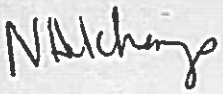
MANCHESTER 1824
The University of Manchester

General Risk Assessment Form

Date: (1)	**Assessed by:** (2)	**Checked by:**	**Location:** (4)	**Assessment ref no** (5)	**Review date:** (6)
16/05/2017 A.Szelc Parts adapted from CO_2 cooling HA		Alex Bitadze **Validated* by:**	Schuster 5.17		

Task / premises: (7)

Using low-temperature evaporator to deposit wavelength shifting (WLS) materials on foils.

Procedure:
1. Clean chamber and crucible to be used with alcohol.
2. Clean substrate foils if they do not have protective films.
3. Install substrate on rotating disc.
4. Weigh the amount of WLS needed.
5. Deposit WLS in aluminum cup. Insert into crucible. Screw on copper cover.
6. Close crucible using Feedthrough knob.
7. Install rotating disk.
8. Remove protective film from substrate (if applicable)
9. Close Chamber. Screw main flange with two holders to close gap.
10. Turn on backing pump. After achieving low 10^-2 mbar, turn on turbo pump. Wait until 10^-6mbar.
11. Turn on chiller, check temperature set to 19.5°C.
12. Turn on crucible heater. Close pressure sensor valve.
13. Turn on quartz deposition sensor, turn on rotating motor, at 200°C,
14. When temperature reaches 220°C, open crucible shutter.
15. At end of deposition close crucible shutter, turn off crucible heater. Turn off deposition sensor. Turn off rotating motor.
16. Turn off vacuum pumps. Break vacuum with gas nitrogen, needs 1.5 bar on gas bottle.
17. Open chamber. Remove disk. Remove substrate. Turn off chiller.

Activity (8)	**Hazard** (9)	**Who might be harmed and how** (10)	**Existing measures to control risk** (11)	**Risk rating** (12)	**Result** (13)
Operation of Evaporator	High Temperature Crucibles. / Fire	Operator cleaning the crucible before evaporation.	Chiller on during breaking vacuum increases cooling down of crucibles. Alternate crucible between evaporations. This results in a crucible being cooled twice and at least 3 hours passing between heating and cleaning. COSHH form for IPA, read by all users. Gloves and safety glasses will be worn. Temperature of vessel when cleaning will be below the flash point of IPA, fire extinguisher present in clean room.	LOW	A
	Nitrogen emptying into the room.	Operators in the room.	Volume of chamber is 0.41% of volume of room 5.17. The full emptying would lower oxygen content by at most 0.1%. See calculations below.	LOW	A
	Heavy chamber lid	Operators inserting disk and substrates and cleaning crucibles. Crush injuries	Hydraulic holders slow fall of chamber. Two person rule: one person always holds the chamber when open. Never put hands in way when lid is closing. Trained first aiders are available throughout Schuster Building, contact details are in the lab. Nearest first aid kit is in 5.22	LOW	A
	Electrically powered	Operator, others in room. Electrical shock, cable trip hazard	1) All electrically-powered components are standard units and regularly PAT tested. Visual user checks before use each time. Any defects will be reported and electrical equipment will be taken out of use. 2) Cables are routed sensibly: at edge of room or under a cable bridge if necessary to traverse a foot path.	LOW	A
	Gas Cylinder Handling	Operator, others in vicinity. Manual handling injuries. Crush injuries.	1) Standard cylinder handling protocols, including no person to travel in a lift with a gas cylinder. Gripper gloves and steel toe cap shoes will be used to avoid crush injuries. 2) Gas cylinder trolley for transport 3) Minimise number of cylinders stored 4) Only trained users who have been on University Compressed Gas Course.	LOW	A

Activity (8)	**Hazard** (9)	**Who might be harmed and how** (10)	**Existing measures to control risk** (11)	**Risk rating** (12)	**Result** (13)
	Warm/hot water in heat chiller	Operator, others in room. Scalds, potential for legionella build-up.	1) Allow contents to cool before touching, e.g. when emptying tank. Oven gloves provided. 2) Empty the tank when not in use and at least once per month.	LOW	A
	Pressurised vessel	Implosion/explosion	Walls of the evaporator are very thick minimising risk. Pressure is very low ($1x10^{-6}$ mBar)	LOW	A

Action plan (14)				
Ref No	**Further action required**	**Action by whom**	**Action by when**	**Done**

Notes to accompany General Risk Assessment Form

Volume of Evaporator chamber is conservatively estimated to be: 0.5 m^3 (chamber diameter is 0.95 m, height of main is 0.54m, volume of lid is conservatively assumed as a cylinder with height of 0.16m). This constitutes 0.41% of volume of the room. Evacuation of the whole volume of nitrogen into the room immediately would result in at most a change in oxygen level from 20.9 to 20.8%: $\eta' = \eta*(V_{room}-V_{chamber})/V_{room}$.

Crucible temperature is roughly around 40°C after one cycle, due to cooling.