

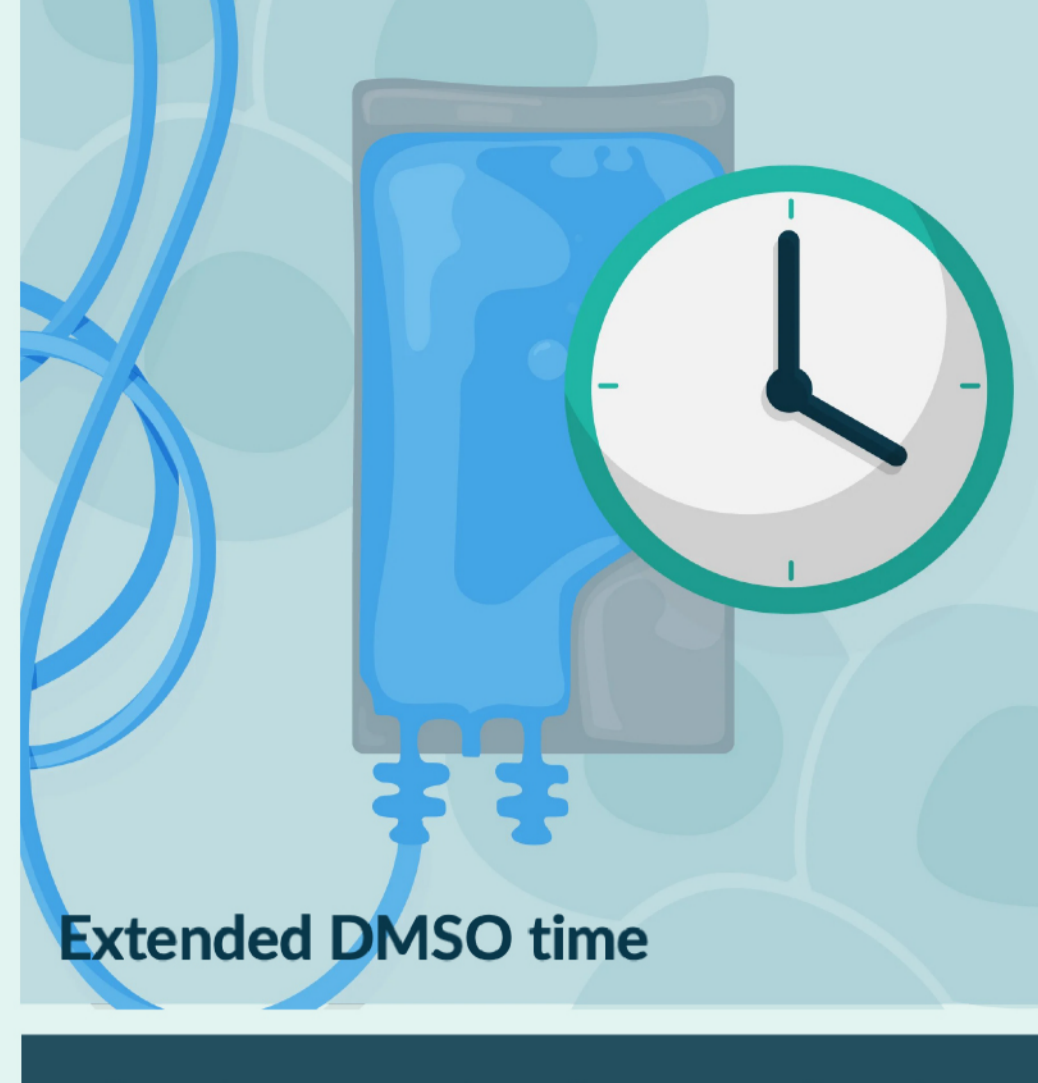
# 5 ways packaging impacts cell therapy outcomes

(and why it's under greater regulatory scrutiny than ever)

## 1 DMSO EXPOSURE

### DMSO exposure time is a risk variable

#### Traditional packaging



Extended DMSO time

#### CellSeal CryoCase



Reduced exposure

Cryobags require air removal and additional handling steps like applying an overwrap bag, a cassette, and labeling all components.

**More manipulation = longer DMSO exposure window.**

With its rigid format and integrated filters, CryoCase® functions as a burp-less solution, eliminating the air removal step, simplifying handling, and reducing product exposure time during critical processing steps.

#### Regulatory context

Regulators examine how reproducible and controlled processes impact cell viability and consistency. This is particularly important when cells are suddenly exposed to conditions that can influence post-thaw outcomes.

**Time in DMSO is not logistics – it's performance control.**



## 2 SYSTEM CLOSURE

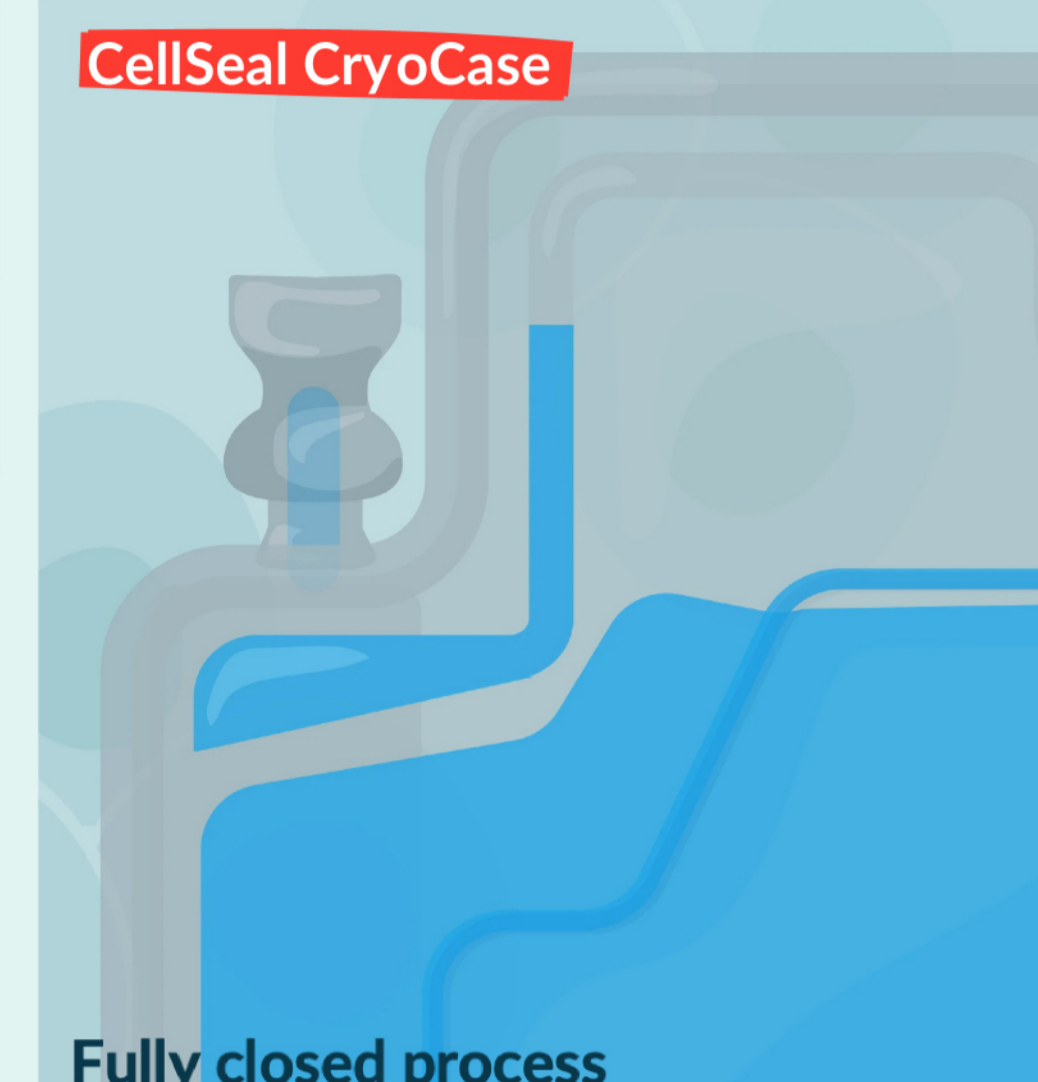
### System closure impacts sterility assurance

#### Traditional packaging



Open handling

#### CellSeal CryoCase



Fully closed process

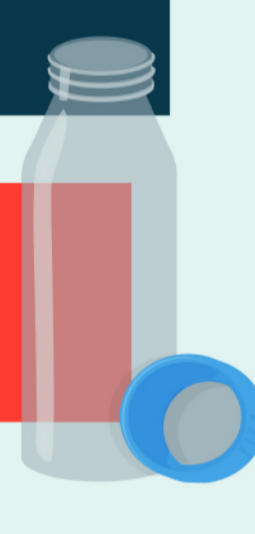
Cryobags can be filled closed, but QC vials typically require open handling and manipulation. Many workflows look like this: **Closed bag >> Open QC vials >> Seal >> Freeze.** That introduces environmental exposure, operator variability, increased handling time, and an overall increased contamination risk.

**CellSeal CryoCase + CellSeal vials for QC = fully closed fill pathway,** the same platform across QC and final drug product design, and reduced operator interventions.

#### Regulatory context

The FDA expects manufacturers to minimize open interventions and demonstrate a clear contamination control strategy. A process described as "closed" should maintain closure throughout all critical handling steps, including QC sampling.

**You cannot claim a closed process if QC sampling is open.**



## 3 QC SAMPLING

### QC samples must be truly representative

#### Traditional packaging



Unmatched materials

#### CellSeal CryoCase



Same material

Cryobags are typically made of EVA or FEP films, whereas screw cap QC vials are typically made of polypropylene. In addition, cryobags are designed to be frozen in sheet form, whereas cryovials are frozen in a cylindrical shape. This results in a different surface area to volume ratio and different leachable and extractable profiles. **QC vials are not representative of the final drug packaging.** That means QC data may not accurately reflect drug product performance.

The CellSeal CryoCase and CellSeal vials are made of the same material and are designed with a comparable surface area to volume ratio. This makes for **more representative QC testing based on thermal dynamics and their leachable and extractable profiles.**

#### Regulatory context

The FDA is increasingly examining container comparability from QC to final drug product, sometimes requiring bridging studies, freeze/thaw equivalence data, and long-term stability expectations.

**Container material and geometry influence cryobiology.**

## 4 INSPECTION

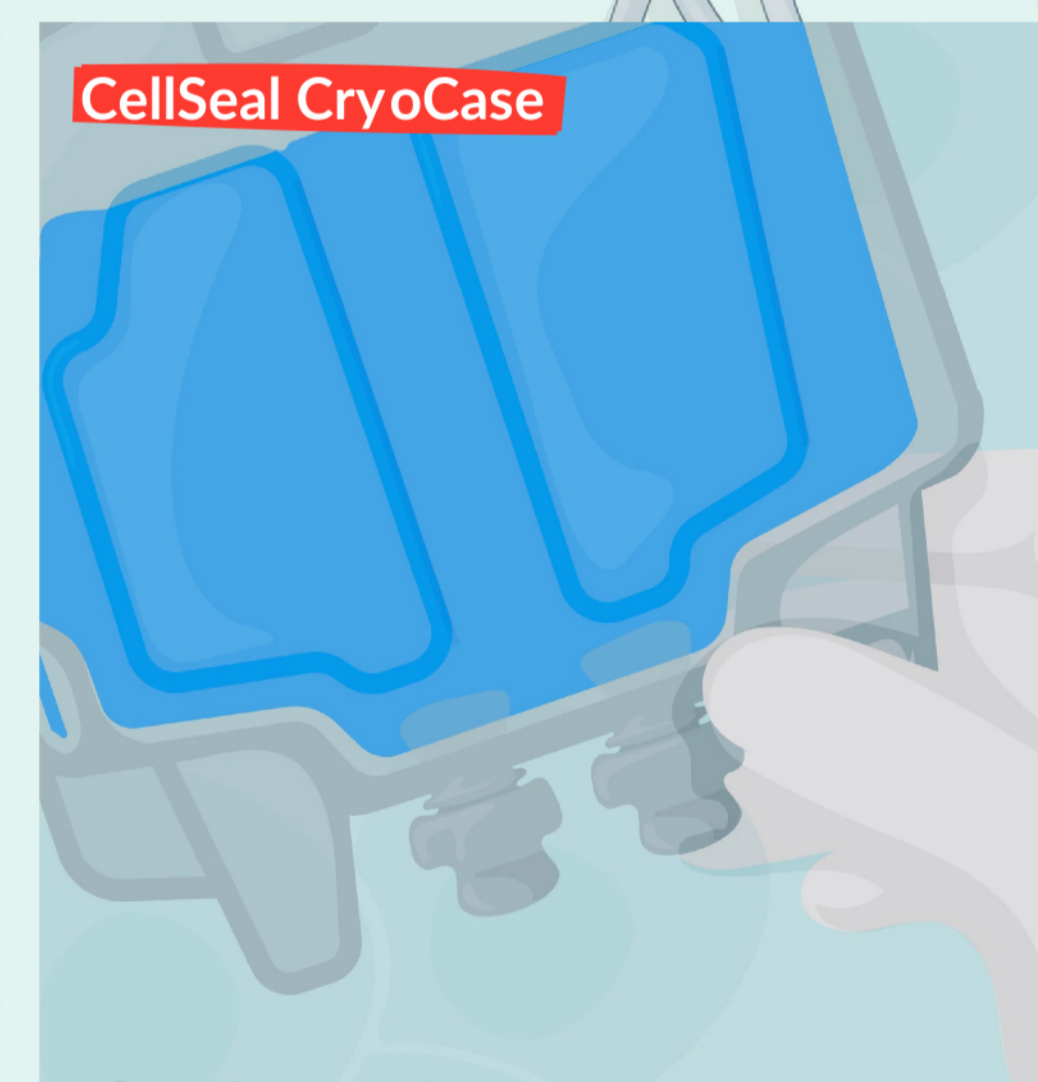
### Inspection visibility affects product confidence

#### Traditional packaging



Limited visibility

#### CellSeal CryoCase



Clear inspection

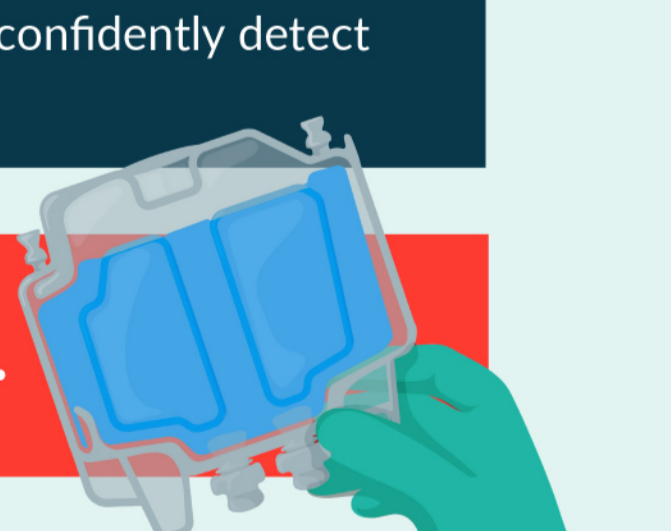
Cryobags provide limited visibility. They can appear cloudy, creased during freezing, and obscure internal particulates, making inspection more challenging and less standardized. **Limited visibility may complicate particulate detection and documentation processes.**

The CellSeal CryoCase is a clear, rigid container. It supports a glass-like surface for easier particulate detection. This results in an **improved visual QA process.**

#### Regulatory context

Visual inspection and particulate assessment remain essential components of release criteria and ongoing quality monitoring. Regulators expect that manufacturers can confidently detect and document visible particulates, and container integrity.

**If you can't see it, you can't confidently inspect it.**



## 5 SCALABILITY

### Manufacturability determines commercial viability

#### Traditional packaging



Fragile & inconsistent

#### CellSeal CryoCase



Robust & scalable

Cryobags can present operational challenges related to fragility, storage configuration, and manual handling variability. As programs scale, these factors can **introduce additional risk into commercial manufacturing workflows.**

The CellSeal CryoCase is engineered for durability, stackability, and structured storage and transport conditions. It can be filled manually during early-stage development, integrated into closed-system processing platforms such as the Signata CT-5 for mid-throughput production, and incorporated into automated or robotic filling lines as manufacturing volumes increase. This flexibility allows developers to evolve their fill/finish strategy without changing the container format.

#### Regulatory context

Beyond initial approval, regulators increasingly evaluate whether a therapy can be manufactured consistently at scale. Regulators look for evidence that the production process is robust, reproducible, and capable of supporting long-term commercial supply without introducing unnecessary complexity or variability.

**A therapy that cannot scale reliably will not succeed commercially.**

