University Health and Safety

Fact Sheet

Laboratory Water Leak Prevention

Water coming through lab ceiling

Wet boxes from flood on floor.

Water damage can be costly and cause serious damage to the building, disrupt operations, and cause personal injury. Water leaks often result from water escaping burst hoses or failed connections on reflux condensers, solvent stills, laser instruments, rotovaps, etc. (Images of water damage at right- condensation on ceiling top and wet boxes below.)

Floods in laboratories are usually caused by building water that was intentionally left running. Before leaving water running unattended, review the guidelines below.

1. Review Unattended Operations fact sheet. Verify your procedure is appropriate for leaving unattended. Follow best practices for leaving experiments running safely while unattended. e.g. Post signage which communicates essential safety information when you're not there.

2. Use alternatives to the continuous flow of building water. In general, **Do not leave building water running unattended!**[1] Alternatives will conserve water in addition to reducing the risk for a large water event.
    - For condenser reactions use water recirculation pumps to limit the potential volume of water that could leak.
    - For vacuum sources use house vacuum or a laboratory vacuum pump instead of a water aspirator.

3. Check all equipment water will flow through.
    - Check integrity of hoses
    - Inspect ALL hose connections. Verify presence of a connector and its condition
    - Inspect sinks and faucets before you leave the laboratory. Check that the faucet is tightly turned off and that the drain is free from obstructions

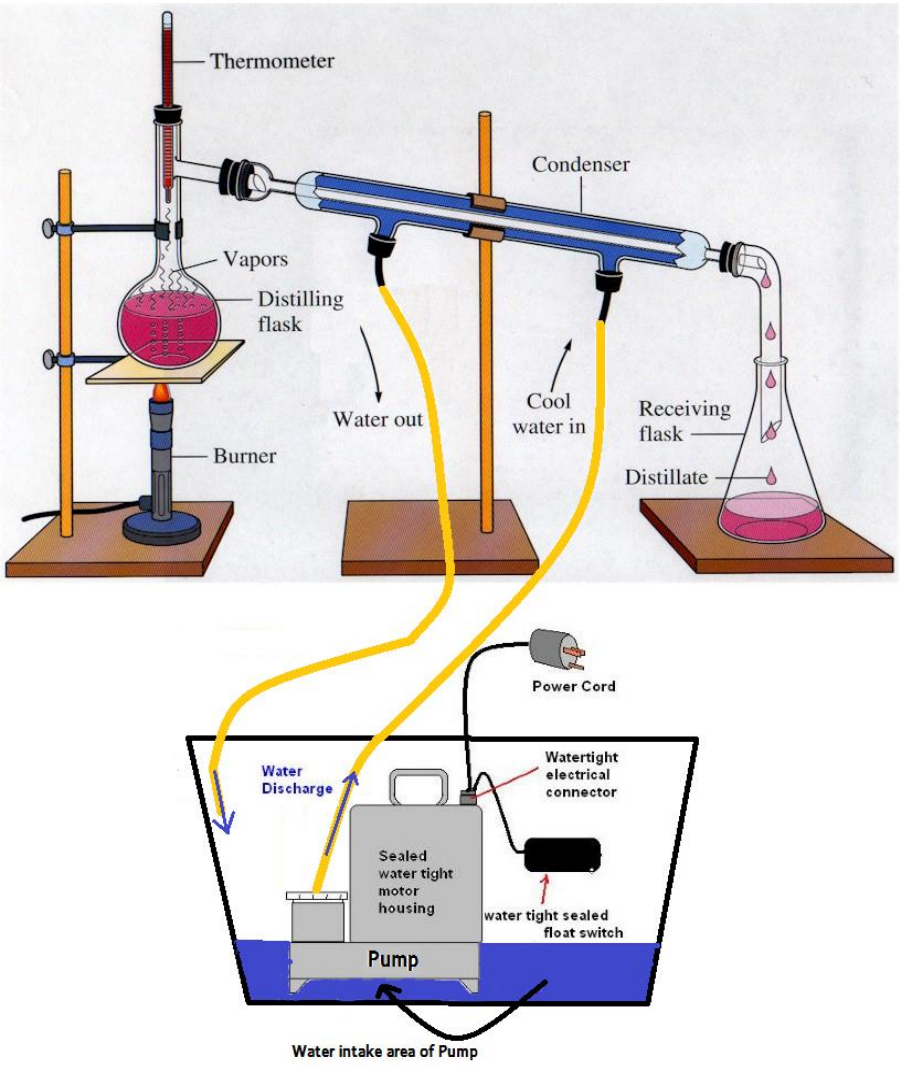
[1] Contact your Department Safety Officer or Research Safety Specialist if your procedure has no alternative to an unattended continuous flow of building water.

Alternatives to the continuous flow of building water.

- For condenser reactions, use water recirculation pumps to limit the potential volume of water that could leak.
- For vacuum sources use house vacuum or a laboratory vacuum pump instead of a water aspirator.

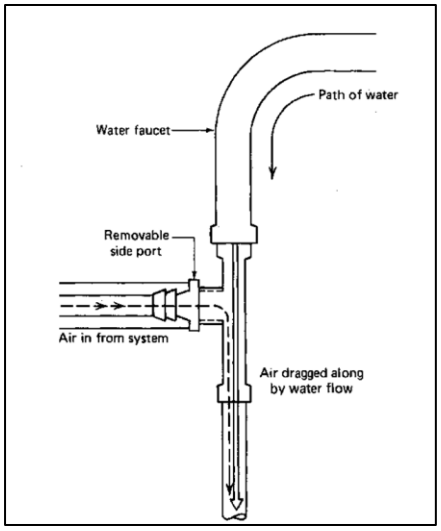
Setting up recirculating water for condenser reactions

Recirculating chiller units are available through scientific supply companies. Another option is a water recirculation pump and bucket (typically 5 gallons). The pumps and buckets are inexpensive, available in a variety of strengths and sizes and can be purchased at any home improvement store. A cooler or insulated bucket with lid, filled with ice provides more efficient cooling and reduces the maintenance needed for longer reactions.



Vacuum pump instead of Water/ Sink Aspirators

A vacuum pump (left) or house vacuum should be used instead of a flowing water aspirator (right). This includes Rotovaps, which in the past they were often connected to water aspirators.



Water aspirators are strongly discouraged[2]:

- The vacuum strength fluctuates unpredictably
- Waste water is contaminated by organic solvents carried out of your flask.
- Water can flow back into your glassware, and contaminate your materials
- They waste an excessive amount of water, which could also result in a very large flooding event. A full blast is needed to create vacuum, which is an estimated at 50,000 gallons/year.

Check all equipment water will flow through

1. Check integrity of hoses and all in-line equipment e.g. "flow meters"

Rubber and plastic hoses get brittle over time, causing them to split or crack. Before use, check condition of tube and ends for signs of wear such as cracks or splits. Plan to replace old hoses before they break. No hose material is expected to last more than 5 yrs, even without heavy use. Also check all in-line equipment for cracks or obstructions.

[2] If using a water aspirator, be sure to only use as much hose as needed to stay in the sink and not so much that the tube is inserted down the drain any more than a foot. For an anecdotal story by Derek Lowe about an aspirator which flooded a neighboring lab see the following link http://blogs.sciencemag.org/pipeline/archives/2008/08/25/how_not_to_do_it_water_aspirators

2. Inspect ALL hose connections. Verify presence of a connector and its condition.

Hose connections are a common failure point. All connectors need to be replaced periodically. Connectors may be susceptible to failure due to corrosion, fatigue, and brittleness.

O-rings are a common source of failure, they deform over-time. Inspect these before every use and replace periodically. O-rings are often found inside connectors that screw on and off an apparatus (image at right -the white connector with the red ring that screws on).

Metal ties should be USED ONLY ONCE (upper left). As repeat bending weakens them and they are also susceptible to failure from corrosion.

Zip ties can be considered more secure than metal ties because they resist corrosion but again have limited life spans (Broken zip-tie which caused a flood upper right.)

Using a metal tie together with zip-tie provides an extra fail-safe. **Do not forget to change ties when disconnecting the hose via an adapter.**

A threaded connection (middle left) is stronger and more secure than a zip-tie or metal twist. However, even threaded hose clamps can become compromised over time, rust, break and cause a flood (middle right). Note- threaded metal clamps are not tight enough for thin lines.

Check all connections on Rotovaps

Rotovaps have multiple locations where hoses can become disconnected and cause a release of water (Lower image). Inspect all of the connections and test them prior to running an experiment

3. Inspect sinks and faucets before you leave the laboratory.

Check that the faucet is tightly turned off and that the drain is free from obstructions. Keep paper towels, notebooks and equipment away from sinks/drains for an approximate radius of 2 to 3 feet. The lower left image shows a clear counter near the sink, while the right two show obstructions to the drain.