| telegram: environment + health |
01 | 2015

Umwelt Bundesamt

How high is the exposure to fine particulate matter at Holi festivals?

Exploratory measurements performed

Holi festivals are open-air music events that are currently very popular with teenagers and young adults. At these events, festival-participants throw special colored powders (Holi colours) into the air at hourly intervals (preceded by “countdowns”) and additionally throw these powders at each other and apply them to hair, skin and clothing (**Figure 1**).

Figure 1: Typical situation during colour throwing after a countdown. Source: Dollars / Fotolia.com.

Because of the size distribution of the powder particles dispersed at these events the emissions result in high levels of fine particulate matter (PM_{10}) in ambient air on the festival grounds and in the near vicinity. The resulting acute exposure to fine particulate matter can be assumed to be very high and may even present a health risk.

In July 2015, the German Environment Agency measured PM_{10} concentrations at a Holi festival using a battery-powered aerosol monitor. The device was kept in a backpack carried by the measurer. Concentrations were measured at the festival site over an approx. 7-minute period before, during and after a countdown. For comparison, measurements were also taken in front of the two entrances to the festival grounds and in the streets directly around them. In addition, a measurement was performed about 300 metres away from the festival grounds.

Particle size distribution was measured using a particle counter and analyser - a method based on the change in an electrical field. In addition, the particle type was determined using light microscopy.

Results and interpretation

Particle concentrations varied widely during the measurement period, depending on the location of the measurer. They were on average 296 µg/l, with several peak concentrations of up to 2,960 µg/m³ (**Figure 2**). For comparison, the 24 h limit value for PM_{10} applicable in the EU is 50 µg/m³ and may not be exceeded more than 35 times per year.

The analysis of the **size distribution of the particles** from the six Holi colours used at the festival showed that 97% of the particles were PM_{10} and a significant proportion (45%) was $PM_{2.5}$. The colours were not powdered starch, like many other Holi colours, but consisted of a fine mineral dust, which on visual inspection was assumed to be talcum. Six bags per person were handed out (included in the ticket price), each bag containing 100 g of coloured powder, more bags could be bought. Assuming 2,500 participants (an estimate which is likely to be less than the average attendance at Holi festivals), means that at least 1,500 kg of

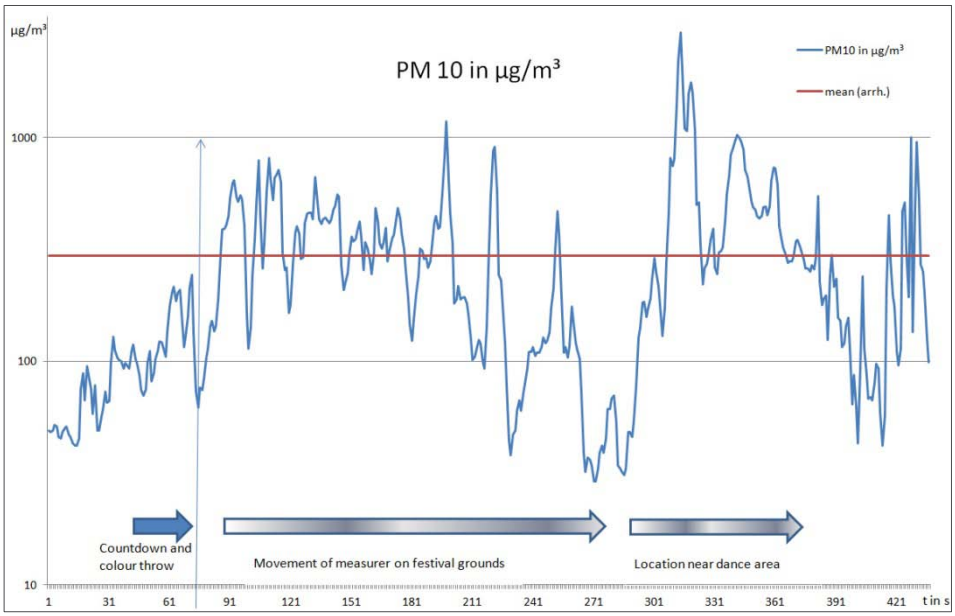

Figure 2: Measurement of PM_{10} over an approx. 7-minute period at different locations within the festival site (but outside the dance area, where exposure is highest)

coloured powder was dispersed. Some of which remained airborne for a length of time as clearly visible air pollution.

PM_{10} concentrations varied greatly both at the festival site and in its immediate vicinity. Nevertheless, the comparison with the concentrations measured at a distance of about 300 metres indicates that Holi festivals generate concentrations that greatly exceed background levels not only on the festival grounds but also in adjoining areas including streets.

Survey about Holi and colour run events

The health relevance of acute exposure to extreme particulate matter concentrations for young people without relevant pre-existing conditions has rarely been studied to date. The UBA is therefore currently conducting a survey about Holi and colour run events. This survey asks visitors of Holi festivals, as a voluntary extreme exposure group, detailed questions about acute and subacute effects they may have observed from high concentrations of fine particulate matter. With the results of the survey we hope to help to improve the assessment of the acute effects of fine particulate matter. **Please help us get as many responses as possible by sending the link** to the online health questionnaire to your friends and colleagues. The participation requires understanding German.

- **http://www.umweltbundesamt.de/umfrage-zu-holi-color-run-veranstaltungen**

Further information

- **A detailed description of the measurement results and further information on the subject of Holi festivals and exposure to particulate matter are provided in the 02/2015 issue of the UMID (environment and human health information service) journal** [Kurzlink: bit.ly/1VMRFN8]
- **UBA thematic web page: Holi – Festival of colour and particulate matter** [Kurzlink: bit.ly/1IJRMoY]

Imprint

Author: Dr. Wolfgang Straff, Environmental Medicine and Health Effects Assessment Section
Editor: Kerstin Gebuhr M.A., General Aspects of Environment and Health Section
Publisher: German Environment Agency | Environmental Hygiene Department
Office address Corrensplatz 1, D - 14195 Berlin
E-mail: **telegramm@uba.de** | Internet: **http://www.umweltbundesamt.de/en**
telegram: environment+health subscribe, unsubscribe, change e-mail address:
http://www.umweltbundesamt.de/en/service/newsletter