

Safety Enhancements for TRU Waste Handling – 12258

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ABSTRACT

For years, proper Health Physics practices and “As Low As Reasonably Achievable” (ALARA) principles have fostered the use of glove boxes or other methods of handling (without direct contact) high activities of radioactive material. The physical limitations of using glove boxes on certain containers have resulted in high-activity wastes being held in storage awaiting a path forward. Highly contaminated glove boxes and other remote handling equipment no longer in use have also been added to the growing list of items held for storage with no efficient method of preparation for proper disposal without creating exposure risks to personnel. This is especially true for wastes containing alpha-emitting radionuclides such as Plutonium and Americium that pose significant health risks to personnel if these Transuranic (TRU) wastes are not controlled effectively.

INTRODUCTION

In order to manage TRU wastes in a safe and efficient manner when glove boxes are not practical, radiological control programs must adopt new practices and procedures that enhance safety. Perma-Fix Environmental Services’ subsidiary waste treatment facility Perma-Fix Northwest Richland, Inc. (PFNW) has safely managed over 400m³ of TRU wastes with an overall volume reduction by developing enhanced personnel protection systems. PFWN has utilized a combination of a highly-trained work force, personnel protective equipment (PPE), communication devices, containment barriers and monitoring systems to develop an enhanced program for processing this waste.

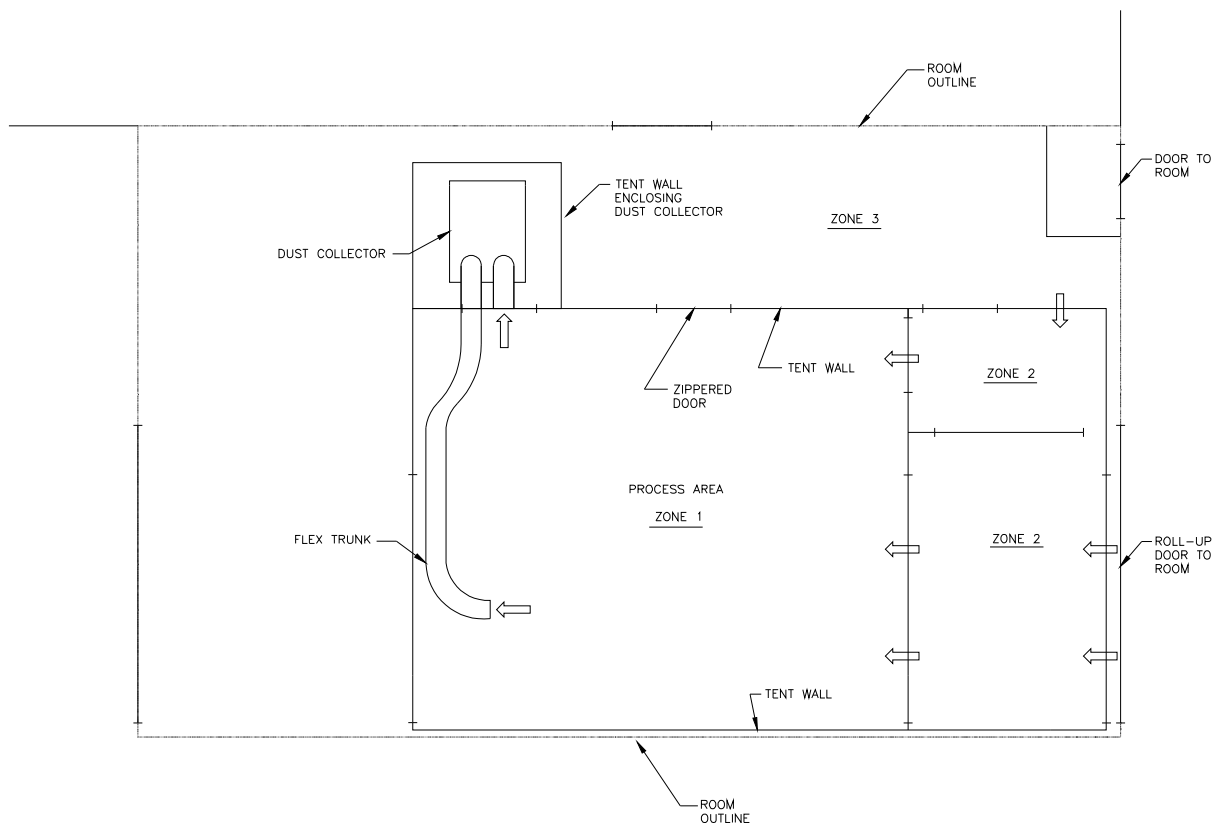
METHOD

Air sampling

PFNW has used a combination of real-time air sampling along with the more traditional air sample pumps and sample heads to monitor the work areas and breathing zones. The primary difference that has been used with the real-time monitors is to not simply use them as a stop work or alarm set point. PFWN has identified a team lead whose primary responsibility is to monitor change and the cause of change in the work environment from outside the contamination area (containment). The team lead watches the real-time monitoring equipment for rapid changes or increases in the working air concentrations. By recognizing the change in the air space and watching the work being performed the team lead can often identify the potential source and/or event

that may have caused the increase or change. By being able to quickly recognize the potential source or problem, the workers inside the containment can work to mitigate the additional release or spread of contamination into the containment air space. Figure 1 is an example of a containment layout. In this instance there would likely be at least one real-time air sampler inside the containment along with two other stationary work zone air samples and the breathing zone lapel-type air sampler on each of the workers in the containment.

Figure 1 is an example containment placed within an example room, for processing and packaging high activity glove boxes and other large items.



Fogging

One method of reducing the airborne concentrations once released into the air space is to apply or release a mist into the air space providing a fog of the area and expediting the removal of the particles in the air. The continuous running of the fogging system is not recommended and must be evaluated for each application. Continuous fogging has not always proven to be beneficial and may introduce new additional hazards. The misting or fogging can be a helpful technique in controlling airborne contaminants but is not to be used as a catchall. PFNW has found that fogging is most beneficial when used

as a tool to help correct or bring the elevated air sample results back to a workable level along with stopping the work or activity being performed that is causing the elevated activity. Fogging is best performed if the moist air is being pulled through the work zone airspace and able to collect and essentially scrub or pull the particles from the air. In the example shown as Figure 1 the makeup air would be coming from the room and Zone 3 areas into the Zone 2 areas and then be pulled across Zone 1 to the dust collector. It would then be identified that the misting system should provide the mist near the Zone 2 boundary within Zone 1. PFNW has found that there are advantages to having the on/off and variable-speed control switch located outside the containment in the event the team must exit the containment but still have the mist applied or it may be determined that fogging is determined to be beneficial to have running before entry. There may also be advantages to the control switch being inside. An important lesson with these projects has been that no one set is perfect for each given waste stream.

Local exhaust

Containment shape and size will need to be considered when determining the proper number of exhaust points and flow rates. As shown in Figure 1, the example containment would be equipped with two exhaust points. Less than two is generally not recommended. Too many locations may also introduce new problems and limit the team lead's ability to place the workers in the safest location as well as identify the cause or source of the elevated air sample results. As in the example containment shown in Figure 1, the primary air is collected into a single corner that the workers are made aware of. The team then can understand and work with the direction the air will be flowing. The use of an additional flex exhaust hose provides the team members with the ability to provide local ventilation to any newly exposed areas while dismantling, cutting or otherwise sizing the glove box or item for final packaging.

Draping

Once the glove box or item is opened or exposed to the containment, the team may use a canvas-type material as a drape cloth to assist in funneling the air flow in the desired direction. This will minimize the exposed surfaces therefore decreasing the potential spreading of contamination into the working air space of the containment.

Container or item prep

Before sizing or processing occurs on an individual item or glove box the team must take the time to look at the item to evaluate and prepare a cut or dismantling plan. The purpose of this plan is to limit the number of cuts and/or breaks that could result in disturbing and releasing unnecessary contamination into the containment work space and therefore increasing the contamination levels for the remainder of the dismantling and repackaging process. A properly designed cut plan can enhance the use of spot exhaust and better utilize draping and the natural containment properties of the item. A goal should be to pull the process air away from the team member performing the dismantling activities.

Surface fixing

All internal accessible areas should have a fixative applied to the surface to assist in minimizing the potential for release of contaminants into the working air space. A fixative may also be applied to the outside areas depending on the condition and contamination levels expected or identified on the outside surfaces. A second layer of fixative is often applied to the areas to be cut or otherwise dismantled. Fixative may be applied by using a spray or roller/brush method or any combination of these methods. For very high levels, PFNW has found that using a spray for the initial application is best followed by back-rolling the potential or suspect areas after the initial spray. Fixing of the surfaces is not a onetime process. It may be determined that the surfaces need to have additional fixative applied throughout the dismantling process. PFNW has found that it is sometimes beneficial to apply a fixative directly behind the cutting tools or seams upon separation.

Worker placement

Avoiding the teamwork location having to be in the air-stream pathway is beneficial in the limiting of their exposure in the event that there is an increase in contamination levels released into the work space. To accomplish this, the workers must understand the air flow inside the containment as well as current conditions. The team lead must continually communicate with the team about the progress being made, what the next step is and the current real-time air sample results.

Tools

PFNW has found that there is not a one-stop shopping list for tools to use. As much as the items differ, the tools and items to be dismantled must be continually evaluated. Cutting tools that have been useful include various saws and blade combinations. Nibblers have also proven to be effective. Supplied air and escape packs with hoods, multiple types of gloves, sleeves and drape cloths all assist in personal protection. Gantries and other lifting devices are essential but must be evaluated with the cut plan because of the difficulty in placing them in the containment part way through an evolution. Different mixtures in the fixative have been found to be more effective depending on the time allowed for it to set up.

Communication

Communication between the team lead and the team is essential. Team members are assigned in the work area (see Zone 1 of Figure 1) as well as support positions in the Zone 2 and Zone 3 areas identified in Figure 1 and the clean areas outside the containment and buffer area surrounding the containment. The team lead must maintain constant communication with the team. Communication in one direction is not sufficient for this process. PFNW has utilized a two-way radio set up that uses the vibration of the skull rather than a mouth piece which has been found to work very well with the

supplied-air respirators. These radios should have their own dedicated channel and are not to be used by other departments or work areas. Due to the potential risks involved in processing this waste/material not only the team but workers in adjacent areas are to understand that dealing with these high-level items and glove boxes takes precedence and is the priority if additional resources are needed in supporting the team.

Employees and teamwork

The best worker for this project may not be the most senior or most experienced worker in the waste management department. Each position requires differing expertise and strengths. The team lead must be able to multi-task and communicate with the various other team members while watching the air sample activity levels, the actions of the team in the containment, and also watching for new or potential hazards. The workers in the containment need to be able to work in confining PPE without getting frustrated and making unnecessary movements that could cause additional airborne contamination. The containment team members need to be able to react quickly to remediate the spread of contamination but not over react. Dropping of tools or cutting outside the cut plan can cause more work and elevated contamination levels being spread into the work space and breathing zones. The support team members need to be able to recognize what tools will be needed next, as well as to continually status their team members and the overall project. Little things like reminding the containment crew to cover the trash receptacle or advising them of a new hazard due to a sharp edge being exposed when the last cut was made or piece of the item was removed can prove beneficial to the safety and efficiency of the overall project.

PFNW has found that when a good team is identified it is best not to mix it up or change it too readily. A good team will notice those things and react together without causing additional work for the next team or for them in the future. An example of how they will commonly work together with a setup as described and shown in Figure 1 could be as follows.

A cut plan has been put together and the glove box is placed inside the containment. A fixative has been applied at the end of the shift the previous day. The team has started dismantling the glove box by removing the windows. While removing one of the windows it catches on the edge of the glove box frame breaking the window glass. The real-time air monitor inside the containment immediately starts to rise in the containment air space. The team lead instructs the support team members outside (if controls are located outside) the containment to turn on the fogging equipment into the containment. The team members inside the containment are instructed to stay where they are but not disturb anything else until further notice. Once the air sample results are shown to stabilize and no longer be on the rise, the team lead instructs the containment team members to pull the drape cloth up over the opening to minimize the size of the opening in the glove box and increase the face velocity of the air across the opening. The drop cloth on the floor can then be folded up over the glass or additional drop cloths can be placed down on the floor to cover the glass. If the air sample concentrations return to a workable level, work may resume or the workers may be instructed to exit the area. The

support team will be instructed to adjust the flow of the fogging equipment as needed or otherwise support the containment team members in exiting the area or containing the broken glass.

RESULTS

The enhancement of using real-time monitoring to identify changes in the work environment rather than the standard use of alarm set points to stop work and evacuate the area has proven to be beneficial to the project and the employees at PFNW. The way PFNW has been using their system could be looked at as using it for near-miss identification rather than accident documentation. While in operation, the real-time air monitors used by PFNW are continually adjusting with the current radionuclide concentration and the total volume. The sample heads are placed in an airstream or pathway that might be considered the worst case scenario allowing PFNW team members to identify changes and compare them to the activities that are going on in the containment. PFNW uses the lapel type breathing zone air samplers to identify the individual exposure of those working in the containment. TRU waste processing is remotely monitored by the team lead using video, audio, and real-time air monitoring outputs to ensure that the operation is being performed to protect the waste-handling personnel. By using this method, changes in the work environment can be immediately detected and mitigated before a stop-work action level is reached. Controlling the change and rate of change in the environment has proven to be a primary key to the safe, successful and efficient processing of TRU waste at the PFNW facility.

Another significant enhancement is training waste handling personnel to operate in new and innovative ways. Training personnel to work together, communicate and react differently has been one of the most significant challenges for PFNW, but has resulted in safe and efficient operations for problem waste streams that require disposition to meet our country's commitment to the citizens and the environment. Continually enhancing operations through process improvements, incorporation of lessons learned and the willingness to look outside normal tendencies are essential tools that are vitally important to managing these and future identified wastes.

Although PFNW has safely managed over 400m³ of TRU wastes with an overall volume reduction, there have been obstacles that need to be continually addressed. These include but are not limited to the following:

Heat

PFNW has had to continually monitor and adjust for heat stress, particularly during the summer months. During the summer months, the hours of the working shifts were changed to perform less work in the afternoon and evening and more of the work was performed in the early morning. Sun shields may be placed on the outside of the building and insulation could be installed to assist in maintaining temperatures in the work areas.

Sharps

It was identified that the dismantling and cutting of metal objects often leave sharp edges when exposed to the workers and can cause damage to the PPE and potentially the workers. To mitigate these sharp edges the team may be required to cover them with duct tape or other padding as soon as they are exposed regardless of the amount of time they are expected to be exposed.

Stay time

Stay time is not only important during high-heat time but also must be considered for other factors such as airborne concentrations of radioactivity and the stress of the current work being performed. PFNW sets time restrictions for each entry and relies heavily on the other team members to watch, communicate and identify if their co-workers are stressed or working out of sync and need to exit the area ahead of the original schedule.

CONCLUSION

Like any good safety program or root cause investigation PFNW has found that the identification of the cause of a negative change, if stopped, can result in a near miss and lessons learned. If this is done in the world of safety, it is considered a success story and is to be shared with others to protect the workers.

PFNW believes that the tools, equipment and resources have improved over the past number of years but that the use of them has not progressed at the same rate. If we use our tools to timely identify the effect on the work environment and immediately following or possibly even simultaneously identify the cause or some of the causal factors, we may have the ability to continue to work rather than succumb to the start and stop-work mentality trap that is not beneficial in waste minimization, production efficiency or ALARA.