DUF6 Conversion Facility Paducah Tour Verbatim Script 2015

NOTE: Read **non italicized** portion more of less verbatim.

Guide visitors to enter door S-1 at DUF6 Administration Building, sign in and step into Admin Building, gathering in training room 105. Visitors will receive PPE (safety glasses, verify shoes adequate), and a general welcome by James Johnson, OAM, Paducah DUF6. A general safety briefing and radiation work permit briefing for the conversion facility and cylinder yard will be conducted by BWCS personnel.

Formally start tour by introducing self.

My name is (_____) , and I am the (Title) at the Paducah Depleted uranium hexafluoride conversion facility.

"The tour is scripted for consistency.. I will be stopping at various points along the tour and providing a brief description of items at that location. No questions will be answered during the tour by me or any escorts or any persons you may encounter. In any emergency situations follow the guidance of the escorts. If you need to use the bathroom facility, we will be stopping before we leave this facility. Should the need arise during the plant tour, you can contact one of the escorts so the group can pause for you.

Visitors need to use 3x5 cards to jot down questions. I have extra cards available upon request. The cards will be collected at the end of the tour by DOE tour escorts and provided to the contracting officer. Please provide your name/contact info on the first card and name on all subsequent cards. We will contact you if we have any need for clarification.

Pass out cards to anyone who needs them. Monitor any persons using the bathrooms. Conduct headcount using sign in sheet as a basis. Jot down number of visitors.

Before exiting Administration Bldg (AB), indicate
You are currently in Bldg C-1100, a two story facility of 9,770 sq. ft. that provides office and administration space for the project. In the first floor are engineering staff, a document storage area, a breakroom and meeting room which are separated by a moveable partition.

Proceed up north stairwell to second floor:
On the second floor are Emergency Management staff, IT support, the local IT server room, support staff including ES&H, Compliance, Human Resources, a Conference room with videoconferencing capability, Nuclear Safety staff, and the Plant Operations Director's suite.

Stop at restroom before departing.
Please make use of the restroom if needed before we depart for the plant portion of the tour. On this tour one escort will trail behind the last person. Please follow me."

Upon exiting the Administration Building meet at the crossroad point between the full cylinder staging area and KOH building entrance:

Some of the buildings that we will tour through are the Conversion Building, Warehouse/Maintenance Building, and Potassium Hydroxide Building. Throughout this facility, there are detectors tied to alarm systems that warn of abnormal conditions. Should we need to take any precautionary actions, following the guidance of the escorts.

The full cylinder pad adjacent to the Conversion Building (*point)* is used for temporary staging of DUF6 cylinders s prior to processing. To the east is the motorized access gate to the cylinder yards where the bulk of the DUF6 inventory is located in addition to the Uranium Oxide that has been generated through the conversion process. We will be driving through those areas later on our tour. The Cylinders are inspected and moved by NCH 35 cylinder handlers to the Full Cylinder staging area. Cylinders are transferred by crane to a transfer cart and then to the monorail crane for movement into the Conversion Building through the double air lock doors.

Cylinders not suitable for the autoclaves because of size or defect, e.g. CV19, would be placed in the Cylinder Evacuation Room (CER), through the airlock doorway on the left. The CER operation has not been started to date but it is anticipated that this operation will started within the next year or so.

We will follow the cylinders into the conversion process in the conversion building but first we will tour the potassium hydroxide or KOH building.

Proceed to KOH building and enter

Pause inside building and perform headcount

This building houses KOH regeneration process equipment. Aqueous KOH is utilized in the HF scrubber systems. Spent KOH solution is regenerated in this building using lime, producing a CaF2 byproduct. This building also houses the deionized water system and associated tanks.

Panning from the right we have:

The KOH system regenerates spent KOH in a batch process. This system is controlled using an Operator Work Station that provides the operator an interface for the start-up, shutdown, general plant control, and monitoring. The operator work stations have a communication link to the integrated control system. There are operator work stations distributed throughout the plant to facilitate monitoring and limited field operations in the areas.

The KOH treatment system includes hydrated lime addition and mixing tanks, storage tanks and a filter press where the CaF2 is collected in drums.

The Deionized Water System (DIW) supplies clean water to boilers located in the C-1300 conversion building as well as providing deionized water to plant support systems such as the hydrogen generators, the deionized water scrubbers, and various locations for flushing purposes . The DIW generation system is a multi-bed adsorption system that requires periodic regeneration.

The KOH storage tank is where KOH is offloaded and this is diluted to provide KOH at the concentration used for KOH scrubbers and for cylinder stabilization.
Proceed to N2 pad:

The nitrogen supply system is leased equipment from Air Liquide. Liquid nitrogen is periodically delivered to the site by truck.

As we continue along the road on the right you can see the cooling tower for the process cooling water system on our right.

Proceed to the H2 generation units.

In front of you are four hydrogen generation supply systems. This system uses a natural gas steam reformation process. This system is in the process of being augmented for long term hydrogen system reliability.

Proceed to the conversion building.
Prior to entering,
Additional facilities included in the yard area are a change house, offices for Support staff, some waste storage buildings and valve houses for our incoming water supplies.

The yard with cylinders single stacked is called the Heel Cylinder Staging Area. Feed cylinders that have been emptied contain some residual material, and are moved to this yard in order to provide a sufficient aging period for background radiation to decay. After sufficient time has passed, these cylinders will be moved to the cylinder stabilization area which will be discussed later. After stabilization the cylinders are moved back to the heel cylinder staging area until they are modified to serve as strong tight containers for the uranium oxide product.

Proceed to monitoring area 1st floor conversion building.

We will enter through door marked ‘Boundary Control Station’ and gather in the open space as beyond. This area has locker rooms, a small storage area, and a small office for radiological control staff. Before we enter, please be sure you are wearing your safety glasses.

Our first stop is the Vaporization area. Please follow me.

The Vaporization area houses ten autoclaves eight of which are used for processing regular cylinders. The autoclaves can accommodate both 30" and 48" diameter cylinders. To date, only 48" cylinders have been processed. The rail tracks and the crane monorail (*point)* along the whole length of the room are used to move cylinders for processing. Cylinders are loaded into the autoclaves where they are heated to vaporize the uranium hexafluoride in order to feed the conversion units.

A brief summary of the autoclave operation is as follows: the Autoclave door is opened, the transfer cart is positioned, the scissor lift is raised, the cradle is moved out of the autoclave, the cylinder is set on the cradle using the overhead crane, and the cylinder and cradle are returned to the autoclave. The cylinder is then manually connected to the DUF6 feed system. The transfer cart is moved, the scissor lift is lowered, and the autoclave door is closed and latched. Once the autoclave door is secured, interlocks are activated. Cylinder heat up, feed, evacuation using vacuum pumps and then the final cool down of the heeled cylinder is monitored and managed by operators in the main control room. The cycle time for a single cylinder is approximately 24 hours.

There were two autoclaves for each conversion line that allows each line to operate continuously. Note that each line has a hot box serving the two autoclaves. The hot boxes contain valve manifolds and vacuum pumps that move material into the conversion units.

Please follow me to the south end of this area to see the Cylinder Transfer System. *Proceed to the Cylinder Transfer system.*

Cylinders that cannot be processed through the Vaporization System will be processed through the Cylinder Transfer System. These autoclaves were designed for at-risk, or suspect cylinders and operate at a lower temperature and pressure. For example, a cylinder with thinning walls can't be taken to full temperature. The UF6 from these cylinders is extracted and then added to the hotbox feeding the Line 1 conversion units.

Please follow me into the next room, the Cylinder Evacuation Room.

Oversized cylinders, such as the CV-19 type, will be processed in this area. The contents of the cylinder will be transferred gradually to the Line one conversion units. Vacuum pumps assist in these transfers. Heat blankets may also be utilized to aid in the transfer operation. Neither the cylinder transfer station nor the cylinder evacuation room have been operated to date.

Thus, there are systems for three types of cylinders, CER for CV19 or odd-sized cylinders, CTS for suspect cylinders and the autoclaves for regular cylinders.

We will now proceed to the Cylinder Stabilization System area which is located at the north end of this room.

Cylinders are returned to the building from the heeled cylinder aging pad for stabilization. The CSS is used to perform stabilization of cylinders in one of the two stations. Potassium hydroxide is used to neutralize any residual heel remaining in the processed cylinders. Once the cylinders have been stabilized, they are returned to the heeled cylinder satging pad

We will now proceed to the oxide powder transfer room.

Proceed to oxide powder transfer room

The conversion process is a continuous process in which almost all of the operations are automated for efficiency, high quality, and safe operation. Operators provide continual monitoring and can make process adjustments from the area control room.. Cylinder transfer and cylinder handling require more manual operations, but most of the actions (outside of actual cylinder movement) will be automated through the Integrated Control System (ICS) that incorporates the operation of the process systems and balance of plant (BOP) systems.

Proceed to Conversion Unit Area 1st floor:

There are four process lines, each with two conversion units. Each conversion unit discharges oxide powder from the bottom. The oxide product is delivered through a rotary valve, then through a heat exchanger to the transfer station. These transfer stations are fitted with a special drum bypass for normal continuous operation during which oxide product is pneumatically transferred and collected in large hoppers on the upper level.

The manifolds to the left control the flow of nitrogen, steam and hydrogen to the conversion units. The gas mixture is heated and introduced to the conversion unit below the distributor plate where it diffuses through into the fluidized bed.

We will now proceed to the second floor.

We are currently performing a significant maintenance evolution which requires partial removal of the heating jackets. The good thing is you will be able to see the conversion unit inside the heating jacket on all lines. However, there are temporary contamination areas surrounding the conversion units which currently take up a large portion of the normally accessible floor space on this level.

To the left are the fluidizing gas manifolds (H2, N2, steam) and overhead are the steam super-heaters. During the conversion process vaporized DUF6 is fed, and reacts with the super-heated steam to form uranyl oxifluoride. The intermediate product is then entrained in the fluidized bed where steam, hydrogen and nitrogen are mixed and fed upward through a flat circular distributor plate. The resulting uranium oxide powder

flows down though a center hole in the distributor plate and is pneumatically transferred and collected and packaged for disposition.

Overall, the process equipment is arranged in four parallel conversion lines, each conversion line consists of two autoclaves which feed to one hotbox and then separates DUF6 flow to two conversion units. Two product streams are produced; a gas mixture which includes hydrofluoric acid and a solid stream of uranium oxide powder. Later in the tour we will see parts of the by-product gas stream where it exits the top of each conversion unit, enters a hydrogen fluoride (HF) recovery system and then process off-gas scrubbers prior to being vented to the facility stack. The Conversion Building is maintained at slight negative pressure as all air and scrubbed off-gas is exhausted through the stack.

Proceed to the third floor.

In front of us is the third floor which requires hard hats to enter. We will not enter the area. This floor is the level where DUF6 is fed into the conversion units. This location also has access points where uranium oxide can be fed into the conversion units if needed following conversion unit maintenance. We will now proceed up the stairs to the Mezzanine area to view the top of the conversion units.

On this floor the top of each of the conversion units can be seen. The product gas stream is filtered and nitrogen is used to back pulse the filter to separate fine oxide from the gas stream exiting the filter. The oxide falls back by gravity into the conversion unit and as the oxide particle size grows fluidization is overcome and it exits the bottom of the conversion unit through the rotary valve into the oxide powder transfer system. The gas stream exits the conversion unit and travels through a backup filter before going on to the offgas system we will see later on the tour.

Also located on this level on the other side of the wall are the oxide hoppers. This room is a contamination zone and therefore we will not be entering the room. However, you will be able to view this area from below later in the tour.

We will now proceed back down to the second floor to follow the oxide powder system..

Proceed to the roll compactor room.

In this room we can see bottom sections of the two oxide hoppers. The oxide from Conversion Lines 1 and 2 go to the south hopper and Conversion Lines 3 and 4 go to the north hopper. A rotary feeder moves the oxide from the hopper, through a roll compactor that compresses the oxide powder into pellets to reduce its volume prior to filling modified empty cylinders.

Follow me back to the stairs as we return to the first floor.

Proceed to the hot-shop area.

In this room is the maintenance 'hot shop' area, Cylinder Modification System, distributor plate and filter cleaning areas, and the oxide cylinder fill station.

Point to the ultrasonic cleaning station.

The ultrasonic cleaning tank is used for maintenance of oxide filters, distributor plates, and cleaning of other parts used in the conversion process.

Point to cylinder modification area.

The Cylinder modification system is used to install a flange on empty stabilized cylinders and cut a hole in the cylinder wall within the flange to be used for filling with uranium oxide.

Proceed to the oxide filling station.

A modified cylinder is moved by the overhead crane to the transfer cart then moved again by a separate crane from the transfer cart to the up-ender transfer cart. The modified cylinder is placed in the up-ender and raised to the vertical position for filling with oxide product. Once filled it is then lowered and moved by crane through the air locked doors to the filled cylinder staging area. At that point in time the cylinders will be relocated to onsite oxide storage areas within the cylinder yards.

Point to the operator work station.

This is another operator work station. This is one of several distributed throughout the facility for remote operations by field operators. The operator work station is in direct communication and part of the Control Room ICS.

We will now proceed to the monitoring area when the each person will be scanned for rad contamination prior to exiting this area. Upon exiting the controlled area we will proceed to the control room.

To use the half body monitors, step in with both feet under the detectors, place your right hand in the slot to the right, and press your right hip snugly against the detector. There are verbal instructions provided by the monitor to ensure proper positioning for monitoring. When directed, turn around and place your left hand in the slot and push your left side against the monitor. You can watch me demonstrate.

Proceed to outside the control room.

Please follow me to the control room area.

As you can see there are office spaces, meeting area, and a break room.

You can see the control room through these windows. The control room contains the integrated control system with dedicated computers that manage the four Conversion Lines and the support systems. The integrated control system consists of the basic process control system (BPCS) and independent safety system (ISS).

There are two white boards which provide facility status information and track Technical Safety Requirements status such as modes of operation and limiting conditions for operation.

The control room computers have a dedicated uninterruptable power supply.

Proceed to the condenser room.

We will now proceed to the HF condenser room. We will not enter into the area requiring a hard hat.

Conversion offgas piping enters from conversion area. The large ceiling heat exchangers condense HF gas to a liquid. The liquid is sent to the HF recovery system, and a small fraction of HF that does not condense is sent to the process offgas system. The process offgas goes through a deionized water scrubber and KOH scrubber system, both of which are located in the Scrubber room which we will be going to next. Most of the HF generated in the conversion process is recovered as product.

On the far side of this room are five boilers that utilize deionized water to produce steam for use in the conversion units.

In addition hydrogen piping passes through this room to the conversion units.

Proceed to the scrubber room. Enter through south door

The liquid HF drains by gravity to the HF Receiver tanks which are the large black tanks on the wall. The vapor from the separators on the condenser room goes through a deionized water scrubber which also goes to the HF Receiver tanks. The HF liquid is then pumped to the HF storage area where it can be dispositioned for sale. The gas from the deionized water scrubber goes through a KOH scrubber where the trace quantities of HF that remain are reacted to remove the fluorine from the gas stream. The gas from the KOH scrubbers discharges into a common gas header which goes through a back-up scrubber for final HF removal and then is discharged out the process ventilation stack.

Support equipment in this room also includes chiller systems for the process cooling water operations throughout the facility.

Proceed to HF storage rail/truck access point, Stop at rope:

The HF transferred from the recovery system to one of six-10,000 gallon HF storage tanks. The HF storage area contains two platforms, one for loading to railcars and the other for tractor trailer loadout of HF product. The piping manifold system has a KOH scrubber to capture all HF vapor fugitive emissions during loadout and from tank vents

Proceed to the chilled water system south west of the conversion building.

This cooling tower provides heat exchange for the conversion building HVAC system.

This standby diesel generator provide backup power to select systems on this site.

Proceed to the electrical room.

Electrical Power is provided via two redundant 13.8 kV electrical feeds that are fed from the main plant switchyard. The main plant switchyard is maintained by others. Within this room is the uninterruptible power supply, an automatic bus transfer switch tied to Stand-by Diesel Generator, four substations, five motor control stations, 480V switchgear, BPCS and ISS cabinets and silicon control rectifiers for various process heaters throughout the facility.

Walk toward mechanical room – north door

This mechanical room contains

- Instrument air compressors and dryers,
- Cylinder upender hydraulic pumps and reservoir.

South door
This section contains chillers and pumps for the HVAC system.

We will now go to the C-1700 Maintenance Building

Enter through storeroom man door

This building houses some limited warehouse space, a maintenance shop area, administrative offices for maintenance support, a breakroom and a change house.

Proceed to guard post for entry into cylinder yard area where a van will be waiting:

Prior to loading van:

The Cylinder Yard contains various assay cylinders. What you see are the typical 48" cylinders. Cylinder movements are needed as only assay level <0.25% are allowed to be processed in the conversion facility at this time.

We will drive by several cylinder yards your viewing and they will be pointed out to you along with the type of cylinder. Please note there are other cylinder yards not adjacent to this area that are also the responsibility of the DUF6 contractor. This area also contains four metal structure buildings used for storage of cylinder yard equipment, supplemental warehouse space, and waste management activities.

Please notice the oxide cylinders are also stored in these yards. They are easily identifiable by the flange that has been added during the cylinder modification process.

Return, enter C-1100

This concludes the DUF6 Project tour today. Please turn any questions on cards that you have and thanks for your interest in our facility.

Collect PPE, sign out visitors, collect 3x5 cards, and release tour.