RADIOLOGICAL INCIDENTS AT SSFL

The following incidents are referred to in a publication by “The Committee to Bridge the Gap” entitled “Past Accidents and Areas of Possible Present Concern Regarding Atomics International”, dated January 18, 1980.

Rocketdyne responded to these issues in a letter to the California Department of Health Services (letter from P. D. Rutherford to R. L Holtzer “Nuclear Activities at Rocketdyne”, 91ETEC DRF-54, January 16, 1991).

Brief summaries are given below including references to reports and internal correspondence.

Subject: AE-6 Power Doubling Excursion
Facility: AE-6
Building: 4093
References: NAA-SR-MEMO 3757, “Release of Fission Gases from the AE-6 Reactor”
Date: March 25, 1959

In March 25, 1959, a release of fission gas within the AE-6 reactor occurred when an operational error was made during the transfer of gases from the reactor core to the holdup tank. This resulted in the release of a small amount of fission products into the reactor room and in the contamination of three members on the operating staff. The contamination was cleaned up quickly and effectively, and there were no measurable radiation exposures to any of the personnel involved.

Calculations based on the operation of the reactor prior to the incident show that maximum release of fission gas in the reactor room would have been less than approximately 10 millicuries, principally Xe-135, and the building volume was sufficient to dilute the activity to a concentration essentially equal to the occupationally permitted concentration for continuous 40-hour/week exposure.

There was no indication of any release to the environment.
The Wash Cell incident occurred on June 4, 1959, at the Sodium Reactor Experiment. This incident involved the reaction of the sodium on one of the reactor fuel elements with water in the wash cell. The wash cell was a specially designed cell in which the fuel elements from the SRE were inserted and washed with water to remove any sodium which had adhered to the surfaces of the element after its removal from the reactor. In this particular incident, there was apparently enough sodium still clinging to the fuel element to cause a reaction with the washwater to produce sufficient pressure inside the cell to force the shield plug and the fuel element connecting rod associated with the element out of the cell onto the floor of the reactor room. Some radioactive contaminated material was released to the reactor room floor and to the equipment adjacent to the wash cell. The shield plug and rod were reinserted into the wash cell, and washing of fuel elements discontinued.

None of the employees received more than a small fraction of the maximum permitted weekly exposure of 300 mrem, and no one received any measurable internal exposure. The contaminated area and equipment were cleaned, and operational activities were resumed.

Air sampling measurements immediately following the incident and at subsequent times indicated concentrations of radioactivity inside the building to be less than the maximum occupational levels. In addition, analysis of soil samples from around the facility demonstrated that the contamination had been confined to the inside of the SRE building.

The Investigating Board report states that "Surveys indicate that there was no measurable release of radiation beyond the SRE building".
This power excursion was a precursor to the fuel melting incident (see below).

The quotation from reference (2) is incorrectly attributed to an AEC investigation/analysis. The opinion was expressed by T. J. Thompson of MIT on page 644 of a textbook which he also edited. The AEC funded, but did not contribute to the textbook.

There was no radioactivity release reported or alleged in this event.
The SRE accident, occurred in July 1959 when there was an accidental partial blockage of sodium coolant in some of the reactor coolant channels. This resulted in the partial melting of 13 of the 43 reactor fuel assemblies and the release of some fission products that contaminated the primary reactor cooling system. All of the reactor safety systems functioned properly, and the reactor was safely shut down. The reactor fuel assemblies were then removed, inspected, and stored at the RMDF. (They were later declad in the Hot Lab, and the fuel and cladding was shipped off-site to an AEC approved disposal facility). A second fuel loading was inserted, and the test operations were continued until the reactor was shut down in February 1964 due to termination of the project.

The major portion of the radioactivity released as a result of the fuel melting was contained in the sodium coolant, but some of the radioactivity was collected in the cover gas in the volume above the sodium coolant inside the reactor vessel. This radioactivity in the cover gas consisted principally of krypton-85 and xenon-135 and was the same type of radioactivity which collected in smaller quantities during normal operation of the experimental power plant.

During normal operations, the cover gas was transferred to large holdup tanks in the SRE facility for the specific purpose of collecting and retaining radioactive gases. After decay, the gas was normally exhausted to the atmosphere through a filtered ventilation system with large quantities of air for dilution of the radioactivity. The releases were always well below those permitted by regulations in existence both then and today.

Following the accident, the contaminated reactor cover gas was transferred to the holding tanks and held long enough for the xenon-135 to decay away (9.1 hour half-life), and then released to the atmosphere through the stack in a controlled manner, in concentrations which met Federal requirements. Based on measurements of the cover gas concentration and volume, less than 5 curies of krypton-85 (10.7 year half-life) was released in this way. The dispersion of the krypton-85 in the atmosphere diluted it so much that it would have resulted in a maximum theoretical calculated dose of 0.06 micrem to someone living in Susana Knolls, the nearest residential areas at that time. This is the amount of dose received from natural external radiation in about 15 seconds and is, of course, a negligible amount. The other fission products were retained in the primary coolant and were removed during cleanup operations.
To summarize, only 5 curies of fission gas was released to the environment and not 10,000 curies. Sodium coolant was cleaned, filtered, reused and ultimately disposed of to an AEC approved disposal facility. SRE sodium coolant was not disposed of in sodium burn pits.
Subject: Tetralin Explosion

Facility: Sodium Laboratory

Building: 4006

References: NAA-SR-4803, “Investigation of Tetralin Explosion”.

Date: August 16, 1959

This was a non-radioactive incident occurring in a non-radioactive facility. There is no allegation of release of radioactivity.

The incident described as a “tetralin explosion” occurred in an apparatus that had been used in a natural convection heat transfer experiment with no-radioactive sodium. Tetralin (tetraphydionaphthalene) was used as a coolant in the apparatus. At the conclusion of the experiment, the tetralin was allowed to remain in the apparatus in a stagnant condition for several months. It appears that auto-oxidation of the tetralin to the hydroperoxide occurred, and the explosion resulted from the rapid decomposition of this compound.

The explosion was totally a chemical event and did not involve any radioactive or nuclear material, and no one was in the room at the time of the explosion.
Subject: Steam-cleaning Pad Contamination
Facility: SRE Steam-cleaning Pad
Building: N.E. of 403
References: Memo from Borg/Marcotte to Fisher “Steam Clean Pad Incident”, June 2, 1960.
Date: March 19, 1960

The allegation has several factual errors. A 2-inch valve (not a pipe) containing radioactively contaminated sodium was steam-cleaned on an outside concrete steam-cleaning pad. The valve did not “explode” though sodium reaction products were spread over the pad. Later hosing of the pad also resulted in the surrounding soil being contaminated. The pad surface and soil were subsequently decontaminated. Survey and sampling of the pad and surrounding soil confirmed that all contamination had been removed. Sampling of the down-slope SRE pond also indicated no contamination.
Operator error resulted in radioactively contaminated water inadvertently being pumped into the sanitary leachfield which serviced the RMDF. Although this is thought to have occurred in 1962, it was only discovered in 1976, and subsequently cleaned up.

A report issued February 23, 1982, ESG-DOE-13365, “RMDF Leachfield Environmental Evaluation Report”, demonstrates that there was no adverse impact on public health due to this contamination incident. This report is public record.

A recent independent study, the Offsite Multi-media Study (and its EPA and DHS participants) which sampled extensively downslope of the leachfield found no levels of contamination which would impact public health and safety.
During the operating life of the reactor core, 80% of the fuel cladding swelled and developed cracks. The fuel rods and cladding did not "melt". This resulted in a slow escape of fission products into the coolant. All radioactivity was retained in the coolant system and cleaned up with the normal coolant cleaning systems. This was not an accident (or even incident) but was reported in the literature on sodium-cooled fuel rod operating experience. Commercial power reactors routinely operate with an allowable, albeit smaller, fraction of failed fuel rods.

No release to the environment occurred.
As with the above issue, the referenced letter mentions similar fuel rod failures (e.g. clad swell and cracking) in the S8DR reactor. This was not an accident, and did not result in any release of radioactivity from the sodium coolant.

No release to the environment occurred.
Subject: Hot Lab NaK Fire
Facility: Hot Lab. Decon. Room
Building: 020
References:

Date: May 19, 1971

Approximately 25 gallons of NaK (a sodium potassium alloy) containing 25 millicuries of fission products burned inside shielded unoccupied cells within the Hot Lab facility.

Measured airborne radioactivity in occupied areas within the facility was well below the permissible concentrations for radiation workers. Measured stack effluent during and after the fire also remained well below the unrestricted area limits of both the California Department of Health Services and the Nuclear Regulatory Commission.

No measurable external or internal exposures to radiation were received by any personnel as a result of the fire.