



BSL2

- Whole blood, serum and urine
- Synthetic messenger RNA-based or recombinant protein-based products
- Rapid respiratory testing performed at the point of care (no nucleic acid isolation)
- Viral vector-based products
- Using automated instruments and analyzers (if aerosol containment is a feature) some devices might be older and not contained
- Staining and microscopic analysis of fixed smears
- Examination of bacterial cultures
- Pathologic examination and processing of formalin-fixed or otherwise inactivated tissues
 - Inactivation methods should be validated
- Molecular analysis of extracted nucleic acid preparations
- Final packaging of specimens for transport to diagnostic laboratories for additional testing
 - Specimens should already be in a sealed, decontaminated primary container
- Using inactivated specimens, such as specimens in nucleic acid extraction buffer
- Performing electron microscopic studies with glutaraldehyde-fixed grids
 - *CDC Source

Additional procedures

- Cytometry – fixed samples

Laboratory Practices and Technique

- Good (Standard) Microbiological Practices
- Access to the laboratory is restricted when work is being conducted
- All procedures in which infectious aerosols or splashes may be created are conducted in BSCs or other physical containment equipment
 - Use safety cups whenever possible to avoid exposure to aerosols.

Primary & Secondary Barriers and PPE

- PPE: gown/lab coat, single gloves, surgical mask, eye protection, face shield
- Work behind plexiglass screen in an isolated designated area (minimum)
- Notify others in the lab
- Work with samples done over a plastic-backed benchtop pad
- Surface decontamination at every step using EPA List N disinfectants and contact times.
- Potentially infectious materials must be placed in a durable, leak proof container during collection, handling, processing, storage, or transport within a facility
- BSCs, if available, are properly maintained and certified
 - Mechanical ventilation systems that provide an inward flow of air without recirculation to spaces outside of the laboratory (recommended)
- A method for decontaminating all laboratory wastes should be available in the facility

Administrative Controls:

- Training and competency verification on donning and doffing required PPE
- Training and competency verification for each procedure performed
- Laboratory personnel have specific training in handling pathogenic agents and are supervised by scientists competent in handling infectious agents and associated procedures
- Occupational health
 - mandatory reporting of any symptoms, any laboratory exposure
 - consider baseline blood, baseline questionnaire, emergency wallet card
- Demonstrated competency on working in a BSC (if available)

BSL2 with BSL3 practices

- Aliquoting and/or diluting specimens
- Inoculating bacterial or mycological culture media
- Performing diagnostic tests that do not involve propagation of viral agents in vitro or in vivo
- Nucleic acid extraction procedures involving potentially infected specimens
- Preparation and chemical- or heat-fixing of smears for microscopic analysis
 - *CDC Source

Additional procedures

- Respiratory samples and secretions
- Stool***
- Cytometry – non-fixed samples
- Inactivated virus lysate
- Work with ANY sample that may produce an aerosol

Laboratory Practices and Technique

Good (Standard) Microbiological Practices as indicated for BSL2

Primary & Secondary Barriers and PPE

- PPE: surgical mask (blood)/N-95 (respiratory secretions), double gloves, impervious gown, eye protection with side shields
- All samples opened inside the BSC in case of spills/leakage. If BSC is not available, don N95 and face shield and work behind plexiglass screen in an isolated designated area, notify other laboratorians, work with samples done over a plastic-backed benchtop pad
- Surface decontamination at every step using EPA List N disinfectants and contact times.

Administrative Controls:

- Scheduled time for handling SARS-CoV-2 samples (best practice)
- Two-person rule for minimizing withdrawing hands from BSC
- Centrifuging of blood specimens is in safety cups or sealed rotor, loaded and unloaded in a BSC
- Training and competency verification on donning and doffing required PPE
- Specific training on use of N95 respirators, if applicable (includes pulmonary function, medical clearance, and fit testing)

*CDC Guidance for Laboratory <https://www.cdc.gov/coronavirus/2019-nCoV/lab/lab-biosafety-guidelines.html>

**WHO Laboratory Guidance https://apps.who.int/iris/handle/10665/339056?search-result=true&query=covid+biosafety&scope=&rpp=10&sort_by=score&order=desrder=desc

***The Lancet [https://www.thelancet.com/journals/langas/article/PIIS2468-1253\(20\)30124-2/fulltext](https://www.thelancet.com/journals/langas/article/PIIS2468-1253(20)30124-2/fulltext)

These considerations do not supersede any regulatory or country-specific in your locale. Laboratory practices, techniques, and administrative controls build upon the previous level. Additional controls are indicated at each level.

BSL3

- Virus isolation/propagation in cell culture and initial characterization of viral agents recovered in cultures of SARS-CoV-2 specimens
- Infectious clone-derived SARS-CoV-2 virus, infectious cDNA SARS-CoV-2 clones and recombinant derivatives.
- Infection of experimental animals with any of the above

Additional procedures

- FACS/High Speed Cell Sorting
- Transfer of inactivated samples outside BSL3
- Inactivation by validated methods with any of the above

Laboratory Practices and Technique

- Good (Standard) Microbiological Practices
 - Follow BSL3 practices and procedures according to CDC BMBL 6th ed.
- Laboratory personnel must receive specific training in handling pathogenic and potentially lethal agents and must be supervised by scientists competent in handling infectious agents and associated procedures.

Primary & Secondary Barriers and PPE

- All procedures involving the manipulation of infectious materials must be conducted within a BSC, or other physical containment devices.
- Respiratory protection is required (N95 or PAPR/CAPR)
- Autoclave waste before disposal
- HEPA filtration of exhaust air is recommended for certain situations **

Transfer of samples outside BSL3- based on risk assessment by biosafety officer

- Ensure lids are tight
- Decontaminate outside of tubes
- Wrap sample with absorbent material
- Individually place into zip-lock bag
- Seal zip-lock bag and change gloves
- Add all wrapped samples into second bag
- Wrap bagged samples in ample packaging and place into designated carrier, firmly attach lid