Liquid Nitrogen - A Critical Component for the Future of Biopharmaceutical Innovation

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From preserving life-saving therapies to accelerating pharmaceutical research, liquid nitrogen (LN_2) is one of the most important technologies supporting today's life sciences industry. Liquid Nitrogen is an important component for the next generation of biological medicines, storing valuable cell lines or supporting cutting-edge research, Pharma organisations and researchers across Ireland rely on liquid nitrogen every day. Rarely seen outside specialist facilities, LN_2 underpins many of the technologies that improve healthcare, advance scientific discovery and supporting modern manufacturing.

MORE THAN JUST A COLD LIQUID

At -196°C, liquid nitrogen provides one of the most effective and reliable methods of preserving biological materials. By rapidly reducing temperature, it effectively halts biological activity, allowing samples to be stored for months—or even years—without significant degradation.

Today, LN_2 plays a critical role across:

- Biopharmaceutical manufacturing
- Pharmaceutical research and development
- Cell and gene therapy
- Universities and research institutes
- Clinical laboratories
- IVF and fertility clinics
- Biobanking and tissue storage
- Food production and industrial processing
- Stem Cell storage

While many people associate liquid nitrogen simply with ultra-low temperatures, its true value lies in protecting materials that are often irreplaceable.

SUPPORTING INNOVATION IN BIOPHARMA

Ireland has become one of the world's leading biopharmaceutical manufacturing locations. As biologics, advanced therapies and personalised medicines continue to evolve, dependable cryogenic storage has become increasingly important.

Liquid nitrogen enables organisations to safely preserve:

- Cell lines
- Master and working cell banks
- Stem cells
- Clinical trial materials
- Biological reference standards
- Patient samples

Maintaining these materials at cryogenic temperatures helps preserve their integrity, supporting consistency in research, manufacturing and quality control while protecting years of scientific investment.

ESSENTIAL FOR RESEARCH

Every day, researchers depend on liquid nitrogen to protect valuable scientific work.

From molecular biology and genomics to regenerative medicine and vaccine development, cryogenic storage safeguards biological samples that may be impossible to replace. Reliable storage allows experiments to be reproduced with confidence while maintaining the quality and viability of critical materials.

For many laboratories, the storage system itself becomes just as important as the samples it protects.

BEYOND EQUIPMENT – COMPLETE INTEGRATED CRYOGENIC FACILITY SOLUTIONS

Successful cryogenic storage involves far more than selecting the right storage vessel. Each facility has unique operational requirements, and the most effective solution is one that integrates equipment, infrastructure, monitoring and safety into a complete, reliable system.

Asistec has extensive experience supporting organisations in the planning and implementation of integrated cryogenic storage facilities, helping customers develop solutions that are safe, compliant and designed around their operational requirements.

TYPICAL INTEGRATED CRYOGENIC STORAGE SYSTEM

The diagram below illustrates the principal elements of a modern cryogenic storage facility. Rather than operating as standalone pieces of equipment, each component works together as part of an integrated system to protect valuable biological materials, support regulatory compliance and ensure operational reliability.
It's not just the facility but includes sample collection, preparation for cryogenic cold storage and then the removal, transportation to the point of use for further processing. This requires a cold chain management protocol.

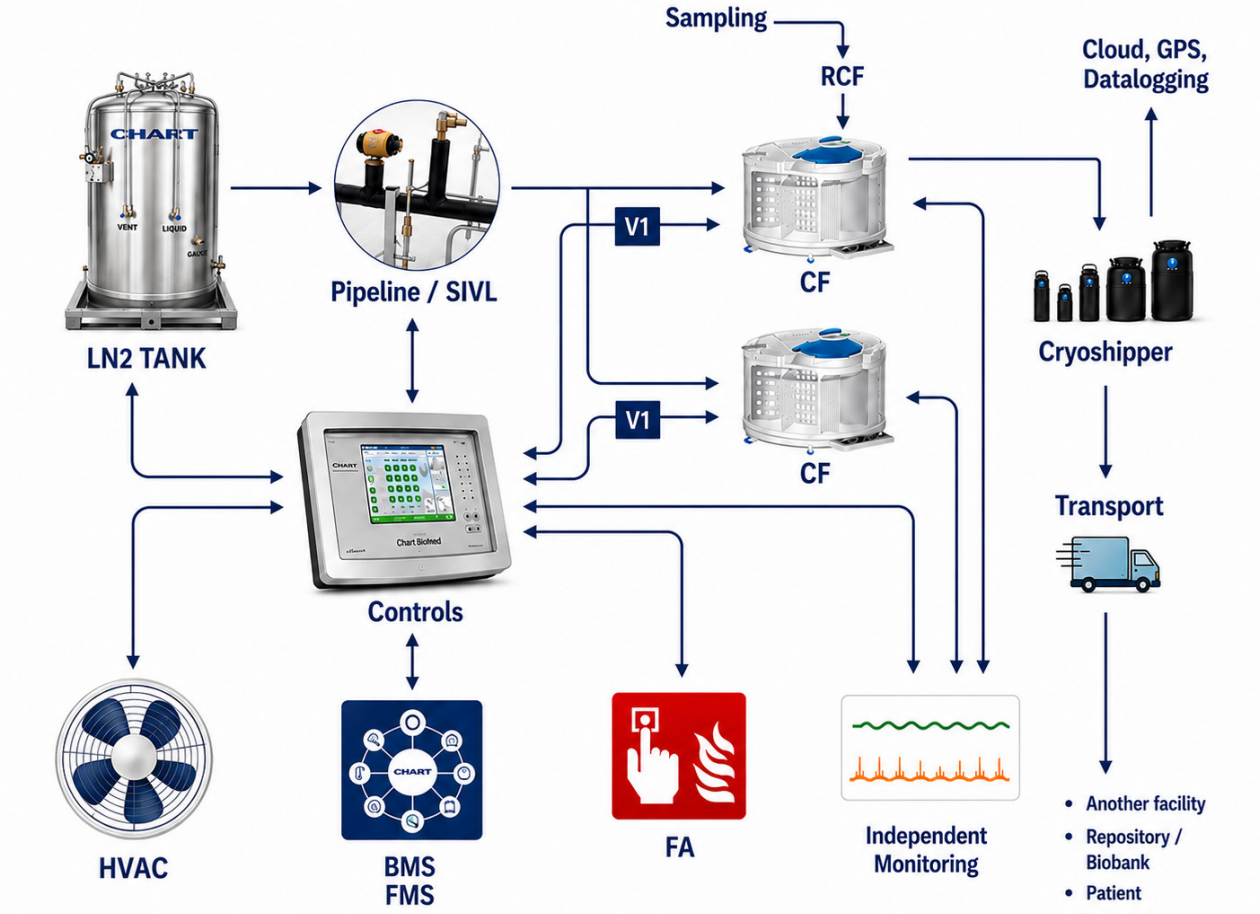

Figure 1. Typical integrated cryogenic storage system showing LN_2 supply, distribution, storage, controls, monitoring and facility interfaces.

Key

CF – Cell Freezer
LN2 – Liquid Nitrogen
FA - Fire Alarm
VI – Vessel Interface
BMS – Building Management System
FMS – Facility Management System
SIVL - Super Insulated Vacuum Line
HVAC – Heating, Ventilation& Air Conditioning
RCF – Rate Controlled Freezer
GPS – Global Positioning System

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KEY COMPONENTS OF THE SYSTEM

Component	Purpose
LN_2 Storage Tank / DEWAR	Stores the liquid nitrogen required for continuous operation
Super Insulated Vacuum Line (SIVL). Vacuum Jacketed. VJ	Transfers liquid nitrogen efficiently while minimising heat gain and product loss
Cryogenic Freezers	Preserve valuable biological materials at cryogenic temperatures
Control System	Manages liquid nitrogen levels and supports reliable system performance. Providing alarms and safety notifications
RCF – Rate Controller Freezer	A controlled system for freezing and thawing Biologicals
Independent Monitoring	Provides continuous monitoring and alarm to protect biologicals, personnel
BMS / FMS Integration	Connects the cryogenic system with building and facility management systems
HVAC Interface	Supports environmental control and oxygen depletion safety
Fire Alarm Interface	Links the system with emergency safety infrastructure
Cryoshippers / Shipping Cases	Safe transportation vessels and shipping containers for biological samples
Datalogging / cloud	Recording the cold chain in its entirety, including the transportation window. Recording temperature data to a cloud based storage system
GPS tracking	Recording the tracking of the cold chain delivery and transportation
Transport	Reliable, experienced transportation suppliers

A COMPLETE CRYOGENIC SOLUTION

At Asistec, we recognise that every cryogenic facility is different. Our role extends beyond supplying equipment: we help customers develop integrated solutions that meet their operational, engineering and regulatory requirements.

Our support can include:

- User Requirement Specifications (URS)
- System design and engineering
- PID and isometrics development
- Facility modelling
- Liquid nitrogen storage and distribution
- Super Insulated Vacuum Line (SIVL) design
- Cryogenic storage equipment selection
- Rate Controlled freezers
- Monitoring and alarm systems
- Building Management System (BMS) integration
- Cryoshippers
- Installation and commissioning
- Validation support, including FAT, SAT and IQ/OQ
- Preventative maintenance programs
- Product, LN2 handling and safety training
- Ongoing technical service and support

By taking a systems approach, organisations can improve reliability, enhance safety, reduce operational risk and protect some of their most valuable scientific assets.

SAFETY AND RELIABILITY MATTER

Working with cryogenic liquids requires specialist equipment, engineering expertise and rigorous safety procedures. Well-designed storage vessels, continuous monitoring, preventative maintenance and appropriate operating procedures all contribute to:

- Reliable sample preservation
- Reduced product losses
- Improved operational safety
- Longer equipment life
- Greater regulatory compliance
- Consistent long-term performance

For critical applications, equipment reliability is every bit as important as the liquid nitrogen itself.

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THE GROWTH OF CELL AND GENE THERAPY

One of the fastest-growing areas within life sciences is cell and gene therapy, where cryogenic preservation is fundamental throughout the development and manufacturing process.

As more advanced therapies move from research into commercial manufacture, organisations require dependable liquid nitrogen systems capable of protecting valuable cell banks, patient samples and therapy materials throughout their lifecycle.

This is increasing demand for high-quality cryogenic storage and transportation solutions that combine engineering excellence, robust monitoring and dependable technical support.

SUPPORTING IRISH SCIENCE AND INDUSTRY

Asistec has supplied liquid nitrogen systems and cryogenic equipment to customers across Ireland for many years.

From research laboratories and universities to pharmaceutical manufacturers, healthcare facilities and biotechnology companies, our team provides more than equipment. We work closely with customers to deliver complete cryogenic solutions, including system design support, installation, commissioning, training, preventative maintenance and ongoing technical service.

By combining engineering expertise with practical application knowledge, Asistec helps organisations protect some of their most valuable scientific and commercial assets.

LOOKING AHEAD

As biologics, personalised medicines, cell therapies and advanced manufacturing continue to transform healthcare, the importance of dependable cryogenic storage will only grow.

Liquid nitrogen may remain largely invisible within modern laboratories and production facilities, but it continues to play a vital role in enabling scientific innovation, protecting valuable biological materials and supporting the development of the medicines of tomorrow.

At Asistec, we are proud to support Ireland's world-class life sciences sector with the expertise, equipment and technical support needed to ensure cryogenic storage systems continue to perform when reliability matters most.