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# Emission Tests of non-HP Toner Cartridges on HP Printer

Sebastian Wientzek, M.Eng.

Fraunhofer Wilhelm-Klauditz-Institute (WKI)

Department of Material Analysis and Indoor Chemistry (MAIC)

Bienroder Weg 54E

38108 Braunschweig, Germany

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## Executive Summary

This study determined the emission rates of an HP Blue Angel certified printing system when using 15 non-HP (imitation and remanufactured) cartridge brands. The emission tests were carried out according to Blue Angel protocol DE-UZ 205.

When the printer is operated with a non-HP cartridge:

- 14 printing systems out of 15 failed the Blue Angel emission requirements when using non-HP toner cartridges.
- Emissions of total volatile organic compounds (TVOC) and styrene were much higher than the Blue Angel limit.
- The printing system is not guaranteed to meet the Blue Angel criteria with a non-HP cartridge.

## 1 Introduction

Indoor air quality (IAQ) is important to human health. To reduce emissions and improve IAQ, the German government has set emission criteria for office equipment with printing function, DE-UZ 205. Devices which fulfill the emissions criteria qualify for certification with the Blue Angel label. Leading printer manufacturers have their products tested before market introduction. Blue Angel emissions tests are based on a manufacturer's printing system, which includes both the OEM (original equipment manufacturer) printer and OEM cartridge. However, there are cartridges available on the market, which are intended to be compatible replacements, but are not produced by an OEM. If an HP printer using non-HP cartridges has not been tested for emissions, the printer's ability to fulfill the Blue Angel emission requirements is unknown.

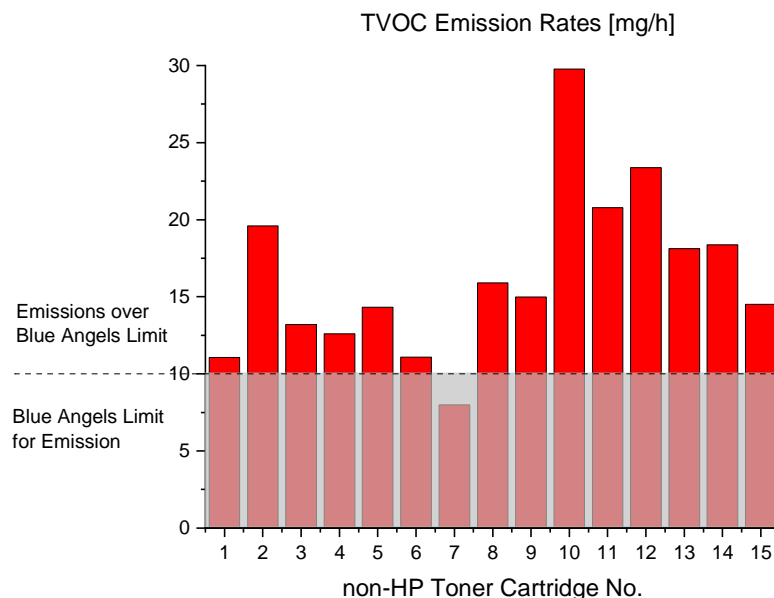
This report summarizes the results of a study, commissioned by HP Inc., where the emission rates of substances from the laser printers HP LaserJet Pro M402dne and HP LaserJet Pro M403d equipped with non-HP toner cartridges were determined at Fraunhofer Wilhelm-Klauditz-Institute (WKI). Based on the standard DIN EN ISO/IEC 17025 the department of WKI for Material Analysis and Indoor Chemistry (MAIC) is an accredited test lab for emission measurements of printers. WKI, located in Braunschweig, Germany, was founded in 1946 by Dr. Wilhelm Klauditz, and joined in 1972 the Fraunhofer Association which is Europe's largest application-oriented research organization. The products and materials WKI examines range from classic wood-based materials through plastics and building products to products from the automotive, electronics, aviation, food and printer industries.

## 2 Methods

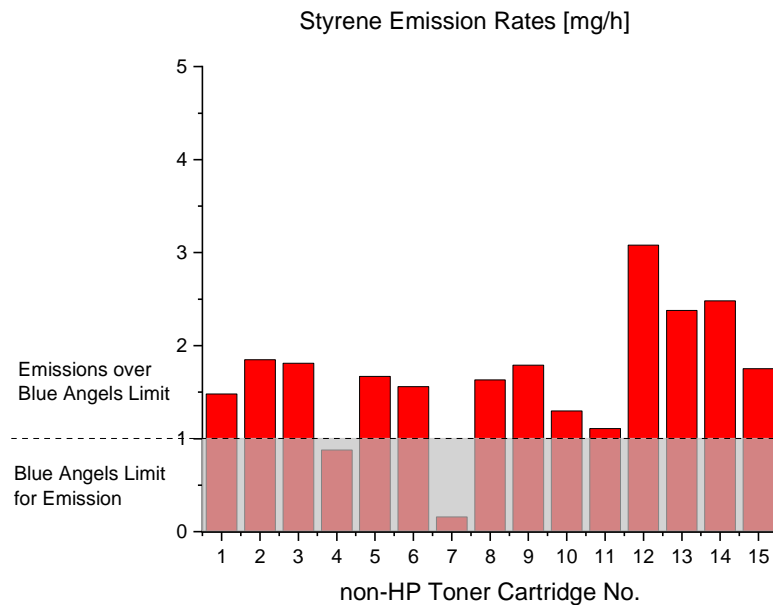
In this study, 15 non-HP cartridge brands were tested with the HP LaserJet Pro M402dne and HP LaserJet Pro M403d. All non-HP cartridges are compatible with the HP printer. The printing paper used in the tests is the HP Multipurpose paper A4 80g. The printers printed 358-385 pages in simplex, monochrome mode at a speed of ~ 38 pages per minute (ppm). Emissions of volatile organic compounds (VOCs), benzene, ozone, dust and fine + ultrafine particles were measured, and their emission rates were calculated according to the Blue Angel test protocol DE-UZ 205.

## 3 Results

Figure 1 shows the emissions of TVOC from the HP printing system using non-HP toner cartridges (N=15) to the Blue Angel limit values. Of the 15 non-HP toner cartridges tested, 14 failed the Blue Angel emissions standard. Specifically, the TVOC emission limit was exceeded by non-HP cartridges by up to 198% over the limit value. Figure 2 shows the emissions of styrene from the HP printing system using non-HP cartridges (N=15) to the Blue Angel limit values. 13 of 15 non-HP toner cartridges produced higher styrene emissions than the Blue Angel emission limit (up to 208%). No non-HP toner cartridge exceeded the limit for benzene or the limit for fine and ultrafine particles. Ozone and dust emissions were also below their respective limits.



**Figure 1. TVOC emission rates of non-HP cartridges (N=15) compared with Blue Angel emission limit (10 mg/h in monochrome mode).**



**Figure 2. Styrene emission rates of non-HP cartridges (N=15) compared with Blue Angel emission limit (1 mg/h in monochrome mode).**

#### 4 Summary

The test results provide the following implications for manufacturers and users:

The Blue Angel emission test for printer certification is carried out on printers operated with OEM toner cartridges. When printers are operated with non-HP cartridges, emissions could change. For printers that obtained a Blue Angel label with OEM toner cartridges, printing with non-HP cartridges does not guarantee the Blue Angel standards will continue to be met.

In this study, the printer operating with non-HP cartridges emitted higher levels of TVOC 93% of the time (14 out of 15), and in 13 cases it emitted higher levels of styrene than Blue Angel limits (87% of the time). The use of non-HP cartridges caused the HP printer to fail the Blue Angel emission requirement 14 out of 15 times.

The use of non-HP cartridges for printing could impair indoor air quality, and it is probable that the combination of a printer with Blue Angel label and the non-HP cartridge cannot meet the Blue Angel criteria.

## Definitions

### VOCs (Volatile Organic Compounds)

General: organic compounds that are emitted from the test object and are detected in the chamber air. For the purposes of this test method: identified and unidentified organic compounds which elute from gas chromatographic separation on a nonpolar column between n-hexane and n-hexadecane, including these compounds. Styrene is one of the volatile organic compounds with a chemical formula of  $C_8H_8$ .

### TVOC (Total Volatile Organic Compounds)

Total content of volatile organic compounds, i.e. the sum of the concentrations of identified and unidentified volatile organic compounds which elute from gas chromatographic separation on a nonpolar column between n-hexane and n-hexadecane.

### Particles

Small bodies suspended in air or gas having specified physical boundaries and consisting of liquid and/or solid substances. The number of particles emitted was determined within the size range of 5.6-560 nanometer.