



NADP Passive Mercury Pilot Network

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"Before I begin, one of the acronyms I'm going to use is completely made up. See if you can figure out which one."

Kickoff Meeting

December 5, 2024

NADP Program Office



Introduction

- **Advocates:** Kristi Morris, David Schmeltz, Winston Luke
- **WSLH:** David Gay, Christa Dahman

ENVIRONMENTAL
Science & Technology **LETTERS**



A High-Precision Passive Air Sampler for Gaseous Mercury

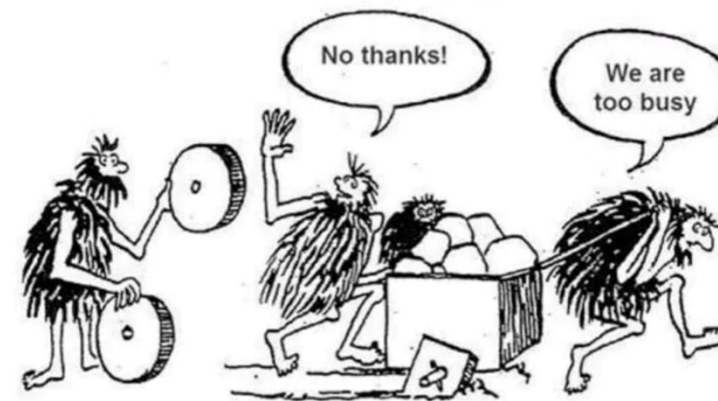
David S. McLagan,[†] Carl P. J. Mitchell,[†] Haiyong Huang,[†] Ying Duan Lei,[†] Amanda S. Cole,[‡] Alexandra Steffen,[‡] Hayley Hung,[‡] and Frank Wania^{*†}

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[‡]Air Quality Processes Research Section, Environment Canada, 4905 Dufferin Street, North York, ON M3H 5T4, Canada

Supporting Information

ABSTRACT: Passive air samplers (PASs) provide an opportunity to improve the spatial range and resolution of gaseous mercury (Hg) measurements. Here, we propose a sampler design that combines a sulfur-impregnated activated carbon sorbent, a Radiello diffusive barrier, and a protective shield for outdoor deployments. The amount of gaseous Hg taken up by the sampler increased linearly with time for both an 11-week indoor ($r^2 = 0.990$) and 12-month outdoor ($r^2 = 0.996$) deployment, yielding sampling rates of $0.158 \pm 0.008 \text{ m}^3 \text{ day}^{-1}$ indoors and $0.121 \pm 0.005 \text{ m}^3 \text{ day}^{-1}$ outdoors. These sampling rates are close to modeled estimates of $0.166 \text{ m}^3 \text{ day}^{-1}$ indoors and $0.129 \text{ m}^3 \text{ day}^{-1}$ outdoors. Replicate precision is better than for all previous PASs for gaseous Hg, especially during outdoor deployments ($2 \pm 1.3\%$). Such precision is essential for discriminating the relatively small concentration variations occurring at background sites. Deployment times for obtaining reliable time-averaged atmospheric gaseous Hg concentrations range from a week to at least one year.



- **Wheel Inventors:**
- University of Toronto
- Tekran Instruments Corp.
- ECCC



Overview

- The primary objective of this initiative is to establish a new monitoring network that will complement existing networks such as Mercury Deposition Network (MDN), Atmospheric Mercury Network (AMNet), and Mercury Litterfall Network (MLN).
- This new network will measure quarterly average Gaseous Elemental Mercury (GEM) using a passive sampler (Tekran MerPAS), which can be easily deployed across the U.S. and internationally.
- It will serve as a foundational network for AMNet, a companion to the MDN, and has the potential to provide average dry deposition estimates for all participating sites.



Overview

- Tekran MerPAS sampler measures Gaseous Elemental Mercury (GEM) in nanograms Hg/m³
- 90-day samples, or 4 sample periods per year
- 4 individual samplers for atmospheric concentration and 2 trip blanks will be deployed
 - These 4 values can be averaged to estimate a quarterly average concentration, and the 4 quarters can be averaged for value.
- 3 samplers and 1 blank will be purchased from Tekran, and 1 sampler and 1 blank will be produced by WSLH (in MerPAS bodies)

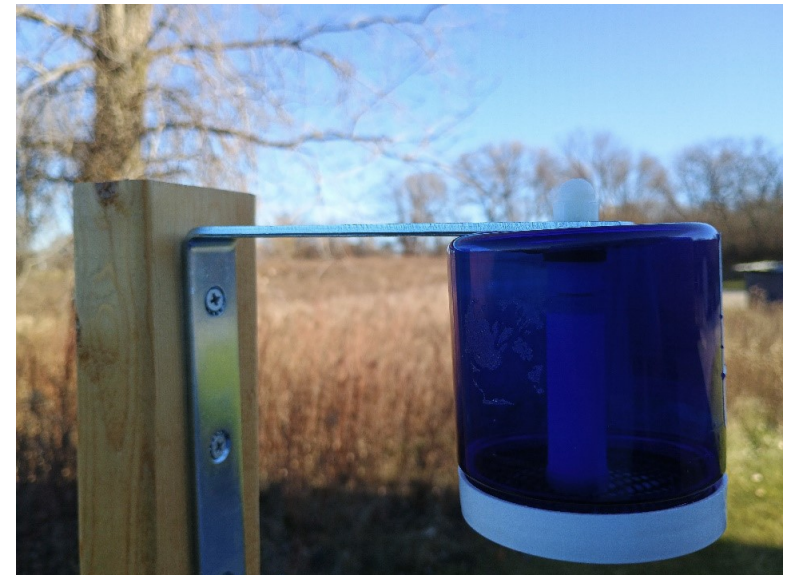


MerPAS Sampler by Tekran®



Mounting Bracket Installation

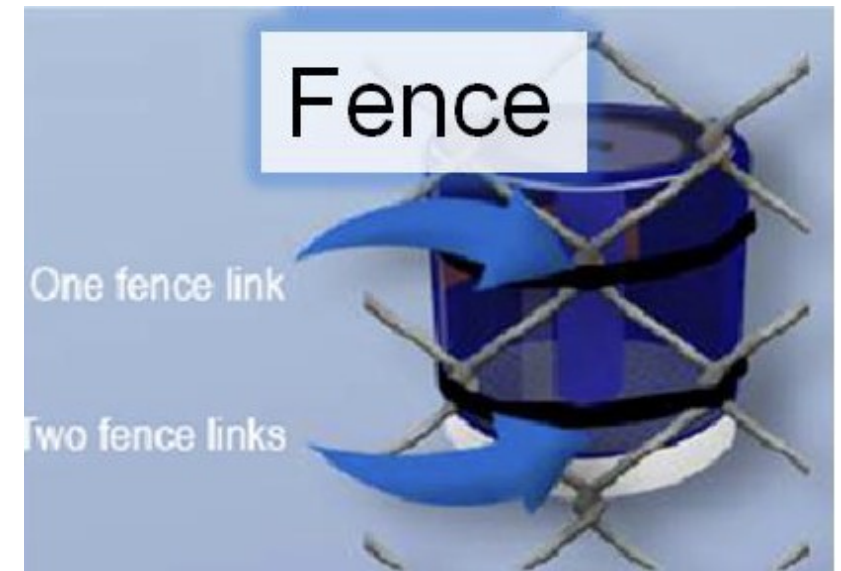
- The first shipment of materials will contain the following parts:
- 4 brackets (6" galvanized zinc)
- 12 screws (1" deck screws with Phillips head)
- 12 washers
- 8 cable ties (21" nylon)





Mounting Bracket Installation

- Before the first deployment: brackets will need to be installed in a location that allows for free-flowing air.
- Other mounting structures may be used as needed, as long as air flow is not obstructed. Screws are preferred for mounting the bracket.
- If cable ties are used for mounting, they should be carefully inspected for signs of weathering and replaced as needed.





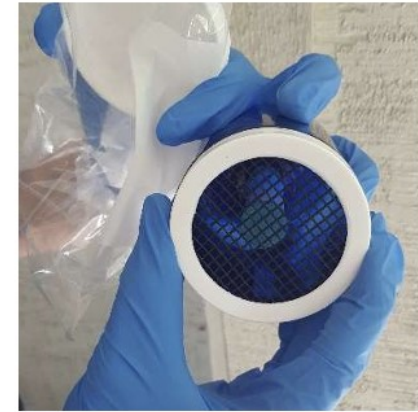
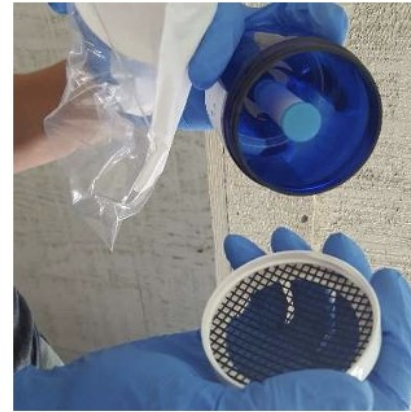
Sampling Schedule

Sample Set Number	Deployment Date	Retrieval Date	Number of Days
1	Tuesday Dec. 31, 2024	Tuesday Apr 1, 2025	91
2	Tuesday Apr 1, 2025	Tuesday Jul 1, 2025	91
3	Tuesday Jul 1, 2025	Tuesday Sep 30, 2025	91
4	Tuesday Sep 30, 2025	Tuesday Dec. 30, 2025	91



Sampling Deployment

- Don gloves and remove the sampler from its bag. Samplers labelled as Trip Blank must remain bagged.
- Record the start date and time on the sampler label and field form.
- Remove the tape and solid lid from the sampler. Screw on the screened lid. Make sure that the screen bends in toward the jar interior (concave). Place the solid lid back in the bag, seal it, and return the bag to the shipping box.





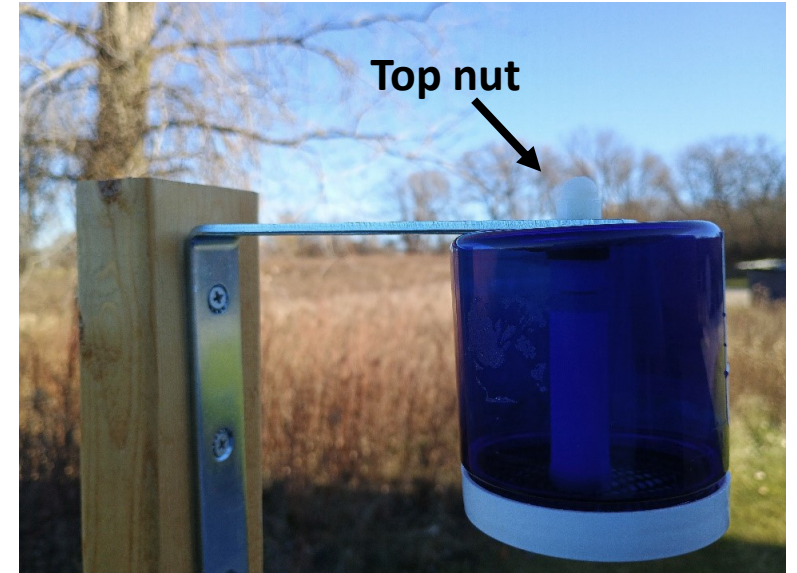
Sampling Deployment





Sampling Deployment

- Remove the top nut and insert the threaded bolt through the hole at the end of the bracket.
- Reattach the nut to secure the sampler at finger-tightness (do not use a wrench). Repeat this for all samplers (not trip blanks).
- Collect all other materials (bags, lids, forms, vinyl tape, additional gloves, trip blanks, etc) and return them to the shipping box. Transport the box to an office location and keep it until you return to retrieve the samplers





Field Form



Passive Mercury Analysis (Pilot 2025)

Send Completed Form with Each Sample Set to:
 NADP Sample Receiving
 465 Henry Mall, Madison, WI 53706

Questions? E-mail:
christa.dahman@slh.wisc.edu

1. NADP SITE Site Name: <input style="width: 100%;" type="text"/> ID: <input style="width: 40px;" type="text"/>		2. OBSERVER Collected by: <input style="width: 100%;" type="text"/> Initials: <input style="width: 40px;" type="text"/>																					
3. SAMPLE START AND END <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="text-align: center;">Date</td> <td style="text-align: center;">Time</td> </tr> <tr> <td style="text-align: center;">MO DAY YR</td> <td style="text-align: center;">0001-2400</td> </tr> <tr> <td style="text-align: center;">ON</td> <td style="text-align: center;"><input style="width: 40px;" type="text"/></td> </tr> <tr> <td style="text-align: center;">OFF</td> <td style="text-align: center;"><input style="width: 40px;" type="text"/></td> </tr> </table>		Date	Time	MO DAY YR	0001-2400	ON	<input style="width: 40px;" type="text"/>	OFF	<input style="width: 40px;" type="text"/>	4. SITE CONDITIONS <i>Please check any and all conditions that apply. Comment on any other site conditions in Block 5.</i> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="text-align: center;">YES</td> <td style="text-align: center;">NO</td> <td></td> </tr> <tr> <td style="text-align: center;">2</td> <td style="text-align: center;">1</td> <td>1. Significant smoke or fire</td> </tr> <tr> <td style="text-align: center;">2</td> <td style="text-align: center;">1</td> <td>2. Industrial or vehicular activity nearby</td> </tr> <tr> <td style="text-align: center;">2</td> <td style="text-align: center;">1</td> <td>3. Farm animal activity nearby</td> </tr> </table>		YES	NO		2	1	1. Significant smoke or fire	2	1	2. Industrial or vehicular activity nearby	2	1	3. Farm animal activity nearby
Date	Time																						
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ON	<input style="width: 40px;" type="text"/>																						
OFF	<input style="width: 40px;" type="text"/>																						
YES	NO																						
2	1	1. Significant smoke or fire																					
2	1	2. Industrial or vehicular activity nearby																					
2	1	3. Farm animal activity nearby																					
5. GENERAL REMARKS <input style="width: 100%; height: 40px;" type="text"/>																							
6. SAMPLE DESCRIPTIONS		FOR LAB USE																					
1. Sampler SN: <input style="width: 80px;" type="text"/>	Sample Type: <input type="checkbox"/> Exposed sample <input type="checkbox"/> Trip Blank <input type="checkbox"/> Other: _____	Sample-specific notes (eg, tape peeling, screen bent): <input style="width: 100%;" type="text"/>	Sample ID																				
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FOR LAB USE Lab Comments: <input style="width: 100%;" type="text"/>		Work Order ID: _____																					
<input style="width: 40px; height: 20px;" type="text"/>		HM receipt initial/date																					



Field Form

6. SAMPLE DESCRIPTIONS

1. Sampler SN:

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Sample Type:

- Exposed sample
- Trip Blank
- Other: _____

Sample-specific notes (eg, tape peeling, screen bent):

Note any unusual site conditions during retrieval

FOR LAB USE

Sample ID



Sample Retrieval

- Return to the site with the box from the previous deployment and the new box for the next deployment.
- Don gloves and remove the sampler from the bracket. Return the nut to the bolt on the top of the sampler.
- Remove the screened lid and replace it with the solid lid.
- Wrap the solid lid with white nylon tape, completing two full revolutions around the jar and lid.
- Place the sealed sampler and screened lid back in the ziptop bag and seal it. Put the bagged samples into the shipping box. Repeat for all deployed samplers.



Trip Blanks

- For the Trip Blanks, remove the sampler from the bag and remove the tape but do not remove the lid.
- Replace the tape with the supplied roll of white nylon tape, completing two full revolutions around the jar and lid. Return the trip blank to the bag, seal it, and place it in the return box.
- Complete the field form with all relevant information.





Shipping Procedures

- Verify that all necessary materials have been returned to the shipping box:
 - 4 deployed samplers
 - 2 trip blank samplers
 - Field form
- Affix the pre-paid shipping label included to the outside of the shipping box containing the samplers that were collected.
- Seal the shipping box, and ship it to the lab for analysis. The shipping address is:

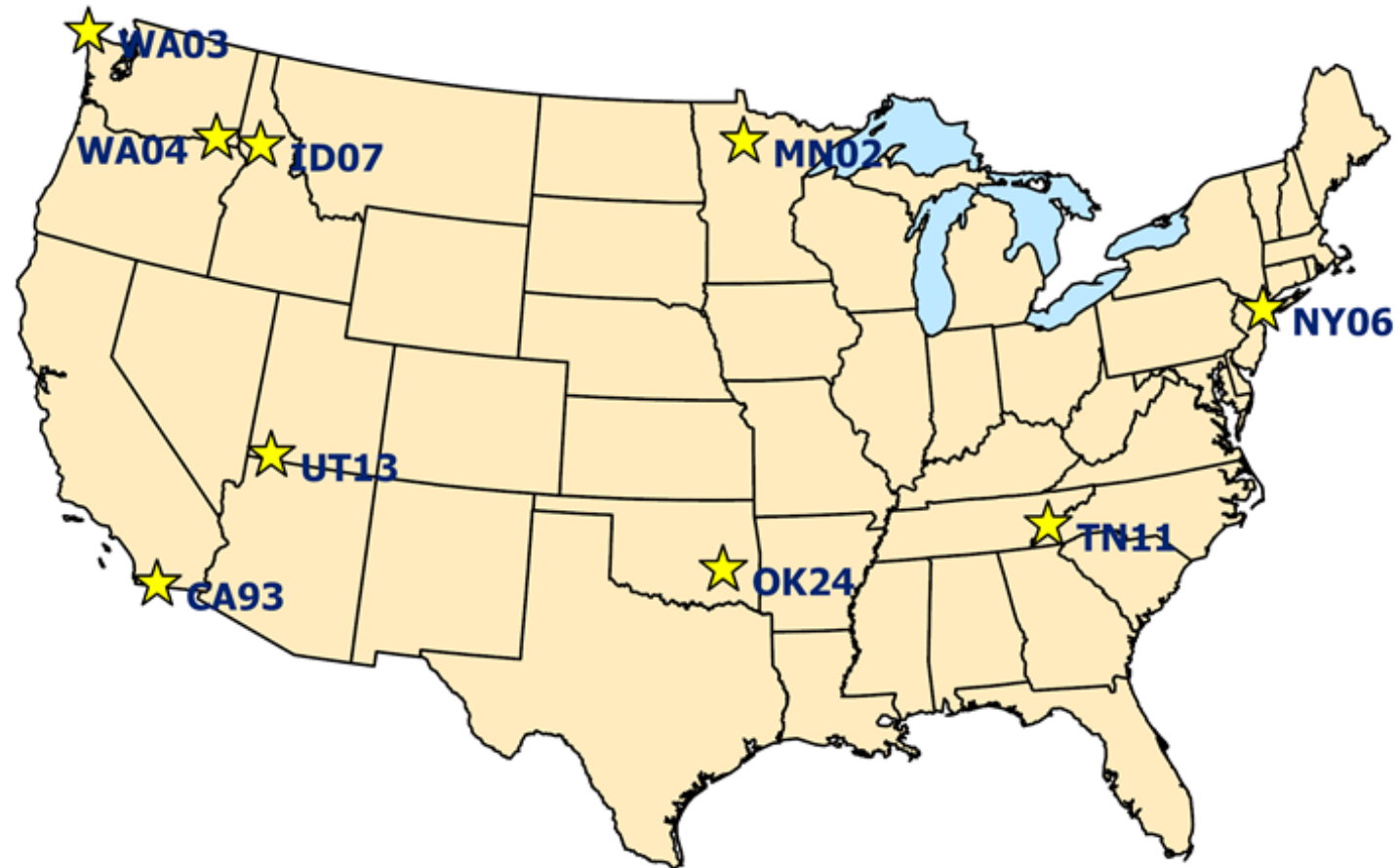
NADP Analytical Laboratory
465 Henry Mall
Madison, WI 53706





Pilot Sites

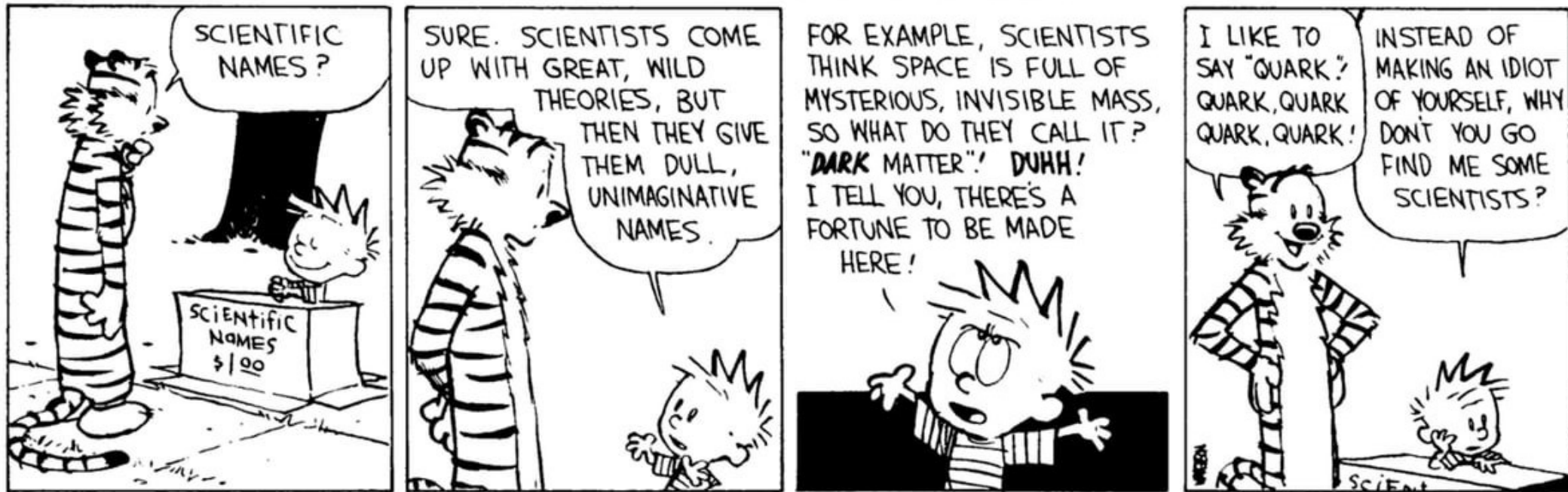
Pilot 2025 – Passive Mercury Network





Network Name?

- Suggestions?





Site Support

- Website: <https://nadp.slh.wisc.edu/hg-passive-pilot-network/>
- Tekran: <https://www.tekran.com/files/MerPAS-Instruction-Sheet.pdf>

Questions:

- related to MerPAS should be directed to Christa Dahman, christa.dahman@slh.wisc.edu, 608-224-4320
- Other questions call 1-800-952-7353 or email rtanabe@wisc.edu.



Questions?

Refer to the website for more information on:

- Joining the pilot Passive Mercury network
- Method Development
- Background on establishing a new NADP network
- References
- <https://nadp.slh.wisc.edu/hg-passive-pilot-network/>