



September 23, 2011  
GDP 11-1029

U.S. Nuclear Regulatory Commission  
Attention: Document Control Desk  
Washington, D.C. 20555-0001

**Paducah Gaseous Diffusion Plant (PGDP)  
Docket No. 70-7001, Certificate No. GDP-1  
Event Report: ER-11-01**

Pursuant to 10 CFR 76.120(a)(4), Enclosure 1 provides the required 60-day written event report pertaining to the declaration of an "Alert" due to a chlorine trifluoride (ClF<sub>3</sub>) release in Building C-350 at the Paducah Gaseous Diffusion Plant (PGDP). Enclosure 2 is a list of commitments made in the report. The Nuclear Regulatory Commission (NRC) was verbally notified on July 27, 2011 at 0443 hrs. NRC assigned No. 47099 to the notification.

Should you require additional information regarding this event, please contact Vernon Shanks, Regulatory Affairs Manager at 270-441-6039.

Sincerely,

*Ma Beulena for*  
James D. Lewis, General Manager  
Paducah Gaseous Diffusion Plant

JDL: DMG: mcl

Enclosures: As Stated

cc: NRC Region II Office  
NRC Resident Inspector – PGDP

United States Enrichment Corporation  
Paducah Gaseous Diffusion Plant  
P.O. Box 1410, Paducah, KY 42002

*IE72*  
*NRSS*

**Event Report  
ER-11-01**

**A. Description of Event**

At approximately 0355 hrs. on July 27, 2011, Building C-335 Operations personnel noted that the current charging operation at Building C-350 had completed feeding of the chlorine trifluoride (ClF<sub>3</sub>) cylinder connected to the manifold within the building. Two operators proceeded to C-350 in order to disconnect the empty cylinder and re-connect a full cylinder to complete the charging operation. The empty cylinder was disconnected and removed without incident. A full cylinder was moved into position in the charging cabinet, secured into place with a strap, and prepared for connection to the manifold. Preparation involves removal of the valve protector cap, verifying the valve stem closed and valve packing tight with a torque wrench, then removing the valve outlet port cap.

The operator placed a new Teflon gasket into the cylinder end of the flexible hose (pigtail) attachment, and connected the end to the cylinder valve. The pigtail was pressurized with 5 to 7 psig air and leak rated for 2 minutes, using a local pressure indicator (PI-13, a 30" Hg vacuum to 60 psig compound gauge). The charging cabinet was then closed. No leakage was noted, and operators proceeded to the next step which is to slightly open the cylinder valve using the same torque wrench as previously used on the valve. Operators noted an audible hiss from the valve, indicating that material was flowing out of the cylinder into the tank piping, which is kept at a partial vacuum. All indications were normal at this point, and the operators waited about 20 – 30 seconds as they completed procedure check lists. The next step is to open the charging cabinet door to install the remote cylinder valve closer to enable full opening of the valve. However, prior to opening the door, one operator noted a change in the sound coming from the cylinder. At this point, the facility hydrogen fluoride (HF) Detection System alarmed indicating a possible release. The operators also noted visible fumes releasing into the charging cabinet. Most of the fumes were being removed by the cabinet exhaust system (which vents to the roof), but a small amount was escaping the cabinet at the top, where there is a hole to allow torque wrench and valve closer shaft access. The operators determined that it was unsafe to try to close the cylinder valve, and evacuated the facility under the plant's See & Flee policy. The operators were not injured.

Plant emergency response forces were notified and responded to the scene. Due to the early morning darkness, significant fog in the area, low wind, and the addition of cooling tower mist, the Incident Commander determined that it was not feasible to readily distinguish the ClF<sub>3</sub> release from the other external conditions and in accordance with Emergency Action Level (EAL) 7.1 declared an Alert at 0415 hrs. Emergency responders, in special protective gear, entered the facility and closed the cylinder valve and tank isolation valve at 0517 hrs. The Alert was terminated at 0636 hrs. following verification by HF sampling that no further hazard existed in building C-350 and other applicable areas.

Post event weighing of the  $\text{ClF}_3$  cylinder indicated that approximately 18 pounds of the chemical was released to the atmosphere. Additionally, chemical reaction products produced during the release may have included chlorine ( $\text{Cl}_2$ ) and hydrofluoric acid (HF).

The event was reportable pursuant to 10 CFR 76.120(a)(4) where an emergency condition has been declared an Alert.

**B. Exact Location of Event**

The event was in Building C-350.

**C. Description of Isotopes, Quantities, and Chemical and Physical Form of the Material Involved**

There was no release of radioactive material related to this event.

**D. Cause of the Event**

The source of the release was determined to be the pigtail to cylinder gasket connection. This was visually evident as the gasket was consumed by the reaction and the portion of the pigtail connection normally supported by the gasket had dropped down slightly, further opening up the release path. Additionally, corrosive reactions were more evident near this location. Teflon gaskets are normally inert to  $\text{ClF}_3$ . However, localized reactions with contaminant materials (even oil from a finger print) can melt the gasket and create a condition where even the Teflon will burn.

The investigation team identified two root causes which contributed to this event taking place. The first root cause identified is the introduction of contaminants to the Teflon gasket inserted into the cylinder end of the pigtail connection. In order to initiate a reaction in the Teflon gasket, it is necessary to have some reactive contaminant present. Since both the pigtail (at PGDP) and the cylinder valve (at the filling vendor) had already been exposed to  $\text{ClF}_3$ , neither of these appears to be a likely candidate for a contamination source. It is considered most likely that this contaminant was introduced during the gasket replacement and pigtail handing evolution during the  $\text{ClF}_3$  cylinder change.

The second root cause is the lack of a functional remote closure mechanism during the period of time between initial cylinder opening and the valve being fully opened which escalated what would otherwise have been a small localized release and gasket failure. In the case of this event, the operators had the time and knowledge to close the cylinder valve to stop the release at the incipient stage, thereby avoiding a reportable release and a declared Alert. However, they lacked the proper tooling to accomplish this action and mitigate the event.

Extent-of-Condition: The C-350  $\text{ClF}_3$  Cylinder Connection activity is the only location where the  $\text{ClF}_3$  bottles are used outside of the C-710 laboratory. Use of this material at C-710 is

performed in a distinctly different manner by trained laboratory personnel. The issues of the C-350 release event were not determined to be applicable to the usage at C-710.

#### **E. Corrective Actions Taken**

The return to service of the C-350 ClF<sub>3</sub> charging station was subjected to an operational readiness assessment that identified the following corrective actions:

1. The leaking ClF<sub>3</sub> pigtail was replaced under work order task (WOT) 1112000-01 and delivered to the Materials and Process Technology lab for further analysis. Completed 8-5-2011.
2. The entire remaining supply of Teflon pigtail gaskets was removed from C-350 and delivered to the Materials and Process Technology lab for testing for contaminants. Testing indicated that the gaskets themselves were not a significant source of contamination to this event. Completed 8-4-2011.
3. The etched viewing glass on the ClF<sub>3</sub> bottle cabinet was replaced under WOT 1112073-01. Completed 8-9-2011.
4. The HF sensor in the ClF<sub>3</sub> charging station was replaced, and the entire system functionally tested under WOT 1110356-01. Completed 7-27-2011.
5. Chemical Operations personnel decontaminated the interior of the ClF<sub>3</sub> station to remove future personnel risks from corrosive reaction byproducts. This activity also cleaned the station view window. Completed 8-5-2011.
6. Instrumentation involved in the pigtail leak rating activity (PI-13) was checked for calibration under WOT 1112008-01. No abnormalities were discovered. Completed 8-5-2011.
7. Mechanical Engineering inspected the ClF<sub>3</sub> charging station and concluded that the station was adequate and operable. Completed 7-28-2011.
8. A pre-job briefing was developed and established to be used for each ClF<sub>3</sub> bottle change. The key points of this briefing include the use of clean gloves and gaskets for each evolution, special cleanliness handling precautions and management of the torque wrench used for opening to allow for rapid cylinder valve closure. Completed 8-5-2011.
9. The gasket/glove handling measures have been changed similar to the C-310 Burp Station operation, wherein each single evolution is performed using a "kit" of a specially cleaned glove and gasket, as opposed to a long-term, common gasket supply. Confirmed complete 9-19-11.

Additional corrective actions not included as part of the readiness assessment:

10. On July 29, 2011, the ClF<sub>3</sub> Cylinder scale was calibrated to ensure that exposed portions were not negatively impacted by the release under WOT 1111997-01.
11. The light bulbs in the interior of the cylinder station were replaced under minor maintenance. Confirmed complete 9-8-2011.

#### **F. Corrective Actions Planned**

The following corrective actions are planned to prevent recurrence of this event:

1. By October 14, 2011, Operations will evaluate changes to the cylinder connection process, including, as necessary, modifications to the cylinder valve closer, to permit remote closure of the cylinder valve during critical steps that might produce a ClF<sub>3</sub> release. Corrective Action #C11I02127-006
2. By December 21, 2011, Operations will revise the CP4-CO-CN2027 procedure to include the following:
  - a. Add the proper torque levels to ensure they are not exceeded for the cylinder valve, valve packing and pigtail fitting connections. Corrective Action #C11I02127-005
  - b. Include provisions to ensure that the pigtail is removed, inspected, cleaned as needed, and reinstalled with new gaskets at least annually to prevent buildup of potentially reactive materials, as well as, inhibiting the possibility of leaking due to gasket movement. The preventive maintenance schedule will also be revised to include these criteria. Corrective Action #C11I02127-003
3. By June 30, 2012 all recommended procedure enhancements and/or modifications from the evaluation of corrective action #1 above will be implemented. Corrective Action #C11I02127-007

These corrective actions are intended not only to prevent this type of event from re-occurring but also provide a quicker and safer approach to mitigate any future abnormality.

#### **G. Extent of Exposure of Individuals to Radiation or to Radioactive Materials**

There were no exposures to radiation or radioactive materials.

**List of Commitments**  
**ER-11-01**

The following is a list of corrective action commitments USEC PGDP will complete to prevent future recurrence of this type of event.

1. By October 14, 2011, Operations will evaluate changes to the cylinder connection process, including as necessary modifications to the cylinder valve closer, to permit remote closure of the cylinder valve during critical steps that might produce a ClF<sub>3</sub> release. Corrective Action #C11I02127-006
2. By December 21, 2011, Operations will revise the CP4-CO-CN2027 procedure to include the following:
  - a. Add the proper torque levels to ensure they are not exceeded for the cylinder valve, valve packing and pigtail fitting connections. Corrective Action #C11I02127-005
  - b. Include provisions to ensure that the pigtail is removed, inspected, cleaned as needed, and reinstalled with new gaskets at least annually to prevent buildup of potentially reactive materials, as well as, inhibiting the possibility of leaking due to gasket movement. The preventive maintenance schedule will also be revised to include these criteria. Corrective Action # C11I02127-003
3. By June 30, 2012 all recommended procedure enhancements and/or modifications from the evaluation of corrective action #1 above will be implemented by Operations. Corrective Action # C11I02127-007