

POLLUTION PREVENTION AT  
LOS ALAMOS NATIONAL LABORATORY  
Removal of Pencil Tanks, TA-55, PF-4, Room 401  
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LA-UR-01- TBD

**Background:**

Radioactive waste from Los Alamos Nation Laboratory's (LANL) Plutonium Processing Facility, TA-55 PF-4 includes pencil tanks which are used to store process liquids. Historically all TA-55 process waste has been considered transuranic (TRU) waste and pencil tanks that have been removed from service have been considered TRU waste.

In 1999 nineteen stainless steel pencil tanks from nitric acid operations were removed from room 409 in building PF-4. Those tanks were wrapped in plastic and foam and placed inside a specially constructed disposal container. The 19 tanks weighed 2515 lbs. and the disposal container itself weighed 1615 lbs. The volume of the 19 tanks was approximately 1m<sup>3</sup> and the disposal container volume was 3.7 m<sup>3</sup>. NMT personnel estimated and additional 1.9m<sup>3</sup> of llw was produced during pencil tank removal operations.

Pencil tanks are designed to be criticality safe. The Pencil Tanks are 6" diameter, approximately 10' long and the centers of the tanks are 18" apart. They may be constructed of either 304 or 316 stainless steel and are connected by 3/4" stainless steel pipe that is joined by a flange. Figure 1 shows the approximate design of one side of a typical pencil tank rack.

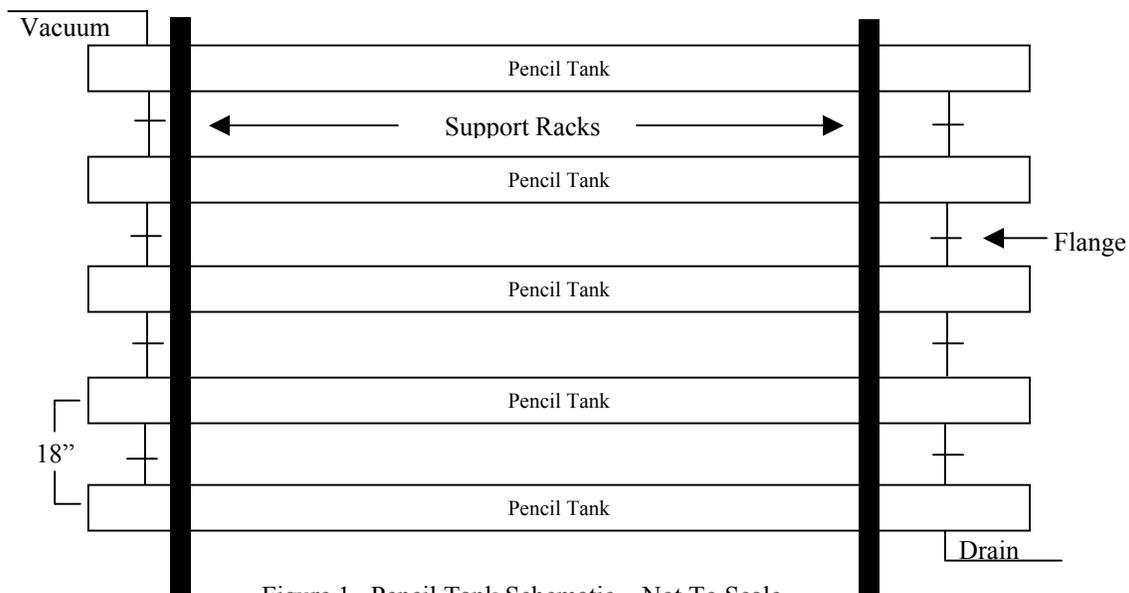


Figure 1. Pencil Tank Schematic – Not To Scale

## The Challenge

There are 13 racks of tanks installed in room 401 of Building PF-4. Ten tanks are installed on each rack with five tanks on each side (130 tanks). All of the tanks will be removed over the next several years because they are reaching the end of their design life. A new vertical tank design has been approved and consists of three 200-liter tanks instead of the ten 50-liter tanks. The vertical tank design will allow mixing of the material within the tanks prior to processing.

A rack of ten individual pencil tanks comprises “tank” T-9. Tank T-9 is currently used for storage of reclaimed nitric acid from the Nitric Acid Recovery System (NARS). Removal of tank T-9 has been planned for FY-02 to make room for the ancillary equipment for a vitrification system that is being installed in room 434A. Room 434A is contained within and accessed through room 401. The need to remove the bottom two pencil tanks within the tank T-9 rack was increased on September 20, 2001 when one of the bottom two tanks began leaking through a welded flange.

During the next several years the 130 pencil tanks in room 401 will be removed from service and replaced with vertical tanks. Using the information from the previous tank removal operation approximately 25 m<sup>3</sup> of TRU waste and 13m<sup>3</sup> of LLW will be generated from the removal of the 130 pencil tanks in room 401. The challenge for the Green Zia Team was to find a way to avoid/minimize the generation of LLW and TRU waste during pencil tank removal operations.

### Green Zia Pencil Tank Removal Team:

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## Process Mapping

The general process map for removing a pencil tank is shown below.

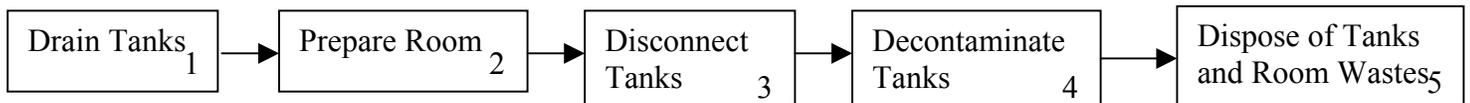


Figure 2. Overall Tank Removal Process

Figures 3 through 5 provide greater detail of the steps involved and the materials used and the waste generated. The decontamination of the tanks is a new step in the tank removal process.

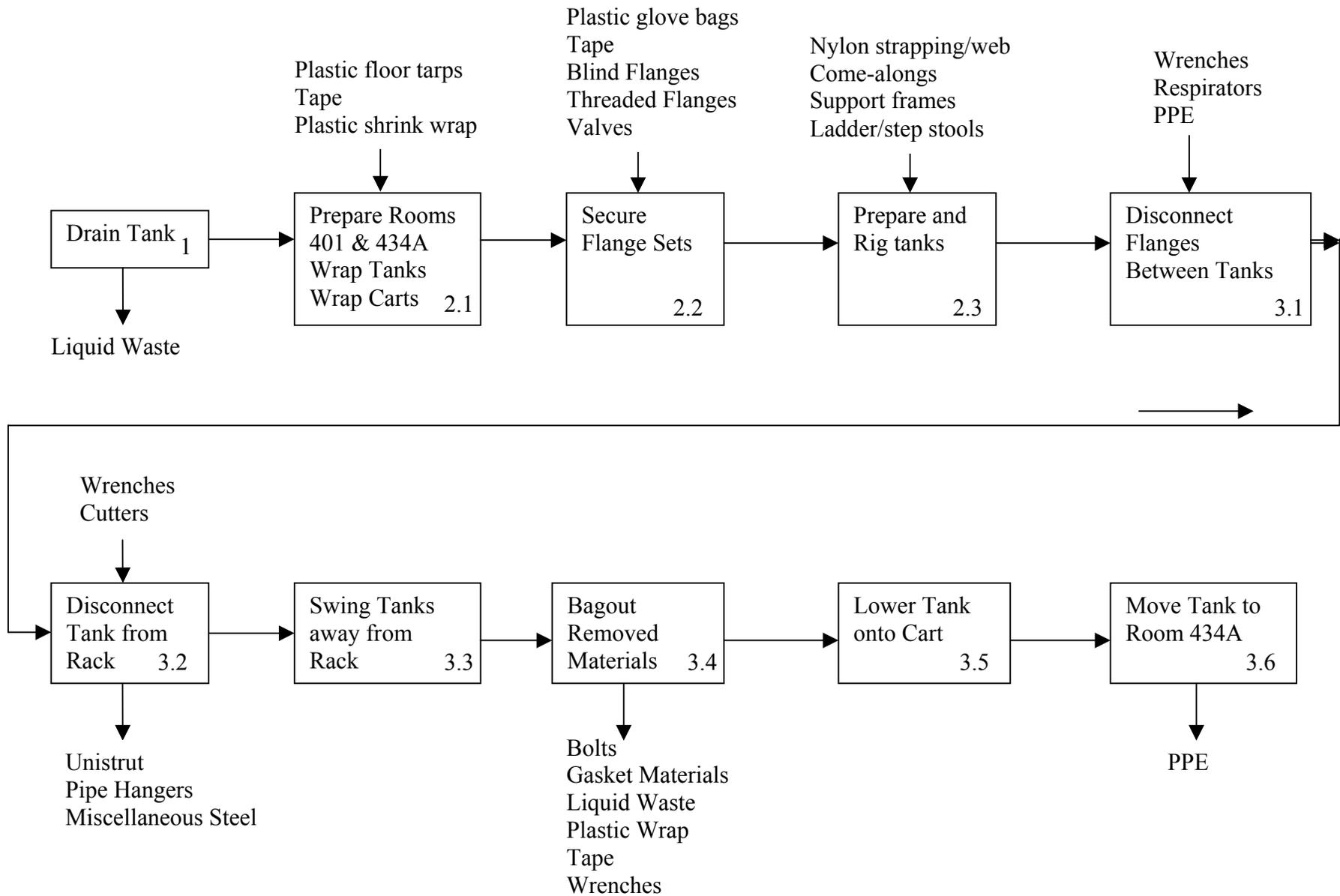


Figure 3. Tank Drain, Room Preparation and Tank Removal Flow Sheet

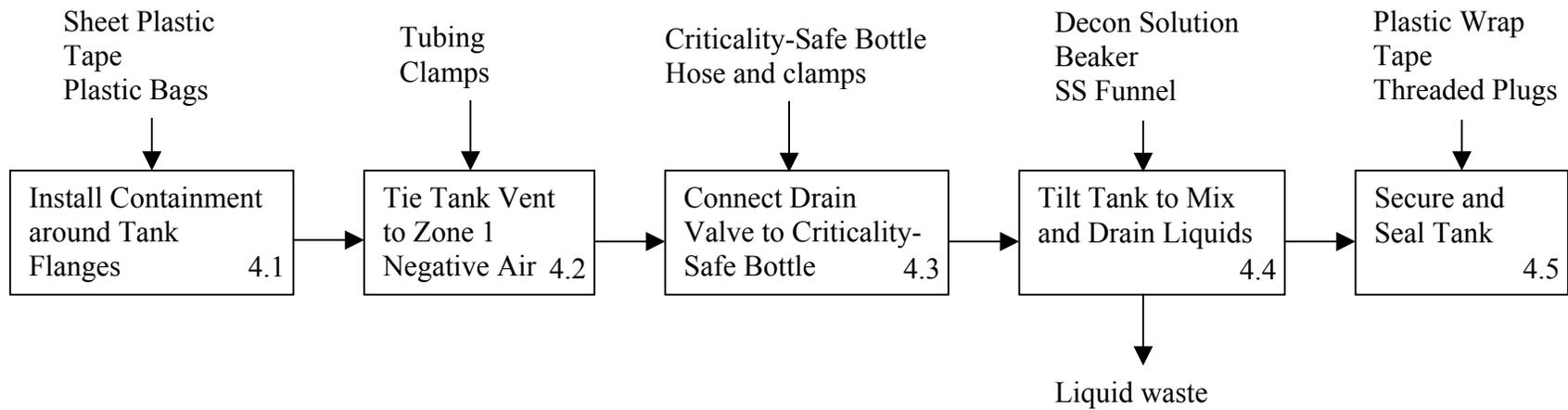


Figure 4. Residual Liquid Management and Internal Decontamination

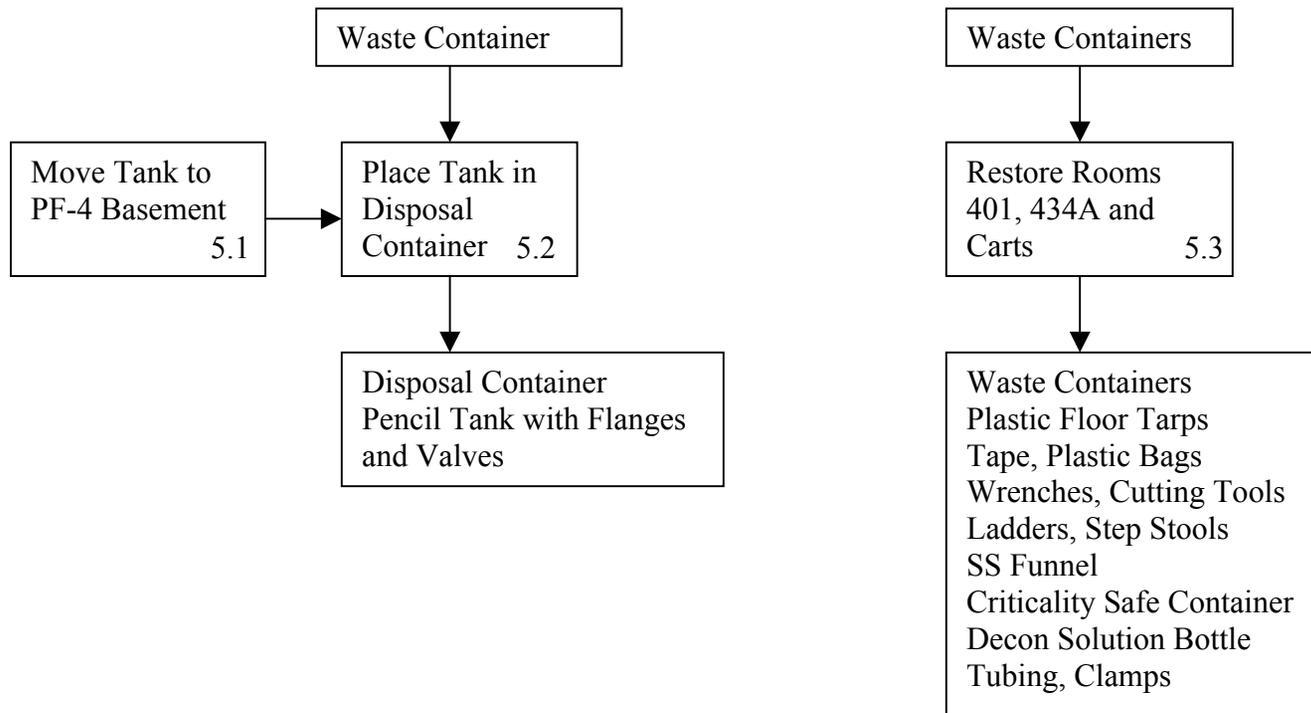


Figure 5. Tank Disposition and Room Restoration

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The nitric acid used to flush and decontaminate the tanks prior to disposal is recycled nitric acid from the NARS. The liquids generated during the removal process are collected and fed back into the recovery process.

With the exception of the tanks themselves and the tank packaging, the solid waste generated will be low-level radioactive solid waste. At this time it is assumed that the tanks are TRU waste. However characterization of the liquids that were drained from the tanks have been initially characterized as LLW. It is possible that assay of the tanks will determine that they are LLW.

The following items are used in the process and will end up as radioactive waste each time a tank is removed:

- Plastic bags – for waste disposal and containment
- Plastic sheeting – used to prepare the room and cover the tanks
- Disposable personal protective equipment (PPE)
- Smears and swipes materials – used to determine contamination levels
- SS funnels - for adding liquids to the tanks
- Blind flanges – used for sealing the tanks after being disconnected
- Threaded flanges – installed on the tanks after separation
- Tape – used to hold plastic in place
- ALARA Paint – used to bind internal tank contamination
- Waste containers – used to contain the tanks and those for combustible materials

Although eventually they will require decontamination and release or will end up as radioactive waste, the following items are used in the process and can remain in the facility for use on all the tank removal operations:

- Wrenches – for disconnecting the tanks from the racks
- Cutting tools – for removing unistrut and other steel rack material
- Carts – used for moving the tanks after removal
- Lifting and rigging materials and equipment – used for lowering the tanks off the racks
- Hoses and fittings – used for hooking the tank vents to the PF-4 ventilation system
- Ladders and step stools – used for accessing the work areas

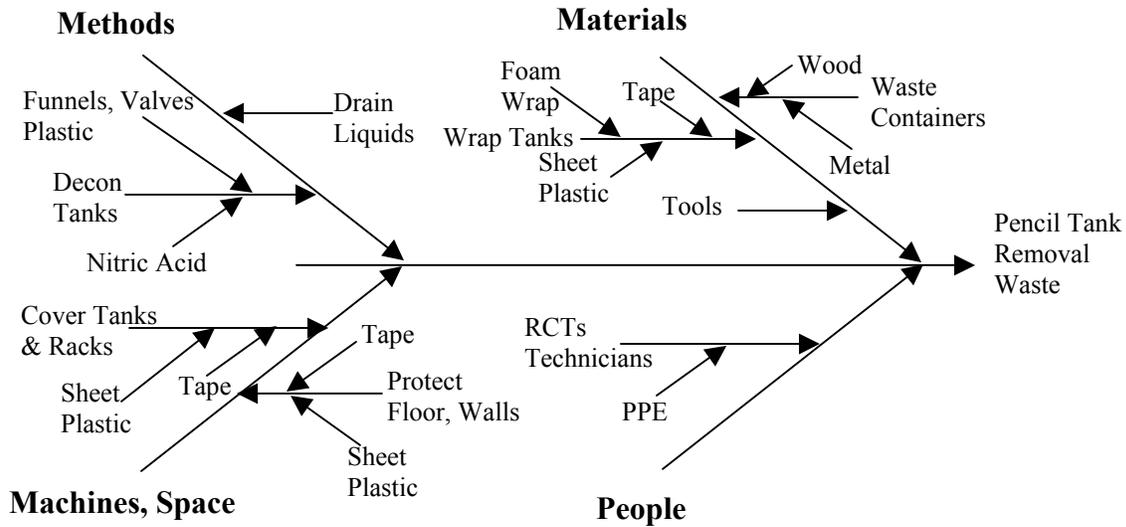


Figure 6. Cause and Effect Diagram for Pencil Tank Waste

### Root Cause

Using the fishbone diagram (Figure 6) the team examined the materials, machines and methods associated with the generation of radioactive waste from the removal of pencil tanks. As can be seen from the Figure 6, there are many sources of waste materials. The pencil tanks and their waste container are the largest volume items. Plastic sheeting and tape are used throughout the removal process and are the largest source of secondary radioactive waste.

### Statement of Problem

Pencil tanks within PF-4 have reached the end of their design life and are being replaced by new tanks. The tanks were not designed for easy removal and previous tank removal operations have generated a large amount of radioactive waste. The Green Zia Team needed to identify a better process for removing pencil tanks without generating additional radioactive waste.

### Generating Process Alternatives

The team members identified alternatives for and minimizing the amount of waste generated during tank removal operations. The alternatives are not exclusive and include material substitution and packaging alternatives. Since the tanks and their support

structures are being replaced there was no alternative to generating them as waste. However the team did develop a method to try to reduce the level of radioactive material within the tanks so that they might be categorized as LLW. The following options for avoiding and minimizing waste generation were identified:

1. Those materials (tools, scaffolding, drain lines) that can be used on all tank removal operations should be stored in the facility for future use rather than discarded after each operation.
2. Since the floor beneath the tank racks and adjacent equipment is covered with tarps for each removal operation, removing an entire rack of 10 pencil tanks will generate the same amount of tape and plastic as removing a single tank. When possible, an entire 10-tank rack should be removed at the same time.
3. The sheet plastic used to cover the floor of the room and to isolate other tanks and equipment should be replaced with washable tarps.
4. Custom designed washable tarps that minimize the use of tape during installation should be used.
5. Hoses used connect the tanks to the ventilation and or drain systems should be sleeved to avoid contamination and reused.
6. Carts, ladders, and step stools should be covered to ease their eventual decontamination. Those items should be borrowed from other areas of PF-4 if they are available.
7. Waste disposal containers for the pencil tanks should be eliminated where possible. Past operations used custom-made disposal containers. If possible the tanks should be transported to TA-54 DVRS in reusable containers.
8. The individual tanks should be wrapped with the minimum amount of material. Shrink-wrap should used where wrapping is required. Design of a reusable duffel bag should be investigated for “wrapping” and moving the tanks.
9. Tanks should be tilted to ensure all the liquids are removed. After draining the tanks should be connected to the PF-4 vacuum system to dry the remaining moisture.
10. The tanks should be rinsed with recycled nitric acid to reduce the internal contamination levels.
11. The inside of the tanks should be coated with a fixative like ALARA paint to limit the spread of contamination when the tanks are processed at the DVRS. The fixative can be placed in each tank through the vent line and spread through the tank by turning and tilting the tank. The tanks should be connected to the PF-4 vacuum system to dry the fixative.
12. The tanks should be assayed individually to determine if they are LLW or TRU waste.
13. Use of a metal platform that is 3 ½’ tall, 18” wide, and approximately 10’ long would enable the workers to reach the upper tanks (approximately 7 feet high) and would be easy to decontaminate and reuse. Such a platform could be used in place of wooden scaffolding and could be reused on other tank removals.

## Rank Ordering of Alternatives

The alternatives are not exclusive of each other and the team felt that all could be implemented. Alternatives 1 – 3, 6 and 8 are the easiest to implement while alternatives 9 through 11 will require additional planning before implementation. Alternatives 4, 5 and 13 require purchasing of materials but should be easy to implement once the materials arrive on site. Alternatives 7 and 12 will require the verification that they can be implemented within existing regulatory and programmatic constraints.

## Action Plan

NMT-2 will be removing at least two pencil tanks in October 2001. Those two tanks are the bottom two in Tank T-9. Alternatives 1 – 11 and 13 will be implemented as part of that tank removal operation. Assay of the tanks on an individual basis (alternative 12) requires scheduling with the appropriate assay personnel and systems. Use of reusable containers for storage of the pencil tanks at TA-54 Area G has been discussed with Solid Waste Operations (SWO) personnel and they have tentatively agreed with that option. SWO personnel have endorsed options 9-11. If the bottom two tanks from T-9 are determined to be LLW, SWO will process them through the DVRS in FY02. Processing the tanks through DVRS will result in a significant volume reduction. If the tanks are TRU waste they will be processed once the DVRS receives authorization to operate as a Nuclear Category 3 facility. The following schedule may be influenced by other priorities within PF-4.

<b>Milestone</b>	<b>Date</b>
Design/Purchase Washable Tarps	October 2001
Remove Bottom 2 Pencil Tanks from T-9	October 2001
Store Equipment for Future Use	October 2001
Decontaminate and Fix Internal Contamination	November 2001
Determine the Amount of Secondary Waste Produced	November 2001
Ship Pencil Tanks to TA-54	January 2001

Use of the alternatives in the removal of additional pencil tanks will be based upon their success in minimizing waste when removing Tank T-9. In accordance with safe work practices a review of their use will be performed following the removal of the first two tanks. Those alternatives that prove successful will be incorporated into the standard process for removing pencil tanks and may be applied to other removal operations.