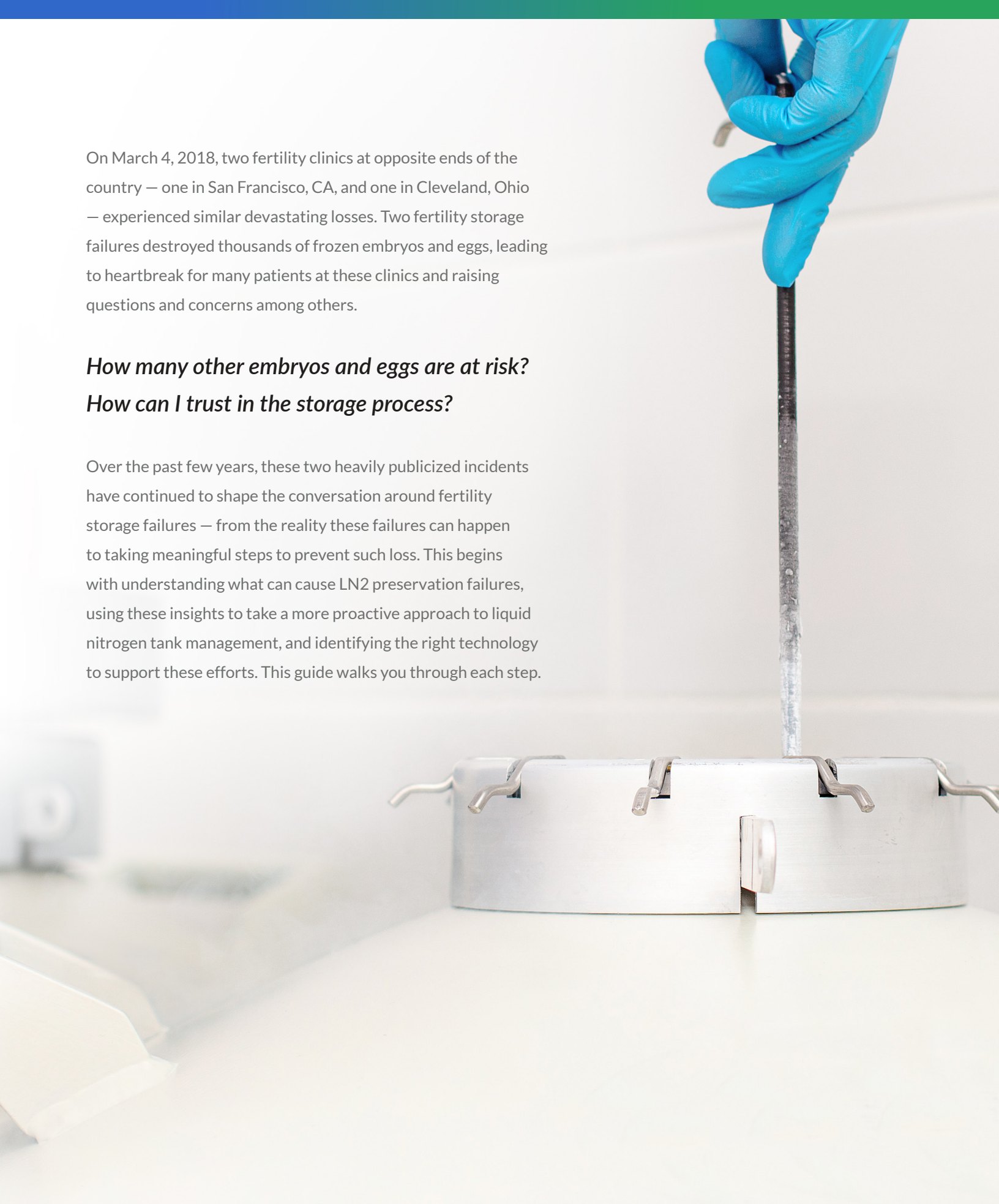
CORIS LIFE SCIENCES MONITORING

HOW FERTILITY STORAGE FAILURES HAPPEN & WAYS TO AVOID THEM

On March 4, 2018, two fertility clinics at opposite ends of the country — one in San Francisco, CA, and one in Cleveland, Ohio — experienced similar devastating losses. Two fertility storage failures destroyed thousands of frozen embryos and eggs, leading to heartbreak for many patients at these clinics and raising questions and concerns among others.

How many other embryos and eggs are at risk? How can I trust in the storage process?

Over the past few years, these two heavily publicized incidents have continued to shape the conversation around fertility storage failures — from the reality these failures can happen to taking meaningful steps to prevent such loss. This begins with understanding what can cause LN2 preservation failures, using these insights to take a more proactive approach to liquid nitrogen tank management, and identifying the right technology to support these efforts. This guide walks you through each step.



Why Do Fertility Storage Failures Happen?

In the wake of the nation's two biggest fertility storage failures — albeit unprecedented — many lab managers considered the question "could this happen in our facility?"

LN2 storage tanks are designed to preserve biological samples at very low temperatures. Because these tanks are so well insulated, including at least six inches of insulation in the lid, the vapor phase above the liquid nitrogen (-196°) in the tank generally remains in the range of -180° to -150°. For long-term preservation, biological samples must be stored colder than -136° — the glass transition point where all biological activity essentially stops.

While investigations have identified potential causes of the storage failures in California and Ohio, there may not always be a clear answer on what is ultimately at fault for allowing temperatures to rise or liquid nitrogen levels to fall without warning, putting invaluable fertility samples at risk. It could be human error, a mechanical issue or a combination of these factors that are to blame.

Failure to Comply with Manufacturer Instructions

While liquid nitrogen tanks share routine maintenance measures, the approach taken is unique to the type of tank or dewar and to the manufacturer's recommendations. Consider the case where liquid nitrogen is manually added to an LN2 tank or dewar. If the incorrect fill method is used, it's possible the cryogenic fluid could come into contact with fertility samples and cause damage, or the LN2 level sensors may not detect the added LN2.

Mismanagement of LN2 Tank Monitoring Activity

In order to measure LN2 levels, lab personnel have traditionally needed to remove the tank lid to insert the rod used to check on LN2 levels. While this manual step inevitably releases ultra- cold LN2 vapor and allows more room-temperature air into the tank, it also creates a concern around misaligned lid closures. If the lid isn't properly seated on the tank, it can cause temperatures inside the tank to further rise and lead to safety issues for personnel on-site.

A Component of the LN2 Tank Fails

Like all storage vessels, LN2 tanks are subject to failure after a certain period of time. This can be attributed to the gradual loss of vacuum that gives the tank its insulative properties. If the tank is mishandled when moved, causing dents or damage to the outer metal shell, the internal structure (specifically the insulating vacuum layer) can be unknowingly damaged and cause equipment to fail faster.

An Alarm System Inadvertently Goes Offline

Alarm systems may be installed on LN2 tanks, but when some systems lose power or their network connection, they go offline, and alerts may not be sent to lab personnel that the system is not being monitored. It could be a case where an alarm system is accidentally unplugged in a high-traffic area of the lab, or a case where a power outage occurs as a result of high winds or severe thunderstorms.

1. https://www.fertstertdialog.com/posts/33372-pomeroy-consider-this#:~:text=These%20storage%20tanks%20have%20remained,usually%20have%20automatic%20refill%20functions

What Can Labs Do Now To Prevent Unexpected Future Failures

Considering the variety of causes that lead to fertility storage failures, there's no single solution to prevent these catastrophic events. Instead, a series of investments must be made over time to help fertility clinics ensure they can provide the stability and care that clinic patients expect.

Making an Investment in...

RELIABLE EQUIPMENT

There are plenty of liquid nitrogen tanks available on the market but not all are built to the same standards. Beyond ensuring that the tank is the right shape, size and material for stored fertility samples, it's beneficial to look for equipment with high-performance construction and advanced thermal insulation properties. These characteristics will minimize vacuum loss and enhance the life span (and the overall reliability) of the LN2 tank.

PROPER TRAINING

Due to the extreme cold of liquid nitrogen and the risk it poses to humans, any personnel handling LN2 tanks should be thoroughly trained on their safe transport and handling. While safety training involves general measures — for example, wearing proper gloves and face protection, avoiding overfilling the tank to more than 80% of its capacity, or properly seating the tank lid in order to prevent pressure build-up — it's also a matter of reviewing a manufacturer's recommendations and integrating them into a clinic's working standard operating procedures.

Let's say a tank has an automatic LN2 refill system that uses two sensors to detect LN2 levels. Once the lower sensor no longer detects liquid, the refill tank adds LN2 until the level reaches the upper sensor, and then stops. During maintenance, you may have to use a manual fill approach and take care not to damage the two sensors. Generally, LN2 reservoir tanks are used to add liquid nitrogen to existing tanks via a flexible stainless steel hose. Yet, because this automated fill approach can vary between different tanks, personnel should look to the manufacturer's manual for specific fill instructions.

PREVENTATIVE MAINTENANCE

Maintaining the performance of liquid nitrogen tanks begins with where they are stored on-site. It's critical that liquid nitrogen tanks are stored in well-lit, well-ventilated areas and isolated from concrete, as this material can corrode the outer shell of the tank and lead to vacuum loss and eventually failure. On a similar note, exposure to cleaning chemicals can have a similar effect, which is why tanks should be cleaned with mild soap and water.

Whether it's a matter of construction in the clinic or repairs to the LN2 tank, there are scenarios where liquid nitrogen tanks must be transported to a new location. These tanks should remain in an upright position in transit, with a roller base used to support the weight of the tank. Any mishandling can dent the exterior of the tank and damage the tank's internal vacuum.

COMPREHENSIVE MONITORING

Personnel should be alerted to low liquid nitrogen levels before they've reached critical levels. The alerts should come before the issue reaches a level so severe that there is the potential for loss.

One proactive measure is to monitor the temperature inside the tank. As liquid nitrogen evaporates, the temperature inside the tank will slowly rise in response, with a misaligned tank lid further speeding up its effects. It is critical to know when the rising temperatures reach a level when more LN2 must be added to maintain proper storage temperatures. Equipping a tank with a real-time remote temperature sensor notifies staff when it's time to refill the LN2 tank, whether they're inside or outside of the clinic.

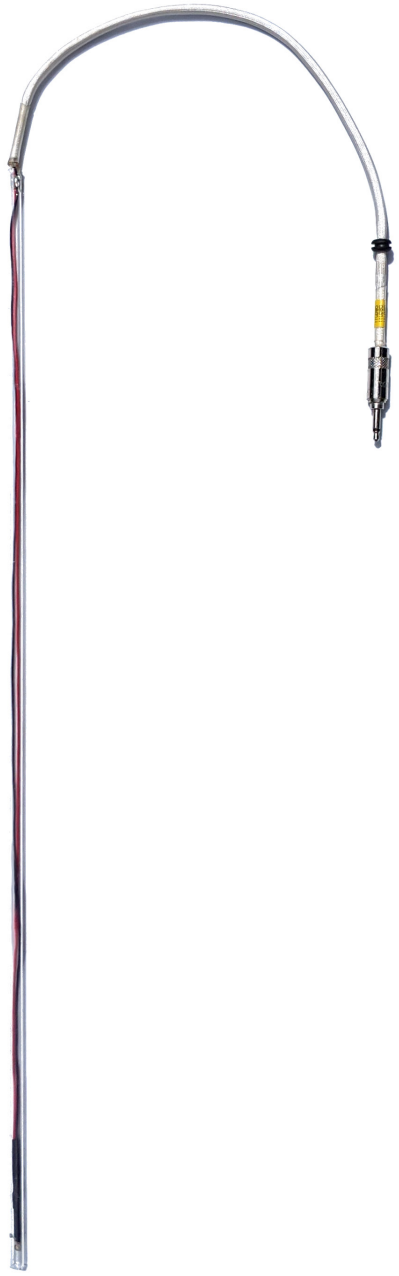
The other option is to directly measure the LN2 levels inside the tank. Traditionally, this involved the weekly process of manually lowering a wooden or plastic stick down to the bottom of the liquid nitrogen tank and withdrawing it to see where the frost level hit. A more efficient option would be installing a sensor-based probe. When the LN2 level gets below the sensor, personnel will get a convenient alert that notifies them it's time to refill the LN2 tank. With fewer manual steps in the monitoring process, the fewer opportunities there are for misaligned lids or temperature variations.

Preparing for the Future with Today's Innovative Technologies

In 2009, 475 women froze their eggs. By 2018, that number climbed to 13,275 — an increase of 2,695%.[2] This number has steadily increased, with fertility clinics across the U.S. reporting as much as a 50% increase in women freezing their eggs since 2019.

With the need to safely store and manage a growing number of fertility samples, fertility clinics will have to purchase additional LN2 tanks to house the samples, and in turn invest more time in training personnel, performing maintenance and monitoring the performance of the systems. Streamlining any step in the monitoring process can be a huge support in optimizing on-site operations for safety and giving back more time to personnel.

2. https://time.com/5927516/egg-freezing-covid-19-pandemic/



That's what you'll find with the CORIS LN2 tank monitoring system.

From one integrated system, we offer three ways to monitor your LN2 tank:

- Internal sensing to monitor temperatures inside the tank
- Internal sensing to monitor the LN2 level inside the tank
- External sensing to monitor the structural integrity of the tank

The real-time data from these sensors alert personnel to low LN2 levels, temperature issues inside the tank, frequency problems in auto-refill tanks (which can run out in facilities and need to be replaced) and vacuum loss in the LN2 tank. The three monitors ensure samples have the proper level of liquid nitrogen they need to be preserved and protected. Plus, with a tiered escalation system in place, you can start to receive alerts when temperatures inside the tank reach or go higher than -160°, and urgent alerts if the temperatures reach -145°.

Alerts are also sent to personnel if an LN2 tank monitor goes offline for any reason, whether it's a matter of being accidentally unplugged or in the event of a power or internet failure. Based on the exact cause, personnel can power back up the tank monitors or move samples to an alternative storage space.

Let the CORIS LN2 monitoring system support your clinic's efforts.

Contact us today.