	McMaster University Risk Management Manual	RMM # 500 Designated Substances Control Program	Final Date: July / 03 Page: A-1
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Appendix A Designated Substance Assessment Form
RECORD OF DESIGNATED SUBSTANCE ASSESSMENT

SUBSTANCE: <i>Arsenic</i>
DATE:

COMPANY: <i>McMaster University</i>
DEPARTMENT OPERATIONS: <i>CEDT, molecular beam epitaxy (MBE)</i>
LOCATIONS: <i>TAB 110A</i>
<u>ASSESSMENT PREPARED BY:</u> <i>BRAD ROBINSON</i> <u>TITLE:</u> <i>RESEARCH ENGINEER / CEDT MANAGER</i> <u>DATE PREPARED:</u> <i>DEC 2005 / rev Jan 12 2006</i>

**APPLICATION - WORKSHEET 1: IS THE DESIGNATED
SUBSTANCE PRESENT?**

1. Do any material safety data sheets from your suppliers indicate the presence of the substance?

YES

NO

2. If substance is present, indicate the department where it is used, nature of the use (i.e. Direct or indirect) and the quantity used per month or year:

<u>Product Name</u>	<u>Department</u>	<u>How Used? Direct / Indirect</u>	<u>Quantity Per Month / Year</u>
Arsine → → Arsenic	CEDT	Indirect Arsenic byproduct	0.5 pounds/year

Note: Arsine excepted, pages, Designated Substance — Arsenic regulation

CONCLUSIONS

Read statements and check applicable box:

Substance not present anywhere in workplace; regulation does not apply
No Assessment needed

Processes / activities have been identified where substance present.
Proceed to worksheet 2.

APPLICATION - WORKSHEET 2: IS WORKER EXPOSURE LIKELY

1. In what form does the substance enter the plant?
 Product Title: *Arsine gas*
 Type of Container: *compressed gas cylinder* Size of Container: *26" φ x 18"*

2. Is this form altered during use or in the operation: YES NO
 If YES, indicate altered form: *gas to solid*

3. Is there a possibility of the substance being releases into the workplace environment during normal use? YES NO
 If YES, indicate the stage of the operation or areas where this can occur. *sample loading daily, machine maintenance twice/year; vicinity of machine*

4. If YES, to Question 3, specify the job functions and approximate number of employees who might be exposed:

Job Function	Number of Employees
<i>research engineer</i>	<i>2</i>

5. If YES, to Question 3, Indicate how workers could be exposed:
 Inhalation Ingestion Skin Absorption
 Skin Contact

6. If NO, to Question 3, is there a likelihood of escape due to leaks, accidents, etc.?
 YES NO

7. Are workers likely to be exposed? YES NO

CONCLUSIONS

Are there any activities / situations where exposure by any route is likely

YES NO

If NO, no further action is necessary. Date Completed _____

If YES, an assessment is necessary – **proceed to Section III**

Note: If protection against exposure has been left up to some engineering control measure which can fail, or deteriorate for any reason, or to a work hygiene practice, an assessment is necessary -**Proceed to Section III**

ASSESSMENT – WORKSHEET 3: PROCESS DESCRIPTION

NAME OF PROCESS: molecular beam epitaxy service

<u>Process Flow</u>	<u>Description</u>	<u>Likely Exposure</u> <u>Yes / No</u>
1. epitaxy	daily operation, crystal growth process	No
2. sample loading	daily procedure, <1 hour per day	Yes (sample block has deposit/flakes)
3. minor maintenance	machine recharge cycle, minor repairs or changes removal/reinstall small components	Yes (deposit/flakes if present may be loose)
4. major maintenance	remove/install/alter large machine components	Yes (deposit/flakes if present may be loose)
5. decommission	machine shut down, prepare for disposal of main chamber; possible exposure to arsenic complicated due to phosphorus fire hazard.	Yes (removal of valuable components may present some loose deposit/flakes)

ASSESSMENT – WORKSHEET 4: EXISTING CONTROLS

<u>Process Flow Stage</u>	<u>Control Description</u>	<u>Problems / Recommendations</u>
2, 3, 4, 5	<p><u>Engineering Controls:</u> room ventilation includes standard HVAC. Additional exhaust via gas cabinets</p>	
3, 4, 5	<p><u>Work Practices</u></p> <p>a) attend to one component at a time, one port at a time</p> <p>b) <u>bake</u> main chamber 150°C+ before vent</p> <p>c) vent to inert N₂</p> <p>d) maximum chamber vent time 1 day; pump down at end of each day.</p> <p>e) monitor for toxic gas byproduct (eg arsine) at all times when chamber open (Zellweger CM4 tape monitor)</p> <p>f) review this document and SOP prior to venting chamber</p>	<p>i) fire hazard due to phosphorus results in smoke consisting of oxides of As (and P)</p> <p>ii) significant arsine byproduct if chamber interior exposed to air (moisture) for periods ~ 1 day (possibly similar for phosphine, stibine)</p>
5	<p>a) at decommissioning and removal of components, seal port with conflat & gasket</p> <p>b) machine decommission/disposal will be contracted out to external hazardous waste management company; consult</p>	<p>prior to beginning to assure compliance with their requirements.</p>

ASSESSMENT – WORKSHEET 4: - EXISTING CONTROLS (cont'd)

<u>Process Flow</u> <u>Stage</u>	<u>Control Description</u>	<u>Problems /</u> <u>Recommendations</u>
2, 3, 4	<p>Hygiene Facilities and Practices:</p> <ul style="list-style-type: none"> - maintain clean work area with disposable surface coverings into bags for hazardous waste disposal - cleanup with designated HEPA vacuum - wet wipe finish cleanup - wash hands after possible exposure - eat in separate lunch area. <p>Training / Information:</p> <p>WHMIS / MSDS / designated substance assessment (this doc.) / SOP manuals</p> <p>New employees, both on the MBE and elsewhere given familiarization introduction to potential hazards and general operations</p>	
3, 4	<p>Emergency Procedures / Equipment</p> <p>have spare flange, cap port and pump vacuum in case of fire; fire extinguisher on hand; type D</p>	
5	see 5(b) previous page	
2, 3, 4	<p>Personal Protective Equipment</p> <p>sample loading tool prevents contact with sample blocks, nitrile disposable gloves or equivalent, lab coat</p>	
3, 4, 5	<p>tyvek suit, hood, booties as required, goggles.</p> <p>N100 dust mask respirator (3M 8233 or equivalent)</p>	

ASSESSMENT – WORKSHEET 5: JOB EXPOSURE ANALYSIS

Process Flow Stage	Job Title	Total Number of Employees	Tasks Where Exposure Likely	Duration Hrs per Week	PPE Req'd To Be Used
1.	1.				
2	research eng.	2	loading samples	5	nitrile gloves sample block bag labcoat, mask, goggles
3	research eng.	2	removing components loose deposit; clean up afterwards	0 hours 2x/year	gloves, boots suit, mask goggles
4	research eng	2	handling, cleaning repairing components, loose deposit, clean up	24 hours 1x/2 years	"
5.	research eng outside contractor	2 estimate several	removing components	1x/>10yrs	"

CONCLUSIONS

Jobs/ tasks to be noted during walk through survey:

Risk of exposure to arsenic is small since machine is not open on routine or daily basis. When open, arsenic deposit is localized to component and debris from open port area.

PPE and cleanup eliminate risk from exposure

Fire hazard, when machine is open, significant in stage 5. Fire => smoke consisting of oxides of As, P, Sb are toxic.

Arsine hazard with prolonged machine open to air

ASSESSMENT – WORKSHEET 6: HEALTH EFFECTS

1. Any reported health effects? If so, describe.

No

2. Any current Medical Program? If so, describe.

No

3. Previous exposure monitoring results? If so, describe.

Swipes and air sample before re-opening building

CONCLUSIONS

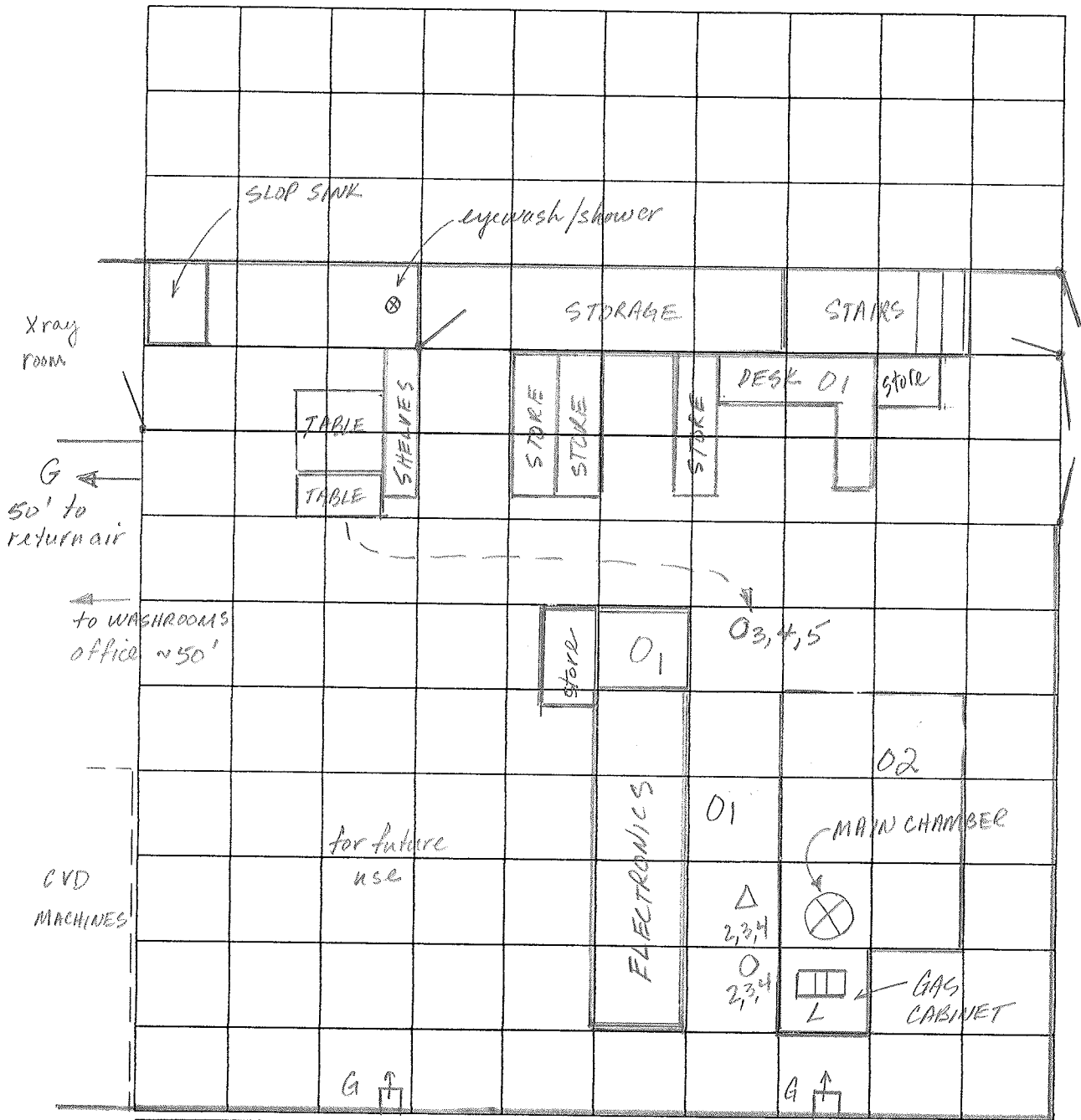
Health effects known at this stage: YES NO *no effects*

Further information required: YES NO

ASSESSMENT – WORKSHEET 7: FLOOR PLAN

LOCATION: TAB 110A

DATE: DEC 2005



DIMENSIONS: L 30' W 30' H ~15'

- WORK STATION – enter number form job title – Worksheet 5
- △ EXPOSURE SOURCE – enter number from Process Flow – Worksheet 3
- VENTILATION – enter L for local exhaust & G for general ventilation

essentially O1 everywhere; table available for temporary O3,4,5

ASSESSMENT – WORKSHEET 8: WALK THROUGH

Evidence of Contamination: NO; fire incident followed by decontamination clean up by Haz mat professionals

Hygiene Facilities and Work Practices:

- isolated eating area, washrooms for washing hands after leaving lab.
- remove disposable gloves before leaving work area

Ventilation Systems:

typical HVAC ventilation plus exhausted gas handling cabinets (max ~ 500 cfm for MBE)

Storage Facilities:

Incoming source in vented gas cabinet
Most arsenic (99%+) resides in main chamber; rest is collected in clean up procedure and stored in baggies for hazardous waste disposal.

ASSESSMENT – WORKSHEET 8: WALK THROUGH (cont'd)

Dispensing Procedures: NA

Housekeeping: slop sink, broom and pan, hepa vacuum, baggies on hand

Personal Protective Equipment:

goggles, gloves, respirator mask on hand
others (suit, booties from CEDT clean room supplies)

Emergency Facilities / Procedures:

Fire extinguisher to include type D, as well as ABC

ASSESSMENT – WORKSHEET 9: WALK THROUGH CONCLUSIONS

1(a). Were any areas found where controls are required or where existing controls may require improvement?

YES

NO

1(b). If YES, indicate the areas where the controls may be required or where existing controls may require improvement.

AREA

SUGGESTED IMPROVEMENTS

stages, decommissioning

use professional Hazmat contractor.

2(a). Personal exposure monitoring is required. YES NO

2(b). If YES, Indicate where:

3. Indicate any workers for whom medical testing and / or examinations may be required.

CONCLUSION: WORKSHEET 10: IS A CONTROL PROGRAM NECESSARY?

<input checked="" type="checkbox"/> CONCLUSION A: NO WORKER'S HEALTH MAY BE AFFECTED.
<input type="checkbox"/> CONCLUSION B: A WORKER'S HEALTH MAY BE AFFECTED.
OVERALL CONCLUSION
A control program is necessary. YES <input type="checkbox"/> NO <input checked="" type="checkbox"/>
Improvements needed in existing program:

DATE: Dec 22/05

SIGNED Brad Robinson
