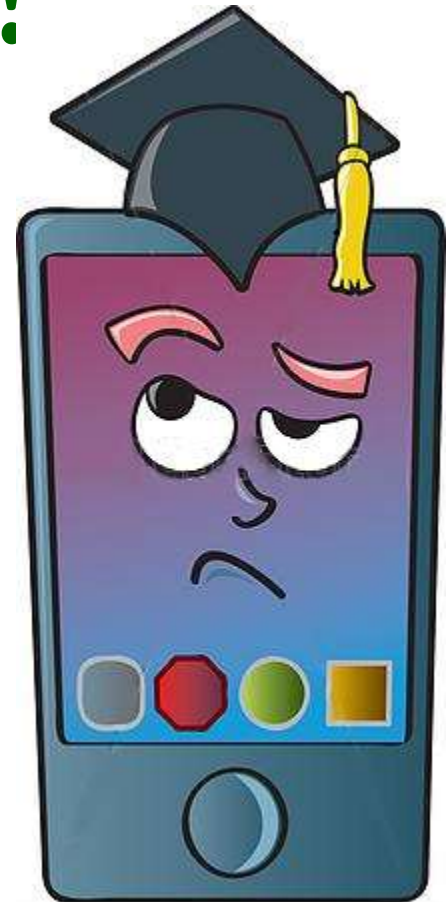


Make your lab like your phone...SMART!



Rick Mealy
George Bowman

Wisconsin DNR
Laboratory Certification



Disclaimer

Any reference to product or company names does not constitute endorsement by the Department of Natural Resources.



Get off the wheel!

- Are you still stuck on the same hamster wheel generating reams of data from samples that are not required and data for which you have no time to review?



...so why not run a...

smart  lab



Work smarter...not harder!



You cannot make this stuff up!

- \$6M Plant upgrade includes \$10K for new lab equipment. In a cost savings measure, the \$10K gets cut. 0.17% of the budget!



- Plant/lab renovation calls for installing a \$10,000 premium water purification system that is over-engineered for the facility. Yet the facility uses a \$650 hand-held colorimeter and needs to meet Phosphorus limits. Oh...and there are no hoods or slot vents!

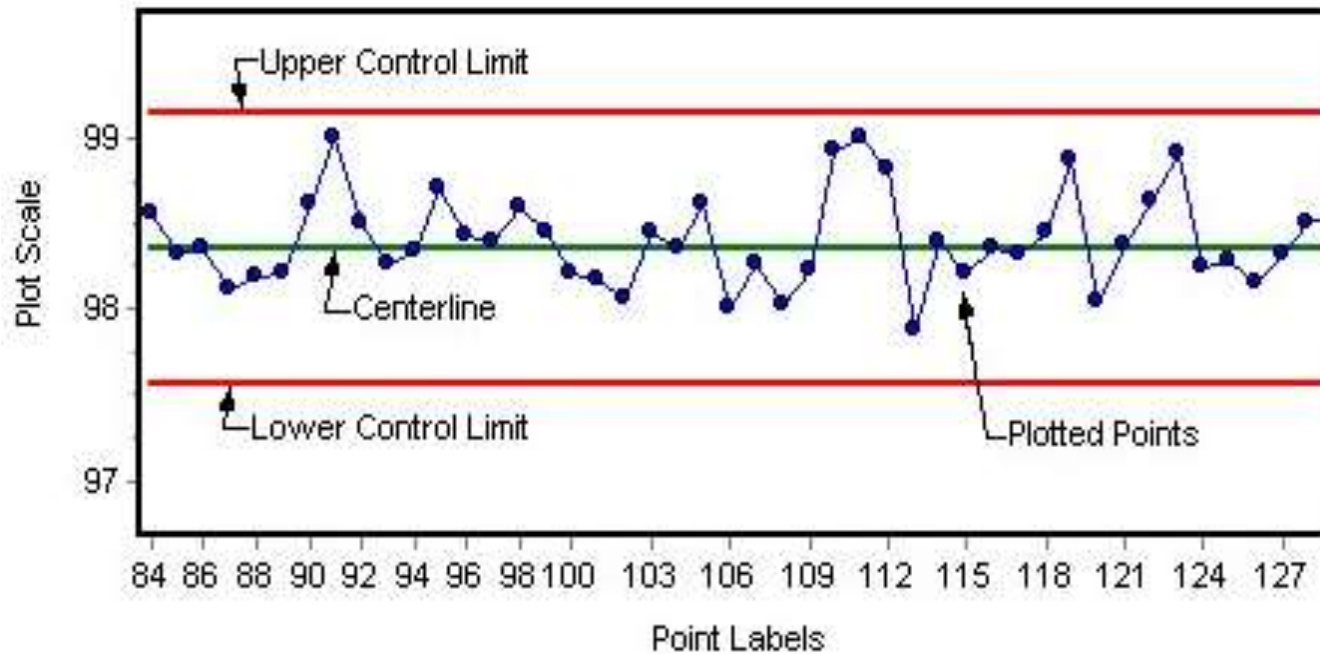
Why should you care?

- Efficiencies impact the bottom line...**\$\$\$**
- Spend budget **\$** on better things
- Saving time allows a lab to bring on additional valuable process control (and potential compliance) testing that there's just no time for now:
 - Volatile acids
 - Total Nitrogen
 - Chlorides
 - COD
 - ????

Are you generating QC
samples but not really
using them?



Control charts are SO 1980!



Yes...there is some value to Control Charts. But if you simply go through the paces to make them...but don't really use them...you are wasting time that could be better spent elsewhere.



And your matrix spikes and duplicates are too!

- You must analyze matrix spikes and replicates (or MS/MSD) **if** the methods require them.
- But if they don't... DON'T DO THEM!
- While MS and DUP can give us information about a matrix, we are most interested in how your lab does when no matrix can be blamed. That is the LCS's role.



- **Bottom line:** Do NOT analyze extra QC have the time and energy to address is by them (we can and WILL cite you!).

Make this switch...
yesterday!



Buy an LDO probe for BOD

- The technology is solid.
- No muss, no fuss.
- Improves reliability & consistency.
- Trouble-free, simple annual maintenance.
- You can make the switch without having to apply for it!
- **Cost of membranes & electrolytes \approx \$150/yr vs. \$100/yr to replace LDO sensor.**
- **That doesn't factor in labor cost.**
- **Once you change the LDO sensor it's ready to go.**
- **Must wait overnight when change membrane**



Make this switch...
soon!



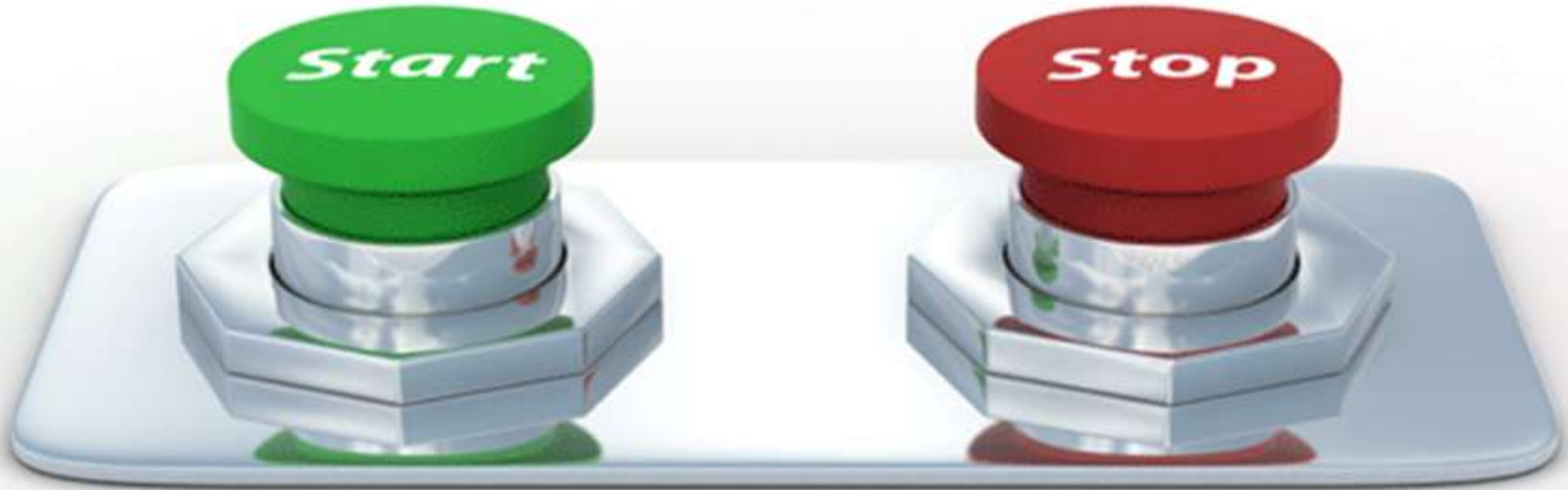
NH₃: Make the switch

- Consider switching to the colorimetric ammonia (TNT method). This method reduces labor by about 40% over the ISE method.



- Note: only suitable for domestic WW effluent unless the lab plans to distill.

NH₃: Make the switch



**Doing NH₃ by
colorimetry**

Doing NH₃ by ISE

...and if you are already accredited for the colorimetry technology (Total P) you will save \$\$ too.

BUT...don't forget that you MUST submit an application before switching and doing testing.

Unnecessary labor costs are quietly killing you.



Buy reagents...don't make them!



BOD STANDARD 198 ppm

Available in 50 ml bottles of solution, prepared and autoclaved to Standard Methods specifications. Each bottle contains enough standard for 7-8 tests. Use 6 ml right out of the bottle per 300 ml BOD bottle. Replace cap and refrigerate the remainder for future use. Shelf-life is one year.



Sterile GGA vials, 6 mL ea.



Reagent cost alone ~ \$60/yr

Pkg of 12 = \$45.00

~\$45/year max.

Pkg of 20 = \$41.05

~\$100/year max.

It only costs an additional ~\$40/year for sterile pre-made 1-use GGA ampules

What's the cost (in materials & labor) of making up your own standards/reagents?

- Expiration date of dry reagents? (Need to re-purchase)
- Dry & desiccate reagents (and document that you did!)
- Weigh them out
- Prepare in solution
- How & when will you know the solution is valid?
- GGA should further be autoclaved
- Reagent tracking
- Solution expiration?
- **Rinse & repeat**

Can you do all that for under \$40/year?

How do we feel about buying prepared reagents and standards?



Do you make one
cookie at a time?

No...you make a batch!



Batch samples for nutrients

- Acid preserve samples for ammonia and total P.
- The holding time is 28 d.
- Run daily ORTHO P instead.
- O-PO₄ tracks really well with Total P for a given plant and is quick & easy.



...but do NOT “pre-dose” bottles with sulfuric acid. Powerful oxidant will actually char bottles.



Batching samples decreases the number of QC samples you analyze, which cuts both your time and the chances of failing QC 😊

Daily Analysis vs. Weekly/Monthly Batching (5 smpl/wk)

DAILY

20 CCV

20 Blanks

20 samples

40 QC

200% QC

Time to
prepare/analyze
60 samples

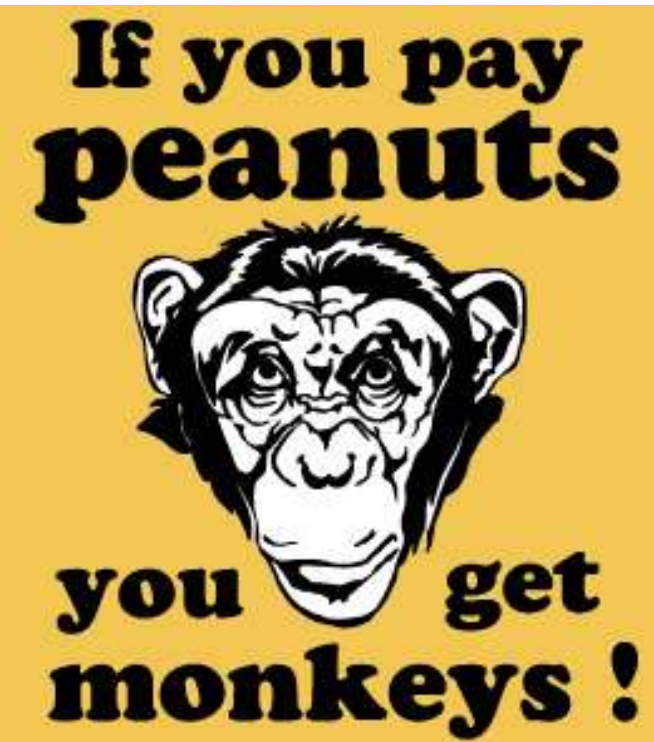
- Use Test N Tube... but for best sensitivity use a single cuvette.
- If use Test n Tube, must neutralize pH before analysis.
- Streamline pH neutralization by adding an exact amount of acid of a known normality and equivalent (slightly less) volume /normality of NaOH.
- DO NOT use pH meter (phosphorus in pH buffers)! Use narrow range pH paper!
- Mechanical pipets are a necessity to make this work (1.5 mLs NaOH...how do you do that without them).

Is daily NH₃ REALLY needed?

Many facilities test for ammonia daily although the data is not critical for immediate process control.

Ask your Superintendent if s/he is actually using the data. If not, why not suggest doing the testing weekly or every two weeks. Don't be afraid to ask questions.

You get what you pay for...
so don't cheap out on a
spectrophotometer



You get what you pay for!



Cute just

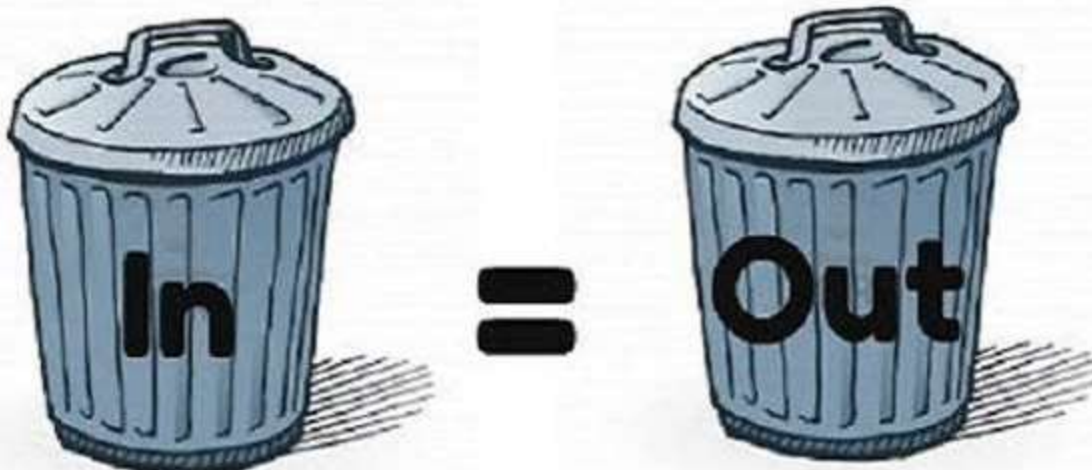


doesn't
That moment when you
realize a minion has worn
a thong

WTF!

Specs: Garbage In = Garbage Out

- Invest in a good spectrophotometer:
- one that **allows for inputting user defined calibration curves.**
- **Consider connecting a printer or laptop** so all raw data can be uploaded directly or printed. This helps reduce the risk of transcription or transposition errors.

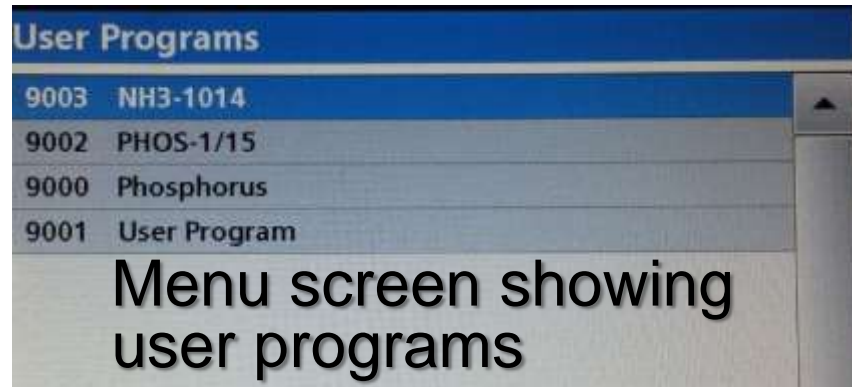


Spectrophotometers

- Older instruments lack the sensitivity and linear range.
- **Sensitivity** is of greatest concern for **phosphorus** with new LOD requirements, but the colorimetric method for **ammonia** results in a fairly intense colored sample that requires **enhanced photometric linear range**.
- New generation instruments have a photometric range of close to 3 absorbance units

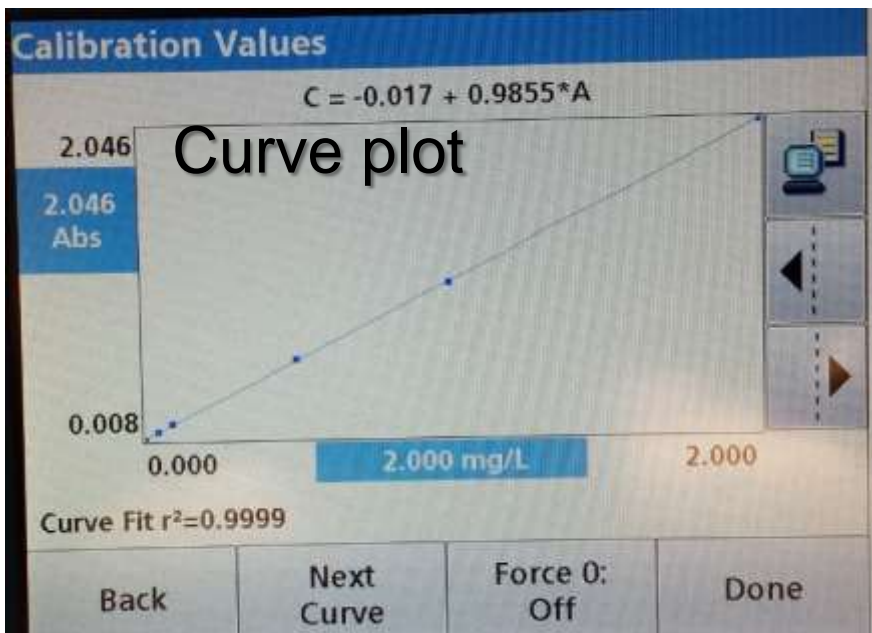
Traceability of a good spec.

- It's easy to create and enter data for user programs!



Food for thought:

If Bowman can do it....



Concentrations with absorbance

mg/L	Abs
0.0000	0.008
0.0500	0.070
0.1000	0.120
0.5000	0.537
1.0000	1.027
2.0000	2.046

Cancel mg/L Abs Next

Stop the madness

Channeling your inner Mel?



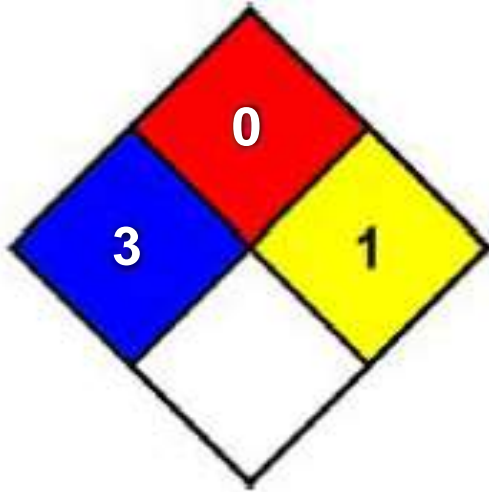
Overkill...Stop the Madness

Whether it's Hydrochloric acid or Bleach

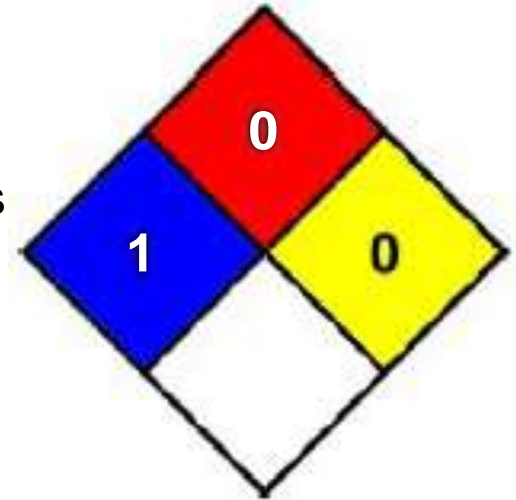
10%

vs.

1%



NFPA health hazard: 3 –
Short exposure could cause serious temporary or residual injury even though prompt medical attention was given.



10% is overkill, people!

- 1% bleach will kill bugs just as effectively as 10%, without the risk.
- 1% HCl will solubilize phosphate just fine.
- 10% HCl is not going to remove dried on “crud”.

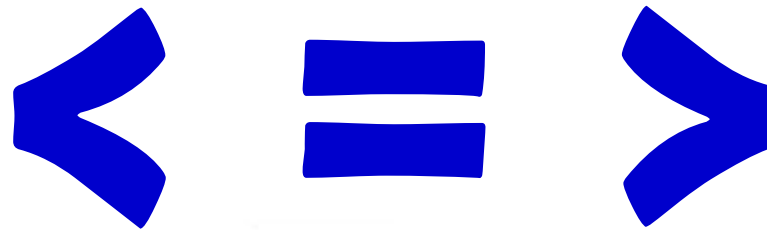
10% HCl or bleach is a health hazard

A picture tells 1000 words...



- Yup...it's in the air.
- And that's the same air you breathe.
- Corrosion effects observed in the lab are quietly working on your lungs too.

Less is more when it comes to bleach and HCl



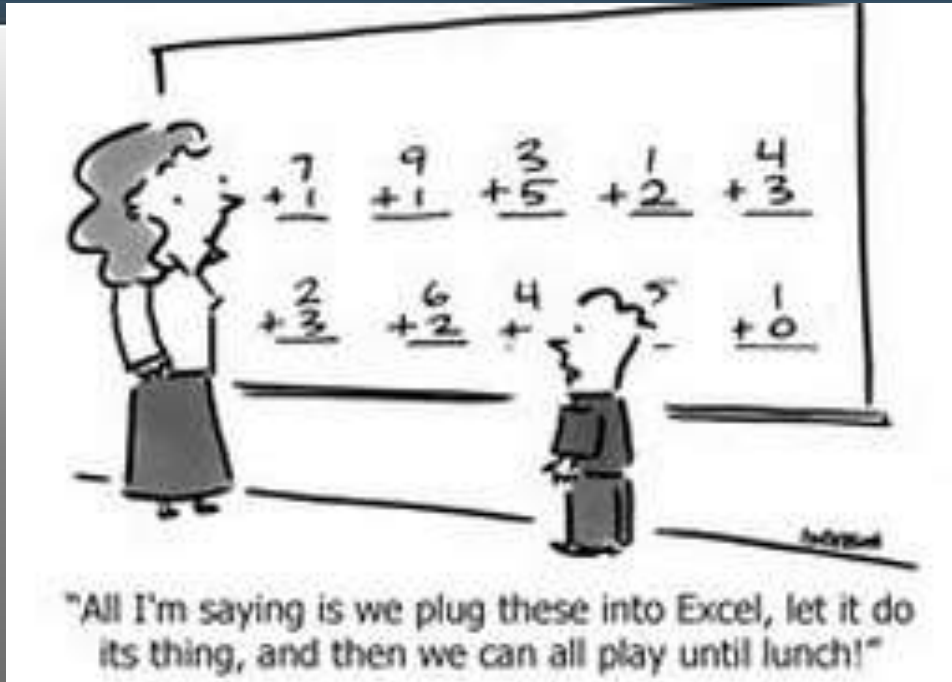
DO NOT wash BOD bottles with HCl alone.

- HCl is nice as an acid, but it's simply NOT going to clean any “yuck” ..especially oil&grease off your bottles....at least not by itself.
- And Step 1 is to avoid “yuck” drying on the bottles...so rinse with hot tap water right after use.
- There is NO substitute for a good quality lab grade non-phosphate detergent and **LIGHT** scrubbing with a bottle brush.
- Always triple rinse with lab reagent water and dry inverted.

Careful with that axe, Eugene

- ...and careful with rinsing glassware with tapwater, too!
- Do you do phosphorus testing?
- If so, does your city add phosphate (in some form) to sequester iron and manganese?
- Then understand that rinsing with tapwater can undo everything you did with an acid wash.



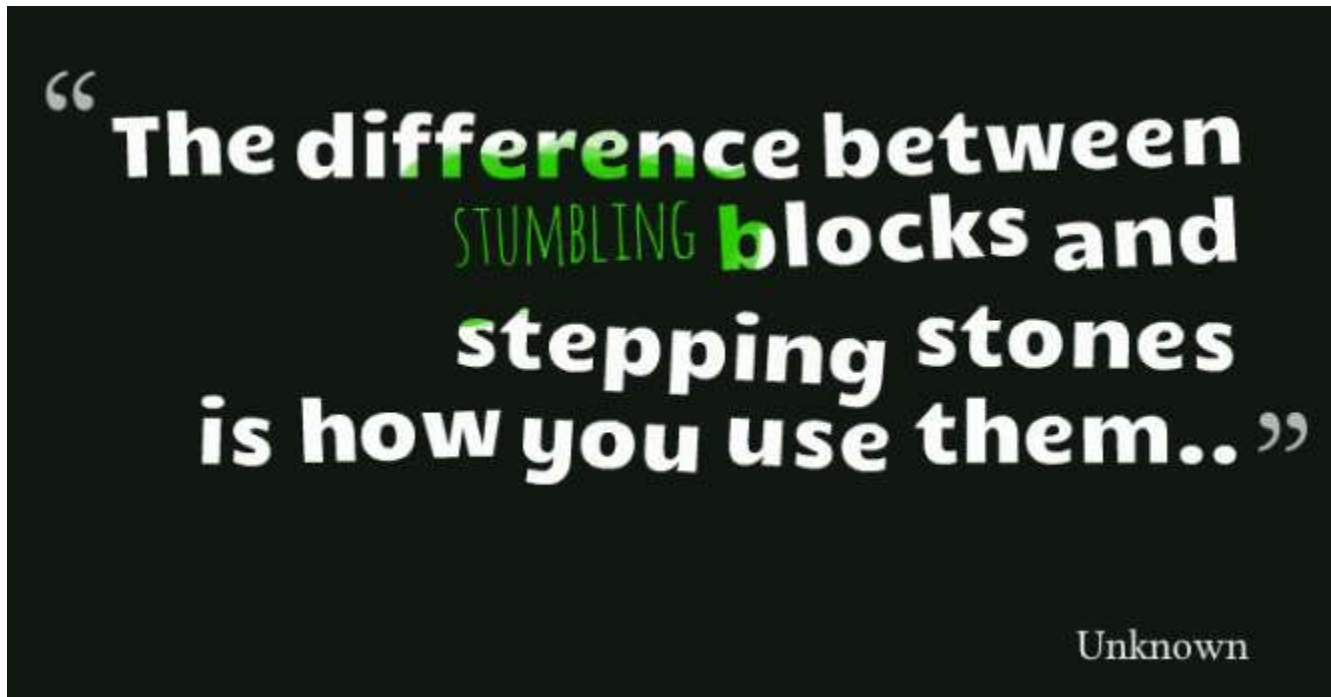


Leave calculations to Excel!



Use forms/auto-calc benchsheets

- Use forms when possible. This **promotes consistency** among all analysts...



- ...and no, consistency is NOT the stumbling block of small minds, Mealy!

Choosing wisely



👉 or 👈



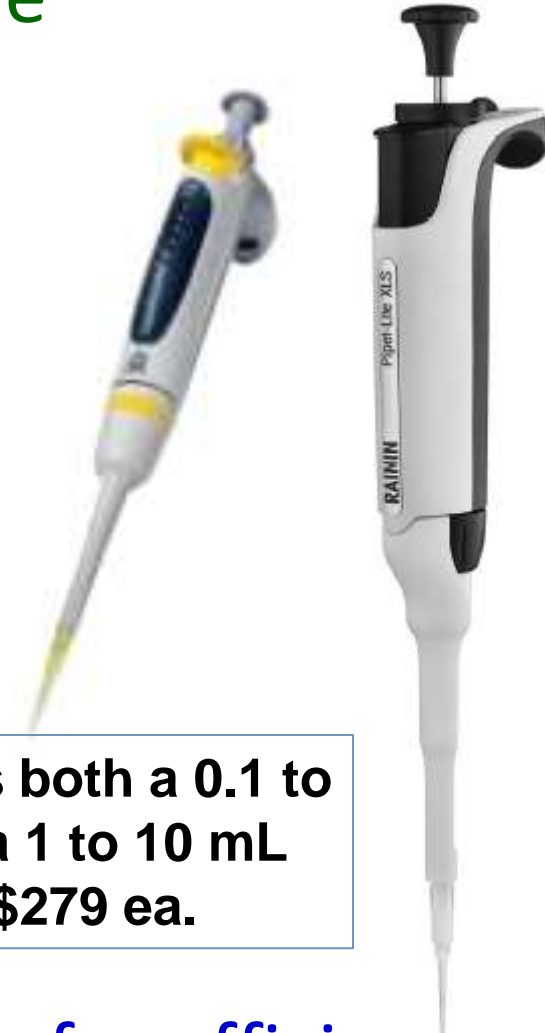
👉 or 👈



The wise choice is mechanical pipets

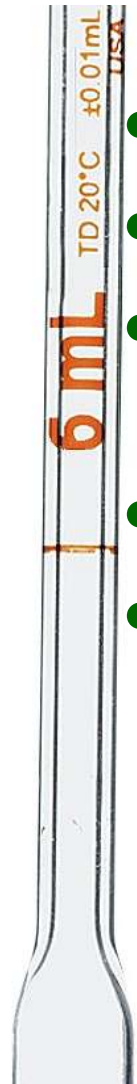
Single-channel

- A 0.1-1 mL and 1-10 mL adjustable pipet are all most labs need.
- No pipet washing.
- Quick and easy to use.
- Single use pipet tips eliminates contamination
- \$350-400 each.
- Making standards is a breeze.



NCL offers both a 0.1 to 1 mL and a 1 to 10 mL model for \$279 ea.

- **Bottom line:** a small price to pay for efficiency, accuracy and precision.



- These are NOT what we mean by mechanical pipettes



- We have noticed variable volume mechanical pipettes lying horizontally on a bench with acid in the tip and the barrel badly discolored from the acid.
- Clean them, replace any damaged parts in the pipette (i.e., o-rings, possibly spring), check the accuracy and then put them back into service.
- Grease o-rings regularly (*there's a reason why the grease is provided*)...and stopcock grease won't cut it!!!
- There are a number of very good quality pipettes out there. Gilson, Rainin, Eppendorf. NCL's "Transferpette" is widely used.

Use mechanical pipets properly!

- Purchase a mechanical pipette stand to store the pipettes when not in use.
- Never lay mechanical pipettes on their side with a tip installed after being used.
- If a tip is going to be kept on the pipette for repeated use, it should be stored in a vertical position on a stand to prevent damage to the mechanism
- Treat them like you would treat your precision tools or a deer rifle--because they ARE precision instruments!!!!



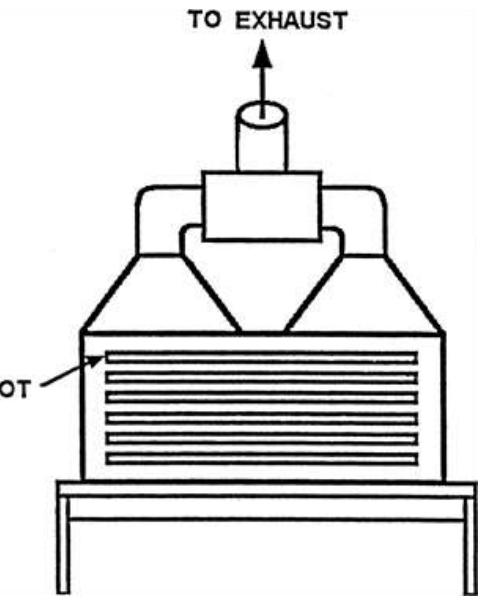
...and while we're on the subject

- We still see labs using 2 to 3 pipets to get a single desired sample volume.
- One lab prepares a 60 mL dilution for their effluent.
- They get this by pipetting 50 mL using a wide-tip volumetric and a 10 mL wide-tip volumetric pipet.
- Error is additive!
- 2 pipets = 2x error.



REALLY???

Get a hood, not a hoodie



This should be the only
mercury in your lab



No more mercury!!!!!!

We still see
oven through
Laboratori
discard the

No time s
thermom
significant
broken.



Mercury?
Accident waiting
to happen

the TSS
ven.
eters and
o Program.

Mercury
e a
ntly



Keep your filters
grounded.



Use aluminum weigh dishes for TSS

- Drying filters alone in the oven is a bad idea.
- You can imprint a number on the tab using a ball point pen. The pen will leave an indentation of the number.
- This is a very easy way to keep track of your samples.
- You would then include the dish number on your TSS bench sheet in addition to the sample ID.



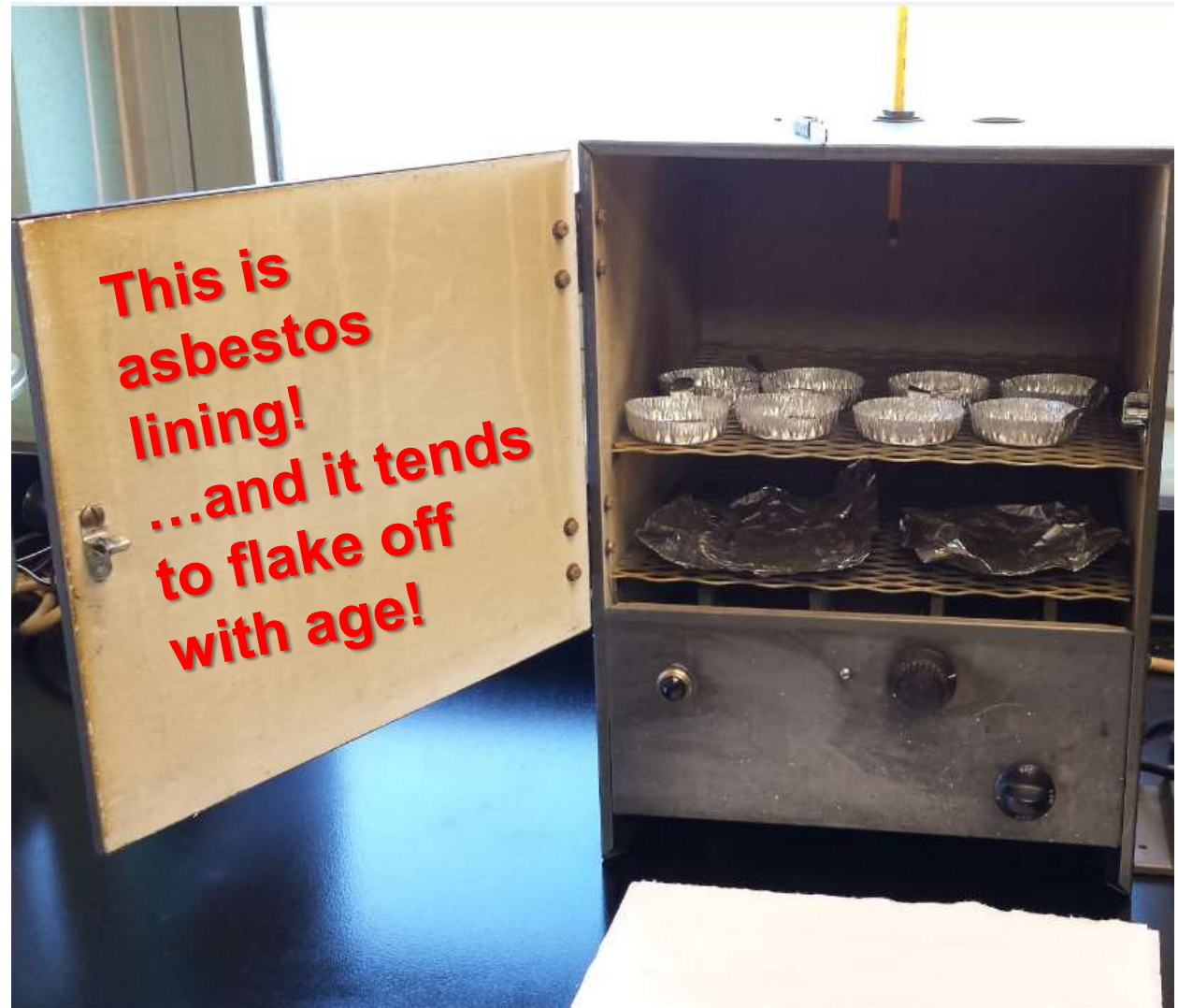


Rapid Fire Time



Get rid of old asbestos-lined ovens!

- Pure, unadulterated health hazard.
- A lawsuit waiting to happen.



- **Let the dead presidents see the light of day!**



- **Pay small now...or BIG later!**

Use Pre-printed labels!



Courtesy of Watertown WWTP and Heart of the Valley WWTP

Get better organized

A simple approach to help remind folks when tasks need to be done.

Higher-tech approach is to do the same thing but with Outlook and a computer or your smart phone calendar.



Watertown Wastewater Laboratory Monthly Checklist

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Notes
Maintenance													
1) Change DO membrane - YSI 5100	1/2	New optical DO meter										1/2	membrane changes not necessary
2) Change NH3 Probe Membrane	1/2	2/19	3/16	4/13									Change #1
3) Change NH3 Probe Membrane	1/29	X	X										Change #2
4) Monthly Balance Check	1/19	2/19	3/16	4/19									
5) Prepare Outsourced Sampling	1/28	NA	NA	4/13									For Following Month ^{MS} Quarterly
6) Dishwash Sample Bottles	1/26	2/19	3/16	4/19									
7) Citranox Soak Pipets	1/29	2/20	3/30	4/15									
8) pH Confirmation Preserved	1/8	2/18	3/18	4/15									pH < 2
9) Bench Sheet Books	1/29	2/20	3/30										
10) eDMR Data Entry	2/9	3/5	4/6										Due by 21st of Next Month
11)													
12) <i>Sampler Jugs as needed</i>				4/8									
As Needed													
1) Bleach + Top Dressing Counters													Not Required by Code

Comments and Supplemental Notes

** started using the new optical DO meter on 1-16-15 after doing side by side comparison to identical Amf*

Summary

- We've offered at least 17 suggestions in our 50 minutes allotted time.
- Each suggestion will either save your health or save you time and \$.
- If you've already incorporated all or most of these, give yourself a pat on the back.
- The rest of you? **What are you waiting for?**

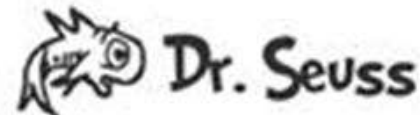


The trouble is,
you think you
have time.

-Buddha

Parting thoughts

You have brains in your head.
You have feet in your shoes.
You can steer yourself
any direction you choose.
You're on your own.
And you know what you know.
And YOU are the one
who'll decide where to go...





consider a micro-distillation system.

- About \$6,000
- Another timesaver.
- Most labs only have one set-up for the manual distillation.

Lachat system uses the gas permeable membrane approach, which is even easier than the traditional micro distillation approach.

