Proposed RoHS Additional Substances Consultation – Medium Chain Chlorinated Paraffins (MCCP)

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Background and issues caused by substitution

AEM is a US trade association representing manufacturers of industrial equipment including products in the construction and agricultural sectors. Some of AEM members' products are in scope of the RoHS directive although many are excluded as types of professional Non-Road Mobile Machinery (as defined by RoHS) or as equipment that is specifically designed to be installed in excluded types of equipment. Products that are in scope are believed to be mainly in RoHS category 11 with some in categories 6 and 9.

Most AEM members' products are complex products designed for long lifetimes and high reliability. They must comply with other legislation apart from RoHS, such as the Non-Road Mobile Machinery (NRMM) Emissions Regulation that necessitates gaining approval in the EU from a Notified Body after any changes are made to product design such as would result from new RoHS restrictions. The NRMM Regulation requires engines to meet strict emissions limits, have proven reliability and long lifetimes and manufacturers must test engines to obtain this data before approval can be granted.

Another issue for AEM's members is that most of their products have niche uses and are not made in large numbers. However many of the component parts used are obtained from suppliers whose main markets are types of products that are excluded from RoHS, such as in heavy goods vehicles. AEM members may buy less than 1% of the total sales of a type of part from a component supplier and so have no influence over if or when the supplier develops an alternative RoHS-compliant version without the newly restricted substance. Suppliers will be reluctant to make changes if most of their customers do not want changes made as they will not want to have to gain re-approval for their products. As a result, it can take AEM's members many years to identify substitute parts, assess them, test them in engines, test in finished equipment and finally apply for EU approval before these can be sold. This can take 10 years or longer if sourcing substitute parts is especially difficult. The use of less reliable or lower performance parts is not an option as EU NRMM Emissions Regulation approval would not be granted. This 10 year timescale assumes that no new restrictions are adopted part way through, because if so, new components would need to identified and tested before finished equipment testing has to be re-started (this takes typically two years), which would extend the overall timescale required significantly.

Due to the considerable difficulties in achieving compliance, along with the uncertainties caused by the exemption request process (e.g. the time taken between submission and publication is now much longer than previously), some AEM members may consider withdrawing products from the EU market. If the next recast review results in the removal of some of the RoHS scope exclusions there could be more EU market withdrawal of products, especially if the list of RoHS restricted substances were to increase from the current 10. This would have a significant negative socio-economic impact on the EU.

The usage of RoHS substances in these products is limited to very small quantities comparing to the overall materials embedded in the finished product, which are nearly always collected for materials recycling or for refurbishment at end of life.

Supply chain RoHS data collection has been a significant challenge for our members due to the complexity of the impacted products and their supply chains. There can be up to 14 companies involved between raw material producer and AEM member manufacturer and this makes obtaining substance data difficult and time consuming. Some suppliers have been able to provide data on the proposed 7 additional RoHS substances, but most do not have this information and it will take some at least a year to obtain this information.

Some AEM members have identified needs for several RoHS exemptions for their products which have been requested in recent years via EUROMOT. Because of the safety, durability, and reliability requirement in our industry, alternative materials for restricted RoHS substances may not be available or feasible for machinery/equipment products that AEM members offer on the EU market The restriction of one or more of the proposed 7 new substances under RoHS is likely to result in need for additional exemption requests from our members. Due to the sophisticated material technologies embedded in the products our members offer, it is likely to take several years to just confirm the need for exemption requests.

AEM members have pointed out that it would be very beneficial across the industrial equipment industry, if any future restrictions were to be application specific, as is the approach used for REACH Annex XVII restrictions, or to exclude types of equipment that are unlikely to enter the EU waste stream due to manufacturers operating within the circular economy and so collect end of life equipment and ensure that it is safely recycled or refurbished for reuse, as is the case with most industrial equipment.

Answers to questions.

1. Applications in which MCCP is in use

a. Please provide information concerning products and applications in which the substance is in use.

AEM members have surveyed their suppliers to determine where MCCP is present and some suppliers have responded with data, but many are at present unable to determine if MCCP is present due to long supply chains. Identified uses include:

- Cable and wires – plasticiser / flame retardant in insulation
- Corrosion resistant coatings
- Adhesives
- Fuel filters and many other types of components with plastic parts
- Expanding foam sealants (fire retardant types), RTD (Reaming/Tapping/Drilling) compounds and acrylic spray paints

According to the KEMI 2016 report: *Study of a possible restriction of MCCP in electrical and electronic equipment regulated under RoHS*[1]:

- The most common use of MCCPs, relevant to electrical and electronic equipment, is in sheathing and insulation of PVC cables and wires.
- MCCPs may also be used in adhesives and sealants, also paints and varnishes used on items of electrical and electronic equipment. However, as KEMI state it is (or has been, based on research work performed to date) difficult to estimate how frequently adhesives and sealants as well as paints and varnishes are used in (and on) electrical and electronic equipment.

According to KEMI (citing the ECB EU Risk Assessment Report of 2005, *Alkanes, C14-17, chloro (MCCP) - Part I-environmenr*), MCCP has the following applications:

- Secondary plasticiser (extender) in PVC;
- Softeners with flame retardant properties in rubber;
- Plasticisers and flame retardants in adhesives and sealants;
- Plasticisers in paints and varnishes;
- Flame retardants (secondarily) in plastics;
- Extreme pressure additive in metal working/cutting fluids;
- Components of leather fat liquors; and
- Carrier solvent in carbonless copy paper.

KEMI additionally states that "main use of MCCPs is as secondary plasticiser (extender) in PVC".

KEMI also comments on the high chlorine content of some of the MCCP congeners (i.e. >50% wt. Cl). This "makes them effective as flame retardants and they are used as such in PVC, rubber and other polymers, including polyurethane, polysulphide, acrylic and butyl sealants and adhesives (UK HSE, 2008)". KEMI further states that "adhesives are used as 'potting agents' in electronic equipment to encapsulate, seal and insulate fragile, pressure-sensitive, microelectronic components and printed circuit boards" and draws on American Chemistry Council, 'Polyurethane Applications', available online at: http://polyurethane.americanchemistry.com/Introduction-to-Polyurethanes/Applications, accessed on 28 November 2015 in this regard.

KEMI gives specific information on the uses of MCCPs in EEE.

- KEMI suggests that "MCCPs predominantly serve as secondary plasticisers in flexible PVC used as sheathing and insulation jackets for cables and wires with rated voltage of less than 250 V". Also, "PVC sheathed cables and wires are used in the vast majority of household electrical and electronic appliances".
- KEMI draws on the Oeko Institute to advise that "MCCPs used for cable and wire sheathing have higher degrees of chlorination (typically around 50–52% wt. Cl) (Öko-Institut, 2008)".
- KEMI gives additional information, as follows:
  According to the EU RAR, the content of MCCPs in such applications varies, depending on the intended function. In general, MCCPs as plasticisers and flame retardants in PVC are typically added at 10-15% w/w of the total plastic. It was commented in consultation that the content can reach up to 20% of the PVC sheathing or insulation of electric cables.
  MCCPs can also be used in rubber insulation and sheathing for cables and wires. MCCP content when used in rubbers appears to be lower, compared to PVC cables. A survey on the use of

[1] https://www.kemi.se/global/pm/2017/pm-2-17-study-of-a-possible-restriction-of-mccp-in-electrical-and-electronic-equipment-regulated-under-rohs.pdf Chapter 2 of this report concerns use of MCCPs in EEE.

chlorinated paraffins in general in the UK rubber industry identified that MCCPs are used in rubber cable covers at a concentration of 3.8% (Brooke, et al., 2009). Furthermore, a survey in Norway identified two cases with MCCP content of 11% and 2.6% in cables (COWI, 2010).

- KEMI suggest that MCCPs – as a type of chlorinated paraffin – can be used in polyurethane, polysulphide, acrylic and butyl sealants and adhesives. In turn, these can all be used in items of electrical and electronic equipment. The following information is provided by KEMI:
    - Non-foam polyurethanes ("potting compounds"): used to protect, seal and insulate fragile, pressure-sensitive, microelectronic components and printed circuit boards. They also act as adhesives and provide solvent, water and extreme temperature resistance.
    - Polysulphide: also used for "potting" purposes in electrical and electronic equipment.
    - Foam polyurethanes: may be found in household appliances, packaging, electronics and other uses.
    - Acrylic: normally used in electronics as Pressure Sensitive Adhesives (PSAs). Reference for this is: Dow Corning, 'Adhesives and Sealants', at: http://www.dowcorning.com/content/etronics/etronicsseal/etronics_newaas_tutorial4.asp, accessed on 28 October 2015.
    - Butyl rubber: used as condenser packing for electrical appliances.
- **Coatings**

  MCCPs can be used as plasticisers in a number of paints and varnishes used on EEE:
    - Dishwasher racks and tumble dryer ventilation hoses are, for example, often coated with PVC.
    - MCCPs with a chlorine content of 50-60% are used as plasticisers in certain paints, varnishes and other coatings. These substances are generally used at concentrations of 1-5% but they can reach up to 20%.
    - MCCPs may be used as plasticisers in resin-based paints but are most frequently used in chlorinated rubber or copolymer paints. However, there is evidence to suggest that businesses are substituting MCCPs from use in this regard. KEMI states: *According to a 2011 report, several groups and businesses no longer use MCCPs in their paints or varnishes, and in one case it was specifically stated that a company located in France made a conscious decision to replace their use of MCCPs for LCCPs due to the toxic effect of MCCPs on the environment (INERIS, 2011).*

i. In your answer please specify if the applications specified are relevant to EEE products and applications or not.

AEM members' products include many types of electrical equipment, but many others are excluded from the scope of the RoHS Directive as they are types of professional Non-Road Mobile Machinery (as defined by RoHS) or parts specifically designed to be installed in excluded types of equipment. MCCP is present in parts (as listed above) of equipment that is in scope of RoHS as well as types that are excluded from the scope of RoHS.

ii. Please elaborate if substitution of the substance is already underway in some of these applications in relation to the properties for which MCCPs are used (for example, combined plasticising and flame retarding properties) and/or in relation to specific applications in which it is used (for example, PVC cables, rubber components, adhesives, etc.), and where relevant elaborate which chemical (substance

level) or technological (elimination e.g. via use of alternative material) alternatives may be relevant for this purpose."

It appears that MCCPs are being substituted from use in paints and varnishes, as is commented upon in the KEMI 2016 report. However, KEMI also point out that: “it is unlikely that one single substance can substitute the MCCPs across all its uses since MCCPs function as both plasticiser and flame retardant”. KEMI also report that the amounts of MCCP used in the EU have declined which may be due to substitution, but may also because of manufacturing relocating to countries outside of the EU. Note that MCCP is both a plasticiser and flame retardant. Substitution by plasticisers alone is not acceptable as but these substances have no flame retardancy properties and are flammable materials. Therefore flame retardants must also be added. Having to add two substances to replace makes reformulation quite difficult to achieve.

b. Please specify if you are aware, if aside from actual use of the substance, it may be re-introduced in to the material cycle through the use of secondary materials.

MCCP-containing PVC and other plastics may be converted to a recyclate leading to the re-introduction of MCCP in to the material cycle.

i. Please detail in this case what secondary materials may contain MCCP’s impurities and at what concentrations as well as in the production of what components/products such materials are used.

According to KEMI (2016), “recycled flexible PVC is predominantly used in the manufacture of materials used in manufacturing road equipment, roofing and insulating membranes, footwear, mats, garden hoses, ropes, etc.” No information is provided by KEMI on concentrations, however. Typically, 10% of recyclate is used and as about 7% of MCCP is used, this would result in a concentration of about 0.7% in materials made using 10% of recyclate.

ii If possible please provide detail as to the changing trends of MCCP concentrations in such secondary materials as well as the changing trend of use of the respective secondary material in EEE manufacture.

The KEMI study found that the quantity used has declined in recent years, but this may be because of EU manufacturing relocating to countries outside of the EU.

c. Please specify in which applications MCCP is used as a material constituent, as an additive or as an intermediate and what concentration of diantimony trioxide remains in the final product in each of these cases (on the homogeneous material level).
MCCP is always used as an additive in flexible materials such as polymers and coatings. Diantimony trioxide is always used additively when used with MCCP. Typical MCCP concentrations are believed to be about 7% but the diantimony trioxide can be very variable depending on the formulation of the polymer and the fire retardancy rating that is required.

Please specify the MCCPs used, e.g. with regard to the degree of chlorination and content of SCCPs.

AEM members do not use MCCP as a chemical, but purchase components and cables in which it has been incorporated by suppliers. As far as we know, there is no (>0.1%) SCCP present in products placed on the EU market as this substance is restricted by the EU POPs Regulation.

2. Quantities and ranges in which MCCP is in use

a. Please detail in what applications your company/sector applies MCCP and give detail as to the amounts of use. If an exact volume cannot be specified, please provide a range of use.

Most uses by AEM members are in wire and cable insulation and in coatings.

b. Please provide information as to the ranges of quantities in which you estimate that the substance is applied in general and in the EEE sector.

One manufacturer has estimated that a typical product contains 4 grams of MCCP and a another has determined that one example product contains 35 grams.

c. If substitution has begun or is expected to begin shortly, please estimate how the trend of use is expected to change over the coming years.

Substitution has not been actively started by AEM members. Cable and component manufacturers have not indicated that they are substituting for MCCP.

d. Please state on the observed decrease of MCCPs used in the EU: is this trend to be understood as a shift away from MCCPs or is the manufacture of MCCP based PVC and other MCCP based components being shifted from EU manufacturers to non-EU manufacturers (i.e. parts are imported to replace the decrease in manufacture)?

AEM is not able to answer this question

3. Potential emissions in the waste stream

a. Please provide information on how EEE applications containing MCCPs are managed in the waste phase (with which waste is such EEE collected and what treatment routes are applied?).
Most MCCP appears to be used in wire and cables. The polymer coating from wire and cable scrap can be stripped off for disposal either as landfill or through incineration. MCCP leakage in well managed landfill sites should not occur and EU emissions legislation (the Industrial Emissions Directive) strictly regulates incinerators in the EU so that no harmful emissions occur. MCCP in small parts in electronic equipment will behave in the same way if the electrical waste is smelted for metal recovery, as the Industrial Emissions Directive is applicable or landfilled.

b. Please detail potentials for emissions in the relevant treatment processes.
Not known to AEM. There is only very limited data on emissions in the EU impact assessment on MCCP[2] but some data is provided in the study by KEMI.

c. How are waste PVC cables, rubber and adhesive containing MCCPs managed in the waste phase and how is copper extracted from such waste to enable recycling?

The polymer coating from wire and cable scrap can be stripped off. Short lengths of wire inside equipment as well as rubber, adhesives and other materials that might contain MCCP are not separated and are safely treated by the electrical equipment recycling process, usually by smelting for metals recovery with afterburners in emissions stacks to ensure that all hazardous by-products are destroyed. This is regulated by the Industrial Emissions Directive and the processes used to remove hazardous by-products are extremely effective.

4. Substitution

KEMI's report states that substitutes are available and some of AEM's suppliers have confirmed that this is possible as long as sufficient time is allowed to meet all safety, reliability and legislation obligations.

Substitution would however be much more difficult if antimony oxide were not permitted to be used (see AEM's submission on this substance). KEMI's report lists alternative plasticisers to MCCP that can be used as substitutes, **but these substances have no flame retardancy properties and are flammable materials**. As a result flame retardants would also need to be added. Some alternative flame retardants are however unsuitable in flexible cables such as mineral types because they make the plastic too hard and rigid. Some other types cannot achieve the required level of fire retardancy. KEMI suggest that several phosphate flame retardants could be used, but some of these are hazardous materials and the global supply of phosphorous used to make these materials is very limited and these are classified by the EU as "Critical Raw Materials".

AEM agrees that substitution of MCCP should be possible, but this would be much more difficult if diantimony trioxide were also to be restricted by RoHS.

5. Socio-economic impact of a possible restriction

If a restriction of MCCP were to be adopted, it will be important to allow manufacturers sufficient time to identify, test and gain approvals for substitutes. From past experience of AEM members with phthalate substitution, this can take up to 10 years or longer if some substitute parts are not available from component suppliers. Note that many components are made primarily for sectors outside of the scope of RoHS and so manufacturers have no incentive to develop substitutes. If research shows that no substitutes exist, AEM could apply for exemptions, but this would not be possible until the research had been completed with suitable results available to justify the exemption. In addition, past experience has shown that it can take more than 3 years (>4 years in recent years) from submission of an exemption request to the exemption being published in the EU Official Journal. On this basis, a minimum 10 year transition period appears reasonable.

If MCCP were to be restricted before fully RoHS compliant equipment can be tested and gain EU NRMM Emissions Regulation approval from a Notified Body, many types of equipment could not be sold in the EU. For example, EU hospitals could not buy emergency generators, with potentially disastrous implications, construction equipment would not be available so that new buildings could not be constructed, and some farm machinery will not be available in the EU therefore affecting food production.

6. Further information and comments

A comprehensive EU risk assessment on MCCP was published in 2008 that concluded that further measures to protect workers were needed, but at that time, none were needed to protect consumers or the environment[2].

KEMI's report makes specific reference to the use of MCCPs in items of electrical and electronic equipment. Information is cited above, as relevant. There does, however, appear to be a discrepancy between the amount used in EEE and total production. An estimate of 15,000 tonnes per year of MCCP in PVC cables is given out of a total EU production of 40,000 tonnes. Some MCCP is probably used in other applications such as coatings, but KEMI has not provided data on all non-electrical uses. A Danish study in 2014 found that MCCPs are still used in building materials (paints/coatings, adhesives and sealants). Also, flexible PVC has several non-electrical uses such as in furniture, flooring and clothes and MCCP may be used in these. Therefore a significant proportion of MCCP may be used in products outside of the scope of the RoHS directive and so if this substance is shown to be harmful, a more effective risk management option would be to adopt a restriction under the REACH Regulation which could restrict all uses.

[2] https://echa.europa.eu/documents/10162/584faee8-d13a-41dd-8b33-959ad1a81171 and https://echa.europa.eu/documents/10162/13630/trd_rar_uk_mccp_en.pdf/b879f97d-9cea-49e1-9a84-4b3c6a4eb447