1. Scope and Application

1.1 The scope of this SOP defines who can use the IRMS and the training required to be a user and super-user.

1.2 The applications of this SOP are for researchers to learn how to use the Oxtoby Isotope Lab IRMS. Using the IRMS requires skills and attention to detail and users must be qualified to use the instruments. The lab manager does not have the time or capacity to run samples for researchers, but can train users to run their samples. Completing this SOP is the first step toward becoming a user or super-user.

2. Summary of Training

2.1 This SOP is used to train potential users how to prepare and run sample on the IRMS. Since the Oxtoby lab is managed by a 1/2 manager, it's important the users are able to run the instruments independently – but they are expensive, so we need to ensure that users are qualified.

Contents

3. Acknowledgements

4. Definitions

4.1 Super-user is staff, student, or faculty memember who is qualified to run and perform minor maintanence on the IRMS, including, but not necessarily limted to, gas replacement, reactor exchange, needle exchange, etc.

4.2 User – is a staff, student, or faculty member who has qualified to prepare and run the IRMS without supervsion.

4.3 Student Researcher – is generally going to be a student who either does not feel confident in becoming a user or simply doesn't have the time to invest in it. Although, a student researcher can conduct sample weighing, data reduction, and sequence creation.

5. Laboratory Policies

5.1 In order to be able to run the IRMS and its associated peripherals, the person must be a Certified User.

5.2 Users are required to run their own samples and should not rely on anybody to run their samples for them. If a user cannot find the time to run their samples, or cannot find another user to run them, sequences should not be ran.

5.3 In terms of instrument use,Payment in kind

5.4 Lab Access

6. Estimated Time

6.1 Estimated time to become a user requires approximately 6 hours of observation, training, and minimally supervised runs. This does not include the time required to read relevant reading material such as manuals and standard operating procedures.

7. Health and Safety

Risk

7.1 Pressurized, Reactive, and Poisenous Gases -Hydrogen (H_2), Oxygen (O_2),Carbon Monoxide (CO_2), Sulfur Dioxide (SO_2)

7.2 Acid Handling - 100% Phosphoric Acid

7.3 Risk of Burns - Hot reactors

7.4 Puncture and Cut Related Wounds - Needles

Safety and Personnnel Protective Equipment (PPE)

7.5 Lab Coat

7.6 Safety Glasses

7.7 Gloves

8. Personnel & Training Responsibilities

8.1 Users will be held to high professional standards and violation will forfeit your privilege to use the lab.

8.2 Researcher training is required before time can be scheduled to use the IRMS and its peripherals.

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

- SOP01 Laboratory Safety

9. Required Materials and Apparati

9.1 Item 1 w/catalog number!

9.2 Item 2

10. Reagents and Standards

Tank Farm 1 (West wall most northern)

10.1 Helium (He) - Tank pressure should be above 500psi and regulated at 50psi.

10.2 Nitrogen (N_2)

10.3 Carbon Dioxide (CO_2)

10.4 Oxygen (O_2)

Tank Farm 2 (West wall most southern)

10.5 Hydrogen (H)

10.6 Carbon Monoxide (CO)

10.7 Hydrogen and Helium (H and He)

10.8 Hydrogen and Carbon Dioxide (H and CO_2)

10.9 Sulfur Dioxide (SO_2)

10.10 Reaction Column packing (add partnumbers for reagents and reactor parts)

Analysis	XX	Copper	
CN	Yes	No	Yes

11. Procedure

11.1 Read general background of how isotope ratio ms works...30 min

11.2 Observe other user(s) operate ...

11.3 Read hardware SOPs and software SOPs?

12. Background

These instruments can range from tens to hundreds of thousands of dollars, and repairs on these instruments can not only be expensive, but they can also cause a backup in jobs. Since it is a fee for service laboratory, clients that submit their samples expect high quality data returned to them in a timely manner so that they may finish their projects. However, if instruments go down, those samples must be placed on hold until the laboratory receives any required parts or they are able to troubleshoot and fix the instruments. It is essential that the laboratory technician using the machines knows how to properly use it, and can troubleshoot when problems arise. When the instrument is new, the instrument users must not only attend extensive training specifically for use of the instrument, but they must also become familiar with the operations manual.

Go into a brief IRMS theory.

Explain the interaction of the peripherals and IRMS.

13. Time Management - Sequence Preparation

13.1 Determine the number of samples will be analyzed, how many accompanying standards will be needed (depending on your data correction scheme), and blanks. Keep in mind the autosampler carousel has only 32 spots.

13.2 Analysis Time - Varies depending on method and analysis type.

FLASH EA

Carbon (^{13}C) takes approximately 5 minutes plus an additional minute or so for peak centering and magnet switching.

NC dual method takes approximately 7 mintues plus and additional minute or so for peak centering and magnet switching.

NCS triple analysis takes approximately 10 minutes and 45 seconds plus an additional minute or so for peak centering and magnet switching.

GASBENCH

Carbonates

Dissolved Inorganic Carbon (DIC)

Breath Gas Analysis

CO_2 in Atmospheric Concentrtions

Water Equilibration (^{18}O/^{16}O)

Water Equilibration (^{2}H/^{1}H)

13.3 Perform instrument tests to verify instrument is functioning properly.

14. QC/QA Criteria

14.1 Evaluate data reduction requirements, linearity, zero enrichment test

15. Trouble Shooting

16. References

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