

OSART Good Practices

CHEMISTRY

Laboratories and measurements

Bushehr, Iran

Mission Date; 20 Sep. - 7 Oct., 2021

Sampling of primary circuit water is performed once per day by the shift laboratory personnel using a sampling glove-box to analyse oxygen and hydrogen concentration. A feed-through line has been designed and manufactured to connect the inside of the sampling glove box with a portable gas analyser located outside the glove-box. This modification allows a more precise and rapid analysis which minimizes the operator's dose intake but still provides effective support for the adjustment of the water-chemistry regime.



Sampling box (before modification by the plant): O₂/H₂ manual measurement

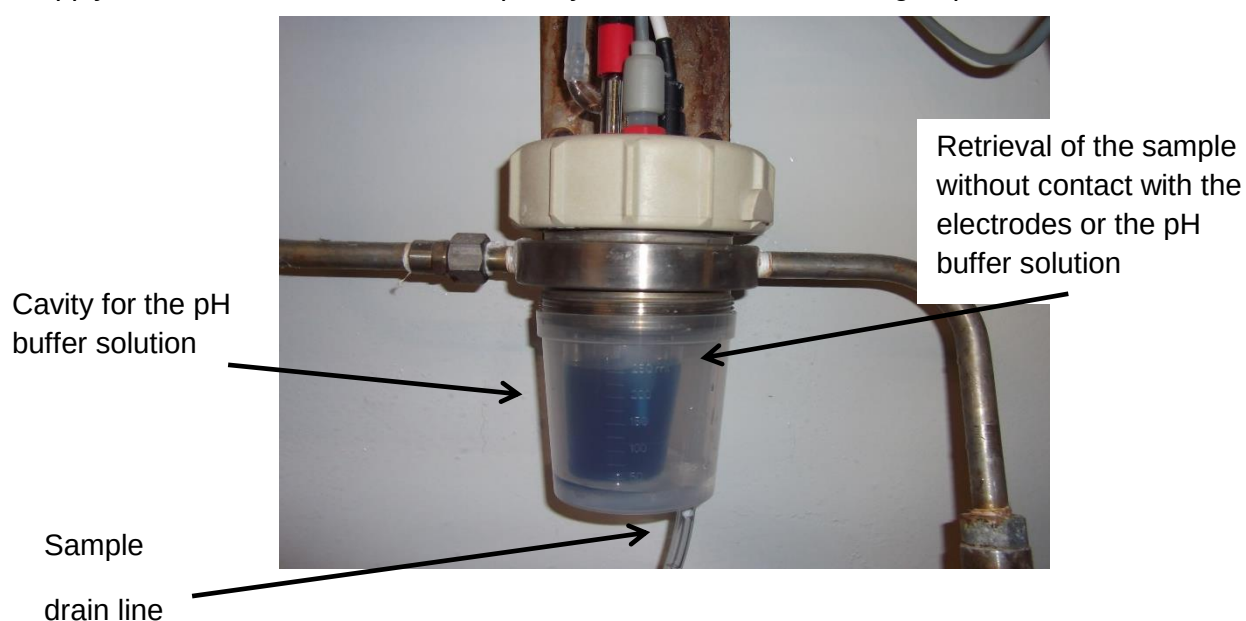


Sampling box (after modification by the plant): O₂/H₂ measurement with portable equipment
Paluel, France

Mission Date; 20 Sep. - 7 Oct., 2021

Every month, a pH-meter calibration is carried out on the steam generators blow down line. The risk analysis reveals a potential for a group 1 event during this activity. In fact, during this procedure the arrival of water is cut which can cause a lack of flow on the activity measurement chains (KRT), located on the same lines.

A customized pots with a 3D printer was created so that the electrodes of the pH meter do not come into contact with the standard solution for calibration. There is no need to stop the water supply to calibrate the unit. This completely eliminates the risk of a group 1 event.



Benefits: Since the implementation of this modification, the Group 1 safety event risk is removed

BEFORE	AFTER
risk of group 1 safety event	eliminates the risk of a group 1 safety event
stressful activity	less stressful activity

Application of hydrogen generators for the operation of gas chromatographs

The plant used hydrogen generators for the operation of gas chromatographs equipped with a flame ionization detector for analyses of hydrocarbons, furan derivatives, and additives in samples of oils.



The purpose of the hydrogen generator was to produce hydrogen by decomposition of distilled water on a solid polymer membrane in an electrolysis cell. For additional hydrogen purification, the generator was equipped with two filters containing molecular sieves and moisture indicators. The required hydrogen pressure was automatically maintained using a semiconductor pressure sensor.

The use of hydrogen generators instead of compressed gas cylinder allows for the safe operation of chromatographs with minimal safety risks. Moreover, by using of hydrogen generators some difficulties associated with handling of compressed gas cylinders such as difficult manipulations and transport, periodic re-examinations or replacement of empty cylinders were eliminated.

The plant had implemented an innovative device to recycle the liquid nitrogen needed to cool the intrinsic germanium (IG) detectors used in the laboratories.

Purpose

Liquid nitrogen (LN) was used to cool intrinsic germanium detector in radiochemistry monitoring equipment. LN was being recycled with the 'ORTEC Möbius Recycler' to significantly reduce the quantity of liquid nitrogen being brought into the radiologically controlled areas (RCA) and the associated risks regarding personnel injury during liquid nitrogen handling.

Description

The Möbius Recycler technology was composed of a cryocooler and a specially designed twenty-seven-litre liquid nitrogen dewar. The Mobius Recycler was installed directly under the radiochemistry monitoring equipment and recycles the liquid nitrogen used for the IG detector cooling.



Figure 1: Mobius Recycler Installed Underneath Intrinsic Germanium Detectors

During a loss of input power, the Mobius Recycler would continue cooling the detector as if it was a standard dewar.

The LN monitor could be remotely mounted and indicated the liquid level, power consumption, and pressure levels allowing for proactive maintenance scheduling.

Benefits

Prior to using the Möbius recycler, the plant had an average of eight liquid nitrogen dewar refills twice a week, involving the delivery of large dewars of about 300 kg. These large dewars presented a safety hazard when maneuvered and transferred into the laboratories, which included the use of an elevator. They also required the handling of a cryogenic liquid, to transfer the liquid nitrogen from the large dewars to the detectors' smaller dewars. Radiation Protection and warehouse personnel were required to support the transfers of these dewars into and out of the RCA on a routine basis. During handling of these large dewars, the plant had two injuries (one broken leg and one back injury).

Now, with the use of the Mobius Recycler, liquid nitrogen refills were performed approximately once every other year under normal, continuous operating conditions. Hence, the ability to provide the liquid nitrogen without the requirement for frequent system refilling, enabled the plant to save time, money and to reduce hazardous material handling. The Mobius Recycler also allowed the plant to reduce the risk of personnel injury. The plant also estimated that the use of the Mobius Recycler saved approximately \$9500 per year.