Guidelines for printing ink manufacturers on safe handling of UV and EB printing inks and their corresponding raw materials and intermediate products

1. Introduction

UV and EB printing inks are intended to be cured after printing by exposure to UV or EB radiation. In order to fulfil their function, products of this type are based on reactive acrylates or other reactive chemicals and in many cases they are classified as skin and eye irritants and with the potential to induce or cause an allergic reaction (sensitisation) on contact with skin.
The objective of the present guideline is to give handling and use recommendations (to the best of our OSRA members knowledge) to protect workers' health during ink manufacture.

2. Selection criteria for raw materials

As acrylates are reactive chemicals (either in their own right or due to residual monomer content), they can interact significantly with living organisms, including human beings.

Health hazards relating to the use of acrylates can include severe skin burns and eye damage (CLP hazard statement H314), skin irritation (H315), allergic skin reaction (H317) and toxicity for reproduction (H360/H361). In addition, some materials may also be dangerous to the aquatic environment (H400/H410/H411/H412/H413).

Therefore, conducting an appropriate risk assessment is essential during the raw material selection process for developing UV and EB printing inks. This includes compliance with applicable industry commitments such as the EuPIA Exclusion Policy for printing inks and related products - Eupia[1].

In order to minimise and prevent risks at their source[2], and in agreement with current legislation relating to safety at work, it is essential to consider whether a particular hazardous material (which might cause a severe injury) could be substituted by a less harmful one.

If this is not possible, effective engineering / administrative-controls and / or personal protective equipment need to be used when handling the selected material. The risk of product decomposition and the simultaneous formation of smoke due to overheating during the production process should also be considered. It is important in such cases to avoid inhaling toxic fumes. As a precaution, temperature interlocks or equivalent equipment should be installed and these scenarios should be incorporated into the Emergency Response Procedure.

[1] *EuPIA Exclusion Policy available on the EuPIA website www.eupia.org.*
[2] *Council Directive 89/391/EEC on the introduction of measures to encourage improvements in the safety and health of workers at work*

3. Ventilation

- Adequate ventilation in the workplace is necessary when handling UV and EB raw materials (ensure workplace air changes are in accordance with Exposure Scenarios annexed to Safety Data Sheets).
- General and/or local exhaust systems, in agreement with Best Available Technologies (BAT) should be installed to remove vapours and aerosols where these may occur during manufacturing operations. Under the hierarchy of controls, engineering controls, such as exhaust systems, take priority over PPE which should be the last resort to protect against risks.
- Additional smoke extraction systems might be necessary for the case of decomposition and simultaneous formation of heavy smoke.

4. Hygiene

- Eating, drinking and smoking are prohibited in all areas where these products are handled.
- Always wash your hands with soap and water after use of UV/EB curable products, and especially before work breaks and at the end of the day.
  Since energy-curing products are not corrosive, their presence on the skin may not be immediately noticed. This increases the potential for skin irritation and normal day-to-day activities may spread the effects to other parts of the body.
- Never use solvents to remove UV/EB products from the skin, or in order to wash the skin - always use an appropriate hand paste or liquid soap.
- Hand cream should be used at the end of the day to prevent dry skin areas from forming caused by repeated washing.

5. Personal Protective Equipment (PPE)

- **Use eye protection**. Wear safety glasses or goggles at all times (check what is prescribed within the product's SDS). Avoid wearing contact lenses during working time.
  For the laboratory: Never look directly at the UV-radiation source (lamps) of UV rigs even with eye protection.
- **Use protective gloves**. EuPIA recommends the use of single use, disposable, non-powdered nitrile gloves for short duration exposures not exceeding 30 minutes, in situations where only splashes are likely to happen. These gloves should not be used where mechanical resistance is required, or where puncturing or tearing of the gloves is likely to occur. They need to be replaced immediately when punctured or degraded.

  Unlined, non-powdered and natural rubber latex-free nitrile gloves with a minimum 0.45 mm thickness are recommended for longer duration use (up to 4 hours continuous) or activities involving mechanical handling. Again, the gloves must be changed immediately when punctured or when a change of appearance (colour, elasticity, shape) occurs.

  Heavy duty, unlined, natural rubber latex-free nitrile gloves are required when handling solvents. Avoid the use of chlorinated solvents and limit the use of ketones (e.g. acetone, methyl ethyl ketone, and methyl isobutyl ketone) and ethyl and butyl acetates, as they may accelerate glove deterioration. Change immediately when punctured or when a change of appearance (colour, elasticity, shape) occurs.

In all cases, purchase gloves from reputable suppliers, as inferior quality gloves may increase the risk of contracting contact dermatitis (irritation, etc.). Take precautions when removing contaminated gloves to avoid skin contact[3] – see HSE UK removing-gloves video

Be aware that protective gloves may increase the risk of entanglement. Keep hands away from operating rotating shafts (mixers), in-running rollers (three roll mills) and other equipment with moving parts, also in the labs.

- **Wear clothing with long sleeves** to protect your arms. When skin exposure is more likely to occur, for example during cleaning activities, protective gloves / gauntlets of an appropriate length to overlap the sleeves of overalls should be worn. Grossly contaminated clothing should be removed and laundered or discarded.

6. First Aid

Follow the advice provided in the corresponding Safety Data Sheet for the material.

The following are standard recommendations from CEPE/ EuPIA:

- **General:** In all cases of doubt, or when symptoms persist, seek medical attention. Never give anything by mouth to an unconscious person. If the subject is unconscious place him in the recovery position and seek immediate medical advice. Avoid personal initiatives.
- **Eye contact:** Remove contact lenses if worn, irrigate copiously with clean, fresh water, holding the eyelids apart for at least 15 minutes (refer to respective SDSs) and seek medical advice.
- **Skin contact:** Remove contaminated clothing. Wash skin thoroughly with soap and water or use a recognised skin cleanser. Do NOT use solvents or thinners. In case of accidental skin contact avoid concurrent exposure to the sun or other sources of UV light, which may increase the sensitivity of skin. Report any skin irritation to your supervisor immediately and consult a doctor.
- **Inhalation:** Remove to fresh air, keep patient warm and at rest. If breathing is irregular or has stopped, administer artificial respiration and seek medical attention.
- **Ingestion:** If bulk ingestion should occur, do NOT induce vomiting and consult a doctor immediately. If accidentally swallowed rinse the mouth with plenty of water (only if the person is conscious) and obtain immediate medical attention. Keep at rest.

7. Cleaning

- Solvents may be used to clean equipment or floor stains. Wear solvent-resistant protective gloves when working with solvents. Those gloves may be different from those suitable for UV/EB products. Check the solvents' SDS. In case of doubt, seek advice of safety officer/safety expert or shift leader/superior prior to taking decisions that may be wrong.
- Contaminated materials (like cleaning rags) should be placed in separate, labelled containers to prevent accidental exposure to others. Such containers should not be exposed to direct sunlight.
- Contaminated combustible materials should be stored in lidded metal containers and removed daily from the workplace at the end of the shift / end of the day. These containers should not be exposed to direct sunlight.

[3] *See www.hse.gov.uk resources for more information*

- Leather items that have been heavily contaminated should be disposed of.
- If clothing has become contaminated, remove and wash skin with soap and water. Use an industrial cleaning service for protective clothing.

8. Storage

- All UV/EB curable products are reactive and must be stored under conditions which will prevent polymerisation and product degradation.
- Store closed containers at temperatures preferably between 10°C and 25°C. Consult the SDS for recommended storage temperatures.
- Keep containers out of direct sunlight. Remember this also during lab activities.
- Avoid excessive heating.
- For prolonged shelf life, do not fill containers to capacity. Air presence (oxygen) prevents polymerisation.

9. Spills

- Do not allow UV / EB inks to enter drains or watercourses. If the product contaminates lakes, rivers or sewage, inform appropriate authorities in accordance with local regulations.
- Wear necessary/suitable protective clothing.
- Isolate and dyke / bund the area of the spill. Contain and collect spillage with non-combustible absorbent materials, e.g. sand, earth, vermiculite, diatomaceous earth and place in container for disposal according to local regulations (see safety data sheet section 13). Dispose of the waste as soon as practicable to avoid long term storage of waste inks.
- Clean preferably with a detergent; avoid use of solvents.

10. Waste disposal

- Cured materials can usually be handled in the same way as regular waste.
- Other waste could be classified as 'hazardous waste' and must be disposed of in accordance with national and European regulations.

11. Safety Training

To raise awareness of the risk while handling UV and EB printing ink and its corresponding raw materials and intermediate products, a regular safety training programme for affected people (production and maintenance) is essential. Inform also workers, dealing with containers with contaminated material (like rags after cleaning up) about the risk of skin irritation.

The content and frequency of such a training programme should be based on the outcome of relevant risk assessments.

Using related pictures might be helpful in order to improve comprehension.

12. Disclaimer

The recommendations in this guide are additional information, however they are not a substitute for Material Safety Data Sheets provided by suppliers.

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