Case study of a site using Subsurface Metabolism Enhancement (SME, patent # 6,464,005) to treat an Oil Re-refinery

Indian Oil, Inc. Indian Oil, Inc. is located in Lindon, UT. This facility has the ability to generate diesel fuel from crude oil stock or used oil. The process is relatively low temperature and has a low impact to the environment. Preparatory to renewing its Used Oil Permits, Indian Oil installed SME to remediate used oil and gasoline found in the soil and groundwater during site investigation.

Under new management, this start up company was in need of a cost effective and proven method of removing hydrocarbons from the subsurface environment. As a requirement for completion of permitting, Indian Oil, Inc. elected to install SME as a permanent, as-needed response to operational spills and releases. The previous company had been responsible for the release of about 50 gallons of petroleum to the subsurface. Subsequent operations have resulted in additional, minor spillage. Concern of frequent hydrocarbon release prompted the Utah Division of Solid & Hazardous Waste to solicit a proposal from Indian Oil, Inc. for controlling the contamination. At Indian Oil, Inc.'s request, Ellis Environmental presented a phased proposal for installing SME that can eventually be converted to an fully automated system of release detection and corrective action.

SME installation was completed by August 4, 2006. The facility was able to continue its normal operations during installation. SME piping was aligned with some of the company's own above-ground conduits to reduce the incidence of floor penetrations. Emissions from SME were vented into the production building, since the emissions were projected to be quite light. During installation of the biosparging wells, at least one boring ignited from gasoline that was not found during the site investigation; there was ample justification for installing a good treatment system.

Results from the operations of SME can be evaluated from two perspectives; the first was the rapid removal of hydrocarbons and the second was the ability of the system to detect new releases. In terms of hydrocarbon removal, of the original 50 gallons of hydrocarbon known to have been released, within the first week (8/11/06), 2.5% of the contamination had been removed. By the end of the first month (9/12/06), 92% of the contamination was removed. After two months (10/6/06), 99% of the contamination was removed.

From the other perspective, SME was able to detect a fresh release during the first month. Verification with the operator was made that a small release from a batch of crude oil had released onto the floor of the processing unit and SME detected the release. After the third month (11/14/06) of operation, the new release has also been remediated. 100% of toluene has been removed, 99+% of benzene, ethylbenzene and xylenes have been removed and over 97% of the TPH has been removed. Biological indicators show that the metabolism is complete after three months operation.

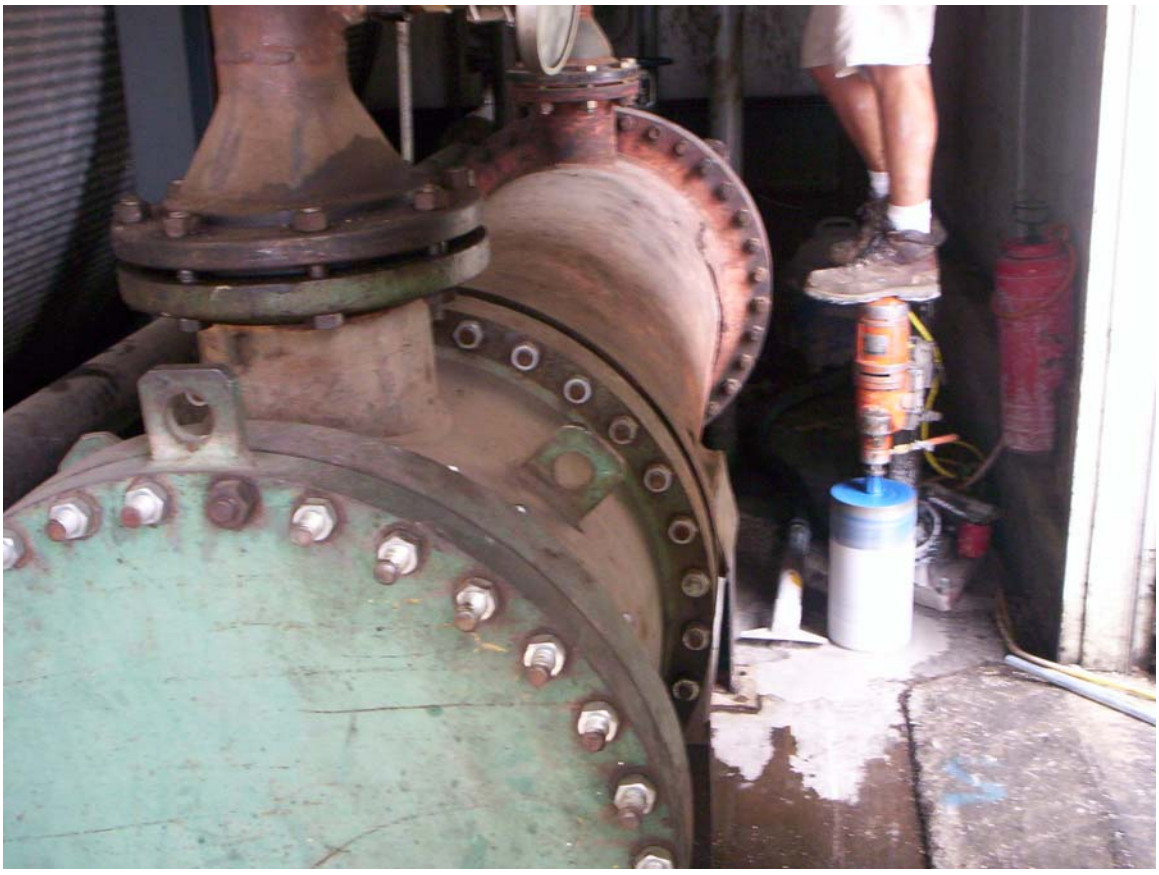
SME will continue to operate as needed to remove spillage from the re-refining or refining operations at this facility. Indian Oil provides a unique method of producing diesel fuel in a way that is very easy on the environment. This project is a symbiosis of several technologies designed to improve our ability to produce fuel and demonstrate a commitment to environmental preservation.

Indian Oil AST to the right and processing facility to the left

Boring a BGE well, note wrapped casing

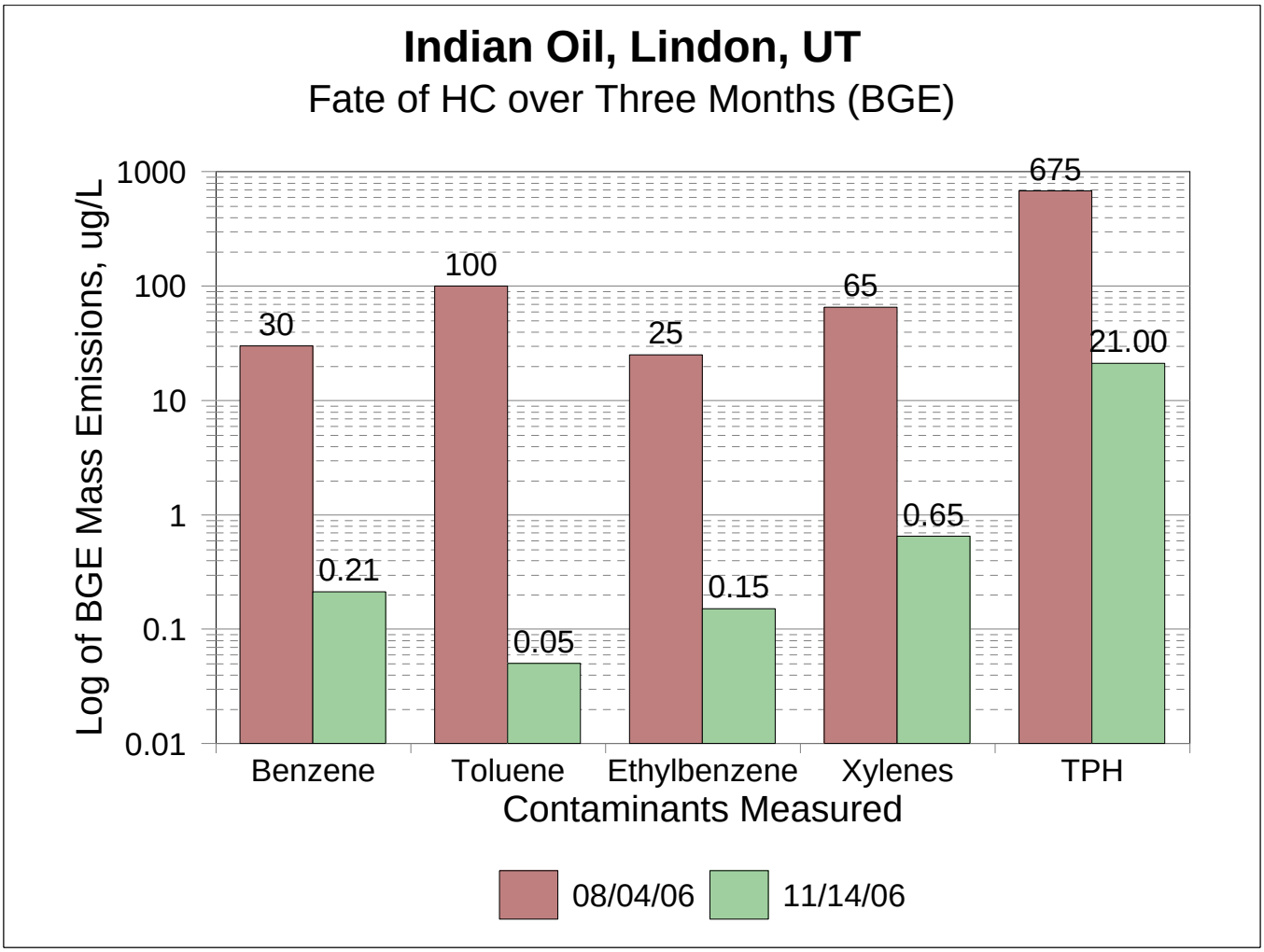
SME piping runs with facility piping; note flow controller and meter tied to pipes

Cutting concrete near heat exchanger

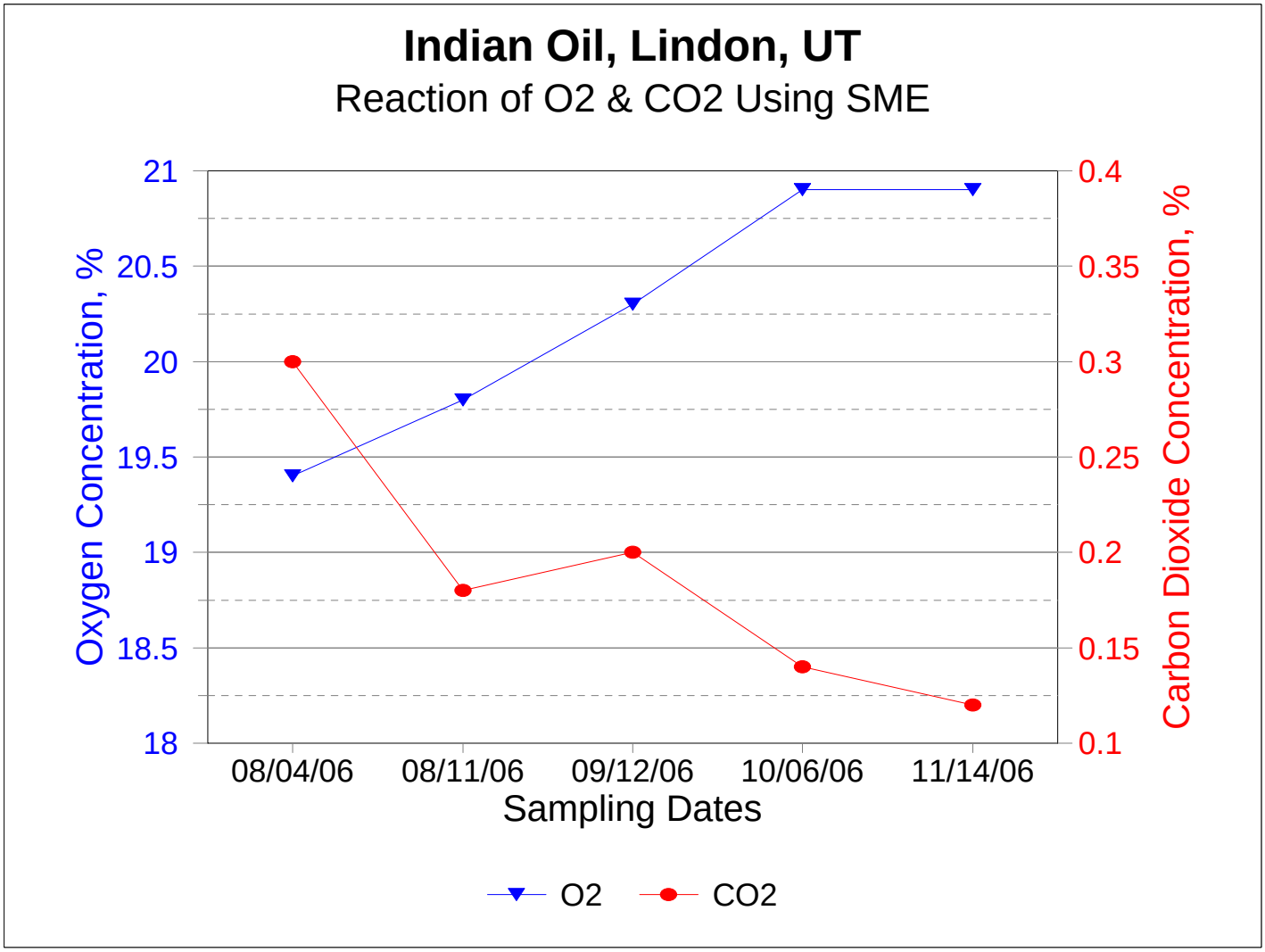


Installing heat exchange piping from compressor

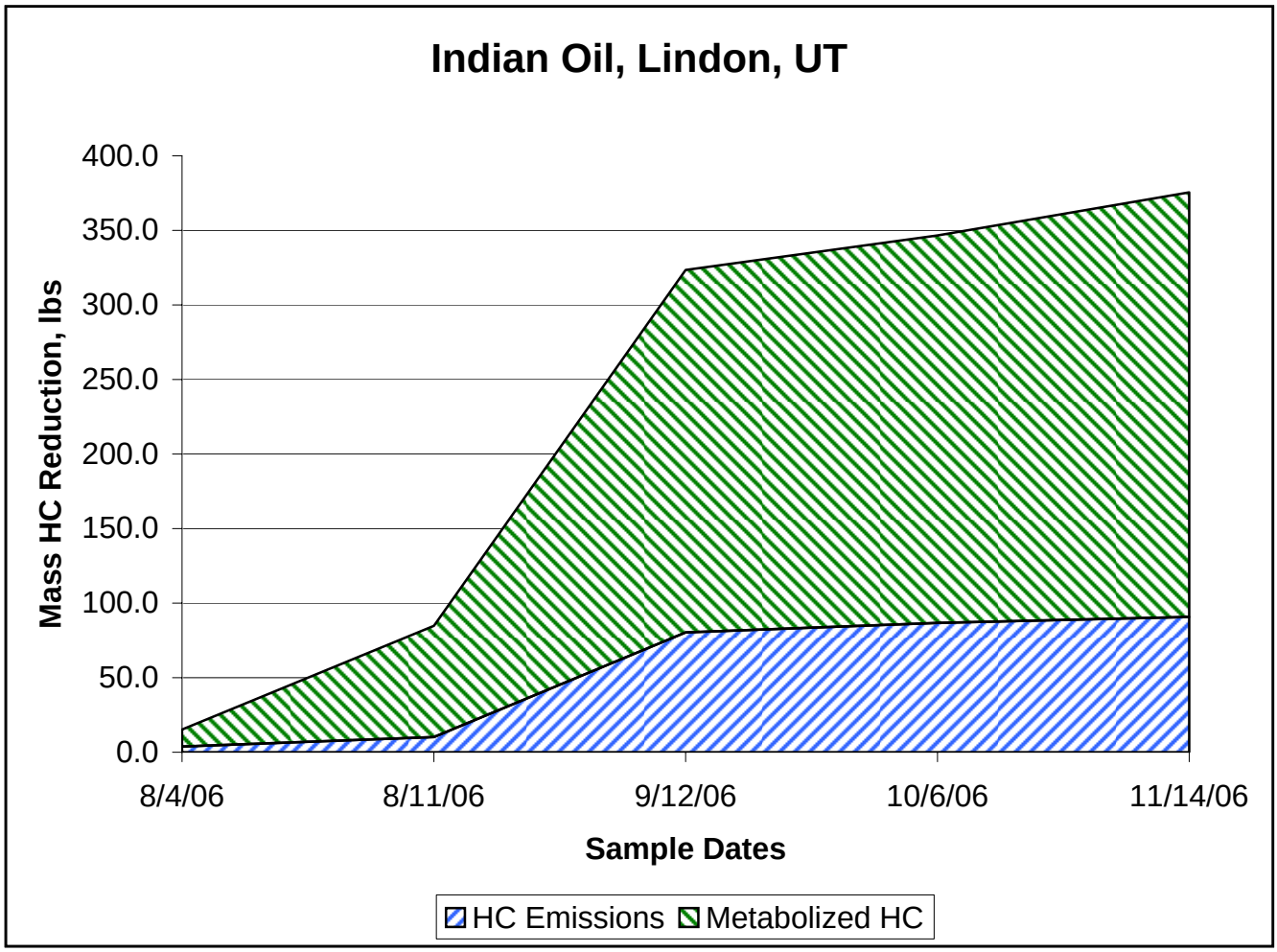
Biosparge well and nutrient well cluster in floor near stair



SME reduces the emission of hydrocarbons rapidly as the biota consume those hydrocarbons in the subsurface. When the measured contaminants concentration approaches non detectable concentrations and the oxygen concentration returns to background concentration, SME has removed sufficient hydrocarbons that the environment can safely remove the remainder, saving cost and time of active remediation.



Oxygen measurements are taken from the Biogenic Gas Extraction (BGE) stack that emits soil gases to the atmosphere. Carbon dioxide measurement may be used as a direct indicator of hydrocarbon consumption, except in alkaline soils. Under alkaline conditions, CO2 is used as a qualitative, not a quantitative indicator of treatment progress.



Mass hydrocarbon removal is calculated from the mass emitted from the Biogenic Gas Extraction (BGE) system and from the depression of oxygen. Oxygen depression is used to calculate the mass of hydrocarbon consumed in the subsurface. This has been found to be a more meaningful measurement than a direct carbon dioxide measurement in alkaline soil. Measuring the air emissions has proven to be a more accurate, less expensive method of interpreting the progress of bioremediation that either monitor well observations or soil boring analyses. These methods are usually used as confirmatory measures when the project is completed.