

## What is Sodium?

- Sodium is a metal.
- Elemental sodium is not found in nature.
- Metallic sodium appears silver to light gray and at room temperature is as hard as cold butter.
- An example of a compound containing sodium is table salt (NaCl).
- Metallic sodium reacts with water.
- Sodium melts at 208° F and boils at 1618° F.



Sodium Metal

# Sodium Component Testing at SSFL

## Where Was The Testing Done?



### Sodium Component Test Installation (SCTI)

- Used to test large steam generators and other sodium system components
- Supplied steam to an on-site co-generation facility.
- Was the largest steam generator test facility in the world.

### Sodium Pump Test Facility

- Tested large scale sodium pumps.
- Largest sodium pump test facility in the world.
- Capable of circulating 55,000 gallons of sodium per minute at temperatures up to 1,100° F.



### Liquid Metal Development Laboratory (LMDL 1 & 2)

- Used for the development of sodium systems instrumentation, friction and wear testing of bearings and seals.
- Developed and tested safe heat removal systems.

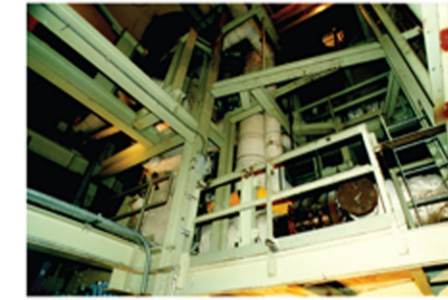
### Large Leak Test Facility

- Investigated safe operating margins for sodium to water steam generators.
- Improved our knowledge of sodium system safety.



### Small Component Test Loop

- Used to test small scale sodium pumps, valves and flow control devices.
- Capable of 3,500 gallons per minute at 1,200° F.



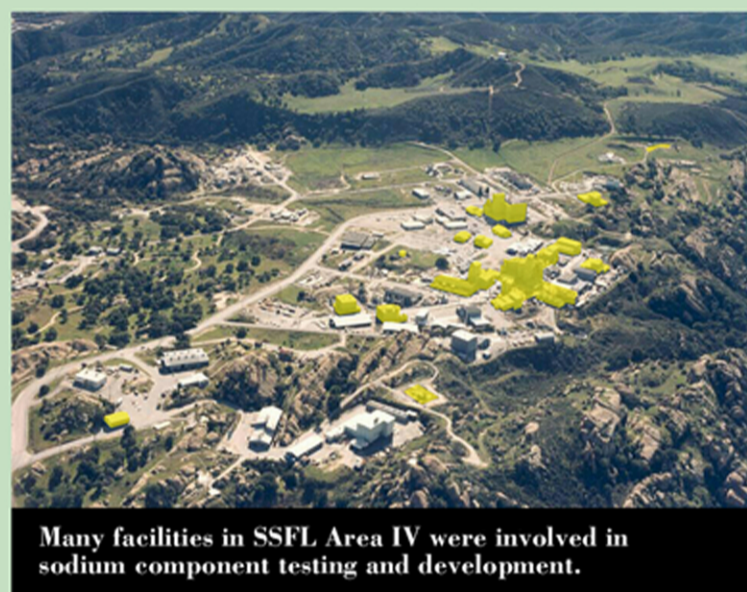
### Chemistry and Instrumentation Laboratory

- Used to support tests and equipment, investigate metal samples and maintain instruments.
- Maintained and calibrated over 7,000 instruments.



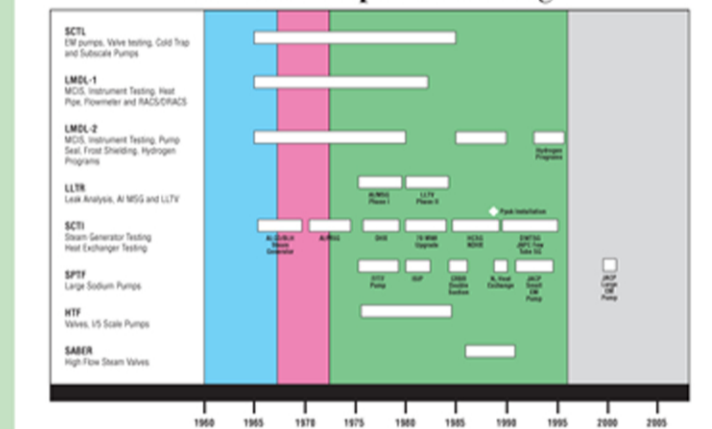
## Why Was Testing Done?

- Testing defined the safety and reliability of the components.
- Sodium components were tested to support the National effort to develop nuclear power.
- Sodium components were tested in a non-nuclear environment to eliminate personnel exposure to radioactive materials.
- Practices and procedures to diagnose and repair equipment were developed to improve worker and system safety.

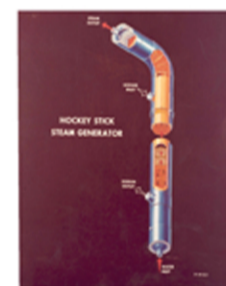


Many facilities in SSFL Area IV were involved in sodium component testing and development.

### Sodium Component Testing



## What Was Tested?



**Steam Generator Development** – Steam generators transfer heat from a sodium system to a water system to produce steam. This steam generator was designed by Atomics International.



**Mechanical Sodium Pumps** – Research into designing efficient, high flow mechanical pumps was performed. Many pumps were developed.



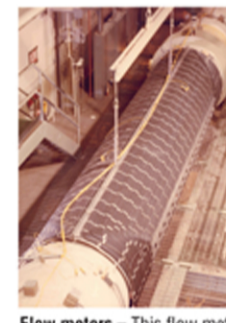
**Evaluation of competing steam generator designs** - The SCTI was used to test and compare competing engineering designs. The 75 megawatt steam generator on the left was designed by Atomics International while the similar sized unit on the right was designed by Babcock and Wilcox.



**Sodium Cold Traps** – High sodium purity was maintained by using this device to cool and isolate impurities. This cold trap has been cut open and solid sodium is seen within.



**Electromagnetic Sodium Pumps** – This pump causes sodium to flow using electromagnetic energy without moving parts.



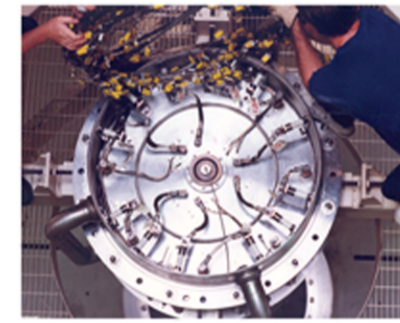
**Flow meters** – This flow meter measured high flow rates of liquid sodium from the outside of the pipe and had no moving parts.



**Few-Tube Test Model** – Tested the concept of incorporating steam leak detection into the tube design of a sodium/steam heat exchanger.



**Natural Draft Heat Exchanger** – This heat exchanger tested and engineering design intended to remove residual heat from a sodium system in the event of a sudden shutdown without using electricity.



**Japanese Sodium Pump Testing** – The Sodium Pump Test Facility was used to test two different electromagnetic sodium pumps for the Japanese.



**Sodium Valves** – Valves to control high temperature sodium were tested with the results used to evaluate and verify a variety of designs.



**Experienced Staff** – In 1974, approximately 1,800 people were involved with the engineering, development and testing of sodium components at SSFL. This photograph of ETEC staff was taken in 1986.

## Why Was Sodium Used?

- Excellent heat transfer properties.
- Has low operating pressure at typical temperatures
- Relatively low melting point.
- Can be pumped using electromagnetic energy.

## Why Area IV?

- Area IV was an isolated site close to utilities and skilled workers.
- The site was the center of excellence for liquid metal technology development for the U.S. Department of Energy.
- Interest in nuclear power declined and sodium component testing was completed in 2001.
- Nearly all sodium test facilities have been removed.