



UNIVERSITY OF KENTUCKY
OCCUPATIONAL HEALTH & SAFETY

**INDUSTRIAL HYGIENE REPORT:
Urethane Deck Coating Exposures
ASTeCC Building**



INTRODUCTION

The purpose of this report is to summarize the assessment by the UK Occupational Health and Safety Division (OHS) of exposures to two isomers of toluene diisocyanate (TDI) within the Advanced Science and Technology Commercialization Center (ASTeCC) Building. UK OHS was contacted by concerned employees in ASTeCC due to odor infiltration during a multi-day project to repair the ASTeCC roof. The actual roofing work was being done by an outside contractor, Insulated Roofing Contractors (IRC). The OHS assessment occurred on August 31 and September 1-2, 2011.

Starting on approximately August 28, 2011, and continuing through September 3, 2011, a five-man crew from IRC was applying a urethane deck coating to the ASTeCC roof sections for water

resistance. The compounds applied were NeoGard® Permthane FR Basecoat (74620 Dark Gray) on the first day of sampling, and Permthane Topcoat White (70613) on the subsequent days. The principal ingredients of both compounds include polymers of TDI, polyisocyanate resin, calcium carbonate, and Stoddard solvent. Both contain between 0.1 and 1.0% monomeric TDI.

The coating materials were pumped up from ground level to the roof, and the crew applied the coating using a spray nozzle system, with brushes and rollers being used in areas where more precision was necessary. The air intakes for the building are also located on the roof. Prior to the coating process, a wooden deflector had been placed around the principal intake in order to pull fresh air from above the intake, rather than at roof level to the side of it. All other entry points into the intake system had also been sealed with plastic sheeting.



Photos above show rooftop following application of Basecoat. Modifications to air intake (wooden deflector, doors sealed with plastic sheeting) are visible.

Upon reviewing the product labels and Material Safety Data Sheets, OHS determined that the ingredient of greatest concern in the both the basecoat and topcoat was the monomeric isomers of TDI (2,4-TDI and 2,6-TDI) that might off-gas from it shortly after application. TDI is a potent respiratory sensitizer and has a very low Permissible Exposure Limit of 5 parts per billion (ppb). TDI also has very poor warning properties, because the lower threshold for odor detection is typically between 0.2 and 0.45 parts per **million** (ppm), almost 100 times higher than the Permissible Exposure Limit.

Other volatile components in the basecoat and topcoat included Stoddard solvent, (d)-limonene, naphtha, and butyl carbitol acetate.

SUMMARY OF SAMPLING RESULTS - ISOCYANATES

In order to determine the potential exposure levels to isomers of TDI within ASTeCC during the roofing operations sampling pumps were deployed to take environmental samples on two different dates: morning through early afternoon of 8/31/11, shortly after an application of Permthane FR Basecoat, and evening of 9/1/11, during and immediately after an application of Topcoat White.

For post-Basecoat sampling on 8/31/11, a total of three sampling pumps were deployed. Based on the area of the roof where the Basecoat had been most recently applied relative to the roof-mounted building HVAC systems, it was determined that the third floor should be the focus of sampling. Pumps were placed in the atrium between ASTeCC and McVey near the elevators, in the hallway outside A-358 (office of TrackFive Diagnostics LLC), and inside A-368 (CeNSE Measuring Laboratory of Drs. Vijay Singh and Chuck May). See photos below.



For the Topcoat sampling on 9/1/11, multiple floors were sampled because the rooftop work was going to be more widespread. Pumps were deployed on the windowsill near A-368 (CeNSE Lab), 2nd floor hallway next to A-256 (L. Heller office), hallway next to A-057 (YT Cheng Lab), and in the receiving area outside A-033C (L. Farmer office). See photos below.



All pumps were pre-calibrated with a Bios DryCal primary standard, and post-sampling calibration checks revealed that no drift had occurred during sampling. Per the instructions of the analytical laboratory, modified OSHA-42 method was used with treated glass-fiber filter cassettes, sampled open-faced. Analysis for both 2,4-TDI and 2,6-TDI was requested. Galson Laboratories in East Syracuse, NY was the analytical laboratory.

On all samples collected, neither isomer of TDI could be detected. The OSHA-42 method is sensitive, and has a lower detection limit of 0.1 micrograms per sample. Based on these results, OHS concludes that **on the days of sampling (8/31/11 and 9/1/11), no detectable exposures to TDI occurred within the ASTeCC Building.**

OTHER COMPOUNDS – Direct-Reading Instruments

In order to measure infiltration of volatile organic compounds (VOCs) into ASTeCC at a time of higher building occupancy following the 9/1 evening application, numerous readings were taken throughout the building during normal working hours on 9/2/11 with a ppbRAE photo-ionization detector (PID). This is a non-specific detector for VOCs that have an ionization potential lower than 10.6 electron-volts.

The PID was calibrated with isobutylene as the standard. Isobutylene has an ionization potential that is not very different from that of naphtha (conversion factor=0.97), or Stoddard solvents (conversion factor=0.69). Based on the odors that occupants and OHS sensed within the suite, it is likely that naphtha or Stoddard solvents were the primary source of odors within the building following the roof coating application.

The PID readings are shown below. Readings were taken in the morning and early afternoon. The high temperature on 9/2/11 was approximately 97°F, which led to rapid volatilization of the roofing compounds which had been applied the evening prior.

Location	Total VOC Readings (isobutylene, parts per billion)
South Stairwell	80-120
3 rd Floor South	280-340
3 rd Floor North	300-400
North Stairwell	1100-2000
2 nd Floor North	250-300
2 nd Floor South	350-390
1 st Floor South	30-200
1 st Floor North	220-310

Location	Total VOC Readings (isobutylene, parts per billion)
Basement North	310-400
Basement South	120-280
Receiving Area	40-200
Outside at pumping area	2-10 parts per million

Assuming that these results are solely due to either naphtha or Stoddard solvents, the exposure levels were still well below the current OSHA PELs for naphtha (100 parts per **million**), or Stoddard solvents (500 parts per million). However, they were present at levels far above the odor threshold, and some employees reported symptoms such as eye and respiratory irritation and mild nausea due to the vapors.

RECOMMENDATIONS

The following recommendations apply **ONLY** to building occupants who could potentially be affected by roofing sealant work performed by the PPD Paint Shop or outside contractors such as IRC. Measurement of personal exposures and a thorough evaluation of training and work practices for PPD Paint Shop employees will be conducted at a future date.

- OHS and PPD should work together to create Fact Sheets or other form of official notification for building occupants when exposures to offensive and potentially injurious agents must occur within occupied spaces, due to the timing of maintenance projects.
- Such notifications/Fact Sheets should be written in such a way to be understandable to employees who do not routinely work with hazardous substances, and who are not versed in the technical and regulatory language of hazard communication and hazard assessment.
- Along with Fact Sheets, potentially affected building occupants must be provided with other appropriate hazard communication materials, such as material safety data sheets, prior to the start of projects.
- Potentially affected building occupants should be given advanced notice of the likely timeframe for projects, so that decisions can be made about whether to temporarily pursue alternate staffing arrangements (e.g. work from home, temporary relocation).
- Continue to consult with Building Operators about the feasibility of temporary modifications or selective shut-downs of building HVAC systems in order to reduce the potential re-entrainment of vapors during future projects.

There will be other roof repair projects on the UK campus in the coming year, using the same or similar roofing compounds. It is imperative that OHS and PPD work together to protect the safety, health, and well-being of all employees affected by these projects.

Thank you for the opportunity to provide assistance. Please contact me (brent.webber@uky.edu, 859-257-7600) if you have any questions about the contents of this report.