S S F L C O M M U N I T Y
A D V I S O R Y G R O U P

Citizens Working Together for the Responsible Cleanup of the Former Santa Susana Field Laboratory

http://ssflcag.net/ mail@ssflcag.net

1959 SRE Accident Fact Sheet

In 1959, a small research reactor called the Sodium Reactor Experiment (SRE) was operated by Atomics International at the Santa Susana Field Laboratory (SSFL) for the U. S. Atomic Energy Commission. In July of that year, SRE experienced significant fuel damage as a result of overheating in the reactor's core. During that event 13 of 43 fuel elements were damaged by localized overheating because of carbonaceous material contaminating some fuel elements and restricting the flow of the molten sodium coolant circulating past fuel rods within the reactor core. Although the peak fuel temperature in the core was always well below the melting temperatures of the uranium fuel and its steel cladding, the hottest central portion of the core reached temperatures that allowed the fuel and its cladding to form an alloy which melted at a lower temperature. From the chemical formula of the alloy it can be determined that a maximum of 1-2% of the uranium fuel melted and released radioactive fission products into the sodium coolant. After an extensive cleanup of the facility and removal of the reactor core, a new core and new sodium coolant were loaded and the reactor continued operation from 1960-1964. It was decontaminated in the early 1970's, released for unrestricted use and the building was used for storage. In 1999, the SRE facility was completely removed.

Of persistent concern to some of the residents of communities surrounding SSFL was the possible release of harmful radioactive material during the 1959 accident. Careful examination of data taken during and after the accident confirms that although some radioactive fission products entered the sodium coolant, no fission products other than gaseous xenon and krypton exited the facility. These gasses are not harmful because they do not interact with matter and rapidly disperse in the atmosphere and decay into inert isotopes. The reactor building was not designed as a containment pressure vessel, since the maximum credible accident would not release enough gas volume to require pressure containment. It was designed, however, to retain gases at about atmospheric pressure, and to reduce diffusion leakage of potentially contaminated gas.

Three fission products are of principal concern: long-lived cesium-137 and strontium-90 and short-lived iodine-131 because of its potential concentration in thyroid glands. First, from the known temperatures reached by the fuel, it is impossible for any strontium to have been released as a gas. Additionally, one of the unique qualities of sodium-cooled reactors with respect to radiological safety is the potential ability of the coolant to retain fission products. Fission product retention results from chemical reactions between the coolant and certain fission products leading to less volatile compounds (e. g. sodium iodide) and the mechanical trapping of particulates by the liquid coolant. The maintenance of a

coolant pool above the core in sodium reactors even with the postulation of severe reactor accidents ensures the continued effectiveness of this fission product retention.

Post-accident examination of the reactor system provided important information about the potential release of fission products to the environment. Only xenon and krypton isotopes were found in the reactor cover gas. The carbonaceous particulate material resulting from the decomposition of tetralin which leaked into the primary sodium was an effective fission product scavenger. These particles concentrated radioactive material by a factor of 10^3 to 10^4 times that of the filtered sodium. The cold trap located in the primary system was effective in removing fission product contamination and appreciable deposition of fission product contamination occurred throughout the primary piping system with strontium, cerium, and zirconium-niobium deposition being much greater than that of cesium or iodine. Additionally, from other experiments with metal fueled liquid metal reactors, it is known that fission product iodine combines with uranium to form uranium tri-iodide which does not have a low boiling point and so remains with the solid or melted uranium. Cesium has a low boiling point but higher than that of iodine. However, the amount of cesium actually released as a vapor from molten uranium fuel is reduced because of the high ratio of uranium to cesium atoms (10,000 to 1) and by the very high solubility of cesium in the uranium.

A continuous environmental monitoring program of soil, vegetation, water and airborne radioactivity was in place at SSFL from 1954 through the SRE operational period. It included monthly sampling of 14 locations for soil and vegetation and four locations for water. There was also a single continuous air monitor. Soil, vegetation and water samples were analyzed for α, β, and γ activities. The continuous air monitor only measured β and γ activities. The α activity is indicative of uranium and plutonium radioisotopes, while the β and γ activities are indicative of fission products. The measurements were sufficiently sensitive to detect the radioactive fallout from weapons testing both in the Soviet Union and at the Nevada Test Site in the United States. Elevated readings correlated very well with known weapons tests and with periods of heavy rainfall at SSFL which removed the fallout from the lower levels of the atmosphere. No measurements at the time of the accident showed elevated α, β, or γ activities. Additionally, the readings at the continuous air monitor were lower than in the months preceding the accident.

In summary, no evidence of cesium or iodine outside of SRE sodium coolant was found and there was no evidence of strontium except in primary SRE piping. The only radioisotopes found in the SRE gaseous effluent were krypton and xenon. There was conclusive evidence of environmental dispersal of strontium and cesium from weapons testing and therefore any strontium or cesium found at SSFL did not come from SRE. The SRE accident is not relevant to the SSFL cleanup, except for the unwarranted concerns it engenders in some members of neighboring communities.