

	Environmental Analysis Teaching and Research Laboratory	Date: 2/12/2018	Number: 70 v0.1
	Standard Operating Procedure	Title: ICP-MS Guide	
	Approved By: TBD	Revision Date: April 25, 2018	

## 1. Scope and Application

1.1 The scope of this SOP is train researchers...

1.2 The applications of this SOP are for...

## 2. Summary of Method

2.1 This SOP does this...

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### 3. Acknowledgements

3.1 This procedure requires XX minutes...

### 4. Personnel & Training Responsibilities

4.1 Researchers training is required before this the procedures in this method can be used...

4.2 Researchers using this SOP should be trained for the following SOPs:

- SOP01 Laboratory Safety
- SOP02 Field Safety

### 5. Health and Safety

#### Risks

5.1 Describe the risk...

#### Safety and Personnel Protective Equipment

### 6. Time Management

6.1 This section is to make users aware of the time commitment before running analyses.

#### Solutions Preparation

#### Methods Development

#### Instrument Start-up

##### Ignition Sequence and Warm Up

##### Performance Checks

#### Analysis and Data Retrieval

#### Instrument Shut-down

### 7. Sample and Standard Preparation

#### Acid Handling Guidelines

- **Never** mix organic solvents like ethanol or acetone with nitric acid ( $\text{HNO}_3$ ) and do not store concentrated acid bottles around organic solvents. The two react violently with each other and create toxic fumes.

- Always add concentrated acid to a comparatively larger volume of deionized water first. **Do not** add water to concentrated acid.
- Be mindful of putting clothing or hands/arms over containers, particulates and dust will fall into them and could affect low level readings.
- Use non powdered gloves
- Acid solutions are diluted by volume. Use full strength nitric and/or hydrochloric acid (~70% and ~37%, respectively) and dilute directly into centrifuge tube or plastic test tube.

**7.1** Example: to make a matrix solution of 1% nitric and 0.5% hydrochloric in a 50 ml centrifuge tube, use 0.5ml of ~70%  $\text{HNO}_3$  and 0.25ml ~37%  $\text{HCl}$ . Then use 18  $\Omega$  deionized water to fill the rest of the tube (49.25mL).

## Creating Standards

- **Do not** use glassware for ultra-trace applications
- Dilute and make standards directly in plastic containers/vials (HDPE or PTFE) whenever possible.
- Use plastic pipettes with no metal parts (metal can rust/corrode and contaminate solutions).
- **DO NOT** pipet out of the standard or acid containers, instead use an intermediate container to pipet out of to prevent contamination of the stock solution.

## Tuning Solutions

- For most purposes, the internal standard tuning solution is diluted to 0.5 ppm at 1%  $\text{HNO}_3$ .
- Tuning solution is diluted to 1 ppb at 1%  $\text{HNO}_3$ .
- P/A factor tuning solution is diluted to 1 ppb at 1%  $\text{HNO}_3$ .

## 8. Procedures

### Creating a Batch

**8.1** Think of a batch file as an all-inclusive file. It includes your method, tune profile, sample list, and other parameters all in one.

**8.2** There are a few rules and limitations with the Masshunter software and batch files:

1. The MassHunter software requires you to make batch files in order to do about basically anything.
2. Once you have run an analysis, or sent your batch file to the queue, you must create a new one in order to run again.

### Creating a Method

## Notable Biases and Interferences

### Instrument Start Up

- 8.3** Make sure to have your method created before turning on the plasma. We want to make sure we are not needlessly using up argon.
- 8.4** Ensure there is enough internal tune solution, rinse, and autosampler rinse and the solutions and standards being used in the autosampler are uncapped and in the proper tray positions. The positions can be verified by looking at the positions within the plasma section ([Plasma] icon)).
- 8.5** Verify the argon Dewar has sufficient levels for analysis and make sure the gas use valve is open.
- 8.6** Check gas supply regulator pressure, it should be at approximately 100psi.
- 8.7** Inspect the PeriPump tubing and fittings and replace if needed.
- 8.8** Attach the PeriPump tubing and clamp them properly.
- 8.9** Clamp the PeriPump tubing located in the back of the autosampler.
- 8.10** Put the internal standard tubing (smaller I.D. tubing) into some 18 Ωwater.
- 8.11** Turn on the ICP chiller and verify it is functioning properly.
- 8.12** Turn on the Plasma by clicking the pulldown next to the [Plasma] icon and click [Plasma on]. When confirming to turn the plasma on make sure [Execute Configured Ignition Sequence] is **unchecked**. IMMEDIATELY record the time when the plasma ignites in the log book.
- 8.13** Let the instrument “warm up” sufficiently by verifying the “SC Temp” is fluctuating between 1.9°C and 2.0°C.

Gas	Pressure	Reorder #
Argon	100 psi	??
Oxygen		

**8.14** Turn on chiller

**8.15** Open argon valve

**8.16** Connect drain and sample tubes to peristaltic pump and clamp.

**8.17** Connect internal standard, should be diluted to 1 ppm or  $1\mu\text{mL}$ .

**8.18** Check Settings, nebulizer, post rotate yes!

**8.19** Turn on circulate water

**8.20** Startup Configuration

**8.21** Instrument set up – various tests done that should be checked.

**8.22** Tuning solutions... Peripump, .5 uL solution.. internal standard concentration will be... speed to 0.3 because the tube stretches out. Stabilizes to 30s, acquisition speed... probe rinse...

**8.23** Check Default Standard Setting

**8.24** P/A solutions

**8.25** Turn on Plasma Mode

**8.26** Enable Configure Ignition Sequence is checked for liquid samples

**8.27** Check meters

IF/Backing Pressure Analyzer Pressure Water Redirected Power Forced Power

**8.28** Skip Warm-up

**8.29** check for bubble moving into pump in tube

**8.30** Autotuning solutions – DI water?

**8.31** Check autoscale on 'Real Time Display'

**8.32** Check Mainframe – performance report, record rsd i6 %... check counts... oxides...cerium (mass 140/156) i 2 double charges (mass 70 mass 40...) i 3, high matrix. check resolution axis around 7. peak width about 10%, .65 - .8, 6.9 ....

## Running a Batch

**8.33** Prepare ...

**8.34**

## 9. Trouble Shooting

## 10. Definitions

## 11. References

11.1 APHA, AWWA. WEF. (2012) Standard Methods for examination of water and wastewater. 22nd American Public Health Association (Eds.). Washington. 1360 pp. (2014).

<https://crustal.usgs.gov/laboratories/icpms/intro.html>