



Gulf Coast Environmental
Systems

CASE STUDY

THERMAL CATALYTIC OXIDIZER
NUCLEAR WASTE - SOIL REMEDIATION | MAY 2019

NUCLEAR POWER

Employees: 138

Industry: Nuclear

Project Type: Soil Remediation

Project Goal: Treat highly contaminated waste vapors

Location: Benton County, Washington

Equipment Type: Thermal Catalytic Oxidizer

EXECUTIVE SUMMARY:

Gulf Coast Environmental Systems was tasked with finding a solution for decommissioned nuclear waste storage tanks that were leaking contaminated toxic vapors into the environment.

CLIENT OVERVIEW:

Seventy years ago, this site produced plutonium for the United States' nuclear arsenal. Now, it's run by the Department of Energy through a contractor. The contractor is managing a \$110 billion cleanup of 56-million-gallons of chemical and nuclear waste, stored in 177 underground tanks. It is estimated that 150-300 gallons of radioactive waste per year was leaking into the environment. This cleanup project is expected to last the next 50 years. This contractor asked GCES to find an extremely long lasting solution that would destroy 99% of the toxins in the polluted waste vapors, that were escaping the tanks.

PROJECT OVERVIEW:

Gulf Coast Environmental Systems was approached by a large engineering firm to design and build a unit that would safely and effectively destroy the dangerous radioactive vapors escaping the containment tanks. This solution would need to run on electric, instead of natural gas.



PROJECT OVERVIEW CONTINUED:

A complex solution was created by GCES that provided the operators of the nuclear site with a catalytic oxidizer containing a preheat exchanger, a VOC catalyst, a NOx catalyst all run on electricity to treat highly contaminated waste vapors.



SOLUTION:

GCES' team of engineers spent time looking at the composition of the contaminated waste vapors escaping the tanks and designed a complex solution, that would attain 99% DRE. This system, created by GCES, provided the operators of the nuclear site with a catalytic oxidizer containing a preheat exchanger, a VOC catalyst, and a NOx catalyst that all run on electricity.

The Catalytic Oxidizer (CATOX) processes melter off-gas that has been treated by a Submerged Bed Scrubber (SBS), Wet Electrostatic Precipitator (WESP), HEPA filters, and an activated carbon bed adsorber.

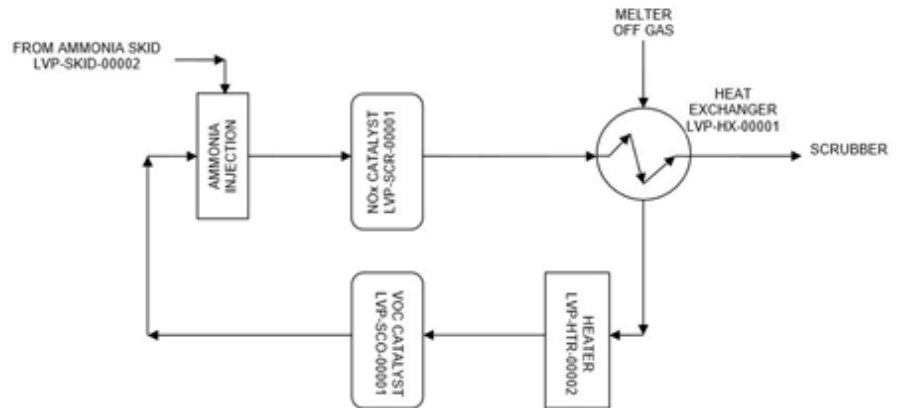
The CATOX consists of 4 primary components: a recuperative heat exchanger, electric heater, Volatile Organic Compound (VOC) Selective NOx case studyOxidation (SCO) bed, and a Nitrogen Oxidizer (NOx) Selective Catalytic Reduction (SCR) bed. An ammonia system was also provided for the reduction of NOx.

A Catalytic Oxidizer works by raising the temperature of the exhaust stream to a point in which the chemical bonds that hold the VOC molecules together are broken (oxidized) across the precious metals from the catalyst media.



The VOCs from the process exhaust stream are converted to carbon dioxide (CO₂), water (H₂O), and thermal energy. In a catalytic oxidizer, the operating temperature is substantially less than straight thermal oxidation, and when combined with a VOC loading level from the process stream, the system can become self-sustaining; often requiring minimal auxiliary fuel to support operation.

2.0.2 TCO Flow Diagram



A catalyst is a substance that accelerates the rate of the chemical reaction of the volatile organic compound, without being consumed. The process of catalytic oxidation which, in addition to reducing fuel consumption, also operates at a lower temperature level, which minimizes the formation of NO_x. The reduction of the CO and minimization of NO_x formation are very important, as both of these compounds are regulated as strictly as VOCs by the Environmental Protection Agency (EPA). In this case, two types of catalyst were used to destroy VOCs and NO_x.

The NO_x Selective Catalytic Reduction Unit: Nitrogen oxide (NO_x) is a byproduct of the combustion across the VOC catalyst (SCO). NO_x is considered a harmful greenhouse gas, and substantial releases into the atmosphere are prohibited by the EPA. The CATOX system is configured with a NO_x reducing catalyst, and an ammonia injection system. The catalytic reaction of the ammonia across the SCR reduces the emission of NO_x by converting it into basic atmosphere elements, nitrogen, oxygen, and water.

GCES spent hundreds of engineering hours designing the perfect systems for this highly volatile, and highly publicized application. The specific needs of the facility were met, and the CATOX system was able to achieve 99% DRE, in addition to removing the NO_x created by the process. This equipment is still a crucial part of this decommissioned sites efforts to reduce emissions, and continues to be a shining example of what pollution control equipment can do to reduce the risk to the public.