

# NFF (CWB) User Handbook

December, 2021

Nanosystem Fabrication Facility (CWB)  
The Hong Kong University of Science and Technology

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# 1 HOW TO QUALIFY AS AN NFF USER

## 1.1 TRAINING

To become an NFF (CWB) user, you must first go through the NFF (CWB) orientation training. The training is divided into four parts:

Part A : Safety Training—conducted by Mr. Ho LI (3 hours)

Part B : Chemical Safety—organized by HSEO (an online self-learning course consisting of two modules: Chemical Safety I (MC07) and Chemical Safety II (MC03))

Part C : Contamination Control and Protocol—conducted by Mr. Henry YEUNG (3 hours)

Part D : NFF (CWB) Booking System—conducted by Mr. Wilson YIP (1 hour)

Venues : NFF (CWB) administration office and NFF (CWB) Phase II

Class size : Maximum of 6 people for part A/D and 12 people for part C

Schedule : See the [NFF \(CWB\) website](#)

Registration : <http://www.nff.ust.hk/en/our-services/safety-training.html>

Charging : Refer to the [NFF \(CWB\) charging scheme](#)

For details, please contact Mr. Wilson YIP,

Tel: (852) 2358 7216

E-mail: [nfkyip@ust.hk](mailto:nfkyip@ust.hk)

## 1.2 NFF (CWB) ADMISSION EXAMINATION

Once you have completed the orientation training, you must pass the admission examination before you can begin working in all NFF (CWB) laboratories.

The examination consists of three papers:

- Paper I—Safety
- Paper II—Contamination Control and Protocol
- Paper III—Process Flow

In general, the examination depends on the schedule arranged by NFF (CWB). The users can choose the available time slot and register for the examination through the web page.

The syllabus of the examination is as follows:

Paper I:

1. Cleanroom Environment
2. MSDS & Material Restriction
3. Alarm System and Emergency Escape Route
4. General Lab Safety
5. Fire and Chemical Safety
6. Equipment and Operation Safety

Paper II:

1. Contamination
2. Process Verification Scheme
3. General Process Requirements
4. Operation Guidelines
5. Cleanliness Levels of Equipment and Wafer Status

Paper III:

1. Paper II Topics
2. Standard Format of Process Flows

If you fail any one of the papers, you can re-take that paper. If you fail any two of the papers, you must re-take the NFF (CWB) orientation training and re-sit the examination.

Format of examination: Open book exam

Duration: 2 hours

### 1.3 USER REGISTRATION AND NFF (CWB) ACCESS CARD

Once you have passed the examination, you can apply for a NFF (CWB) project by the procedures set out below:

1. Download the NFF (CWB) project application form at <http://www.nff.ust.hk/en/download/forms.html>
2. Fill in the application form and submit it to Mr. CHEUNG Tak Leung together with:
  - a. Your Chemical Safety I (MC07) and Chemical Safety II (MC03) certificates
  - b. Process flow with your supervisor's signature
  - c. An NFF (CWB) access card material request form (\$100 will be deducted from your supervisor's project account)
3. You may not transfer or lend your own NFF (CWB) access card to anyone else.
4. You must apply for an NFF (CWB) project within six months of the date on which you pass the admission examination. Any project application after six months will not be accepted, and you must re-take the NFF (CWB) orientation training and re-sit the admission examination.
5. If there is no access record for six months but not more than 12 months, your NFF (CWB) access card will be deactivated but you can contact Mr. CHEUNG Tak Leung to re-activate it.
6. If there is no access record for more than 12 months, you have to re-take the NFF (CWB) orientation training and re-sit the admission examination to re-activate your access card.
7. If you lose or damage your access card, you have to pay HK\$100 (NOT deducted from your supervisor's project account) to have it re-issued.

## **2 HOW TO BECOME A QUALIFIED USER FOR NFF (CWB) EQUIPMENT**

### **2.1 EQUIPMENT TRAINING**

After your process flow is approved, you are allowed to book and operate equipment which you are qualified to use. To become a qualified user, you are required to attend equipment training before you can book and operate equipment in NFF (CWB). Please follow the general procedures set out below:

1. Familiarize yourself with the operating manual of the equipment. The manuals can be accessed in the equipment reservation system.
2. Attend the equipment hands-on operation training delivered either by a NFF (CWB) staff or a qualified user of your team/group.
3. To attend the training provided by a NFF (CWB) staff, you must register beforehand via the equipment reservation system. Once you are logged in, go to the “Equipment Operation Training” option in the “User Info” menu. A confirmation email will be sent to you in due course regarding the training date, time and venue.
4. You should not run processes for your sample during the hands-on training

### **2.2 EQUIPMENT TRAINING PROCEDURES**

NFF (CWB) provides different training modes for different equipment. The training modes are categorized as follows.

1. Peer-to-peer training
  - a. Read the operating manual and watch the video
  - b. Look for a senior member who is a qualified user of that equipment to train you
  - c. When getting familiar and feeling confident with such operation steps, contacts a NFF (CWB) staff for taking the exam in order to get the qualification
2. Self-learning with practice
  - a. Register for the training in this page

- b. Look for a senior member who is a qualified user of that equipment to train you
  - c. When getting familiar and feeling confident with such operation steps, contacts a NFF (CWB) staff for taking the exam in order to get the qualification
3. Training class
- a. Register for the training in this page
  - b. Wait for the training schedule (normally within a month after registration) which will be announced by email

### **2.3 EXAMINATION**

You must sit the qualification examination within one month of attending the equipment hand-on operation training. An email will be sent to you to remind you to attend the examination. You can do so by contacting your trainer for the examination at a date that is available for both you and the trainer. Once you pass the exam for a particular machine, you will be allowed to book and use that machine. You can check to see which equipment you are allowed to use by logging in to the NFF (CWB) booking system.

### **2.4 GREEN CARD POLICY**

1. Objectives
- a. Encourage more practices on equipment operation and training for “green” users.
  - b. Avoid serious operational mistakes from or accidents involving “green” users.
2. What is the “P Card”

The NFF (CWB) “Probation Card” (“P Card”) is an access card for “green” users to access the NFF (CWB) labs.

3. Who are “green” users?
- a. Without any experiences in working in the NFF (CWB) cleanrooms.
  - b. Have not been using the NFF (CWB) cleanrooms for 1 year or more.



- c. Undergraduate students are “green” users throughout the whole period working in the NFF (CWB) labs.
4. Dos and Don'ts for “green” users
- a. Labs. access time is limited from 9:00 to 17:00 in the labs. opening day.
  - b. Must consult the NFF (CWB) staff before starting a process.
  - c. “Green” users are not allowed to start any wet processes, prepare or dispose any chemicals without monitoring by the NFF (CWB) staff (or by another regular NFF (CWB) user within the same research group who has been a regular user for at least 6 months, if the regular user is willing to take the responsibility\*).
5. Promotion from the “green” user status to the regular user status
- a. Completed a 3-month probation period since the project start date and accumulated total working hours of at least 50 hours in any of the NFF (CWB) labs.
  - b. Received no warning letters from the NFF (CWB) management.
  - c. No recommendations by any NFF (CWB) staff to extend the probation period.
6. Extension of the “P Card” period

The probation period can be extended for one or multiple three-month cycles, until the user is ready to be promoted to the regular user status.

7. Demotion from the regular user status to the “green” user status

A regular user who has received two warning letters from the NFF (CWB) management after the effective date of the policy or has caused a serious safety issue will be demoted to the “green” user status.

\*Notes:

- 1. All existing NFF (CWB) users before the effective date of the policy are classified as REGULAR users.

2. All NFF (CWB) new users joining after the effective date of the policy are classified as GREEN users.
3. For NFF (CWB) new users who have extensive relevant process experiences elsewhere may apply to the NFF (CWB) management for shortening the probation period to a minimum of one month and accumulated total working hours of at least 30 hours in any of the NFF (CWB) labs. The NFF (CWB) management will evaluate each application on a case-by-case basis upon receiving relevant documents from the new user.
4. In the case that a “green” user has violated any of the NFF (CWB) regulations on laboratory safety or contamination, the user is subject to the same penalty as a regular user.
5. Regular users who take on the role to monitor green users will be subject to the same penalty if the green user commits a violation under their supervision.

Below are the penalties stipulated for violating the NFF (CWB) regulations on safety and contamination:

No. of times of violations	Safety	Contamination
1	2 weeks	1 week
2	4 weeks	2 weeks
3	8 weeks	4 weeks
4	The user status will be terminated. If the user wishes to access the NFF (CWB) again, the user will be required to re-take and to pass the NFF (CWB) safety training and operational training as a new user.	

6. In the case that a “green” user has caused a serious operational mistake or an accident, which causes personnel injuries, equipment damages, irreversible contaminations, or has committed serious misconducts in the NFF (CWB) labs, the user is subject to the same penalty as a regular user. The penalty will be determined by the NFF (CWB) management deemed proper to the situations.

### **3 NFF (CWB) OPERATION HOURS**

#### **3.1 NFF (CWB) PHASE II**

NFF (CWB) Phase II is open from 9:00 am to 11:59 pm from Monday to Friday, except public holidays.

#### **3.2 NFF (CWB) ENTERPRISE CENTER**

NFF (CWB) Enterprise Center is open 24 hours from Monday to Friday, except public holidays.

#### **3.3 NFF (CWB) TSV PROCESS LABORATORY**

NFF (CWB) TSV Process lab. is open from 9:00 am to 11:59 pm from Monday to Friday, except public holidays.

#### **3.4 NFF (CWB) DRIE PROCESS CENTER**

NFF (CWB) DRIE center is open from 9:00 am to 5:30 pm from Monday to Friday, except public holidays.

#### **3.5 NFF (CWB) NANOFABRICATION DEMONSTRATION LAB**

NFF (CWB) NDL is open from 9:00 am to 5:30 pm from Monday to Friday, except public holidays.

## 4 NFF (CWB) CHARGING SCHEME

Charging calculations are based on

- Users' lab access time and equipment usage time;
- Lab in-and-out record (lab access);
- Equipment check-in-and-check-out record (equipment usage);
- Material price;
- Quotation (external users and internal users)
- Contract rate (agreement between client and R&D Corporation)

### 4.1 HKUST STUDENTS/STAFF (HKUST INTERNAL USERS)

1. Charges for lab access
  - a. Issue of access card, HK\$100/card and non-refundable
  - b. Account maintenance fee , HK\$150/month
  - c. Entry fee, HK\$10/hr., minimum payment HK\$10 in each entry and capped at HK\$600/month. (If you fail to tap your card on the reader upon leaving the lab, you will be charged for the rest of the day)
  - d. Replacement of lost or damaged access card, HK\$100/card  
(Note that if you do not use your access card for six months, it will be suspended automatically. If you do not use it for 12 months, you will be treated as a NEW USER.)
2. Charges for Equipment Usage
  - a. Four categories of equipment
    - i. Category 1: free of charge
    - ii. Category 2: HK\$20/hr., min. charge HK\$20 (1hr) and round up to the nearest whole hour afterwards.
    - iii. Category 3: HK\$60/hr., min. charge HK\$30 (0.5hr/half session time), charge per minute afterwards.
    - iv. Category 4: HK\$120/hr., min. charge HK\$60 (0.5hr/half session time), charge per minute afterwards.
  - b. The calculation is based on when you check in and out for the equipment.
  - c. Capped at HK\$3,000/month/user
3. Others
  - a. Materials and consumables (price are subject to change)
  - b. Gold and platinum (prices are subject to change)
  - c. NFF (CWB) safety orientation (Parts A, C and D), HK\$1,050/person (Refund to PI account by deduction with account maintenance cost for seven months starting from project application).
  - d. Mask making, HK\$1,000/pc, 5-inch masks
  - e. E-beam lithography process (refer to the Table 1)
  - f. Service charge, HK\$416/hr. (internal job request)

For equipment usage, a penalty of HK\$400 will be imposed if you book a piece of equipment but fail to show up and check in the equipment.

## **4.2 STUDENTS/STAFF FROM COLLABORATION BETWEEN HKUST AND LOCAL TERTIARY INSTITUTIONS**

### 1. Charges on lab access

- a. Issue of access card, HK\$100 and non-refundable
- b. Account maintenance cost, HK\$150/month
- c. Entry fee, HK\$10/hr., minimum payment HK\$10 in each entry and capped at HK\$600/month
- d. (If you fail to tap your card on the reader upon leaving the lab, you will be charged for the rest of the day.)
- e. Replacement of lost or damage access card, HK\$100/card  
(Note that if you do not use your access card for six months, it will be suspended automatically; if you do not use it for 12 months, you will be treated as a NEW USER.)

### 2. Charge for lab or equipment usage

- a. Lab usage, HK\$377/hr., based on the record on your access card
- b. Equipment usage, HK\$377/hr., based on when you check in and out for the equipment
- c. If the lab access time and the equipment usage time overlap, you will only be charged for one of them.
- d. Capped at HK\$15,000/month/user

### 3. Others

- a. Materials and consumables (price is subject to change)
- b. Gold and Platinum (price is subject to change)
- c. NFF (CWB) orientation training (Parts A, C and D), HK\$1,050 per person
- d. Mask making, HK\$1,426/pc, 5-inch mask
- e. E-beam lithography process (refer to Table 1)
- f. Charges for service provided by staff, HK\$540/hr.
- g. Equipment training, HK\$377/job.
- h. Equipment qualification, HK\$377/job.

Remarks:

1. Types of projects for collaboration between HKUST and local tertiary institutions.
  - a. Joint project of UGC/RGC funding projects (eg. CRF, AoE and TBRS).
  - b. Joint project of ITF.
  - c. Joint project of Inno Hong Kong.
2. Project approval letter and PI/co-PIs list must be submitted during the project application.
3. **Users without the HKUST F.O. account will pay an additional 30% of the above charges to cover administrative cost.**
4. For equipment usage, a penalty of HK\$400 will be imposed if a user has booked a piece of equipment but failed to show up to check-in the equipment.
5. For equipment damages resulting from negligence, the NFF (CWB) will charge in full or part for repair costs.

#### **4.3 STUDENTS/STAFF FROM LOCAL TERTIARY INSTITUTIONS (EXTERNAL USERS)**

1. Charges on lab access
  - i. Issue of access card, HK\$100 and non-refundable
  - j. Account maintenance cost, HK\$150/month
  - k. Entry fee, HK\$10/hr., minimum payment HK\$10 in each entry and capped at HK\$600/month
  - l. (If you fail to tap your card on the reader upon leaving the lab, you will be charged for the rest of the day.)
  - m. Replacement of lost or damage access card, HK\$100/card  
(Note that if you do not use your access card for six months, it will be suspended automatically; if you do not use it for 12 months, you will be treated as a NEW USER.)
2. Charge for lab or equipment usage
  - a. Lab usage, HK\$753/hr., based on the record on your access card
  - b. Equipment usage, HK\$753/hr., based on when you check in and out for the equipment
  - c. If the lab access time and the equipment usage time overlap, you will only be charged for one of them.
3. Others
  - a. Materials and consumables (price is subject to change)

- b. Gold and Platinum (price is subject to change)
- c. NFF (CWB) orientation training (Parts A, C and D), HK\$2,000 per person
- d. Mask making, HK\$2,852/pc, 5-inch mask
- e. E-beam lithography (refer to Table 1)
- f. Charges for service provided by staff, HK\$540/hr.
- g. Equipment training, HK\$753/job.
- h. Equipment qualification, HK\$753/job.

An additional 30% administrative charges will be added to the above charges.

For equipment usage, a penalty of HK\$400 will be imposed if you book a piece of equipment but fail to show up and check in the equipment

#### **4.4 OTHER USERS (INDUSTRY, OVERSEAS UNIVERSITY AND OTHER USERS)**

##### 4. Charge on lab access

- a. Issue of access card, HK\$100 and non-refundable
- b. Account maintenance cost, HK\$150/month
- c. Entry fee, HK\$10/hr., minimum payment HK\$10 in each entry and capped at HK\$600/month
- d. If you do not use your access card for six months, it will be suspended automatically. You must then attend the safety orientation training to regain access.
- e. If you do not use your access card for a year, you will no longer be considered as a qualified lab user. To regain the user qualification, you must attend the user orientation training and sit the admission examination again.
- f. If you lose or damage your access card, you have to pay HK\$100 to have it reissued.

##### 5. Charge for lab or Equipment Usage

- a. Lab usage, HK\$1,143/hr., based on the record on your access card
- b. Equipment usage, HK\$1,143/hr., based on when you check in and out for the equipment
- c. Lab usage time is based on the record on your access card
- d. Equipment usage is based on when you check in and out for the equipment
- e. If lab access time and the equipment usage time overlap, you will only be charged for one of them

6. Others

- a. Materials and consumables (price is subject to change)
- b. Gold, Platinum and Germanium (price is subject to change)
- c. NFF (CWB) orientation training (Part A, C and D) HK\$3,000 per person
- d. Mask making, HK\$4,500/pc, 5-inch mask
- e. E-beam lithography process (refer to Table 1)
- f. Charge of service provided by staff, HK\$540/hr.

An additional 30% administrative charges will be added to the above charges

For equipment usage, a penalty of HK\$400 will be imposed if you book a piece of equipment but fail to show up and check in the equipment

**4.5 EQUIPMENT/PROCESS CATEGORIES**

Category 1 (Free)	<ul style="list-style-type: none"> <li>• All metrology equipment</li> <li>• Microscopes</li> <li>• Ovens/hot plates</li> <li>• USI Wafer Cleaner</li> <li>• Karl Suss Bonder SB6</li> <li>• Surface Profiler</li> </ul>
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Category 2 (HK\$20/hour)	<ul style="list-style-type: none"> <li>• Sputtering machines</li> <li>• E-beam evaporators</li> <li>• CNT MWPECVD</li> <li>• RTAs</li> <li>• PECVDs</li> <li>• LPCVDs</li> <li>• Ion implanter</li> <li>• Wet-stations</li> <li>• Photoresist Coaters</li> <li>• Wafer Tracks</li> <li>• O2 Plasma Ashers</li> <li>• Critical Point Dryer</li> </ul>
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Category 3 (HK\$60/hour (HK\$1/min))	<ul style="list-style-type: none"> <li>• Dry etchers</li> <li>• Oxidation</li> <li>• Diffusion</li> <li>• ALD</li> <li>• Silicon epitaxy</li> </ul>
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	<ul style="list-style-type: none"> <li>• Nanoscribe 3-D Printer</li> </ul>
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Category 4 (HK\$120/hour(HK\$2/min))	<ul style="list-style-type: none"> <li>• Aligners</li> <li>• CMPs</li> <li>• Wafer polisher</li> <li>• Wafer grinder</li> </ul>
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**Table 1: Charges for the E-beam lithography process**

	Substrate	Long Job	Short Job
HKUST Internal Users	5" soda lime	HK\$3,100	HK\$3,100
	5" quartz mask	HK\$3,100	HK\$3,100
	wafer/chip	HK\$3,100	HK\$3,100
	nano-imprint mask	HK\$3,100	HK\$3,100
External Users	5" soda lime	HK\$17,694	HK\$17,205
	5" quartz mask	HK\$17,694	HK\$17,205
	wafer/chip	HK\$17,694	HK\$17,205
	nano-imprint mask	HK\$17,694	HK\$17,205
Industry Users	5" soda lime	HK\$19,494	HK\$18,105
	5" quartz mask	HK\$19,494	HK\$18,105
	wafer/chip	HK\$19,494	HK\$18,105
	nano-imprint mask	HK\$19,494	HK\$18,105

Short Job: Exposure time < 3 hours

Long Job: Exposure time > 3 hours

## **5 NFF (CWB) EQUIPMENT BOOKING POLICY**

You are required to strictly follow the equipment booking policy set out below. The policy is designed with the fair distribution of resources in mind and is applicable to all NFF (CWB) users with access to the NFF (CWB) equipment reservation system.

### **5.1 BOOKING**

1. Transfer of booking is not allowed.
2. When you come to the lab, you must check in before you can operate any equipment that you have reserved. Please refer to Section 6 for how to check in and out for equipment.
3. The equipment can be booked two weeks in advance.
4. Each project initially has 20 hours to reserve machines. Your project can remain 20 booking hours if you check in the reserved machine on time and then check out it after finishing your job; otherwise, the deducted hours for machine reservation will not be given back to your project
5. If you miss the check-in period for your booking and the time slot remains unoccupied, you can make a new reservation and check in.
6. Bookings may be canceled via the NFF (CWB) booking system at least one day in advance.
7. You are only allowed to reserve the equipment that you have been trained and are qualified to operate.

### **5.2 PENALTY**

1. A penalty of HK\$400 will be imposed if you fail to show up and check in a booked equipment.
2. You should not try to hack into the booking system, such behavior will incur serious penalty.

## 6 CHECKING IN AND OUT FOR EQUIPMENT

You are required to check in and out for the equipment that you have reserved. When the equipment has been checked in, it will not be open for bookings by other users and the usage charges may be calculated based on the check in and check out record. Failure to do so will violate the rule and may be considered as cheating and your card may be revoked.

There are two ways of checking in for the equipment:

1. Check-in through the NFF (CWB) equipment reservation website via the computer in the lab.
2. Tap your NFF (CWB) access card on the corresponding equipment card reader.

### 6.1 CHECKING IN AND OUT VIA THE NFF (CWB) EQUIPMENT RESERVATION WEBSITE

To check in via the NFF (CWB) equipment reservation website, you may do so as early as 5 minutes prior to the start of your session and as late as halfway into your session. If you fail to check in within that time frame, your booking will be automatically cancelled and the equipment will become available for booking by other users.

You may also perform check-in with your access card, in which case you may check in anytime within the scheduled time slot (Details is described below)

If you miss the check-in period and the time slot remains unoccupied, you may make a new reservation and check in.

You must check in and out for any photolithography equipment so that the appropriate charges may be calculated. If you do not check out, you will be charged until another user checks in for the same piece of equipment. If there are no other user checks in for the equipment, you will be charged until 11:59 pm that same day.

## **6.2 INTRODUCTION OF EQUIPMENT CHECK IN/OUT SYSTEM BY NFF (CWB) ACCESS CARD**

The NFF (CWB) access card is RFID-enabled. You use it to access NFF (CWB) laboratories as well as to reserve equipment. All equipment in the laboratory is now installed with a card reader and a red LED, regardless of whether reservation is required for the equipment or not. To check in, simply tap your access card on the reader. The red LED will turn ON if the check-in is successful. When the red LED is OFF, the equipment is locked and cannot be operated.

## **6.3 GENERAL REGULATIONS**

1. You must use your own NFF (CWB) access card to enter the NFF (CWB) clean room as well as checking in and out for equipment. Transfer of the NFF (CWB) access card is strictly prohibited.
2. You must check in for the equipment and unlock it within the first half of the booked time slot. You cannot unlock the booked equipment if you do not have a lab access record.

## **6.4 IDLE STATUS OF CARD READER**

1. The red LED on the card reader should be turned on (Fig. 1) when the equipment is ready to use. If the red light keeps flashing, the card reader is experiencing problems. Please contact NFF (CWB) staff for assistance.
2. The red LED (fig.2) attached beside or near the card reader should remain off when the equipment is not in use.

## **6.5 HOW TO USE THE ACCESS CARD**

- 1) For equipment that requires checking in
  - Reserve the equipment through the NFF (CWB) equipment reservation system.
  - Tap the card on the card reader, which will then emit a “beep” sound.
  - The red LED turns on (Fig. 3) to indicate that the equipment is unlocked and ready to use. Otherwise, the red LED remains off and the card reader will emit a “beep” sound three times.
- 2) For equipment that requires checking out

- Tap your access card on the card reader, which will then emit a “beep” sound.
- The red LED turns off (Fig. 2) to indicate that you have successfully checked out and the equipment will be locked. Otherwise, the red LED will remain on and the card reader will emit a “beep” sound three times.

3) For equipment that does not need reservation

- To use the equipment, tap your card on the card reader. The red LED turns on to indicate that the equipment is unlocked and ready to use.
- Once you finished using the equipment, tap your card on the card reader. The red LED will turn off and the equipment will be locked.



Fig. 1 The circled red light should always keep ON when the equipment ready to use



Fig. 2 The red LED turns OFF to indicate that you have successfully checked out and the equipment will be locked.



Fig. 3 The red LED turns ON to indicate that the equipment is unlocked and ready to use.



Fig. 4 The 3<sup>rd</sup> generation card reader with timer and display embedded. Once check in, timer will start to count down and equipment will be unlocked for operation

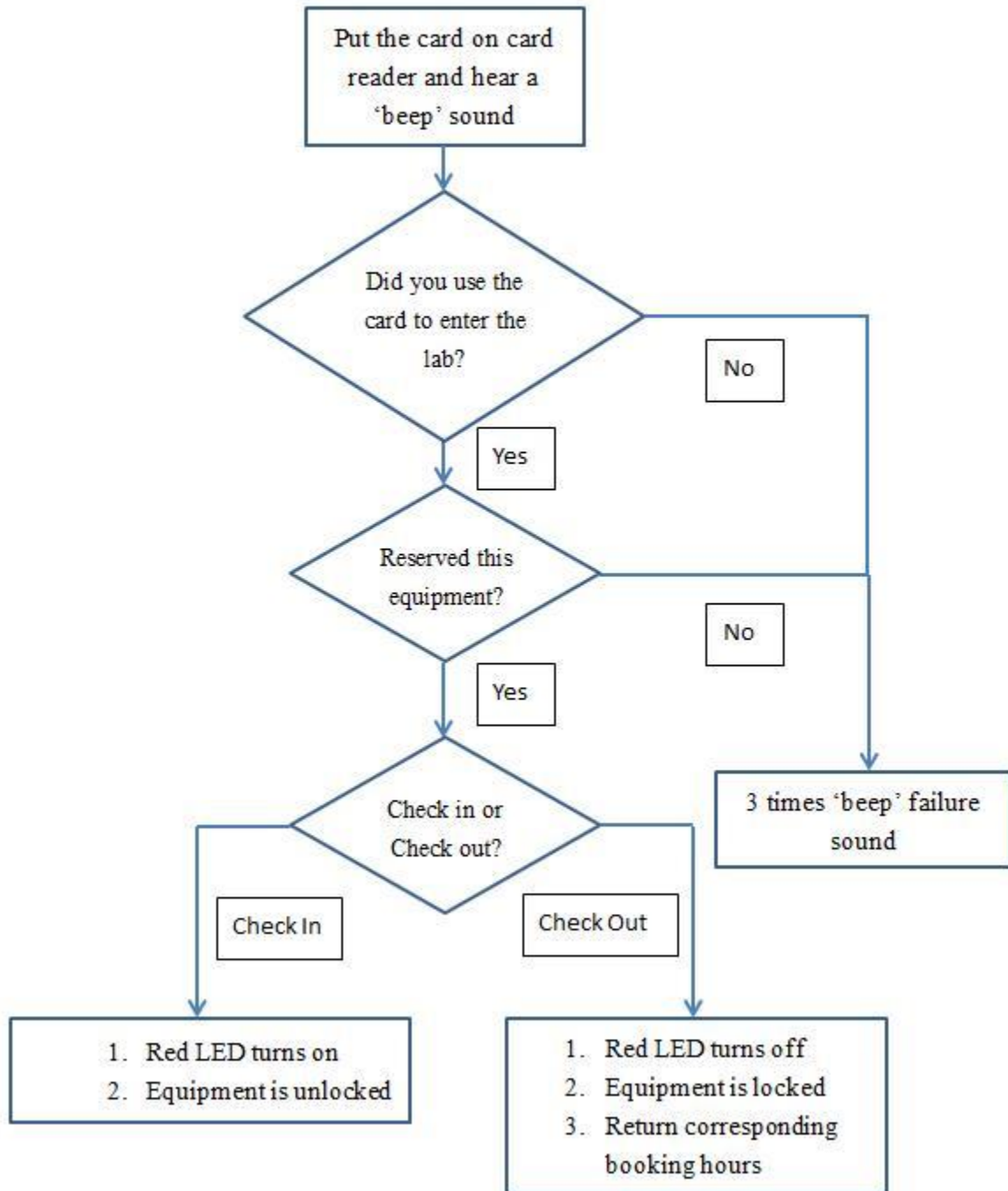
## 6.6 USING THE NFF (CWB) ACCESS CARD

1. You can check in and out for the equipment WITHIN the reserved time slot. For example, if you have reserved the 9 am–12 pm session, then you can check in for the equipment at or after 9 am and check out for it at or before 12 pm. This differs from the way where you perform check-in or check-out via the NFF (CWB) reservation website.

2. You can check in for consecutive reserved time slots. For example, if you have reserved three consecutive sessions 9 am–10 am, 10 am–11 am and 11 am–12 pm, you can check in for all of them in one go by tapping your access card on the card reader.
3. You can also check out for consecutive reserved time slots. For example, if you have reserved three consecutive sessions 9 am–10 am, 10 am–11 am and 11 am–12 pm, you can check out for all of them in one go by tapping your access card on the card reader.
4. You can still check in for the equipment in the second half of the reserved time slot. For example, if you have reserved the 9 am–10 am time slot, you can still check in at say 9:40 am. This differs from the way where you check in via the NFF (CWB) reservation website.
5. It is your responsibility to check out for the equipment after each operation.

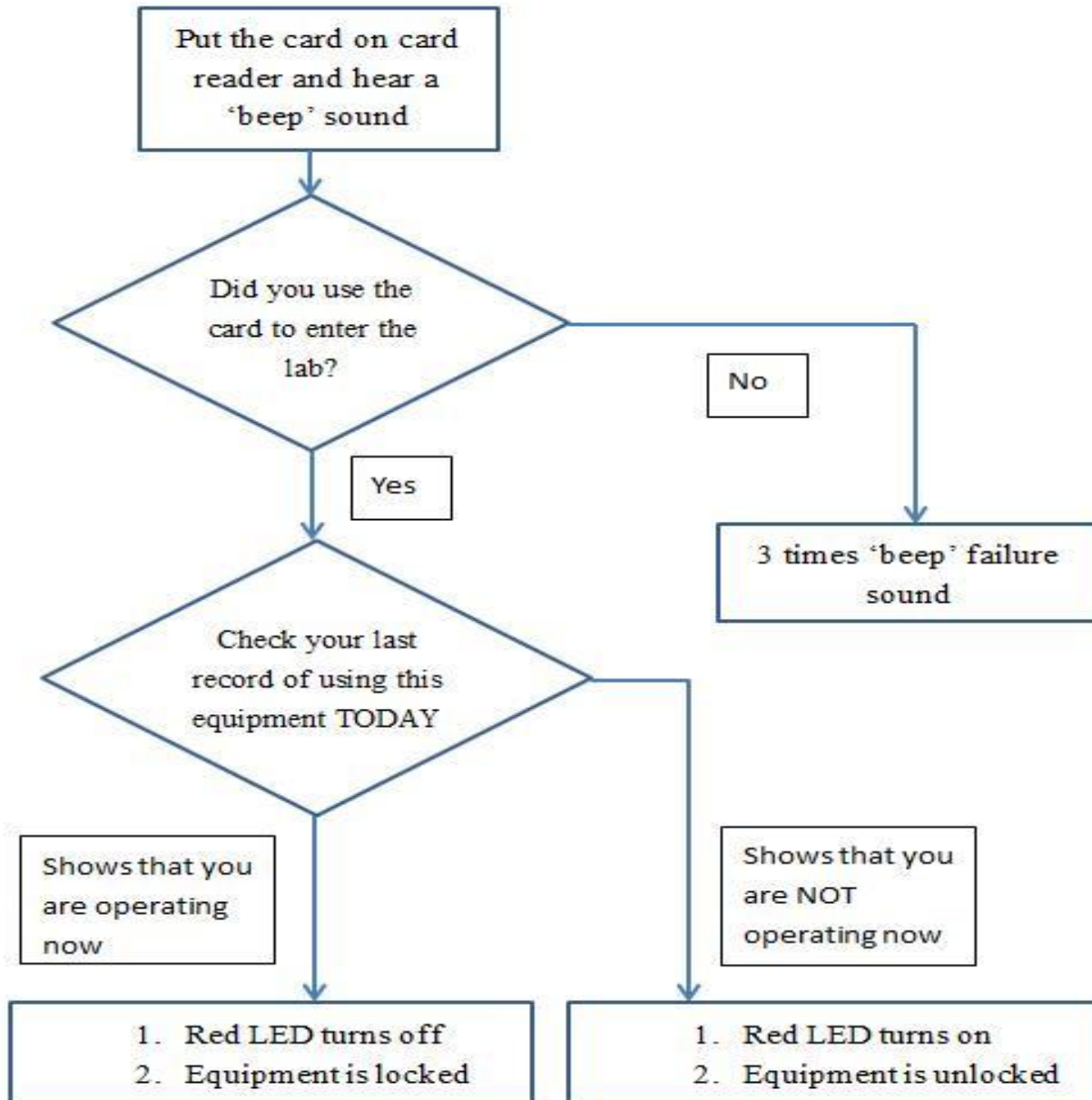
## 6.7 PROCESS FLOW OF THE CARD READER SYSTEM

For reserved equipment





For equipment that does not need reservation



## 7 RULES AND REGULATIONS

### 7.1 NFF (CWB) PHASE II AND NFF (CWB) ENTERPRISE CENTER

#### NFF (CWB) Laboratory Rules and Precautions

##### General Safety Rules

1. Follow all safety policies as posted or stated by NFF (CWB) staff.
2. Follow all laboratory instructions of NFF (CWB) staff.
3. Report any unsafe conditions to NFF (CWB) staff.
4. Safety goggles must be worn when operating equipment.
5. Use the appropriate personal protective equipment (PPE) provided.
6. Never take shortcuts because of haste and laziness.
7. Never bypass equipment interlocks for convenience.
8. Never operate equipment when tired or ill.
9. Never work alone in the laboratory. This rule is absolute and non-negotiable.
10. Never perform unauthorized experiments.
11. Do not touch any liquid you are unsure of. Treat it as harmful or call NFF (CWB) staff to handle it.
12. Never run in the laboratory. Cleanroom booties worn over shoes are slippery.
13. Access the laboratory within the stated opening hours only.
14. Turn off all lights and the liquid nitrogen supply and lock the doors before leaving the laboratory unattended.
15. Notify NFF (CWB) staff immediately in case of injury, a fire or an explosion, or a spill.
16. Familiarize yourself with the safety exits.
17. Familiarize yourself with the locations of the fire extinguisher, eye washer, and safety shower in the laboratory and learn how to use them.

18. Do not wear open-toe shoes, slippers, sandals or shorts in the laboratory.
19. Do not wear contact lenses in the laboratory.
20. Do not wear jewelry in the laboratory as it may become trapped in the moving parts of equipment and cause severe injuries.
21. Get proper training before operating the machine. If you are still not familiar with the operation, consult NFF (CWB) staff.
22. Do not tamper with any of the gas boxes on the floor.
23. A buddy system should always be used when working in or near a hazardous environment, never work alone even for a minute.
24. Do not take anything for granted when working with an inexperienced buddy. Check every operation before and after it is performed.

### **Safety Precautions**

1. Clean room attire protects the product but does not protect the person wearing it.
2. When you wear a bunny suit, your skin is usually damp with perspiration, lowering your electrical resistance to current. Be extra cautious around electrical equipment.
3. Clear hoods, safety glasses, and goggles drastically reduce your peripheral vision. Use extra caution when moving about the clean room.
4. The loose fabric of clean room attire can easily become tangled in machinery. Allow yourself extra room around mechanical equipment.
5. Clean room gloves impair your manual dexterity and your sense of touch and response to heat. By the time you feel warmth, the glove may have already melted through to your hand.
6. The hood or face shield covers your nose. This raises the threshold detection value for all chemicals.
7. The bunny suit desensitizes all your body. You are less likely to be aware of brushing against objects in the clean room.
8. Clean room booties worn over shoes are slippery, and the more booties are worn, the more slippery it becomes.

9. Learn about the chemicals that you are using by referring to the MSDS, which tells you about the physical, chemical, and toxicological properties of the chemicals.
10. Plan your operation or experiment carefully, bearing in mind the hazardous properties of material involved.
11. Learn how to use fire-fighting equipment.
12. Keep all fire doors always closed.
13. Beware of floor openings.
14. Do not panic if you hear an alarm. Find out where the alarm comes from and call SCC for help. (Also refer to Section 11 EMERGENCY PROCEDURES for appropriate actions);
15. Familiarize yourself with all emergency procedures NOW, not when an emergency occurs.
16. Know the emergency contact point (posted beside each telephone).

### **General Operation Rules**

1. Use your own NFF (CWB) access card to enter and leave the NFF (CWB) lab.
2. Use the NFF (CWB) Equipment Reservation System.
3. Use your own access card to check in and check out for your booked equipment.
4. Only operate the equipment that you have trained and passed the qualified examination for and been approved by NFF (CWB) staff.
5. Do not leave an on-going experiment unattended.
6. Report any problems with the equipment by filling in the log sheet.
7. Never try to fix the piece of equipment if you find it faulty being used. Always seek assistance from NFF (CWB) staff.
8. Clean up your work area and the equipment and put items back in their original locations before leaving the laboratory.
9. Always keep the NFF (CWB) laboratory clean and tidy.
10. Hang up your cleanroom garment on your assigned hanger before leaving the NFF (CWB) cleanroom.

## 7.2 NFF (CWB) NANOFABRICATION DEMONSTRATION LAB, NDL

- It is under planning

## 7.3 Disposal of Hazardous Materials

### 7.3.1 Disposal of broken glassware and broken wafer

All broken glassware and broken wafer should be placed in the glass collection box

### 7.3.2 Disposal of Chemicals

Different chemicals call for different disposal methods as shown in the table below. Disposal of chemicals should be handled by NFF (CWB) staff.

Chemical	Disposal Method
Hydrogen Peroxide	Acid Waste to N-tank
Sulfuric Acid	Acid Waste to N-tank
Nitric Acid	Acid Waste to N-tank
Hydrofluoric Acid and Its mixture	HF Waste to HF Collection Tank
Phosphoric Acid	Acid Waste to N-tank
Freckle Etch Solution	HF Waste to HF Collection Tank
PAD Etch Solution (777 Etchant)	Acid Waste to N-tank
Hydrochloric Acid	Acid Waste to N-tank
Acetic Acid	Acid Waste to N-tank
Buffer Oxide Etchant (BOE)	HF Waste to HF Collection Tank
TMAH	Acid Waste to N-tank
Potassium Hydroxide	Acid Waste to N-tank
Ammonia Hydroxide	Acid Waste to N-tank
Photoresist	Non-halogenated Organic Waste Container

Acetone	Non-halogenated Organic Waste Container
IPA	Non-halogenated Organic Waste Container
Thinner	Non-halogenated Organic Waste Container
Chrome Etchant	Acid Waste to N-tank
Chlorobenzine	Halogenated Organic Waste Container
Developer	Non-halogenated Organic Waste Container
HMDS	Non-halogenated Organic Waste Container
Resist Stripper	Non-halogenated Organic Waste Container
Mechanical Pump Oil	Lubrication Oil Tank
Water	Acid Waste to N-tank

## 8 CONTAMINATION CONTROL

Contamination control, or C2 for short, is the protection of samples, process equipment and personnel from contaminants.

- All users must follow the NFF (CWB) laboratory rules and regulations to reduce particle generation and protect samples.
- All chemicals, materials, and samples being processed, and equipment are grouped into three levels of contamination risk: Clean, Semi-clean and Non-standard.
- Wafers are downward compatible. The processes will be allowed only when the cleanliness level of wafers is the same or a higher level of cleanliness than that of equipment.
- Wafers are not upward compatible. Once they come into contact with anything less clean, they will be regarded as contaminated. That is to say, wafers are never allowed to go back to the original group once contaminated.
- Before designing your process flow, familiarize yourself with the Cleanliness Levels of Equipment and Process Verification Scheme. All work in NFF (CWB) should follow the process flow strictly to reduce cross-contamination.

## 9 NEW MATERIAL ASSESSMENT

- Standard materials refer to the materials normally processed by the equipment, which are listed on the website for equipment booking.
- New materials refer to the materials that are not normally processed by the equipment.
- Before any new material is to be processed using the equipment in NFF (CWB), you must first submit the Safety Assessment on User Requested Process form, together with the process flow, Material Safety Data Sheet (MSDS) and the referenced technical papers to NFF (CWB) management for approval.
- In the form, you must declare if the new material is hazardous or may cause cross-contamination and propose cleaning procedures for both equipment and the processed samples.
- You must also state the hazard of the chemicals or exhaust gases that would be generated during the processing of the new material and propose procedures for disposal.
- You are responsible for some of the additional expenses for the disposal of chemicals or exhaust gases generated during the processing of the new material.
- You are responsible for cleaning the equipment after each use unless it is deemed too complicated or hazardous and has to be handled by NFF (CWB) staff.
- The new material and process flow will need to be evaluated and approved by NFF (CWB).
- Approved materials may only be processed on special equipment and stored in NFF (CWB) for a limited period of time. Once the project is finished, those items must be removed from the laboratory.



## 10 PENALTIES

The stated penalties are the minimum degree and may be adjusted according to the nature of the incident.

### 10.1 SAFETY

	1 <sup>st</sup> time	2 <sup>nd</sup> time	3 <sup>rd</sup> time
Rule violation	User rights and lab access will be suspended for two weeks	User rights and lab access will be suspended for four weeks	User rights and lab access will be suspended for eight weeks or may even be revoked permanently

### 10.2 OPERATION

	1 <sup>st</sup> time	2 <sup>nd</sup> time	3 <sup>rd</sup> time
Rule violation	User rights and lab access will be suspended for one week	User rights and lab access will be suspended for two weeks	User rights and lab access will be suspended for four weeks

### 10.3 EQUIPMENT CONTAMINATION

If you contaminate the equipment because you did not follow operational procedures or you put unauthorized material into it, NFF (CWB) staff have the right to ask you to decontaminate the equipment under their supervision and you are liable for the associated cost.

### 10.4 EQUIPMENT DAMAGE

If you damage the equipment because you failed to follow operational procedures or you put unauthorized material into it, you are liable for the repair or the replacement costs.

### 10.5 EQUIPMENT BOOKING

If you reserve equipment but fail to show up and check in for it, you will be liable to a penalty of HK\$400.

# 11 EMERGENCY PROCEDURES

## 11.1 EMERGENCY EVACUATION (NFF (CWB) PHASE II AND NFF (CWB) ENTERPRISE CENTER)

All NFF (CWB) users must evacuate the NFF (CWB) laboratory in the following events:

- Electrical failure
- Toxic/Corrosive/Flammable Gas alarms go off (e.g. phosphine, silane, chlorine, ammonia, hydrogen bromide, boron trichloride)
- Fire alarms go off
- Chemical spills (e.g. solvents, acids and bases, hydrofluoric acid)
- Exhaust failure

## 11.2 EMERGENCY EVACUATION PROCEDURES

- The prime concern is the safety of all personnel.
- Do not remove your cleanroom clothes and evacuate immediately according to the emergency evacuation plan.
- No matter where and why the alarm is sounding, evacuate the laboratory with your buddy immediately.
- Tell other users, if possible, to evacuate the laboratory.
- Notify NFF (CWB), HSEO and Security Office immediately.
- Do not return to the dangerous area until further notice.
- Do not return to the cleanroom until further notice.

## 11.3 EMERGENCY RESPONSE PLAN

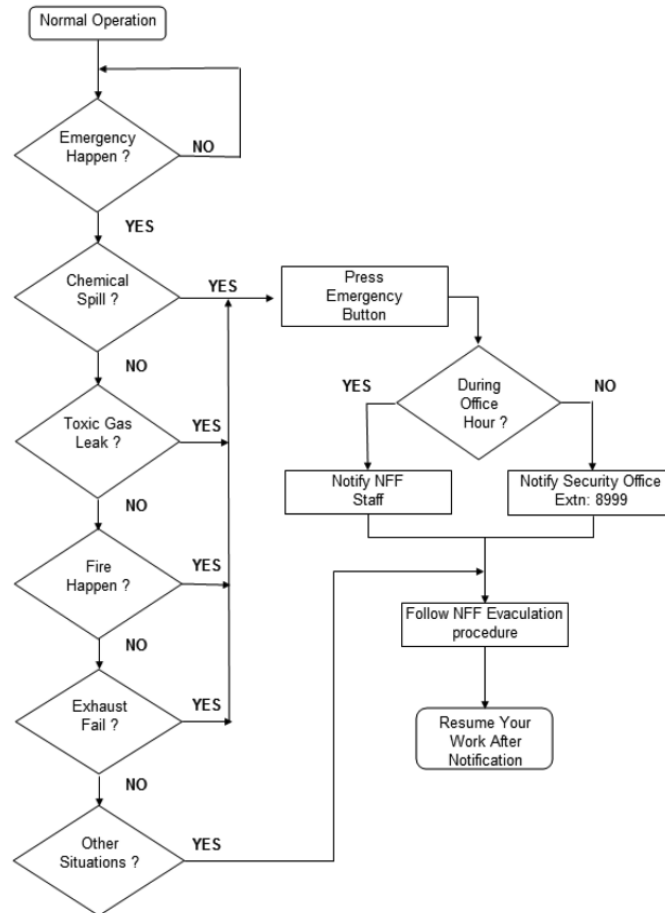
All emergency situations should be promptly reported to NFF (CWB) or Security Office by calling

- A. NFF (CWB) on-campus emergency team\*
- B. Security Office (Tel: 2358-8999 or 2358-6565 24/7)
- C. HSEO Office

\*NFF (CWB) emergency response team members:

- Mr Wong Chun Keung, Tel: 9753-1662 (Team Leader)
- Mr Peter Pun, Tel: 9789-9508

- Mr. Brial Kwok, Tel: 6622-3455)



### Safety Equipment

- First-aid Kit
  - The first-aid kit contains adhesive bandages and standard first-aid bandages for minor abrasion or burns.
- Fire Extinguisher and Blanket
  - Use the fire extinguisher only to extinguish small fires, e.g., trash can fire, wiper on hotplate, etc. and only after summoning help. Wrap the fire blanket around anyone who is on fire in order to put out the flames.
- Chemical Spill Kit

- Apply a caustic neutralizer, an acid neutralizer or a solvent adsorbent
- Material Safety Data Sheet
- Fire Escape Routes Plan
- Eye Washer and Safety Shower
  - Chemical splashes over the eyes
 

If chemicals are splashed into your eyes, call out so that your buddy can lead you to the eye washer in the NFF (CWB) cleanroom immediately. Wash your eyes with water for at least 15 minutes to ensure the chemicals are completely removed. TIME IS OF THE ESSENCE.

If chemicals are splashed over your body, a safety shower is needed immediately. Remove all contaminated clothing while flushing with water and make sure the chemicals are completely removed. TIME IS OF THE ESSENCE.
  - Chemical spills on your clothes/body
 

Use the shower if you spill dangerous chemicals on your clothes/body. Working together with your buddy, immediately begin flushing with plenty of water and remove all contaminated clothing. Continue the shower for at least 15 minutes. TIME IS OF THE ESSENCE.
- Automatic Fire Sprinkler System
 

NFF (CWB) has an automatic fire sprinkler system which is triggered by heat during a fire. Also, any pressure drop sensed in the water line will automatically trip the fire alarms and FSD/NFF (CWB)/Security Office would be immediately notified.
- Chemical Spill Containment/Clean-up
 

Plastic bottles containing neutralizer granules for acids and bases and absorber granules for solvent spills are available in the laboratory. Pour the granules around the spill in a ring to contain it and then fill the ring to absorb the spill.
- Calcium Gluconate Gel for Treatment of Skin upon HF Exposure.
 

The calcium ions in calcium gluconate can bind to free fluorine ions before the latter penetrates the skin and destroys the deep tissue layers and the bones.

The calcium gluconate gel in the laboratory comes in a tube and can be found near the acid hood. It can be applied to affected skin after flushing the skin with a large amount of water. Apply the gel every 15 minutes and rub it into the skin continuously until pain

and/or redness disappears. In addition, anyone who has been exposed to HF must go to the hospital for treatment as soon as possible. The incident must be reported to NFF (CWB).

## **12 ALARM SYSTEM IN NFF (CWB)**

### **12.1 TOXIC GAS LEAKAGE ALARM SYSTEM**

Several kinds of electronic gases are used in NFF (CWB) including silane ( $\text{SiH}_4$ ), germane ( $\text{GeH}_4$ ), dichlorosilane ( $\text{SiCl}_2\text{H}_2$ ), chlorine ( $\text{Cl}_2$ ), boron trichloride ( $\text{BCl}_3$ ), ammonia ( $\text{NH}_3$ ), 50% phosphine in silane (50%  $\text{PH}_3$  in  $\text{SiH}_4$ ), arsine ( $\text{AsH}_3$ ), phosphine ( $\text{PH}_3$ ) and boron trifluoride ( $\text{BF}_3$ )

Some of these gases are toxic, corrosive, or pyrophoric and a toxic gas detection system is in place to monitor them. There are six repeater alarm panels in different areas of the NFF (CWB) lab to show the alarm status. Once the system detects a gas concentration above a certain level, it will give an audio and visual alarm. If an alarm is heard, all users must strictly follow the evacuation procedure to leave the lab.

### **12.2 PERSONAL PROTECTIVE EQUIPMENT (PPE)**

PPE is personal protective equipment designed to protect the well-being of lab users and staff. PPE includes

1. face shields which are designed to protect your face and neck
2. safety glasses which are used to protect your eyes from flying objects, particulates, or glare.
3. chemical resistant gloves and apron which protect you from chemical splashes and spills.

### **12.3 EMERGENCY ALARM BUTTON**

In case of an emergency, for example, an acid or chemical spill, a fire, or a gas leakage, press the emergency alarm button to notify other lab users to evacuate the lab. Familiarize yourself with the location of the emergency buttons.

### **12.4 HF WASTE COLLECTION TANK ALARM SYSTEM**

The HF waste collection tank alarm is located between wet stations D and E in NFF (CWB) Phase II. As soon as the level of HF waste in the tank rises above a certain level, the buzzer and the alarm light will be triggered. When an alarm sounds, you must report to NFF (CWB) staff immediately.

### **12.5 DI WATER AND NEUTRALIZATION ALARM SYSTEM**

The DI water and neutralization alarm system is located between wet stations D and E in NFF (CWB) Phase II. The system triggers an alarm when the tank level is high, when the tank level is low, and when the system is experiencing a fault. When an alarm sounds, you must report to NFF (CWB) staff immediately.