NLHRS Quality Assurance Program
Guidance for Final Reports and Inquiries

The final QAP report does not mean anything if the recipient laboratory does not read and take advantage of opportunities for improvement. The National Laboratory for HIV Reference Services (NLHRS) actively encourages laboratories to take advantage of their performance evaluation and provides the following guidance.

Interpretation, Responsibilities and Performance Evaluation – The interpretation and dissemination of performance should not be restricted to the direct users of the assays in question. All levels of management should be advised and aware of the results from each test event. Because senior management may not be familiar with the evaluation, knowledge translation and use of simple terms is encouraged so they can gain an appropriate level of understanding regarding the purpose and evaluation of proficiency testing. To appeal a result or evaluation, please contact the NLHRS (nlhrs-lnsrv@phac-aspc.gc.ca).

It should also be highlighted that performance is more than a 'Pass' or acceptable 'z-score'. While a 'Fail' or less-than-satisfactory z-score should prompt a root-cause analysis into their validated methods and QC controls, a Pass/acceptable z-score with a high standard deviation may reveal a trend that requires monitoring.

Due Diligence Review of PT Results – The NLHRS recommends that results of each test event be reviewed. The NLHRS provides a final report which allows each laboratory to compare their performance against the group and individual laboratories. While the NLHRS ensures that the statistical treatment of the group data is conducted with utmost scrutiny and review, we recommend each laboratory exercise due diligence and verify that results are consistent with their own calculations especially those participating in the HIVVL program.

Root-Cause Analysis of Unsatisfactory Performance – In the event where there is a need for root-cause analysis, the laboratory should identify and document them according to their quality management system. Not all investigations will require the same depth depending on how critical the test is, the frequency of unacceptable/questionable results and level of bias. The laboratory should establish its own criteria for initiating a root –cause analysis which should take into consideration frequency of participation in proficiency testing, how critical the test in question is, etc. A stepwise approach should be undertaken using a standardized form (the NLHRS can provide theirs if need be), which at minimum should include;

- Review of the raw data, overall performance, results of past test events & internal QC data.
- Plan for corrective action(s)
- Execution and recording of the corrective action(s)
- Monitoring of implementation

Main Reasons for Unsatisfactory/Questionable Performance – Root-cause analysis should identify the reason(s) for unsatisfactory/questionable performance (troubleshooting table on page 2). These will likely fall into one of the following categories in order of importance *(VAM Bulletin –Ellison, SLR Issue 33 – Autumn 2005, pp21-22)*:

1. Sample preparation
2. Equipment failure
3. Human error
4. Calibration
5. Measurement method (wrong or inappropriate selection)
6. Calculation error
7. Post-testing (units, interpretation, format)
8. QAP item problem
9. Sample transport and storage
10. Primary sampling
11. QAP provider problem

These causes can be classified in three broad categories;

1. Clerical Issues – Although these do not impact the actual technical performance, they highlight the value of proficiency testing in that it identifies problems that may result when reporting results to a client or customer. These include transcription errors, mislabeling, incorrect units, etc. Once identified if clerical errors continue to be a regular cause for unsatisfactory PR performance results, then investigation into the quality management system regarding personnel and their training should be launched.
2. Technical Issues – There are a multitude of levels at which the cause(s) for unsatisfactory/questionable performance could exist including storage/treatment of the PT samples, method and use of internal QC material, equipment problems, facility issues, data processing

3. QAP Provider Issues – There may be no problems identified to the individual laboratory and instead related to the PT provider. Here problems such as inappropriate sample matrix differences between routine samples and actual PT reagents, deterioration of the PT samples, lack of stability/homogeneity within the sample, inappropriate or no instructions, inappropriate storage of PT samples at the origin of the PT provider, incorrect peer group, calculation, performance evaluation score and other data entry.

Troubleshooting; common causes of outlying and/or aberrant results.

Type of Error	Possible Cause(s)	Pre-Analytical	Analytical	Post-Analytical
Sample mix-up	Can occur during specimen reception or testing. May result in outlying/aberrant results for one or all samples mixed-up.	✓	✓	
Transcription	• Incorrect test ordering by physician	✓		
	• Incorrect shipment address	✓		
	• Selecting the wrong assay for data entry	✓		
	• Interchanging results for two or more specimens			✓
	• Entering incorrect results			✓
	• Entering values in the incorrect field (e.g., OD as S/Co)			✓
	• Entering values in the incorrect unit (e.g., IU/mL instead of $\log_{10}$ copies/mL)			✓
	• Using a comma instead of a dot to denote a decimal point			✓
	• Selecting the incorrect assay interpretation or analyte			✓
	• Failure to recommend follow-up testing where necessary			✓
	It is recommended all results that are manually transcribed or entered electronically be checked by a second individual to avoid transcription errors.			
Outlying and/or Aberrant Results (random error)	Sporadic test results identified as outlying and/or aberrant can be classified as random events. Possible causes of random error include:			
	• Incorrect sample storage/shipping conditions	✓	✓	
	• Incorrect test method	✓	✓	
	• Insufficient mixing of sample, especially following freezing		✓	
	• Poor pipetting		✓	
	• Ineffective or inconsistent washing		✓	
	• Transcription errors	✓		✓
	• Cross-contamination or carryover	✓	✓	
	• Presence of inhibitors to PCR		✓	
Outlying and/or Aberrant Results (systematic error)	A series of test results identified as outlying and/or aberrant may be due to a systematic problem. Systematic problems may be due to:			
	• Reagents contaminated, expired or subject to batch variation		✓	
	• Instrument error or malfunction		✓	
	• Insufficient washing		✓	
	• Incorrect wavelength used to read the assay result		✓	
	• Cycling times too long/short or temperature too high/low		✓	
	• Incubation time too long/short or temperature too high/low		✓	
	• Insufficient mixing/centrifuging before testing		✓	
	• Incorrect storage of test kits and/or reagents	✓		
	• Contamination of master-mix, extraction areas or equipment		✓	
	• Ineffective extraction process		✓	
	• Degradation of master-mix components		✓	
	• Suboptimal primer design (in-house assays)		✓	

This table was modified from a report produced by the National Reference Laboratory (NRL), Melbourne, Australia.