



UNIVERSITY OF KENTUCKY  
OCCUPATIONAL HEALTH & SAFETY

**INDUSTRIAL HYGIENE REPORT:  
Urethane Deck Coating Exposures  
Taylor Education Building**



## **INTRODUCTION**

The purpose of this report is to summarize the assessment by the UK Occupational Health and Safety Division (OHS) of occupational exposures to two isomers of toluene diisocyanate (TDI) within the Taylor Education Building. The assessment focused on the Room 170 suite, which housed two branches of the College of Education, Department of Education, School, and Counseling Psychology (abbreviated as EDP in online materials). The two EDP branches housed in the 170 suite are the Autism Research Group and the School Psychology Program. UK OHS was contacted by concerned EDP employees due to odor infiltration during a multi-day project to repair flat sections of the Taylor roof. The OHS assessment occurred on June 6 and 7, 2011.

Starting on approximately June 2, and continuing through June 7, 2011, a four-man crew from the UK Physical Plant Division (PPD) Paint Shop applied a urethane deck coating to the flat roof sections for water resistance. The compound applied was NeoGard® Urethane Deck Coating (7430-28 White), whose ingredients are crystalline silica, menthadiene, petroleum distillates, titanium dioxide, TDI, TDI polymer, and xylenes.

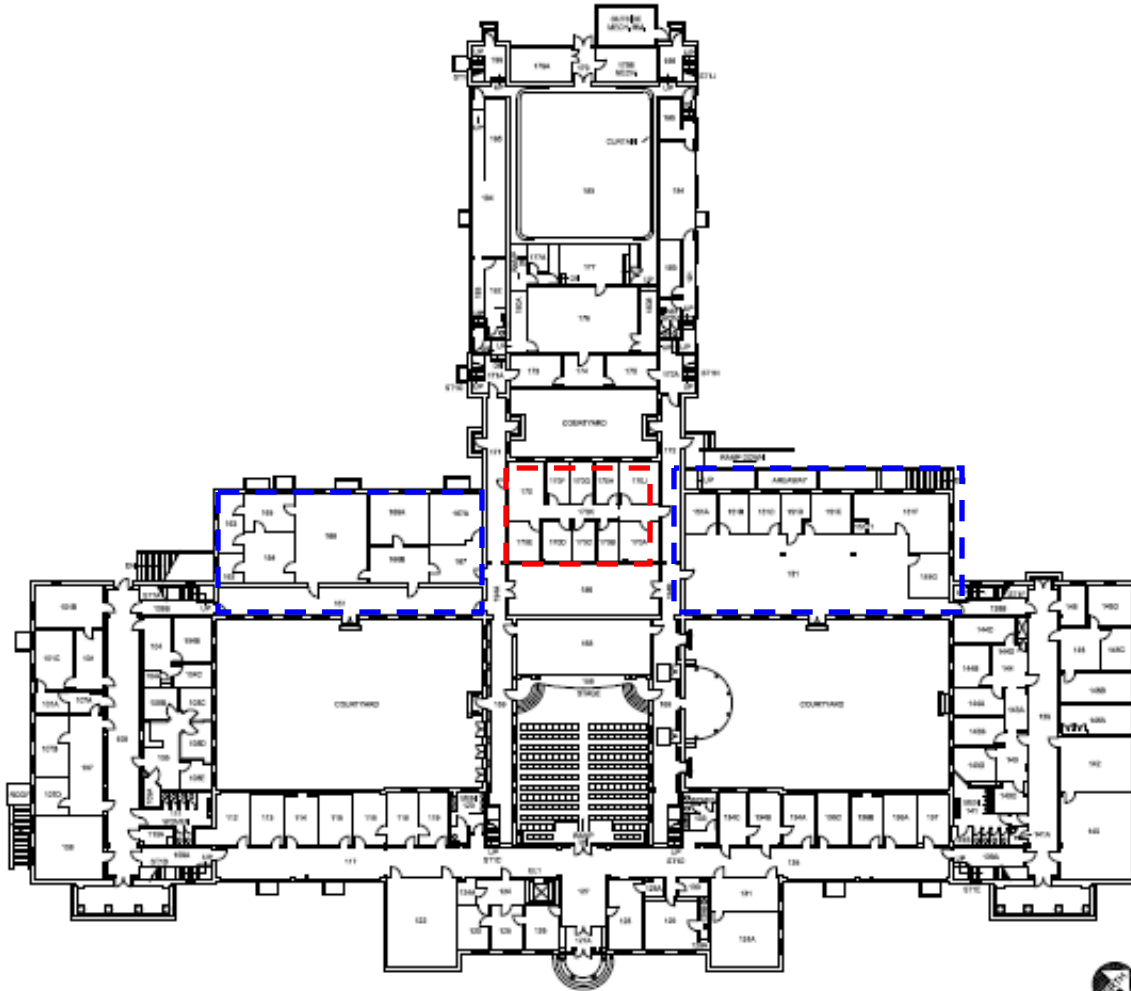
The crew applied the coating using paint rollers with extension poles. Because vapors from this coating are heavier than air, they tend to sink below the roof level and were thus detectable within certain areas of Taylor with a portable photo ionization detector (PID). Two coats were applied to all flat sections, with the second coat not applied until the roof was completely dry from the first coat as well as subsequent dew/condensation.



*Photos of various segments of the Taylor Education Building roof receiving a urethane deck coating*

Based on OHS interviews with the EDP personnel, none had been made aware through any formal means that this project would occur or how long it would take, and none had been provided with information such as a Material Safety Data Sheet (MSDS) to learn about the contents and possible hazards of the NeoGard® urethane deck compound before or during the painting. It was also determined that no modifications were made to the HVAC system during the project, such as blocking off the fresh air intakes, in order to reduce potential entrainment of vapors.

The EDP personnel in the 170 suite became aware of the project on Thursday, June 2, 2011, due to the presence of previously unknown odors within their suite. They did not call OHS until June 6, after the odors returned following a weekend away and became strong enough to disrupt regular work activities. OHS arrived on-site later that day to begin the assessment.



*First-floor plan, Taylor Education Building. The 170 suite is located within the red-dashed box. The blue-dashed boxes indicate areas where deck compound was being applied to flat-roof surfaces on 6/7/11.*

Upon reviewing the product label, OHS determined that the ingredient of greatest concern in the NeoGard® 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 coating included menthadiene, petroleum distillates, and xylene.

## SUMMARY OF SAMPLING RESULTS

In order to determine the potential exposure levels to isomers of TDI within the 170 suite during the roofing operation, sampling pumps were deployed to take environmental samples on 6/7/11. One pump was placed at the front reception desk, and collected samples for a total of 390 minutes in order to determine compliance with the Occupational Safety and Health Administration (OSHA) 8-hour Permissible Exposure Limit (PEL). Another pump was placed on top of a file cabinet in the office of J. Birdwhistell and R. Johnson, and was used to collect two 15-minute samples to determine compliance with the OSHA Short-Term Exposure Limit (STEL). All pumps were pre-calibrated at 1.0 liters per minute flow rate, 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.



*Sampling pumps with treated glass-fiber filters (left, right) and a photo-ionization detector (center) were used to measure exposures in the 170 suite.*

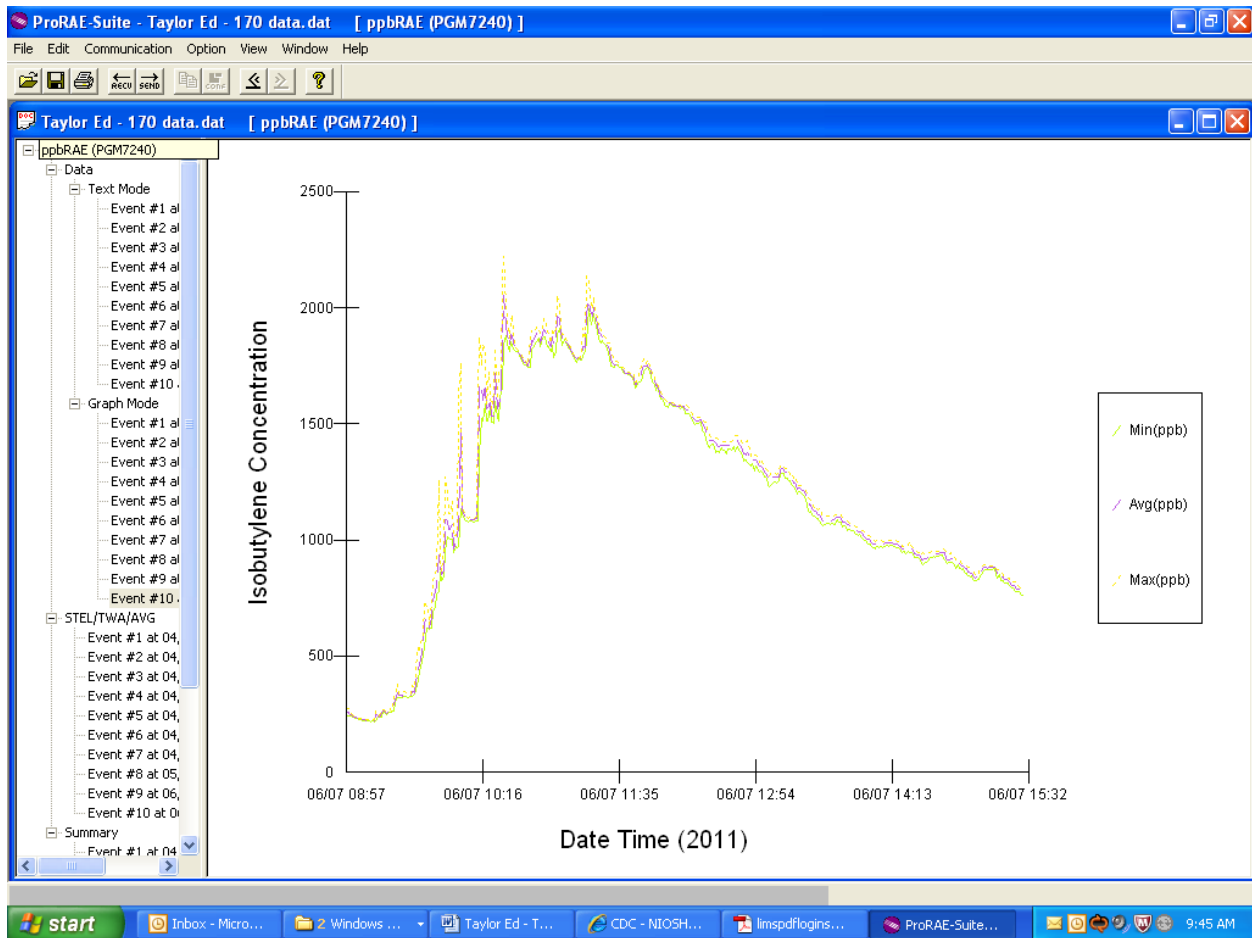
On all samples collected, neither isomer of TDI could be detected. The OSHA-42 method is sensitive, and has a lower detection limit of 0.1 micrograms per sample. Based on these results, OHS concludes that **on the day of sampling (6/7/11), no detectable exposures to TDI occurred within the 170 suite.**

In order to measure infiltration of volatile organic compounds (VOCs), a ppbRAE photo-ionization detector (PID) was deployed and placed at the reception desk on 6/7/11. 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 a very similar ionization potential to petroleum distillates (conversion factor = 0.97). Based on the odors that occupants and OHS sensed within the suite, it is likely that petroleum distillates were the

primary source of odors. Though the deck compound contained both petroleum distillates and menthadiene (limonene), both of which are VOCs that can be detected by the PID, the prevailing odor was described by occupants as more like petroleum or kerosene than citrus.

The PID readings are shown below. Between approximately 10am and 11:30am, peak VOC levels between 2000 and 2200 parts per billion were detected, but throughout the day there were levels detectable with both the PID and through the occupants' sense of smell.



Assuming that these results are solely due to petroleum distillates and not limonene/menthadiene, the exposure levels were still well below the current OSHA PEL for petroleum distillates (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. 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).
- Consult with the Building Operator about whether it might be feasible to temporarily modify (or even shut down) 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](mailto:brent.webber@uky.edu), 859-257-7600) if you have any questions about the contents of this report.