Appendix A Designated Substance Assessment Form

RECORD OF DESIGNATED SUBSTANCE ASSESSMENT

SUBSTANCE:	MDI
DATE:	June 4, 2009

COMPANY: McMaster University - Chemical Engineering

DEPARTMENT OPERATIONS:

LOCATIONS: John Hodgins Engineering Building (JHE) 131

ASSESSMENT PREPARED BY: Rena M. Cornelius & Kyla Sask
Users: Rena M. Cornelius & Kyla Sask

TITLE: Research Engineer, Departments of Chemical Engineering and Pathology and Molecular Medicine

DATE PREPARED: June 4, 2009

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 [X] 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:

Product Name	Department	How Used? Direct / Indirect	Quantity Per Month / Year
Methylenebis (phenylisocyanate): Synonyms: MDI, methylenebis-isocyanate, isonate, diphenyl methane diisocyanate	Chemical Engineering	direct; transferred with spatula to glass flask .	intermittent; 1 to 100 g per experiment; 0 to 4 experiments each month.

CONCLUSIONS

Read statements and check applicable box:

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

[X] 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? solid
   Product Title: Methylenebis(phenyl isocyanate), 98%
   Type of Container: brown bottle Size of Container: 500g chemical in ~1000 mL

2. Is this form altered during use or in the operation: YES [X] NO [ ]

   If YES, indicate altered form: MDI reacts with PTMO to yield prepolymer. Prepolymer reacts with PEO to yield polymer.

3. Is there a possibility of the substance being releases into the workplace environment during normal use? YES [ ] NO [X]
   If YES, indicate the stage of the operation or areas where this can occur.

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

Job Function	Number of Employees

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 [X] NO [ ]

7. Are workers likely to be exposed? YES [ ] NO [X]

CONCLUSIONS

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

YES [X] 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: Synthesis of Polyurethane

Process Flow	Description	Likely Exposure Yes / No
1. Transport MDI from freezer to fume hood ~~in a plastic carrier.~~	-all processes carried out in fume hood -the desired amount of MDI is weighed out in the fumehood using a spatula directly into the reaction vessel (i.e round bottom flask, 500 mL reaction kettle) -product is removed from the reaction vessel following completion of the reaction. -product is stored in (1) liquid form, or (2) precipitated in water, filtered, dried,and stored in solid form .	-Yes if bottle is dropped and breaks, however the spill will be contained within the plastic carrier. -No
2. Measure out MDI into round bottom flask (10 min)		-No
3. Add PTMO/DMF OR toluene/PU to flask (15 min)		-No
4. Allow reaction to proceed for 1-2 hours (70 C)		-No
5. Add PEO/DMF OR toluene to round-bottom ~~flask.~~		-No
6. Allow reaction to proceed for 1 hour (80C).		-No

PTMO=polytetramethyleneoxide, PEO = polyethylene oxide,
DMF = dimethylformamide

ASSESSMENT – WORKSHEET 4: EXISTING CONTROLS

Process Flow Stage	Control Description	Problems / Recommendations
	Engineering Controls: -fume hood -HVAC maintains laboratory temperature/humidity at reasonable (normal) values **Work Practices** -double glove (nitrile) -splash-proof safety goggles -lab coat -only one person should be working in the fume hood -post sign on fume hood indicating isocyanate is being used -1 to 100 g used 0-4 times each month. -total working time is ~4 hrs -evaluate laboratory heat & humidity; do not work with MDI if extreme conditions exist OTHER EMERGENCY EQUIPMENT -safety shower, eye-wash fountain	

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

Process Flow Stage	Control Description	Problems / Recommendations
	Hygiene Facilities and Practices: -do not inhale nor make skin contact with MDI -wash hands after using MDI -MDI can aggravate asthma/respiratory problems	-do not take lab coat out of lab -no food/drink in lab -complete health questionnaire every six months
	Training / Information: MSDS, CHEMINFO, WHMIS	
	Emergency Procedures / Equipment 1. Advise others of spills (e.g. supervisor, dept. safety committee, EOHSS) 2. If there is contact with MDI and DMF, wash affected area (mouth/skin) with lots of water. Wash skin with soap. 3. If inhaled/swallowed, get fresh air and call physician immediately. Do not induce vomiting. 4. If contact with eyes, rinse eyes with lots of water. Seek medical advice.	-sweep up, place in bag, dispose in hazardous waste. -avoid raising dust. -wash spill site with water after pickup is complete. -blot away MDI/DMF on clothing -wash contaminated clothing immediately -do not induce vomiting if swallowed; -call x88 if emergency is beyond your control -get medical check-up by physician if exposed to MDI or if you experience symptoms
	Personal Protective Equipment -double glove (nitrile) -splash-proof safety goggles -lab coat -use the buddy system when using MDI	

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. during routine work, exposure to MDI is unlikely to occur				
Transport of MDI from fridge to fumehood.	Research Engineer (Rena Cornelius)		Accidental breakage of bottle resulting in release of MDI	1 minute	Double nitrile gloves, goggles, closed toe shoes.
Transport of MDI from fridge to fumehood.	Ph.D Candidate (Kyla Sask)		Accidental breakage of bottle resulting in release of MDI	1 minute	Double nitrile gloves, goggles, closed toe shoes.

CONCLUSIONS

Jobs/ tasks to be noted during walk through survey:

-store MDI, under nitrogen in a sealed container, in freezer at -20C.
-product (polyurethane) should be stored in amber bottle at room temperature.

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.

No

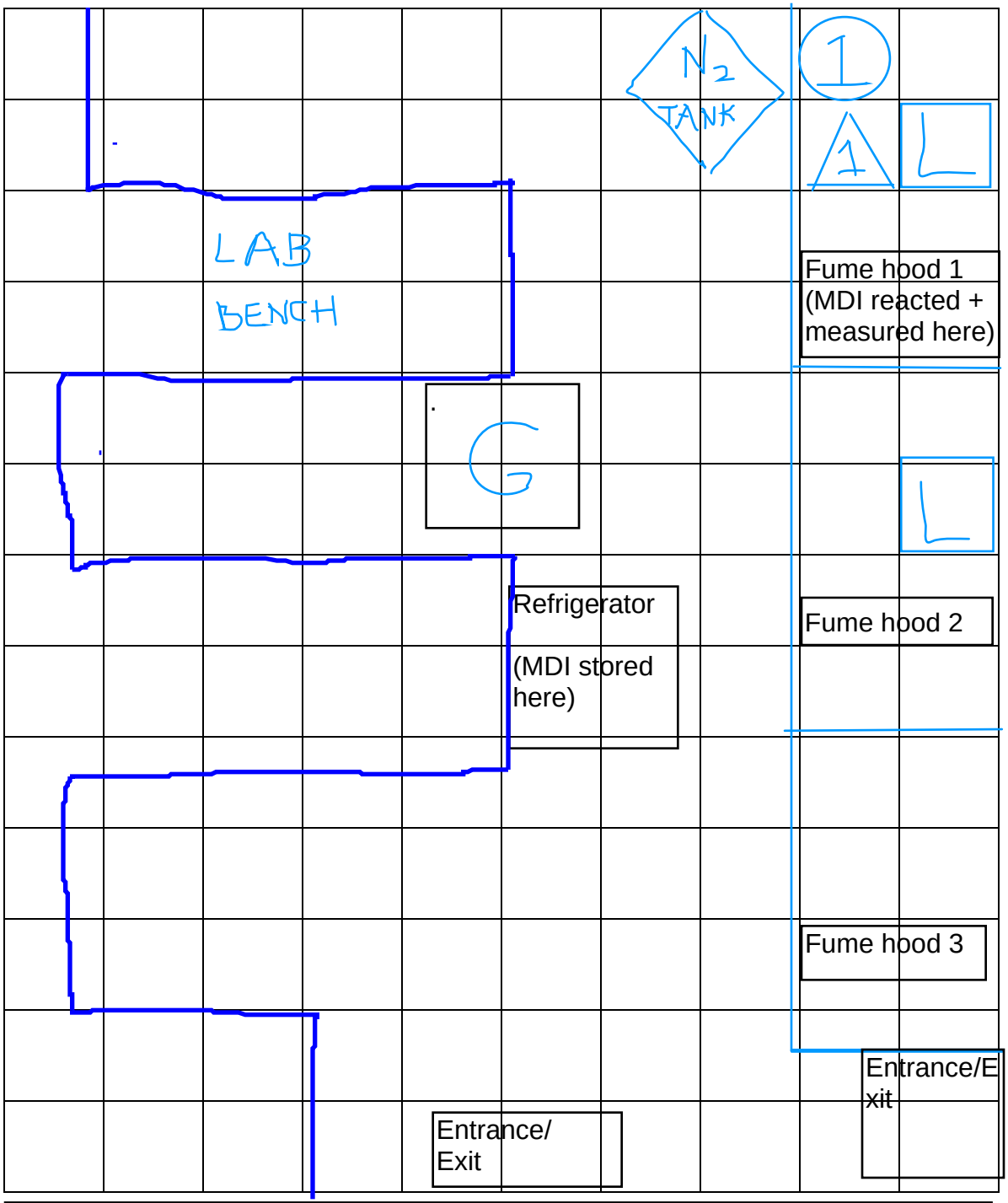
CONCLUSIONS

Health effects known at this stage: YES ☐ NO ☒

Further information required: YES ☐ NO ☒

ASSESSMENT – WORKSHEET 7: FLOOR PLAN

LOCATION: JHE 131 **DATE:** June 29, 2005



DIMENSIONS: L 25 ft W 20 ft H ~10 ft

○ 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

ASSESSMENT – WORKSHEET 8: WALK THROUGH

Evidence of Contamination:

None

Hygiene Facilities and Work Practices:

-double glove (nitrile)
-splash-proof safety goggles
-lab coat; must remain in lab
-wash hands after using MDI
-only one person should be working in fume hood; post sign on fume hood indicating isocyanate is being used
-do not inhale MDI

Ventilation Systems:

-in fume hoods (local) and in lab rooms (general)

Storage Facilities:

-Freezer (-20C)
-store MDI under nitrogen gas in cool, dry environment; store product (polyurethane) in amber bottle at room temperature.
-prevent direct exposure of MDI to moisture (store in freezer & in tinted airtight bottles sealed with parafilm) KEEP LAB LOCKED

HARMFUL EFFECTS OF MDI ON THE BODY
-irritating to eyes, respiratory system, and skin.
-hazardous decomposition products: carbon monoxide, carbon dioxide, nitrogen oxides and hydrogen cyanide.
-harmful by inhalation. Lachrymator. Target Organ: Lungs.
-may cause respiratory sensitization by direct skin contact/inhalation.
-exposure effects may be sudden or delayed

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

Dispensing Procedures:

-immerse used spatula in fumehood container that has water
-dispose of empty, sealed MDI vial, stored under nitrogen, in hazardous waste

Housekeeping:

-keep MDI bottles and vials closed when not in use; seal lids with Parafilm
-decontaminate empty MDI containers/handling equipment with decontaminant solution (e.g. concentrated ammonium hydroxide (4-8%), liquid detergent (2%), + water (90-94%)), then allow containers to stand open or loosely-covered for at least 24 hrs.; do not empty MDI into drains; dispose of MDI as a hazardous waste
-store vermiculite on floor, adjacent to fume hood and vented flammables cabinet

Personal Protective Equipment:

-double glove (nitrile)
-splash-proof safety goggles
-lab coat; must remain in lab
-use the buddy system when using MDI

Emergency Facilities / Procedures:

(1)Advise others of spills (e.g. coworkers, supervisor, dept. safety committee, EOHSS)
(2) If there is contact with MDI, wash affected area (mouth/skin) with lots of water. Wash skin with soap.
(3) If swallowed/inhaled, get fresh aid and call physician immediately. Do not induce vomiting.
(4) If contact with eyes, flush eyes for 15 minutes with lots of water. Seek medical advice.
(5) If there is a spill, cover spill with inert sorbent material; use vermiculite clean-up; ventilate area by operating fume hoods at max. flow rate; contain spill in hazardous waste container; put sign on door indicating presence of hazard as well as contact info of MDI user.
(6) If fire, call x88. Use carbon dioxide/dry chemical powder to put out fire.
(7) Call 88 if ANY emergency is beyond your control. (Do not leave lab unattended).
(8) Fill out incident report form.

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

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?

☒ CONCLUSION A: NO WORKER'S HEALTH MAY BE AFFECTED.

☐ CONCLUSION B: A WORKER'S HEALTH MAY BE AFFECTED.

OVERALL CONCLUSION

A control program is necessary. YES ☐ NO ☒

Improvements needed in existing program:

DATE: June 4, 2009 **SIGNED**