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Safety Bulletin

Assessment of Isocyanate Exposure During Outdoor Spray Application of Polyurethane Foam for Cavity Wall Insulation

Polyurethane foam is rapidly growing in popularity as the thermal insulation of choice for brick cavity wall insulation. This process involves the spraying of polyurethane foam through airless spraying equipment onto the exterior skin of the building before the brick veneer is built. The substrate for application is generally concrete (precast, poured-in-place or block) or gypsum board on steel studs. The foam thickness is generally 36mm to 75mm and the foam material is expected to seal all joints, imperfections and around brick ties.

Exterior cavity wall insulation is performed by a crew of two men, a Foam Mechanic (the sprayer) and a helper.

The work is normally performed from scaffolding installed by others (usually the brick masons) and proceeds in "lifts" depending on scaffold spacing. The spray gun is held directly in the Foam Mechanics hand in similar fashion to a paint gun. It is mandatory that the sprayer wear full face or hood type fresh air supplied respirator with the usual precautions being taken to ensure the good quality of the supplied air.

The helper normally wears a double cartridge respirator and his time is divided between the

ground/truck, assisting the Mechanic to move the spray hose on the scaffold and masking/de-masking building elements against overspray. The helper is generally more than 3 meters (10') from the sprayer and usually at much greater distances - 6 meters (20') or more. It is the purpose of this project to determine the levels of MDI produced by the spray application of the polyurethane. We were particularly interested in the levels at distances and locations where the helper might be working.

Method

Sampling Procedure:

Samples were collected using a Bacharach/GMD Systems 800 - 700 Sure Spot MDI Test Kit. Each test was run for 10 minutes at one (1) litre per minute and MDI level determined from a colour concentration calculator. The time/flow rate calibration allowed for a 33% margin of error on the side of safety. Samples were collected in eight (8) locations.

- 1) North West Corner - 10' downwind from sprayer and horizontal.
- 2) South Wall - 10' downwind from

sprayer and horizontal.

- 3) East Wall - 10' upwind from sprayer and horizontal.
- 4) East Wall - 10' downwind from sprayer and 6' above.
- 5) South Wall - 10' upwind from sprayer and 6' below.
- 6) East Wall - attached to sprayers mask.
- 7) North Wall - 10' downwind from sprayer and 10' out horizontal.
- 8) North Wall - 10' downwind from sprayer and horizontal.
- 9) 20' horizontally out from sprayer (behind).
- 10) 25' downwind from sprayer horizontally and 5' out.

Note:

Wind direction southwest and from 5 to 10 km/hr.

Test results were as follows:

- 1) 0.200 mg/m³
- 2) 0.045 mg/m³
- 3) 0.030 mg/m³
- 4) 0.040 mg/m³
- 5) 0.010 mg/m³



- 6) 0.260 mg/m³
- 7) 0.010 mg/m³
- 8) 0.260 mg/m³
- 9) non-detectable
- 10) non-detectable

Spray Equipment/Materials:

Equipment:

The foam was sprayed using a Gusmer H2000 machine registering 1,000 psi at the pump.

Material:

The material was a standard 2 lb/ft³ system using a blend of polyol and isocyanate.

Exposure Levels:

As expected the highest levels recorded were at the sprayer location and directly downwind and horizontal with the sprayer and in the same plane as the work surface. In these three cases (tests 1, 6 and 8) the levels were at or exceeded allowable (Workers' Compensation Board of British Columbia) levels. In all other cases; upwind, above, below or out from the sprayer the levels recorded were well below allowable levels.

Conclusions:

From the data gathered in this test project it was possible to detect definite trends which should be suitable for extrapolation to similar situations.

1) In all cases the sprayer must wear fresh air supplied full face/hood respirator protection. The sprayer exposure level will frequently exceed the W.C.B. ceiling limit of .02 ppm.

2) Provided helpers are not working directly downwind and close to the sprayers they would not exceed the W.C.B. standard.

3) From the data it should be possible to establish an exclusion zone around the spray operation outside of which overspray and limit exceeding vapour concentrations would not occur. Still Air - 20' each side of sprayer. Upwind - 10' from sprayer. Downwind - 25' from sprayer or as determined from spot jobsite testing. This exclusion zone is very dependent on wind speed.

4) Sprayers (Foam Mechanics) should be trained in the use of MDI concentration Spot testing equipment.

General Notes:

1) It will be noted that testing was carried out at closer distances to the spray operation than originally proposed. Preliminary testing in preparation for this project indicated that no detectable results would be achieved if testing was carried out at 20' - 25' except directly downwind with wind speeds exceeding those during which cavity wall insulation is applied without hoarding.