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EVALUATION OF THE PORTSMOUTH GASEOUS DIFFUSION PLANT ATMOSPHERIC VENTS

By

THE VENT COMMITTEE

January 2, 1985

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EVALUATION OF THE PORTSMOUTH GASEOUS DIFFUSION PLANT ATMOSPHERIC VENTS

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THE VENT COMMITTEE

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January 2, 1985

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TABLE OF CONTENTS

TABLE OF CONTENTS (Cont.)

TABLE OF CONTENTS (Cont.)

I. SUMMARY

Evaluation of the Portsmouth Gaseous Diffusion Plant atmospheric vent streams has been conducted to provide assurance that all plant gaseous effluent streams that have the potential of discharging uranium into the environment are properly measured for accountability purposes. The Vent Committee was assigned the following tasks: (1) identifying all significant gaseous effluent streams in the gaseous diffusion cascade and its support facilities, (2) evaluating the emissions from each and (3) assessing the need to install accountability measurement systems for each location determined to have the potential for unmeasured or inaccurately measured uranium loss that could have an adverse impact on the Portsmouth Cascade Inventory Difference.

The three process buildings and twelve support buildings were identified to contain atmospheric vents that have the potential of discharging uranium into the environment. Based on the committee's review of the various operations, seven vent stacks are recommended for installation of permanent continuous accountability samplers; three vent stacks are recommended to have effluents returned to the Cascade (shut down to atmosphere) or further evaluated with portable continuous sampling units to determine the need for permanent measurement; and seven venting operations (including 11 vent stacks) are recommended to be measured with portable continuous sampling units to determine the need for installation of permanent accountability measurement systems.

The vents that have been determined to require action are listed on the following table in a general order of decreasing importance for each category.

A. Recommendation to Install Permanent Accountability Samplers

Facility	No. of Vents	Type of Discharge
1. High Assay Sampling Area (HASA)		
A. Cold Trap and Evacuation System	1	Vacuum Pumps
B. Sampling Cubicle Exhaust	1	Exhaust Fan
C. Oven Exhaust	1	Exhaust Fan
2. X-330 Cold Recovery/Wet Air Evacuation System	1	Air Jets
3. X-333 Wet Air Evacuation System	1	Air Jet
4. X-333 Cold Recovery System	1	Air Jet
5. X-700 Furnace Stand	1	Air Jet

B. Recommendation to Return Vent Effluent to Cascade (Shut Down to Atmosphere) or Further Evaluate with Portable Continuous Sampler

Facility	No. of Vents	Type of Discharge
1. X-342 Feed Vaporization Building	1	Air Jet
2. X-343 Feed Vaporization and Sampling Building	1	Air Jet
3. X-344 UF_6 Sampling and Transfer Facility	1	Vacuum Pumps

C. Recommendation for Further Evaluation with Portable Continuous Samplers to Determine the Need for Permanent Measurement

Facility	No. of Vents	Type of Discharge
1. X-705 Decontamination Building		
a. Small Parts Decontamination Leaching Handtables	3	Exhaust Fans
b. "F" Area Calciner - Solution Recovery	1	Exhaust Blower
c. Small Parts Decontamination Spray Tank Leaching Operations	1	Exhaust Fan
d. X-705A Incinerator	2	Vacuum Exhaust and Supply Fans
e. Small Parts Dismantling Room	2	Exhaust Fans
f. Large Parts Decontamination - South Annex	1	Exhaust Fan
g. Small Parts Decontamination Technetium Scrubber Columns	1	Air Jet

II. INTRODUCTION

Uranium losses in the atmospheric vent gases of isotopic enrichment facilities impact the areas of uranium accountability, health and safety, environment, security and public relations. The effluent gases from certain process and support facilities, which normally contain residual amounts of uranium in both the gaseous and particulate forms, are vented to atmosphere from a multitude of vent stacks distributed among various buildings on plantsite. The amounts of uranium present in these effluent gases are strictly controlled by operational and administrative controls, as well as various types of abatement and monitoring systems. However, in addition to the normal operating losses, there arise occasional operational situations in which the vent control limits are exceeded for periods of time, necessitating the careful quantitative measurement of the amounts of uranium and U-235 lost to the environment. Unmeasured or improperly measured uranium vent losses, especially from the high assay portion of the plant, can introduce uncertainties in the uranium material balance and must be accurately quantified for proper uranium inventory and safeguard procedures. The task of identification and evaluation of the various gaseous effluent streams and recommendations for installation of quantitative measurement systems on those determined to have the greatest potential for unmeasured uranium/U-235 loss was assigned to the Vent Committee to assist in the resolution of the Portsmouth Gaseous Diffusion Plant Inventory Difference Investigation.

III. DISCUSSION

The development of a continuous sampling system for monitoring airborne radioactive discharges to ensure compliance with environmental regulations and to quantify the amount of uranium for accountability purposes has been underway for the past two years. This sampling system has been designed and operated on the Purge Cascade vent stream to evaluate its performance and reliability to accurately and sensitively monitor uranium and technetium discharges to the atmosphere. The sampler flow passes a measured portion of the vent gas through three alumina-filled traps in series, which collect the uranium on the trapping medium for a period of approximately one week. The alumina is then removed and analyzed to determine the amount of uranium collected over the sampling period. In addition to the sampler flow, the total vent flow is measured by a flow-sensor probe installed in the vent header close to the sampling point. The combined data from the analysis of the uranium collected on the trapping media, total sampler flow and total vent flow for the sampling period are used to quantify the amount vented. This continuous sampling system is the type proposed to be installed at the various vent locations for which there is an identified requirement.

The major emphasis of this report has been placed on uranium accountability due to the inventory difference investigation. The present continuous samplers have demonstrated the ability to adequately quantify routine, low-level uranium emissions from the Top and Side Purge Cascades over the past year. However, the committee feels the following areas of uncertainty in the sampler performance presently exist:

1. The ability of the present samplers to accurately detect and quantify technetium emissions is questionable. Continuous sampler technetium results are several orders of magnitude lower than the accepted data from laboratory gas bulb sampling at the Purge Cascade vent streams.

2. The ability of the present samplers to remain in service during a venting incident has not been demonstrated. High concentrations of UF_6 may plug the sampling system and/or alter the designed sample flow characteristics, causing erroneous results. The possibility of a total failure during a venting incident may also exist. Investigations are presently underway to better define this uncertainty.

3. The adaptability of the present sampler to all vent stream measurement applications may not be realistic. Effluent vent streams are discharged to atmosphere by either air jets, vacuum pumps or ventilation exhaust fans. The present sampling system has been designed to operate on the discharge of air jets, and may require design changes or further development to adapt to the vacuum pump and exhaust fan applications.

4. The timely reporting requirements of major releases (greater than one pound of any radioactive substance) from vents other than the Purge Cascades to the EPA and the DOE may be jeopardized. Unacceptable delays may result due to the sample collection and analytical times required for this type of sampler.

In addition to atmospheric vent streams recommended for installation of permanent samplers, various support facilities' vent stacks will involve continuous sampling at designated locations over periods of several months each to evaluate the need for installation of permanent samplers. The Chemical and Materials Technology Department has initiated a project to build two portable continuous sampler units to be used in this effort and will issue detailed sampling specifications for each location determined to need permanent accountability measurement.

Fifteen buildings at the Portsmouth site were identified to contain atmospheric vents that have the potential of discharging uranium to the environment. A systematic review of each building's vent stack(s) and the operation(s) associated with each one was performed to evaluate the potential for unmeasured or inaccurately measured uranium loss.

The following factors were reviewed for each vent stack to determine the potential for uranium loss and if accountability measurement or further evaluation with portable samplers would be necessary:

1. The quantity, assay and state (gas, solid or liquid) of the uranium material(s) handled by the associated operation(s).

2. The present monitoring techniques, abatement systems, and operational and administrative controls, where applicable.

3. The types of equipment used to discharge the vent stream to atmosphere.

A brief description of each system, together with recommendations for vent monitoring requirements, follow:

1. X-326 PROCESS BUILDING

A. Atmospheric Exhauster Station

The X-326 Building Atmospheric Exhauster Station contains four air jets, eighteen banks of 5-inch diameter chemical traps (3 traps per bank), and eight vacuum pumps. The four air jets (A, B, C and D jets) discharge into a common vent pipe header, which consists of four 4-inch pipes that extend from the operating floor through the roof at the south end of the process building. The eight wet-air vacuum pumps are piped in parallel and discharge to atmosphere through a separate vent stack.

a. Cell Service/Wet Air Evacuation System

During the course of the investigation, the practice of evacuating wet air to atmosphere after cell maintenance in the X-326 Process Building was discontinued. Wet air and cell purge gases had previously been vented to atmosphere through six parallel banks of chemical traps either by the eight wet air vacuum pumps or by "D" jet. When any cascade equipment or a cell is opened to atmosphere for repair or replacement of equipment, wet air enters the cell. Prior to admitting UF_6 into the cell, wet air was evacuated to atmosphere to prevent UO_2F_2 deposits and impairment of barrier permeability. However, high assay UF_6 may also be present in the purge gases and/or building evacuation header system. The potential for loss of uranium from the X-326 evacuation system was determined to be very high, and as a result, procedures were implemented to return all X-326 cell purge gases to the Cascade at designated, monitored locations.

The wet-air pumps and associated vent stack have not been used for some time. This vent stack is not presently monitored, but remains in standby status. These pumps were previously used to evacuate cells to a very low pressure after maintenance activities.

"D" jet is currently inactive. This jet has been used for technetium hot air treatment purge gas evacuations to atmosphere, wet air evacuations to atmosphere, and emergency purging operations at Side or Top Purges. To prevent venting of gases containing high concentrations of uranium, technetium hot air treatment and wet air evacuation gases were sampled in the equalized building evacuation header before the block valve (ETI-1) at the chemical trap inlet prior to evacuation to atmosphere. Technetium hot air treatments were evacuated through one bank of MgF_2 traps before being discharged to atmosphere via this jet. Presently, technetium from hot air treatments is cold trapped and the residual gases are returned to the Cascade. Although procedural changes have been made and now all cell evacuations are currently being taken back to the Cascade, use of "D" jet for emergency purging may be necessary periodically. A continuous accountability sampler was installed on the "D" jet discharge piping. This sampler starts automatically when the air supply is valved onto "D" jet.

Recommendations:

1. The wet-air pump vent stack should be measured for accountability if this system is made operational in the future.

2. The accountability sampler, presently installed, should remain on the discharge of "D" jet to provide adequate information in the event this system is used. The possibility of using this jet for a purge assist requires the installation of a flow-sensor probe; this addition is presently planned.

b. Space Recorder Return Line

The "A" jet is currently inactive; however, plans are to activate this jet to exhaust the combined sample gas return flows from the Top and Side Purge Cascade space recorders. The space recorders, which are located in ACR No. 6, are ionization chambers used to monitor qualitative changes in UF_6 concentration in the vent streams. The four space recorders obtain the respective gas sample flows from the inlets and outlets of the Top and Side Purge Cascade chemical traps vent streams and return the combined sample flows through a common pipe to be exhausted by this jet. If a significant amount of material is observed in the vent stream, the space recorders sound an alarm.

There are two small alumina traps in series installed on this vent stream line. If the space recorders indicate a significant release, these traps will be changed out. Although this is a continuous mode of operation, the potential for loss through this jet is considered low due to the small flow rates, monitoring capabilities and trapping system.

Recommendation:

No accountability sampler is recommended for the "A" jet discharge.

c. Auxiliary Air Jet

"B" jet is an auxiliary air jet, which is piped in parallel with the "C" and "D" jets. This is an inactive jet in standby with no future plans for use.

1. If actions are taken to use "B" jet, then an accountability sampler would be required.

2. Administrative controls to prevent the use of this air jet should be in place.

d. Top and Side Purge Cascades

"C" jet is an active air jet which is operated continuously to discharge lights and other non-UF_6 gases to the atmosphere from the combined Top and Side Purge Cascades. Before being ejected to atmosphere, purge gases are passed through banks of five-inch alumina traps operated in parallel. There are several monitoring systems used for the Purge Cascades vent streams. Gas bulb samples are withdrawn from the inlets and outlets of the alumina traps of both the Top and Side Purge Cascades every four hours, or more frequently as required by the Operating Methods or when equipment is out of service. Space recorders are used for continuous monitoring of both Top and Side Purge inlets and outlets to the alumina traps to detect qualitative changes in UF_6 concentration. Also, continuous uranium analyzers qualitatively monitor the Top and Side Purge inlets' uranium concentrations to the alumina traps at ten-minute intervals. Finally, two redundant continuous uranium samplers are installed after the "C" jet discharge. These "after-the-jet" samplers are the prototype uranium accountability and environmental samplers, which are being developed and are being considered for use to measure other plant vent streams. In addition to vent concentration monitoring, Purge Cascade chemical trap radiation surveys are performed every two weeks to detect any unusual uranium buildup, and the trap material is presently changed routinely after thirty days of onstream service time regardless of the trap radiation levels. Frequent trap changes in the Purge Cascades are based on the loss in uranium trapping efficiency of the alumina over time which results from the reaction with non-UF_6 reactive fluoride gases present in these vent streams.

During the past year, there have been changes in the purge vent operating philosophy, which have reduced the chances of high UF_6 vent concentrations at the "C" jet discharge:

- o If sample results or monitoring equipment before the jets (preferably at the chemical trap inlets) indicates high ppm uranium (greater than 75 ppm UF_6 Vol.), the purge vents are valved off until the problem is resolved and the vent concentration is returned to an acceptable level.

- o The philosophy that the Purge Cascades are to be used to reduce the UF_6 concentrations in the vent gases to acceptable levels, and the alumina traps are to be used to remove trace amounts of uranium and smooth out small fluctuations in the vent UF_6 concentrations has been implemented.

Recommendations:

1. The potential for the loss of significant amounts of high assay material from the Purge Cascades warrants the redundant accountability monitoring systems presently installed on the discharge of "C" jet.

2. Continue routine laboratory gas bulb sampling of Top and Side Purge Cascade vent streams every four hours around the clock.

   While the likelihood of venting high UF_6 concentrations is much lower now with the improvements that have been made, development of onstream analyzers is not yet to the point that Operations feels confident in reducing the frequency of laboratory gas bulb samples, which are used to provide a backup check of these systems, as well as provide timely vent data for reporting requirements to the DOE and the EPA in the event of a release. In addition, technetium emissions is a problem from an environmental standpoint. While the continuous sampler provides a good means of quantifying routine uranium emissions, there are unresolved differences between the technetium results observed between this type of sampler and the laboratory grab sample data. Until this discrepancy is resolved, and the continuous samplers are able to detect and accurately quantify technetium emissions, we are obligated to report using the established method (laboratory grab samples).

B. Seal Exhaust Stations

The X-326 Seal Exhaust System consists of three stations equipped with vacuum pumps that discharge the gas evacuated from the seals to atmosphere. Area 4 Station serves Units X-27-1, 2, 3, X-25-1 and the Extended Range Product Withdrawal (ERP) Station utilizing 32 vacuum pumps. Area 5 Station serves Units X-25-2, 3 and 4, and Area 6 Station serves Units X-25-5, 6 and 7. Areas 5 and 6 utilize 24 vacuum pumps each. At the discharge of each pump is an oil separator, which removes the oil that has leaked through the oil seal of the vacuum pump and entered the gas stream. Three 5-inch diameter alumina traps piped in parallel are provided at the suction of each pump to absorb UF_6 that may have entered the system as a result of a seal failure. The discharge of each pump is connected to the station vent pipe that discharges to atmosphere through an oil trap on the roof of the process building.

Each station is monitored by continuously drawing a portion of the seal exhaust gas through a salicylic acid sample tube located on the inlet supply line to the chemical traps. The salicylic acid is monitored once each shift for color change. Radiation surveys of the alumina traps and oil traps on the roof vent stacks are taken monthly.

The Area 4 Seal Exhaust Station also services the ERP Station seal exhaust. Daily gas bulb samples are presently taken from the ERP Station seal exhaust header to call attention to any seal problems, which would result in increased uranium concentrations in the seal exhaust header. Salicylic acid samples may soon replace gas bulb sampling at this location.

If salicylic acid or gas bulb samples show greater than 10 ppm UF_6, action is initiated to locate the source of the uranium, and corrective action is taken to stop the source of uranium.

Experience has shown that the radiation levels, monitored monthly on the oil traps on the vent stacks, have not increased significantly over the past year. If material was being vented to atmosphere through the seal exhaust headers, the oil trap radiation readings would provide adequate warning. In the event that a large quantity of uranium did manage to break through the alumina traps, it would react with the pump oil causing obvious operational problems. Careful measurement of uranium and U-235 in the pump oil and spent alumina removed from these stations is judged as an adequate accountability procedure.

Recommendations:

1. Accountability samplers are not recommended for the X-326 Building seal exhaust vent stacks.

2. Salicylic acid test results should be documented each shift for each station in the appropriate area log book.

C. Seal Exhaust Station Wet Air Pump Systems

Each of the three Seal Exhaust Stations in the X-326 Building contains wet air pump systems consisting of three banks of

5-inch alumina traps and three wet air pumps each, which discharge into their respective seal exhaust discharge header vent to the roof. These systems are currently inactive and all wet air is being evacuated back to the Cascade. These systems are identical to the Seal Exhaust Systems discussed in the Seal Exhaust System Section. There are no future plans to utilize these systems in the X-326 Building.

Recommendations:

1. Because these systems are presently inactive, no accountability sampler is recommended for these systems. However, if it is decided to activate the wet air pump systems, then the need for accountability samplers should be reevaluated.

2. Administrative controls to prevent the use of these systems should be in place.

D. Product Withdrawal Vent Stack

The Product Withdrawal vent to atmosphere is currently inactive. This was an unmonitored vent, which was used once a day. Its purpose was to evacuate wet air from the supply and return pigtails prior to initiating a withdrawal of material and also to leak test the withdrawal system. When a new cylinder was connected, the supply and return lines were evacuated through two 5-inch alumina traps in series via a vacuum pump to atmosphere. There should be minimal amounts of UF_6 in these gases. Monthly radiation surveys were conducted to assure timely trap changeouts prior to breakthrough.

If administrative controls were properly followed when the system was in operation, there was little chance of material loss from this vent. These administrative controls involved proper valving methods and conducting radiation surveys on the alumina traps. If administrative controls were not properly followed, significant high assay material losses could have been encountered. For this reason, the use of this system has been eliminated on a trial basis. Currently, when a new cylinder is connected, the supply and return lines are evacuated via the product withdrawal return line back to the Cascade. If no significant problems are encountered during this trial period, the system will be permanently removed by cutting the supply line to the pump, capping this line, and removing the pump and trap system.

Recommendation:

Currently, no accountability sampler is recommended. If tests are successful, plans should be completed to dismantle the system. However, if problems are encountered during this trial period, and this system is reactivated, installation of an accountability sampler should be reconsidered.

E. Extended Range Product (ERP) Station Vent

The ERP Station vent to atmosphere is currently inactive and unmonitored. Its purpose was to evacuate wet air from the station after the system had been exposed to atmospheric moisture during maintenance activities. A Kinney vacuum pump was used to withdraw the wet air through two 5-inch alumina traps in series before discharging to atmosphere. Monthly radiation surveys were conducted on these traps to assure timely trap changeout prior to breakthrough. This system was used about once a month or as compressors failed.

If administrative controls were properly followed, there was little chance of material loss from this vent. These administrative controls involved obtaining a UF_6 negative prior to maintenance activities which expose the system to wet air, proper valving methods, and conducting radiation surveys on the alumina traps. If administrative controls were not properly followed, significant material losses could have been encountered. For this reason, the use of this system has been eliminated on a trial basis. If no significant problems are encountered during this trial period, the system will be permanently removed from the ERP Station by cutting the supply line to the pump, capping this line, and removing the pump and trap system. Currently, all wet air is being returned to the Cascade in the X-326 Process Building.

Recommendation:

Currently, no accountability sampler is recommended. If the trial period is successful, plans should be completed to dismantle the system. However, if problems are encountered during this trial period, and this system is reactivated, installation of an accountability sampler should be reconsidered.

F. Product Purification Exhaust to Room

This system is currently an inactive, unmonitored system. There is no known record of its use, and there are no future plans to utilize this system. There are two alumina traps in series that were intended to be used with a vacuum pump to pull the material through the traps and discharge it into the room. This system, if used today, might also present a health hazard, which decreases the likelihood that it would ever be used without modification.

The vacuum pump has been removed from the system and a "Danger Do Not Operate" tag placed on the second alumina trap outlet valve. All the valves in the system are closed.

Recommendation:

No accountability sampler is needed unless future plans call for activating this system.

G. High Assay Sampling Area (HASA)

There are three atmospheric interfaces associated with the HASA Area. Two of the interfaces, the sampling cubicle exhaust system and the oven exhaust system, discharge outside the X-326 Building into the track alley. The third interface, the cold trap and evacuation system, is associated with the product cylinder heating, sampling and transfer operations.

The purpose of the sampling cubicle exhaust system is to provide protection to the employees in the sampling cubicle during sampling operations. This exhaust system helps protect the employees in case of a pigtail rupture, valve leak, sample bomb leak, or any other UF_6 release inside the sampling cubicle area. This is currently an unmonitored system. The exhaust gases are passed through HEPA filters before being discharged to the track alley. There are presently no routine checks made on the condition of the HEPA filters. Although this exhaust system is activated only while cylinders are being sampled in the sampling cubicle area, the potential for unaccounted material loss through this exhaust system is unknown.

The oven exhaust system provides protection to the employees in the HASA Area during cylinder connecting and disconnecting operations. This exhaust system helps protect the employees in case of a pigtail rupture, valve leak, fitting leak or any other UF_6 release occurring in the oven. The exhaust gases pass through HEPA filters before being discharged to the track alley. There are presently no routine checks made on the condition of the HEPA filters. Although this system is activated only while cylinders are being connected and disconnected in the ovens, the potential for unaccounted material loss through this exhaust system is unknown.

Recent HEPA filter integrity tests performed in August, 1984, showed efficiency ratings of 99.98% for the sampling cubicle filters and 98.97% for the oven exhaust filters. An efficiency rating of 99.97% is considered passing. New HEPA filters are presently on order.

The third atmospheric interface is the cold trap and evacuation system, which consists of two five-inch cold trap cylinders operated in series followed by two parallel chemical traps and two parallel vacuum pumps. This system is used to remove UF_6 from purge gases generated during cylinder heating and sampling operations as well as to cold trap liquid UF_6 evacuated during cylinder liquid sampling. The vacuum pumps discharge to atmosphere through a two-inch vent pipe into the track alley on the west side of the X-326 Process Building. This system was designed to handle high concentrations of high assay UF_6 in both the gaseous and liquid states. If the cold traps are not operated properly, or if the purge gases or liquid UF_6 are processed through the system too quickly to allow adequate residence time for trapping, UF_6 can enter the chemical traps and ultimately be vented to atmosphere without measurement. This is an unmonitored system and is used daily during cylinder heating, sampling and transfer operations. The potential for unaccounted high assay material loss through this system is high.

While no vent monitoring is done at the HASA facility, routine IHHP surveys of contamination levels, as well as routine air samples taken in the sampling cubicle, indicate unmeasured uranium losses may be occurring.

Inventory differences, oven contamination, frequent vacuum pump failures, and abnormally high chemical trap loadings have prompted a review of HASA operations. Sampling of high-pressure VHE product cylinders after extended storage has contributed to the above-mentioned problems. Presently, only recently withdrawn product cylinders whose pressures have not led to the severity of the problems encountered with the cylinders from storage are being sampled and shipped to customers. This has improved the uranium material balance; however, these problems will reappear when the sampling of cylinders from storage is resumed. A method needs to be developed to remedy this high pressure cylinder problem. The current HASA Facility is not designed for adequate handling of high pressure cylinders.

Specialized attention has been directed towards the HASA operation since February, 1984. A team consisting of representatives from Uranium Operations, Production Engineering, and Cascade Operations has reviewed the HASA system and has made recommendations to improve both the efficiency of the trapping system and the uranium material balance around the sampling facility. The following changes have been made as a result:

- o The piping associated with the two chemical traps has been modified to allow operation of the traps in a "series-only" configuration.
- o The chemical trapping media has been changed from alumina pellets to soft sodium fluoride pellets (500-600^{o}F preparation temperature) for more efficient trapping.
- o The two vacuum pumps have been modified so the oil can be sampled or replenished while the pumps are in operation.

- An internal restriction that was identified at the inlet pipe to the east chemical trap has been removed.

- An operational technique to leave the cold trap outlet valve closed during sampling has been implemented to allow the evacuated UF_6 a longer residence in the cold traps prior to evacuation through the chemical traps and vacuum pumps. This mode of operation should reduce chemical trap loading and vacuum pump maintenance.

- The pressure in the isolated cold traps can now be monitored in the sampling cubicle as a result of implementing the above-mentioned operational technique.

- Rascal radiation surveys are conducted periodically on the chemical traps by Chemical Operations. In addition, weekly MCA (multichannel analyzer) scans are being performed on the chemical traps by Nuclear Materials Engineering when the MCA is available for service.

- Material accounting methods have been corrected so that the uranium in the vacuum pump oil and decontamination solutions is now credited to the HASA material balance instead of the Cascade account.

Six of the last eight months in FY-1984 have shown gains in the HASA uranium material balance, which has reduced the HASA inventory difference by about one-half. An overall gain in the uranium inventory has also been achieved for the first two months of FY-1985.

Recommendation:

While the improvements recommended by the review team have reduced material losses, no method to quantify the material that is still vented was addressed. Since this facility deals strictly with costly high assay material, there are environmental and security concerns which make quantification of these losses a necessity. Therefore, it is recommended that accountability samplers be installed on each of these three atmospheric interfaces. The oven and cubicle exhaust ducts should be sampled after the HEPA filters whenever the exhaust fans are turned on. The vacuum system should be sampled after the discharge of the vacuum pumps, when the pumps are running.

***

2. X-330 PROCESS BUILDING

A. Cold Recovery and Wet Air Evacuation

The X-330 Cold Recovery and Wet Air Evacuation area has one 4-inch atmospheric vent pipe that discharges from the roof of the process building. This facility contains two banks of alumina traps (six traps per bank) and two banks of sodium fluoride (NaF) traps (six traps per bank) used in conjunction with two air ejectors, both of which discharge into the same vent pipe. The alumina traps are used to reduce uranium emissions when wet air from cell and auxiliary equipment maintenance activities is evacuated to atmosphere. These traps are used only when there is no evidence of UF_6 (<10 ppm), F_2, or ClF_3.

When the gases to be processed contain significant quantities of UF_6 (>10 ppm), they must first be processed through Cold Recovery. Cold Recovery processes material containing UF_6 mixed with other lower molecular weight gases. The gaseous mixture is passed through cold traps and the temperature is reduced until the UF_6 is frozen out. Next, the gas is directed through chemical (NaF) traps to remove residual UF_6, and the remaining low molecular weight gases are then vented to atmosphere by air jets. Once filled, the cold traps are isolated and heated. The vaporized UF_6 is routed to holding drums and is eventually returned to the Cascade at a point of matching assay.

Two space recorders are available to monitor venting operations at various locations on the manifold of the air jet suctions. Both space recorders are used when simultaneous venting operations are taking place to monitor each vent stream. These space recorders obtain their sampling supplies from the various locations on the jet suction manifold and return through a small 1/2-inch air jet located at the discharge of the No. 1 air ejector. The laboratory sample tap is located on the space recorder sample supply line and is used to take gas bulb samples upon request to verify space recorder operation.

Uranium inventory losses for accountability are calculated from space recorder data for Cold Recovery operations. However, uranium losses from wet air evacuation operations have never been measured for accountability adjustments. Wet air evacuations are monitored only by a space recorder for control purposes.

Studies of space recorder operation based on 1982 data have confirmed that uranium concentrations in the vent streams, as calculated from space recorder data, are inaccurate compared to Laboratory analyses of gas bulb samples. Space recorders appear to be adequate instruments for qualitative control of normal operations in this facility. However, from an accountability standpoint, space recorder data are less than adequate. In the event of a release, the space recorder would go off scale and the amount of uranium discharged to atmosphere could only be guessed. Current practices cannot provide adequate accountability for uranium lost from this vent stack.

Large volumes of light gases containing variable amounts of uranium in both the gaseous and particulate form are vented to atmosphere through this system. This vent is judged to have a high potential for unmeasured uranium loss.

Recommendations:

1. Install a continuous, flow-proportional, isokinetic accountability sampler and total flow measurement device on the 4-inch vent pipe past the location where the air ejector discharge pipe and air jet bypass line join together. This sampler should activate automatically when the air supply is turned on to either or both jets. (Note: A sample collection device or medium that will not be affected by F_2, HF or ClF_3 should be developed; i.e., ClF_3 will strip away previously trapped uranium on an alumina collection medium and bias U measurements.)

2. Cut and cap the 100-psig plant air line, located on the discharge of the No. 3 air ejector (through valve 3AJA2). No practical justification for the existence of this air line could be found and use at this location would only cause inaccuracy in accountability sampling.

3. Continue to use space recorders for qualitative operational control of Cold Recovery and wet-air evacuation venting operations.

4. The air ejector bypass valve, 3AJBP, should be closed and tagged "Stop Do Not Operate." The sampler should be manually activated if this route to atmosphere is ever used.

5. Routine "Rascal" radiation surveys of the alumina traps should be set up to detect uranium buildup and assure timely changeout of trap material prior to breakthrough.

B. Seal Exhaust Stations

The Seal Exhaust System in the X-330 Process Building consists of two evacuation stations equipped with vacuum pumps, alumina traps and one atmospheric discharge vent each. Area 2 Seal Exhaust Station handles assays less than 5 percent, while the Area 3 Station is of always-safe design to handle assays greater than 5 percent.

Area 2 Seal Exhaust Station evacuates the seals from units X-29-1 and Units X-31-1 through X-31-5. The station contains four 300 cfm Kinney vacuum pumps connected in parallel. These pumps are used to discharge the gas evacuated from the seals to the atmosphere through a common discharge line, which runs from the operating floor where the pumps are located, to the roof of the process building. Oil separators are provided on the discharge of each pump to remove any oil in the gas stream that leaks through the oil-sealed pumps. The vent pipe, located on the roof, discharges the effluent gas stream through a small oil trap to atmosphere. Three 10-inch alumina traps, which are operated in parallel, are located on the suction side of each vacuum pump to absorb UF_6 that may be present in the system due to a seal failure.

Area 3 Seal Exhaust Station evacuates seals from Units X-29-2 through X-29-6 and consists of twelve 100 cfm vacuum pumps, which are operated in parallel. This system is similar in operation to the Area 2 Station except that the suction of each pump is provided with three 5-inch (always-safe) alumina traps connected in parallel.

Area 3 Wet Air Evacuation Station operates on the same principle as the Seal Exhaust Stations and also has one atmospheric vent. This station consists of nine 100 cfm vacuum pumps connected in parallel with three 5-inch alumina traps located on each pump suction. The effluent gas stream from the pumps is discharged through oil separators and an oil trap to atmosphere. This station has been placed in standby and is no longer used to evacuate wet air. The two Seal Exhaust Stations can be tied into the Area 3 Wet Air Evacuation Station, which can be taken out of standby status and used as a spare in the event of a failure.

The Area 2 seal exhaust is monitored continuously by a space recorder, which samples the gas leaving the alumina traps prior to the vacuum pump suctions. A space recorder is used to monitor UF_6 in the Area 2 seal exhaust vent stream because during the CIP Program this system was modified in a manner which increased the potential for UF_6 to enter the seal exhaust system. Monitoring of this seal exhaust line will permit backup detection for the presence of excess UF_6. The space recorder would provide more timely response if modified to monitor the inlet to the alumina traps to identify problems before the traps become loaded.

Area 3 system is monitored at the inlet to the traps continuously with salicylic acid, which is checked once each shift for the presence of UF_6. Radiation readings are taken at both Seal Exhaust Stations each month on each alumina trap. Three locations are measured per trap (top, middle, and bottom) to detect any uranium buildup.

Based on periodic trap radiation readings and continuous monitoring, either by a space recorder or salicylic acid, these three vent streams are not judged to be major pathways for significant uranium inventory loss. In the event that a large quantity of uranium did manage to breach the alumina traps, it would react with the vacuum pump oil causing obvious operational problems. Careful measurement of uranium and U-235 in the pump oil and spent alumina removed from these stations is judged as an adequate accountability procedure.

Recommendations:

1. Accountability samplers are not recommended for these three vent streams.

2. Area 2 Seal Exhaust Station space recorder sample lines should be modified to provide the capability for the space recorder to monitor the seal exhaust header at the inlet to the alumina traps. This would allow for more timely alarm to abnormal operating conditions, prevent chemical trap loading and reduce vacuum pump maintenance.

3. Administrative controls should be implemented to allow the use of the Area 3 Wet Air Evacuation Station for emergency seal exhaust use only.

4. Results of salicylic acid tests should be documented each shift in the Area 2 log book.

C. Interim Purge System

The X-330 Interim Purge Facility was provided to serve as a temporary alternative for the Top and Side Purge Cascades during plant operation prior to the completion of the purge facilities. The system consisted of nine surge drums, four holding drums, four cold traps, and eight 50 cfm Beach-Russ vacuum pumps. Light gases were removed from the Cascade by cold trapping the UF_6 and discharging the purge gases from the cold traps through two parallel banks (3 traps per bank) of 5-inch alumina traps to atmosphere. A space recorder was originally provided on the outlet of the alumina traps to monitor and control discharges from this vent stream.

The use of this atmospheric vent to remove lights has been discontinued; however, the capability for operation still exists. In the unlikely event this venting system is reactivated, accountability monitoring would be necessary.

Recommendations:

1. There is presently no justification to install an accountability sampler at this inactive vent location.

2. Administrative controls to restrict the use of this atmospheric vent should be in place.

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3. X-333 PROCESS BUILDING

A. Cold Recovery and Wet Air Evacuation

There are two separate vents to atmosphere associated with the Cold Recovery and Wet Air Evacuation Systems. Each vent pipe is equipped with an air ejector and discharges from the roof of the process building. These systems are similar to the X-330 Cold Recovery and Wet Air Evacuation Facility.

Effluent gases from Cold Recovery operations are routed through one of two banks of sodium fluoride traps to remove residual UF_6 before being vented to atmosphere by the air jet. Each bank consists of six, five-inch diameter traps connected in parallel. A space recorder is used to monitor the gas for UF_6 after the chemical traps at the air jet suction. Laboratory gas bulb samples are taken upon request to verify space recorder operation. Radiation surveys are also conducted monthly on the chemical traps to detect uranium loading.

The other vent is used to evacuate wet air from cell and equipment maintenance if there is no evidence of uranium, F_2 or ClF_3. This system is also equipped with an air ejector. Wet air is directed through one 24-inch diameter alumina trap to remove residual UF_6 prior to discharge to atmosphere by the air jet. A space recorder is used to monitor for UF_6 in the vent stream between the chemical trap outlet and the air ejector. Monthly radiation surveys are also conducted on this trap to detect uranium loading.

Similar to X-330, uranium inventory losses for accountability are calculated from space recorder data for Cold Recovery operations. Wet air evacuations are monitored only by the space recorder for control purposes. Uranium losses from evacuation operations have never been quantified and adjusted into the Cascade ID.

Space recorder operation and trap radiation surveys appear to be adequate monitoring for operational control. But, from an accountability standpoint, space recorder data are unacceptable. During normal operation, the space recorder will indicate qualitative changes in UF_6 concentration, but does not have the quantitative accuracy needed for accountability.

During a release, the space recorders would go off scale and the amount of uranium lost to the atmosphere could only be guessed. Although these systems handle low assay UF_6 (< 2 %), both the Cold Recovery and Wet Air Evacuation vents are judged to have a high potential for release of large amounts of uranium. Current practices cannot provide adequate accountability for material loss via these vent streams.

Recommendations:

1. Install a continuous, flow-proportional, isokinetic accountability sampler and total flow measurement device on each vent after the air jet. These samplers should activate automatically when the plant air supply is turned on to the jets.

2. Continue to use space recorders for qualitative operational control.

3. Implement administrative controls to prevent the use of the air jet bypass on the wet-air evaucation vent stream.

B. Seal Exhaust Stations

There are two Seal Exhaust Stations in the X-333. Area 1 Station is used to evacuate seals throughout the building. The second station is used to evacuate seals from the Low Assay Withdrawal (LAW) Station. Two separate systems are necessary because the building's Seal Exhaust Station was not designed for nuclear criticality safety at the higher assays that the LAW Station is designed to handle. The Area 1 Station is designed to handle assays as high as 2%, while the LAW Station can handle up to 10% enrichment of U-235.

At the Area 1 Station, the building seal exhaust is drawn through ten 24-inch diameter alumina traps connected in parallel by ten 300 cfm Kinney vacuum pumps. The discharge from each pump flows through an oil separator, which then is vented to atmosphere through an oil trap on the process building roof.

The LAW Station's seal exhaust is drawn through three 5-inch diameter alumina traps connected in parallel by two 17.7 cfm Welch vacuum pumps. The discharge from the pumps is then vented to atmosphere.

The Area 1 seal exhaust is monitored continuously by a space recorder, which samples the gas leaving the alumina traps prior to the vacuum pump suctions. A space recorder is used for quick identification of excess UF_6. (See Area 2 Seal Exhaust Section, X-330 Process Building.) This space recorder would provide more timely response if modified to monitor the inlet to the alumina traps to identify problems before the traps become loaded.

The gas stream at the inlet to the alumina traps is tested with salicylic acid for the presence of UF_6 once per shift. Monthly radiation surveys of the traps are also performed to detect uranium loading. The LAW Station seal exhaust, when used, will have the same checks as Area 1 Station with the exception of the space recorder. Another barrier in the path of uranium to atmosphere is the pump oil. The reaction of oil with uranium causes the oil to thicken and results in the slowing of the pump. This effect is used as the primary changeout criteria for the traps. If a large amount of uranium breaks through the alumina trap, obvious operational problems will ensue. Once the pump locks, the gas cannot be vented to atmosphere.

With the current monitoring of the system and the fact that the pumps would lock during a large release, both Seal Exhaust Stations are considered to have low potential for losing uranium. Current trap changeout procedures should be maintained. Careful measurement of uranium and U-235 in the pump oil and alumina removed from these stations is judged as an adequate accountability procedure.

Recommendations:

1. The space recorder line on Area 1 Seal Exhaust Station should be modified to provide the capability for the space recorder to monitor the inlet to the alumina traps.

2. Results of salicylic acid tests should be documented each shift in the Area 1 log book.

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4. X-342 FEED VAPORIZATION AND FLUORINE GENERATION BUILDING

The X-342 Feed Plant is equipped with two banks of cold traps, each of which contains three 12-inch modified cylinders in separately refrigerated wells. These cold traps are used to freeze out UF_6 that is evacuated from the autoclave systems after feeding or sampling operations. Piping is designed so that either of the two autoclaves can be evacuated to either cold trap unit. Also, cold trap cylinders can be used in series or individually. The non-condensible gases from each cold trap unit are routed to two 10-inch diameter alumina traps, which can be operated in series or parallel. These chemical traps remove residual UF_6 from the remaining low-molecular weight gases, which are then vented to atmosphere by a two-stage air jet.

The cold trapping method of removing UF_6 from a light gas stream is a batch process, which is dependent on the heat transfer from the refrigeration system to cool the UF_6 in the cold trap cylinder. The surface area of the traps is small; therefore, time is a critical factor in achieving proper separation. Operating the system in a continuous flow mode or not allowing sufficient recovery time between evacuation and pump down will cause excessive quantities of UF_6 to be discharged to the chemical traps and ultimately jetted to atmosphere.

This vent is unmonitored and no data are taken on the chemical traps. Interlock valves are installed on the suction and discharge of the chemical traps to reduce the possibility of continuous flow-mode operation. Since this facility can handle assays up to 5% UF_6 in the liquid state, the potential for unmeasured losses is high.

Recommendations:

1. This material should be returned to the Cascade and this vent to atmosphere eliminated. Volumes handled by the system are low. This approach would eliminate costs associated with operating traps and totally stop emissions from this vent source.

2. If Recommendation No. 1 is not followed, a portable continuous accountability sampler should be installed on this vent stream for a period of time (3-4 months) to evaluate the need for a permanent sampler.

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5. X-343 FEED VAPORIZATION AND SAMPLING FACILITY

The X-343 Feed and Sampling Facility has essentially the same atmospheric interface and associated operations as the X-342 Building. There are three banks of cold traps, each of which contain three modified 12-inch cylinders in separately refrigerated wells. Piping to the header from each of the seven autoclaves is designed so that any cold trap can be used in conjunction with any autoclave. The cold trap discharge is routed through its respective bank of two 10-inch alumina traps in series or parallel. The gases discharged from the chemical traps are vented to atmosphere by a two-stage air jet. This is also a batch operation.

This vent is unmonitored and no data are taken on the chemical traps. Interlock valves are installed on the suction and discharge of the chemical traps similar to X-342. This system handles low assay UF_6 (<5%) in the liquid state and is judged to have a high potential for unmeasured loss.

Recommendations:

Same as those for X-342 Building.

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6. X-344 BUILDING UF6 SAMPLING AND TRANSFER FACILITY

This facility contains four banks of cold traps and four banks of chemical traps. These banks, numbers one, two, three, and four correspond to autoclaves numbers one, two, three, and four. The evacuation piping is such that both cold traps one and two can be used on autoclaves one and two. Cold traps three and four can be used on autoclaves three and four.

Each refrigerated cold trap unit contains three modified, 12-inch cylinders that are used to freeze out UF_6 that is evacuated from autoclave systems. The piping is designed so that cold trap cylinders may be used in series or parallel. The discharge of the cold traps is routed through its respective bank of 10-inch chemical traps, which can be operated either in series or parallel. The discharge of the chemical traps goes to the suction of a Welch pump, which discharges into a common header and atmosphere. The vent stack for this sampling facility is unmonitored.

The cold traps are removed once each month at inventory time and weighed. Usually, traps A and B of each bank contain 100 Kgs or more of UF_6. These two cold traps (A and B) are replaced with empty cylinders. Trap C very seldom has a sufficient amount of UF_6 to warrant changing. The chemical traps are charged with alumina and are changed only when the Welch pump locks. In talking with Supervision, they feel this is an adequate mode of operation. They reason that the oil in the pump prevents UF_6 from escaping; and when the pump locks, they change both the pump and alumina in the chemical traps.

Maintenance changes the oil in the Welch pump weekly, and even with this changeout frequency, pumps still lock as a result of contaminated oil.

This facility handles an assay of 5% UF_6 or less, and since all sampling is in the liquid state, the potential for unmeasured loss is very high.

Recommendations:

1. In order to totally eliminate emissions from this vent, the effluent material should be returned to the cascade. This approach would eliminate the costs associated with frequent vacuum pump maintenance and operation of the chemical traps.

2. If Recommendation No. 1 is not followed:

- o Interlock valves should be installed on the suction and discharge of the chemical traps that will close automatically when the evacuation is open to the cold traps, and will open when the evacuation to the cold traps is closed. X-344 and X-342 have this system.

- o Radiation surveys should be conducted on the chemical traps each week, or more frequently if necessary, to detect uranium buildup and assure timely changeout of trap material.

- o An accountability sampler should be installed to monitor the discharge of the vacuum pumps for a period of at least six months to evaluate the need for permanent installation and measurement.

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7. X-345 SPECIAL NUCLEAR MATERIAL BUILDING

The X-345 Building processes non-UF_6 nuclear material scrap (U_3O_8, UNH, etc.) returned for recycling and requiring handling, sampling, and storage. A glovebox is provided for sampling material for uranium content and assay. The use of the glovebox provides containment of the material being sampled. Since the system operates at a negative pressure, any possible leakage will be inleakage. The glovebox vent to the roof is equipped with HEPA filters to remove particulates. IHHP air samplers are run both inside and outside the glovebox when it is in use. This system is presently operated only a few times a year.

All samples in this facility are in the granular or solid form and never in liquid or gaseous form. Therefore, the risk of venting material is essentially zero.

Recommendation:

Currently, no additional monitoring of this system is recommended.

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8. X-710 TECHNICAL SERVICES BUILDING

The X-710 Technical Services Building is equipped with a multitude of exhaust fans as an integral part of the heating, ventilating, and air-conditioning system (HVAC). These exhaust fans serve two purposes: general building ventilation and laboratory fume hood exhaust. General exhausts are installed in storage areas, restrooms, room bypass ventilation, and pipe spaces. Individual exhaust fans serve each of some 165 laboratory fume hoods installed in the many analytical laboratories throughout the building. For the purpose of materials accountability, only fume hood exhausts will be discussed.

The laboratory fume hoods installed in the X-710 Building are almost entirely of the auxiliary air design. Filtered outside air is provided at the face of the hoods by one of five auxiliary air units. In combination with conditioned room air, sufficient air is available to maintain adequate fume hood face velocities and provide a safe working environment for handling toxic and noxious materials required in analytical procedures. The hoods operate on a continuous basis and are an integral part of maintaining air balances within the building. By design, the laboratory work areas are maintained at a negative pressure with respect to the building corridors to prevent contaminants from infiltrating these areas in the event of a mechanical failure or a significant material release.

Five laboratory rooms with exhaust ducts handle only tails or normal assay material. Material in these areas will most usually be found in 2-S type containers and handled in gas phase only at ambient or slightly elevated temperatures. A worse case incident in these areas could involve up to 4.9 lbs. of material. Four laboratory rooms with exhaust ducts may be handling material up to and including VHE product. Container sizes may vary from 1/4-inch hoke tubes to 2-S cylinders containing <10 grams up to 4.9 lbs. of material. In all cases, the material transfer weights are known upon receipt of the sample container, during subsampling operations, and ending weights. Material accountability weights plus or minus a few grams are readily available in case of a material release. Past containment studies made by outside A-E's were determined by the DOE to be too costly to provide total containment in these areas.

It is believed that monitoring effluent streams from the X-710 Building for ID purposes is not warranted. The documentation of cylinder weights adequately provides for material accountability.

Recommendation:

None.

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9. X-705 DECONTAMINATION BUILDING

A. Large Parts Decontamination in the South Annex

Any large cascade equipment suspected of containing amounts of technetium is disassembled and decontaminated in the X-705 Annex. The Annex is an enclosed containment area used for the disassembly of equipment, which when opened, has the potential to cause a significant contamination of the environment and/or personnel.

The two major operations performed in the Annex are the 25-size compressor disassemblies and the 25-size converter nozzle installations. Various other miscellaneous jobs are performed in the Annex, such as the alumina trap regeneration for the X-700 Furnace Stand and disassembly of 25-size converter tube bundles. During these operations, the Annex doors are closed and a negative pressure is maintained on the room with the use of a large exhaust fan, which pulls the air through an absolute filter prior to exhausting it to the atmosphere.

The absolute filters on the X-705 South Annex ventilation system are changed when the pressure differential reaches 5 inches of water (6-8 weeks of operation). The alarm and interlock to automatically shut down the ventilation fan is set at 6 inches of water. The impact of this operation on materials accountability is unknown at present.

Recommendation:

It is recommended that this vent be further evaluated with a portable continuous sampler during compressor tear down operations to determine the need for permanent sampler installation.

B. Small Parts Decontamination Leaching Handtables

Three handtables are used in the leaching process by which nitric acid solution is added to uranium-bearing solids (incinerator ash or PG dust UO_2F_2) to dissolve the uranium. The resulting solutions are then further processed for recovery of the uranium.

An exhaust fan pulls a vacuum through the hood for each handtable, and the NOx, uranium and technetium vapors are exhausted through the roof of the X-705 Building. The impact of this operation on materials accountability is unknown at present.

Recommendation:

It is recommended that this exhaust stream be further evaluated with a portable continuous sampler during leaching operations to evaluate the need for permanent sampler installation.

C. Small Parts Handtables and Pit Hoods

All small parts contaminated with visible uranium compounds are precleaned in six small parts handtables (Columns G-17 and 18) or the seal dismantling room handtable (technetium contamination). After the visible deposits are removed, final decontamination is accomplished at the Small Parts Pit.

The handtables utilize nitric or citric acid solutions to clean the small parts such as seal parts, pigtails, cylinder valves, control valves, etc. The acid solution is stored beneath each table and is recirculated by a pump for thorough mixing. The tables are ventilated by exhaust fans, which pull noxious fumes (NOx) out of the building. A hand-held recirculating hose is used to direct the decontamination solution onto the parts. After the parts are sponged or wire brushed, they are rinsed in the next handtable with hot water. From there, they are transported to the Small Parts Pit for final decontamination.

The Small Parts Pit (Columns G-14 and 15) is utilized for final decontamination of small parts on which there is no visible contamination or which have already been pre-cleaned at a handtable. Safety equipment (masks, hoses, etc.) which might be damaged by the harsh chemicals in the handtables, are also cleaned at the Pit.

The Small Parts Pit is in the shape of a "T". Ventilation ducts are located at each end of the cross of the "T", which exhaust any fumes generated by the decontamination process. At the base of the "T", there is a blower, which pushes fumes toward the ventilation ducts. The chemicals used in the Pit include: citric acid, nitric acid, boric acid, sodium carbonate, detergent, Steam Eze, steam and isopropyl alcohol.

A glass blast unit is used to decontaminate small parts with contamination that has embedded into the metal surfaces. The glass blaster is in an enclosed glovebox and is connected to the Small Parts Pit ventilation system through a cyclone separator. The cyclone drops the dust out of the vent gas stream into a 5-inch can, so that it can be dumped back into the hopper. Items cleaned in the glass blaster include: small hand tools, blow-out preventers, small compressor parts, and other types of equipment, which contain numerous slots and bolt holes where contamination can accumulate. Rusted items are also cleaned in the unit because contamination may be lodged under the rust flakes.

The amounts of uranium on the equipment cleaned in both the Small Parts handtables and Pit are small, do not volatilize, and therefore, do not exhaust through the ventilation ducts. Only noxious fumes are vented from the building.

Recommendation:

No accountability sampling is recommended for these vents.

D. Small Parts Decontamination Spray Tank Leaching Operations

The two small parts tanks are used for two purposes: (1) For the leaching process by which nitric acid solution is sprayed onto contaminated NaF and/or alumina pellets to dissolve the uranium; and (2) To clean degreased contaminated equipment by spraying it with nitric acid, citric acid, carbonate solution, or rinse water.

The exhaust fan pulls all NOx, uranium and technetium vapors from both tanks and exhausts them through the roof of the X-705. The impact of this operation on materials accountability is unknown at present.

Recommendation:

It is recommended that this exhaust stream be further evaluated with a portable continuous sampler during leaching operations to determine the need for permanent sampler installation.

E. X-705 Small Parts Dismantling Room

This facility is used to dismantle seal parts as completely as possible to facilitate decontamination. Seal dismantling is done with an induction heating device that melts the silver solder in the seal parts. Miscellaneous jobs, such as MgF_2 trap and GCEP trap regeneration, are also performed in the seal dismantling room. The seal dismantling room is an enclosed room with a separate filtering and ventilation system, which maintains a negative pressure on the room. The room is ventilated through the X-705 roof. The impact of this operation on materials accountability is unknown at present.

Recommendation:

It is recommended that this exhaust stream be further evaluated with a portable continuous sampler during seal dismantling operations to determine the need for permanent sampler installation.

F. <u>Large Parts Decontamination - Tunnel</u>

Large equipment, which has been disassembled, is decontaminated in the large parts spray booths (tunnel). The parts are loaded onto tunnel dollies at the north end of the tunnel (Column F-11), and positioned so that liquid will not collect in an unsafe geometry. A roller chain drive pulls the dollies through the spray booths.

The tunnel contains five booths in series. The first three are recirculating booths in which the decontamination solutions drain into storage columns located in the basement, and are then pumped back to the spray heads. The solutions are reused until their uranium or total dissolved solids content makes it necessary to change out the solutions.

Spray booths No. 1 and No. 2 use citric acid at a 0.3M concentration while spray booth No. 3 uses 3M nitric acid as a decontamination solution. The fourth booth is a non-recirculating water rinse booth where sanitary water is sprayed over the parts and the effluent is discharged to the X-701B Holding Pond. The fifth booth is a warm air drying chamber.

The tunnel basement contains the decontamination solution storage columns. There are six banks of storage columns: two for raffinate storage, two for citric acid storage, one for nitric acid storage, and one for contaminated acid storage.

Each of the five tunnel booths and each of the six banks of storage columns are ventilated. Each tunnel booth has an exhaust fan which energizes only when the solution spray has been stopped and the door is opened. The fumes and moist air are exhausted from each booth before entry is permitted. Each of the six banks of storage columns in the basement are vented to the atmosphere to allow for transfer operations.

Recommendation:

These vents exhaust only moist air and acid fumes and will not need to be monitored for uranium accountability.

G. <u>Laboratory Sampling Hoods</u>

The X-705 Laboratory performs many various sample analyses for the Chemical Operations Department. These analyses are run on recovery solutions, incinerator ash, decontamination solutions, fluorine, HF, chemical cleaning solutions, Furnace Stand gas samples, Biodenitrification samples, and Heavy Metals/Ion Exchange solution samples. These analyses include: uranium (ppm), U-235 (ppm), U-235 (assay), pH, nitrates, technetium, etc. Small sample quantities are analyzed and disposed of in the Lab.

Experiments or analyses that would generate caustic fumes are carried out in one of three fume hoods. These hoods are exhausted to the roof of X-705. Each hood contains a 1-inch furnace-type filter, which filters the caustic fumes. Very small quantities of contamination are present in the samples to be analyzed and any contamination would be filtered through the furnace filter before being vented to atmosphere.

Recommendation:

No accountability samplers are recommended for these hood vents.

H. Cylinder Cleaning Operation

UF_6 cylinders of various sizes ranging from 48-inch diameter down to 5-inch diameter are decontaminated in X-705 to remove heel quantities of UF_6.

Large cylinders (48-inch and 30-inch) are cleaned on three turning fixtures located in the small parts area of X-705. A fourth, smaller unit is used for cleaning 8- and 12-inch cylinders. Cylinder decontamination solution (boric acid) is prepared in a mixing tank where boron is added to act as a neutron poison. After this process is complete, the solution is pumped into storage Columns A and B.

The cylinder pressure is checked, and if there is a positive pressure, a transfer line is attached to the cylinder valve and the pressure is released by venting the contained gases through the boric acid solution in Column B to the atmosphere. An air jet is then used to pull a vacuum on the cylinder. Boric acid is introduced into the cylinder, which is then rotated and tilted for 30 minutes; subsequently, the solution is then vacuumed into Column C and sampled. If the uranium is greater than discard limits, the solution must be recovered.

With the cylinder unit, as many as four 5-inch cylinders can be cleaned at one time. The inlet manifold from the recirculating pump outlet is connected to the dip-leg valve, and the outlet is connected to the other (white) valve. The cylinder valves are opened and any internal pressure is released through a packed overflow vent column. The carbonate tanks are then valved into the manifold and carbonate solution circulates through the cylinders and back into the storage columns for 45 minutes. The pump is then shut off and the cylinders are inverted to drain. Plant air is valved into the cylinder at 100 psig to force the sodium carbonate solution back to the storage columns. The cylinders are then uprighted and rinsed twice with cold water.

After the 5-, 8-, or 12-inch cylinders have been rinsed, they are taken for final rinsing to the cylinder cleaning pit where the stems are removed from the cylinder valves. A steam and sanitary water mixture is flushed through the cylinder for the final rinse. Nitric acid is used to clean the exterior of the cylinders. The pit has an exhaust hood to exhaust any noxious gas (NOx).

Since most UF_6 cylinders received at X-705 are already at a vacuum, and because those that are at positive pressure must either be discharged through a boric acid solution (48-, 30-, 12-, or 8-inch cylinders) or a packed overflow column (5-inch cylinder), it is unlikely that uranium would be vented in this operation.

Recommendation:

No accountability samplers are recommended for these vents.

I. Small Parts Decontamination Technetium Scrubber Columns

This facility is used to purge technetium from MgF_2 traps or from 25-size converters. The MgF_2 traps/25-size converters are connected to the scrubber columns, which are filled with boric acid and potassium hydroxide. Dry air is passed through the MgF_2 pellets/25-size converter, through the scrubber columns, and then air-jetted through a vent to atmosphere. The impact on this operation on materials accountability is unknown at present.

Recommendation:

It is recommended that this vent stream be further evaluated with a portable continuous sampler during operation to determine the need for permanent sampler installation.

J. "B" Area Calciner, Handtable and NOx Scrubber Vent

In X-705 Solution Recovery, the uranium in the decontamination solutions (uranyl nitrate) is concentrated through evaporation, extracted with solvent, stripped with de-ionized water, and further concentrated through evaporation. This concentrated uranyl nitrate is then fed into one of two "B" area calciners and heated to 1400°F to form uranium oxide (U_3O_8). The coarse solids are roll milled and moved by gravity to the discharge end of the revolving, sloped calciner tube where the product falls into receiving containers, which are inside gloveboxes. The calciners are vented through two NOx scrubbers, which are designed to condense and reduce acid vapors and nitrous oxide fumes from the calciners and handtable off-gases. The handtable is used to complex the fluorides produced from dissolving contaminated solids (NaF) in order to recover the absorbed uranium. This handtable is seldom used and the vent has a series of NOx scrubbers filtering the effluents.

Recommendation:

Installation of accountability samplers at this location is not recommended.

K. Solution Recovery Leaching Spray Tank Handtable Vent

The uranium-bearing solids (alumina or NaF) are mixed and digested in the spray tank/leaching operation with a solution of nitric acid and water. The slurry that is formed is pumped to the flocculating columns where suspended solids are partially separated from the uranium-bearing solution. The flocculated solution is fed into a filter table where the liquid, which may contain dissolved uranium and technetium compounds, is drawn off by a vacuum and the solid material is collected as a filter cake. The filter table has an exhaust hood that draws the noxious fumes away from the operator and exhausts outside.

Recommendation:

As above, it is not recommended to install accountability samplers at this location.

L. NaOH Precipitation Enclosure Vent

Mixed acids from the X-710 Laboratory, which contain uranium, are precipitated with NaOH to remove the uranium in the X-705 NaOH precipitation enclosure. The uranium is precipitated from the mixed acids by adding sodium hydroxide (NaOH) to the solution until it reaches a pH of 8.0 to 9.0. The precipitate is then filtered from the solution by means of a filter table. The supernatant liquid is either sampled and saved or discarded based on sample results. The filter cake and precipitate are removed from the table, placed in a polybottle, and mixed with nitric acid, which redissolves the uranium precipitate. The mixture is again filtered through the table where the filter cake redeposits. The cake is rinsed to remove residual uranyl nitrate solution. All solutions are drained into polybottles for later processing through Recovery. The enclosure is vented to the X-705 roof for removal of noxious fumes.

Recommendation:

Since NaOH does not volatilize the uranium and technetium, no accountability sampler is recommended for this vent.

M. <u>Uranium Oxide Blending and Sampling Glovebox Vents</u>

Cans of uranium oxide, which are produced from the Recovery calciners, are placed in the blender glovebox for blending. The can is placed in a holder within the glovebox and rotated for approximately 35 minutes. An exhaust blower provides a vacuum on the glovebox. The air is drawn first through a roughing filter and then through HEPA filters prior to being vented to the atmosphere. It is unlikely that the can would break open, but even if that happened, the oxide is in a solid form and would not volatilize.

Recommendation:

Installation of an accountability sampler on this vent is not recommended.

N. <u>X-705 "F" Area Calciner Solution Recovery</u>

The "F" area calciner is used to convert the uranyl nitrate solution from Solution Recovery into uranium oxide. This unit is an electrically-heated rotary calciner. Solution is fed to the calciner at a rate of 10 liters per hour via a packed column, where the solution runs countercurrently to the gases being exhausted from the calciner. The feed solution scrubs the off-gases from the calciner, and the off-gases preheat the feed solution. The nitrous oxides generated in the calciner are vented through the packed feed column. Exhaust from this column passes through a 4-inch cyclone separator, which removes any liquid contained in the exiting gases. The inlet line to the exhaust blower is baffled for further removal of any contained liquid.

Gas leaving the exhaust blower passes through the exhaust gas scrubber column, which uses recirculating water spray and a series of trays and weir overflows to obtain contact between the exiting gas and water within the column. The nitrous oxide removal efficiency of this scrubbing system is approximately 55 percent. The impact of this operation on materials accountability is unknown at present.

Recommendation:

It is recommended that this vent stream be further evaluated with a portable continuous sampler to determine the need for permanent sampler installation.

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10. X-705A RADICATOR EXHAUST

The X-705A Radicator is a controlled air, dual chamber incinerator for the thermal destruction of classified and contaminated solid waste. The upper chamber is propane fired to above 1000°F to remove smoke, odor, and particulate emissions from the flue gas. After the incinerator is loaded and purged, the pilot light is lit and the main propane burner is ignited to preheat the upper chamber to about 1000°F. After the bottom chamber is lit, the door is clamped shut, activating air supply valves, which introduce the proper amount of air for efficient combustion. After the burn is completed, the contaminated ash is shoveled out of the lower chamber into a screened hopper to filter out foreign material. A pneumatic vacuum system pulls the ash from the bottom of the hopper and deposits it in a storage hopper. The air is pulled through a sintered metal roughing filter and a bank of high-efficiency filters inside X-705A before being exhausted through the vacuum pump. The impact of this operation on materials accountability is unknown at present.

Recommendation:

Both the stack and vacuum exhaust vents should be further evaluated by portable continuous samplers during operation to determine the need for permanent sampler installation.

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11. X-700 CONVERTER SHOP AND CLEANING BUILDING

In the X-700 Building, the only atmospheric vent that has the potential of emitting uranium or technetium to the atmosphere is located at the Furnace Stand. This vent is an 8-inch diameter stack, which emits vent gases from each stand after technetium and uranium have been removed through banks of alumina and NaF traps, respectively. In addition, further uranium removal is promoted prior to the NaF traps by a cold trap cylinder, if the uranium concentration is greater than 2200 ppm. Typically, this vent stream consists of nitrogen, fluorine, HF, and slight traces of uranium, technetium, and other impurities from the converter. These gases are vented to atmosphere by a two-stage air jet.

Whenever operators are treating or purging a converter at the X-700 Furnace Stand, the vent is sampled once every four hours at the outlet of the chemical trap bank being used. When the analysis indicates greater than 20 ppm uranium, the traps are changed out.

Recommendation:

An accountability sampler and total flow measurement system should be installed on this vent.

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12. X-744G BULK STORAGE BUILDING

In the X-744G Building, there was one vent to atmosphere that has been dismantled. This vent was used for physical sampling of solid scrap material. The most frequently sampled material was trapping material. The most uranium that could have been released was the amount that would have been carried out by dust particles of trapping material released during handling operations. Due to the use of HEPA filters, the amount of dust discharged to atmosphere was quite small. This vent was, therefore, considered to have had a low potential for losing uranium.

Recommendation:

If a similar vent is built in X-744G and used for the same type of sampling, there is no need to monitor the effluent for accountability purposes.

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13. X-760 CHEMICAL ENGINEERING BUILDING

The Chemical Engineering Building, X-760, has one vent to atmosphere. Its primary purpose is to discharge the fumes from silver soldering. Occasionally, it is used for the calibration of an instrument, such as a gas analyzer. It is possible that uranium could be emitted during this operation; however, the amount of uranium released during a calibration would be insignificant.

Recommendation:

Since there are plans to discontinue the use of this vent, it should be left unmonitored.

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14. X-770 MECHANICAL TESTING BUILDING

The X-770 Building, once used for training operators and testing gaseous diffusion equipment, is now in long-term standby, and there are no plans to reactivate it. There are eight exhaust fans over the high bay areas and one in the cold trap room that could have exhausted uranium released during a testing period. There are no direct vents to atmosphere that could have discharged uranium.

Recommendation:

Since the building is no longer used, and would require considerable modification before it could be returned to service, there is no need to monitor this building for inventory purposes.

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15. X-720 MAINTENANCE AND STORES BUILDING

There are two vents in the X-720 Building that discharge to atmosphere. One is in the cleaning room where small parts of instruments are cleaned, while the other is in the line recorder room.

The cleaning room handles equipment that is too small for decontamination in X-705. Since these instruments are slightly contaminated, there is a possibility that a small amount of uranium could be released from this area. However, the amount is so insignificant that it could have no effect on inventory.

Recommendation:

It is recommended that this vent be left unmonitored.

In the line recorder room, calibration standards for line recorders are prepared. These standards constitute the major potential source for a uranium release in X-720. They are made from depleted material at low pressure, in a container approximately the size of a 2S sample container. If one of the standards would be released to the atmosphere, the loss would be less than two kilograms. Records are kept on the weight of the parent cylinder. There is no history of a release in the room, and if a release did occur, a fairly accurate estimate of the amount released could be made by weight difference.

Recommendation:

It is recommended that this vent be left unmonitored.

TR-011485-WTB ***