

February 28, 2008

Mr. Tony LaGrange  
President  
Quantum Group  
14601 – 134 Avenue  
Edmonton, Alberta  
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Re: Site Visit to the San Francisco Bay Area Rapid Transit District (BART), Richmond, CA on Feb 11, 2008 –Spray Application of Polyurea

This visit was performed on behalf of Huntsman Polyurethanes, LLC by request of the Industrial Hygiene Team Lead, Americas EHS Center of Excellence, The Woodlands, Texas.

The purpose of the visit was to:

- Perform air monitoring using the Sure-Spot test method to evaluate airborne concentrations of MDI inside and outside the tent enclosure during spraying.
- Evaluate the appropriateness of respirators and other PPE used during spraying by the sprayer and helper.
- Determine whether the transit cars seats and trim can be reassembled by BART personnel without undue concerns of exposure to residual MDI.

Air monitoring results indicate that airborne concentrations of MDI may exceed the OSHA Permissible Exposure Limit (PEL) near the open doors of the rail cars during spraying. See Table I, Sample # 2. Although there is a small blower at one end of the car and a window exhaust fan at the other end to provide exhaust ventilation, the turbulence, created by the high pressure sprayer, and wind, when coming in from outside the tent, tend to overcome their effectiveness. Considerable amount of overspray was noted coming out from the open car doors into the tent as the sprayer was making his pass along the car floor. The airborne concentrations of MDI in the sprayer's (and maybe his helper's) breathing zone is, in all likelihood well above the OSHA PEL.

Airborne concentrations of MDI were not detected outside the tent and barely detected inside the mid-entrance to the tent during spraying. Airborne MDI was also not detected when the sprayer was applying a white strip polyurea coating inside the car using the air pressurized caulking gun.

The sprayer wore a full-face air-purifying respirator (APR) with combination organic vapor (OVA)/P-100 cartridges, gloves, long sleeve sweat shirt and painters pants.

The sprayer's helper, who was handling the hose stood several feet behind the sprayer and wore a half-mask APR/P-100 cartridges, goggles, gloves, sweat shirt and pants. Parts of the face and neck of both sprayer and helper were exposed to the overspray.

Without knowing the typical airborne concentration of MDI in the sprayer's or helper's breathing zone during spraying, one doesn't know if the maximum use concentration (MUC) is exceed when using the half-mask or full-face air-purifying respirator (APR) to protect against MDI. For example, given a protection factor of 10 for a half-mask APR, the maximum use concentration (MUC) for a short-term task (15 minutes) would be 200 parts per billion [ppb] (20 ppb exposure limit x 10-fold protection factor). Therefore, if the airborne concentration in the breathing zone of the sprayer would be greater than 200 ppb, the half-mask respirator would not be appropriate, and one would have to use another type of respirator with an assigned protection factor (APF) greater than 10. A properly fitted full-face APR with an APF of 50 may be used for short-term

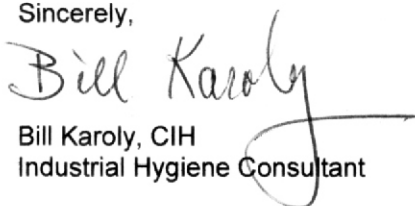
tasks (15 minutes) in airborne concentrations of MDI up to 1000 ppb or less. Unless the manufacturer/supplier of the respirator has test data to show APFs greater than 50, loose fitting face piece hoods and helmets, such as those for powered air-purifying respirators (PAPRs) receive an APF of 25 from both OSHA and NIOSH.

#### **RECOMMENDATIONS**

- Conduct air monitoring using impingers to evaluate the airborne concentrations of MDI in the breathing zones of the sprayer and helper during spraying. Average the results from 3-6 samples and determine if half-mask or full-face APRs or PAPRs may be used.
- If monitoring is not performed, the sprayer and helper should use a continuous flow, tight fitting full-face air-supplied respirator.
- Cover up any open facial skin and neck of both sprayer and helper to protect from dermal contact with overspray.
- Consider using hooded Tyvek® coveralls during spraying to protect the sprayer's and helper's skin from dermal contact, and their clothing from being contaminated, with overspray.
- To prevent/minimize the overspray from entering the tent, consider closing (for example with plastic sheets) the two side entrances to the rail cars during spraying.
- Given the very fast curing time for this two-component polyurea coating – less than one minute, BART personnel can re-assemble the seats and trim in the cars without concerns of exposure to residual MDI.

Please call me at (610) 322-2621 if you have any questions or would like to discuss any of the above information in more detail.

Sincerely,

A handwritten signature in cursive script that reads "Bill Karoly". The signature is written in dark ink and is positioned above the printed name and title.

Bill Karoly, CIH  
Industrial Hygiene Consultant

## **DESCRIPTION OF THE PROCESS**

The floor of rapid transit cars are sprayed with a two-component MDI based polyurea coating. The cars are housed in a large temporarily constructed tent located away from the main building. The tent is large enough to easily enclose two cars (each car is 70 feet long). The tent (approximate dimensions are 40' wide x 30' high x 180' long) has adjustable flap openings at each end and one opening in the middle for in-and-out worker traffic.

The seats, trim and carpeting are removed from the cars by BART personnel. After the cars are moved into the tent, the subcontractor prepares the insides by taping plastic sheets to the sides and ceiling of each car, except the floor, to protect from the overspray. The same subcontractor sprays the polyurea coating to the floor using a high pressure sprayer. Considerable amount of overspray occurs during spraying. Some of the overspray exits from the two open side doors on the railcar into the tent; however, the polyurea react in less than a minute and the resulting overspray particulate is inert.

Three passes are made in each car. The spray duration for each pass is 15-20 minutes. A speckled finish and a white strip (in the middle of the car) are applied using a static mixing air pressurized (~20 psi) caulking gun.

The two component polyurea, PRECIDIUM™ 550D-FR (iso and resin), is supplied by the Quantum Group, Tony LaGrange (877.454.9166), Alberta, Canada.

Contacts at BART were Richard Burr, Superintendent (510.412.5509) and Mike Turner, Assistant Shop Superintendent (510.412.5330), 1101 – 13<sup>th</sup> Street, Richmond, CA.

The spray equipment used is an XP2 Plural Component Pump. It is supplied by Innovative Painting and Waterproofing, and maintained by Tim Chicaul (760.677.7295). Tim is the technical consultant for the equipment. The polyurea spray is applied at about 2200 psi.

## **EXPOSURE LIMITS**

Substance	OSHA PEL	ACGIH Recommend Threshold Limit Values (TLVs®)
Methylene Diphenyl Diisocyanate (MDI)	0.2 mg/m <sup>3</sup> ceiling 20 ppb	0.051 mg/m <sup>3</sup> 8-hr TWA 5 ppb

OSHA's designations of occupational exposure limits are called Permissible Exposure Limits (PELs). PELs published in Title 29 of the code of Federal Regulations (CFR), Part 1910, Subpart Z. The law requires compliance with these regulations in the United States.

The American Conference of Governmental Industrial Hygienists (ACGIH) developed exposure limits called Threshold Limit Values (TLVs). These values are not law but are recommended guidelines.

Most exposure limits represent time-weighted average (8-hr TWA or 8-hr TLV/TWA) concentrations to which, it is believed; most members of the working population can be repeatedly exposed, during an 8-hour day, 40-hour week, for a working lifetime, without any adverse effect. Time-weighted averaging permits excursions above the exposure limits provided they are compensated by equivalent excursions below the limits during the workday.

A ceiling limit is a concentration that should not be exceeded at any time during the workday.

## **DOD TECHNOLOGIES, INC. SURESPOT TEST METHOD**

The direct reading short-term samples were taken with the DOD Technologies, Inc. GMD Surespot direct reading test strips. The Surespot system is a colorimetric method of detection. Air is drawn through a detector strip at a nominal flow rate of 1.5 liters/minute. If MDI is present, the card will turn a pink to red color. The intensity on the color strip is then compared and matched to the color intensity on the reader card and a reading in parts per billion (ppb) is obtained. Results from this sampling method are at best semi-quantitative and should be used for screening purposes only.

### **MAXIMUM USE CONCENTRATION (MUC)**

MUC means the maximum atmospheric concentration of a hazardous substance from which an employee can be expected to be protected when wearing a respirator, and is determined by the assigned protection factor of the respirator or class of respirators and the exposure limit of the hazardous substance. The MUC can be determined mathematically by multiplying the assigned protection factor specified for a respirator by the required OSHA permissible exposure limit, short-term exposure limit, or ceiling limit. When no OSHA exposure limit is available for a hazardous substance, an employer must determine an MUC on the basis of relevant available information and informed professional judgment.

**TABLE I**  
**DOD TECHNOLOGIES SURESPOT SAMPLING RESULTS – MDI**  
**BART, RICHMOND, CA**  
**FEBRUARY 11, 2008**

<b>Sample #</b>	<b>Sample description and time</b>	<b>Results (ppb)</b>
1	Inside tent, near open entrance door to car - spraying began at far end @ 0850	ND<2.5
2	Inside tent, near second open entrance door to car, spraying about half done @ 0855	20-30
3	Outside of tent about 5-10 feet from end entrance @ 0915	ND<2.5
4	Repeat #3 @ 0925	ND<2.5
5	Mid entrance opening to tent, just inside tent @ 0930	D<2.5
6	Applying white strip inside car using air pressurized (~ 20 psi) caulking gun, and standing about 3' behind sprayer – sample taken mid-afternoon	ND<2.5

ND< = not detected, less than

D< = detected less than

All samples were taken for a period of two minutes

The detection limit for a 2 minute sample is 2.5 parts per billion (ppb)

OSHA PEL = 20 ppb ceiling



January 28, 2008

Safety Notice:

The inhalation of the Precidium 550D FR Resin or Isocyanate can cause respiratory damage. Combining of the resin and isocyanate will form an inert polymer that produces no toxic vapors. The formation of the inert polymer takes from 10-30 seconds to occur depending on the temperature. Therefore overspray can be harmful if inhaled in this time period.

The spackling polymer takes from 20-60 seconds to become inert after mixing the resin and isocyanate. Overspray can be harmful from inhalation in this time.

Use local exhaust ventilation to keep airborne concentrations below the TLV(Threshold limit value). Suitable respiratory equipment should be used in cases of insufficient ventilation or where operational procedures demand it. Suitable respiratory equipment for applicators or anyone in the vicinity would be a minimum of charcoal filter with canisters for organic vapors and isocyanate. Suitable eye protection would be goggles or a full face mask.

Regards,

A handwritten signature in blue ink, appearing to read "Shawn Chizen", is positioned above the printed name.

Shawn Chizen,  
Chemist  
Quantum Group  
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Fax: (780) 488-6134

*Providing Solutions!*