ID	Substance name	Cas N°	Hazard	Main use in EEE	Stakeholder input		
					Specification of use: Component(s) in which substances is contained	Qty (%)	General comments
1	Antimony Trioxide	1309-64-4	Carc Cat. 3 R40	Synergist brominated flame retardants;	Ceramics hobs in Household appliances equipment housings, mouldings, connectors and many other electrical components. Used as catalyst for film polymerisation (no known substitutes) Used in some types of optical glass (no known substitutes)	0,1-7	– Chemically bound in silicate-matrix (Glass) antimony trioxide does not appear anymore as such in the product. – To comply with obligatory fire regulations, Sb_2O_3 must be used with most types of brominated flame retardants and in PVC. – There are no substitutes that are as effective. – Only brominated flame retardants are suitable for some types of plastic[1] – EU Risk assessment, concluded: o no risk for consumers (including EEE applications) o No risk for environmental exposure – It is generally accepted in Dir 1999/45/EC and future GHS that substances in massive (amorphous) alloys, plastic and elastomers do not present a danger to human health by inhalation, ingestion or contact with the skin or to the aquatic environment in the form in which they are placed on the market. **So from a regulatory point of view no need / value to restrict under RoHS.**

[1] Danish EPA study – see table 2.2 http://www2.mst.dk/Udgiv/publications/2007/978-87-7052-351-6/pdf/978-87-7052-352-3.pdf

2	Antimony Compounds	-	Xn; R20/22 N; R51-53	Flame retardant; melting agent in CRT glass; solder material (antimony-tin) Melting agent in CRT glass	No specific comments		– Most antimony compounds used in EEE are exempted from the Sb group classification in Annex 1. – Exception Sodium Antimonate, but this compound is no longer present in this form in the finished articles – Link between R51/53 and current PBT criteria is inappropriate for metals and metals compounds. Inorganic substances are currently exempted from Annex XIII of REACh for these reasons – Use of Sb in pigments was assessed in the Antimony trioxide RAR (no risk at consumer level) – **So from a regulatory point of view no need / value to restrict under RoHS.**
3	Arsenic/ Arsenic compounds	7440-38-2	T; R23/25 N; R50-53 Carc. Cat 1, R45	III-V group semiconductor substrate (GaAs) Flame retardant	Ceramics hobs in Household appliances Semiconductor devices and lasers. Also in photodiodes and thermal imaging – Category 9 applications Arsenic/arsenic compounds are not used as flame retardants		– It generally accepted in Dir 1999/45/EC and future GHS that substances in massive alloys, plastic and elastomers do not present a danger to human health by inhalation, ingestion or contact with the skin or to the aquatic environment in the form in which they are placed on the market. – Chemically bound in silicate-matrix (Glass) – Arsenic based semiconductors are used because of their unique combinations of

							characteristics. There are no known alternatives available for most applications – Proprietary critical use in energy saving applications in electronic equipment – In some application any risks can be properly controlled and not present in finished article.
4	Beryllium metal	7440-41-7	Carc. Cat. 2; R49 T+; R26 T; R25-48/23 Xi; R36/37/38 R43	In alloys; copper-beryllium alloy; Connectors: contact springs, improves elasticity of copper alloy; Finger clips PCs: maintains electrical conductivity in metal housing; Monitors Relays: improves properties of	Used in ceramic components in electronics 3 %in copper alloys. Precision co-axial connectors to meet high reliability (xks connects) standard IEEE Std 287-2007 to 110 Ghz. Because beryllium metal is transparent to x-rays, it is widely used as the window on high-resolution x-ray machines used for mammography. A useful property of copper beryllium is its corrosion resistance. Copper-beryllium housings are specifically used in under-water applications to protect the electronics from the corrosive effects of	ppm – 2%	– Beryllium oxides and not Beryllium metal is not used in ceramic components in electronics – Copper-beryllium is the spring material that has the longest life and is the most reliable. – It is also more expensive than steel or phosphor bronze (inferior substitutes) and so is used generally only if there is no alternative. – Be metal is not produced in the EU. – Be metal is generally not used in consumer electronics. – Copper beryllium alloys containing a maximum of 2% – Be is used in very small amounts (ppm range) in EEE. – Copper beryllium alloys are utilized to increase electrical and thermal conductivity, enhance product performance, facilitate miniaturization of components and products, and increase component and product reliability.

				copper contact springs Switches: high strength, high conductivity Laser printers: Rotating mirror, lightweight rigidity for precision instrumentation	seawater. Copper beryllium is used in products and components for critical electronic industry applications, such as small springs and connectors in cellular telephones, and connectors and shielding in computers.		– Consequently, products manufactured with copper beryllium are more efficient, conserve energy and natural resources, and increase product life –
5	Beryllium oxide	1309-64-4	Carc Cat. 3 R40	Synergist brominated flame retardants;	Used in ceramic components in electronics Properties of beryllium oxide are required for high standard precision insulators.		– BeO is not produced in the EU. – BeO is generally not used in consumer electronics. – Beryllium Oxide has the highest thermal conductivity of any electrically insulating material. – Its thermal conductivity is similar to that of copper and so is used as an insulator on high power semiconductors to conduct heat away from the device. – The next best material is aluminium nitride which has a thermal conductivity only one half that of BeO. – BeO is expensive and so is used only if there are no alternatives. – Parts containing BeO should be marked with a warning that it is present. – These substances are very valuable and

							thorough recycling economically interesting.
14	GalliumArsenide	1303-00-0	Human carcinogen	Power Amplifiers, semi conductors	Semiconductors Only used for very high frequency ICs and other devices State of the art substrate of many LED types		– GaAs semiconductors use less power, are less susceptible to heat and are much faster than silicon. – Substitution where possible already done with silicon-doted materials. No further substitution possible. – No alternative for many colors
18	Nickel	7440-02-0	Carc. Cat 3 R40 R43	Stainless steel, Plating, Decorative metal finishes, barrier layer	Used in pigments Used in lamps		– No known alternative available – EU Risk assessment confirmed no risk conclusion for consumers with exception to those applications/ forms with prolonged skin contact and failing the EU sweat test. – The marketing & use for these uses is already restricted in annex XVII of REACh. – The sensitation end-point is not within the scope of RoHS – **So from a regulatory point of view no need / value to restrict under RoHS.**
25	Selenium	7782-49-2	T, R23/25 R33 R53 Toxic/ danger for culminative effects/	Rectifiers and detector instruments, Photoreceptor, Semiconductor material, light	Uses include alloy additive, in glass, light detection semiconductors such as infrared detectors (cat 9) Rarely used in rectifiers.		– Selenium is an essential element in the human diet and so trace quantities in the environment are normal and beneficial. – Many uses where substitution is difficult or impossible, due to combination of beneficial

			Environmental	receiving element, photocell	(mainly as spare parts, not used in new equipment Potential largest scale application are solar cells, where copper indium diselenide and related material promise low cost production and large area photovoltaic cells		properties – Substitute for cadmium, no alternative – Proprietary critical use in energy saving applications in EEE
30	Nickel Trioxide	1314-06-3	Carc Cat 1; R49 R43 R50	May be used as an electrolyte	Use as battery electrolyte is outside of scope of RoHS Also used for preparation of pigments which are mixed oxides and usually do not contain dinickel trioxide		– Already restricted by entry 27 of Annex XVII – Substance used as an electrolyte in batteries, exempted from scope of RoHS – Inorganic metal salts classified as R53, incl. Ni-Salts are exempted from the PBT criterion, since the criteria were found not to be appropriate – Ni-RA concluded no bio-accumulation potential, to the contrary even biodilution over the food chain – **So from a regulatory point of view no need / value to restrict under RoHS.**

31	Diarsenic trioxide; arsenic trioxide	1327-53-3	T+,Carc. Cat 1: R45; Xn, R22 R43 N, R50-53	May be used in certain glass-materials, less than 5000ppm	This no longer used in glass		– Restricted in marketing & Use, only use and in glass is exempted and already regulated in annex XVII of REACh.
34	Nickel dihydroxide	12054-48-7	Carc. Cat 3, R40 Xn, R20/22 R43 N, R50-53	May be present in certain plastics, metallic- or ceramic materials	Used to make pigments		– Used to make pigment, but not present in product. – Nickel compounds already restricted in marketing and use under REACh Annex XVII entry 27. – Inorganic metals salts classified as r53 incl. Ni- Salts are exempted from PBT criterion, since the criteria were found not appropriate. – The Nickel Risk assessment, concluded no bioaccumulation potential, even some biodilution over the food chain – **No reason for need/ value to restrict under RoHS**
36	Divanadium Pentoxide; Vanadium pentoxide	1314-62-1	Muta.Cat.3; R68 Repr.Cat.3; R63 T; R48/23 Xn; R20/22 Xi; R37 N; R51-53 (checked)	May be used in plastics, metalic- or ceramic materials	V2O5 is not used in plastics, metallic-or ceramic materials, but it is used to make other materials that are used as additives to these materials Vanadium pentoxide used as as electrolyte in redox batteries		– Only use of V2O5 in electrical equipment is as a heat detector such as in bolometers (Cat 9) – Use of vanadium pentoxide used as one of the electrolytes in redox batteries, but it is only present in the fully charged states and battereries are excluded from the scope of the RoHS-directive

37	Nickel disulphate	7786-81-4	Carc.Cat.3; R40 Xn; R22 R42/43 N; R50/53	May be used in plastics, metalic- or ceramic materials	Used to make other nickel compounds, not used in electrical equipment		– Nickel compounds already restricted in marketing and use under REACh Annex XVII entry 27 – No used in E & E equipment – EU Risk assessment concluded there is no risk for consumers – Metal salts classified as R50/53 , incl. Ni-salts are exempted from PBT criterion, since the criteria currently used are deemed in appropriate – EU Risk assessment also concluded that there is no bioaccumulation effect and even some biodilution effect along the supply chain. – **So from a regulatory point of view no need / value to restrict under RoHS.**
38	Cobalt Oxide	1307-96-6	Xn; R22 R43 N; R50/53	May be used in plastics, metalic- or ceramic materials	Used to make pigments Used in glass for special lamps (black light blue lamps)		– Due to inert character of glass not released
39	Cobalt	7740-48-4	R42/43 R53	May be used in plastics, metalic- or ceramic materials	Used as catalyst for film polymerisation in E & E applications Used in stainless steel as alloying element		– No substitutes available – It generally accepted in Dir 1999/45/EC and future GHS that substances in massive alloys, plastic and elastomers do not present a danger to human health by inhalation, ingestion or contact with the skin or to the aquatic environment in the form in which they are placed on the market. – Metal salts classified as R50/53 , incl. Ni-salts

							are exempted from PBT criterion, since the criteria currently used are deemed in appropriate – **So from a regulatory point of view no need / value to restrict under RoHS.**
43	Thalium	7440-28-0	T+; R26/28 R33 R53	May be used in plastics, metalic- or ceramic materials	Thalium compounds are used in HID lamps Has been used in photocells and infrared detectors but this used has largely been phased out Used in X-ray detectors (Cat 8 & 9)		– No alternative available, as possible substitutes contain Mercury, cadmium or Lead, but are drop in replacements – Metal salts classified as R50/53 , incl. Ni-salts are exempted from PBT criterion, since the criteria currently used are deemed in appropriate – **So from a regulatory point of view no need / value to restrict under RoHS.**