

## **Cleanroom rules and regulations**



**Nanolab@TU/e**

**[www.tue.nl/nanolab](http://www.tue.nl/nanolab)**



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## Introduction to the cleanroom

Welcome as a user of the cleanroom. Our facility is located in the Spectrum building of the Faculty of Applied Physics. It is the main research facility inside the building, maintaining a ISO 6 (Class 1000) working environment.

The cleanroom has three levels. The normal working environment is situated on level 1. Level 2 is above the ceiling and not accessible. This level contains the filter fan units that are responsible for the laminar down flow through the working environment on level 1. The ground level is called Subfab. This area is reserved for auxiliary equipment like vacuum pumps, exhaust ventilation channels and gas lines.

The air flow inside the cleanroom is from top to bottom. In between the walls the air is transported up to maintain a circulation of air. Each time the air passes through a filter fan unit, the HEPA filter will filter any particle larger than  $0,5\mu$ . This system will guarantee a ISO 6 cleanroom, together with important behaviour and safety rules. It is mandatory for each and every one to follow these rules to ensure a clean, healthy and safe working environment.

## Opening hours and entry rules

The cleanroom is only accessible with an authorised TU/e badge from Monday till Sunday between 07:00 and 23:00 hours. Be aware! These opening hours are for the Spectrum Building also. This means it is not possible to leave the building after 23:00 hours and before 07:00 hours. Make sure you leave the cleanroom in time to prevent to be locked in.

It is not allowed to enter the cleanroom alone. Especially outside business hours and during the weekend it is mandatory to enter with at least one other authorised person. There are additional rules when working outside business hours and during the weekends due to safety reasons. Not following these rules will lead to appropriate measures as described in this document.

There is a limitation when working outside normal business hours (between 08:00 and 19:00 hours) due to a delayed response time of help in case of an accident. The following activities are allowed outside business hours:

1. Lithography tools including coating, baking and developing (use only chemicals when these are prepared in normal business hours),
2. All Oxford tools,
3. MOVPE and MBE. Changing MO's or gas bottles is strictly forbidden,
4. Evaporators and sputter tools,
5. Metrology tools,

All other processes are forbidden unless appropriate measures are taken and only with approval of the Cleanroom Safety Committee.

It is not allowed to prepare chemicals outside business hours or during the weekend. Use of chemicals during the weekend is only allowed with approval of Huub Ambrosius or Barry Smalbrugge. The request form is attached at the end of this document.

To open the door to the cleanroom you have to hold your TU/e badge against the badge reader. The door will get unlocked and your name will appear on the registration screen. It is mandatory to register with your TU/e badge, even when you enter the cleanroom with someone else. You are also obligated to use your TU/e badge when leaving the cleanroom. Do not leave the cleanroom doors open for an extended time and make sure the door is closed completely when entering or leaving the cleanroom.

Your presence in the cleanroom will be registered for safety and economic reasons. This information will be kept for a maximum of six months.

## Personal belongings

Contamination of the cleanroom has to be prevented as much as possible. This starts with keeping most particle generated materials outside the gowning. The gowning is not a wardrobe. Coats, jackets, sweaters umbrellas, bags and backpacks must be left outside the gowning. There is a coat stand outside the gowning on the altar for this purpose. Use of this coat stand is at your own risk. Nanolab@TU/e is not responsible for theft or loss of personal belongings.

There are lockers available to store personal belongings and valuables. These lockers can be used with a Campus Card. Please follow the instructions on the door of the locker. In case of malfunction, please contact the reception of FLUX. It is always preferable to keep valuables and personal belongings in your office.

## Cleanroom dressing procedure

Entrance to the cleanroom is only allowed when wearing the appropriate cleanroom clothes. It is mandatory to wear a cleanroom hood, cleanroom suit and overshoes at all times and in the proper way. All personal clothing has to be completely covered. Make sure no (loose) hair sticks out. Special beard covers are available for those who are wearing a beard. This has to cover the beard and moustache in the proper way at all times.

Not following the cleanroom dressing procedure will lead to an increased amount of particles inside the cleanroom and an increased risk in contamination of your samples and materials which has to be prevented as much as possible.

Nitrile gloves are also mandatory. They provide a first protection against possible contaminated objects like door handles and are a first barrier for chemicals. But be aware these nitrile gloves are not chemical gloves. If there is a suspicion of contaminated gloves, please dispose them in the proper way and take a new pair.

Two posters with the dressing procedures are visible inside the gowning as a reminder. A copy of the posters are also provided with this document.

It is mandatory to leave your cleanroom suit and hood at one of the hangers when leaving the cleanroom. Even if you are only away for a few minutes. Never leave your cleanroom suit on the bench or on any other surface.

## Cleanroom box

You will be provided with a cleanroom box when cleanroom authorisation is granted. This box has to stay inside the cleanroom and has to be used for storing samples and the materials you are working on.

The cleanroom box contains a timer, safety goggles and a set of different tweezers. When permission is granted to work with chemicals, a set of personal chemical identification cards will be provided. It is mandatory to use these personal chemical identification cards when working with chemical processing.

The cleanroom box is personal and you are responsible for this box at all times. A deposit of € 100 has to be paid by bank transfer. A mandate form for authorisation is available. Returning the deposit is possible by filling out the Request of Payment form. The responsibility for this lies completely with the user. The Request of Payment form can be found at the TU/e website.

Students will not be provided with a cleanroom box. They are obligated to use the cleanroom box of their cleanroom supervisor.

## Hearing protection

The systems inside the cleanroom produce a lot of noise. Most of the noise levels are produced by the filter fan units in the ceiling. Measurements have been made to determine the exact noise pressure which is approximately 76 dB(A). This is a safe environment to work for eight hours or more without hearing protection.

Nevertheless the noise levels and its frequency can be troublesome at times. It is possible to get personal hearing protection, specially made to fit in your ears. Nanolab@TU/e will not provide this hearing protection. Please revert to the safety technician of your group for ordering or your own company. An official TU/e request form is available and attached to this document.

## Safety Goggles

In principle it is allowed to be inside the cleanroom without wearing safety goggles. Nevertheless it is mandatory to wear safety goggles in designated areas. These areas are the Yellow Room and the area surrounding the wet chemical benches, behind the yellow/black line. Use of safety goggles in those areas is also obligated when you are not working with chemicals. A personal safety goggles is provided with the cleanroom box. Safety goggles are also available in two special boxes that are located next to the wet chemical area, and next to the rack with cleanroom boxes.

Remember: spectacles are NOT safety goggles. You need to wear safety goggles over your own spectacles.

## Use of equipment

Use of cleanroom equipment is only allowed after an extensive course. These courses are given only by the responsible technician. Use of equipment is subject to special rules depending on the type of equipment. The additional rules will be provided during the equipment course. All equipment is provided with a status card that shows if it's UP or DOWN at a glance. Also the name and phone number of the responsible technician is noted.

1. It is not allowed to use equipment if you are not instructed and permitted to operate the equipment,
2. It is not allowed to use the equipment without a reservation in the Living Database,
3. It is not allowed to make hardware or software modifications in any way,
4. It is not allowed to use the equipment when it is stated with DOWN in the Living Database, or with the status card,
5. Keep the equipment and working area clean,
6. Report any faults or defects to the responsible technician immediately,
7. Refer to the Living database for the up-to-date status of the equipment,

An extensive list with all equipment and responsible technicians can be found on the Nanolab@TU/e website also.

Misuse of equipment and unauthorised use of equipment will result in a penalty.

## Wet chemical processing

It is not allowed to use wet chemical processing without a proper introduction and instruction by a staff member. All wet chemical processing have to be performed inside the designated wet bench.

When performing wet chemical processing it is obligated to use personal safety protection like proper chemical gloves, safety goggles (even when wearing spectacles yourself) or additional safety equipment. Safety goggles are mandatory behind the yellow blocked line and inside the Yellow Room. Personal safety goggles are provided with the Cleanroom Box. Additional safety goggles for students and visitors are available.

1. It is prohibited at all time to take chemicals inside or outside the cleanroom,
2. It is prohibited to perform chemical processing that is not described in a procedure that has been approved by the Cleanroom Safety Committee,
3. It is mandatory to use your personal chemical identification cards when using chemicals,
4. Dispose your own chemicals in the designated waste container when ready,
5. Make mention if chemicals are running out or waste bottles are full,

Not following these rules will have a direct effect on the safety of yourself and your colleagues. Breaking the rules will result in a penalty.

Refer to the Cleanroom Safety Committee if chemical processing not described in one of the procedures is desirable. A proper process description and safety inquiry has to be made before the process is granted.



## CMR materials

Many different chemicals are being used inside the cleanroom. Before working with chemicals it is highly advisable to be aware of the risks and possible health issues. Material Safety Data Sheets (MSDS) are available for every chemical that can be found inside the cleanroom.

Extra care has to be given to carcinogenic, mutagenic and reprotoxic materials (CMR materials). Exposure to carcinogenic agents can increase the possibility to induce cancer. Exposure to mutagenic agents can cause a permanent change in the genetic materials inside cells (mutations). Exposure to reprotoxic agents can have an adverse effect on sexual function and fertility in both males and females.

Please refer to the latest updated list of all materials that have CMS risks (Dutch only)

<https://www.arboportaal.nl/externe-bronnen/inhoud/instrumenten/lijst-van-kankerverwekkende-mutagene-en-voor-de-voortplanting-giftige-stoffen>

Cleanroom users that have a child wish or already are pregnant need to be extra careful and prevent possible contact with CMR materials. Please refer to the TU/e policy *“Pregnancy & Employment”*.

## In case of an emergency

The cleanroom is a high risk environment. Different sorts of chemicals are being used and a selection of dangerous gasses are present in the subfab and cleanroom. There have been taken precautions to make working inside the cleanroom as safe as possible. Even so, there is always a risk something happens.

The cleanroom is provided with smoke detection, high sensitivity particle detection and gas detection. All these systems are fully automatic and will give an early warning signal when something goes wrong. This can be a visual alarm or an evacuation alarm. The gas systems of the cleanroom will go into safe state automatically when an alarm occurs.

### Evacuation alarm

The evacuation alarm is a slow-whoop signal with a spoken message. You have to leave the cleanroom in an orderly manor by taking the nearest emergency exit. Make sure you leave your workspace safe behind to prevent a possible second emergency. Do not use the elevators during an evacuation. Take any visitors with you.

The meeting point in case of an evacuation is the “Forum” of Metaforum, also known as *“Market Hall”*. Make sure you are acquainted with this location so it can be found without any problems.

### Visual alarm

A visual alarm means something is wrong but the situation is not yet dangerous. You have to be alert and follow the orders of the support staff when given. It is NOT necessary to leave the cleanroom without notice. Ask any support staff member if you have a question or doubts about the visual alarm. Sometimes a visual alarm will go together with a local alarm signal. This is not an evacuation signal.

A visual alarm can be a prelude to an evacuation alarm.

## Chemical accidents

In case of a chemical accident you have to rinse yourself excessively with water for at least 20 minutes, or as long as possible. Use one of the eye wash showers or emergency showers. When your clothing is contaminated, remove all clothing while rinsing with water.

Cry for help to get assistance from your colleagues. If someone next to you has a chemical accident, please assist him or her. Be alert with your own safety. Always (ask someone to) call the emergency number (040 247) 2222 to report the accident, even if it seems to be insignificant. Also report to one of the NanoLab@TU/e staff.

## Other accidents

Other accidents also need to be reported to the NanoLab@TU/e staff. In case of a severe accident like cutting yourself or injuries due to falling, always (ask someone to) call the emergency number (040 247) 2222 to report the accident. If necessary TU/e personnel will arrive to give assistance of emergency help.

## Manual evacuation alarm

It is possible to activate a manual evacuation alarm by pressing one of the fire alarm buttons or one of the gas detection buttons. Misuse will lead into punitive measures.

## Cleanroom plan

A schematic floor plan of the cleanroom and subfab is provided with the locations of all emergency exits and safety equipment. Please refer to the end of this document.

## Cleanroom behaviour rules

The following rules have to be obeyed. Following these rules will lead to proper cleanroom behaviour.

1. Follow cleanroom dressing procedure,
2. Only enter the cleanroom with cleanroom clothing and the provided nitrile gloves,
3. Always use cleanroom clothing in the appropriate way when working inside the cleanroom and be sure your own clothes are covered properly by the cleanroom clothing,
4. Replace your cleanroom suit at least once a week, preferably on Friday or any other last working day,
5. Only place your cleanroom clothing on one of the hangers. Do not leave the clothing lying around,
6. Always attach your name card to make your cleanroom suit personal and for recognition inside the cleanroom,
7. Close the main entrance door and ensure the electronic lock is engaged before putting on the cleanroom suit,
8. When entering the cleanroom, close the outer door completely before opening the inner door,
9. At all times it is prohibited to open your cleanroom suit inside the cleanroom,

10. Do not leave your cleanroom suit on the hanger when not using the cleanroom for a longer period of time. Place your suit in the dirty laundry bin in that case,
11. It is prohibited to take dust-generating materials like (uncoated) wood, paper, card box of rusted materials inside the cleanroom. Also styrene foam is not allowed,
12. The gowning is not a wardrobe; leave coats, jackets, sweaters, umbrellas, bags and backpacks outside,
13. Use the lockers on the altar for storing personal belongings and valuables,
14. Do not eat or drink inside the cleanroom. Chewing gum is also not allowed,
15. Do not smoke inside the cleanroom. Also do not smoke just before entering the cleanroom; wait at least twenty minutes before entering,
16. Only use exclusively special cleanroom paper,
17. Do not open emergency exits unnecessary. An alarm will go off if you do so,
18. It is not allowed to run inside the cleanroom. Always move calm and in a controlled manner,
19. Use the decontamination room to transport consumables or large materials. Make sure all materials are cleaned before entering the cleanroom,
20. Clean materials before bringing them inside the cleanroom,
21. Always keep your workspace clean. Store materials in the personal cleanroom box. Do not leave materials lying around,
22. Orders by the support staff have to be obeyed at all time,

## Cleanroom safety rules

1. The entrance door has to be closed after entering or leaving the cleanroom,
2. For safety reasons it is forbidden to work alone inside the cleanroom,
3. It is not allowed to use (portable) music systems like MP3 players inside the cleanroom,
4. Always wear gloves to prevent accidental contamination with chemicals,
5. Replace gloves immediately after using dangerous chemicals,
6. Safety goggles are mandatory beyond the yellow blocked line and inside the Yellow Room,
7. It is not allowed to work with two or more persons in the same wet bench at the same time,
8. In case of an accident or emergency always call (040 247)2222 and report the state of the emergency,
9. It is forbidden to enter the cleanroom when the door is blocked with the warning belt,

## Penalty in case of breaking the cleanroom rules

Not obeying the cleanroom rules is a serious offence. It will have an effect on the cleanroom conditions or on the safety of all other cleanroom users. The number of repeated violations will affect the severity of the penalty.

All technicians working for NanoLab@TU/e and the cleanroom management are members of the facility support staff and are obliged to report all violations including names to the Cleanroom Safety Committee. The facility support staff may also enforce a cleanroom exclusion for the day on which the safety violation is observed.

The Cleanroom Safety Committee is the only body allowed to give the official warnings and exclude people from access to the cleanroom for a longer period of time. They will send an email to the cleanroom management and supervisor of the person involved after each violation.

### After the first violation

An official warning is given and possible cleanroom exclusion for the rest of the day

### After the second violation

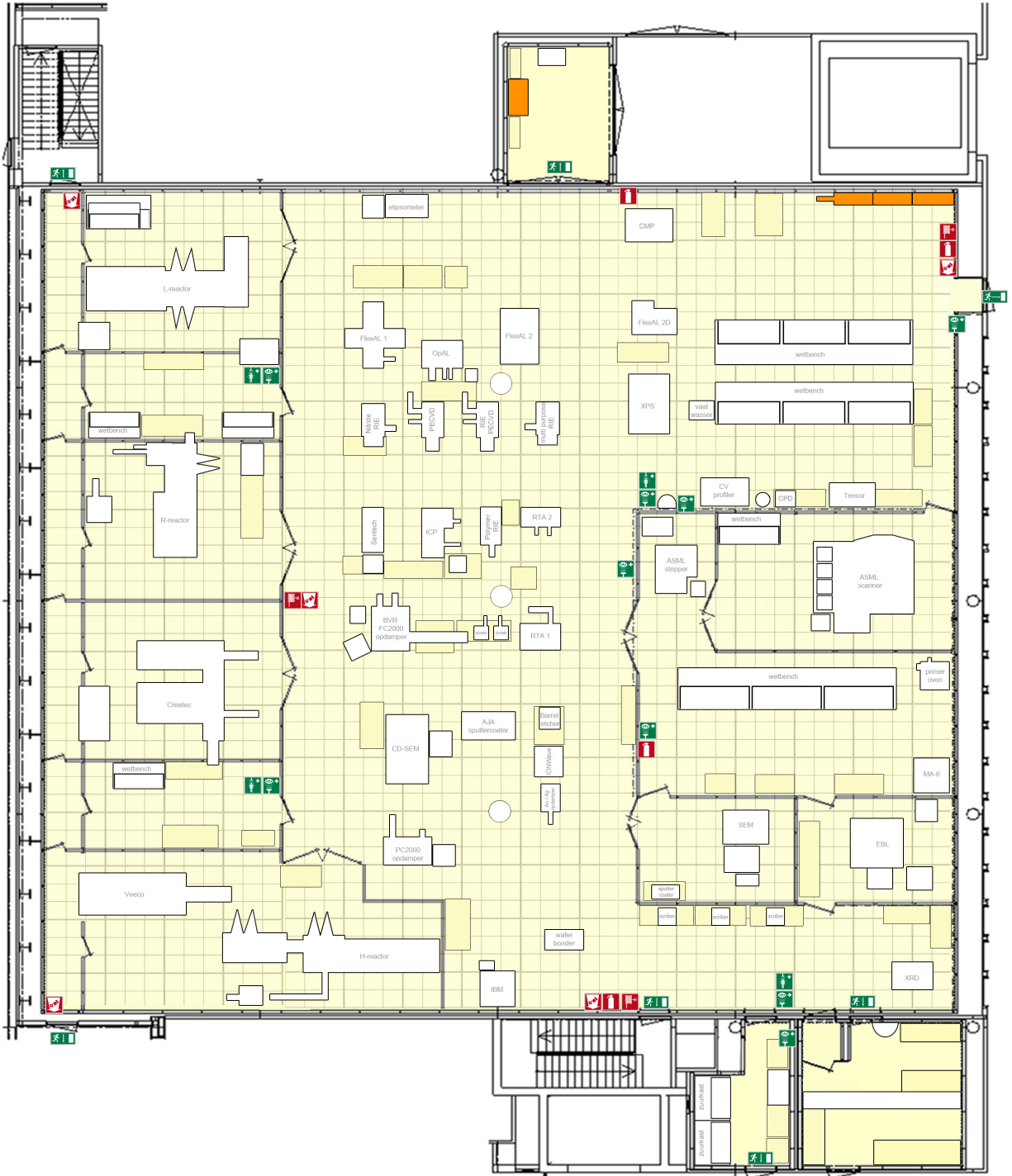
A second official warning is given and two weeks of cleanroom exclusion

### After the third violation

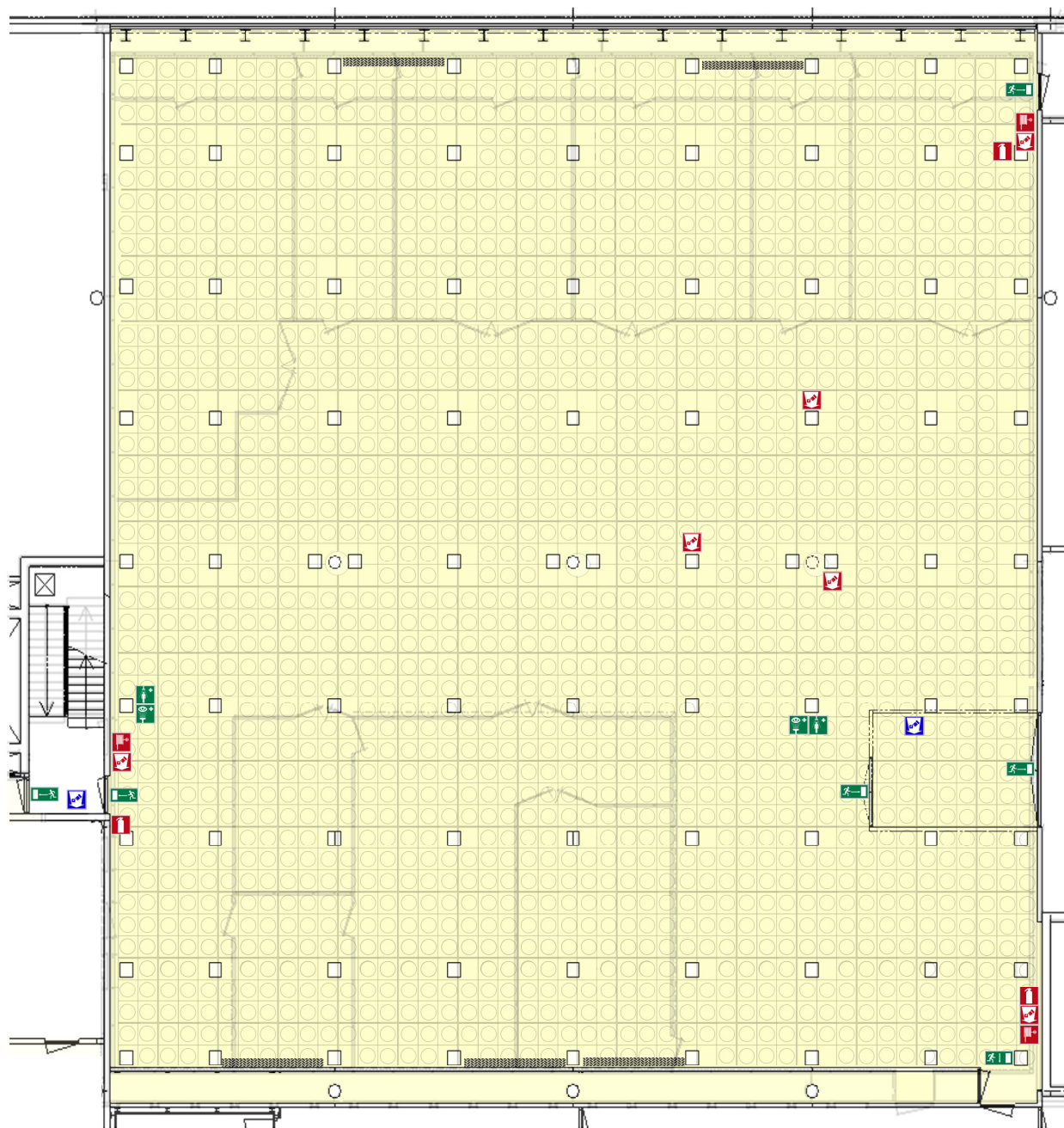
Permanent cleanroom exclusion

## Cleanroom floor plan

Cleanroom Spectrum (SP1.40), including Gowning (SP1.28) and decontamination room.



## Cleanroom Subfab (SP0.28), including decontamination room.



## Appendix

### Nanolab @ TU/e staff

General Director:	dr. H.P.M.M. Ambrosius (Huub)
Logistics manager:	H.N. Harmsen (Nando)
Technicians:	ing. J.Bolk (Jeroen)
	ing. B. Barcones Campo (Beatriz)
	ing. E.J. Geluk (Erik Jan)
	ing. J. van Gerwen (Jeroen)
	ing. H.W.J.J. van de Laar (Robert)
	ing. F.W.M. van Otten (Frank)
	drs. E. Smalbrugge (Barry)
	ing. P.J. van Veldhoven (René)
	ing. T. de Vries (Tjibbe)

## Order form hearing protection

Use of hearing protection inside the cleanroom is not required.

The costs incurred in hearing protection (otoplastic) are paid by the group.

The order form (next page) should be completed, whereby the cost centre number of the group needs to be stated under 'order number'. The form should be signed by an authorised person from the group.

The completed form should be taken to one of the following shop of Schoonenberg Hoorcomfort

Winkelcentrum Woensel 402-404 – 5625AG Eindhoven (040 292 65 59)

It is advisable to make an appointment by telephone in advance.

The fitting process takes about 15 minutes

The otoplastc will be sent by post

The delivery time after the fitting is about 2 to 4 weeks.



## Opdrachtbon voor ELACIN otoplastieken (Order form for ELACIN otoplastics)

**Intersafe Groeneveld B.V.**  
Kamerlingh Onnesweg 2  
Postbus 86 3300 AB Dordrecht  
Internet: [www.intersafe-groeneveld.nl](http://www.intersafe-groeneveld.nl)



Bedrijf: Technische Universiteit Eindhoven Faculteit Technische Natuurkunde Postbus 513 5600 MB Eindhoven		<b>Onderstaande in te vullen door de CG</b>	
		Kostenplaats CG	.....
		Naam tekengemachtigde CG	
		.....	
Relatienummer	01012355	.....	
Contactpersoon		Handtekening tekengemachtigde CG	
Adviseur Arbo	ing. T.J.Eijkemans	.....	
Telefoon:	040-2475914	.....	
Email:	t.j.eijkemans@tue.nl	Datum:	.....

	In te vullen door de CG / Enter details by CG
Naam drager Wearer's name	.....
Afdeling Department	.....
Personeelsnummer Staff registrationnumber	.....
Telefoonnummer Telephone number	.....

Type otoplastiek	Type filter
Clearsound	RC13

**Vooraf een afspraak maken** voor het aanmeten bij 1 van de onderstaande servicepunten.  
*Please make a fitting appointment in advance with 1 of the service points below.*

Dichtst bijzijnde servicepunt Nearest service service point	Deze opdrachtbon meenemen naar de audicien Take this order form to the audiologist	
1. Schoonenberg Hoorcomfort	Nieuwstraat 7-A	040-2950156
2. Schoonenberg Hoorcomfort	Winkelcentrum Woensel 416	040-2926559

### Veilig werken Veilig gevoel

FORTIS 256145768 • ING 65 42 39 460 • Postbank 23 56 70 •  
BTW nr. NL 005178034 B02 Inschrijving handelsregister Dordrecht nr. 23019792

## Request for use of wet chemical processing during the weekend

Name : Full name

Telephone : Telephone

Name second person : who will accompany you

Date : which weekend will you be working

Which chemicals are being used

<input type="checkbox"/>	(NH <sub>4</sub> ) <sub>2</sub> HPO <sub>4</sub> Titanium etch	<input type="checkbox"/>	H <sub>2</sub> O/NH <sub>4</sub> OH/H <sub>2</sub> O <sub>2</sub>	<input type="checkbox"/>	NH <sub>4</sub> OH/H <sub>2</sub> O <sub>2</sub>	<input type="checkbox"/>	Mesitylene
<input type="checkbox"/>	Acetone	<input type="checkbox"/>	H <sub>2</sub> SO <sub>4</sub>	<input type="checkbox"/>	HSQ 6% resist	<input type="checkbox"/>	MIBK / IPA rinse for ZEP
<input type="checkbox"/>	Acetone for Lift-off	<input type="checkbox"/>	H <sub>2</sub> SO <sub>4</sub> /H <sub>2</sub> O <sub>2</sub>	<input type="checkbox"/>	IPA Rinse for PMMA	<input type="checkbox"/>	MIF-826 Dev (TMAH)
<input type="checkbox"/>	AZ 400K Dev (KOH)	<input type="checkbox"/>	H <sub>3</sub> PO <sub>4</sub> diluted	<input type="checkbox"/>	IPA/MIBK Dev for PMMA	<input type="checkbox"/>	MIF-826 for Silicon etching
<input type="checkbox"/>	AZ-Dev	<input type="checkbox"/>	H <sub>3</sub> PO <sub>4</sub> /HCl	<input type="checkbox"/>	Isobutyl methyl ketone	<input type="checkbox"/>	n-Amylacetate dev for ZEP
<input type="checkbox"/>	buffered HF	<input type="checkbox"/>	HCL 37% : HNO <sub>3</sub> 65% = 3:1	<input type="checkbox"/>	Isopropanol (IPA)	<input type="checkbox"/>	NH <sub>4</sub> OH diluted
<input type="checkbox"/>	CH <sub>3</sub> OH/Br <sub>2</sub>	<input type="checkbox"/>	HCl conc	<input type="checkbox"/>	K <sub>3</sub> (Fe(CN) <sub>6</sub> ) solution	<input type="checkbox"/>	NH <sub>4</sub> OH/H <sub>2</sub> O <sub>2</sub> /H <sub>2</sub> O RCA1
<input type="checkbox"/>	Chromium etchant	<input type="checkbox"/>	HCl: CH <sub>3</sub> COOH	<input type="checkbox"/>	KI/I <sub>2</sub> solution	<input type="checkbox"/>	OPD-4262 Dev (TMAH)
<input type="checkbox"/>	Citric acid in solution	<input type="checkbox"/>	HCl diluted	<input type="checkbox"/>	KOH (33% by weight)	<input type="checkbox"/>	Oxalic acid titanium etch
<input type="checkbox"/>	Citric Acid regrowth	<input type="checkbox"/>	HCl/H <sub>2</sub> O 1:1	<input type="checkbox"/>	Kookpuntbenzine 100-140°C	<input type="checkbox"/>	OCG-Dev
<input type="checkbox"/>	Citric acid/H <sub>2</sub> O <sub>2</sub>	<input type="checkbox"/>	HCl/H <sub>2</sub> O <sub>2</sub> /H <sub>2</sub> O RCA2	<input type="checkbox"/>	ma-D 332s Dev	<input type="checkbox"/>	RBS solution
<input type="checkbox"/>	Copper polishing etch	<input type="checkbox"/>	HF (10%)	<input type="checkbox"/>	ma-D 332s Dev (NaOH)	<input type="checkbox"/>	RI-9180 n-butyl Acetate
<input type="checkbox"/>	DE-9040 n-methyl Pyrrolidone	<input type="checkbox"/>	HF (5%)	<input type="checkbox"/>	ma-D 531s (TMAH)	<input type="checkbox"/>	C <sub>4</sub> H <sub>4</sub> KNaO <sub>6</sub> / H <sub>2</sub> O <sub>2</sub> / HCl
<input type="checkbox"/>	Ethanol	<input type="checkbox"/>	HF diluted (1%)	<input type="checkbox"/>	ma-D 531s Dev	<input type="checkbox"/>	(NH <sub>4</sub> ) <sub>2</sub> Sx / H <sub>2</sub> O
<input type="checkbox"/>	H <sub>2</sub> O/H <sub>2</sub> SO <sub>4</sub> /H <sub>2</sub> O <sub>2</sub>	<input type="checkbox"/>		<input type="checkbox"/>	Mask cleaning solution	<input type="checkbox"/>	UPW for rinsing
<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>	HNO <sub>3</sub> conc

If the requested chemical is not mentioned in the list above, it will never be allowed during the weekend.

Authorisation can only be given by Huub Ambrosius or Barry Smalbrugge.

It is prohibited to use wet chemical processing during the weekend without their authorisation.

The second person also need to have permission to enter the cleanroom and to use wet chemical processing.

For more information please turn to the document “*Cleanroom Rules and Regulations*”.

Signature

