Interim Laboratory Biosafety Guidelines for Handling and

COVID-19

Updated Dec. 13, 2021

Summary of Recent Changes

Updates as of December 13, 2021

- Updated waste management guidance

View Previous Updates

Key Points

- This guidance is intended for clinical laboratory and support staff who handle or process specimens associated with COVID-19. For guidance on point-of-rare testing, see the Guidance for SARS-CoV-2 Point-of-Care and Rapid Testing
- All laboratories should perform a site-specific and activity-specific risk assessment and follow Standard Precautions when handling clinical specimens. See Biological Risk Assessment: General Considerations for Laboratories
- Refer to List N on the Environmental Protection Agency (EPA) website for EPA-registered disinfectants that have qualified under EPA's emerging viral pathogens program for use against SARS-CoV-2.
- Cultures of SARS-CoV-2 should be handled in a Biosafety Level 3 (BSL-3) laboratory using BSL-3 practices, and inoculation of animals with infectious wild-type SARS-CoV-2 should be conducted in an Animal Biosafety Level 3 (ABSL-3) facility using ABSL-3 practices and respiratory protection.
- Suspected and confirmed SARS-CoV-2 positive clinical specimens, cultures, or isolates should be packed and shipped as UN 3373 Biological Substance, Category B.

All clinical specimens may contain potentially infectious materials. Precautions should be taken when handling specimens suspected or confirmed to be positive for SARS-CoV-2, the virus that causes COVID-19. Timely communication between clinical and laboratory staff is essential to minimize the potential risk of handling specimens from patients with possible SARS-CoV-2 infection. These specimens should be labeled accordingly, and the receiving laboratory should be alerted to ensure proper specimen handling. General and specific biosafety guidelines for handling SARS-CoV-2 specimens are provided below.

General Guidance

All laboratories should perform a site-specific and activity-specific risk assessment to identify and mitigate risks. Risk assessments and mitigation measures are dependent on:

- The procedures performed
- Identification of the hazards involved in the process and procedures
- The competency level of the personnel who perform the procedures
- The laboratory equipment and facility
- The resources available

Follow Standard Precautions | Section IV when handling clinical specimens, all of which may contain infectious materials. Standard Precautions include hand hygiene and the use of specific personal protective equipment (PPE) determined by the potential for exposure to blood, body fluids, and infectious material. PPE, such as laboratory coats or gowns, gloves, eye protection, or a disposable mask and face shield, can help protect the skin and mucous membranes of the eyes, nose, and mouth.

For more information, see

- Biological Risk Assessment: General Considerations for Laboratories
- Core Infection Prevention and Control Practices for Safe Healthcare Delivery in All Settings

- Occupational Safety and Health Administration (OSHA) Bloodborne Pathogens Standard

Decontaminate work surfaces and equipment with appropriate disinfectants by using an EPA-approved disinfectant for SARS-CoV-2 . Laboratory waste generated during processing and testing should be discarded as biohazardous waste. Waste disposal regulations vary from state to state; therefore, all waste disposal procedures must comply with local, regional, state, national, and international regulations. See EPA regulations and State Universal Waste Programs in the United States for more information.

For training courses available online, see Biosafety Training.

Routine Diagnostic Testing

Routine diagnostic testing procedures, such as the following activities, can be handled in a BSL-2 laboratory using Standard Precautions:

- Initial processing of specimens
- Using automated instruments and analyzers
- Staining and microscopic analysis of fixed smears
- Examination of bacterial cultures
- Pathologic examination and processing of formalin-fixed or otherwise inactivated tissues
- 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
- Performing routine antibody or antigen detection tests

Anatomic Pathology

The practice of anatomic pathology plays a critical role in determining accurate disease diagnoses by studying organ tissues and fluids. Anatomic pathology includes **surgical pathology, histotechnology, cytology, and autopsy.**

Risks associated with surgical pathology and some cytology procedures occur when manipulating fresh tissue and body fluids from patients who may have an unknown or known infectious disease, such as COVID-19. Risks are increased in the surgical grossing room during manual specimen handling, tissue dissection, and the preparation of frozen tissue sections using a cryostat. These procedures can result in percutaneous exposures from punctures or cuts, droplet or aerosol exposures from blood and body fluid splashes, and surfaces contaminated with the virus.

Clinical laboratory and support staff need to be aware of these risks and provided effective mitigation procedures. See Laboratory Frequently Asked Questions for more information.

For information on **autopsies**, see Collection and Submission of Postmortem Specimens from Deceased Persons with Known or Suspected COVID-19

Note: Anatomic pathology uses different procedures and workflows than those used in clinical pathology, and therefore the risks and mitigation controls needed to protect personnel may be different. At a minimum, all personnel—whether practicing anatomic or clinical pathology should follow Standard Precautions | Section IV when handling clinical specimens, including hand hygiene and the use of PPE, such as laboratory coats or gowns, gloves, eye protection or a disposable mask and face shield, to help protect the skin and mucous membranes of the eyes, nose, and mouth.

Decentralized and Point-of-Care Testing

Point-of-Care (POC) tests are intended to supplement laboratory testing or extend testing to communities and populations that cannot readily access laboratory testing. In addition, POC testing helps address emerging outbreaks quickly.

See Guidance for SARS-CoV-2 Point-of-Care and Rapid Testing for more information.

For self-test kits, see Self-Testing.

Environmental Testing

This guidance for environmental testing is intended only for laboratories that perform virus concentration as part of the wastewater/sewage surveillance testing procedure. This guidance does not include public health or clinical diagnostic laboratories that handle SARS-CoV-2 clinical specimens or BSL-3 laboratories that perform culture and isolation of SARS-CoV-2. Site- and activity-specific biosafety risk assessments should be performed to determine if additional biosafety precautions are needed based on situational activities, such as high testing volumes, and the likelihood of generating infectious droplets and aerosols.

Procedures that concentrate viruses, such as precipitation or membrane filtration, can be performed in a BSL-2 laboratory with unidirectional airflow and BSL-3 precautions, including respiratory protection and a designated area for donning and doffing PPE. The donning and doffing spaces should be separated from each other to avoid cross-contamination. Work should be performed in a certified Class II biological safety cabinet (BSC).

Specimen Packing and Shipping

Suspected or confirmed SARS-CoV-2 positive specimens, cultures, or isolates must be packed and shipped [14 MB, 10 pages] | Download [1 MB, 10 pages] as UN 3373 Biological Substance, Category B, in accordance with the current edition of the International Air Transport Association (IATA) Dangerous Goods Regulations and U.S. Department of Transportation's (DOT) Transporting Infectious Substances Safely publication. Personnel must be trained to pack and ship according to the regulations and in a manner that corresponds to their function-specific responsibilities.

Specimens should be shipped at 2-8°C with ice packs in a leakproof primary container, leakproof, watertight secondary container, and rigid outer packaging to protect the specimens during shipment. If the specimen is frozen, ship overnight on dry ice. The primary receptacle and secondary packaging should maintain their integrity at the temperature of the refrigerant used, even if the refrigerant's temperature changed. Packages containing dry ice should be designed and constructed to

used, even if the refrigerant's temperature changed. Packages containing dry ice should be designed and constructed to prevent pressure buildup and allow gas release that could rupture the packaging. A shipper's declaration is not required for UN 3373 Biological Substances, Category B shipped specimens. However, if an Air Waybill is used, the "Nature and Quantity of Goods" box should show "UN 3373 Biological Substance, Category B" along with the number of packages. If specimens are shipped on dry ice, include UN 1845, Dry Ice, and the dry ice net weight. See IATA Packing Instructions 650 for additional information.

When using ice packs, ensure the outer package has been appropriately marked and labeled with the following:

1. Hazard labeled with UN Identification Number already on the label – UN 3373
2. Biological Substance, Category B
3. Shipper's name, address, and phone number
4. Receiver's name, address, and phone number
5. Name and phone number of a responsible person is optional if it is on the airway bill

When using dry ice in the package, ensure the outer package is appropriately marked with the following:

1. Hazard labeled with UN Identification Number already on the label – UN 3373
2. Biological Substance, Category B
3. Hazard labeled with UN Identification Number – UN 1845
4. Dry Ice along with the net weight (kg) of the dry ice
5. Shipper's name and address
6. Receiver/Consignee name and address
7. Name and phone number of a responsible person

If the packages require an overpack, ensure the outer package is appropriately marked with the following:

1. Hazard labeled with UN Identification Number already on the label – UN 3373
2. Biological Substance, Category B
3. Hazard labeled with UN Identification Number – UN 1845
4. Dry Ice along with the net weight (kg) of the dry ice, if applicable
5. Shipper's name and address
6. Receiver/Consignee name and address
7. Name and phone number of a responsible person

Decontaminate work surfaces once specimens are packaged. See the decontamination section on this page below.

See APHL Packaging and Shipping Evaluation Tool , APHL Packing and Shipping Guidance for Biological Substances, Category B Specimens , and WHO Guidance on regulations for the transport of infectious substances 2019 – 2020 for more information.

Procedures with a High Likelihood of Generating Droplets or Aerosols

Many routine laboratory procedures can generate aerosols and droplets that are often undetectable. For example, the following laboratory procedures have been associated with the generation of infectious aerosols and droplets: centrifugation, pipetting, vortexing, mixing, shaking, sonicating, removing caps, decanting liquids, preparing smears, flaming slides, aliquoting and loading specimens, loading syringes, manipulating needles, syringes or sharps, aspirating and transferring blood and body fluids, subculturing blood culture bottles, spilling specimens, and cleaning up spills.

Procedures with a high likelihood of generating aerosols or droplets should be conducted using either a certified Class II BSC or additional precautions to provide a barrier between the specimen and personnel. Examples of these additional precautions include centrifuge safety cups, sealed centrifuge rotors to reduce the risk of exposure to laboratory personnel

precautions include centrifuge safety cups, sealed centrifuge rotors to reduce the risk of exposure to laboratory personnel, and additional PPE, such as an N95 respirator or disposable mask with a face shield.

Site- and activity-specific biosafety risk assessments should be performed to determine if additional biosafety precautions are warranted based on situational needs, such as high testing volumes.

Aerosols and droplets containing particles <100 µm in diameter are not visible to the naked eye. Laboratory workers may not be aware that such particles are being generated during many laboratory procedures. These particles could be inhaled or could cross-contaminate work surfaces, materials, and equipment.

Infectious aerosols are small liquid or solid particles suspended in the air that contain infectious agents. They can disperse throughout the laboratory and remain infective over time and distance. These particles are of a size that may be inhaled into the lower respiratory tract (<5 µm in diameter). Examples of organisms transmitted by aerosols include spores of Aspergillus spp., *Mycobacterium tuberculosis*, rubeola virus (measles), and varicella-zoster virus (chickenpox).

Infectious droplets are traditionally defined as larger particles (>5 µm in diameter) that rapidly fall out of the air, contaminating gloves, the immediate work area, and the mucous membranes of the persons performing the procedure.

Examples of infectious agents transmitted via the droplet route include *Bordetella pertussis,* influenza viruses, adenovirus, *Mycoplasma pneumoniae*, SARS-associated coronavirus (SARS-CoV), Group A *Streptococcus*, and *Neisseria meningitidis*.

Pneumatic Tube

CDC recommends that each laboratory perform a risk assessment before using the pneumatic tube system to transport suspected or confirmed SARS-CoV-2 specimens. Each facility should conduct a site- and activity-specific risk assessment of the procedures performed, identifying the hazards involved in the process, the competency level of the personnel performing the methods, and the laboratory facility. An institution's biosafety professional, laboratory management, scientific/clinical, and safety staff should be involved in conducting the risk assessment process to determine the appropriate specimen transport practices to implement at the facility.

Facilities should ensure that all personnel transporting specimens via pneumatic tubes are trained in safe handling practices, specimen management, and spill decontamination procedures.

For additional information about performing a risk assessment, refer to the Biological Risk Assessment: General Considerations for Laboratories and the Biosafety in Microbiological and Biomedical Laboratories (BMBL) 6th Edition , Section II – Biological Risk Assessment, pages 9-20.

For additional information, refer to the following:

- Guidelines for Safe Work Practices in Human and Animal Medical Diagnostic Laboratories MMWR, Supplement / Vol. 61 January 6, 2012

Virus Isolation

Virus isolation in cell culture and initial characterization of viral agents recovered in cultures of SARS-CoV-2 should be conducted in a BSL-3 laboratory using BSL-3 practices. To determine appropriate biosafety mitigation measures, laboratories should perform an activity-specific biosafety risk assessment that evaluates laboratory facilities, personnel and training, practices and techniques, safety equipment, and risk mitigation measures. Biosafety professionals, laboratory management, and scientific and safety experts should be involved in the risk assessment process.

Inoculation of animals with infectious wild-type SARS-CoV-2 virus should be conducted in an ABSL-3 laboratory using ABSL-3 practices and respiratory protection.

For more information, see:

- Biosafety in Microbiological and Biomedical Laboratories (BMBL), 6th Edition

- Severe Acute Respiratory Syndrome Coronavirus 2 from Patient with Coronavirus Disease, United States
- SARS-CoV-2 Viral Culturing at CDC

Decontamination

Decontaminate work surfaces and equipment with appropriate disinfectants. Use EPA-registered disinfectants with label claims that they are effective against SARS-CoV-2. Follow manufacturer's recommendations for use, such as dilution, contact time, and safe handling. For additional information, refer to EPA Resource Conservation and Recovery Act (RCRA) Regulations. See EPA regulations and State Universal Waste Programs in the United States for more information.

For training courses available online, see Biosafety Training.

Laboratory Waste Management

Always discuss used and unused COVID-19 test kit waste with your facility waste management contractor, your State Department of Public Health, and the test manufacturer's technical support. All waste disposal must comply with local, regional, state, national, and international regulations. Waste disposal regulations vary at the state and local levels; see Environmental Protection Agency Regulations and State Universal Waste Programs in the United States for more information.

Additional Resources

- APHL Risk Assessment Best Practices
- APHL Packaging and Shipping Evaluation Tool
- APHL Packing and Shipping Infectious Substances Training Requirements Job Aid
- APHL Packing and Shipping Guidance for Biological Substances, Category B Specimens
- Biological Risk Assessment: General Considerations for Laboratories
- Biosafety in Microbiological and Biomedical Laboratories (BMBL), 6th Edition
- CDC 2007 Guideline for Isolation Precautions: Preventing Transmission of Infectious Agents in Healthcare Settings
- CDC Guidance for Point-Of-Care and Rapid Testing
- CDC Isolation Precautions
- CDC Laboratory Frequently Asked Questions
- CDC Schematic for packaging, UN 3373 Category B
- CFR 49 PART 173.134 Class 6, Division 6.2
- CFR 49 PART 173.199 Category B Infectious Substances
- CFR 49 PART 173 General Requirements for Shipments and Packaging
- Environmental Protection Agency (EPA) regulations
- EPA List N: Disinfectants for Use Against SARS-CoV-2

FAQs to Lower Minimum Required Biosafety Containment Level for Research Subject to Guidelines (NIH)

Guidelines for Safe Work Practices in Human and Animal Medical Diagnostic Laboratories

Guide to Packaging Category B Diagnostic Samples

IATA Packing Instructions 650 for UN 3373

Click on “Infectious substances,” then the download option packing instructions.

Laboratory Biosafety Guidance for Research with SARS-CoV-2 and IBC Requirements (NIH)

Longhorn PrimeStore Molecular Transport Medium Fact Sheet

Preparing and Supporting Laboratories Responding to COVID-19

Safe Labs

Saf-T-Pak Packaging Checklist, see Category B

SARS-CoV-2 Specimens: Packing and Shipping [14 MB, 10 pages] | Download [1 MB, 10 pages]

SARS-CoV-2 (COVID-19) Fact Sheet: Guidance – Proposed Use of Point-of-Care (POC) Testing Platforms for SARS-CoV-2 (COVID-19)

Standard Precautions | Section IV

State Universal Waste Programs in the United States | Hazardous Waste | US EPA

WHO Laboratory biosafety guidance related to the novel coronavirus (2019-nCoV)-World Health Organization

WHO Laboratory Biosafety Manual, 4th edition

Previous Updates

Updates from Previous Content

Revisions made on October 26, 2021 include:

- Added definition for aerosols and droplets
- Added pneumatic tube guidance
- Added shipping instructions

Revisions made on June 12, 2021 include:

- Added new training resource for specimen packing and shipping

Revisions made on September 19, 2020 include:

- New link under Resources to DLS Preparing and Supporting Laboratories Responding to COVID-19 page

Revisions made on August 7, 2020 include:

- Standard Precautions

Revisions made on July 16, 2020 include:

- Added DOT resources to Specimen Packing and Shipping and Resource section

Revisions made on July 13, 2020 to update:

- Language for virus isolation

Revisions made on June 3, 2020 include:

- Added anatomic pathology guidance for COVID-19
- Updated Point-of-Care testing guidance for COVID-19

Revisions made on May 11, 2020 include recommendations for:

- Point-of-Care testing guidance for COVID-19
- Added information on *PPE* to the "General Guidance" section
- Added *Biological Risk Assessment: General Considerations for Laboratories* resource to the "General Guidance" section
- Added *Core Infection Prevention and Control Practices for Safe Healthcare Delivery* resources to the "General Guidance" section
- Added *OSHA Bloodborne Pathogens Standard* resource to the "General Guidance" section
- Added *EPA-approved disinfectant for SARS-CoV-2 resource* to the "General Guidance section
- Added *Environmental Protection Agency (EPA) regulations* and *State Universal Waste Programs in the United States | Hazardous Waste | US EPA* resources to the "General Guidance" section
- Added information on *PPE* to the "Anatomic Pathology" section
- Deleted "Decentralized and Point-of-Care Testing" section and provided a link to the updated *Guidance for SARS-CoV-2 Point-of-Care and Rapid Testing* webpage
- Added information on *N95 respirator and disposable mask* to "Procedures with a High Likelihood of Generating Droplets or Aerosols" section
- Added language on *avoiding cross-contamination* to the "Environmental Testing" section
- Add language on *Animal Biosafety Level 3 (ABSL-3) practices during inoculation of animals with infectious wild-type SARS-CoV-2 virus* to the "Virus Isolation" section
- Added link for *state EPA regulations* to the "Laboratory Waste Management" section
- Added links to the "Additional Resources" section

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