Guidance for the Use of Liquid Nitrogen

Introduction

- The Comprehensive Analysis Center for Science(CACS) at Saitama University is a shared facility available to faculty, staff, graduate students, and undergraduate students. We provide access to liquid nitrogen facilities, analytical instruments, and related facilities to support a wide range of education and research activities.

- When using liquid nitrogen, users are requested to understand the purpose of shared use, comply with all rules, and take appropriate care to prevent accidents.

Eligible Users

- Liquid nitrogen may be used by faculty members, staff, students, research students, and researchers who handle it for educational or research purposes, and who have completed this guidance.
- If a third-year undergraduate student affiliated with a laboratory collects liquid nitrogen, the supervising faculty member must provide hands-on instruction, in addition to completion of this guidance.

Preparation

- If a faculty member plans to begin using liquid nitrogen, please apply to the administrative office of the Center for issuance of a liquid nitrogen user card.

- Users must prepare their own dedicated insulated container (Dewar flask).

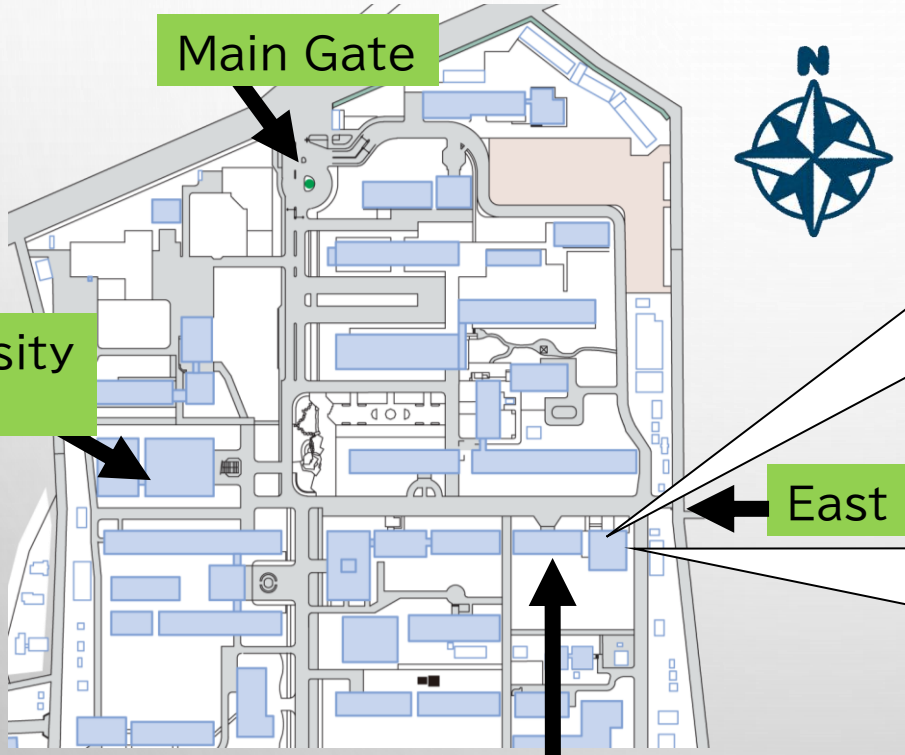
Supply Hours

Supply Hours: Weekdays, 9:00 AM - 5:00 PM

Closed: Saturdays, Sundays, public holidays, and days designated by the Center

※ Use outside these hours may result in future suspension of liquid nitrogen use for users affiliated with the relevant laboratory.

Supply Location



CACS office(3rd floor)

Liquid Nitrogen Dispensing Shed

Dispensing Fees

- Fees are charged based on the amount of liquid nitrogen dispensed.
- For amounts of 5 L or less, the charge will be calculated as 5 L. Because a significant amount of liquid nitrogen is required to cool the dispensing lines, users must dispense at least 10 L each time.
- The unit price is calculated based on the dispensing record from the previous fiscal year. Excessive loss during the current fiscal year may affect the unit price for the next year. Small-volume dispensing is not permitted.

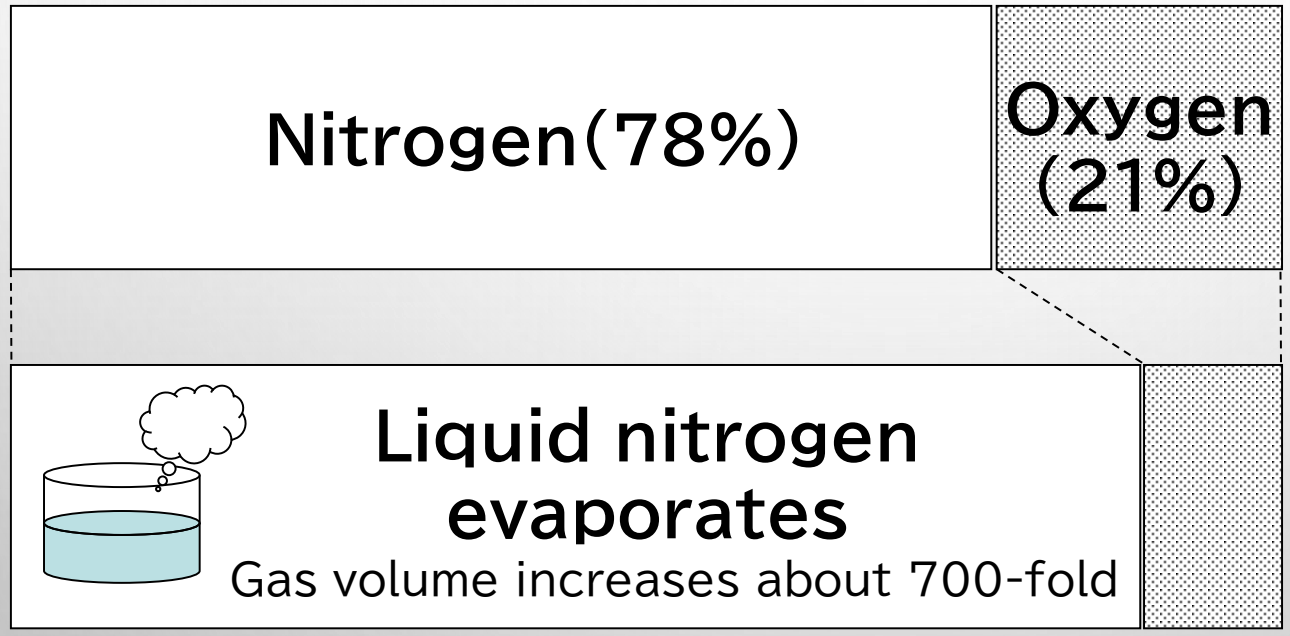
Hazards of Liquid Nitrogen

Oxygen deficiency

Frostbite

Explosion

Oxygen Deficiency Caused by Liquid Nitrogen (1)



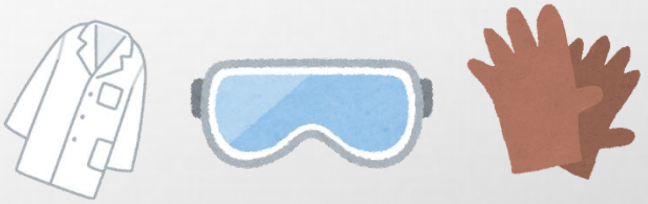
Oxygen Deficiency Caused by Liquid Nitrogen (2)

Stages	Oxygen concentration In the air (%)	Symptoms
Stage 1	16~12	Headache, Tinnitus, Nausea etc.
Stage 2	14~9	Intoxicated state, Confusion etc.
Stage 3	10~6	Loss of consciousness etc.
Stage 4	Below 5	Coma, fainting etc.

Ensure adequate ventilation at all times

Frostbite Caused by Liquid Nitrogen

- Contact with liquid nitrogen
- Contact with the cold gas released from liquid nitrogen
- Contact with metal cooled by liquid nitrogen



Always wear protective equipment
(long-sleeved lab coat, safety goggles, and dry cryogenic gloves)

Emergency response

- Do not forcibly remove anything stuck to the skin
- Rinse with water or lukewarm water
- Seek medical attention

Explosion Hazard Caused by Liquid Nitrogen

Do not seal the container.
(Except for containers equipped with a check valve.)

When liquid nitrogen evaporates, its volume increases to more than 700 times, creating an explosion hazard if the container is sealed.

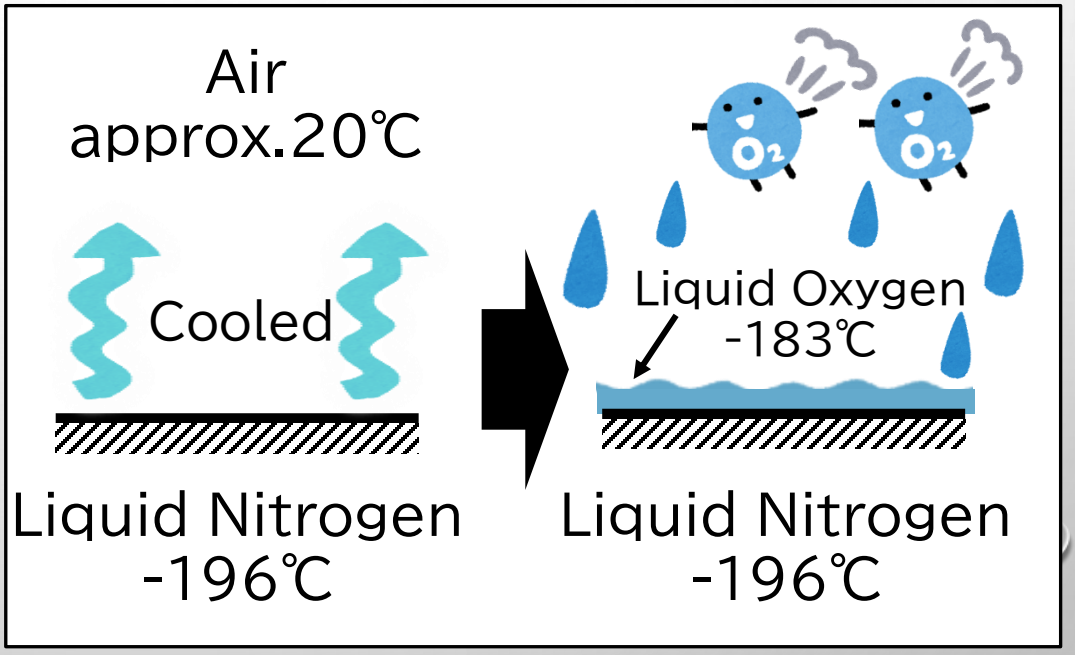
If moisture freezes and causes the lid to stick, the container may also become sealed. Take care to prevent the lid from becoming stuck.

Important Note: Liquid Oxygen

Place the lid on the container.
Do not leave the container open.

Boiling point
of nitrogen: −196℃

Boiling point
of oxygen: −183℃



Keep away from oils and grease

Important Note: Examples of Liquid Nitrogen Accidents at Other Universities

1. Fatal accident caused by oxygen deficiency

1992	Liquid nitrogen was released to lower the temperature of a cold room

2. Container rupture / explosion accident

2013	A vacuum flask was sealed after being filled with liquid nitrogen, causing the internal pressure to rise.

3. Frostbite

2011	Liquid nitrogen entered a shoe and remained inside without evaporating.

Other Important Notes

- Please avoid dispensing small volumes.
- If you need to dispense 50 L or more, please do so in the morning.
- Liquid nitrogen may be dispensed even while the storage tank is being filled by the tanker truck.



Procedure for Dispensing Liquid Nitrogen (1)

Hold your liquid nitrogen user card over the card reader to unlock the door.
Even if the door is already open, you must still scan your card so that your use is recorded.

Procedure for Dispensing Liquid Nitrogen (2)

After opening the door, place the doorstop to keep the door open. The door may be difficult to open depending on the temperature and other conditions.

Procedure for Dispensing Liquid Nitrogen (3)

Disinfect your hands and wear leather gloves.
Then gently insert the dispensing tube into the Dewar flask.

Procedure for Dispensing Liquid Nitrogen (4)

Turn the valve counterclockwise.
To prevent the valve from sticking, open it fully and then turn it back half a turn.

Procedure for Dispensing Liquid Nitrogen (5)

Relationship Between the Weight and Volume of Liquid Nitrogen

Kg	L
4.03	5
8.06	10
12.09	15
16.12	20
24.18	30
40.30	50

Reference:
Density of Liquid Nitrogen
0.806 kg=1.00 L
1.000 kg=1.24 L

When dispensing liquid nitrogen, measure the weight using the scale. Please refer to the table for the relationship between weight and volume. The same table is posted on the door of the dispensing shed.

Procedure for Dispensing Liquid Nitrogen (6)

Please wait until the dispensing tube and the container have cooled sufficiently.
Liquid nitrogen may take 5 to 10 minutes to begin collecting in the container.
(The time required depends on the piping and container temperature,
container size, and outside temperature.)

Procedure for Dispensing Liquid Nitrogen (7)

Do not touch the dispensing tube with bare hands, as this is extremely dangerous.

Procedure for Dispensing Liquid Nitrogen (8)

If the amount of liquid nitrogen exceeds the capacity of the container, it will overflow from the opening.
Stop dispensing before this happens.
If overflow occurs, remain calm and close the valve.

Procedure for Dispensing Liquid Nitrogen (9)

Do not leave the dispensing area while liquid nitrogen is being dispensed.
If you must leave during a large-volume dispensing operation (30 L or more), calculate the expected completion time and return before overflow occurs.
Please fill in the required information on the whiteboard on the door.

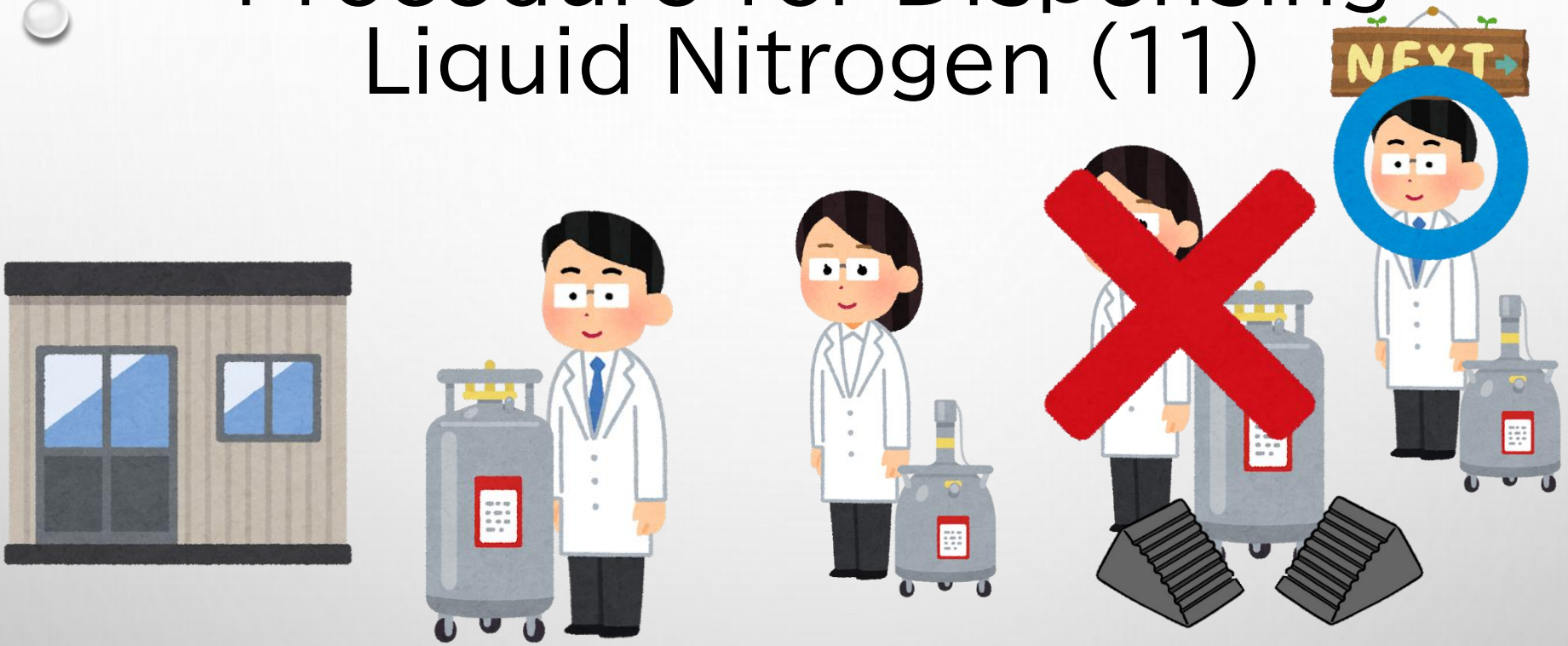
Procedure for Dispensing Liquid Nitrogen (10)

Entrance Card for the Dispensing Shed

Card No.

After dispensing liquid nitrogen, be sure to return the leather gloves to their original place.
Then enter the required information in the liquid nitrogen dispensing log kept inside the dispensing shed.
After completing the entry, make sure the door is securely closed before leaving.

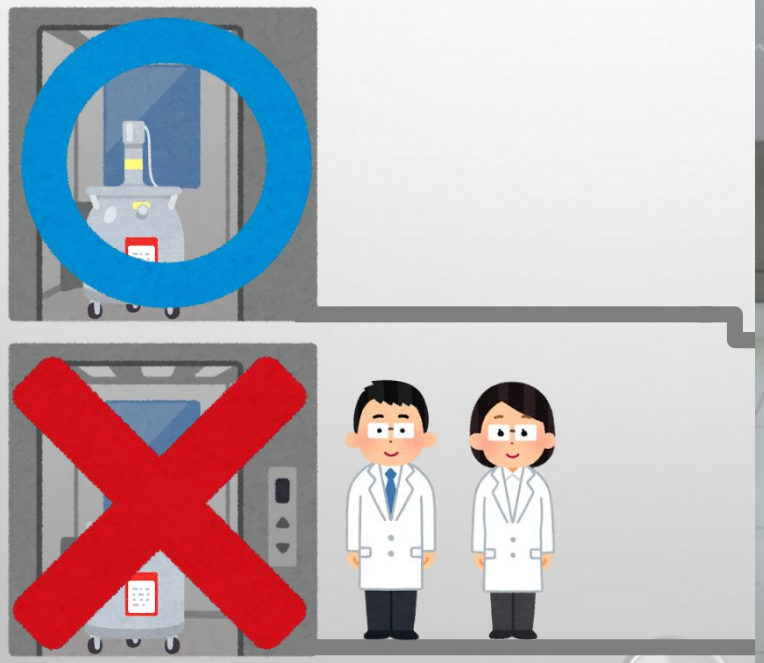
Procedure for Dispensing Liquid Nitrogen (11)



- You may leave the area after placing your container in the waiting line.
- For containers with casters, take measures such as using wheel stoppers to prevent movement.
- If you are absent when it is your turn, priority will be given to those who are present.

Precautions for Transporting Liquid Nitrogen (1)

To prevent oxygen deficiency, do not ride in the elevator with a container containing liquid nitrogen.



Precautions for Transporting Liquid Nitrogen (2)

- Large containers have a high center of gravity and may tip over if they catch on a step or uneven surface.
- Transport them with two or more people.

Pushing only at the top may cause tipping

Push evenly across the container

THANK YOU FOR YOUR ATTENTION.