Installation of a Tank and Vault Drying System in the Tank Farm at the West Valley Demonstration Project – 11113

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ABSTRACT

The West Valley Demonstration Project (WVDP) is taking proactive measures to maintain the underground Tank Farm in a condition that will essentially preclude the chance of a tank leak for years to come. Unlike most other facilities at the WVDP that now have a prescribed closure plan based on the recent Final Environmental Impact Statement and the associated Record of Decision, agreement between the various stakeholders on the type of closure for the Tank Farm with its four underground waste tanks has not yet been reached. A closure decision is planned in the next phase of decision, anticipated by 2020, and implementation of the decision could take many additional years.

The Tank Farm consists of two 2.9 million liter (760,000-gallon) carbon steel tanks, each contained in separate underground steel-reinforced concrete vaults, and two 54,000 liter (14,300-gallon) stainless steel tanks both contained within a common underground steel-reinforced concrete vault. All of the structures were constructed in the mid-1960s and have been in service since then. The tanks were designed with a 50-year design lifetime. The two large carbon steel tanks, Tanks 8D-1 and 8D-2, were emptied of liquids to the extent possible in 2003, leaving less than 19,000 liters (5,000 gallons) of liquid in each tank. Due to at least one breach in the underground carbon steel ventilation system, groundwater added an additional 30,000 liters (8,000 gallons) to Tank 8D-1 after it was emptied. For the past eight years, the groundwater levels had to be closely monitored and managed to prevent the local groundwater level rising to the elevation of the ventilation line and adding more liquid into Tank 8D-1. The two smaller stainless steel tanks, Tanks 8D-3 and 8D-4, contain 6,000 liters (1,600 gallons) and 22,000 liters (5,900 gallons), respectively. They contain proportionately more liquid than the larger carbon steel tanks. Although the WVDP is still considering retrieval and treatment of the mixed waste (radioactive and RCRA hazardous) liquids in the stainless steel tanks, the drying system will begin to concentrate the stored liquids in the interim.

In order to prolong the lifetimes of the tanks and be able to support any closure alternative being considered, as well the elimination of a potential tank leak, liquids inside the four tanks and three underground vaults are being evaporated. Once the liquids are evaporated, the relative humidity in the tanks and vaults will be maintained at or below 30 percent to greatly reduce and essentially halt tank interior and exterior corrosion. The liquids are being evaporated using a commercially available rotary wheel desiccant dryer. The dryer sends extremely dry air into the tanks and the vaults which house the tanks. The dry air picks up moisture from the existing liquid heels and wet surfaces inside the tanks and the vaults. The moist vault outlet air is recirculated back through the dryer to remove the moisture and return dry air back into the vaults. The more contaminated tank air exits the tanks through new stainless steel underground lines that connect into an existing HEPA-filtered and monitored system where the moist air is discharged up the existing permitted stack. The moist air from reactivation of the desiccant wheel is also routed to the same existing filter system for discharge.

This paper describes the development of the Tank and Vault Drying System (T&VDS), installation and testing of the system, its drying capabilities and the simultaneous replacement of the nearly 50-year old underground ventilation lines.

INTRODUCTION

The WVDP is located about 30 miles south of Buffalo, New York, on the site of a former commercial spent fuel reprocessing facility which operated from 1966 to 1972. Approximately 640 metric tons of commercial and defense fuels were reprocessed at the site using the PUREX and THOREX processes. In 1980, the West Valley Demonstration Project Act was signed, directing the U.S. Department of Energy (DOE) to solidify the HLW remaining from reprocessing operations; develop containers for the permanent disposal of the solidified HLW; transport the HLW to a federal repository; dispose of low-level and transuranic (TRU) wastes resulting from HLW solidification; and decontaminate and decommission the HLW storage tanks, solidification facilities, and any materials/hardware used during the Project. Although the DOE is responsible for this clean-up project, New York State owns the site property and funds a portion of Project costs.

At the start of the Project, approximately 2.3 million liters (600,000 gallons) of neutralized PUREX high-level radioactive waste remained on the site in an underground, carbon steel tank designated Tank 8D-2. This waste consisted of insoluble hydroxides and other salts that precipitated out of the highly concentrated waste solution to form a bottom sludge layer, and a liquid (supernatant) upper layer rich in sodium nitrate and sodium nitrite. In addition, approximately 31,000 liters (8,200 gallons) of acidic THOREX waste, commingled with the recovered thorium, remained in a smaller, underground, stainless steel storage tank designated Tank 8D-4. West Valley Nuclear Services Company (WVNSCO), the original prime contractor to the DOE, pretreated the HLW and solidified over 99% of this material in a borosilicate glass waste form. Approximately 90% of the remaining liquids left in the tanks following HLW vitrification was retrieved, treated and stabilized into a solid waste form that was subsequently shipped for off-site disposal. This left just 76,000 liters (20,000 gallons) of residual liquid remaining in the two 2.9 M-liter (760,000-gallon) carbon steel tanks and two 54,000-liter (14,300-gallon) stainless steel tanks combined.

West Valley Environmental Services LLC (WVES), the current prime contractor, has been responsible for on-going tank monitoring and maintenance since July 2007. The high water table in the Tank Farm area, combined with underground vaults that have leakage pathways and a 45-year old underground tank ventilation system that was constructed with carbon steel materials with an identified breach in the 16-inch underground ventilation header, have required significant resources to manage and were factors considered in conceptualizing how to reduce the risk of a tank leak and prolong the tank lives. These discussions were brought to the forefront with the Core Team chartered by the DOE to facilitate exchange of information between all of the regulatory agencies involved with the site and its eventual decommissioning and closure. The Core Team endorsed installation of a Tank and Vault Drying System to reduce the risk of a tank leak and prolong tank containment until the tanks can be decommissioned.

Design bases were established by WVES and a conceptual design with a detailed cost estimate was prepared with the aid of a local engineering firm, InTomes Technical Services, Inc. Armed with a conceptual design and cost estimate, DOE and WVES were successful in obtaining funding for the remainder of the design effort, installation and start-up. Timing of the conceptual design activities coincided with opportunities for *American Recovery and Reinvestment Act (ARRA) of 2009* authorization; funding for this work was officially approved in May 2009 with the requirement that the system be operational by December 2010.

BACKGROUND

Since 1989, the previous site contractor, WVNSCO, has taken actions to further reduce corrosion of the carbon steel HLW tanks based on corrosion coupon analyses and recommendations from corrosion experts. Corrosion inhibitors were added into Tank 8D-1 to reduce pitting corrosion in 1989. A nitrogen inerting system was installed in 1996 which added nitrogen gas into the vaults surrounding the carbon steel HLW tanks to minimize external corrosion by reducing the electrolyte (moisture and humidity) and the oxygen concentration. The nitrogen purge was replaced by dry instrument air in 2007 to reduce costs and eliminate the hazard of liquid nitrogen storage and handling.

In 2002, WVNSCO, proposed a vault drying system to evaporate liquids external to the tanks, contained in the pans and vaults, and provide a low relative humidity in the vaults. This system was conceived to reduce external tank corrosion since metallurgical analysis of corrosion coupons inside the tanks and vaults indicated that external tank corrosion was taking place faster than internal corrosion. The liquids inside the tanks contained corrosion inhibiting chemicals, whereas the groundwater external to the tanks had no chemical inhibitors. The addition of chemical corrosion inhibitors to the vault and pan liquid was not practical since this liquid was periodically pumped to the site's low level liquid treatment system for decontamination before being released to the environment. The system was identified with features that would permit extending dry air supply lines into the 8D-1 and 8D-2 tanks in the future if desired to evaporate the residual liquids. Due to costs and some uncertainty as to how effective the system may be in evaporating pan and vault liquids, the design was not approved. Instead, efforts were undertaken to further mitigate the infiltration of groundwater into the underground vaults by injecting at various locations a mixture of Portland cement and bentonite grout into the earthen cover over the 8D-2 vault, the vault that had the highest rate of infiltration. This was conducted in the summer of 2003. Relative humidity sensors were installed into the vaults to obtain moisture data over the course of a year. Since the liquids in the two large underground tanks were retrieved to the extent practical in 2003, the levels were expected to be reasonably uniform. Through detailed monitoring and trending, it was discovered that each large tank (8D-1 and 8D-2) lost 4,000 liters (1,000 gallons) in volume per year due to the evaporation associated with active tank ventilation. The rate of evaporation was more pronounced in the winter with the cold, dry air infiltration into the tanks. During the humid summer months, no reduction of tank volume was observed, in fact, the levels sometimes increased slightly in the summer months due to moisture in the warm infiltration air condensing in the cooler underground tanks. These observations clearly indicated that drying out the vaults and tanks was practical.

TANK AND VAULT DRYING SYSTEM OBJECTIVES

The basic objectives of the Tank and Vault Drying System (T&VDS) are to evaporate the remaining residual liquids inside the tanks, evaporate groundwater that infiltrates into the underground vaults and containment pans, and maintain a low relative humidity inside the tanks and vaults so that tank corrosion is essentially halted. The design life of the T&VDS is 30 years allowing for periodic maintenance and repair activities. The design life was chosen to help ensure that the system would function until closure decisions for the tanks are made and implemented. By evaporating the remaining liquids in the tanks, there is no credible potential for a tank leak after the tank interiors are dried out. Since the original design life of the tanks was 50 years and the tanks are now 45 years old, evaporation of the current liquid is viewed as a method of preventing a near-term leak. Groundwater that continues to infiltrate through imperfections in the underground vaults, despite repeated mitigating actions, and collects in the bottom of the vaults and pans must be periodically pumped to the on-site water treatment facility. The liquid and the associated moist air and tank surfaces above the liquid in the pans and vaults contribute to external tank corrosion which is more significant than internal tank corrosion and also complicates tank leak detection. By evaporating this liquid external to the tanks, the need for liquid pumping and treatment is eliminated and external tank corrosion is greatly reduced. The system will maintain the tank interior and exterior environments at a relative humidity less than 30%, which is expected to halt any further tank corrosion. This is important to be able to prolong the lifetimes of the tanks and maintain all closure alternatives under consideration viable until these closure decisions can be made and implemented.

A critical design requirement was to utilize the existing Permanent Ventilation System and its NESHAP-permitted stack to exhaust the moist air from the system. This stainless steel ventilation system was installed in the mid-1980s to ventilate the HLW pretreatment process vessels and support building, as well as the HLW tanks during remote riser installation and pump installation into the tank risers. The PVS consists of redundant filter trains with each train composed of a moisture separator stage, heater, prefilter stage, upstream HEPA filter stage and downstream HEPA filter stage. The filter system has redundant exhaust fans that will operate with either train in service. A stack monitoring system, completely updated in 1999, monitors for the presence of alpha and beta contamination. There are redundant alpha and beta CAMs as well as paper filters that are counted weekly. The nominal system capacity is 110 cubic meters per minute (4,000 cubic feet per minute).

TANK AND VAULT DRYING SYSTEM DESIGN PROCESS

WVES developed the functional requirements and design criteria for the system and issued them in October 2008. With the assistance of a local engineering firm, InTomes Technical Services, Inc., a conceptual design (Fig. 1) was developed after evaluating various alternatives through a value engineering process. A detailed cost estimate was prepared for the remaining design, construction, installation and start-up activities. WVES prepared a proposal for this work and presented it to the DOE in March 2009. Due to personnel downsizing and the labor force near-fully occupied performing other site projects, WVES chose to subcontract most of the system design and installation work though a competitively bid design/construct subcontract.

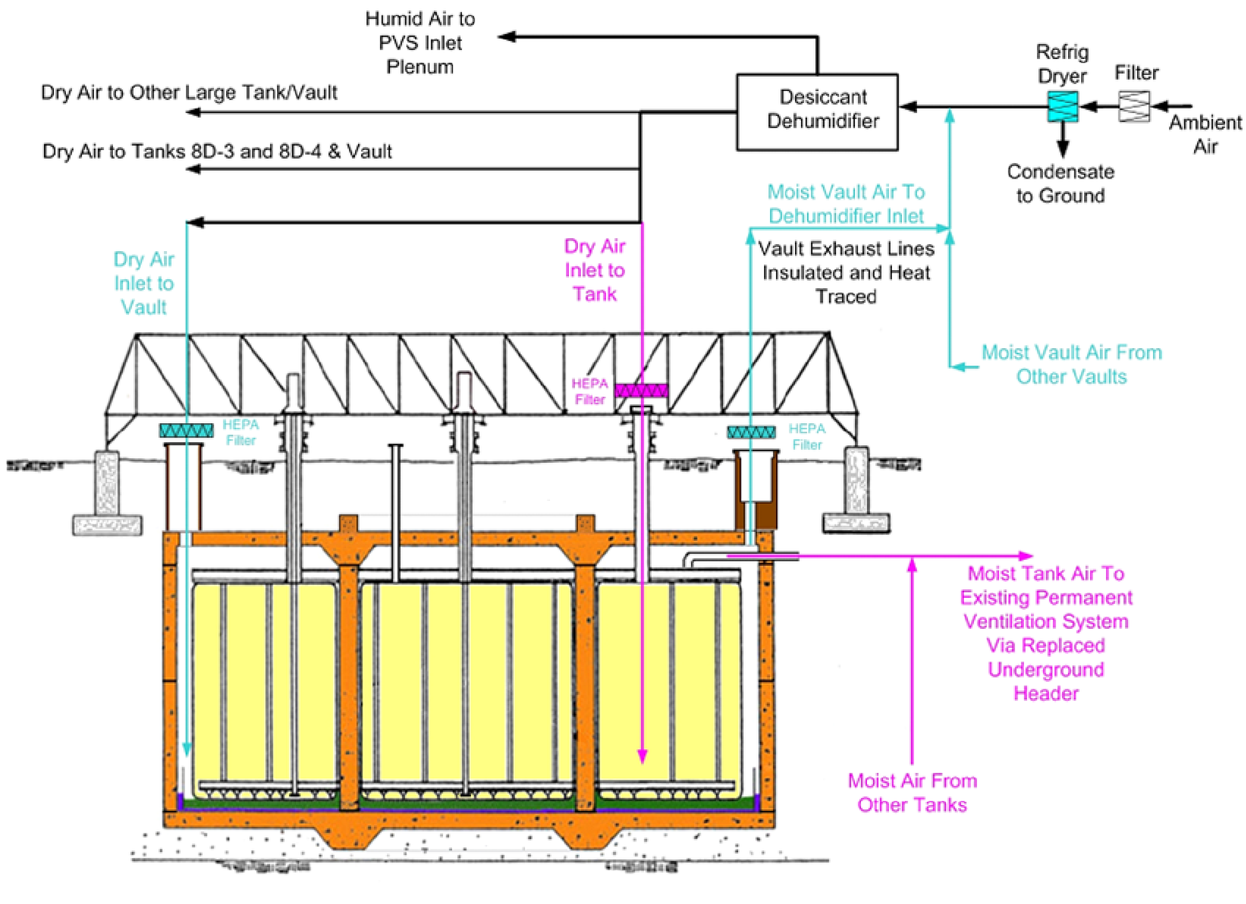

Fig. 1. Tank and Vault Drying Schematic.

WVES assembled a procurement specification that addressed the installation of a Tank and Vault Drying System and the replacement of the breached underground ventilation line. A local construction company teamed with other local companies to provide design, geotechnical, electrical and quality assurance support. This subcontract was awarded in June 2009, the month after the ARRA funding was authorized, to a team of local companies led the Butler Construction Co. of WNY, Inc. who was responsible for the subcontract project management and general construction activities. Teaming partners consisted of:

- McMahon & Mann Consulting Engineers P.C. – site work & geotechnical design
- M/E Engineering, P.C. – mechanical & electrical design
- Quackenbush Co., Inc. – mechanical and drying equipment construction
- Ferguson Electric Construction Co., Inc. – electrical construction
- HF Darling, Inc. – shoring design
- Quality Inspection Services, Inc. – quality assurance/quality control management

The DOE, WVES and the Butler Construction Co. team began the preliminary design of the T&VDS shortly after award. An interactive preliminary design review was conducted on October 29, 2009, with participants from all subcontractor team companies, DOE, WVES departments, New York State Energy and Research Development Authority (NYSERDA), New York State Department of Environmental Conservation (NYSDEC), U.S. Environmental Protection Agency (USEPA), Nuclear Regulatory Commission (NRC) and the New York State Department of Health (NYSDOH). Following resolution of design comments, the final system design was initiated in November 2010.

During the design process, progress updates were provided periodically to the Core Team, the West Valley Citizen's Task Force and the local community, as well as those agencies that participated in the design review. The final interactive design review was conducted on February 22, 2010, and attended by essentially the same participants as the preliminary review.

The final design specified the dry air flows to each tank and vault to evaporate the liquids in a timely manner and be able to maintain a 30% relative humidity or less, 95% of the time, after the liquids are evaporated. The dry air is provided by the installation of a rotary desiccant dryer assembly in the Mechanical Equipment Room of the Permanent Ventilation System Building. This area was chosen to avoid construction of a new structure to contain the dryer.

All four tanks are supplied dry air from the desiccant drier through a new aboveground stainless steel ventilation network branching off the 46-cm (18-inch) dry air supply header. The moist air removed from the tanks is exhausted through underground ventilation lines that connect to the inlet plenum of the PVS. The dry air to the vaults is supplied from the same dry air supply header, but the moist air from the vaults is returned to the dryer through new stainless steel piping that connects to a 41-cm (16-inch) moist air exhaust header. This recycled moist vault exhaust air is mixed with conditioned make-up air which then passes through the rotary desiccant dryer and subsequently the dry air supply header. The desiccant is contained on a permeable wheel that rotates slowly at eight revolutions per hour. While most of the desiccant wheel is removing moisture from the process, a small pie-shaped section is being reactivated from a stream of heated outside air. The reactivation process removes the moisture from the desiccant wheel. The hot, moist air from wheel reactivation is routed to the PVS inlet plenum where it is filtered and monitored before exhausting up the stack. The system was designed to be energy efficient with features to limit the regeneration heat input to only that necessary to produce the desired dry air relative humidity and a variable frequency drive on the dry air supply fan to be able to reduce supply air flows and energy demands as the various liquids are evaporated. At this point, the system only needs to supply enough dry air to evaporate vault in-leakage and maintain the desired relative humidities. Each dry air supply branch contains a butterfly throttling valve and a mass flow sensor to measure the air flow and facilitate flow rebalancing as conditions change. All vault exhaust lines have relative humidity sensors that measure the moisture being removed from each vault.

The design dry air flows to each of the tanks and vaults are shown in Table 1 together with the anticipated time to evaporate the current liquids in each component. These times are based on estimated ambient air in-leakage rates and theoretical evaporation rates; actual durations could vary depending on actual in-leakage and PVS performance with the additional moisture load.

Table 1. Design Dry Air Flows					
	Dry Air Supply (m^3/min)	Dry Air Supply (ft^3/m)	Current Liquid Volume (liters)	Current Liquid Volume (gallons)	Est. Time to Evaporate (years)
Tank 8D-1	14.4	510	53,000	14,100	1.2
Tank 8D-2	14.4	510	17,000	4,400	0.4
Tank 8D-3	2.4	85	6,000	1,600	2.2
Tank 8D-4	2.4	85	22,000	5,900	7.8
8D-1 Vault	14.4	510	8,700	2,300	0.3
8D-2 Vault	31.1	1100	30,000	7,800	1.5
8D-3/4 Vault	2.4	85	4,200	1,100	0.5
Reactivation	31.7	1120	---	---	---

In addition to designing the above-ground T&VDS stainless steel lines, the replacement underground ventilation lines were designed using schedule 10 stainless steel piping. The replacement ventilation exhaust lines for Tanks 8D-1 and 8D-2 each consist of 30-cm (12-inch) pipe with butterfly throttling valves, relative humidity sensors and mass flow sensors. These lines are welded to the existing carbon steel piping stubs left at the two vault walls after removal of the old carbon steel ventilation lines and are joined together in a manifold that mates with the existing 41-cm (16-inch) carbon steel ventilation header that supplies the PVS.

Removal of a portion of the original underground ventilation line also eliminated the previous ventilation pathway for Tanks 8D-3 and 8D-4. To address this issue, a 10-cm (4-inch) hot tap was made in the existing 10-cm (4-inch) stainless steel ventilation line and this new branch routed to the adjacent, newly installed underground manifold. The new line incorporates a throttling valve, relative humidity sensor and mass flow sensor. With the installation of this more direct ventilation pathway for Tanks 8D-3 and 8D-4, the original Tank Farm filter system and the two large condenser structures can be easily decommissioned with minimal effort and then demolished.

PREPARATIONS FOR TANK AND VAULT SYSTEM INSTALLATION

One of the first steps taken before removal of the underground piping included the excavation of three pits by the general contractor to ascertain the actual locations of the ventilation line and the other lines in the same pipe bank. These were completed in October 2009. After the locations of the critical lines in these three locations were established, an as-built drawing was drafted to aid in the design and excavation processes. WVES sampled the asphaltic coating on the carbon steel ventilation lines just below the ground surface to establish whether the coating contained asbestos, which would invoke additional protective measures during removal of the underground lines. The results of samples taken on four different lines indicated that no asbestos controls would be necessary.

Just before the final design review was conducted, the rotary dryer was ordered since it was the only long-lead equipment. The dryer specified is manufactured by Munters, Model HCD-4500 (Fig. 2). This type of dryer is typically used to remove humidity in large arenas and auditoriums, but was suitable for our use in providing a large flow of very dry air into the underground tanks and vaults. Following the final design review, the Butler Construction team began procuring the remainder of the equipment and materials, and began the process of developing construction work packages that controlled on-site construction and installation activities.

Fig. 2. Munters Rotary Dryer, Model HCD-4500.

While equipment was being procured and the ground thawed in April 2010, Butler Construction personnel began the Tank Farm excavation and WVES personnel initiated the process of removing the contaminated underground HLW tank ventilation system that was known to have a breach in the line. This was no small task since the lines ran 2.4 to 4.2 meters (8 to 14 feet) below ground amidst a bank of over 15 process and utility lines and conduits. Further complicating the excavation were the tight confines between the two large tank vaults and the fact that this original piping had been field run, meaning that the historical drawings did not depict the actual location of the lines. WVES developed a glove bag design that was used to cut through the four 20-cm (8-inch) above-ground lines that connected the WTF condensers to the active underground ventilation header. The use of a glove bag to contain the selected reciprocating saw while it cut through the piping and both ends of the cut was mocked up and cuts practiced on similar clean pipe. Modifications were made to the equipment and saw to optimize the process and ensure that any contamination internal to the piping would be contained. The many preparations paid off with the above-ground piping removed in short order. The presence of an internal vacuum inside these lines aided in contamination control and resulted in minimal contamination within the glove bags. An inflatable bladder inserted in the underground ventilation header together with a separate port that was connected to a HEPA filtered vacuum system provided isolation between the initial line removal and the active use of the header to ventilate the two large waste tanks, while still maintaining the line being cut under a negative pressure.

Above-ground temporary ventilation lines were run from the inside of Tank 8D-1 and Tank 8D-2 up through existing tank risers and from a port in the underground line ventilating Tanks 8D-3 and 8D-4. The discharges were connected into a new manifold installed on the inlet plenum to the PVS. 25-cm (10-inch) and 10-cm (4-inch) PVC piping and valves were used for these temporary lines. These lines were needed when those portions of the underground system that support tank ventilation were removed. Based on the success in contamination control using the capture velocity of ambient air being drawn into the saw kerf during the cutting process with the glove bags, and the difficulty in setting up glove bags on the ventilation header in the deep excavation, WVES chose to explore the possibility of cutting the main underground header with the internal vacuum used as the primary mode of contamination control and a tack mat under the cut. After mock-ups and practice on a section of similar pipe, removal of the original ventilation 41-cm (16-inch) carbon steel ventilation header began in May 2010. Sleeving was slid over the completed kerf before the newly cut section of piping was removed. This allowed for contamination control during the separation of the cut lines. The sleeving was then taped between the pipes and cut. Plugs were inserted into the cut ends of the piping and the ands were subsequently bagged. The removed pipe sections were loaded into an intermodal type waste container.

Ventilation line removal progress was slowed by the discovery of an asbestos coating on an adjacent steam line, until a separate work package was issued and the team was temporarily augmented by additional asbestos qualified workers. Shortly afterwards, the workers noticed a different texture on the underground ventilation line coating. Work was halted to test for asbestos and the results came back positive. This was a significant setback because additional sampling indicated the remainder of the lines to be removed contained asbestos in the coating, despite the negative results on samples taken on the initial sections of the lines. New personnel, including an asbestos-qualified supervisor were assigned from other projects and trained in the cutting process.

When the ventilation header was completely removed, the 30-cm (12-inch) schedule 60 branch piping to Tanks 8D-1 and 8D-2 were removed back to stubs protruding through the vault walls. The cutting process was modified somewhat since the tank itself was providing the negative pressure in these lines, with the tanks ventilated through the temporary ventilation lines.

Measurements were taken for the new replacement stainless steel ventilation lines and shop fabrication began. One of the challenges in the installation of the new piping (Fig. 3) was making the connections between the new stainless lines and the carbon steel stubs that remained.

Fig. 3. Installation of new underground ventilation line.

After considering flanges with gaskets or O-rings, WVES decided to utilize large socket couplings custom-fabricated from larger carbon steel pipe. This allowed the dissimilar metal weld to be performed in the fabrication shop with final similar metal welds performed in the field, and left no flanged joints buried underground. Each tank ventilation exhaust line was equipped with a new throttling valve to adjust flows, a relative humidity sensor and a mass flow sensor. Signals from the relative humidity sensors were routed back to the Tank Farm programmable logic controller (PLC). After testing, the excavation containing the lines was backfilled and the new lines placed into service. The temporary ventilation lines were then isolated and portions removed.

TANK AND VAULT SYSTEM INSTALLATION

During replacement of the underground ventilation lines, the above-ground piping was run between the rotary dryer and all the access points to the tanks and vaults (Fig. 4). Schedule 10 pipe of varying sizes was used to provide maximum design flows to each tank or vault. Dry air supply lines were not insulated due to the dryness of the air being supplied, however, the moist air exhaust lines from the three vaults were heat traced and insulated to avoid internal ice build-up during the winter months.

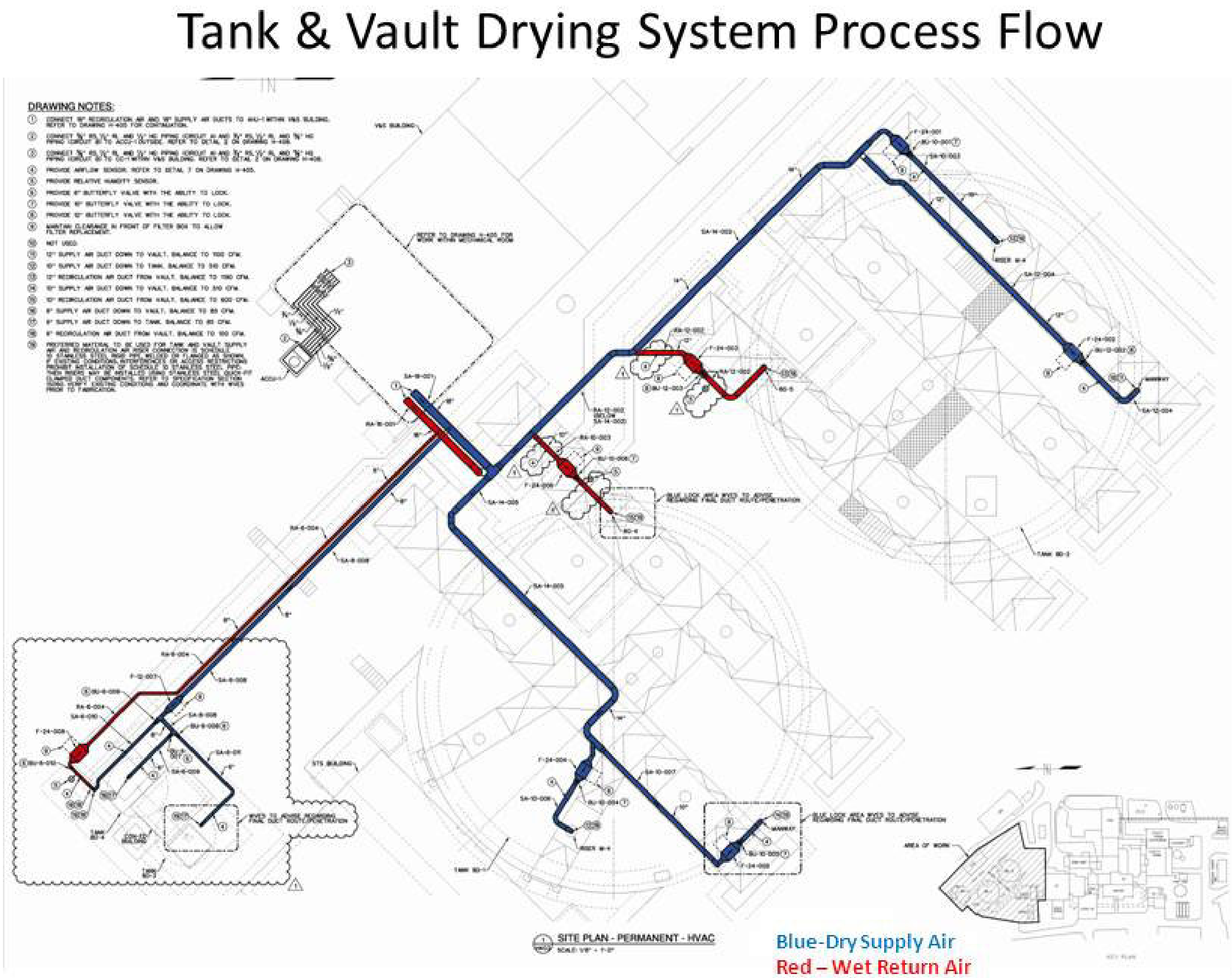

Fig. 4. Tank and Vault Drying System Piping Layout.

The teamwork between the Butler Construction Team and WVES personnel was outstanding. Subcontract personnel installed all the piping and hangers and WVES personnel installed the dry air diffusers into each vault and tank. Dry air supply was ducted to the bottom of the tanks and vaults to aid in evaporating the standing liquids. Diffusers at the ends of the supply lines were provided to minimize the air velocity out of the dry air supply duct to avoid disturbing contamination on the internal tank and vault surfaces after the liquids evaporate and prevent this contamination from becoming airborne and finding its way to the PVS filters. The goal is to keep the radioactivity contained inside the vessels and not allow it to escape through the outlet ventilation lines. HEPA filters were installed in each of the three vault exhaust lines close to the vaults to trap locally any airborne contamination that could be discharged from the vaults, two of which are slightly contaminated. Normal particulate filters were provided in the dry air supply lines entering the tanks and vaults to limit the spread of contamination if there was some unforeseen upset event that allowed the air flow in the tanks and vaults to be pushed back into the supply lines. Radiological control survey points were established on the filters and other portions of the system for periodic monitoring and trending. The complete piping system and associated monitoring and control circuits were completed on December 15, 2010.

The WVES PLC monitors the relative humidity outputs from each tank and vault outlet to monitor system effectiveness, support future system flow rebalancing and maximize liquid evaporation from the four tanks and three vaults. In addition, the PLC monitors tank pressures and operation of the PVS operating fan, two independent parameters. If the tank negative pressures begin to reach atmospheric pressure or if the PVS fan shuts down, the Munters rotary dryer will be automatically shut down to avoid sending any further dry air into the tanks and vaults. This is obviously an important safeguard to avoid pressurizing tanks with extremely high contamination levels remaining inside.

TANK AND VAULT SYSTEM START-UP

WVES completed a readiness assessment prior to starting radioactive operations with the new system, involving each organization on site. Upon receiving approval on December 16, 2010 to begin operations, the start-up team, composed of WVES and subcontractor personnel, worked together to cautiously and systematically send dry air to the vaults, one at a time, while monitoring drying system performance and PVS parameters: stack flow rate, temperature and relative humidity at the filters. Following the vaults, dry air was then supplied to the four tanks sequentially, again monitoring both systems and balancing flows as required to approach design flow rates. Balancing continued as an iterative process until design air flows were achieved on December 21, 2010. Operators and maintenance personnel were trained on system operations and responses to upset conditions using the newly developed standard operating procedure. The system was turned over to Operations on December 30, 2010 following development of an open items list to capture the remaining minor work; the list was formally recorded in the site's tracking system.

FUTURE APPLICABILITY

Although the Tank and Vault Drying System was implemented at the WVDP to prolong tank integrity until decommissioning plans can be agreed upon, the system could be applicable to those tanks in the DOE Complex that have known or suspected leaks. The materials in the tanks could be dried out to limit further liquid leaks and the dry material removed with methods that don't involve the use of water or other liquids.

CONCLUSIONS

The Tank and Vault Drying System has been successfully installed at the WVDP and is currently evaporating remaining liquid heels in the four underground waste tanks and their three concrete vaults. Operation of the Permanent Ventilation System (PVS) is being closely monitored and is handling the small additional moisture load without any issues. Both systems are operating as expected. Tank and vault liquid levels are beginning to trend down indicating evaporation of the residual liquids is taking place.

The joint design, construction and start-up with both WVES and Butler Construction Team personnel utilized the best knowledge and experiences of the organizations involved and led to the success of the project while providing a high return value for the ARRA funding provided by DOE.

The project timeline is summarized in Table 2, Project Chronology on the next page.

Table 2. Project Chronology

Sept 2008	DOE authorizes T&VDS conceptual design
Oct 2008	Design criteria and functional requirements issued
Dec 2008	Conceptual design and detailed cost estimate developed
Mar 19, 2009	Issue procurement package for competitive bids
Apr 30, 2009	Competitive bids received for Tank & Vault Drying System design/build
May 11, 2009	ARRA funding for completion of project design, construction and start-up authorized by DOE
Jun 24, 2009	Design/build subcontract placed with Butler Construction Co. of WNY, Inc.
Jul 16, 2009	Kick-off Meeting with all subcontractor companies
Oct 29, 2009	Interactive Preliminary Design Review
Feb 22, 2010	Interactive Final Design Review
Apr 6, 2010	Begin installation of Tank & Vault Drying System
Apr 13, 2010	Begin removal of above-ground condenser ventilation supply piping
May 17, 2010	Begin removal of underground ventilation piping
Aug 18, 2010	Initial in-place testing of rotary dryer
Sep 20, 2010	Remove pump from Tank 8D-4
Oct 11, 2010	Complete removal of underground ventilation piping
Oct 27, 2010	Complete installation of new underground piping
Nov 16, 2010	Remove pump from Tank 8D-3
Dec 16, 2010	Declare readiness to start up the T&VDS
Dec 21, 2010	System operating with balancing complete
Dec 30, 2010	System turned over to Operations

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