

# Preserving the past for the future.

## Benefits at a glance

- Improved safety through training
- Humidified nitrogen for wider range of artefacts
- Single direction flow and pressure release valves for increased safety
- No risk of artefact dehydration

## The customer

Sydney University Museums (SUM) – comprising the Nicholson and Macleay Museums and the University Art Gallery – are home to some of Australia’s oldest university collections, some of which date back to the 1850s. They include natural history pieces, historic photographs, ethnography items, scientific instruments, art and antiquities. Visitors will even find artefacts from ancient Egyptian times such as mummies, monumental sculptures, inscriptions and ancient organic materials.

Every year, SUM attracts some 125,000 visitors, many of whom are passionate about Egyptian artefacts and the ancient world they represent. SUM is committed to preserving the precious and irreplaceable historical artefacts that have been entrusted to them so future generations can continue to enjoy these treasures of times past.

## The challenge

One of the key challenges in preserving artefacts lies in avoiding contamination and deterioration through contact with air and the oxygen contained in air. This can be achieved with nitrogen-based anoxic treatment. Originally developed in 1960s, anoxic treatment is used regularly by museums around the world. Contemporary anoxic treatment is similar to the modified atmosphere treatments used to extend the shelf life of common supermarket foods. The artefacts are placed in oxygen-tight bags which are flushed with nitrogen and sealed with oxygen scavenging packs that are designed to remove any oxygen that remains in the bag.

This helps preserve artefacts, primarily by preventing insect attack. In addition, artefacts packed into high-barrier plastic film bags and suitably stored are protected against deterioration resulting from fluctuating or excessively high or low humidity levels and damage from exposure to light.

SUM did have a nitrogen purging system in place – but this had not been used regularly in recent years. In addition, SUM wanted to ensure that the process complied with present-day safety standards and regulations and also maximise the effectiveness of the anoxic treatment. SUM thus engaged The Linde Group to perform a comprehensive audit of the nitrogen-based anoxic treatment programme and equipment in place and design a solution tailored to the museum’s current needs.

## The solution

Having also consulted literature and concept sketches supplied by SUM, BOC Australia (a member of The Linde Group) determined that the existing process was out-of-date and did not meet the safety or integrity standards required by the museums. Originally designed by laboratory technicians, the process showed no real consideration for the potential hazards involved. Having established the unsuitability of the system in use, BOC went on to custom-design a new solution.

To gain hands-on insights into concrete preservation requirements, Linde engineers visited the site, looked at how museum staff intended to use the equipment and explored the special needs of the objects. This project also called for a certain degree of sensitivity. "When people think about mummies, it can be easy to forget that they are human beings, so we discussed with the BOC engineers onsite about any cultural issues when working with human remains. We are very mindful that we are dealing with human beings and try to treat them with respect," said Alayne Alvis, Sydney University Museums' Conservator.

BOC understood the importance of keeping the artefacts in a constant environment, protected from any drastic fluctuation in humidity, light and gas levels. The key concern when using nitrogen for the anoxic treatment is that – in its purest form – nitrogen is quite dry, and can cause the objects to become dehydrated and possibly embrittled.

BOC thus developed a tailored process to deliver nitrogen at the correct relative humidity level. The process involves placing the artefact in a nearly completely sealed bag with two small openings for nitrogen injection and venting. Once the nitrogen supply has been tested, the gaseous nitrogen is passed through a series of chambers before being used to purge the atmosphere from the bag. The first chamber is used to pass the nitrogen through water to humidify it before it is mixed with dry nitrogen in the second chamber.

The resultant mixture is then analysed for correct relative humidity in a third chamber with a hygrometer before being applied to the bag containing the artefact. When the humidified nitrogen passes into the bag at the opening, it causes the atmosphere to flow out of the bag through the other opening. Having the gas at correct relative humidity prevents dehydration of sensitive organic material.

As part of BOC's improvements, single-direction flow valves and a pressure release valve were included into the design of the purge unit. BOC also tested the specially fabricated equipment in house before delivering it to SUM.

Two mummies held by the Nicholson Museum were the first artefacts to be treated with the new anoxic solution.

## Benefits

The solution from The Linde Group has delivered a number of benefits to SUM. The use of humidified nitrogen has increased the museums' ability to protect a wider range of artefacts from deterioration. Conditioning from a 'dry' nitrogen to a humidified nitrogen treatment process has ensured that vulnerable organic objects like mummies are not at risk of dehydration. "The updated anoxic treatment process has enabled us to know that we can consistently create the correctly conditioned gas to treat our artefacts and has allowed us to treat larger objects and extend the range of objects that we can treat. Shifting to Linde's product has given us the confidence that our staff will be applying the treatment in a controlled and safe environment," explained Ms Alvis.

In addition, fitting the equipment with single direction flow and pressure release valves has increased the safety of using nitrogen in anoxic treatments. Last but not least, BOC staff training has empowered SUM staff with the knowledge to carry out the anoxic process safely. "BOC has provided invaluable training to ensure that both our staff and artefacts are protected throughout the process," said Ms Alvis.



## Linde AG

Linde Gases Division, Seitnerstrasse 70, 82049 Pullach, Germany

Phone +49.89.7446-0, Fax +49.89.7446-1216, [fumigants@linde-gas.com](mailto:fumigants@linde-gas.com), [cropscience.linde-gas.com](http://cropscience.linde-gas.com)

Disclaimer: The Linde Group has no control whatsoever as regards performance or non-performance, misinterpretation, proper or improper use of any information or suggestions contained in this instruction by any person or entity and The Linde Group expressly disclaims any liability in connection thereto.