**FACILITIES CHECKLIST**

**Water Supply:**

☐ Facility has a main water supply company

☐ Water delivery lines are maintained and repaired

☐ Water outages possible (due to seasonal conditions or rationing)

 ☐ Facility has backup water supply during outages

**Electrical Supply:**

The type of power supply and its reliability may influence the number, size, and type of storage equipment you choose.

Voltage used at your site:

☐ 110v

☐ 220v

☐ Other, please specify

☐ Site has Surge Protection

☐ Individual Equipment

☐ Building wide

☐ Site experiences rolling or intermittent blackouts

☐ Site has Emergency Power Off Controls

☐ In lab

☐ In common areas

**Backup Power Supply:**

No matter where you are located, at one time or another, you will lose power—some places more frequently than others. It is critically important that your backup power supply is able to support your equipment until the main power is back.

☐ Facility has an uninterruptable power source (UPS) that maintains a continuous supply of electric power to connected equipment when utility power is not available

☐ Facility has backup power source with sufficient capacity for existing equipment

☐ Facility has a backup generator

☐ Backup generators are routinely tested to ensure system will start on demand and carry the required load

☐ Annual testing is done on diesel storage for excessive water or bacterial build-up

*Best Practice*: Computer systems and electronics systems, such as environmental monitoring systems, safety systems (e.g., oxyget sensors, ventilations systems) or controllers for liquid nitrogen freezers, should be protected by a UPS. UPSs used in repositories should be tested on an annual basis to ensure their proper backup capabilities.

*Best Practice*: A generator should have a fuel supply to run continuously for a minimum of 48 hours and preferably a minimum of 72 hours, with an ability to re-fill fuel storage supplies.

*Best Practice*: Repositories that utilize generators should have an established plan for sources to replenish fuel supplies in case of an emergency. This plan should include tests of suppliers and backup suppliers committed to provide the fuel as needed.

*Best Practice*: Repositories should contact suppliers to be placed on a list as an entity that receives a quick response should an emergency situation arise.

*Best Practice*: The power generator system should be included in a frequent preventative maintenance plan, which includes weekly testing for automatic starting and power generation and load tested monthly. If load testing places sensitive equipment at risk, the generator should be tested less frequently. Those systems that have an automatic transfer switch should also be tested on a periodic basis (e.g., every six months).

*Best Practice*: Staging of the sequence of start-up for mechanical freezers and other systems should be considered to ensure sufficient downtime to allow the compressors to come to rest before restart.

**Flooring:**

Flooring surfaces used in repositories should be appropriate for the equipment and refrigerants used in daily repository activities. Flooring should be easy to clean and facilitate the movement of equipment when circumstances warrant. Special consideration should be given to the flooring in regions where liquid nitrogen is used, as vinyl tile will crack and cause a hazard if liquid nitrogen is spilled directly onto it.

**Ambient Temperature:**

The ideal ambient temperature in the biorepository is ≤22°C, which ensures optimal performance of the freezers and refrigerators. Also, keeping the humidity under control is important when storing certain specimens at room temperature.

☐ Ambient temperature is maintained within defined limits not to exceed 22 °C

☐ Heating capacity is sufficient to prevent the freezing of water in drain lines

*Best Practice*: For optimal life of the mechanical refrigeration equipment, repository ambient temperatures should be monitored and not allowed to exceed 22 °C (72 °F). This is particularly critical for rooms containing multiple mechanical units.

**Air Flow & Circulation:**

Air circulation is important to prevent excess moisture and condensation. High humidity can lead to fungal growth, which may affect specimen integrity and cause health problems for the staff. It is also important to provide enough space between refrigerators and freezers for air circulation to prevent overheating of compressors, which may shorten compressor life. Poor air circulation may also lead to the growth of mold and other harmful microbial contamination.

☐ Air circulation is sufficient to prevent excess moisture and condensation

☐ Sufficient space is available for optimal air circulation in areas housing freezers and refrigerators

☐ Adequate ventilation where liquid nitrogen and dry ice are used

**Waste:**

Some waste associated with biological materials must be disposed of separately from other waste because they are considered as potentially infectious. These include:

* all sharps, e.g. glass implements, needles, syringes, blades, etc. coming from facilities using infectious materials
* biologically cultured stocks and plates, human blood or tissues

Other waste generated in the biorepository, that are not contaminated with biological agents or materials, are not treated as a biohazard and may be discarded in the regular trash container.

☐ Facility has a service available for removing biohazardous materials

☐ Institutional system in place for properly disposing of biohazardous materials

Here is an example of a work stream for handling biological lab waste:

<http://web.princeton.edu/sites/ehs/biosafety/biosafetypage/disposalchart.htm>

**Fire Prevention:**

Repositories should have a written fire prevention plan. The plan should include a list of major hazards, potential ignition sources, proper handling and storage procedures for hazardous materials, and the type of equipment necessary to control each major hazard. The plan should include procedures for regular maintenance on equipment used to prevent or control sources of ignition or fires and the name or job title of employees responsible for maintaining the equipment.

☐ Fire suppression equipment at the facility

*Best Practice*: Use extinguishers that contain a non-corrosive gaseous suppressant in repository areas.

**Fumigation & Vermin Control Service:**

☐ Facility has a pest control plan

☐ Facility has regularly occurring pest prevention activities

**Access:**

Repositories should be equipped with a system that adequately limits access to the specimens and protects against physical intrusion from unauthorized individuals. Doors should be locked. Keys should be controlled, with a record maintained of each person having access to the repository. Only persons assigned to repository operations should have access to the material stored within. Freezers or environmental storage equipment that store valuable or sensitive specimens should be individually locked.

☐ System in place to prevent unauthorized individuals access to area where biospecimens and data are stored

*Best Practice*: Mechanical keys employed in a respository should be ones that cannot be readily duplicated.

**Emergency Preparedness:**

☐ Risk assessment done for site/facilities

☐ Disaster recovery plan

*Best Practice*: Repositories should have a checklist of activities for “on call” staff to follow during an emergency. “On call” staff should be familiar with the location and operation of certain key equipment and controls (e.g., circuit boards) that may need to be checked during an emergency.

**Security System:**

The biorepository should have basic security systems to protect the specimens. These systems should be monitored and alarms responded to 24 hours per day, 7 days per week. A responsible person should be available at all times to serve as the first responder and take the necessary action(s) to respond to an alarm in a time frame that prevents or minimizes loss or damage to the stored materials. Systems should be in place to initiate calls to other staff trained in emergency response when the first individual fails to acknowledge/respond to the alarm.

**Storage Equipment Options/Considerations:**

Biospecimens should be stored in a stabilized state. In selecting biospecimen storage, consider the types of biospecimens to be stored, the anticipated length of storage, the research that will be done using the biospecimens, and any environmental conditions (e.g., humidity level, light, etc.) that may be important.

Options include:

* Cryopreservation
* Formalin or alcohol fixation and paraffin embedding
* Liquid Nitrogen (LN2) tanks
* Mechanical freezers
	+ Ultra low (-80 °C) freezers using cascade compressor cooling system
	+ Ultra low (-80 °C) Freezers using free-piston Stirling engine cooling system

Of these two types of mechanical freezers, the free-piston Stirling engine cooling system seems to be the most promising new technology for use in low-resource settings. In addition to a full size freezer, there is an undercounter -80 freezer ( 3.7 cu. Ft.) that can be modified (by the vendor) to run off of a car battery for backup power. There also is a portable -80 freezer that is a convenient size for collecting specimens in the community setting and transporting back to the facility. It can plug into the car adapter, has a battery pack that lasts for up to an hour in the field, and runs on 150 watts. Below is a link to a description of this model. If you are already using this product at your site, please let us know what you think. <http://stirlingultracold.com/shuttle_home>

The World Health Organization International Agency For Research on Cancer has a very good description of these different types of biospecimen storage options: <http://www.iarc.fr/en/publications/pdfs-online/wrk/wrk2/Standards_ProtocolsBRC.pdf>

**Refrigerators:**

Refrigeration is the preferred storage medium when the material should be kept cool but does not require freezing. Refrigerators are often used for the storage of media and additives for processing specimens. It is important to ensure that the temperature is maintained within the specified operating range, not just below a maximum temperature. Some high value materials should be maintained precisely between 2 °C and 8 °C. The facility operator should ensure that refrigerator temperatures are monitored.

**Ambient Temperature Storage**

New technologies have enabled the stabilization and long-term storage of DNA and RNA samples at room temperature. This has tremendous implications for research in low-resource settings as this would significantly reduce the cost of biobanking (e.g., space and energy use) and would remove one of the greatest obstacles, which has been the need for reliable electricity for ultra low storage units. At a minimum, it may be a good alternative for backup storage for some material types. But, it is important to add that, prior to implementing, all matrices should be evaluated to confirm that they are appropriate for downstream applications.

Here is an article evaluating ambient storage of DNA samples:

<http://www.ncbi.nlm.nih.gov/pubmed/19737132>

 **Backup Storage Capacity:**

You will need adequate backup capacity for refrigerators and freezers in the event of possible equipment failure (see Best Practices for recommendations). It is preferable that the backup units are on site but, when that is not feasible, you should make arrangements for space in a nearby facility for the transfer of biospecimens in case of an emergency.

*Best Practice*: Extra capacity equipment should be equal to the capacity of the largest single storage unit and should be maintained in reserve at operating temperature.

*Best Practice*: The total amount of backup storage required for large repositories should be determined empirically, but will typically be 1.5% to 3% of the total freezer capacity for liquid nitrogen storage and will be 10% for mechanical freezer storage. Backup space should be available in the repository, if possible.

*Best Practice*: Repositories should have a written procedure for transferring samples from a failed or malfunctioning unit (one that has exceeded or is on the verge of exceeding its acceptable operating temperature range or become over-filled) and for the return of the samples to their original location once it is considered safe to do so. The procedure should include the freezer or refrigerator name or number as well as the location within the freezer where the samples have been relocated.

**Equipment Maintenance Considerations:**

Regularly scheduled maintenance and calibration of your equipment is essential to ensure the highest quality of your specimens. This includes disinfecting equipment that is exposed to potentially infectious materials.

☐ System in place for preventive maintenance and repair of storage equipment, supporting systems and facilities

☐ System in place for the calibration of all instruments

*Best Practice*: Well-qualified personnel with expertise in monitoring and repairing repository equipment (especially freezers and refrigerators) should be used for regular and emergency repairs.

*Best Practice:* Repositories should maintain spare parts for critical equipment, especially for aging equipment for which parts may not be readily available.

*Best Practice:* Calibration records should include the appropriate standard reading taken both before and after calibration.

*Best Practice*: A log of calibration records should be kept that includes the date of the calibration, the name of the individual performing the calibration, the name of the device used against which the instrument is calibrated, and a reference to the standard operating procedure used to perform the calibration.

Sources:

**2012 Best Practices for Repositories**

Collection, Storage, Retrieval, and Distribution of Biological Materials for Research

International Society for Biological and Environmental Repositories, Third Edition

**Common Minimum Technical Standards and Protocols for Biological Resource Centres Dedicated to Cancer Research**

World Health Organization International Agency for Research on Cancer (IARC)

Working Group Reports Volume 2