GA commercial pesticide applicators license is required to apply any herbicide to a solar facility.

[15] Environmental Protection Agency, webpage: Overview of the Spill Prevention, Control, and Countermeasure (SPCC) Regulation, www.epa.gov/oil-spills-prevention-and-preparedness-regulations/overview-spill-prevention-control-and

[16] P. Sinha, G. Heath, A. Wade, K. Komoto, 2018, Human Health Risk Assessment Methods for PV, Part 1: Fire risks, International Energy Agency (IEA) PVPS Task 12, Report T12-14:2018, https://iea-pvps.org/wp-content/uploads/2020/01/HHRA_Methods_for_PV_Part1_by_Task_12.pdf