METHOD #: 220.1	Approved for NPDES (Editorial Revision 1974, 1978)
TITLE:	Copper (AA, Direct Aspiration)
ANALYTE:	CAS # Cu Copper 7440-50-8
INSTRUMENTATION:	AA
STORET No.	Total 01042 Dissolved 01040 Suspended 01041
Optimum Concentration Range:	0.2-5 mg/L using a wavelength of 324.7 nm
Sensitivity:	0.1 mg/L
Detection Limit:	0.02 mg/L

1.0 Preparation of Standard Solution

1.1 Stock Solution: Carefully weigh 1.00 g of electrolyte copper (analytical reagent grade). Dissolve in 5 mL redistilled HNO_3 and make up to 1 liter with deionized distilled water. Final concentration is 1 mg Cu per mL (1000 mg/L).

1.2 Prepare dilutions of the stock solution to be used as calibration standards at the time of analysis. The calibration standards should be prepared using the same type of acid and at the same concentration as will result in the sample to be analyzed either directly or after processing.

2.0 Sample Preservation

2.1 For sample handling and preservation, see part 4.1 of the Atomic Absorption Methods section of this manual. Sample Preparation 1. The procedures for preparation of the sample as given in parts 4.1.1 thru 4.1.4 of the Atomic Absorption Methods section of this manual have been found to be satisfactory.

3.0 Instrumental Parameters (General)

3.1 Copper hollow cathode lamp
3.2 Wavelength: 324.7 nm
3.3 Fuel: Acetylene
3.4 Oxidant: Air
3.5 Type of flame: Oxidizing

4.0 Analysis Procedure

4.1 For analysis procedure and calculation, see "Direct Aspiration", part 9.1 of the Atomic Absorption Methods section of this manual.

5.0 Notes

5.1 For levels of copper below 50 μg/L, either the Special Extraction Procedure, given in part 9.2 of the Atomic Absorption Methods section or the furnace technique, Method 220.2, is recommended.

5.2 Numerous absorption lines are available for the determination of copper. By selecting a suitable absorption wavelength, copper samples may be analyzed over a very wide range of concentration. The following lines may be used:
327.4 nm Relative Sensitivity 2
216.5 nm Relative Sensitivity 7
222.5 nm Relative Sensitivity 20

5.3 Data to be entered into STORET must be reported as μg/L.

5.4 The 2,9-dimethyl-1,10-phenanthroline colorimetric method may also be used (Standard Methods, 14th Edition, p. 196).

6.0 Precision and Accuracy

6.1 An interlaboratory study on trace metal analyses by atomic absorption was conducted by the Quality Assurance and Laboratory Evaluation Branch of EMSL. Six synthetic concentrates containing varying levels of aluminum, cadmium, chromium, copper, iron, manganese, lead and zinc were added to natural water samples. The statistical results for copper were as follows:

Number of Labs	True Values μg/Liter	Mean Value μg/Liter	Standard Deviation μg/Liter	Accuracy as % Bias
91	302	305	56	0.9
92	332	324	56	-2.4
86	60	64	23	7.0
84	75	76	22	1.3
66	7.5	9.7	6.1	29.7