

MANAGEMENT OF CHEMICAL SUBSTANCES WITH ECOLOGICAL RISK

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Abstract: Environmental Management offers research and opinions on use and conservation of natural resources, protection of habitats and control of hazards. Contributions are drawn from biology, climatology, ecological economics, environmental engineering, environmental law, geology, information science and more. Environmental Management presents the work of academic researchers and professionals outside universities, including those in business, government, research establishments, and public interest groups, presenting a wide spectrum of viewpoints and approaches. The REACH regulation is a European Community law which requires the registration, evaluation, and authorization of all substances that are manufactured or imported into the EU depending on their weight and health risk. SVHC is a chemical substance (or part of a group of chemical substances) for which it has been proposed that the use within the European Union be subject to authorisation under the REACH Regulation.
Key words: Environmental Management, Substance of Very High Concern, REACH Regulations.

1. INTRODUCTION

Exposure to hazardous substances can have significant adverse effects on human health on soil, surface water, groundwater and ecosystems (Figure 1). As well as endangering health, these substances can limit the use of land and reduce its value, cause corrosion that may be threaten building structures.

Contamination is not always limited to a specific site. Hazardous substances may seep through the soil into groundwater, or be carried to nearby land and waterways in rainwater or on dust particles. Vapour and gases from contaminated land may present additional risks of explosion and odour.

Environmental management systems include five core elements: policy, planning, implementation, measurement and review (Figures 2). These elements comprise a continuous improvement process designed to manage and progressively reduce an organisation's impact on the environment.



Fig. 2 Environmental Management System – Safety and security

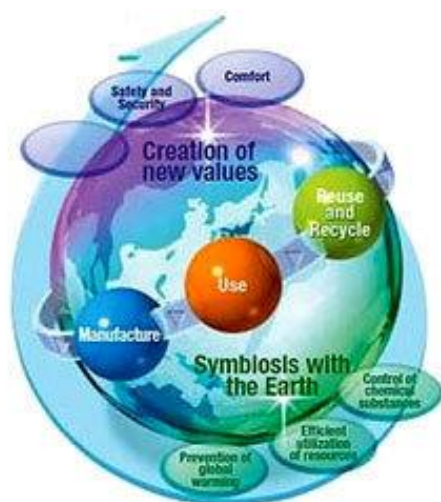


Fig. 1. Symbiosis with the Earth

2. LG ELECTRONICS EMS

Conforming to the international standard, ISO 14001, an environmental management system (EMS) provides the structural framework for an organisation to deal with its environmental issues. Some advantages of incorporating environmental management into existing business practice are:

- meeting the due diligence required of directors and managers,
- financial savings,
- proactive environmental responsibility,
- a sustainable competitive advantage.

An effective integrated management system incorporates EMS, occupational health and safety (OH&S) and quality management.

LG Electronics declared in 2005 its intention not to obtain products containing any of the six hazardous substances specified by the EU. By launching the "LG Electronics Green Program", the company strictly

manages its systems to ensure that the various components, raw materials, packing materials, and batteries in its products do not contain hazardous substances.

LG Electronics recognizes that existing legal requirements are not always enough to protect human health and the environment. If the impact on the environment and human health is not scientifically proven, but there is enough doubt that there might be an adverse effect, LG Electronics will follow the Precautionary Principle as referred to in the 1992 Rio Declaration of *The United Nations Conference on Environment and Development (UNCED)*, also known as *Earth Summit (Portuguese Eco '92)*.

3. HAZARDOUS SUBSTANCES FOR MANAGEMENT

The hazardous substances that have been banned from use by law or that LG Electronics has decided to phase out or reduce, due to their risks, are managed separately in the categories A1, A2, and B.

Level A1 comprises six hazardous substances that are specified in the EU's RoHS (*Restriction of Hazardous Substances*) regulations like heavy metals such as lead, mercury, cadmium, hexavalent chromium and its chemical compounds, as well as bromine-based flame retardants such as PBB (*polybrominated biphenyl*) and PBDE (*polybrominated diphenyl ether*).

Level A2 comprises substances that are either banned by various national or international legislation (other than the RoHS regulations), or substances that LG Electronics has decided to phase out due to the risk it poses to human health and the environment like chlorine compounds, asbestos, organic tin compounds, formaldehyde, nickel, arsenic, nitro compounds and other substances that could destroy the ozone (*perfluorooctane sulfonate, pentachlorophenol*) etc.

Level B includes substances that must be monitored or reduced. They are PVC (*poly(vinyl chloride)*), BFR (*brominated flame retardants*), phthalates, beryllium, antimony, selenium, VOC (*volatile organic compounds*) and so on.

LG Electronics operates a measurement system, whereby the content of hazardous substances is assessed right down to the last detail. The company's 19 LG production operations around the world use X-Ray Fluorescence (XRF) equipment in order to examine whether or not any parts or products contain hazardous substances.

4. COMPLIANCE WITH EU REACH REGULATION

The REACH (*Registration, Evaluation, and Authorization of Chemical*) regulation is a European Community law which went into force in June 2007 and requires the registration, evaluation, and authorization of all substances that are manufactured or imported into the EU depending on their weight and health risk.

LG Electronics has established a step-by-step process and is committed to providing our customers with information about the chemicals in products, as required for compliance with REACH. LG Electronics requires all relevant supplier to (pre)-register substances and preparations used in industrial (including engineering) processes and will also monitor and support (pre)-registration by suppliers.

LG Electronics' obligation to provide SVHC (*a substance of very high concern*) information is only applicable if a substance included on the candidate list is present in an article in a concentration above 0.1% weight by weight, as per REACH. The SVHC "candidate list" can be updated at any time i.e. it is a "living list". An updated version of the "candidate list" can be found in the ECHA (*the European Chemicals Agency*).

SVHC is a chemical substance (or part of a group of chemical substances) for which it has been proposed that the use within the European Union be subject to authorisation under the REACH Regulation^[1]. Indeed, listing of a substance as an SVHC by ECHA is the first step in the procedure for authorisation and restriction of use of a chemical. The first list of SVHCs was published on 28 October 2008 and updated on 13 January 2010. (*Candidate List of Substances of Very High Concern for authorisation*)^[2].

The criteria for assessment of SVHC substances are given in Article 57 of the REACH Regulation .

A substance may be proposed as an SVHC if it meets one or more of the following criteria:

- it is carcinogenic;
- it is mutagenic;
- it is toxic for reproduction;
- it is persistent, bioaccumulative and toxic (PBT substances) according to the criteria set in Annex XIII to the REACH Regulation .

-it is very persistent and very bioaccumulative (vPvB substances) according to the criteria set in Annex XIII to the REACH Regulation

-there is "scientific evidence of probable serious effects to human health or the environment which give rise to an equivalent level of concern".

5. PROCEDURE FOR LISTING SVHCs

There are three priority groups for assessment (*Article 58.3, REACH Regulation*):

- PBT substances and vPvB substances;
- substances widely dispersed during use;
- substances used in large quantities.

Proposals for inclusion of a substance on the list of SVHCs can come either from the European Commission or one of the Member States of the European Union. The proposals are made public by the European Chemicals Agency and are open for public comment for 60–90 days. If the substance is deemed to meet one or more of the criteria, it is then listed as an SVHC (*Article 59, REACH Regulation*).

Once a substance has been listed as an SVHC, the Agency commissions a technical report from one or

more national or private laboratories, which analyses the available information on manufacture, imports, uses and releases of the substance, as well as possible alternatives and the Agency decides whether to prioritise the substance, in effect, whether to make a recommendation to the European Commission to add the substance to Annex XIV of the REACH Regulation, making its use subject to authorisation.

There are some direct consequences of including a substance on the list of SVHCs. Suppliers of pure SVHCs must provide their customers with a safety data sheet (SDS) (*Article 31.1, REACH Regulation*). Suppliers of mixtures of substances which contain more than 0.1% by weight of any SVHC must provide their

customers with a safety data sheet on request (*Article 31.3, REACH Regulation*). Manufacturers or importers of articles containing more than 0.1% by weight of any SVHC must provide their customers, and consumers on request, with adequate information on the safe use and disposal of the article, including the name of the SVHC(s) concerned (*Article 7, REACH Regulation*). From 1 June 2011, manufacturers and importers of articles will also have to notify the European Chemicals Agency of the quantities of SVHCs used in their articles (*Article 7, REACH Regulation*). The substances were all listed by the European Chemicals Agency on 28 October 2008 (*Decision ED/67/2008 -Table 1*).

Table 1. Substances of very high concern

<i>Substance name</i>	<i>EC number</i>	<i>CAS number</i>	<i>Reason for inclusion</i>	<i>Priority</i>
<i>Arsenic pentoxide (diarsenic pentaoxide)</i>	215-116-9	1303-28-2	<i>carcinogen</i>	<i>No</i>
<i>Arsenic trioxide (diarsenic trioxide)</i>	215- 481-4	1327-53-3	<i>carcinogen</i>	<i>No</i>
<i>4,4 Diaminodiphenylmethane (MDA)</i>	202-974-4	101-77-9	<i>carcinogen</i>	<i>YES</i>
<i>Cobalt(II) chloride (cobalt dichloride)</i>	231-589-4	7646-79-9	<i>carcinogen</i>	<i>No</i>
<i>Lead hydrogen arsenate</i>	232-064-2	7784-40-9	<i>carcinogen toxic for reproduction</i>	<i>No</i>
<i>Sodium dichromate</i>	234-190-3	7789-12-0 10588-01-9	<i>carcinogen mutagen toxic for reproduction</i>	<i>No</i>
<i>Triethyl arsenate</i>	427-700-2	15606-95-8	<i>carcinogen</i>	<i>No</i>
<i>Benzyl butyl phthalate (BBT)</i>	201-622-7	85-68-7	<i>toxic for reproduction</i>	<i>YES</i>
<i>Bis(2-ethylhexyl) phthalate (DEHP)</i>	204-211-0	117-81-7	<i>toxic for reproduction</i>	<i>YES</i>
<i>Di butyl phthalate (DBP)</i>	201-557-4	84-74-2	<i>toxic for reproduction</i>	<i>YES</i>
<i>Anthracene</i>	204-371-1	120-12-7	<i>PBT</i>	<i>No</i>
<i>Hexabromocyclododecane (HBCDD), including all major diastereomers</i>	247-148-4 221-695-9	134237-50-6 134237-51-7 134237-52-8	<i>PBT</i>	<i>YES</i>
<i>Short chain chlorinated paraffins (C₁₀-C₁₃ chloroalkanes SCCP)</i>	287-476-5	85535-84-8	<i>PBT vPvB</i>	<i>YES</i>
<i>Tributyltin oxide (Bis(tributyltin) oxide, TBTO)</i>	200-268-0	56-35-9	<i>PBT</i>	<i>No</i>
<i>Muskxylene (5-tert-butyl-2,4,6-trinitro-m-xylene)</i>	201-3219-04	81-15-2	<i>vPvB</i>	<i>YES</i>

The European Commission number, or EC number, is a seven-digit code that is assigned to chemical substances that are commercially available within the European Union :

- EINECS numbers start with number 200-001-8 (formaldehyde). There are currently 100,204 entries.
- ELINCS numbers start with 400-010-9 (trade name: "indosol yellow SF-2RL"). There are currently 4,381 entries.
- NLP numbers start with 500-001-0 ("2-methylpropene, trimers"). There are currently 703 entries.

The EC Number may be written in a general form as: NNN-NNN-R, where R is a check digit and N represents integers. The check digit is calculated using the ISBN method.

The identification of chemical compounds according to a systematic numbering method established by the Chemical Abstract Service (CAS), Columbus, OH, now called the CAS Registry Number denoted by [CARN], includes up to nine digits separated by hyphens into three groups [NN...NN-NN-N]. The first part of the number, starting from the left, has up to six digits and the second part has two digits (NN). The final part

consists of a single check digit (N).The CAS Registry Number may be written in a general form as: [N(n)...N(k)...N(4)N(3)-N(2)N(1)-R] with $n_{max}=6$. The check digit R is developed by following a standard calculation method in which R represents the check digit and N represents a fundamental sequential number. The check digit is the derived from the following formula:

$[nN+...4N+3N+2N+1N] / 10 = Q + R/10$ where Q represents an integer that is discarded. The CAS numbers for groups of compounds such as "SCCP" are indicative. Such groups can include several compounds, each of which has a different CAS number. Other 14 substances were listed by the European Chemicals Agency on 13 January 2010 - Helsinki (*Candidate List of Substances of Very High Concern for authorisation-Table 2*)

Table 2 Information on the substances of very concern added to candidate list

<i>Substance name</i>	<i>EC number</i>	<i>CAS number</i>	<i>Reason for inclusion</i>	<i>Potential uses</i>
Anthracene oil	292-602-7	90640-80-5	PBT, vPvB. Carcinogen, category 2	Anthracene and carbon black, reducing agents in blast furnaces components in bunker fuel, impregnating sealing and corrosion protection
Anthracene oil, anthracene paste, distn. Lights	295-278-87	91995-17-4	PBT, vPvB, Carcinogen, category 2 Mutagen, category 2	
Anthracene oil, anthracene paste, anthracene fraction	295-275-9	91995-15-2	PBT, vPvB. Carcinogen, category 2	
Anthracene oil, anthracene-low	292-604-8	90640-82-7	PBT, vPvB, Carcinogen, category 2 Mutagen, category 2	
Anthracene oil, anthracene paste	292-603-2	90640-81-6	PBT, vPvB, Carcinogen, category 2 Mutagen, category 2	
Pitch, coal tar, high temp	266-028-2	65998-93-2	PBT, vPvB. Carcinogen, category 2 ¹	Electrodes for industrial applications, - heavy duty corrosion protection, special purpose paving, manufacture of other substances and the production of clay targets
Aluminosilicate Refractory Ceramic Fibres		650-017-00-8	Carcinogen, category 2	Insulation of industrial furnaces and equipment, equipment for the automotive and aircraft/aerospace industry. In fire protection (buildings and industrial process equipment)
Zirconia Aluminosilicate, Refractory Ceramic Fibres		650-017-00-8	Carcinogen, category 2	Hhigh-temperature, almost exclusively in industrial applications (insulation of industrial furnaces and equipment, equipment for the automotive and aircraft/aerospace industry) In fire protection (buildings and industrial process equipment)
2.4 -Dinitrotoluene	204-450-0	121-14-2	Carcinogen, category 2	Production of toluene disocyanate, which is used for the manufacture of flexible polyurethane foams. Gelatinizing-plasticizing agent for the manufacture of explosives.

Diisobutyl phthalate	201-553-2	84-69-5	Toxic for reproduction, category 2	As plasticiser for nitrocellulose, cellulose ether, polyacrylate and polyacetate dispersion, As a gelling aid in combination with other plasticiser, which are widely used for plastics, lacquers, adhesives, explosive material and nail polish.
Lead chromate	231-846-0	7758-97-6	Carcinogen, category 2. Toxic for reproduction, category 1.	Manufacturing pigments and dyes, and as a pigment or coating agent in industrial and maritime paint products or varnishes. Potential uses may be associated with the formulation of detergents and bleaches, photosensitive materials, the manufacture of pyrotechnic powder or the embalming/restoring of art products.
Lead chromate molybdate sulphate red (C.I. Pigment Red 104)	325-759-9	12656-85-8	Carcinogen, category 2. Toxic for reproduction, category 1	As a colouring, painting and coating agent in sectors such as the rubber, plastic and paints, coatings and varnishes industries. The production of agricultural equipment, vehicles and aircraft as well as road and airstrip painting.
Lead sulfochromate yellow (C.I. Pigment Yellow 34)	215-693-7	1344-37-2	Carcinogen, category 2. Toxic for reproduction, category 1	Colouring, painting and coating agent in sectors such as the rubber, plastic and paints, coatings and varnishes industries. Production of agricultural equipment, vehicles and aircraft as well as road and airstrip painting. Camouflage or ammunition marking in the defence area.
Tris(2-chloroethyl) phosphate(TCEP)	204-118-5	15-96-8	Toxic for reproduction, category 2	Additive plasticizer and viscosity regulator with flame-retarding properties for acrylic resins, polyurethane, polyvinyl chloride and other polymers. Adhesives, coatings, flame resistant paints and varnishes, The furniture, the textile and the building industry.

5. CONCLUSIONS

Implementation of a practical environmental management system requires a detailed understanding of the organisation, its products and services and their interaction with society and the market place.

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