

2001 - STUDY PERFORMANCE AND ACCREDITATION

Laboratory Accreditation: Proof of Performance

Introduction

"Do accredited environmental laboratories actually perform better?" The Canadian Association for Environmental Analytical Laboratories (CAEAL) attempted to answer this question in a 1997 article entitled "Laboratory Accreditation: Proof of Performance for Environmental Labs" (Canadian Chemical News, September 1997). The original study has been republished in Australia and Hong Kong, and many people have asked if we had repeated the study. Since we now have data from additional years of performance testing (PT) studies, we have repeated the original study.

CAEAL is committed to working with the laboratory community and their clients to achieve and demonstrate the value of implementing the highest quality standards in Canadian environmental laboratories. To this end CAEAL and the Standards Council of Canada (SCC) jointly delivers an accreditation program for environmental laboratories in Canada.

The accreditation program is based on ISO/IEC 17025 *General Requirements for the Competence of Testing and Calibration Laboratories*. Laboratory performance for many accredited parameters is evaluated through inter-laboratory proficiency testing, and laboratory capability is assessed every two years by a laboratory site assessment covering the lab's quality system and its technical capabilities for the specific tests.

By mid 2001, more than 120 environmental labs were participating in the joint SCC/CAEAL accreditation program, representing about 38 percent of all labs accredited by the SCC for all areas of testing. Another 160 to 170 labs are involved in only the proficiency testing, making a total of 270 to 280 labs in CAEAL's proficiency testing (PT) program.

Our 2001 Study

As with the 1997 study, we have compared the PT performance of accredited labs from the joint SCC/CAEAL program with the performance of non-accredited labs that received identical proficiency testing samples. The same five parameters used in the 1997 study were examined again for the follow-up: biological oxygen demand, total suspended solids, chloride, dissolved iron, and fecal coliforms. Laboratories which participated in the proficiency testing studies were required to analyze four samples of different concentrations for each parameter, from which CAEAL determined an overall score through statistical analysis. The maximum score is 100, a pass is ≥ 70 , and approximately 5% of the results are expected to be considered unsatisfactory due to statistical treatment of the data.

The total data set examined here includes twelve proficiency testing studies: the 1997 study examined data for 6 studies between and 1994 and 1996, and the 2001 study examined data between 1997 and 1999. For each study, the same number of accredited and non-accredited labs were selected for each parameter (by random selection if the entire data set was not used). *Within* each study (periods 1994-1996 and 1997-1999), the same labs were used to avoid the 'learning curve' influence of labs that had just joined the program, but a lab used in the 1997 study was not necessarily used in the follow-up. The number of labs that met the criteria varies by parameter (see table 1). In total, 528 sets of results were used in the 1997 study and 462 in the 2001 study.

It should be noted that, in researching the 2001 study, additional parameters were considered and examined. The data set for these parameters was determined to be unsatisfactory and therefore not included in this paper but may be reconsidered during subsequent studies.

Table 1. Number of Laboratories Meeting Criteria for Specific Parameters.

Parameter	1997 Study (1994-1996)		2001 Study (1997-2000)	
	Pairs of Labs	Data Pairs	Pairs of Labs	Data Pairs
Biochemical Oxygen Demand (BOD)	24	144	16	96
Total Suspended Solids (TSS)	27	162	16	96
Chloride (CL)	13	78	13	78
Dissolved Iron (DFE)	13	78	16	96
Fecal Coliforms (FCOL)	11	66	16	96

Results

The performance of accredited and non-accredited labs has been compared by using three measures: (1) the average score, (2) the number of labs which achieved perfect scores of 100, and (3) the number of labs which did not achieve satisfactory scores of at least 70 out of 100. The results of these comparisons for each parameter are shown in Figures 1 to 3.

Figure 1. Comparison of Mean Scores, 1997 & 2001.

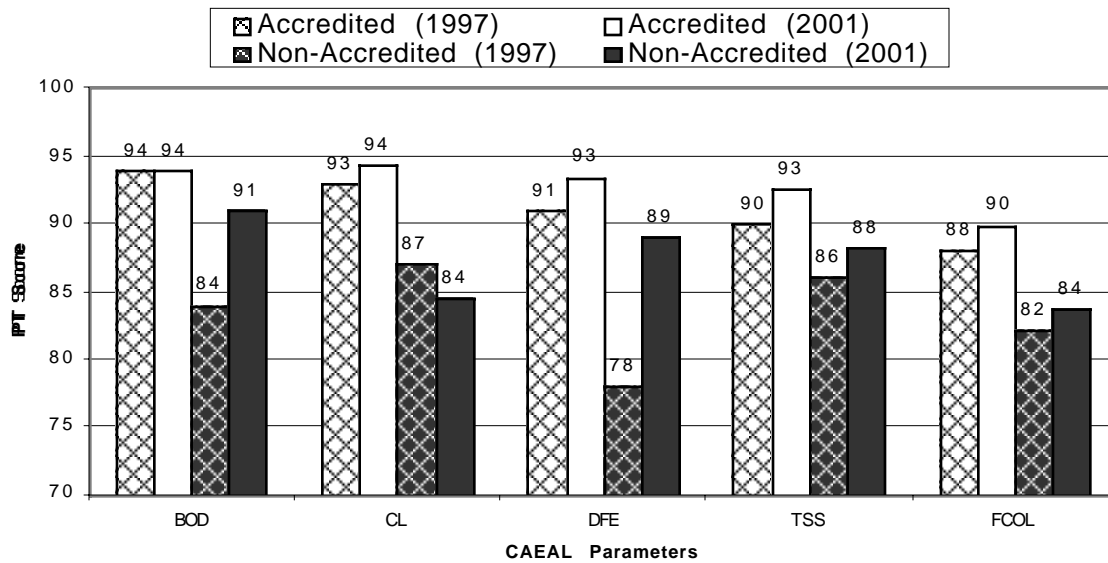


Figure 2. Comparison of Perfect Scores, 1997 & 2001.

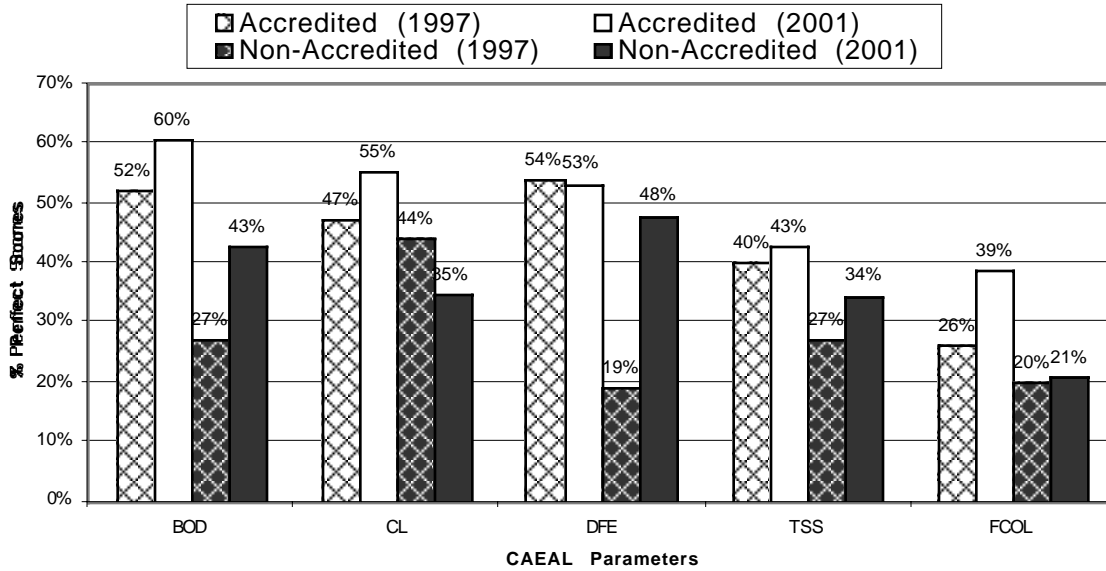
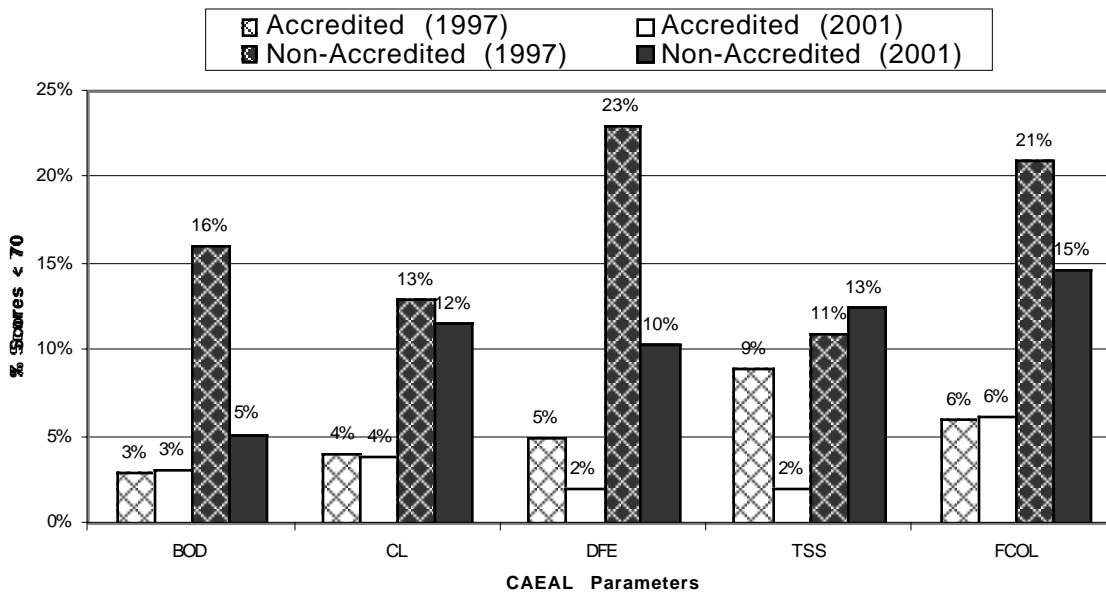


Figure 3. Comparison of Unsatisfactory Scores, 1997 & 2001.



Conclusions

Similar to results found in the 1997 study, accredited labs achieved higher mean scores (92% versus 87% for the entire data set), a greater number of perfect scores (46% of accredited labs versus 36% of non-accredited labs) and fewer unsatisfactory scores (3% of accredited labs versus 17% of non-accredited labs) on proficiency testing samples over a three-year period. The pattern of results was very consistent; the same conclusion applied to each of the five parameters as well as to the total data set *in each study*.

In each study, accredited labs outperformed non-accredited labs in all three measures. Between studies, the average mean score improved for both types of labs (1.1% by accredited versus 4.8% by non-accredited). The marked improvement of non-accredited labs between studies deserves comment and can be explained in two ways: 1) improved analytical techniques due to accumulated experience in the program and 2) a tendency by non-accredited labs to seek accreditation.

At study conclusion, accredited labs averaged approximately 6.72 years participation and non-accredited, 4.23 years – a difference of almost 2.5 years. Further, a 1.1% improvement on an already high (91 out of 100) average mean score and almost 7 years of participation would suggest that accredited labs appear well along the ‘learning curve’ having firmly established, time-tested analytical techniques. Non-accredited labs, on the other hand, appear to have gradually moved up the curve to the point where some labs either felt ready for accreditation or were required to pursue accreditation under new provincial requirements.

To this end, it appears that, on average, over 33% of non-accredited labs eventually sought accreditation in either 2000 or 2001 (see Table 2). Lab motivation to seek accreditation is beyond the scope of this paper, but certainly a shift toward accreditation by non-accredited labs appears to be one influence on our study results.

Table 2. Number and % of Non-Accredited Labs That Sought Accreditation in 2000 or 2001.

Parameter	2001 Study (1997-1999)		
	Pairs of Labs	Labs Seeking Accreditation	%
Biochemical Oxygen Demand (BOD)	16	5	32%
Total Suspended Solids (TSS)	16	5	32%
Chloride (CL)	13	3	23%
Dissolved Iron (DFE)	16	6	38%
<u>Fecal Coliforms (FCOL)</u>	<u>16</u>	<u>7</u>	<u>44%</u>
TOTAL	77	26	34%