

SAFETY AND BEHAVIOUR RULES

Version 4.9.2 – 23-02-2023



Kavli Nanolab Delft
Enabling nanodevice fabrication

Topics

1. General
2. Cleanroom conditions
3. Access
4. Clothing
5. Working alone
6. Working with chemicals
7. Chemical spill
8. Working with equipment
9. Contamination control
10. Emergency procedures
11. Document version control

Annex 1	Regulations working beyond normal working hours
Annex 2	Risk categories of chemicals
Annex 3	Maps of VLL
Annex 4	Key-card and user box procedure
Annex 5	Images of alarm buttons and safety aids
Annex 6	Evacuation routes cleanroom VLL
Annex 7	Reservation Manager
Annex 8	Procedure for private cleanroom suits
Annex 9	Procedure for working with III-V materials
Annex 10	Agreement form for partial use of wet-bench area

1. General

Scope

This document describes the safety and behaviour rules for using the fabrication facilities in the Kavli Nanolab (KN). In the appendices specific items are worked out in somewhat more detail. For additional information about KN organisation (e.g. technical staff, equipment, reservations, process information, procedures, news etc.) see KN web site: [Kavli Nanolab Delft \(tudelft.nl\)](http://KavliNanolabDelft.tudelft.nl)

Important phone numbers:

Emergency	by internal phone net of TNO	2222
Emergency	by cell phone	015-2788888
Ewan Hendriks	consumables, chemicals, key-card access issues	06-41775723

Important time frames

Normal working hours:	: Monday through Friday, from 8:00 am till 17:00.
Beyond normal working hours	: On working days, from 7:00 to 8:00 and 17:00-22:00 and on Saturday/Sunday from 10:00- 17:00
Cleanroom closed	: all other hours.

2. Cleanroom conditions

The cleanroom is a class 10000 (ISO7) laboratory, with class 100 (ISO5) work area for the critical processes. Typical class 100 workstations include the wet benches for wet-chemical processing, areas for sample inspection and areas for critical sample mounting and preparation.

The wet benches are standard in a so-called standby position with the window down (almost closed). Upon activation the window will go up halfway, the extraction through the working surface area will increase correspondingly and also the inflow of clean air from the top. In this situation the wet bench is ready for use. Altogether the air balance is tailored to slight under-pressure inside the wet bench so that all chemical vapour will be kept inside and will be extracted. In the forefront of the clean benches an enhanced top-down clean airflow keeps 'dirty' class 10000 air away from the class 100 wet bench interior. After 3 minutes of no activity the window of the wet bench will go back to the standby position, with simultaneous switch-back to reduced air flow settings, but still with guaranteed air inflow to keep any vapour inside.

3. Access

Due to the large user community and the limited suit hanger availability, cleanroom access (by reserving a cleanroom suit hanger) is regulated by reserving a slot within our equipment reservation software (NIS). Each Thursday a group of about 150 users get access for a 7 day period, reserved in NIS by their group leader or by an assigned person within their faculty/company. Suits are reservable within NIS on a weekly, few day and singular day basis. A general week suit reservation and few day/single day suits may be done by a user him/herself in NIS. It is essential to know all safety rules. Each new user must agree with the KN hospitality declaration in which is stated that this safety and behaviour rules are read and understood.

- a) A map with emergency exits indicated and information about how to handle alarm situations is located at different locations in the cleanroom.
- b) In the cleanroom surveillance cameras are present. In case of suspected unsafe behaviour, damage of process equipment or theft of valuables the video recordings can be inspected by the KN manager operations or the safety officer and one dedicated staff member. The system is not used for real time surveillance. Maximum period of filing is 7 days.
- c) The ultimate sanction for misbehaviour is banning from the cleanroom for a period of time. In all cases it will also be reported to the supervisor of the user involved. The following sanctions apply:
 - YELLOW CARD: - warning only, remains active for 6 months.
 - 2 yellow cards within 6 months results in a red card.
 - RED CARD: Exclusion from clean room. Exclusion time to be determined based on severity of the transgression.
- d) Access is only possible with the personalised key-card, giving permission to those areas you are authorized to. The key card is made available by TNO according to their procedures. KN facilitates the key card procedure for appropriate access to the process modules according to proven skills. The current procedure for getting the TNO key card is outlined in Annex 4.
- e) It is not allowed to enter the cleanroom without using your personalised key-card by walking in with someone else. Also, each time you leave the CR you should log-out. The fire department of Delft requires unambiguous registration and monitoring 24 hours a day, via the entrance control system for all relevant areas.
- f) It is not allowed to lend your key-card to another person. In case you lost your key-card, you should immediately inform the KN staff so they can de-activate it.
- g) A guest pass can be obtained from the KN staff people. User name must be filled-in on the white board next to the door from TNW to the bridge to VLL.
- h) Visitor access is limited and only possible with personal permission from the manager operations. They must be under supervision of an authorised user at all times and may not touch anything inside the CR.
- i) Access only when proper clothing is used (see chapter 4).
- j) New users have a so-called 'pupil status' and should be under continuous supervision of their mentor(s). Users in the pupil status can work in the CR with their mentor(s), and can only do practical work after following the relevant demonstrations given by a KN staff member or video instruction.
- k) Upgrade from pupil to regular authorized user will be done after passing the relevant test(s) by the KN staff.
- l) After passing the wet-bench test access to the wet bench area door (p.00.300) will be granted. In case of partial use of this area a special form must be filled-in and approved by the KN staff (Annex 10).
- m) Each user must have a so-called user box. The user box contains a booklet for making notes, basic tools for processing and the box is used for exclusive storage of samples. The procedure is outlined in Annex 4.
- n) In case of pregnancy and breast-feeding it is not allowed to work in the cleanroom.

- o) In weeks 26 and 48 the cleanroom is closed for facility maintenance.
- p) Limited availability of first aid/BHV people (from KN staff and TNO staff) could result in a change from normal working hour regime to outside working regime. This could be the situation in holiday season for instance. This will be communicated via NIS.
- q) People who don't need the access to wet bench facilities but are only going to use the inspection equipment like SEM's will not get access through door p.00.300, but will enter the module via door p.00.819.

4. Clothing procedure

- a) You are required to wear the prescribed clothing. When entering the cleanroom for the first time you will get proper instructions how to wear the cleanroom clothes.
- b) **Gowning procedure:**
 - 1st bench:
 - Disposable plastic cover over TNO pass (in case you do not wear inside the coverall)
 - Disposable plastic cover(s) over phone or tablet
 - Hair cover
 - Pair of blue shoe covers (while passing the bench)
 - Firstly nitrile gloves and secondly PE gloves
 - Area between benches:
 - Mouth mask over your nose and mouth (only mandatory for moustache- and beard wearing)
 - (Disposable or fabric) hood over your head
 - Use Personal coverall corresponding to the hanger you reserved in NIS (note that sleeves should never touch the floor and that the hood is inside the coverall. (When you reserved a day-suit a disposable coverall is preferred, a disposable hood is attached to the coverall in that case.)
 - 2nd bench:
 - A pair of cleanroom boots (while passing the bench, do not put the sole of the boots on the bench)
 - Remove PE gloves (and leave the nitrile gloves on)
- c) **Leaving the cleanroom:**
 - Use PE gloves over the nitrile gloves as temporarily measure between the benches.
 - Return the boots sole-to-sole under the bench.
 - Hang the personal coverall back in the coat-rack on your personal number. Take care that the sleeves of the coverall never touch the floor. Throw disposable suits into the trash.
 - After the first bench take of (1.) blue shoe covers, (2.) plastic cover for phone or badge, (3.) gloves and (4.) hairnet
 - Final step is ALWAYS washing your hands.
- d) Sample boxes, tools or any other goods that go in and out the cleanroom go through the transport lock (p.00.804) and need to be cleaned by IPA wipes. Dirty wipes to be disposed in dedicated exhausted red waste bin.
- e) Laptops are not allowed in the cleanroom unless you have permission by KN staff.
- f) Regular KN staff wears light blue clothes. Students and guests wear white clothes. All people wear boots, gloves and a cap.
TNO users wear dark blue/yellow outfit with TNO label, cleaning staff people wear a green outfit.
- g) Dirty clothes can be put in the laundry basket. Clean outfits are available from the limited stock in cabinets.
- h) Broken suits can be placed in the laundry basket; by putting a knot in the fabric, the laundry cleaning can be notified of the broken status.

5. Working beyond normal working hours

Working in the cleanrooms beyond normal working hours is only allowed under strict limitations. Beyond normal working hours is defined as Monday through Friday from 07:00 a.m. – 08:00 a.m. and 5:00 p.m. – 10:00 p.m. and on Saturdays, Sundays and during bank holidays the cleanroom is accessible from 10:00am -5:00 pm (Beyond working hours!).

Primary limitation is that the user is qualified as independent and experienced user having passed successfully relevant tests of operational skills.

Beware that no emergency response team is available in this period. In any emergency situation you should press the appropriate alarm button (see Chapter 10) and inform the safety organization by calling 2222 (internal phones) or 015 27 88888 (it is advised to put this number in your cell phone), and go the emergency collection point. During afterhours so called "bikers" from the G4S safety group at the reactor institute will be alarmed and

will travel to the meeting points. (in front of the main gowning room and/or outside the building (van der Waalsweg 14) They can offer only first aid assistance but will not enter the cleanroom.

Dependent on the situation and the equipment to be used 3 categories are distinguished.

In Annex 1 the current regulations are shown in detail per module and tool, and in Annex 2 the risk categories of the most important chemicals are listed.

Low risk ALLOWED

When you are the only person in the lab, you are obliged to keep in touch with somebody outside the VLL every 30 minutes. This external person should know that you are working in building 104 in the TUD district, and in case of emergency call 015 27 88888. The user should call either 015 2788888 or 2222 in case of emergency.

In this category

- sample inspections and measurements
- spin coating, exposure and development
- organic processing, except hot acetone (see also Ch. 6)
- evaporation, sputtering
- Fluorine- and Oxygen-plasma processing

Medium risk ALLOWED with buddy

- wet inorganic processing with medium risk chemicals (see Ch. 6), but no mixing.
- hot acetone
- Atomic Layer Deposition (ALD)
- PECVD: loading/unloading the machine
- LN2 dewars coupled to thin film process equipment, or Hitachi FEG refill
- Critical Point Drying (CPD)
- Filling dewars or vessels with LN2 from the central tap.
- Rapid thermal annealing (RTA).
- Dicing.

High risk NOT ALLOWED

- Inorganic processing with high risk chemicals (see section 6).
- Furnaces.
- Critical Point Drying (CPD)
- Technical interventions (with or without supplier)

BUDDY:

A buddy is a second experienced person who is in the same module within eye-sight of the user and should be well qualified to operate in case of emergency.*

During daytime high risk chemical processing requires a buddy. It is very likely that enough people are around so that you do not need to organize a buddy upfront. However, you should check this before starting the work and inform the buddy about the work you intend to do. In the afterhours a buddy is required for the medium risk processes and you should organise this upfront.

**TU01,02,03,07,08, 09 and 10 are considered as individual modules.*

6. Working with chemicals

- Always work in the centre of the bench for optimal safety and cleanliness.
- Watch the status of the control lamps: 'safe' (🟢), 'needs attention' (🟡), 'unsafe' (🔴)
- Always wear safety glasses, an apron and black gloves when working in the inorganic benches.
- Avoid inhalation of and exposure to vapour when working in the laminar flow of the wet benches. Never work with your head inside a wet bench.
- Don't put your user box inside the wet bench.

f) Independent working with chemicals is allowed only when you attended the demonstration of chemical handling **and** scored a good result for the relevant test after practicing sufficient time under mentorship.

g) Handling

- Handle any bottle with both your hands.
- For transport to other modules use the dedicated buckets (red for organics, black for inorganics).
- Always return the bottle into the cabinet before starting the chemical processing.
- Doors of chemical cabinets must be closed all the time.
- Chemicals in the cabinets are registered. Please return bottles to the same place. If they are empty, put them in the designated cabinets, and always with the cap screwed on the bottle.
- Use half empty bottles first before you take a complete new one.
- Don't touch other things outside of the bench with your black gloves (excl. tissues, chemical cabinet and used glassware cabinet).

h) Labelling of bottles and beakers:

- Put a readable label (you can use the label printer) on bottles with fresh chemical mixtures: name of the chemical, start date, user name, phone number.
- All beakers should be marked with the name of the chemical solution, except the Teflon or plastic beakers which are used for HF and BOE only, because cleaning of ink on Teflon or plastic is troublesome.
- If you need to leave your samples in solution unattended you need to use a dedicated, plasticized info card and fill it in completely.
- If you need to leave your samples in solution overnight you also need to use the dedicated info cards.
- Unmarked chemical solutions will be removed.

i) Waste

- collect organic liquids in the appropriate waste jerry cans and dirty cleanroom wipes with organic residues in the waste bins inside the benches.
- dispose acid, alkaline solutions and TMAH based developers by using the venturi pump.
- Acid or alkaline residues from samples or glassware and any moisture in the bench working area can be flushed with excess of DI water from the water brush.
- All inorganic waste is collected in the central waste tank in the basement where it is neutralized.
- Never leave residues of chemicals when you are ready with your activities. Clean everything, also the workplace if necessary, so as to avoid risk of injury to colleagues. Prior to placing used glassware in the dedicated cabinet rinse inorganic chemicals with water and organic chemicals with the appropriate solvent (most of the times you can use acetone, but please check).
- Si wafers or wafer pieces, glass residues and contaminated consumables/disposables are collected in dedicated containers installed for the given waste materials.
- For III-V materials such as GaAs and InP (including Si substrates with III-V nanowires) the designated waste containers need to be used and breaking is only in designated exhausted working areas.

j) When working in chemical benches, tissues should not be laid in front of the bench as they block the flow of air into the bench surface and create a "bridge" for the fumes from under the bench to the user area.

k) It is strictly forbidden to use non-registered chemicals. Only the KN staff people can give approval for use of new chemicals because we need to assess the safety risks, chemical storage and waste disposal.

l) Do not use original chemical bottles for storing your own mixtures. Ask the KN-staff for a new and clean bottle.

m) MSDS (Material safety data sheets) of chemical products are available in appropriate places. Consult them prior to use. They are available in English and Dutch.

Organic chemicals

- Small amounts of organic chemicals (solvents, resists, developers, strippers) are in the LOW risk regime, which means that you can process them at any time. See also Annex 2. In this low risk category: Acetone (cold), Ethanol, Isopropylalcohol (IPA), MIBK, PGMEA, Anisol, Ethyllactate, NMP/PRS, DMSO, Ethyllactate, Ethylacetate, Amylacetate, Dimethylformamide.
- Hot-acetone and hot-anisole are in the medium risk regime (vapours are highly explosive), which means that in the afterhours a buddy is required and the maximum quantity of liquid is 100 ml.
- Most organic chemicals are highly flammable and therefore never place organic solvents close to or directly on a hot plate. Organic solvents may only be indirectly heated in a 'au-bain-marie' bath and maximum operation time is restricted to 3 hours. The temperature must be 10 degrees below the boiling point of the organic liquid and may not exceed 80 °C. Beakers with hot organic liquids, e.g. during lift-off, need to be covered by a glass dish or by Al foil in order to avoid evaporation.
- Keep organic liquids strictly separated from acids, peroxides, alkalines, etc. because of explosion risk.
- TMAH (also MF type of developers) is to be considered as an inorganic material (see below).

Inorganic chemicals (acids and alkalines)

- Inorganic chemicals are in the LOW risk regime, MEDIUM risk regime or in the HIGH risk regime. See also Annex 2.
- When making chemical solutions, always add the acid or alkaline to the water (and not vice versa).
- Black neoprene gloves and apron must be used at all inorganic benches at all times. Check beforehand the condition of the gloves with a nitrogen gun. If applicable, both trainer and trainee should both wear protective clothing.
- Keep acids and bases apart.
- Direct heating of inorganic mixtures at temperatures higher than 80 °C is only allowed in day time and only after personal approval of the set-up by the KN staff.
- Don't walk with apron and black gloves outside the chemical area and never touch door handles with the black gloves.
- Bottles should be washed with DI water after use.

Low risk inorganic

- In this category: TMAH < 5% as used in developers (e.g. MF series). It is used in the *organic* benches and disposal is via venturi pump.

Medium risk inorganic

- In this category: acids like hydrochloric acid (HCl), sulfuric acid, acetic acid, phosphoric acid, Cr etch (5% nitric acid, 15% CeNH₄NO₃) and transene-D, and alkalines like KOH and Ammonia.
- Processing during afterhours requires the presence of a buddy, mixing of chemicals is not allowed (prepare your solution beforehand) and the maximum quantity of liquid is 100 ml. If one of these points is not fulfilled the process is considered to be high risk and it must be done during office hours.

High risk inorganic

- In this category: Hydrofluoric acid (HF) in any concentration, TMAH (>5%), fuming HNO₃, piranha, RCA1, RCA2, aqua regia
- Working with HIGH risk inorganic chemicals is not allowed in the afterhours.
- A buddy must be present at all times.
- For working with HF and for preparing reactive mixtures (like piranha, RCA1 and 2, aqua regia) wearing a face shield is required (in addition to apron and neoprene gloves).
- HF attacks glass and therefore you should always use Teflon or plastic beakers.

Spin coating and Baking

- a) Do not place tissues in front of the hotplates. They can swirl up when the window of the bench closes and then stick to the surface of the hotplate.
- b) For keeping the hotplates clean, you need to use a 6 inch wafer or a wafer of your own.
- c) Clogged spinner chucks may not be mechanically cleaned and can be put inside a chemical waste cabinet after which KN staff will take care of chemical cleaning.

III-V materials

III-V materials are considered toxic in case airborne particles are inhaled. Specific rules for working with III-V's are described in the protocol of Annex 9 and apply to all users with III-V containing substrates and samples.

New materials

For any new material KN staff has to approve the use and way-of-working first before it and be introduced in the cleanroom. Please fill in the SOP (standard operation form) and contact the KN staff. Assessment will include safety risks and operating procedures.

7. Chemical Spill

In chemical spill we distinguish:

- A. spill inside the bench
- B. spill outside the bench but not in contact with persons
- C. spill (any volume) with body contact.

In case of **simultaneous spill** on body and outside the bench you should take the most extensive combination of all actions prescribed. The resulting actions on activating one of the alarms are described in Ch. 10.

A. Spill inside the bench

Inorganic and organic spill can be washed away with water.

B. Spill outside the bench

Activate the 'evacuation alarm' by pressing the yellow box,

Always inform company safety group (BHV) about what happened, directly or via available staff.

- During office hours the emergency response team will clean up the spill.
- During afterhours go to the emergency collection point outside the building and inform the bikers if possible. The cleanroom stays closed till the next working day when the KN staff will take care of cleaning.

C. Spill on the body

Organic liquids

Potentially irritating. No permanent damage to person expected.

- Users can rinse chemical spill on body or eyes with water or with Diphoterine in case of developers.
- Cleanroom should be evacuated by pressing the evacuation button. Users must call alarm number (2222) by telephone him/herself and go to meeting point.
- Bikers will be alarmed and will go to the meeting point (van der Waalsweg 14)
- During office hours the emergency response team will be alarmed too.

Acids, alkalines

Potentially injury to person in the form of corrosive burns

- The user shouts for help to buddy in the CR
- Treatment of chemical spill on body or eyes with Diphoterine first and later by rinsing with water. In case of excessive spill use the shower.
- Cleanroom should be evacuated by pressing the evacuation button. User or buddy must call alarm number by telephone (2222)
- Bikers will be alarmed and go to meeting point. During office hours the emergency response team will be alarmed too.
- Bikers can offer first aid assistance, decide that the buddy accompanies the victim to the hospital by taxi or decide to call an ambulance. In all cases the MSDS sheet should be taken along.

HF and HNO₃

Potentially fatal because in case of toxic vapors (HNO₃) or direct contact (HF, TMAH (>5%))

- The user shouts for help to buddy in the CR
- Treatment of chemical spill on body or eyes with Diphoterine (all inorganics except HF) **or** Hexafluorine (by HF) and later by rinsing with water. In case of excessive spill use the Hexafluorine DAP or Diphoterine DAP.
- In case of HF treatment is with Hexafluorine. After this staff will take over for further care before arrival ambulance.
- Buddy or user pushes the evacuation alarm.
- Emergency response team will be alarmed and enter CR.
- The bikers will be alarmed and will go to meeting point.
- Emergency response team and bikers can offer first aid assistance.
- BHV staff can decide that the buddy accompanies the victim to the hospital by taxi (015-2191918) or decide to call an ambulance (112). In all cases the MSDS sheet should be taken along.
- In case of an HF incident the victim always needs to be taken to the hospital along with MSDS sheet and HF kit.

8. Working with equipment

- a) Reservation of equipment is by online booking in The Nanolab Information System (NIS): [NIS | Log in \(nanolabnl.nl\)](https://nanolabnl.nl)
Each reservation of must be reconfirmed between 48 and 2 hrs before starting time.
For some machines maximum time periods and maximum hour quota may apply. If you need more time than the standardly allotted time slot allows, please contact the equipment owner. See also annex 7.
- b) New cleanroom users work under mandatory supervision of a mentor. Independent operation of equipment is allowed when the new user has passed the appropriate test on a machine or process
- c) When a machine goes into failure, it is not allowed to do any maintenance but one should warn immediately the equipment owner or his back-up and change the status of the machine to *"Down by user"*.
- d) Convince yourself before starting the machine if it works properly and is in a good condition.
- e) It is mandatory to fill in the digital log books with pre-defined data fields, such as process parameters or measurement data.
- f) After using the machine leave it behind in its original state.
- g) Never adjust valves for compressed air, nitrogen, etc. This may influence the performance of the machine and possibly damage it.
- h) When a machine does not work properly and may give danger to people, the red emergency stop button (EMO) of the machine must be pushed. See also Ch. 10 par. 4.
- i) With big problems like leakage of gasses, fumes and / or liquids the evacuation button must be pushed immediately. See chapter 10 par 3.
- j) Usage of own USB sticks for data transfer is strictly limited because of continuous danger of computer viruses. Only the use of dedicated USB sticks for a dedicated set of tools is allowed. Keep these sticks with the corresponding equipment accordingly.
- k) Spin coating chucks that are not approved by the KN staff are not allowed and will be removed. In general chucks marked with KN can be used.
- l) A system which is indicated down is not allowed to be used!

9. Contamination control

- a) It is not allowed to leave your samples or tools in the cleanroom processing areas. On a daily bases we will check the working areas and, if present, will take away the samples or beakers. They will not be destroyed, but will be kept for one week and can be retrieved from the KN staff.
- b) Each user must have of a personal user box to store all personal items like substrate boxes, tweezers, timer, safety glasses, syringe, pen, etc. The user box with basic tools is to be obtained against a deposit. See also Annex 4.
- c) For working with III-V materials a special protocol applies (Annex 9). Please inform one of the staff members when you need to start working with III/V materials the first time to be updated about the additional rules.
- d) Wear cleanroom clothing in the correct way and always wear gloves until you have undressed at the first bench. See chapter 4.
- e) Redundant clothes (jacket, jumper, etc.) and bags should be kept outside the clothing room. Valuables can be stored in lockers at the entrance to the clothing room for the period that you are in the cleanroom. Please be aware that lockers will be opened, emptied and reset regularly and that they are not meant for storage of samples.
- f) Use special cleanroom paper for making notes. Normal paper is allowed only when sealed in plastic. No pencils for writing. Wood, cardboard, etc. are strictly forbidden.
- g) Avoid any turbulence: no hurry, use minimal working area in a wet bench, and keep working in the centre of the down flow.
- h) Stay with your head outside wet bench.
- i) Keep cleanroom clean, e.g. by keeping the emergence exit doors closed and keeping the escape routes free.
- j) Do not use make-up and/or perfume, and refrain from smoking one hour before you enter the cleanroom.
- k) Laptops, tablets without plastic cover or any other electronic devices are only allowed after approval by the KN staff and thorough cleaning with IPA wipes in the transport lock. For cell phones and sample boxes please read section 4d) and e).
- l) Metal tweezers or own purchased tweezers are not allowed in the cleanroom due to contamination issues. Use high temperature resistant tweezers allocated close to high temperature equipment for sample handling.

10. Emergency procedures

There are 5 ways to initiate help in case of emergency. Images of the alarm buttons are shown in Annex 5. In case of an evacuation log-out at any badge reader outside the cleanroom if possible or, if not logged-out, report yourself to the safety staff. In the off hours go to the emergency collection point at door 14 (see Annex 3). Response time in normal working hours is 5 minutes for the emergency response team and BHV (Company safety group). Beyond normal working hours it may take 15 minutes before the fire brigade of Delft and TU bikers arrive.

1. PHONE

Internal TNO number 2222 (or 015-2788888 by other phones)

Mention the number of the building which is 104 (VLL)

This method is typical for small-scale incidents (personal problems) and in “outside working hour” situations.

Result of alarm activation:

With alarm no. 2222 one is directly connected to the emergency centre of the TU district at the Reactor Institute.

With the known building no. 104 they switch directly to the VLL emergency group.

2. EVACUATION ALARM

In wet bench area's (yellow box)

in the yellow room it may appear as the same colour of the white walls

This alarm is especially for situations where chemical (toxic, corrosive) vapours may contaminate the cleanroom air.

Typical areas: wet bench modules (TU1 (P.00.380), TU2 (P.00.400), TU3 (P.00.420), TU7 (P.00.360), TU8 (P.00.340/341), TU9 (P.00.320) and TU10 (P.00.321))

When to apply?

1. Liquid is on the floor, liquid leaks somewhere, or (undefined) smell arises.
2. Someone is exposed to chemical liquids.
Also: treat this person immediately with Diphoterine (in case of alkalines) and acids) or Hexafluorine (in case of HF). In extreme cases one could apply the big shower nearby.
3. Someone is exposed to chemical fumes and / or gases.
Also: Bring the person immediately into fresh air. However, pay attention to your own safety. If you find action by yourself too dangerous, leave it to the emergency response team.

Result of alarm activation:

1. Alarm lights and an acoustic signal are activated. Everybody must leave the cleanroom immediately.
2. Emergency response team, BHV (Company safety group) and first-aid people are warned.
3. Air recirculation will stop in order to prohibit further expansion of the contamination.
4. Doors with interlock will be unlocked.

NB EVACUATION alarm is an internal process, no connection to fire brigade of Delft. Always report your findings by phone to number 2222 (internal) or 015-2788888 by (other phone)

In thin film area's (yellow box)

This alarm is especially for situations with thin film process equipment, like evaporators, sputterers, etch reactors, PECVD and furnace equipment.

Typical areas: modules TU12 (P.00.390), TU13 (P.00.370), TU14 (P.00.330) and TU15 (P.00.350).

When to apply?

1. When you suspect that a machine is not working properly **and** poses a threat to people present in the cleanroom.
2. When gases or cooling liquids leak somewhere.

Result of alarm activation:

1. Alarm lights and an acoustic signal are activated. Everybody must leave the cleanroom immediately.
2. Emergency response team, BHV (company safety group) and first-aid people are warned.
3. Processes are switched off. Gas lines are closed and pumped down, equipment goes back into stand-by position. Also all wet benches will be closed automatically.
4. Doors with interlock will be unlocked.

NB EVACUATION alarm is an internal process, no connection to fire brigade of Delft. Always report your findings by phone to number 2222 (internal) or 015-2788888 by (other phone)

3. EMERGENCY OFF EQUIPMENT (EMO) (red button on tools or wet-benches)

This button must be pushed in case of danger with equipment (e.g. smoke in a tool). It switches off and powers down the equipment or wet-bench.

No alarm will be generated.

Please warn the equipment owner immediately.

4. FIRE ALARM (red fire-alarm box)

This manual alarm should be activated in any case of fire.

Result of alarm activation:

1. Alarm lights and acoustic signal are activated. Everybody must leave the cleanroom immediately.
2. Emergency response team, BHV (company safety group), first-aid people and the fire brigade of Delft are alarmed.
3. All processes in the cleanrooms are interrupted, gas lines are closed and pumped down. Equipment goes back into stand-by position. Also all wet benches will be closed automatically.
4. Air recirculation will stop.
5. Doors with interlock will be unlocked.

5. GASALARM and FIRE DETECTION (automatic)

This alarm is an automated system, based on continuous measurement of the concentration of critical gases (flammable, toxic or corrosive) or dust particles (fire detection). This alarm will be activated as soon as gas or particle concentrations are measured beyond a given threshold value.

Result of the alarm activation:

1. Warning signs light up and an acoustic signal is activated. Everybody must leave the cleanroom immediately.
2. Emergency response team, BHV (company safety group), first-aid people and the fire brigade of Delft are alarmed.
3. All processes in the cleanrooms are stopped, gas lines are closed and pumped down. Equipment goes back into stand-by position. As a consequence all clean benches will be closed.
4. Air recirculation will stop.
5. Doors with interlock will be unlocked.

In summary the general emergency procedure:

- As soon as the audio and visual alarm signals are active, you must leave the cleanroom immediately using the nearest emergency exits (see Annex 6) and next leave the VLL building. Don't care about the cleanroom clothes you are wearing. Log out with your personal key card when leaving VLL or inform a first aid/BHV person.
- If you have anything to report you can go to the CR control room on the 1st floor in VLL (day time only) or go to the emergency collection point (off hours).

11. Document Version Control

1		Working document (unpublished)
2.1.		Draft version
2.2.	29-05-2012	First officially published version
2.3.	18-06-2012	Minor modifications and clarifications
2.4.	07-08-2012	Change of emergency stops
2.5.	30-11-2012	Additions to TNO pass procedure and reporting to emergency collection point.
2.6.	10-01-2013	Minor changes in wording.
2.7.	20-02-2013	Update of emergency procedures
2.8.	08-01-2014	Update on key card procedure, TMAH, working beyond office hours, CR map
2.9.	15-05-2014	Labelling of overnight samples, new reservation manager
3.0.	14-07-2015	visual key cards, yellow/red card sanctions
3.1.	15-07-2015	correction of errors in document
3.2.	28-01-2015	new scheme for non-office hours
3.3.	01-09-2015	pregnancy rule
3.4.	10-03-2016	camera surveillance, S-passivation, spin coating chucks, new scheme for non-office hours
3.5.	17-10-2016	update scheme non-office hours
4.0.	15-05-2017	major change in risk regimes for working with chemicals, general update of all rules
4.1.	29-01-2018	buddy within eye-sight, III-V waste, inorganics: check gloves and indirect heating
4.2.	14-03-2018	gloves first procedure
4.3.	01-06-2018	further measures for preventing cross-contamination and III-V protocol (Annex 9)
4.4.	31-08-2018	fine tuning of double gloves procedure
4.5.	11-10-2018	update working with chemicals in accordance with wet bench training
4.6.	15-03-2019	mandatory logbooks, spin coating procedures added and some minor clarifications
4.7.	01-05-2019	detailed rules for yellow and red cards, partial access wet bench area (Annex 10)
4.8.	01-10-2020	Adaptions due to additional Covid 19 rules, breast-feeding and fire detection
4.9.1	23-05-2022	Adaptions: 1) removal Evacuation button 2) LDB replaced by NIS 3)Alarm number 4) opening times.
4.9.2	23-02-2023	Gowning, tweezers, Equipment high/medium/low risk, opening times TNO reception,

Annex 1

Equipment list Kavli Nanolab

Equipment list Ravi Ranaiah						
code	name	type	owner	back-up	risk	
	Lithography					
L1	EBPG-5000+	Vistec EBPG5000+	A. v Run	A. v Langen	LOW	
L1a	EBPG-5200	Vistec EBPG5200	A. v Run	A. v Langen	LOW	
L2	NUV	EVG 620	B. v.d. Bulk	E. Straver	LOW	
L4	Laserwriter-1	Heidelberg	A. v Langen	C. de Boer	LOW	
L11	spinner 1		E. Straver	B. v.d. Bulk	LOW	
L12	spinner 2		E. Straver	B. v.d. Bulk	LOW	
L13	Laminator		Dyna Tex DXM-123-02	B. v.d. Bulk	E. Straver	LOW
L14	mask spinner		Karl Suss CT60	A. v Langen	E. Straver	LOW
L15	Wafer track	Suss Delta 80	E. Straver	B. v.d. Bulk	MEDIUM	
L16	hotplate 1		E. Straver	B. v.d. Bulk	LOW	
L17	hot plate 2		E. Straver	B. v.d. Bulk	LOW	
L18	hot plate 3		E. Straver	B. v.d. Bulk	LOW	
L19	spinner 3		E. Straver	B. v.d. Bulk	LOW	
	Inspection					
I1	Optical microscope 4	Olympus BX53	L. Schriek	E. Straver	LOW	
I2	SEM Hitachi	Hitachi S4800	H. Miro	R. v.d. Kolk	LOW	
I3	Alignent microscope 2	Leica Ergolux	A. v Run	A. v Langen	LOW	
I4	SEM Nova Nano	FEI Nova Nano	H. Miro	R. v.d. Kolk	LOW	
I6	Helios FIB/SEM	FEI Helios CX	H. Miro	D. Lauer	LOW	
I7	Optical microscope 1	Olympus BX5	L. Schriek	E. Straver	LOW	
I8	Optical microscope 2	Olympus BX51	L. Schriek	E. Straver	LOW	
I9	Optical microscope 3	Olympus BX51	L. Schriek	E. Straver	LOW	
I10	Alignment microscope 1	Leica Ergolux	A. v Run	A. v Langen	LOW	
I11	Leitz 1	Leica Ergolux	L. Schriek	E. Straver	LOW	
I12	Leitz 2 (IR cam)	Leica Ergolux	L. Schriek	E. Straver	LOW	
I13	Leitz 3	Leica Ergolux	L. Schriek	E. Straver	LOW	
I14	3D microscope	Keyence	L. Schriek	E. Straver	LOW	
I16	Particle counter	Spotifix	L. Schriek	B. v.d. Bulk	LOW	
I17	Microscope	Zeiss	Chung-Kai Yang	Z. Heidarnia	LOW	
I18	SEM Hitachi	Regulas8230	H. Miro	R. v.d. Kolk	LOW	
I19	Optical microscope	Leica INM20	L. Schriek	E. Straver	LOW	
I20	Lift-Off microscope	DinoLite	L. Schriek	E. Straver	LOW	
I21	Optical Microscope 5	Olympus BX53	L. Schriek	C. de Boer	LOW	
I22	Contour 500	Bruker WLI interferometer	L. Schriek	R. v.d. Kolk	LOW	
	Ovens					
O1	Furnace oxidation	Tempress A2	R. v.d. Kolk	C. de Boer	HIGH	
O2	Furnace anneal	Tempress A3	R. v.d. Kolk	C. de Boer	HIGH	
O3	Furnace LPCVD	Tempress A4	R. v.d. Kolk	C. de Boer	HIGH	
O4	RTP	SSI - Solaris 100	R. v.d. Kolk	C. de Boer	HIGH	
O5	Vacuum oven	Thermo Hereaus	E. Straver	B. v.d. Bulk	LOW	
O8	Vacuum oven 2	Binder	E. Straver	B. v.d. Bulk	LOW	

O9	Drying Oven Top	Venticell	B. v.d. Bulk	E. Straver	LOW
O10	Vacuum oven	Binder	E. Straver	B. v.d. Bulk	LOW
O11	Dry oven	glassware	E. Straver	B. v.d. Bulk	LOW
O13	Vacuum anneal oven	Diamond films	E. Straver	B. v.d. Bulk	MEDIUM
O14	Drying Oven Bottom	Venticell	B. v.d. Bulk	E. Straver	LOW
PVD					
P1	Leybold	Leybold Heraeus LH560	M. Fischer	B. van Asten	LOW
P2	Temescal	Temescal FC-2000	B. van Asten	M. Fischer	LOW
P3	AC-dielectric	Alliance AC450	M. Fischer	B. van Asten	LOW
P4	AC-Metal1	Alliance AC450	M. Fischer	B. van Asten	LOW
P5	SEM sputter coater	Leica	H. Miro	M. vd Krogt	LOW
P6	AC-Metal2	Alliance AC450	M. Fischer	B. van Asten	LOW
P7	AC-EVA 450	Alliance EVA450	B. van Asten	M. Fischer	LOW
P8	QT-AJA	AJA int.	M. Fischer	B. van Asten	LOW
P9	Plassys	MEB550S2	B. van Asten	M. Fischer	LOW
P10	MB-AJA	AJA Int.	M. Fischer	B. van Asten	LOW
P11	Super-AJA	AJA int.	M. Fischer	B. van Asten	LOW
CVD					
C1	ALD Oxford	Oxford Instr. Flexal	B. van Asten	M. Fischer	LOW
C2	Oxford PECVD	Plasmalab 80plus	R. v.d. Kolk	M. Fischer	MEDIUM
C3	CNT/ First Nano	First Nano Easy Tube 2000	R. v.d. Kolk	C. de Boer	MEDIUM
C4	ALD Veeco	Veeco Fiji G2	B. van Asten	M. Fischer	LOW
C5	Diamond CVD	SEKI SDS6300	T. Yamamoto	R. v.d. Kolk	MEDIUM
C6	ALD Picosun	Picosun R200	S. Amitonov		LOW
C7	ALD Anric	AT410	B. van Asten	M. Fischer	LOW
C8	ICP PE-CVD	Oxford Instr. Flexal	R. v.d. Kolk	C. de Boer	MEDIUM
C9	ALD Picosun 2		M. Aghaee	B. van Asten	LOW
Measurement					
M1	Ellipsometer	Woollam	L. Schriek	R. v.d. Kolk	LOW
M2	Stressmeter	Flexus (TOHO)	L. Schriek	R. v.d. Kolk	LOW
M3	4-point probe	Lucas Labs	L. Schriek	R. v.d. Kolk	LOW
M4	AFM	Bruker Fast Scan	L. Schriek	R. v.d. Kolk	LOW
M5	Raman	Renishaw	L. Schriek	R. v.d. Kolk	LOW
M6	Profiler Bruker 1	Bruker Dektak XT motorized	L. Schriek	R. v.d. Kolk	LOW
M7	Profiler Bruker 2	Bruker Dektak XT manual	L. Schriek	R. v.d. Kolk	LOW
M8	Probe Station	SPS 1000	L. Schriek	R. v.d. Kolk	LOW
M9	FR portable	ThetaMetris	L. Schriek	R. v.d. Kolk	LOW
M10	particle counter	CVS	L. Schriek	B. v.d. Bulk	LOW
M11	XRD	Bruker XRD	H. Miro	H. Miro	MEDIUM
Dry etching					
E1	Oxford Estrelas DSE	Plasma Pro 100	C. de Boer	R. v.d. Kolk	LOW
E2	AMS-Bosch	Adixen ICP-100	C. de Boer	R. v.d. Kolk	LOW
E3	AMS100 Cryo	Adixen ICP-100	C. de Boer	R. v.d. Kolk	LOW
E5	Sentech RIE F1	Etchlab200	C. de Boer	R. v.d. Kolk	LOW
E6	Sentech RIE F2	Etchlab200	C. de Boer	R. v.d. Kolk	LOW
E7	TePla-1	TePla 300 Plasma asher	C. de Boer	R. v.d. Kolk	LOW

E8	Oxford CI ICP	PlasmaLab100	C. de Boer	R. v.d. Kolk	LOW
E9	Oxford CI Cobra III-V	PlasmaPro 100 Cobra	C. de Boer	R. v.d. Kolk	LOW
E10	SCIA Ion Beam Etcher	scia Mill 150	C. de Boer	R. v.d. Kolk	LOW
E11	Teppla-2	GIGAbatch Plasma Etcher	C. de Boer	R. v.d. Kolk	LOW
E12	Zone II for SEM	Hitachi	H. Miro	—	LOW
Wet chemistry					
W1	CPD-Right	Leica	E. Straver	B. v.d. Bulk	MEDIUM
W3	HF-VE	Idonus	E. Straver	B. v.d. Bulk	HIGH
W5	KOH etch-Left	-	E. Straver	B. v.d. Bulk	MEDIUM
W6	CPD-left	Tousimis	E. Straver	B. v.d. Bulk	MEDIUM
W7	KOH etch-Right	-	E. Straver	B. v.d. Bulk	MEDIUM
W8	Au plating	Autolab	E. Straver	B. v.d. Bulk	MEDIUM
W9	Wet Bench A	-	E. Straver	B. v.d. Bulk	HIGH
W10	Wet Bench B	-	E. Straver	B. v.d. Bulk	HIGH
W11	Wet Bench C	-	E. Straver	B. v.d. Bulk	HIGH
W13	Vacuum Desiccator 1	Ted Pella Pelco	E. Straver	B. v.d. Bulk	LOW
W14	Vacuum Desiccator 2	Ted Pella Pelco	E. Straver	B. v.d. Bulk	LOW
W15	Ultrasonic bath 1	—	E. Straver	B. v.d. Bulk	LOW
W16	Ultrasonic bath 2	—	E. Straver	B. v.d. Bulk	LOW
W17	Ultrasonic bath 3	—	E. Straver	B. v.d. Bulk	LOW
W18	Vacuum Desiccator 3	—	E. Straver	B. v.d. Bulk	LOW
Miscellaneous					
V1	Wafer dicer Disco	DAD3320	A. v Langen	C. de Boer	LOW
V2	Wafer bonder	EVG 501	R. v.d. Kolk	B. van Asten	MEDIUM
V3	Wire bonder	Westbond 454647E	L. Schriek	R. v.d. Kolk	LOW
V4	Breaking tool	Lattice Gear	B. v.d. Bulk	E. Straver	LOW
V5	Sample Cleaner	Zone-II	H. Miro	L. Schriek	LOW
V6	Powatec Expansion tool	Weidmann	A. van Langen	B. v.d. Bulk	LOW
V7	Breaking tool	—	D. van Woerkom	E. Straver	LOW
V8	LN2 SEM (set van 2)	—	H. Miro	B. van Asten	MEDIUM
V9	LN2 vulstation	—	B. van Asten	C. de Boer	MEDIUM
V10	LN2 Estrellas	—	B. van Asten	C. de Boer	MEDIUM
V11	LN2 MBE	—	B. van Asten	C. de Boer	MEDIUM
V12	LN2 Plassys	—	B. van Asten	C. de Boer	MEDIUM
V13	LN2 AMS Cryo	—	B. van Asten	C. de Boer	MEDIUM
V14	UV/Ozone Cleaner	Bioforce	E. Straver	B. v.d. Bulk	LOW
V15	Clean-up Station	KN Lab	L. Schriek	C. de Boer	LOW

Annex 2

Risk Regimes Chemicals

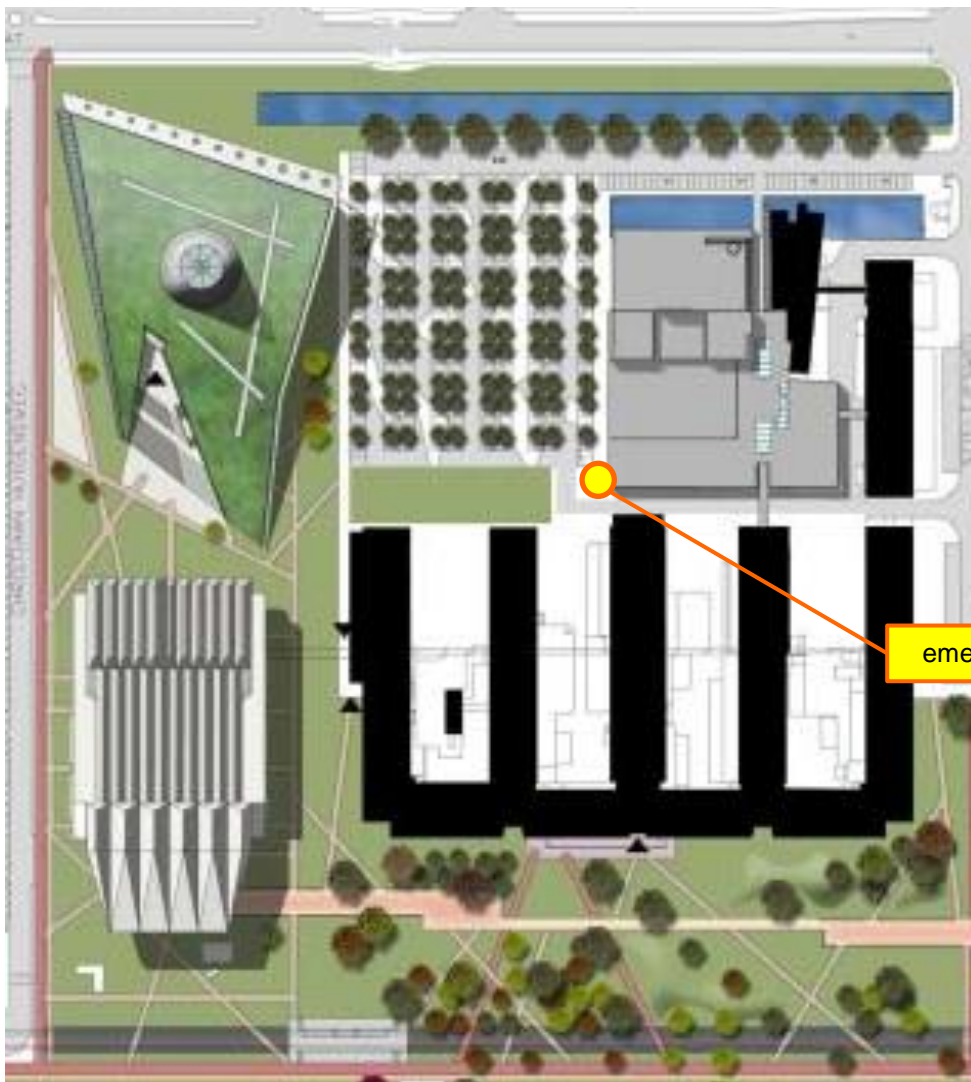
Green = Low, Yellow = Medium, Red = High risk

Chemicals	RISK Category	GHS codes	safety aids
Flammable and irritating	LOW RISK		
General			
Aceton (cold)	Highly flammable. Irritating to eyes. Vapours may cause drowsiness and dizziness.	flammable irritating	water
Ethanol	Highly flammable. Irritating to eyes.	flammable	water
Methanol	Toxic by inhalation; in contact with skin; if swallowed. Highly flammable.	flammable toxic health hazard	water
Isopropyl alcohol (IPA) 2-propanol	Irritating to eyes. Vapours may cause drowsiness and dizziness.	flammable irritating	water
Sulfur	Harmful if swallowed; contact with skin; if inhaled.	irritating	water
Solvents - resists			
MIBK Methyl Isobutyl Ketone 4-methyl-2-pentanone	Harmful by inhalation. Irritating to eyes. Irritating to respiratory system.	flammable irritating	water
PGMEA	Flammable liquid and vapor. Irritating to eyes.	flammable irritating	water
Anisole (cold)	Flammable liquid and vapor. Repeated exposure may cause skin dryness or cracking.	flammable	water
Ethyl lactate	Flammable liquid and vapor. May cause respiratory irritation. Causes serious eye damage.	flammable irritating corrosive	water
Cyclopentanone	Flammable liquid. Irritating to skin; to eyes.	flammable irritating	water
Developer/strippers			
TMAH <5% in MF developer	Causes serious eye damage. Irritating to eyes.	health hazard irritating	diphoterine
NMP N-Methyl-2-pyrrolidone	Irritating to eyes. Irritating to respiratory system. Irritating to skin. May cause harm to the unborn child.	health hazard irritating	water
PRS 3000	Flammable liquid. Causes serious eye damage. Irritating to skin. May cause respiratory irritation.	health hazard irritating corrosive	water
Methyl Sulfoxide Dimethyl Sulfoxide (DMSO)	Causes skin irritation. Causes serious eye damage.	irritating	water
Dimethylformamide (DMF)	Flammable liquid and vapor. Harmful by inhalation. Harmful in contact with skin; to eyes. May cause harm to the unborn child.	flammable irritating health hazard	water
Amyl acetate Pentyl acetate	Flammable liquid and vapor.	flammable	water
Toluene	Highly flammable. Irritating to skin. May cause drowsiness or dizziness.	flammable irritating health hazard	water
Xylene	Flammable liquid and vapor. Harmful in contact with skin; to eyes; if inhaled.	flammable irritating	water

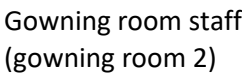
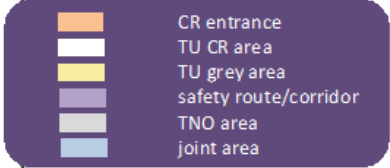
Chemicals	RISK Category	GHS codes	safety aids
	MEDIUM RISK		
Solvents - explosive			
Acetone (hot)	Irritating to eyes. Vapours may cause drowsiness and dizziness.	flammable irritating	water
Anisole (hot)	Flammable liquid.	flammable	water
Acids, alkalines - corrosive			
Hydrochloric acid (HCl)	Harmful if swallowed. Toxic by inhalation. Causes severe skin burns.	corrosive irritating	diphoterine
Sulfuric acid (H ₂ SO ₄)	Toxic by inhalation. Causes severe skin burns. Risk of serious damage to eyes.	corrosive	diphoterine
Acetic Acid	Flammable liquid and vapor. Causes severe skin burns and eye damage.	flammable corrosive	diphoterine
Phosphoric acid (H ₃ PO ₄) / Transene-D	Harmful if swallowed. Causes severe skin burns. Risk of serious damage to eyes.	corrosive irritating toxic health hazard	diphoterine
KOH solution	Harmful if swallowed. Causes severe skin burns. Risk of serious damage to eyes.	corrosive irritating	diphoterine
Ammonia (28% NH ₄ OH) / Ammonium Hydroxide	Causes severe skin burns and eye damage. Harmful by inhalation.	corrosive irritating	diphoterine
Cr etch 5% nitric acid 15% CeNH ₄ NO ₃	Causes severe skin burns and eyes damage. Harmful if swallowed; in contact with skin; inhaled.	corrosive irritating oxidizing health hazard	diphoterine
	HIGH RISK		
Poisonous (lethal)			
HF <7% (incl. BOE)	Poisonous if ingested, at skin contact and if inhaled Causes severe injury to skin and eyes	toxic corrosive	hexafluorine
HF 7-50%	Fatal if swallowed; in contact with skin; if inhaled. Cause severe skin burns and eye damage. May cause respiratory irritation	toxic corrosive	hexafluorine
Ammonium fluoride (NH ₄ F)	Toxic by Inhalation; in contact with skin; if swallowed.	toxic	hexafluorine
TMAH >5%	Fatal if swallowed; in contact with skin; if inhaled. Causes severe skin burns and eye damage.	toxic corrosive	diphoterine
Fumic Nitric Acid (100% HNO ₃)	Very toxic by inhalation. Causes severe skin burns. Irritating to respiratory system. Risk of serious damage to eyes.	oxidizing corrosive toxic health hazard	diphoterine
Nitric Acid (65% HNO ₃)	Very toxic by inhalation. Causes severe skin burns. Irritating to respiratory system. Risk of serious damage to eyes.	oxidizing corrosive	diphoterine
Highly Reactive			
Piranha (H ₂ O ₂ /H ₂ SO ₄)	Strongly oxidizing Very toxic by inhalation. Causes severe skin burns.	oxidizing	diphoterine
RCA 1/2	Harmful if ingested. Very toxic by inhalation. Strongly oxidizing. Causes severe skin burns.	corrosive oxidizing	diphoterine
Aqua Regia (HNO ₃ /HCl)	Causes severe injury to skin and eyes. May cause respiratory irritation Harmful if inhaled; swallowed. May intensify fire; oxidizer.	corrosive irritating oxidizing health hazard	diphoterine
Hydrogenperoxide (H ₂ O ₂)	Harmful by inhalation; if swallowed. Causes severe injury to skin and eyes. Irritating to respiratory system.	oxidizing corrosive irritating	diphoterine
Perchloric acid (HClO ₄) 60%	Harmful if swallowed. Causes severe injury to skin and eyes. May cause respiratory irritation. May cause fire or exploding; strong oxidizer.	oxidizing irritating health hazard corrosive	diphoterine
Ammonium sulfide solution 20%	Causes severe burns. Risk of serious damage to eyes.	corrosive	diphoterine

Annex 3

Van Leeuwenhoek Laboratory (VLL)



Module entrances



Annex 4

Key card and user box procedures Kavli Nanolab

Key card

After personal intake, a mail is being sent to TNO with a request for a badge. This need to be followed up with a visit to the TNO service desk at Stieltjesweg 1 for taking a picture and verifying your identity (please bring a passport or ID card). Opening time of the TNO service desk is from 11:00-16:00. After a few weeks you will receive an email by one of the KN staff members to pick up your final photo pass. During the waiting period for your personal badge, you are allowed to enter the cleanroom with your/(a) mentor as long as you stay in close company with the mentor. He is responsible for your safety during this period and he is not allowed to leave you alone at any time. For new company members we have visitor badges available during this period.

Upon entering and leaving the cleanroom under normal conditions it is mandatory to use your key card at the reader of the CR entrance. Badges are strictly personal. In case you forgot your badge, you may borrow a guest badge from one of the staff members.

In case of emergency you should leave the CR using the nearest exit and log-out may be done at any other reader.

User box

1. Purchase Kavli Nanolab user box in the Central Storage ("magazijn") in the C-wing (ground floor) of TN-building against a personal deposit of € 100. Applicant will sign for receiving a user box with complete tool set.
2. Submit a digital copy of the receipt of your card payment to Ewan Hendriks (or just show your user box).
3. Upon storing your box in the CR please ask for a sticker with name and indication of rack number and position. Always store your box in the designated location. Boxes at other locations will be removed.
4. At the end of the project: hand over the user box with complete tool set back to Kavli Nanolab together with the TNO key card. Missing elements in the tool set can be purchased in the Central Store on the account of user's research section. (full procedure: see below "sign out instructions")
5. After receiving key card and complete user box, Kavli Nanolab will take care for reimbursement of the deposit of € 100. Please also disclose your full address data and IBAN bank account number.
6. If you moved to another location than TUD and have not returned your user box and TNO card, boxes will be removed from the cleanroom 6 months after last log-in. Users will be notified just once by e-mail. Boxes will be kept apart for another 6 months and will then be cleaned-up and re-circulated for new users.

Sign out instructions Kavli Nanolab Cleanroom

You are registered as a Kavli Nanolab user and want to sign out of the cleanroom. What do you need to do?

1. Collect your user box inside of the cleanroom with all the belongings:
 - Pincet 2APCR.SA (PEEK tip tweezer)
 - Pincet 4WF CPR.SA (PEEK tip tweezer)
 - Stopwatch
 - 1 Stirrer Magnet Small
 - 1 Stirrer Magnet Large
 - Safety Goggles
 - USB stick CLEANROOM USE ONLY

You can remove your personal belongings outside of the user box and keep this if wanted. Clean your user box with an IPA wipe before taking it out of the cleanroom. User box can also be removed by the KN staff member at request.

2. Bring your user box with all the belongings and your TNO badge to room D173 (office Eugene Straver and Brian van den Bulk). If you don't bring your TNO badge, it will cost you 25 EUR from your deposit.

3. Fill in the form with all you details (form may be downloaded from our website) to get your deposit, and send this digitally to: Eugene Straver (e.j.m.straver@tudelft.nl) or Ewan Hendriks (e.j.p.p.hendriks@tudelft.nl)

Annex 5

Alarm buttons and safety aids

- Unlock doors green



- Evacuation yellow



- Emergency Power Off of equipment or benches



- Fire alarm red



- Hexafluorine

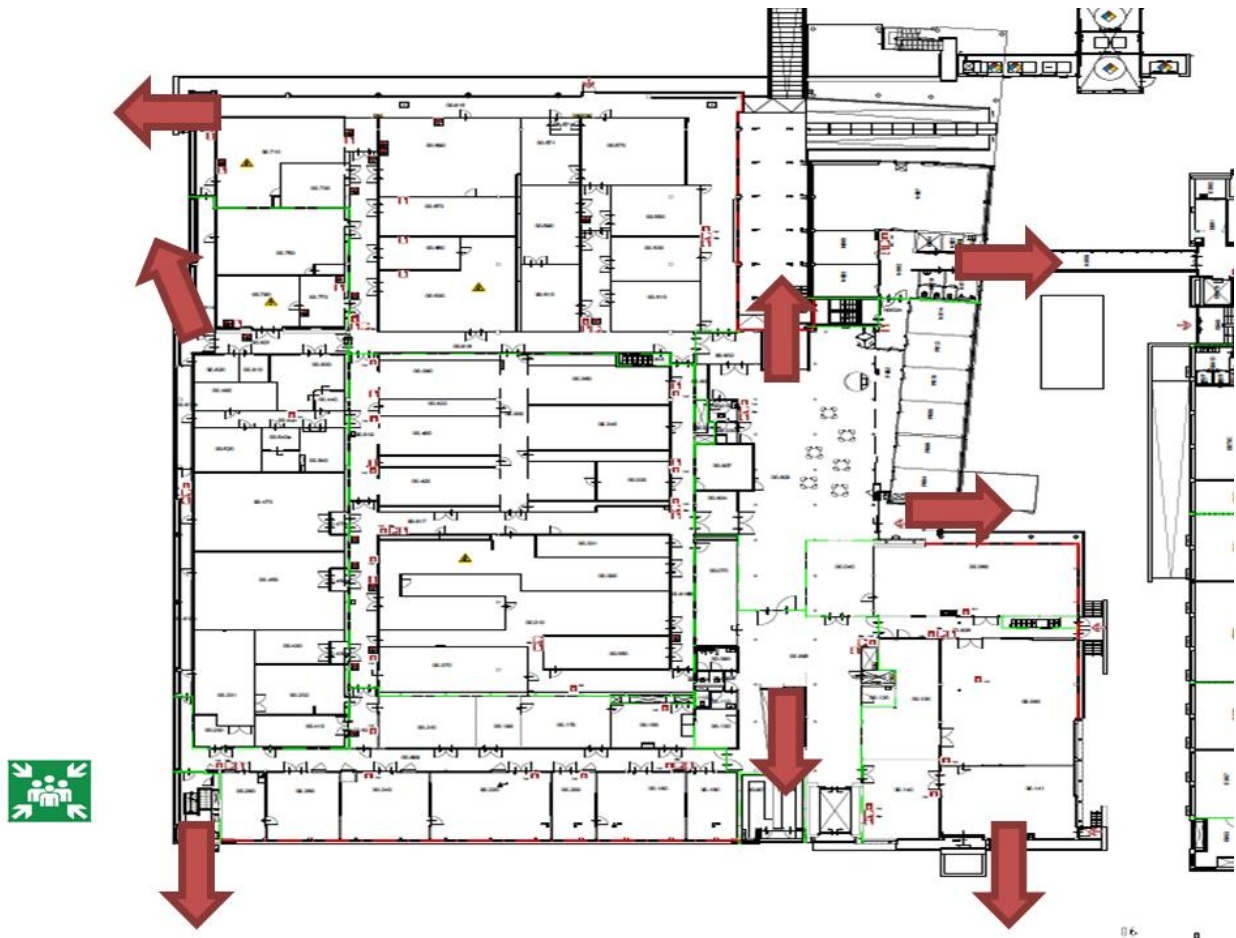


- Diphoterine



Annex 6

Emergency Exits VLL



Annex 7

Equipment Reservation System (Nanolab Information System (NIS))

Log in at: <https://nis.nanolabnl.nl> Log in with your NetID.

For you as a user reserving the equipment is the most relevant feature: under cleanroom you will find the **equipment / planner**.

Equipment planner.

Here you can find all the available equipment of KN.

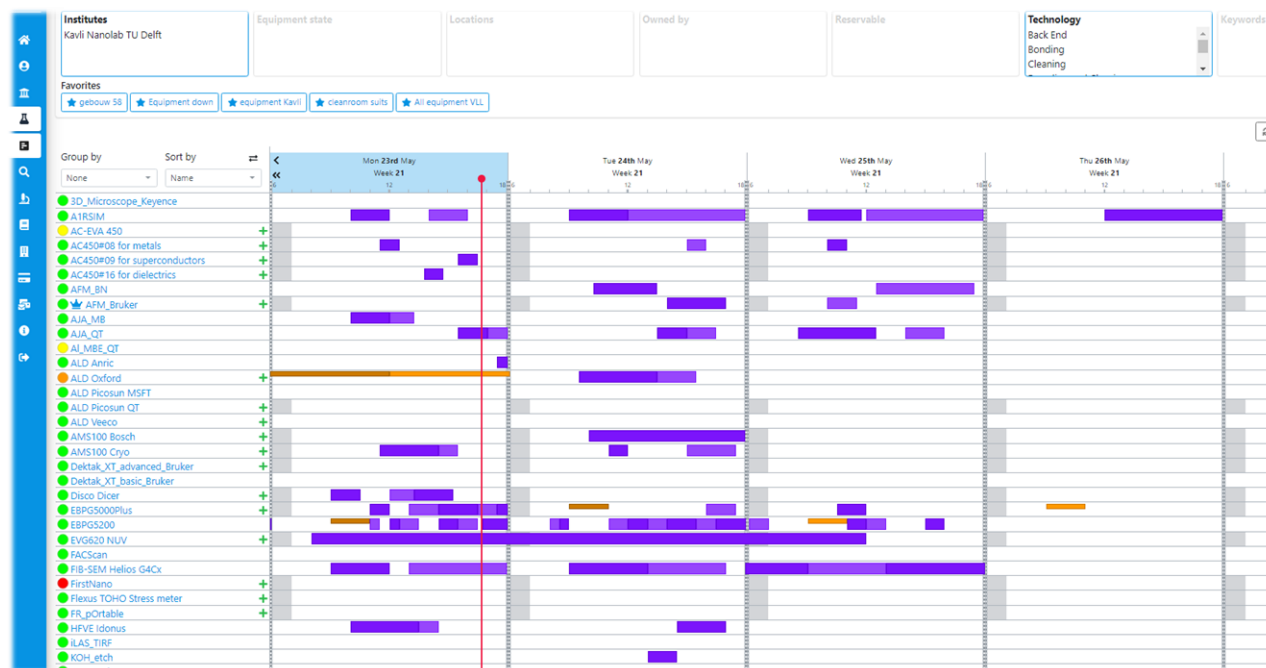
Customized grouping can be made by Institute, equipment state, location, owned by etc.

Booking can be done by clicking the “plus” sign on the right side of the equipment name, and choosing the required date and time and project number. Colours indicate different stages of reservation. In case of a system down situation the equipment can be blocked for reservation for an estimated down period (done by the equipment owner).

Some machine can be booked for specific time slots only, and also can have quota for maximum use per unit of time (like the EBPBG or Dual Beam).

Reservations need to be confirmed between 48 hrs and 2 hrs (EBL 8 hrs) before the time slot starts. You will receive an email 24 hrs in advance. Unconfirmed time slots will be available for other users when the reconfirmation period has ended.

By the way: not showing up after 10 minutes of the confirmed time means that the machine is free for others.



Annex 8

Gowning rules

Due to COVID-19, non-personal cleanroom suits were not allowed anymore. To combat spread of viruses every user can claim his/her own cleanroom suit hanger with own cleanroom suit.

Suit reservation is done in NIS reservation software in the same way as equipment is being reserved.

There are multiple ways to arrange a suit, depending on the amount of time you want to spend into the cleanroom.

In case you need a suit for a full week you have the option to claim a so called “week suit” at the discretion of the various user groups (companies, PI lab etc.). A designated person within a group or company is allowed to do the reservations for his own group. These designated persons have to reserve the suits on the names of the persons who will be the actual user of the week suit. Once the available “week suits” of his group are occupied, the user him/herself is allowed to reserve a -general use- “week suit” in NIS. The reservation of this general use “week suit” is strictly personal.

For shorter periods (from one day up to four days) a suit could be reserved in NIS reservation software. Also these suit reservations are strictly personal.

Visitors are only allowed with written permission of the Kavli Nanolab staff. Visitors are only allowed during daytime (unless agreed with the Kavli staff member) and should be accompanied by fully certified cleanroom user. Visitors are not allowed to touch any system in the lab and are not allowed to be left alone at any time.

To further combat spread of viruses, temporary hoods are available. These can be thrown away after use. Within the hood extra fabric is folded, attached to the neckline. This can be folded out and placed on the shoulders to ensure the hood properly seals the body from the cleanroom. Mouth masks are advised, but only mandatory for beard and moustache wearers. Normal fabric hoods are also allowed and supplied. Also single use disposable suits are available, for multiple day cleanroom access a fabric suit is preferable.

Below in the picture you find a possible week suit outfit.



Annex 9

Procedure for working with III-V materials

Please find the document at:

[Safety \(tudelft.nl\)](https://tudelft.nl/safety)

Annex 10

Agreement for working partially in the Wet Bench Area

The usual Wet Bench Area test consists out of the following points:

1. Cleaning of the sample with fuming nitric acid (HNO₃).
2. Spin coating with photoresist (S1813).
3. Use of profiler (Dektak).
4. Inspection with light microscope.
5. Safety questions.

Point 1 – 4 can be replaced or removed after a discussion with the Wet Bench KN staff (Eugene Straver).

Write down the description of your work:

.....
.....
.....

The following agreement is made:

Point 1

- Will not work with strong acids, strong bases and HF.
- In the test it will be replaced by....

Point 2

- Will not do spin coating.
- In the test it will be replaced by....

Point 3

- Will not use the profiler.
- In the test it will be replaced by....

Point 4

- Will not use the light microscope.
- In the test it will be replaced by....
-

For agreement

If the user is not following this agreement, his/her cleanroom authorisation will be blocked

Date:

Name:

Signature:

Date:

Name Wet Bench Area staff member:

Signature: