**PATRAM 2019**
**August, 2019**
**New Orleans, LA, USA**

# Orano TN's Expertise Providing Pool Cleanout Equipment Services for Operating and Decommissioned Nuclear Power Plants

Cheryl Laws, Jay Thomas, Sandrine Toupiol

Orano TN

## ABSTRACT

Orano TN (TN) and BSI formalized a teaming agreement affirming their leading market position for pool cleanout services. In turn, TN completed the purchase in 2018 of BSI-developed, state-of-the-art and industry-proven equipment for the processing of irradiated hardware.

The specialty equipment, for the reduction and processing of reactor component volume, enhances TN's used fuel pool cleanout services, and includes a combination compactor/shear for control rod blades and fuel channels, a velocity limiter shear, a stellite roller ball punch, and a mobile rod cutter. This equipment, combined with TN's industry workhorse, the TN RAM Type B transport cask, provides customers with a turnkey solution for comprehensive reactor pool services to move used fuel and obsolete radioactive components to secure on-site dry storage or remote burial. In addition, TN and BSI signed a teaming agreement to continue using BSI's experienced operations staff and innovative engineering support to carry out these projects.

The TN-BSI team recently completed a used fuel pool cleanout project at a shutdown pressurized water reactor (PWR) in coordinated operations, including the loading and shipment of irradiated components and used fuel racks. Key to this success was the use of an innovative unique thimble plug spring removal tool that significantly reduced the amount of Greater than Class C (GTCC) waste remaining in storage.

The new equipment is intended to expand TN's services in the commercial and federal markets, including those of the U.S. Department of Energy and international regions. Over 20 reactor shutdowns have been announced in the US, with more expected in the next decade. The ability to segment, load and transport waste so as to optimize limited cask volumes leads to significant cost savings in LLW disposal. While these pool cleanout services are more in line with BWRs (control blades, stellite bearings, velocity limiters), PWR operators can also benefit from this technology.

This paper will present a description of the pool cleanout equipment, as well as TN's growing capabilities to meet industry needs.

## 1. Introduction

All nuclear power reactors produce irradiated reactor components that are considered as waste material requiring disposal. Boiling Water Reactor (BWR) Nuclear Power Plants (NPPs) produce significant quantities of irradiated reactor components which are stored in their used fuel pools. In order to free up pool space and reduce area radiation dose rates these components are periodically processed and loaded into Nuclear Regulatory Commission (NRC) licensed transport casks for transportation to a disposal site. Pressurized Water Reactors (PWR) also create irradiated reactor components (flux wires, thimble plugs, RCCAs, control rods, sources and filters) but in smaller volumes than BWRs and, thus, are not subject to the same storage issues. However, upon plant shutdown, most PWRs are opting to remove their used fuel racks and to clean out the irradiated hardware in their pool immediately after the used fuel is moved to dry storage.

The closure of the Barnwell Disposal Facility (BDF) in 2008 to all but the three Mid Atlantic compact states (SC, NJ and CT) contributed to the buildup of irradiated hardware in used fuel pools around the country. Clive, the only other disposal facility at the time, accepted only Type A waste. Consequently, many BWR plants began processing and storing the Class B/C waste on site. When the company, Waste Control Specialists (WCS), was founded in 2012, many of the BWRs elected to return to the disposal option as WCS accepts Class B and C waste.

## 2. Processing waste

The primary advantages of processing (compacting and segmenting) irradiated hardware before disposal are volume reduction and minimization of Greater-Than-Class C (GTCC) waste. When off-site disposal is chosen, reducing the volume maximizes efficiency and reduces overall cost as fewer shipments are required.

The industry has a limited number of NRC-licensed waste transport casks. The TN-RAM cask can accommodate approximately 60 $ft^3$ of waste in a disposal liner. To maximize the space in the liner, it is necessary to compact and cut the larger components. For example, control rod blades (in crucifix configuration) can be flattened to approximately a 1.5- to 3-inch thickness with negligible spring back so that the flattened components can be more easily stacked inside the liner. The TN-RAM liner can hold approximately 16 CRBs once they have been processed (compared to 2-3 without processing). The same process is used to flatten spider assemblies from PWR plants.

TN's pool cleanout equipment can be modified to support projects in research reactors and facilities.

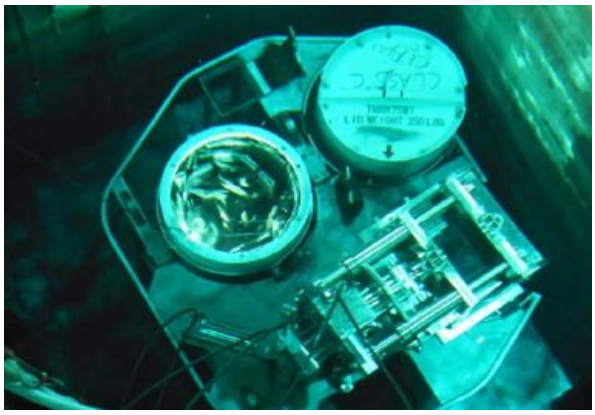

Figure 1 Top view of control rod blades loaded in a liner

## 3. Pool cleanout equipment

a. **Activated services shear (ASX)**: designed to provide both compaction and shearing functions for activated hardware components – directly above the TN-RAM liner (for BWR CRBs and fuel channels, and PWR thimble plugs and reactor control cluster assemblies).

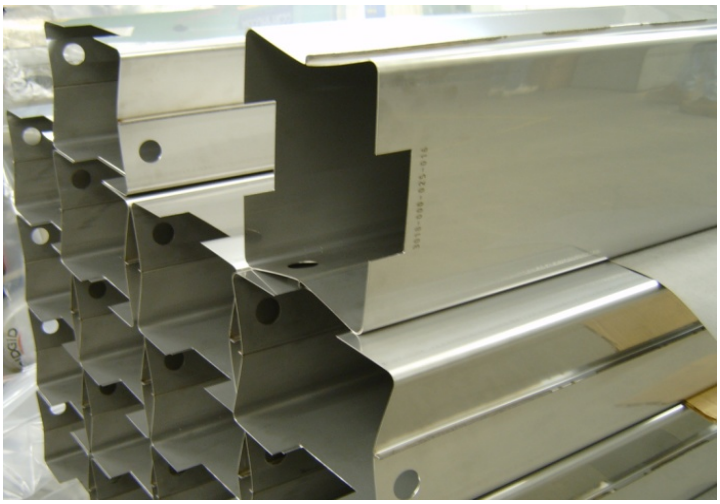

Figure 2 Control rod blade sheaths reduce contamination on equipment and reduce dose, supporting TN's commitment to ALARA (typically less than 2.2R total during load in and load out).

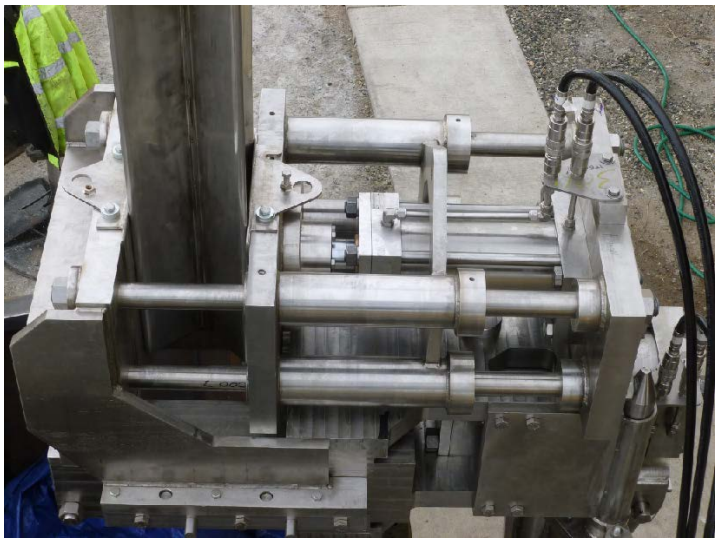

Figure 3 Activated services shear (ASX) showing sheathed CRB ready for compaction. This function is typically done in the fuel pool. ASX is remotely operated with a compaction force of 280,000 lbs.

Figure 4 Flattened CRB in ASX (photo taken in pool during compaction)

b. **Activated services shear stand (ASXS):** designed to position the SX over the top of a TN-RAM liner – the seismically qualified stainless steel frame stabilizes the liner during loading. The liner is tilted in the stand during loading so that the blades remain vertical.

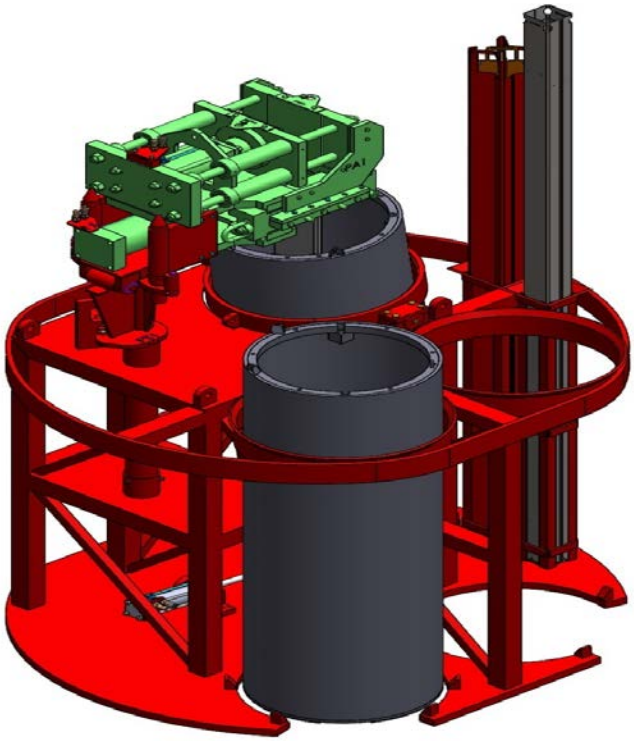

Figure 5 ASXS drawing, showing 2 liners in stand

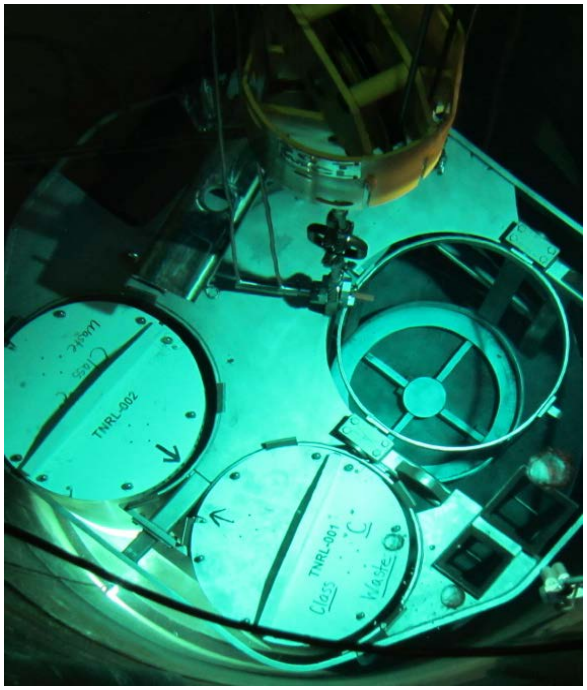


Figure 6 Large footprint for stability; used with pivot stand to position ASX over liner, which reduces debris from cuts falling into pool

c. **Activated services punch (ASP):** designed to remove 4 stellite roller bearings and bearing axles on each CRB before compaction.

d. **Velocity limiter shear (VLS):** Using demineralized water hydraulics, the VLS is designed to remove the velocity limiter from the bottom of each CRB before compaction to reduce GTCC waste. Improved design to remove crud traps, the VLS remains in a holder after the cut for secure handling.

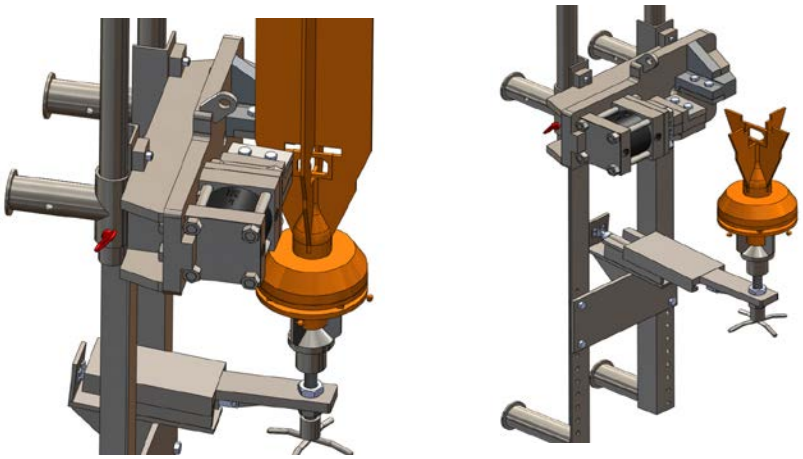

Figure 7VLS drawings

e. **Mobile rod cutter (MRC):** used to segment fuel rods and LPRMs, this is an off-the-shelf hydraulically powered shear-type cutter modified to operate remotely underwater to cut various components.

Figure 8 Mobile Rod Cutter

f. **Thimble plug handle puller:** This is a unique hydraulic-based tooling specifically developed to remove the Inconel springs from select thimble plugs enabling disposal of the thimble plug as acceptable disposal site waste. The spring, which is typically GTCC, can then be stored for future disposal when the DOE deems this type of waste acceptable.

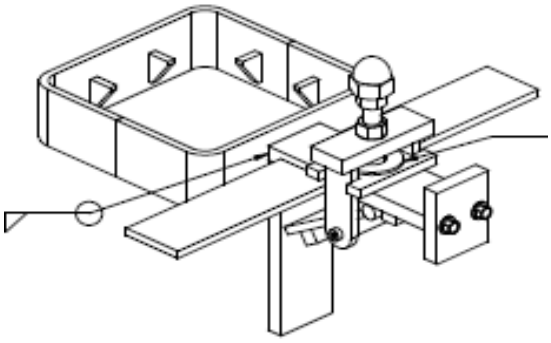

Figure 9 Thimble plug handle puller

g. **HPU:** skid mounted system qualified to provide remote control operation by wired pendant control (used for all BSI component processing machines).

## 4. Conclusion:

Irradiated hardware in both BWR and PWR fuel pools can be efficiently and safely processed and loaded for disposal using this equipment. The most significant advantage of the processing equipment is the volume reduction of irradiated hardware to maximize the capacity of the disposal cask, resulting in benefits to TN customers. Pool cleanout equipment is meticulously maintained using the latest technology and can be modified for a particular site's needs. The use of sheaths on CRBS or fuel channels helps to keep the processing equipment clean and to reduce fall-out debris during cutting. TN's equipment and operators are second to none and consistently finish projects below ALARA site goals. Whether it is for a scheduled periodic pool cleanout or a decommissioning project, TN has a proven track record in the industry.