

HOW TO CONDUCT A WASTE (OR PROTOCOL) AUDIT

WHAT ARE WASTE AUDITS?

- [WASTE AUDITS](#): allow labs to record what is in waste bins, recycle bins, solvent waste containers etc. and determine the volume of waste being correctly sorted
- [PROTOCOL AUDITS](#): record what is wasted after a protocol or kit and determine if there are ways to reduce the waste produced, miniaturize your experiments, or recycle/recover/replace reagents
 - For example: a lab mixes reagents for a PCR and found that they could aspirate water THEN master mix, so they could reuse the same tip (which halves tip usage for this prep!)
 - Labs can also reuse conical tubes for reagents, or repeater pipette tips for aliquoting reagents

WHY CONDUCT A WASTE AUDIT?

- Understand volume of waste being produced in your lab and determine priorities, or create goals and strategies for waste diversion
- Can be useful to show your lab if they are properly recycling, and determine why things are not being recycled
 - [MIT study shows the importance and impact of proper waste management](#)
- Allows labs to adopt new signage, different sized bins, etc. to help make it easy and simple to recycle properly
 - Note: If recycling bins are too contaminated with non-recyclables, custodians just toss it!
- Change how we purchase
 - Allows labs to contact suppliers and ask for alternatives with less waste, or that are more recyclable eco-friendly, or alternatives with longer shelf lives (if you notice your lab is getting rid of lots of expired reagents)
- Reduce packaging and shipping
 - Consolidate orders/suppliers within the lab or between labs
 - Purchase in bulk
 - Right-size purchases
 - Reuse packaging like coolers
- Collaborate with other labs or universities to see if they have alternatives that create less waste, share our best practice tips, and update protocols as we publish (for example, update on protocols.io with the “green” versions of the protocols, and include tips and tricks to make the protocol sustainable)
 - Research and find alternatives (for example: [replacing single-use plastics with glassware](#))
 - Determine if protocols can be miniaturized (for example: for bacterial transformations instead of using the entire 50 uL tube for 1 transformation, divvy up the sample into 5 tubes and transform 5 instead, then use the [drop-plate](#) or [drop-track](#) method to reduce agar and plastic requirements when plating so you can plate all 5 transformations on a single plate)
 - Determine if experiments need to be done, or if you can use existing datasets instead
- Recycling, replacing, or recovering waste where possible (some examples and links below)
 - Solvents: [solvent waste recovery](#), [solvent reuse](#), [solvent repurpose](#), or [solvent replacement](#)
 - Gloves or plastics recycling: [Kimberly Clark](#), [PolyCarbin](#), [Terracycle](#), and [Medline](#)
 - Packaging recycling: [Corning](#) offers flexible package recycling programs from their packaging, [NEB](#) and [Sigma-Aldrich](#) offer Styrofoam recycling.

OTHER RESOURCES OR TIPS?

- See our [“How to Conduct a Waste Audit”](#) checklist below and our [Waste Audit Template Form](#), check out our [slide deck](#) with example protocol audits, and make sure to:
 - Inform custodians of the audit date(s)
 - Don't tell your lab the date(s) of the audit, as this may change their behaviours
 - Tell the lab the results during lab meeting updates / do quality control checks after the audit
 - Have your checklist or forms ready:
 - [Caltech Green Labs Waste Audit Form](#) (there are many options available if you don't want to use ours, including this [Waste audit template form](#), or this [Example checklist](#))
- Work with members to offer recommendations
 - Some good resources we found include: [University of Bristol Plastics Guidance](#), Article – [Reducing Plastics in an Microbiology Lab](#), Article – [UCLA Lab Waste Survey](#)

HOW TO CONDUCT A WASTE AUDIT

<p>STEP 1:</p> <p>ORGANIZE YOUR TEAM</p>	<p>a. Gather trusted and trained personnel for the audit. You can opt for a cross-functional team, with students, post-docs, and/or staff members. This way you will have specialists to provide input throughout the process and brainstorm effective solutions together. You will also stay on top of any safety hazards, wasteful expenditures, incorrect waste disposal practices, and can determine the best solutions for each issue together.</p> <p>b. Decide which bins (recycling, trash, hazardous waste, etc.) and rooms you would like to audit.</p>
<p>STEP 2:</p> <p>SET A DATE</p>	<p>a. Set a suitable date that fits everyone's schedule. Also determine how long your audit will be conducted over (1 day, 3 days, 1 week, etc.) and inform custodians of these plans so they don't accidentally deal with your waste during the audit.</p> <p>b. Ideally you should not inform other lab members of this audit beforehand, as their behaviours will change and provide you inaccurate data.</p> <p>c. Ensure that no special events or protocols are planned for that week so waste assessments are not impacted by these issues.</p>
<p>STEP 3:</p> <p>GATHER PPE AND OTHER EQUIPMENT, AND SORT YOUR TRASH</p>	<p>a. Find an open area to sort the waste, document, and analyze.</p> <p>b. Have extra PPE (may include gloves, face masks, rubber gloves, lab coats, etc. depending on the waste types)</p> <p>c. Tongs to handle waste materials</p> <p>d. Containers to store the waste (we recommend bags or reusable storage containers)</p> <p>e. Labels, boxes, permanent markers</p> <p>f. Spreadsheets, checklists, and clipboards or computers to record the data</p> <p>g. Camera to document the process and results</p> <p>h. Weighing scales</p> <p>i. Garbage bags or bins to re-bag the waste afterward</p> <p>j. Be sure to sort the waste materials carefully, label all types of waste and the locations they came from, and record their weights on a spreadsheet</p> <p style="padding-left: 20px;">i. You may also want to take notes on what materials are able to be recycled or reused, and check if hazardous, sharps, or other prohibited items are being incorrectly disposed of.</p>
<p>STEP 4:</p> <p>ANALYZE DATA TO DETERMINE CURRENT DIVERSION RATE</p>	<p>a. If you are using the spreadsheet with this walkthrough, it will be tabulated for you as you fill in the fillable sections of the second tab. Otherwise, all you have to do is divide the weight of incorrectly sorted materials from the whole, and multiply by 100%.</p> <p>b. Determine which locations generate the highest amount of waste, what kinds of items are being produced, and options to reduce waste production.</p> <p>c. You can also gain important data by interviewing lab members.</p> <p>d. Set up recycling goals and announce this to your team.</p> <p>e. Share the results of your audit. Discuss with your entire lab the results and suggest possible new plans that could be put into place. The new recycling schemes won't work unless you have support from your lab members, and they may have valuable feedback or suggestions you haven't thought of!</p> <p style="padding-left: 20px;">i. Suggestions could include making a recycling program for specific items, updating signage, or making a list of acceptable items for each location.</p> <p style="padding-left: 20px;">ii. Dedicate time and resources to ensure that the percent of recyclable or reusable materials increases.</p> <p>f. Calculate the costs of things that are thrown away (for example: expired reagents – you can also examine purchasing schedule for these reagents, and ask for proof of expiry from vendors, if a reagent is expiring too soon, ask to return the item and send one with a longer shelf-life)</p>
<p>STEP 5:</p> <p>USE DATA TO MAKE INFORMED WASTE DISPOSAL DECISIONS</p>	<p>a. Regular waste audits are important for continued success. Your lab personnel can change quickly, and so can the needs of your group. As such, we recommend conducting a waste audit at least once a year, but more often if you are able.</p> <p>b. Introduce inventory systems to prevent over-purchasing??</p> <p>c. Work with members to offer recommendations (see above for some articles we found useful)</p>