Heat Wave Guidelines for Protecting Animals, Equipment, Data and Specimens

Subject: Information on what to do during a heat wave and how to prepare your area for the next wave. (Special thanks to Cathy Booth for her leadership in this effort and to Birgit Walker, Tony DeLuca and Reese Zasio for their contributions)

In July of 2006 the Bay Area experienced a record heat wave. This heat wave resulted in a “severe” Stage Two Chilled Water Curtailment that impacted the School of Medicine research areas. During this period - four freezers, a laser, biosafety cabinet, computer and cryogenic probe failed due to high room temperatures. We all want to avoid such losses in the future. The following guidelines were utilized in the Beckman Center and were so effective that we wanted to share them with other researchers to utilize in their areas should we experience similar conditions in the future.

We welcome input from other areas – a good idea or story is always worth sharing!

Chilled Water Curtailment Stages:

Stage One – Comfort cooling will be curtailed or turned off
Stage Two – Temporary disruption to research and teaching areas or increased temperature chilled water will be supplied to all research buildings
Stage Three – Long term disruption to research, teaching and outpatient care; and chilled water temperatures will be higher than stage two
Stage Four – Long term disruption to animal holding facilities
Stage Five – Long term disruption to patient care areas

Priority List:
Take action as soon as a curtailment is announced, don’t wait for rooms to heat up.
1. Protect research animals
2. Protect –80 degree freezers from overheating and failing
3. Protect incubators from overheating and killing cell cultures
4. Protect refrigerators and freezers from overheating
5. Protect computers from heat damage
6. Protect Lasers and equipment that utilizes chilled water for cooling
7. Protect any other equipment that is sensitive to heat. – take time to review the specifications on all critical equipment

Minimizing Heat Generation:
Turn off all equipment that is not in use that can be safely turned off. This is especially important for equipment located in a room with freezers or other critical equipment. You’ll be amazed by how many things are running and haven’t been used in several hours or even weeks. Many generate incredible amounts of heat that the reduced cooling capacity may not be able to handle and which will eventually contribute to premature equipment failure.
Examples of heat producing equipment that can be turned off if not in use:
- Centrifuges: these can be quickly re-cooled for use by putting a bag of dry ice in the chamber for a few minutes. There is no need to keep the centrifuge on all the time maintaining 4 degrees centigrade.
- Refrigerators and freezers: after turning off, leave the doors open a crack to prevent condensation and mold growth. Put down towels or dishpans if the freezers have ice build-up, which will be melting.
- CO2 Incubators: leave the doors open a crack to prevent condensation from building up and collecting in the sensors. Only older sensors are susceptible to water damage but it’s difficult to know which ones they are. It’s easiest just to leave the door open for all incubators that are turned off.
- Ovens, printers, computers and water baths.
- Minimize use of glass washing machines and autoclaves.
- Copiers: utilize the power saver mode. If warm-up takes too long it may not be practical to shut down after each use.
- Discourage use of lasers, since they generate so much heat. If they are cooled by the chilled water system, they probably shouldn’t be used at all.

General Building Cooling Measures:
- Sometimes one side of the building is cooler than the other and by using very large fans in the halls the cool air can be moved to the warmer areas.
- Determine if it is cooler outside than inside and if appropriate, prop open all building doors. This is especially true in the mornings, but it’s important to close the doors when it warms up outside.

Protective Measures:
1. Animals – if room temperatures are greater than 85 degrees F, animals should be returned to their holding facility.
2. Computers - should be turned off when the room temperature reaches 85 degrees F. Failure to do so may cause immediate damage or cause computers to fail prematurely a few months later. Heat related damage to computers is not always immediate.
   - This provides supervisors with an additional parameter to think about when deciding whether to ask someone to leave or work from home.
3. Specimens - Have a back-up plan for critical material if freezers fail (e.g., establish a “buddy system” with colleagues in other buildings; consider temporary storage in liquid nitrogen, if appropriate; ship samples off site, over dry ice, to external colleagues and collaborators).
4. –80 degree freezers – Keep the air around these as cool as possible, try to maintain ambient temperatures below 85 degrees. It’s hard on compressors to run constantly, which is what happens if the room is too warm. Things you can do are:
   - Make sure the filters and condensers are clean and not plugged with dirt. Cleaning instructions below
   - Pull the freezers away from the wall and other equipment for better ventilation
   - Blow a fan on the freezer or use it to circulate air through the room
o If other heat producing equipment is nearby, turn it off if possible or move it elsewhere.
  o Don’t open the freezer door unless absolutely necessary
  o Don’t put dry ice in the freezer unless the freezer has failed and there is no back-up freezer available, or use of liquid nitrogen is not an option.

5. **–20 degree freezers** – These produce a lot of heat and will get very hot on the outside. Ways to cool them:
  o Move freezer away from the wall and other equipment to allow ventilation
  o Blow a fan on the freezer or through the room
  o Drape wet towels on the sides of the freezer and blow a fan through the room. Evaporation works very well to cool the freezer.
  o Move freezer into a cold room, being careful to plug it in all the way. We moved a freezer that then defrosted because the plug outlet was tight and the plug didn’t go in all the way.

6. **Tissue Culture Incubators** – The danger is that the room will be warmer than the set temperature for the incubator and the incubator will overheat, killing cultures. Things to try to keep incubators cool:
  o Close sash on biosafety cabinets and turn off the blower
  o Turn off any incubators that aren’t being used, leaving door open a crack.
  o Blow a fan out the door to remove the heat from the room
  o If incubators are still in danger of overheating, siphon a little of the water from the water jacket and add cooler water. It could be difficult to maintain proper chamber temperature, and the researchers should take responsibility for this.
  o Drape wet towels on the sides of the incubators, if accessible, and blow a fan on them.

7. **Lasers, Cryogenic Probes and equipment cooled by Chilled Water:** these should all be shut down immediately when a Stage Two is announced. They are heat generators, often very expensive, and are very sensitive to changes in room temperature or the chilled water cooling capacity.

8. **Liquid Nitrogen Cell Freezers:** these should be fine during the heat wave, but liquid nitrogen tanks may not last as long as they would under normal conditions. Check the supply and reorder early if necessary.

9. **Cold Rooms:** Cold rooms worked great during the chilled water curtailment and were a good location for freezers, incubators, and people that were overheating. Problems noted with cold rooms were condensation on the outside of the door and in the windows, and mold on outside doorframes.

10. **Warm Rooms:** These may overheat – keep a watch on their temperatures.

**DRY ICE WARNING:** There is a great temptation to use dry ice to help cool down ambient air temperatures, but please do not do so. There is a significant asphyxiation hazard associated with this material. As you know, dry ice is frozen carbon dioxide (CO₂). When it builds up, particularly in poorly ventilated areas, it can displace sufficient oxygen to be fatal. Please use alternate methods for keeping things cool.
Preparing for the Next Wave:
1. Keep fans on hand - at least enough for each equipment room, tissue culture room, and any other rooms with critical and sensitive equipment.
2. When possible, leave ventilation space around heat producing equipment or put the equipment next to something that doesn’t also produce heat.
3. Manage your specimens – prioritize and inventory them according to value and replacement difficulty; store duplicates off-site whenever possible.
4. Perform routine maintenance on -80 and −20 degree freezers to remove dust from filters and condensers (see below).
5. Flat dollies for moving equipment are often useful during emergencies, keep some on hand in your building/area.
6. Make it a practice to turn off equipment that isn’t used frequently.

Cleaning Instructions:

1 Cleaning Instructions for −80 Degree Freezer Filters and Condensers
   1. The filter is visible through a grate on the lower front of the freezer. If you see dust build-up on the filter, it should be cleaned.
   2. The grate is usually hinged on one side and can be pulled open like a door. Give it a firm tug. Some grates are held shut by a couple visible screws. Remove the screws
   3. Remove the filter pad from the grate
   4. Clean the filter by gently vacuuming or pulling the dust off by hand. You can then also wash the filter in cold water. Pat it dry with towels. Place it back in the grate.
   5. The condenser can be seen when the grate is open. It looks like the ends of many sheets of very thin metal, side by side, with a little space between each sheet. These can become packed with dirt, which will prevent the system from being able to cool. The dirt needs to be removed, but be careful so the fins, or thin sheets, don’t get bent.
   6. To clean the condenser, vacuum with a soft brush attachment. Alternatively, you can brush the fins or just pick the dust out with your fingers. Whatever is used, be gentle.

2 Cleaning Instructions for −20 Degree Freezers and Refrigerators
   1. Most household type freezers and refrigerators have cooling coils or condensers that are accessible through a grate at the bottom front.
   2. Remove the grate.
   3. Remove the condensation pan, if there is one.
   4. Then do your best with whatever vacuum attachments you have to get the dust off of the cooling coils. Don’t be overzealous as the fans can be bent by a hard whack from a vacuum pole.
   5. When done, replace the condensation pan and the grate.