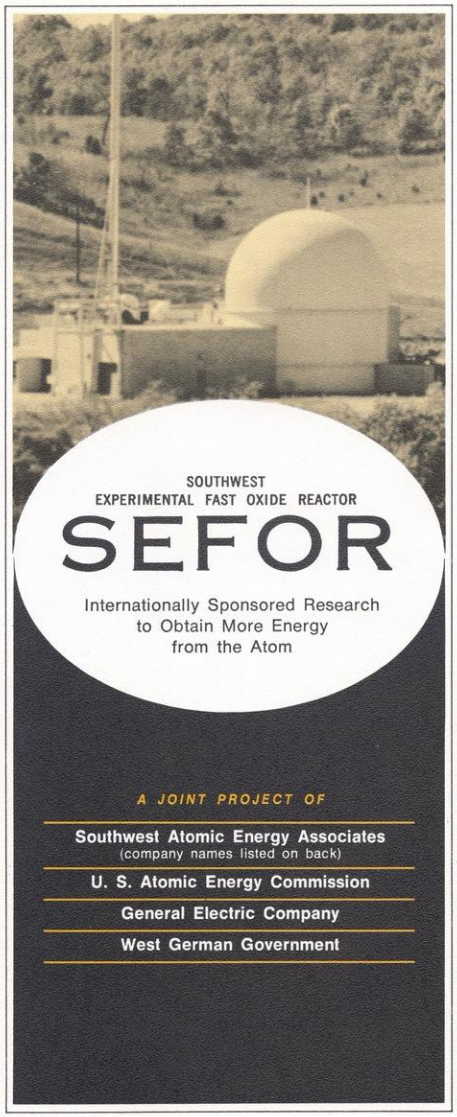
Decommissioning and Disposal of Arkansas Research Reactor Southwest Experimental Fast Oxide Reactor (SEFOR)

by Steve Mack, Health Physicist
Arkansas Department of Health
Radiation Control Program

ARKANSAS DEPARTMENT OF HEALTH



ARKANSAS DEPARTMENT OF HEALTH

SEFOR

- A 20 Megawatt (thermal)
- Sodium Cooled Test Reactor
- Fuel = Plutonium Oxide-Uranium Oxide

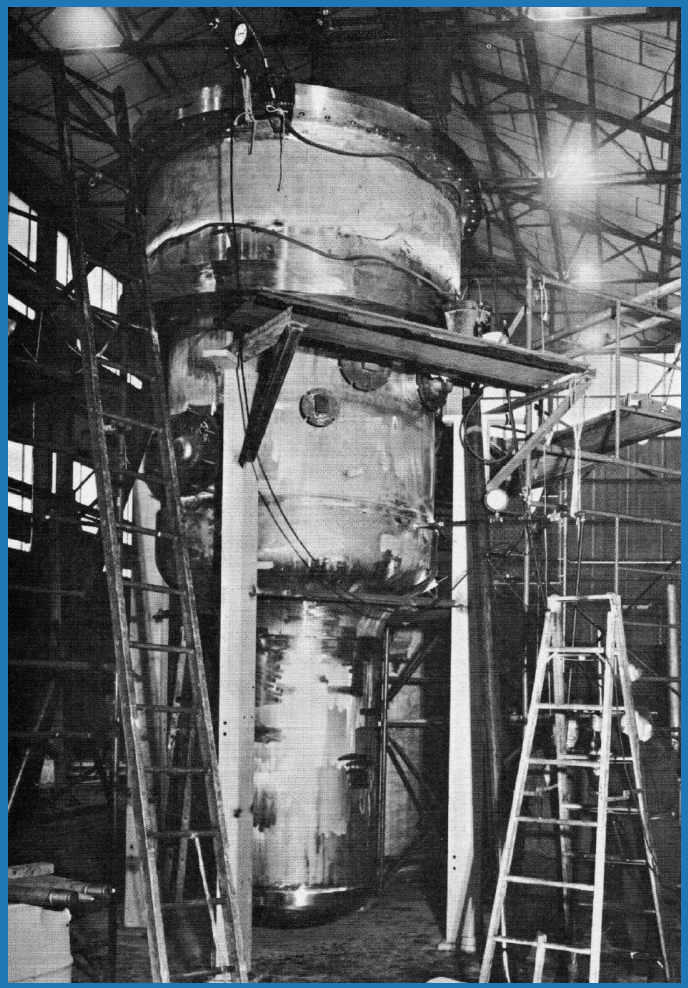
SEFOR

- A Pilot test to demonstrate whether liquid metal fast breeder reactors could be used for power production.
- The facility was used to generate physical and engineering data needed to design large-scale liquid metal fast breeder reactor.
- SEFOR was used to verify the theoretically calculated Doppler Effect in an operating fast oxide reactor.
- SEFOR was not used to generate power.

SEFOR

- Construction complete – 1968
- Operations began – 1969
- Core loading began – Early 1969
- First full power operation – Early 1971

SEFOR – Reactor (circa ~1966)



ARKANSAS DEPARTMENT OF HEALTH

SEFOR

ARKANSAS DEPARTMENT OF HEALTH

SEFOR

ARKANSAS DEPARTMENT OF HEALTH

SEFOR

ARKANSAS DEPARTMENT OF HEALTH

SEFOR

ARKANSAS DEPARTMENT OF HEALTH

SEFOR

Escape Trunk

ARKANSAS DEPARTMENT OF HEALTH

SEFOR

SEFOR

- A total of 1288.204 equivalent full power hours of energy were generated by SEFOR
- Total critical time = 3895.1 hours
- Total heat generated = 25,764 megawatt-hours

SEFOR

- In 1972, after the experimental program was successfully completed, the facility was deactivated and placed in safe storage.
- Fuel Removed.

SEFOR

- Deactivation completed – 1974
- Arkansas Department of Health issued a possession only license.

SEFOR

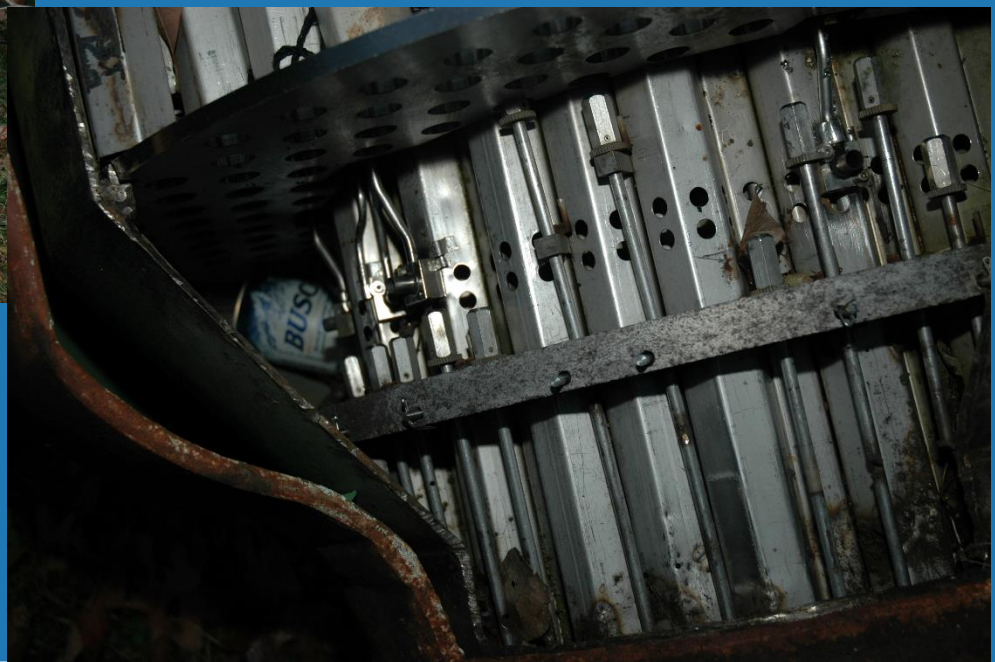
- University of Arkansas – Fayetteville acquired SEFOR – 1975
- Used for instrument calibration and research for less than one-year.

SEFOR

- Since that time the U of A has acted as a caretaker for the facility.
- Cost of maintaining the facility and the potential liability had made decommissioning the site desirable.
- The U of A had sought out DOE funding for a number of years.

ARKANSAS DEPARTMENT OF HEALTH

SEFOR



ARKANSAS DEPARTMENT OF HEALTH

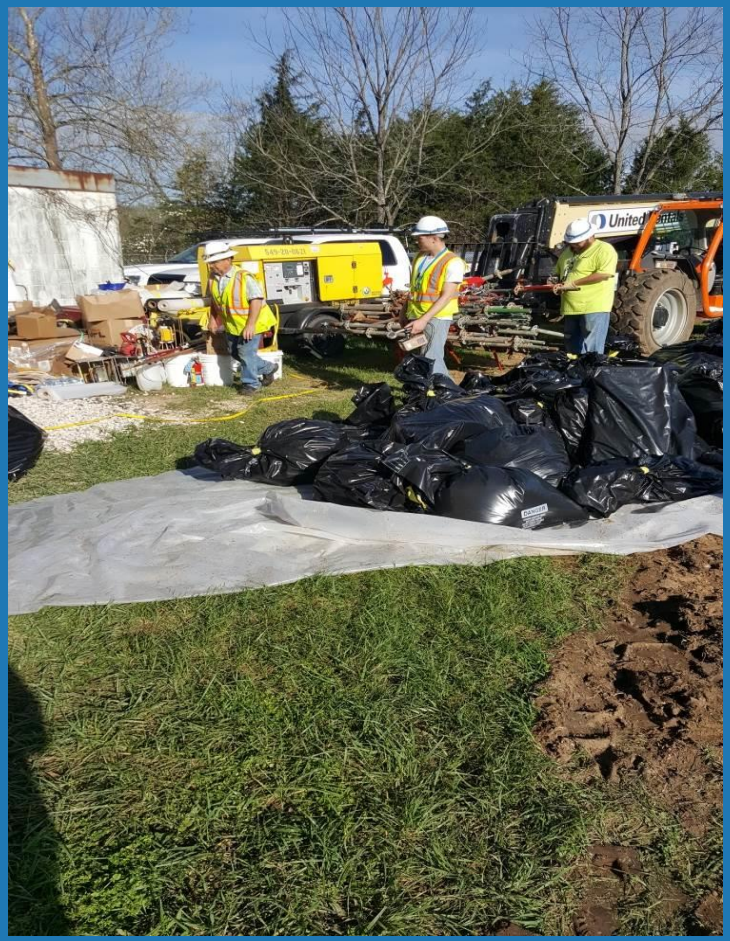
SEFOR

Challenges to the decommissioning:

- Multiple other contaminants (asbestos, lead, diesel, sodium (cooling system)
  - ADH and ADEQ involvement
- Water, Water, Water
- Public perception

Phase 2 - Asbestos Abatement

~6200 tons removed



Phase 2 - Sodium Passivation

Several hundred pounds of Sodium passivated

Phase 2 - Demolition

~3400 tons of C&D waste removed
~380 tons of scrap metal removed
~4900 tons of backfill material delivered

The End of Phase 2
Sept 11, 2017

Phase 3a – Environmental Cleanup

~81 tons of Soil removed from Burn Pit and Water Tank locations

Burn pit was not a part of the original operations, but due to unauthorized entry and the burning of copper wire.

Phase 3a – Rad Material Removal

~16 tons of LLRW removed

Phase 3b – Containment Bldg Demo

~ 1300 tons Asbestos removed

~800 tons Scrap Metal removed

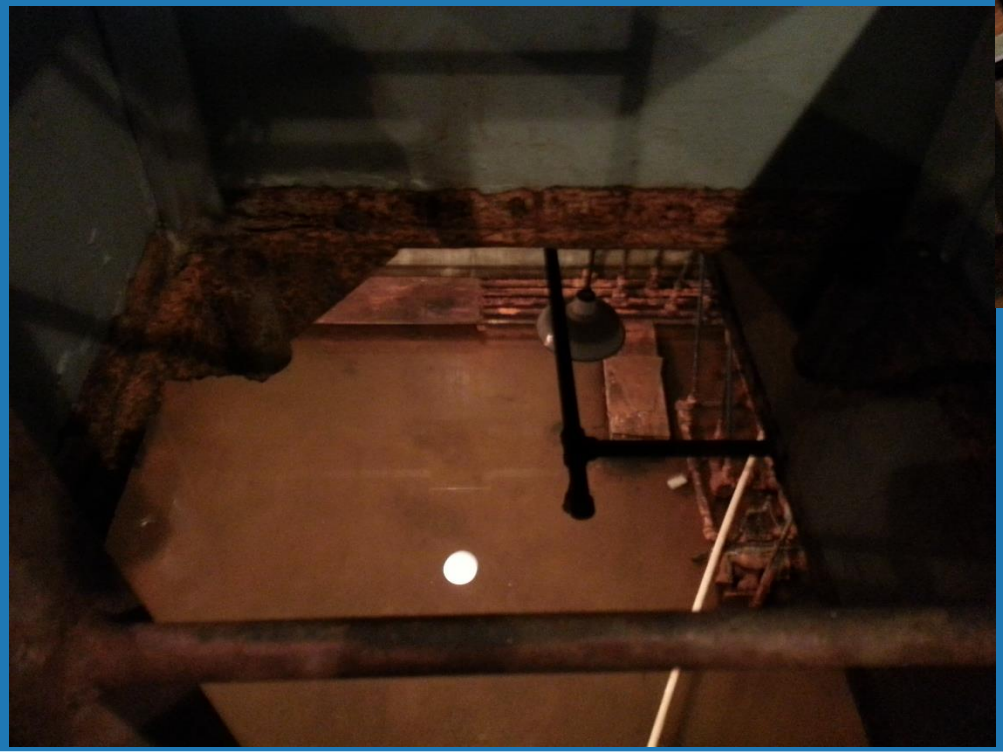
~10 tons C&D Waste removed

ACCELERATOR

- A Cockcroft Walton accelerator was placed in the Reactor Support Facility Storage Vaults.
- The accelerator was contaminated with tritium.
- This led to contaminated water collecting in lower portions of the facility.

ARKANSAS DEPARTMENT OF HEALTH

ARKANSAS DEPARTMENT OF HEALTH



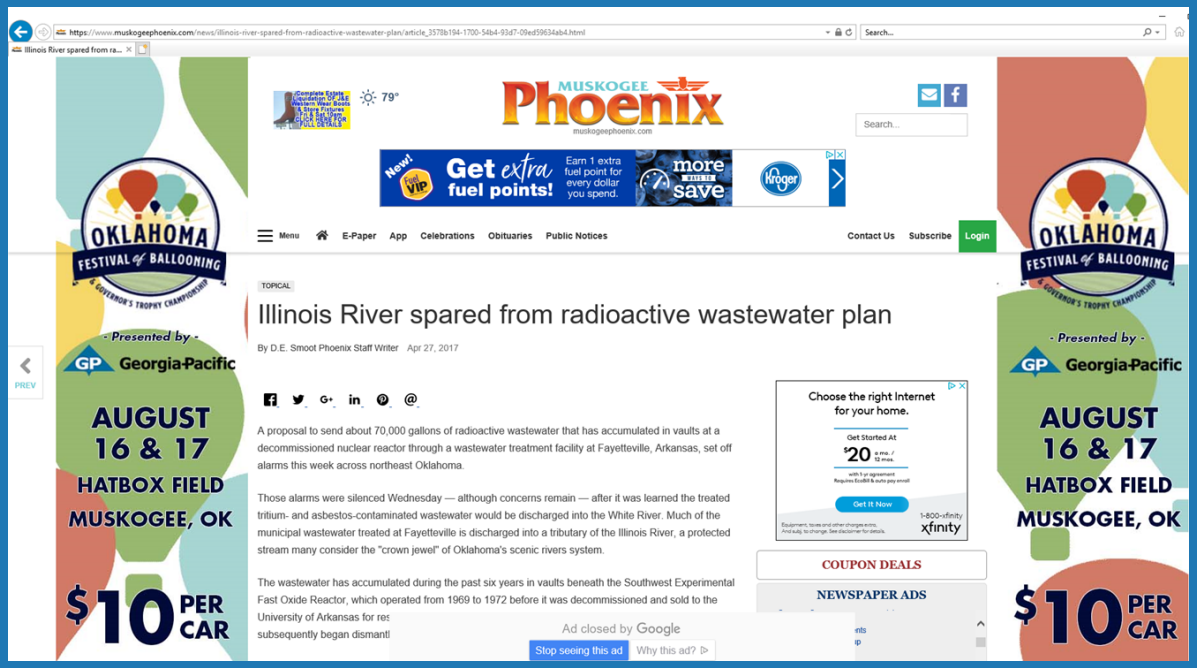
SEFOR

- Water contained in the vaults was sampled and was found to be below the limits for sanitary sewer release.
- No sanitary sewer on-site.
- Water had to be trucked to the campus for disposal.

ARKANSAS DEPARTMENT OF HEALTH

SEFOR

UofA, Don't SEFOR Our Rivers
With 70,000 gallons of Tritium



70, 000 gallons of radioactive wastewater

Phase 3b - Reactor Vessel Removal

Reactor Vessel weighed ~42 tons

ARKANSAS DEPARTMENT OF HEALTH

Removal of Reactor Vessel

BB

Wed 10/17/2018 4:32 PM

Bernard Bevill

TROULBE IN PARADISE == SEFOR REACTOR NEWS CREATING MAJOR STIR IN NEVADA!

Please see the attached news story from the Nuclear Street dealing with the SEFOR Lift.

In this article, reference is made to the SEFOR reactor core being removed and ready to be shipped to Nuclear Security Site in Nevada.

This in turn has created a substantial stir within the Nevada Governor's office and other Nevada political areas!

It should be pointed that "reactor vessel" was lifted on Monday. The "reactor core" was removed and shipped to an AEC facility when the original SEFOR Owners defueled the reactor back in the early 1970's prior to transfer to UA in 1975.

MEANWHILE, Energy Solutions is actively engaged to correct the misinformation by others.

Dr. Smith and Stephanie should be made aware of this matter.

Should you have ANY questions, please contact.

THANKS!

Phase 3b - Rx Pkg. Transport/Disposal

Total vehicle weight was 160 feet long, 18 feet wide and 407,000 pounds

Traveled through 8 states in 15 days

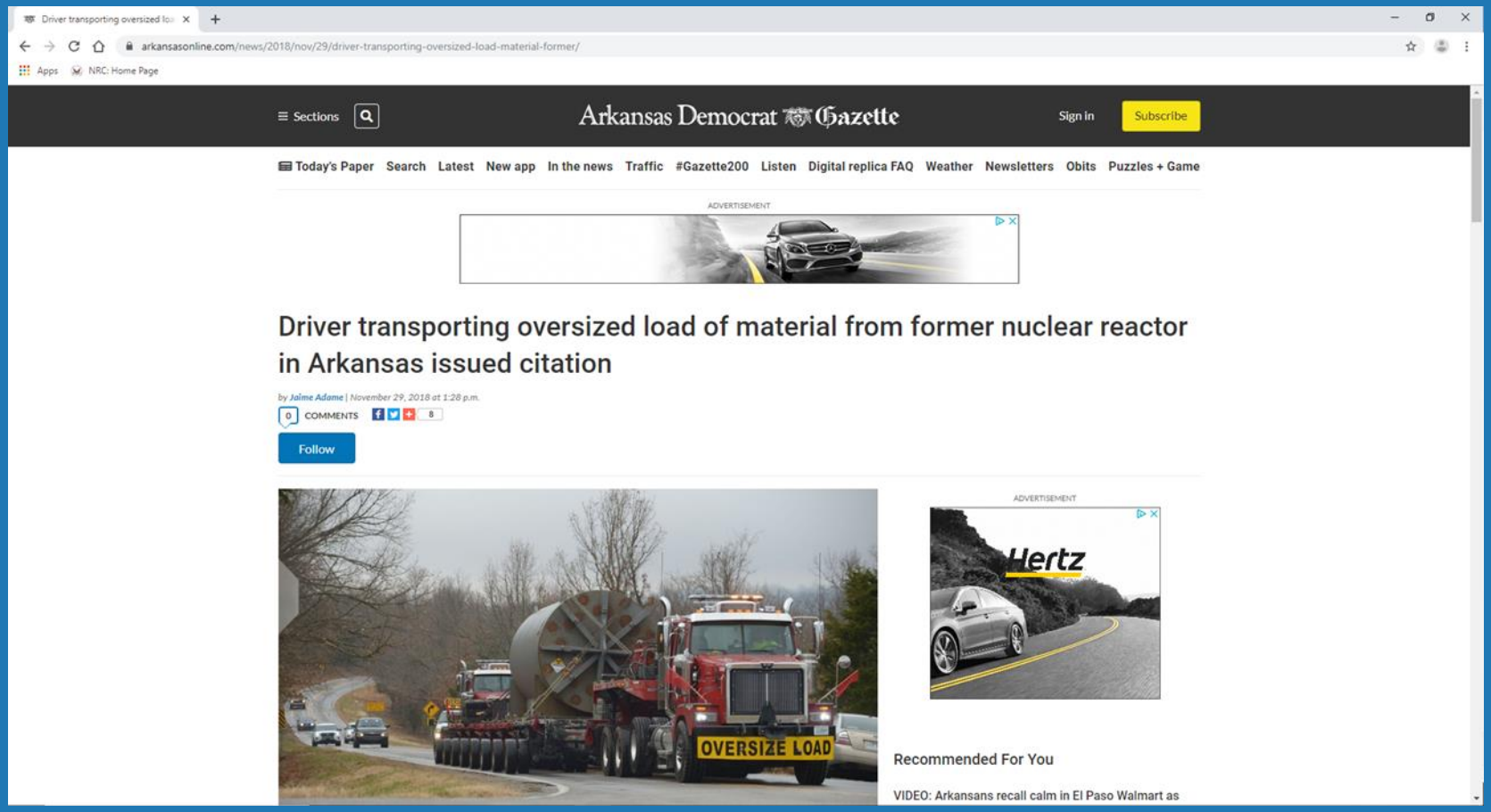
ARKANSAS DEPARTMENT OF HEALTH

SEFOR

SEFOR Rx Vessel Package Leaving SEFOR Site – Nov 29, 2018

ARKANSAS DEPARTMENT OF HEALTH

SEFOR



SEFOR

- While in transit, there were daily updates regarding progress and any issues.
- The SEFOR reactor shipment arrived at the disposal facility on the morning of December 13, 2018. (15 days)
  - Except for a ticket in Arkansas, the shipment made the trip with minimal delays or problems.

Phase 3b – LLRW Removal/Disposal

~570 tons of LLRW removed
(30 trucks / 40 containers)

Arkansas Radiation Control Program – site visit March 26, 2019

On March 26, 2019, the Arkansas Department of Health Radiation Control Program performed and on-site visit of the SEFOR site

The purpose of the visit

- Obtain split samples with EnergySolutions
- Perform an independent/confirmatory walk over survey

ARKANSAS DEPARTMENT OF HEALTH

ADH Performing Independent Walk-Over Survey – Mar 26th

ARKANSAS DEPARTMENT OF HEALTH

ENERGYSOLUTIONS

51

Soil Samples Staged for Weighing and Separating – Mar 26th

Separating and Weighing FSS Soil Samples – Mar 26th

SEFOR

Throughout the project 10 community meetings were conducted with the last on April 11, 2019.

ARKANSAS DEPARTMENT OF HEALTH

NWA Democrat-Gazette/CHARLIE KAIJO Dale Quinton of Strickler reacts Thursday as he's acknowledged during a public meeting at the Strickler Fire Department community center in Fayetteville. Quinton helped with digging at the Southwest Experimental Fast Oxide Reactor site.

SEFOR Decommissioning Summary

- Phase 1 – 2009 to 2011 ~$1.5M
  - HSA, Characterization, D-Plan, minor Demo
- Phase 2 – 11/21/2016 to 9/11/2017 ~$10.5M
  - Secondary Structure Demo and Cleanup
- Phase 3a – 10/4/2017 to 3/30/2018 ~$3.5M
  - Containment Cleanout and Prep for Rx Removal
- Phase 3b – 5/25/18 to 5/23/19 ~$10.3M
  - Rx Removal, LLRW Disposal and FSS

TOTAL ~$25.8M

SEFOR

The Arkansas Department of Health, Radiation Control Program, Released the site for unrestricted use on June 3, 2019

SEFOR Today

ARKANSAS DEPARTMENT OF HEALTH

ARKANSAS DEPARTMENT OF HEALTH

Contact information:
Steve Mack, Health Physicist
Arkansas Department of Health
Radiation Control

steve.mack@arkansas.gov

Get yourself a hobby, because licensees will drive you crazy!!