

**Assessment of Performance Testing Results in 1997
and Response to Laboratory Questionnaire**

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Introduction:

The international community presently lacks the ability to determine the quality and credibility of environmental measurements required to make sound decisions in matters related to international security, public health, and business and investment-related considerations. This situation, which is widely known by researchers in the field, adversely impacts the capability for assessing potential forensic incidents, establishing general environmental assessments, and acquiring the information necessary for sound business investment decisions.

Background:

Accurate and credible laboratory measurement capability is important to the international community both for issues related to national security and to environmental assessment measurements. The increased potential, due to the recent emergence on the world scene of many non-aligned countries, for proliferation of technology related to nuclear and/or chemical weapons of mass destruction makes accurate laboratory measurement capability of particular importance at this time. Furthermore, such lack of credibility has jaundiced public perception of the capabilities of current scientific technology and led to a quite general skepticism of the results of scientific studies and the resulting recommendations for public action. As a first step toward progress, a prototype intercomparison program was designed in 1994 and implemented in 1995 under the management of Auburn University at Montgomery. The three selected substances were: (1) dioxins and furans: the organic compounds of interest, (2) plutonium: the radionuclide and (3) Cd: the heavy metal. Dioxins and furans were selected as representative of the highly toxic persistent organic pollutants (POPs), because of the continuing interest in improving the

understanding of dioxin movement in the Russian environment and the potential for large health risks (Yufit 94, Feshbach 95). Plutonium was chosen instead of some more common radionuclides like Cs - 137 because the difficulty of the proper analytical methods for Pu analysis has led to much controversy and confusion in the aftermath of earlier environmental studies (Chechetkin, 93.) Cd was chosen because it is typical of several important heavy metal toxic materials.

Results from the Prototype Study:

The results obtained in this work indicate that current estimates for laboratory accuracy are likely overly optimistic. The fraction of all analyses outside the acceptable range was lowest for cadmium, for which 20% or 3 of 15 analyses were outside the acceptable range (3 high and 0 low). There were 18 Pu measurements made: 7 of the results were exceedingly high and 2 low). The fraction of dioxins-furans samples outside the acceptable range was almost equal, i.e. 21% or 17 of 80 analyses outside the acceptable range (13 high and 4 low). The highest fraction of unacceptable results occurred for the plutonium analyses: 50 % were outliers.

Extension of Prototype Study:

ICE extended its invitation for participation in its FY 97 work to some 68 additional countries and received a positive response from 35 countries. ICE has working agreements whereby two major reference laboratories of the U.S. Department of Energy laboratories (the Environmental Measurements Laboratory (EML), in New York City, and the RESL, in Idaho Falls, Idaho) are providing samples to participants in the FY 97 intercomparison work. In addition, NIST is providing samples for the ICE studies at minimal cost-reimbursement We have observed some surprising deficiencies (in QAP46 results, partially complete as of July 1997) in analytical capability both for domestic and foreign. We present below a preliminary compilation of the results.

Laboratory Needs/Deficiencies reported in questionnaire

Need or deficiency	Percentage of Need
Better reference solutions	68%
Sharing person to person or conferences	71%
Training	26%
Equipment Need/Deficiency	26%
Better procedures	10%

Technology Shortcomings observed in the QAP 46 results

Lab Name and Capability Summary	Analytes with which the laboratory showed a Deficiency	Possible cause of the Problem
Bedford Institute, Nova Scotia <i>(approx. 100 person institute, excellent equipment, training status is unknown at present)</i>	Air filter Co-60	Improper geometry calibration. Poor reference solution.
Laboratorio de Fisica Nuclear, Costa Rica <i>(size unknown, no alpha or beta spectrometry, no capability for organic analysis, training is a weakness)</i>	Air filter Co-60	Improper geometry calibration. Poor reference solution.
Service Mixte Radiologique et Biologique, France <i>(government laboratory, excellent equipment, state of training and procedures unknown)</i>	Co-60 Pu-238	Improper calibration. Unknown problem.
Bhabha Atomic Research Centre, India <i>(major government research center, needs better tracer solutions and improved methods, training status is unknown, equipment appears to be high quality)</i>	Pu-239 Sr-90	Unknown problem (very low result.) Unknown problem (very low result.)
Los Alamos National Lab., New Mexico <i>(premier government laboratory, very surprising and unknown problem at this time, indicates that it can happen to the best)</i>	Cs-134 (in air filter 30 % high) Sr-90 (factor of 20 high in air filter and water) (factor of 6 high in soil) Co-60 K-40	Improper calibration. Improper calibration (very high result.) Improper calibration (very high result.) Improper calibration (low result factor of 2.)

Lab Name and Capability Summary	Analytes with which the laboratory showed a Deficiency	Possible cause of the Problem
National Radiation Laboratory, New Zealand <i>(premier government laboratory, no external QA program (except for ours) is available, very appreciative to join our program, needs more QA staff and training)</i>	Sr-90 Co-60	Unknown problem. Improper calibration.
Khlopin Institute, St. Petersburg Russia <i>(premier government institution, excellent equipment and personnel, needs better reference solutions, has extreme difficulty finding money to buy calibration solutions, has both very high (irradiated fuel) and very low laboratories on site)</i>	Am-241 K-40 U-238 Co-60	Unknown problem. Calibration problem. Unknown problem. Calibration problem.
University of Istanbul, Turkey <i>(new university laboratory, very eager to join our program, has multiple problems as stated in their correspondence, they expected to do poorly, needs procedures, training and personnel exchanges, their ability to do both alpha and gamma spectrometry is questionable)</i>	(difficulty with essentially all nuclides) Co- 57 Co- 60, Cs-134 Cs-137 Mn- 54 Sb- 125 Am- 241 K- 40 Pu- 239	Unknown range of problems Communications indicated inexperienced staff and poor reference solutions Need personal contacts and training