Santa Susana Field Laboratory

The Use of Trichloroethylene at NASA's SSFL Sites

This provides information on the cleanup of NASA properties at the Santa Susana Field Laboratory (SSFL).

The Bravo Test Stands (including those pictured above) were among four areas NASA used for testing rocket engines.

NASA owns and administers 451.2 acres in two areas of the Santa Susana Field Laboratory (SSFL). NASA recognizes the importance of communicating directly with the community regarding our current and former operations at SSFL and the ongoing environmental cleanup taking place throughout the entire 2,850-acre facility. The other areas of SSFL are owned and operated by the Boeing Company.

The SSFL began operations in 1948 and was divided into four so-called "Administrative Areas" which are flanked on two sides by undeveloped land. Initially, Areas I and II were owned by the United States Air Force (USAF) - and administered by the former Rockwell International (and its Rocketdyne Division, later acquired by Boeing), which tested several types of rocket engines for use in defense programs and, with NASA, for the Space Program. In 1973, NASA acquired from the USAF the 409.5 acres it had owned in Area II. The Area I acres, acquired by NASA in 1978, had contained a Liquid Oxygen (LOX) Plant, which operated from the early 1950s until the late 1960s, when LOX was utilized in testing liquid-fueled engines. The plant's buildings and tanks were removed in the 1970s.

NASA used Area II to conduct research, development and testing of rocket engines associated with the Apollo and Space Shuttle Programs. Area II contained four locations known as "test areas," most built between 1954 and 1964. These were open-framed, metal structures with concrete foundations, as well as related buildings. Each of the stands - known as Alfa, Bravo, Coca and Delta - had three or more "test positions" (also often referred to as test stands) for firing the engines. Use of most test stands was largely curtailed after the 1960s, but Coca Test Stand #4 was used extensively in support of Space Shuttle Main Engine research and development in the 1970s and early 1980s. All testing has ceased.

In the early 1980s, Rockwell International discovered that historical rocket engine testing and cleaning operations throughout the SSFL had resulted in chemicals making their way into soil, surface water and groundwater. For example, in Area II there were several solvents found, predominantly trichloroethylene (TCE). TCE had been used in large quantities by the USAF and NASA to clean liquid-fueled rocket engines both before and after each test. NASA takes full responsibility for the cleanup of its two areas. We believe it is important to let you know about what occurred, and about the cleanup that is taking place - or is planned - in the SSFL areas that NASA administers.

SEE OTHER SIDE

What is TCE?

Trichloroethylene (TCE) is a non-flammable, colorless liquid that belongs to a group of chemicals known as Volatile Organic Compounds (VOCs). It is used mainly as a solvent for removing grease from metal parts, and in adhesives, paint removers and spot removers. The chemical and physical properties of TCE remain in groundwater for long periods of time. The possibility for health effects from TCE depends on the duration and magnitude of exposure. Over the years, some TCE from SSFL operations moved deep into SSFL groundwater and was absorbed in sandstone fractures. Some TCE also migrated to areas off site of Area II, but still within the boundaries of the SSFL.

The groundwater at SSFL is currently not used for drinking water and, based on our investigation, does not affect any municipal or agricultural water supplies.

Coca Test Stand #4 was used during Space Shuttle Main Engine testing.

for your information

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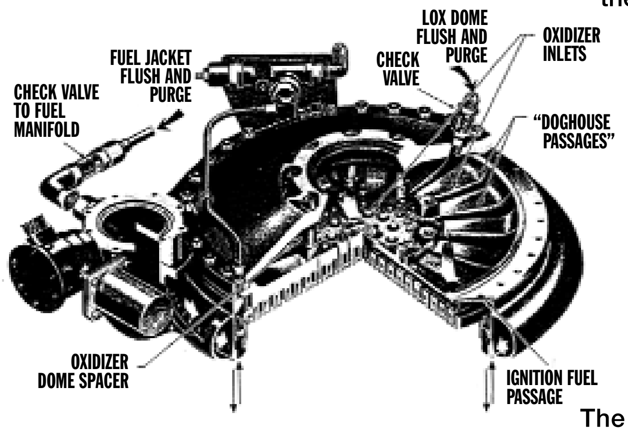
How Was TCE Released?

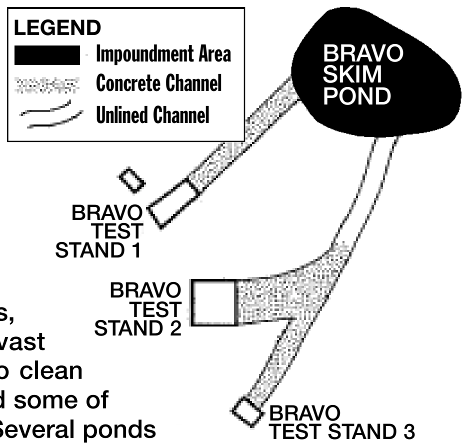
The USAF and then NASA conducted tests for several large rocket engines, including the Atlas Thor, F-1, H-1 and RS-27 programs. These engines were liquid-fueled, combining kerosene and liquid oxygen. During "hot fire" tests, an engine would be checked and calibrated for firing and the ignition sequence started. Liquid oxygen (LOX) was fed into the engine's fuel injector, then kerosene was pumped through what was termed a "fuel jacket" consisting of tubes bent to the configuration of the fuel chamber. The fuel would pass down through tubes in the "jacket," and into the injector, where it would blend with the LOX. The mixture then passed into the combustion chamber, where it was ignited. Because kerosene left behind hydrocarbon deposits and vapors in the engine, deposits had to be flushed away; otherwise they could possibly have caused explosions during testing. As a result, NASA, the USAF and Rocketdyne followed a careful decontamination process, using TCE to flush the engine immediately before and after each test. Because TCE was used to clean only kerosene-fueled engines, it was not utilized during Space Shuttle Main Engine tests conducted at SSFL in the 1970s and 1980s.

TCE was injected into the thrust chamber of rocket engines, such as the one shown below.



The flushing procedure involved pumping TCE through fuel channels in the engine's thrust chamber, then through the injector (where the kerosene and LOX mixed before engine ignition). The procedure called for letting the solvent overflow the injector for 30-35 minutes and also flushing the dome in the engine through which the LOX had been fed. The amount of TCE used in flushing depended on the thrust capacity of the engines. The Atlas program, sponsored by both the USAF and NASA, used the largest amounts of TCE.

Before 1961, TCE and water flowed into ponds including this one in the Bravo Test Stand Area.



From 1954 through 1993, there were more than 21,500 kerosene-fueled rocket engine test firings at SSFL that required TCE flushing, most of them in Area II. The majority of tests (95%) took place between 1955 and 1966. During the entire testing period for kerosene-fueled engines, some 500,000 gallons of TCE were released into the ground with the vast majority (97%) occurring before 1961. Prior to that year, the TCE used to clean engines ran down into a concrete spillway, which led to unlined ponds and some of the TCE spilled into the soil, eventually making its way into groundwater. Several ponds were subsequently excavated and backfilled. In 1961, the USAF instituted a TCE recovery system, consisting of "catch pans" located at each test position, which were connected by hose and pipeline to a collection storage tank. This TCE was later sold for recycling.

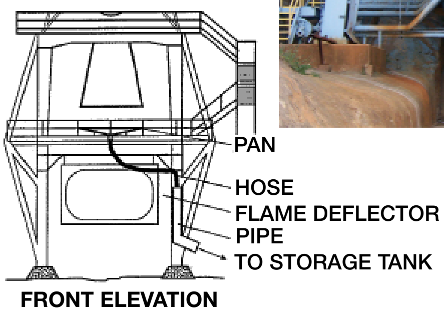
This Bravo test stand was used for test-firing engines with liquid fuel (kerosene). TCE was used to flush the engines before and after each test. This photo shows the bottom of the test stand.

On-site groundwater monitoring wells were installed in the mid-1980s. They have been sampled regularly since then, with results from the 1980s and 1990s indicating that the highest levels of TCE were found close to areas where engines had been tested. Since 1984, NASA has been using a pump-and-treat system to clean 1.7 billion gallons of groundwater containing TCE. A new centralized groundwater treatment system is expected to begin operation in late 2008. All investigation and cleanup activities will be completed by 2017. We look forward to keeping the community up to date on our plans and activities.

After 1961, a TCE Recovery System was put in place. This diagram shows the system at the bottom of a test stand.

A conical pan was fabricated to act as a funnel type device to collect the flushed TCE. The TCE then drained through a hose, to a pipe attached to the front leg of the stand, then to a recovery tank.

The purpose of this recovery system was the cost saving associated with returning the solvent to the vendor for recycle.



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