Institutional Biosafety Committee - UTEP	
Title: **IBC Standard Operating Procedure – Lentivirus Vectors**	
Date in Effect: 8 October 2025	**Revision Date:**
In Effect ☒ Rescinded ☐	**Date Rescinded**:

A. Background

Lentiviral vectors are commonly used tools for gene delivery due to their ability to stably integrate into both dividing and non-dividing cells. As derivatives of the Human Immunodeficiency Virus (HIV-1) and Human T-lymphotropic Virus (HTLV), they require stringent biosafety practices due to their origin and integration potential. Replication-incompetent lentiviral systems pose risks such as generation of replication-competent lentivirus (RCL) and insertional mutagenesis. These vectors are typically handled at Biosafety Level 2 (BSL-2) with additional precautions for certain procedures, including animal work and aerosol-generating tasks.

Experiments using lentiviral vectors must receive approval by the UTEP Institutional Biosafety Committee (IBC) before being conducted. The University of Texas at El Paso IBC requires the Principal Investigator (PI) and laboratory personnel to receive biosafety and laboratory safety training prior to performing BSL-2 experiments.

B. Lentiviral Vectors: Overview and Generations

The genome of lentiviruses contains essential genes (gag, pol, env, tat, rev) and accessory genes (vif,vpr, vpu, nef). Certain lentiviral vectors are designed to be less pathogenic than wild-type lentiviruses due in part to the separation of genes required for packaging of viral particles onto several plasmids, replacement of the native lentiviral envelope protein, and elimination of accessory genes that are essential for replication of wild-type lentiviruses. Lentiviral vector systems designed with these enhanced safety features cannot replicate in human cells and are defined as replication-deficient lentiviral vectors

C. NIH Guidance

Per the NIH Guidelines, work involving lentiviral vectors is classified under Section III-D-1 and requires IBC approval prior to initiation. Although RCL testing is negative, enhanced BSL-2 (BSL-2+) practices should be used, particularly during vector production and concentration.

D. Health Hazards and Risks of Lentiviral Vectors

Working with lentiviral vectors poses both short-term and long-term health risks due to their ability to integrate into the host genome. Lentiviruses and lentiviral vectors are transmissible through injection, ingestion, exposure to broken skin or contact with mucous membranes of the eyes, nose and mouth.

Potential Health Effects:
Acute infection with Lentivirus can cause "flu-like" symptoms including fever, nausea, vomiting, and myalgia. Following an accidental exposure, a lentiviral vector could potentially infect the lab worker. This could result in permanent transgene expression in the worker as well as result in activation (or inhibition) of host genes due to insertional mutagenesis. Activation of oncogenes or inactivation of tumor suppressor genes could lead to the development of cancer.

Post-Exposure Concerns:
Post-exposure prophylaxis (PEP) using HIV antiretrovirals (e.g., raltegravir, tenofovir) may be recommended within 72 hours. Rapid medical evaluation is critical after any suspected exposure.

Personnel Exposed to Biohazard:
Personnel exposed to Lentivirus should report to the Emergency Department and Occupational Health and Safety. Contact the Biosafety Officer if you are unsure of the proper response and complete the EH&S Incident and Injury report form found at https://www.utep.edu/ehs/_files/docs/forms/ehs-injury-incident-report.pdf.

E. Biosafety Precautions

Proper biosafety practices are critical when handling lentiviral vectors due to the risk of exposure, insertional mutagenesis, and unintended gene delivery to laboratory personnel. The following biosafety precautions must be always followed to ensure containment and personnel safety.

Containment Level:
First and second-generation Vectors require BSL-2+ (enhanced) containment, while third generation and above require BSL-2. Enhanced containment for third generation is required if:

- Oncogenic or toxic transgenes are present
- Large-scale production (>100 mL)
- CRISPR/Cas9 components are used

Handling:
Personnel handling lentivirus must complete EH&S Laboratory Safety Training, Bloodborne Pathogens Training, and the Occupational Health Medicine Questionnaire (OHP).
Use of a certified biosafety cabinet (Class II) is required for all manipulations involving viral vectors, including aliquoting, infections/transductions, and animal inoculations. For sharps, use safety-engineered sharps when necessary or avoid where possible.

Pay special attention to the possible generation of aerosols:

- Centrifuge with sealed safety cups or rotor caps
- Strict attention should be paid to surface and equipment decontamination
- Personal Protective Equipment (PPE) required includes eye protection (goggles or face shield), double gloves for 1st/2nd generation and single gloves for 3rd

generation unless otherwise required, solid-front disposable gowns or snap-front lab coats with cuffed sleeves, and surgical mask or N95 respirator depending on aerosol risk based on risk assessment

Decontamination and Waste Disposal:
Wipe all surfaces with 1:10 bleach or other EH&S-approved disinfectant (≥30 seconds contact time). Heat inactivation can be accomplished at 56°C for 30+ minutes. For biohazardous waste, identify the types of biological waste generated. Liquid culture waste is treated with 1:10 household bleach for 30 minutes before being carefully poured down the drain (while wearing full face protection), followed by a copious amount of water to prevent corrosion. Solid disposal items such as pipets, tips or other materials used during the procedures should be treated with 1:10 bleach for 30 seconds and placed in an autoclavable bag that is loosely closed to allow for steam penetration. The bag is then autoclaved and placed in red infectious waste bin for disposal. Sharps such as needles with syringe, blades, and Pasteur pipettes (these are discouraged) are placed within a conveniently located puncture resistant, autoclavable (vented) biohazard sharps container, closed when 2/3 filled or sooner, placed in an infectious waste bin for disposal.

Animal Handling Guidelines:
Infected animals shed lentivirus, cages, and bedding are considered biohazardous for a minimum of 7 days from animal inoculation. Animals must be housed at ABSL-2 for 7 days minimum but may downgrade to ABSL-1 after cage change, unless human cells are used or there are ongoing high-risk experiments. For rodents that contain any human cells or tissues, step down to ABSL-1 will not be allowed.

F. References

NIH Guidelines for Research Involving Recombinant or Synthetic Nucleic Acid Molecules (NIH, 2023) - https://osp.od.nih.gov/wp-content/uploads/NIH_Guidelines.pdf

Cornell University EHS. (2024). *Lentiviral Vectors (1st and 2nd Generation) BARS*.

Cornell University EHS. (2024). *Lentiviral Vectors (3rd Generation and Above) BARS*.

NIH. (2023). *Biosafety Considerations for Research with Lentiviral Vectors*. https://osp.od.nih.gov/wp-content/uploads/Lenti_Containment_Guidance.pdf

CDC. (2020). *Biosafety in Microbiological and Biomedical Laboratories (BMBL), 6th Ed.* https://www.cdc.gov/labs/bmbl/

Schlimgen et al. (2016). *Risks Associated with Lentiviral Vector Exposures and Prevention Strategies*. *J Occup Environ Med*, 58(12), 1159–1166. https://doi.org/10.1097/JOM.0000000000000879