VERIFICATION AND VALIDATION TOOLKIT

Safety Considerations and Risk Assessments

To ensure correct diagnosis and treatment, clinical laboratory testing must be accurate and reliable. A key component of the quality assurance process is the verification or validation of new instruments and tests to confirm their ability to perform prior to implementation.

The Verification and Validation Toolkit walks users through this process and provides additional resources, templates and examples for use in the laboratory.

Find the complete toolkit at aphl.org/VV-Toolkit

The toolkit has eight sections:

1. Verification and Validation 101
2. Verification and Validation Process Checklist
3. Obtaining Appropriate Test Samples
4. Qualitative Assays
5. Quantitative Assays
6. Related Processes
7. Safety Considerations and Risk Assessments
8. Cost Analysis and Budget

Prior to working with a new biological or chemical agent or validation of a new test, safety should be considered in order to protect the health of employees.[1] Safety risk assessments are a systematic procedure for identifying and managing hazards in all stages of the testing process (pre-analytical, analytical, and post-analytical) and should be performed for both biological and chemical and risks. Risk assessments allow the laboratorians to evaluate the work environment, laboratory processes, equipment and available protective measures.

While this step is not required for a verification or validation, inclusion of the laboratory's safety professional during the planning stages of a verification or validation demonstrates commitment to the safety culture of a laboratory. It is the best opportunity to protect employee health in a preventive—rather than reactive—way. Making recommendations in advance allows for effective mitigation procedures and training needs.

Risk Assessment Considerations

Biological Considerations

- Pathogenicity of the agent of interest
- Route of Transmission
- Agent Stability
- Infectious Dose
- Immune status of worker
- Agent Concentration
- Agent Volume
- Splash Potential
- Aerosol Generation
- Percutaneous Hazard
- Biosafety Laboratory Level
- Work Practices
- PPE (Head, Body, Respiratory)
- Viability Study
- Exposure Control Plan
- Vaccination Availability
- Treatment Availability

Chemical Considerations

- Sample Matrix
- Known or Suspected Chemical Hazards (Grade, Concentration, Manufacturer, MSDS)
- Splash Potential
- Health Hazard
- Flammability
- Reactivity
- Oxidizing Potential
- Corrosion Ability
- Environmental Hazards
- Chemical Incompatibilities
- Chemical Storage
- Carcinogen
- Reproductive Toxin
- Toxicity
- Route of Exposure
- Action Levels and Permissible Limits
- Hazardous Operations
- Physical or Equipment Hazards
- Engineering Controls
- Containment Resources
- PPE (Head, Boby, Respiratory)
- Waste Management and Disposal

Other Considerations

Some laboratories find it useful to assess the probability and severity of identified risk. Probability refers to the likelihood of an identified risk occurring, while severity refers to the magnitude of the potential consequences if a risk is not appropriately mitigated. The probability and severity assessment helps the laboratory to prioritize the risks and mitigation strategies in a strategic way.

Risk Assessment Tables

Tables 1–3 can be used to assess the risk level associated with each hazard identified in the pre- analytical, analytical and post-analytical stages.

- **Table 1** is used to rate the likelihood of the hazard occurring.
- **Table 2** is used to rate the consequence if the hazard were to occur.
- **Table 3** is used to identify the initial risk level of each hazard based on the likelihood and consequence determined from Tables 1 and 2. For example, if your hazard likelihood is likely and the hazard consequence is moderate then the initial risk level is high per the risk assessment matrix.

A **Residual Risk Rating** is determined after mitigating the initial risk with control and protection procedures. It requires analysis of the initial risk rating and mitigating factors to determine if the residual risk rating is lower, higher or the same.

Table 1: Likelihood of Hazard Occurrence[2]

Hazard Likelihood	Hazard Likelihood Description
Rare	Will only occur in exceptional circumstances.
Unlikely	Not likely to occur within the foreseeable future.
Possible	May occur within the foreseeable future, sporadic exposure is possible.
Likely	Likely to occur within the foreseeable future, routine exposure is likely.
Highly Likely	Almost certain to occur within the foreseeable future, consistent exposure is highly likely.

Table 2: Consequence of Hazard Occurrence[3]

Hazards Consequence	Hazard Consequence Description
Insignificant	No treatment required
Minor	Minor injury requiring First Aid treatment (e.g., minor cuts, bruises, bumps)
Moderate	Injury requiring medical treatment or lost time
Major	Serious injury (injuries) requiring specialist medical treatment or hospitali-zation
Critical	Loss of life, permanent disability or multiple serious injuries

Table 3: Risk Assessment Matrix[4]

		Hazard Consequence				
		Insignificant	**Minor**	**Moderate**	**Major**	**Critical**
Hazard Likelihood	**Rare**	Low	Low	Low	Medium	Medium
	Unlikely	Low	Low	Medium	Medium	High
	Possible	Low	Medium	High	High	High
	Likely	Low	Medium	High	High	Extreme
	Highly Likely	Medium	Medium	High	Extreme	Extreme

Frequency for Reviewing a Risk Assessment

Risk assessments should be reviewed regularly to ensure they are up to date and comply with any changes in regulations or work environment.[3]

- The laboratory must review the risk assessment effectiveness at least annually. Risk assessment evaluations may be required more frequently if multiple instances of deviation from established quality thresholds appear in the test system.
- The evaluation must include a review of all components listed in the risk assessment (specimen, testing personnel, environment, reagents, test system) and the QC Plan. It must indicate whether the risk assessment has been effective, and if not, what adjustments are necessary to consistently assure quality.
- Following any quality failures, or when there have been significant changes in any aspect of the original risk assessment, the laboratory must re-evaluate the plan and adjust, if necessary.
- When a quality failure occurs, the laboratory must determine the cause of failure and its impact on patient care, and make any necessary adjustments to the risk assessment.

Hazardous Waste Management

In the performance of testing, hazardous biological, chemical or radiological waste may be generated. The laboratory should have a plan in place which specifies the proper disposal of these wastes. When performing a validation or verification, the laboratory should review the possible generation of hazardous wastes and ensure they are compliant with the laboratory's hazardous waste management plan.

Additional Risk Assessment Resources

Biological Risk Assessment Template for All New Assays

References

1 Safeopedia. Safety Risk Assessment. Accessed October 15, 2023 from: www.safeopedia.com/definition/731/safety-risk-assessment

2 CDC Center for Surveillance, Epidemiology and Laboratory Services. Reynolds L Salerno. Risk Assessment: The Foundation of Every Good Biorisk Management System. March 2, 2020. Accessed January 15, 2024 from: www.cdc.gov/safelabs/docs/CLEARED-Salerno-Biosafety-Symposium-Risk-Assessment-FINAL.pdf

3 World Health Organization. Laboratory Biosafety Manual (pages 16 and 25). 3rd Edition. Geneva. 2004. Accessed January 14, 2024 from: www.who.int/publications/i/item/9789240011311

4 Salerno, R, and Gaudioso, J. (2015) Laboratory Biorisk Management: Biosafety and Biosecurity, CRC Press.

Association of Public Health Laboratories

The Association of Public Health Laboratories (APHL) works to strengthen laboratory systems serving the public's health in the US and globally. APHL's member laboratories protect the public's health by monitoring and detecting infectious and foodborne diseases, environmental contaminants, terrorist agents, genetic disorders in newborns and other diverse health threats.

7700 Wisconsin Avenue, Suite 1000 Bethesda, MD 20814 | 240.485.2745 | www.aphl.org

This publication was supported by Cooperative Agreements #NU60OE000104, 100% funded by the US Centers for Disease Control and Prevention (CDC). Its contents are solely the responsibility of the authors and do not necessarily represent the official views of CDC or the US Department of Health and Human Services.