

Filter Extraction via the SimPrep Autodilution System

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Standard Operating Procedures

RTI SOP# Ion3

Filter Extraction via SimPrep Autodilution System

Analytical Sciences
Discovery Sciences
RTI International*
Research Triangle Park, NC

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1.0 PURPOSE

This Standard Operating Procedure (SOP) describes the process for delivering deionized (DI) water via the SimPrep Autodilution System to sample tubes containing filters that will be extracted.

2.0 SCOPE

This SOP applies to particulate matter with an aerodynamic diameter of less than or equal to 2.5 micrometers (PM_{2.5}) on 47-millimeter (mm) nylon filters from the Chemical Speciation Network (CSN) and 37-mm nylon filters from the National Park Service (NPS). The procedures may also be applied for filters received for special projects; however, the volume should be adjusted accordingly.

3.0 RESPONSIBILITY

Management (Center Directors, Principal Investigators, Study Directors, or equivalent) is responsible for ensuring that the procedures outlined in this SOP are performed by trained laboratory staff supporting the project.

4.0 PROCEDURE

This section of the SOP outlines how to initialize the instrument (**Section 4.1**), set up the sequence (**Section 4.2**), and begin the sequence (**Section 4.3**).

4.1 Initializing the SimPrep Autodilution System

Note: When the SimPrep Autodilution System has been used to conduct analyses, Analysts will leave it drained at the end of each day; therefore, the instrument must be restarted and initialized before use.

The following procedures will be used to initialize the SimPrep Autodilution System:

1. Select the “SimPrep” shortcut

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2. Check the following parameters for use:

Location	Parameter	Amount
Settings -> Station -> Misc.	Purge Volume	10,000 microliters
Settings -> Station -> Misc.	Loop Volume	50,000 microliters
Settings -> Station -> Syringes	Syringe Size (S1)	50,000 microliters
Settings -> Station -> Syringes	Syringe Size (S2)	1,000 microliters
Settings -> Station -> Diluents	Diluent	DI water

3. Purge the autodilution system by selecting the purge icon at the top of the screen. Repeat selection five times to fully prime the valve.
4. Set each rack to 3 rows and 7 positions.
5. Set up two bottles filled with DI water for each SimPrep autodilution system. Use a rinse bottle for the probe station and another bottle for providing the volume of DI water to be dispensed into the sample tubes.
6. Empty and rinse the DI water reservoir for the dispenser and probe rinse before every use.

4.2 Setting up the Sequence

The sequence may be added manually or selected from the saved files directory.

The following procedure is used to create a manual sequence:

1. Verify status is set to the green triangle, which indicates that the sample needs to have DI water added.
2. Set Name column to "Dispense".
3. Set Position to rack number and position number. An example for the first position in rack one would be R1-01.
4. The autodilutor performance is assessed quarterly and results are documented and maintained in Johnson 260 with the autodilutor. Reference the most recent volumes listed to set the correct volume to dispense either 25,000 when extracting samples for CSN or 20,000 μL for NPS samples. If you plan to extract non routine samples, you may conduct a check of the system to assess the appropriate volume setting required to meet the targeted accuracy following the procedure used in the "Demonstration of Autodilutor Performance" worksheet.
5. Set up the sequence for the exact number of samples that are to be extracted.

The following procedure is used to load a sequence from the saved files:

1. Select “Open Saved File”.
2. Select the file specific for either NPS or CSN sample extraction.

4.3 Beginning the Sequence

The following procedure is used at the beginning of a sequence:

1. Verify that the volume to be added is correct for the samples to be extracted.
2. Select the start button located at the top of the screen.
3. Verify that the probe is aligned correctly, and that water is being dispensed in the correct vial. The sequence will stop when all vials have been filled.
4. When the sequence has ended, replace the caps on extracted samples.

5.0 MAINTENANCE

Verify the accuracy and precision of the instrument quarterly and document results using the “Demonstration of Autodilutor Performance” worksheet.

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TITLE: Demonstration of Autodilutor Performance
System ID #: _____

General Instructions
This worksheet applies to use of the SimPrep AutoDilution system. The purpose of this worksheet is to demonstrate proficiency for chemists and technicians. If the relative standard deviation is not greater than 5 %, the chemist or technician is deemed qualified to utilize the autodilutor. The review can be completed by any technician or chemist who has previously demonstrated proficiency using the autodilution system. Initial and date each task as soon as it is completed; sign the bottom of the page when all entries have been completed and have reviewer sign bottom of page. Data entries should be performed using indelible blue or black-ink ballpoint pens. Be sure to record scientific observations and deviations from this procedure on this document.

Reagents	Supplier	Date Prepared	Exp. Date
Deionized (DI) Water	Milli-Q IQ7000	Resistivity reading _____	Drawn daily

Equipment	Manufacturer/Model	Serial Number or ID# / Location
Deionized (DI) Water System	Millipore / Milli-Q IQ7000	F2SB29069 / Johnson, Lab 187, Bay 6
SimPrep AutoDilution System	SimPrep	0122138A560/ Johnson, Lab 187, Bay 6
SimPrep AutoDilution System	SimPrep	0122139A560/ Johnson, Lab 187, Bay 6
50 mL Plastic Digestion Tubes	Mold Pro/ MP-108PW	n/a
Analytical Balance (RTI Bal 291)	Mettler Toledo/ XP205	1128372296/ Johnson, Lab 268
Calibration Weight Set	Fisher Scientifics	A-263/ Johnson, Lab 268

Procedure: RECORD WHICH SYSTEM IS BEING USED: _____

- Rinse gloved hands with DI water and dry with KimWipe.
- Gather 22 empty 50 mL plastic digestion tubes and number each tube and corresponding cap.
- Calibrate the analytical balance using calibration weight set in accordance with SOP 100-EQP-004.5, "Calibration, Use and Maintenance of Balances"¹. Take the mass of each empty tube, including cap, and record in table 1, 2, and 3 in "Mass of Tube" column.
- Fill the 2-liter plastic bottle used with the SimPrep auto dilution system with DI water directly from the Milli-Q system. Resistivity reading **must be 18.2 Mo**.
- Purge the SimPrep autodilution system at least 5 times using the system software.
 - o 1 2 3 4 5
- Program the autodilutor to dispense 20,000 microliters of DI water into tubes 1 and 2 and 25,000 microliters into tubes 3 and 4. Program in accordance with RTI SOP#IONS3 SOP "Filter Extraction via SimPrep Autodilution System"².
- Uncap tubes 1 to 4 and arrange in order in autosampler racks.
- Deliver the programed amounts of DI water into tubes 1 through 4 using the SimPrep by hitting start in the program.
- Cap tubes 1-4 with corresponding caps and use analytical balance to obtain the mass of the filled tubes. Record in Table 1 in "Mass of Tube and Water" column.

1

Analyst Signature: _____ Date: _____ Reviewer Signature: _____ Date: _____

Filename Demonstration of SIMPREP Performance Worksheet. V2_052223

Figure 1. Example of Demonstration of Autodilutor performance (page 1 of 4).

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<p><input type="checkbox"/> Calculate the "Volume of Water" using the following equation and record value in Table 1:</p> <ul style="list-style-type: none"> o "Volume of Water" = "Mass of Tube and Water" – "Mass of Tube" <p><input type="checkbox"/> Calculate the Volume Difference using the following equation and record values in Table 1:</p> <ul style="list-style-type: none"> o "Volume Difference" = "Simprep Volume Setting" – ("Volume of Water"*1000) <p style="text-align: center;">TABLE 1: Determination of Accurate Simprep Settings – SYSTEM 1</p> <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th style="width: 8%;">Tube Number</th> <th style="width: 18%;">Simprep Volume Setting (uL)</th> <th style="width: 18%;">Mass of Tube (g)</th> <th style="width: 18%;">Mass of Tube and Water (g)</th> <th style="width: 18%;">Volume of Water (mL)</th> <th style="width: 18%;">Volume Difference (uL)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>20,000</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>2</td> <td>20,000</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>3</td> <td>25,000</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>4</td> <td>25,000</td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table> <p><input type="checkbox"/> Determine new SimPrep volume settings for 20,000 uL and 25,000 uL using the following equation:</p> <ul style="list-style-type: none"> o "Corrected Simprep Volume Setting" = "Simprep Volume Setting" + "Volume Difference" <p>Record the results below:</p> <p>SYSTEM 1: Corrected Simprep Volume Setting for 20,000 uL: _____ Corrected Simprep Volume Setting for 25,000 uL: _____</p> <p><input type="checkbox"/> Program the autodilutor to dispense the "Corrected Simprep Volume Setting for 20,000 uL" of DI water into tubes 5-13 and the "Corrected Simprep Volume Setting for 25,000 uL" into tubes 14-22.</p> <p><input type="checkbox"/> Uncap tubes 5-22 and arrange in order in autosampler racks.</p> <p><input type="checkbox"/> Deliver the programed amounts of DI water into tubes 5 through 22 using the SimPrep by hitting start in the program.</p> <p><input type="checkbox"/> Cap tubes 5-22 with corresponding caps and use analytical balance to obtain the mass of the filled tubes. Record in Table 2 and 3 in "Mass of Tube and Water" column.</p> <p><input type="checkbox"/> Calculate the average and standard deviation for the volume of DI water dispensed at both the "Corrected 20,000 uL" setting and the "Corrected 25,000 uL" setting. Calculate the relative standard deviation (RSD) = standard deviation divided by the mean multiplied x 100. The RSD should not be greater than 5%. Record calculated results in appropriate spots below Table 2 and 3.</p> <p>COMMENTS:</p> <div style="border: 1px solid black; height: 80px; width: 100%;"></div> <p style="text-align: center;">2</p>			Tube Number	Simprep Volume Setting (uL)	Mass of Tube (g)	Mass of Tube and Water (g)	Volume of Water (mL)	Volume Difference (uL)	1	20,000					2	20,000					3	25,000					4	25,000				
Tube Number	Simprep Volume Setting (uL)	Mass of Tube (g)	Mass of Tube and Water (g)	Volume of Water (mL)	Volume Difference (uL)																											
1	20,000																															
2	20,000																															
3	25,000																															
4	25,000																															

Analyst Signature: _____ Date: _____ Reviewer Signature: _____ Date: _____

Filename Demonstration of SIMPREP Performance Worksheet_V2_052223

Figure 2. Copy of Demonstration of Autodilutor performance page 2 of 4).

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TABLE 2: Simprep System Check Corrected 20,000 Setting Volume Setting: _____ μ L

Tube Number	Mass of tube (g)	Mass of tube with water (g)	Volume of water (mL)
5			
6			
7			
8			
9			
10			
11			
12			
13			

Average: _____

Standard Deviation: _____

TABLE 3: Simprep System Check Corrected 25,000 Setting Volume Setting: _____ μ L

Tube Number	Mass of tube (g)	Mass of tube with water (g)	Volume of water (mL)
14			
15			
16			
17			
18			
19			
20			
21			
22			

Average: _____

Standard Deviation: _____

Analyst Signature: _____ Date: _____ Reviewer Signature: _____ Date: _____

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Figure 3. Copy of Demonstration of Autodilutor Performance (page 3 of 4)

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COMMENTS:

References:

1. *RTI SOP 100-EQP-004.5: Calibration, Use and Maintenance of Balances*
2. *RTI SOP Ions 3: Extractant Via SIMPrep Instrument*

Analyst Signature: _____ Date: _____ Reviewer Signature: _____ Date: _____

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Figure 4. Demonstration of Autodilutor performance (page 4 of 4).

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REVIEW AND REVISION HISTORY

Version	Describe Major Changes or Indicate “Reviewed with No Revisions”	Effective Date/ Review Date	New Review Date
1	Create new SOP for new Systems Installed 6/1/2022	6/1/2022	6/1/2023
2	Updated Worksheet for performance demonstration for autodilutor and assign SOP a number and performed general edits with formatting	6/7/2023	6/7/2024

SOP Revision and Review Instructions:

- For revisions: authors incrementally increase the version number and add the description of revisions to the “Review and Revision History” form. Upon receipt of the signed, revised SOP, the SOP Coordinator assigns the new effective date.
- For reviews with no revisions, the SOP Coordinator updates the “Review and Revision History” form and assigns the next date for review upon receipt of a completed review notice.