



VIRAL SAFETY • VIRAL CLEARANCE

Viral Safety for Animal-Derived Materials

GLP viral clearance and viral safety programs for collagen, gelatin, tissue-derived matrices, serum and plasma components, and other animal-origin inputs.

Viral safety data for complex biological materials

Animal-derived materials bring viral safety challenges that cell-line biologics do not: variable matrices, source-species adventitious agent risk, manufacturing steps that are difficult to scale down, and product-specific regulatory expectations.

Cytaclar North America designs GLP viral clearance and viral safety programs from raw-material risk through clearance validation, with feasibility work up front so the definitive study is designed once.

MATERIALS WE SUPPORT



COLLAGEN & GELATIN

Bovine, porcine and other animal-origin structural proteins



TISSUES & MATRICES

Dermis, pericardium, bone, ECM and biologic scaffolds



SERUM & PLASMA

Animal-origin supplements, fractions and process inputs



OTHER RAW MATERIALS

Enzymes, extracts and other animal-derived process components

REGULATORY FRAME

Study designs grounded in ICH Q5A(R2) principles and adapted for tissue, device and raw-material matrices.

Built around the realities of animal-derived products

WHAT MAKES THESE STUDIES DIFFERENT

- 01** Matrix components can cause cytotoxicity or interfere with virus recovery and infectivity readouts.
- 02** Low-pH, chemical, thermal, wash, filtration and extraction steps may each contribute to clearance.
- 03** Product form changes study design: solution, gel, sheet, sponge, tissue or finished device.
- 04** Feasibility work is often essential before committing to a definitive GLP design.

HOW CYTACLAR DESIGNS FOR THEM

- 01** Risk-based model and relevant virus panel, selected by source species, material and process.
- 02** Matrix-specific cytotoxicity, interference and spike-recovery assessment.
- 03** Scale-down model review and worst-case parameter definition.
- 04** Cell-based infectivity quantitation ($TCID_{50}$), with qPCR supporting removal steps where appropriate.

Unit operations commonly evaluated

Each step is evaluated on its own mechanism. Cumulative clearance is claimed only across orthogonal steps, in line with ICH Q5A(R2) principles.



CHEMICAL / pH

Acid or alkaline treatment, solvent/detergent and other chemical inactivation



THERMAL

Heat treatment, pasteurization, drying and other temperature-driven steps



PHYSICAL REMOVAL

Virus filtration, washes, precipitation, extraction and separation steps



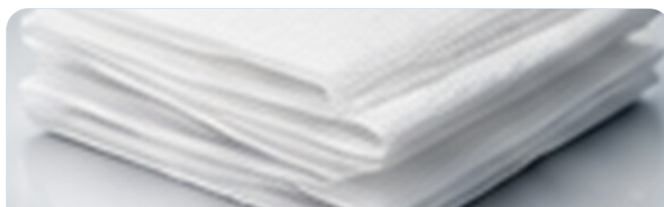
PURIFICATION

Chromatography, depth and adsorptive filtration, and related downstream operations



MULTI-STEP PROCESSES

Step-wise LRVs for each operation, combined only where mechanisms are orthogonal



CUSTOM PROCESSES

Designs adapted to unusual matrices, device components and tissue-derived products

Multi-Spike Viral Clearance

A faster, more efficient path to robust clearance data.

Multi-spike studies evaluate two or more model viruses in a single run, with each virus titrated in its own specific infectivity assay. This approach delivers the same scientifically robust clearance data as traditional mono-spike studies, while significantly reducing time, cost and material requirements.

KEY BENEFITS



COST SAVINGS

- Fewer process runs
- Fewer titrations and assays
- Fewer consumables and reagents
- Lower overall study cost



TIME SAVINGS

- Generate multi-virus data in the same timeframe as a single-virus study
- Accelerates development and regulatory decision-making
- Ideal for late-stage programs, investigations and rapid revalidation



MATERIAL SAVINGS

- Requires less test material per study
- Particularly valuable for limited, expensive or difficult-to-manufacture materials
- Enables efficient evaluation of multiple viruses without additional material

HOW IT WORKS

1

Two or more model viruses are spiked into a single process load at defined concentrations.

2

Each virus is quantified using its own validated infectivity assay (e.g., TCID₅₀), with appropriate controls to confirm no interference between viruses or with indicator systems.

3

Clearance values are calculated for each virus in the same way as a mono-spike study.

4

Panel selection and spike combinations are customized to your source species, material and process during feasibility.

FLEXIBLE AND CUSTOMIZED



ADAPTED TO YOUR NEEDS

Virus panel and combinations are selected based on your source species, product, process and regulatory requirements.



FEASIBILITY FIRST

Assess compatibility, recovery and assay performance to confirm the optimal multi-spike design for your material and process.



BROAD CAPABILITY

Combinations can include enveloped and non-enveloped viruses, DNA and RNA viruses, tailored to your specific program.

WHEN TO CONSIDER A MULTI-SPIKE STUDY



Late-stage programs



Regulatory questions



Investigations
(deviations, process
changes)



Rapid revalidation
needs

**The same robust clearance data.
Fewer runs. Faster decisions.**

Multi-spike studies apply to liquid process intermediates. Panel selection and virus compatibility are confirmed during study design and feasibility.

Method published in *Biotechnology and Bioengineering*, DOI 10.1002/bit.70085.

Model virus panel

Model viruses should cover a range of genome type, envelope, size and physicochemical resistance. Including a small non-enveloped virus demonstrates robust process capability.

Virus		Family	Genome	Size (nm)	Resistance
DNA • ENVELOPED					
BV	Baculovirus	Baculoviridae	dsDNA	21 × 260	■ ■ ■ Medium
HSV-1	Herpes simplex virus type 1	Herpesviridae	dsDNA	150–240	■ ■ ■ Medium
HSV-2	Herpes simplex virus type 2	Herpesviridae	dsDNA	150–240	■ ■ ■ Medium
PRV	Pseudorabies virus	Herpesviridae	dsDNA	120–200	■ ■ ■ Low
DNA • NON-ENVELOPED					
Ad5	Adenovirus 5	Adenoviridae	dsDNA	80–100	■ ■ ■ High
MVM	Minute virus of mice	Parvoviridae	ssDNA	18–24	■ ■ ■ High
PPV	Porcine parvovirus	Parvoviridae	ssDNA	18–24	■ ■ ■ High
SV40	Simian virus 40	Polyomaviridae	dsDNA	40–50	■ ■ ■ High
RNA • ENVELOPED					
BVDV	Bovine viral diarrhea virus	Flaviviridae	ssRNA	40–60	■ ■ ■ Low
HIV-1	Human immunodeficiency virus type 1	Retroviridae	ssRNA	80–110	■ ■ ■ Low
IAV	Influenza A virus (H1N1)	Orthomyxoviridae	ssRNA	100–120	■ ■ ■ Low
VSV	Vesicular stomatitis virus	Rhabdoviridae	ssRNA	70–150	■ ■ ■ Low
XMuLV	Xenotropic murine leukemia virus	Retroviridae	ssRNA	80–110	■ ■ ■ Low
TGEV	Transmissible gastroenteritis virus	Coronaviridae	ssRNA	100–120	■ ■ ■ Low
RNA • NON-ENVELOPED					
EMCV	Encephalomyocarditis virus	Picornaviridae	ssRNA	25–30	■ ■ ■ Medium
FCV	Feline calicivirus	Caliciviridae	ssRNA	35–39	■ ■ ■ Medium
HAV	Hepatitis A virus	Picornaviridae	ssRNA	25–30	■ ■ ■ Medium
Reo-3	Reovirus type 3	Reoviridae	dsRNA	60–80	■ ■ ■ Medium

Resistance refers to physicochemical resistance to inactivation. Panel selection and virus availability confirmed during study design.

Flexible execution to meet your needs

We offer three levels of service so you can choose the right level of support for your program, timeline and internal resources.

Level 1

The sponsor executes the scaled-down process in our laboratory. We oversee virus spiking and perform all titrations.



Level 2

Our personnel assist the sponsor in executing the scaled-down process in our laboratory, alongside spiking and titration.



Level 3

The scaled-down process is tech-transferred to us. Our personnel execute the entire study end to end.



WHAT WE PROVIDE

At every level the sponsor supplies reagents, columns and filters. We supply the laboratory and standard equipment including HPLC, the selected virus panel, virus spiking and all quantitation assays.

Viral safety built around your material, not a template.

01

DESIGN BEFORE COMMITMENT

Scientific input on virus panel and study design before the protocol is locked.

02

FEASIBILITY FIRST

Matrix-specific cytotoxicity, interference, spike recovery and assay suitability before definitive GLP execution.

03

FLEXIBLE EXECUTION

Three service levels, from sponsor-run studies to full tech transfer and end-to-end execution.

04

DIFFICULT MATRICES

Practical study design for viscous, cytotoxic, solid and tissue-derived materials.

05

GLP RIGOR

Study conduct and reporting designed to support regulatory submissions.

**Science that earns confidence.
Partnership that earns trust.**

HEADQUARTERS & LABORATORY

Frederick, Maryland, USA

REGIONAL LABORATORY

Shanghai, China

FORMERLY TEXCELL NORTH AMERICA