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**EMISSION MEASUREMENT CENTER  
APPROVED ALTERNATIVE METHOD (ALT-006)**

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**INDUCTIVELY COUPLED PLASMA - ATOMIC EMISSION SPECTROMETRY  
ANALYSIS OF LEAD, MERCURY, BERYLLIUM, AND ARSENIC AS AN  
ANALYTICAL ALTERNATIVE FOR METHODS 12, 101A, 104 AND 108A.**

**INTRODUCTION**

Emission testers have expressed interest in the use of inductively coupled plasma - atomic emission spectrometry (ICP- AES) as an alternative to atomic absorption (AA) analysis as specified in EPA Methods 12, 101A, 104 and 108A for the analysis of lead, mercury, beryllium and arsenic, respectively. The purpose of this guideline is to identify criteria for allowing ICP-AES analysis in lieu of AA analysis for these test methods.

**SUMMARY**

Atomic absorption spectrometry was selected for these methods primarily because of its low detection limit. The analytical costs for AA are also lower than ICP-AES for analysis of these metals individually. However, ICP-AES may be applicable for metals analysis in several situations. For example, in some cases low detection limits may not be necessary or may be resolved through increased sample collection. In other situations, an AA may not be as readily available as an ICP-AES and other technical concerns, such as minimum detectability can be addressed. Further, the ICP-AES may be used to analyze several metals in one sample providing an economic advantage over atomic absorption.

**CRITERIA**

The ICP-AES may be used for analysis of lead (Method 12), mercury (Method 101A), beryllium (Method 104), an arsenic (Method 108A) in lieu of AA provided the following conditions are met:

1. Sample collection, sample preparation and analytical preparation procedures are as defined in the EPA test method except as necessary for the ICP-AES application.
2. Quality Assurance/Quality Control (QA/QC) procedures, including audit material analysis, are conducted as prescribed in the EPA test method. The QA acceptance conditions must be met.
3. The limit of quantitation<sup>1</sup> for the ICP-AES must be demonstrated and the samples concentrations reported should be no less than two times the limit of quantitation. The limit of quantitation is defined as

10 times the standard deviation of the blank value. The standard deviation of the blank value is determined from the analysis of seven blanks.

Note that reports indicate that for mercury and those elements that form hydrides, a continuous-flow generator coupled to an ICP-AES offers detection limits comparable to cold vapor AA.<sup>2</sup>

#### **REFERENCES**

1. Mac Doughal, D., Anal. Chem., 1980, **52**, 2242.
2. Coles, B. J., and Thompson, M., Analyst, 1984, **109**, 529.