

nexperia	Test Requirements for Hazardous Substances in Products and Packaging	EHS
Document: XPR-0009		
Date: 12-Dec-2023		Sustainability

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1 OBJECTIVES / PURPOSE

Nexperia's products and their packaging must not contain hazardous substances according to the definitions in XPR-0007 at levels above our established thresholds which can be liberated under normal usage and handling conditions throughout their functional lifecycle and during end-of-life disposal. Nexperia must ensure to not put anything on the market that contains hazardous substances above allowed levels as specified by law or by other regulations. To facilitate this, our suppliers and subcontractors (collectively referred to as "Suppliers" henceforth) are obligated to furnish a Certificate of Analysis (CoA) as an analytical proof. The CoA should confirm that the concentration of selected substances adheres to our specified requirements. Nexperia subsequently uses these CoAs to provide our customers with documented assurance of the compliance of our finished products.

2 SCOPE

This procedure applies to all materials, parts, (semi-)finished goods, subassemblies, and the packaging materials used for finished Nexperia products, all of which will henceforth be referred to as 'materials'. The scope of this procedure covers materials intended for either consumer market release or internal business evaluation purposes.

3 RESPONSIBILITIES AND RISKS

3.1 Roles and Responsibilities

Who	What
Customer	Requests CoA from Nexperia to obtain proof of compliance.
Customer Representative	Nexperia colleague supporting a customer. Often Sales Quality Engineer.
ECO-Products Group	Maintains a repository of CoA. Reviews CoA of to-be-qualified materials. Requests regular updates from Suppliers. Verifies compliance of incoming CoA. Uses CoA to answer chemical compliance requests.
Manager ECO-Products	Oversees activities. Can be consulted for expertise and any supportive activity regarding compliance requirements.
Supplier	Arranges tests of supplied materials and submits resulting CoA to Nexperia in a timely manner. Accountable for any non-compliance.
Sourcing Manager	Supports requests for CoA with Suppliers where necessary. Involved in any escalation procedure if Supplier is reluctant to comply or does not respond adequately within 14 days after request.
Applicant	Stakeholder requesting an assessment of environmental compliance, for example in the context of initial material qualification or material change, see XPR-0318. Typically Package R&D or Business Group. Subjects incoming CoA to an initial check on completeness and plausibility. Makes CoA available to ECO-Products.

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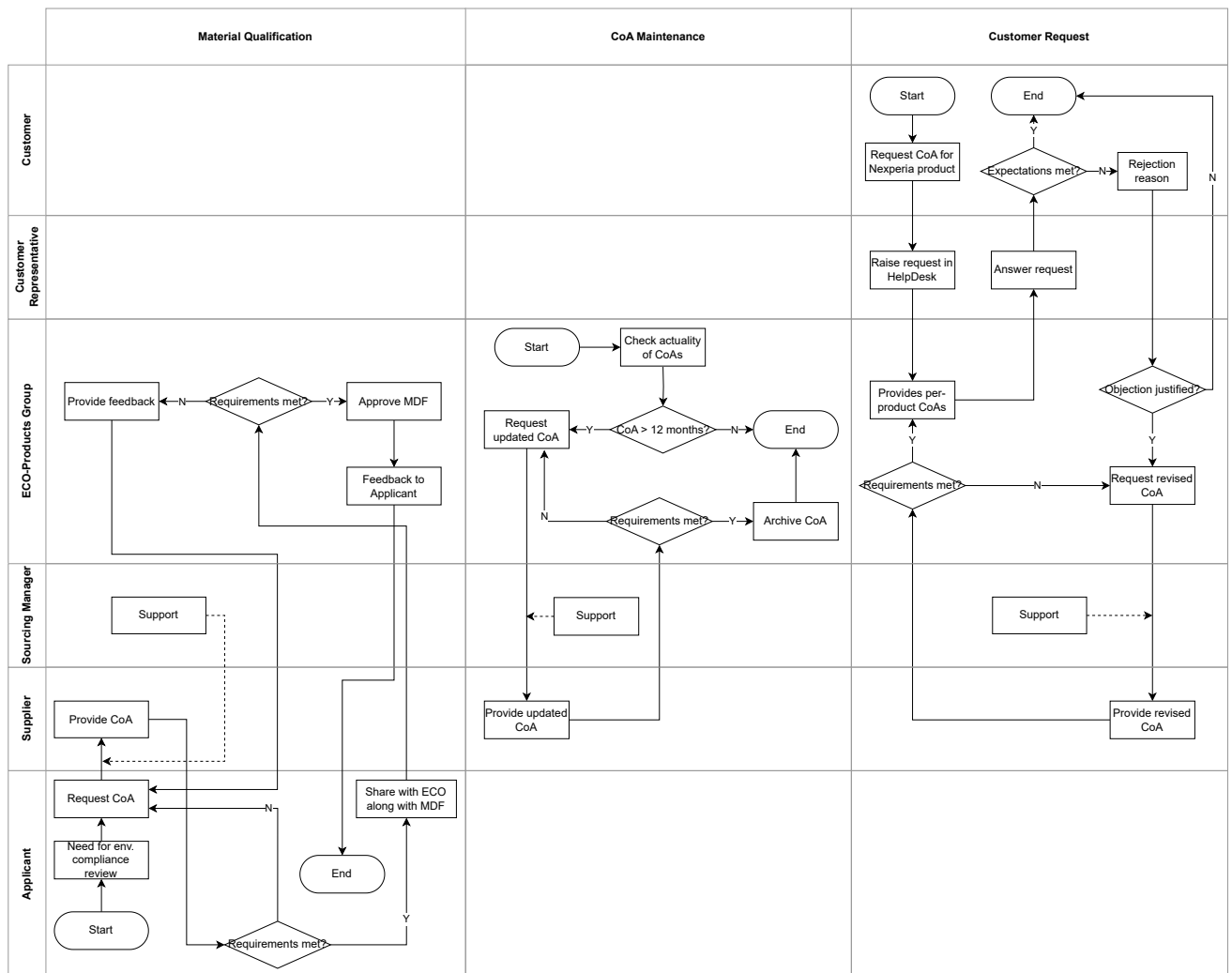
3.2 Rules

Relevant stakeholders must follow the process described herein and shall be informed in case of any non-compliance.

3.3 Risks

The primary risks encompass the potential non-compliance of Nexperia products. While our standard Terms & Conditions of Sales manage the direct financial risks towards our customers, non-adherence to this procedure could significantly tarnish Nexperia’s reputation. This could ultimately lead to a loss of business. Non-compliance with legislative requirements carries even graver consequences. These could range from blocked shipments and monetary fines to the shutdown of operational facilities, and in extreme cases, legal actions leading to imprisonment of responsible individuals.

4 FLOWCHART



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5 PROCEDURE

5.1 Verifying Compliance

Suppliers are required to provide evidence on compliance with the requirements mentioned in 5.1.1 and 5.1.2 on the homogeneous material level. For a more detailed guidance on individual test scopes, including material examples, please refer to 5.1.3

The test scope, e.g., which tests need to be carried out on which kind of homogeneous material, depends on the nature of the material. Nexperia distinguishes between metals, non-metals (adhesives, substrates, mould compounds, inks, plastics, cellulose-based materials like cardboard and paper, ...), and metalloids (dies, ceramics, ...). For maximum allowable concentrations of individual substances, please refer to XPR-0007.

Additional tests might be required due to specific customer needs. The decision on such requirements is at the discretion of and must be approved by the ECO-Products Manager.

5.1.1 Mandatory per Nexperia

- Directive 2011/65/EU, amended by Directive (EU) 2015/863, commonly referred to as "RoHS 2 amended" (RoHS: Restriction of Hazardous Substances Directive).
- EU Directive 94/62/EC, commonly referred to as PPW, Packaging and Packaging Waste Directive. For packaging designated to be used for shipping Nexperia products to customers.
- Nexperia Halogen-Free Definition. Homogeneous materials designated to be incorporated into products meeting the Halogen-Free definition (cf. XPR-0213).¹

5.1.2 Required per Nexperia's Customers

For specific homogeneous materials designated to be incorporated into Nexperia products, additional test reports are required:

- As
- Sb²
- PFOS and PFOA
- F³
- Be⁴

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5.1.3 Material Test Requirements Matrix

		non-metals							metals					metalloids		
		part of the product							packaging	part of the product						
		Molding/Potting Compound	Die Attach Epoxy/Film	Ink/Paint	Coatings (Passivation Layer, Solder Mask)	Glass	Plastic Housing	Substrate (Pre-preg, Core)	Cellulose (Cardboard, Paper), Plastics, Inks, Labels, ...	Leadframe	Plating	Bonding Wire	Solder	Pad Layer/Under Pad Layer/ Under Bump Metallization	Dies	Ceramics
PPW	Cd								X							
	Hg								X							
	Pb								X							
	Cr ⁶⁺								X							
RoHS 2 amended	Cd	X	X	X	X	X	X	X		X	X	X	X	X	X	X
	Hg	X	X	X	X	X	X	X		X	X	X	X	X	X	X
	Pb	X	X	X	X	X	X	X		X	X	X	X	X	X	X
	Cr ⁶⁺	X	X	X	X	X	X	X		X	X	X	X	X	X	X
	PBBs	X	X	X	X		X	X							X	
	PBDEs	X	X	X	X		X	X							X	
Halogen-Free¹	Sb ²	X	X	X	X	X	X	X		X	X	X	X	X	X	X
	Cl	X	X	X	X	X	X	X							X	
	Br	X	X	X	X	X	X	X							X	
Additional Requirements	F ³	X	X	X	X	X	X	X								
	As					X										
	Be ⁴								X	X	X	X	X			X
	PFOS PFOA			X	X											

- 1 Required only if the respective homogeneous material is designated to be incorporated into a Halogen-Free product.
- 2 Note that Nexperia's Halogen-Free standard covers antimony oxides. Analytical tests usually yield a total antimony content that is used as a basis to calculate a theoretical content of antimony trioxide, Sb₂O₃.
- 3 Fluorine shall be tested using IC with an MDL of ≤ 50 ppm. In case a fluorine concentration exceeding 50 ppm is found, Supplier must ensure that a credible non-PFAS source for the fluorine contents is provided in the full material declaration made available to Nexperia using XTE-0008.
- 4 Required only for copper metals, copper alloys, and beryllia ceramics.



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5.2 Requirements on Testing Laboratories

Tests shall be performed by a 3rd party test lab accredited according to the ISO/IEC17025 standard. Examples of accredited test labs include CTI, EMTEK, Intertek, IST, KTR, SGS, Bureau Veritas, and TÜV. In-house and 3rd party test labs not accredited according to ISO/IEC17025 standard are not acceptable. A valid certificate is required as evidence.

5.3 Requirements on Testing Methods

- All materials must be tested at the homogeneous material level in a solid state as present in the final product. Substrates, passive components, ... consist of several homogeneous materials that shall be tested in separate and preferably prior to assembly. Metallic pre-plating applied to lead frames via electrogalvanic plating (e-plating) processes from a solution of the respective metal ion may be treated differently because of the following reasons.
 - i) Test reports obtained from analyses carried out on a solution are not meaningful as the concentration of any hazardous impurity may not be compared to the concentration in the final (solid) state. Comparable is true for tests conducted on solid metal salts used to create e-plating solutions.
 - ii) Typical pre-plating layers have thicknesses in the micrometer range and may exhibit rough boundaries between individual layers, rendering any attempt at mechanical separation futile.
 - iii) A typical minimum sample amount required for a chemical analysis carried out by an ISO/IEC 17025-accredited laboratory is 5 g. For a typical Nexperia semiconductor product, mechanical separation of tens of thousands of individual components might be necessary to obtain enough sample material.

In such cases, Nexperia may accept single test reports covering the aggregate of lead frame base material and individual plating layers.

- Regarding layer-like packaging materials like papers with adhesive layers, Nexperia accepts test reports on the whole-material level.
- Non-metallic materials must be tested in cured state. The curing conditions do not need to follow the specific curing process Nexperia is using, since specific parameters can't be met outside of Nexperia's processes. Typical examples of materials that shall be tested in cured state include adhesives and solder pastes.
- All pre-treatment and test methods shall follow the requirements mentioned in Table 1. The decision on whether test methods other than those mentioned are considered acceptable is at the responsibility of the Manager ECO-Products.

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Table 1: Individual CoA test items including pre-treatment/test methods and analytical equipment depending on the respective analyte's material type.

Substance	Material	Pre-Treatment and Test Method	Analytical Equipment
Arsenic (As)	Glass	US EPA 3052 US EPA 3050B	ICP-OES/ICP-MS
Antimony (Sb)	Metals, Metalloids and Non-Metals	US EPA 3052 US EPA 3050B	ICP-OES/ICP-MS
Beryllium (Be)	Metals and Metalloids	US EPA 3052 US EPA 3050B	ICP-OES/ICP-MS
	Non-Metals	Not required	
Cadmium (Cd)	Metals, Metalloids and Non-Metals	IEC62321-5:2013 US EPA 3052	ICP-OES/ICP-MS/AAS
Hexavalent chromium (Cr ⁶⁺)	Metals	IEC62321-7-1:2015 (spot test or boiling water test)	UV-VIS
	Metalloids and Non-Metals	IEC62321-7-2:2017	UV-VIS
Lead (Pb)	Metals, Metalloids and Non-Metals	IEC62321-5:2013 US EPA 3052	ICP-OES/ICP-MS/AAS
Mercury (Hg)	Metals, Metalloids and Non-Metals	IEC62321-4:2013 US EPA 3052	ICP-OES/ICP-MS/AAS
PFOS and PFOA	Inks and paints Coatings	DIN CEN/TS 15968	LC-MS (MDL ≤ 25 ppb)
Phthalates (DBP, DIBP, BBP, DEHP)	Metals	Not required	
	Metalloids and Non-Metals	IEC 62321-8:2017	GC-MS
Polybrominated biphenyls (PBBs) Polybrominated diphenyl ethers (PBDEs)	Metals	Not required	
	Metalloids and Non-Metals	IEC62321-6:2015	GC-MS/LC-MS
Halogens F, Cl and Br	Metals	Not required	
	Metalloids and Non-Metals	BS EN 14582 IEC62321-3-2 EPA SW-846 5050	CIC (MDL ≤ 50 ppm)

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5.4 Requirements on Certificates of Analysis

- Languages other than English are not acceptable.
- Incoming CoA(s) shall be one or more original and unaltered PDF file(s) containing text and images as provided by the certified lab(s). Scanned, photographed, modified, and/or image-only PDF files are not accepted.
- Periods of more than one month between sample receiving date and date of issue are not acceptable.
- CoA should contain the following information, where items 1 to 7 are mandatory to uniquely identify a material.
 1. Name and address of testing laboratory
 2. Report number
 3. Report date (date of issue)
 4. Name and signature of lab supervisor
 5. Sample description (including type/model name of the product)
 6. Sample receiving date and testing period
 7. Tested substances with individual test methods and test results, together with analytical instruments used and the method detection limits (MDL)
 8. Pre-treatment method and measurement process (flowchart)
 9. Photograph of tested sample
- Any change in manufacturing location, chemical composition, or source of origin of a raw material requires an updated CoA. Regardless of this, a CoA must be updated when the validity period of one year (365 days) after date of issue is exceeded.
- A CoA must be made available to Nexperia upon request for at least ten years after last shipment date. Feedback is expected within seven days of request.

6 RECORDS

CoA submitted by Suppliers should be checked for compliance to the requirements as explained in this procedure. When the requirements are met, CoA need to be archived by ECO-Products group per material and/or (sub-)component level for traceability purposes and maintained for a minimum of ten years after last date of shipment to customers.

Record Type	Physical Location of Record	Responsible Role
Write-protected PDF documents	SharePoint	ECO-Products Group

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7 DOCUMENT INFORMATION

7.1 References

Document Number	Document Name
XPR-0007	Nexperia List of Hazardous Substances in Products and Packaging
XPR-0213	RHF-2006 Classification for Semiconductor Products
XPR-0318	Full Material Declaration Process
XTE-0008	Nexperia Material Declaration Form

7.2 Terms, Acronyms and Definitions

7.2.1 General

Acronym / Term	Definition
AAS	Atomic absorption spectroscopy
BBP	Benzyl butyl phthalate
CIC	Combustion ion chromatography
CoA	Certificate of Analysis
DBP	Dibutyl phthalate
DEHP	Di(2-ethylhexyl) phthalate
DIBP	Diisobutyl phthalate
ECO-Products	Environmental Compliance Organization for Products
GC-MS	Gas chromatography-mass spectrometry
ICP-AES (= ICP-OES)	Inductively coupled plasma atomic emission spectroscopy (= inductively coupled plasma optical emission spectroscopy)
ICP-MS	Inductively coupled plasma mass spectrometry
LC-MS	Liquid chromatography mass spectrometry
MDF	Material Declaration Form
PBBs	Polybrominated biphenyls
PBDEs	Polybrominated diphenyl ethers
PFAS	Per- and polyfluoroalkyl substances
PFOA	Perfluorooctanoic acid
PFOS	Perfluorooctanesulfonic acid
PPW	Packaging and Packaging Waste Directive
RoHS	Restriction of Hazardous Substances Directive
TLV	Threshold limit value
UV-VIS	Ultraviolet-visible spectroscopy

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7.2.2 Specific

Term	Definition
Coating	Product in liquid, paste, or powder form that, when applied to a substrate, forms a layer possessing protective, decorative, and/or other specific properties. Metallic plating layers are not included.
Homogeneous Material	<p>A material of uniform composition throughout or a material, consisting of a combination of materials that cannot be disjointed or separated into different materials by mechanical actions such as unscrewing, cutting, crushing, grinding, and abrasive processes.</p> <p>The definition is consistent with EU Directive 2015/863/EU. Per this document, the following examples illustrate what is and is not a homogeneous material:</p> <ul style="list-style-type: none"> - A plastic cover is a homogeneous material if it consists of one type of plastic that is not coated with other materials, or has other materials attached to it. - A cable that consists of metal wires surrounded by non-metallic insulation materials is not a homogeneous material because mechanical processes could separate the different materials. - A semiconductor package contains many homogeneous materials that include, e.g., caps, headers, mould compounds, die attach adhesives, die coatings, bonding wires, lead frames, platings, various types of solder (bumps, masks, pastes, wires, balls, flux), laminates, inks, etc. - Printed circuit board laminated materials consist of glass cloth, resins, and copper foil that each represent a homogeneous material.
Packaging Material	<p>All products made of any material of any nature to be used for the containment, protection, handling, delivery, and presentation of goods, from raw materials to processed goods, from the producer to the user or consumer. Examples include reels, trays, cover tapes, carrier tapes, tubes, plugs, cushions, foams, boxes, quality assurance (QA) seals, labels, desiccants, and inks.</p> <p>In addition, "non-returnable" items used for the same purposes shall be considered to constitute packaging. The term "packaging" is the same as the semiconductor terminology for "outline packing".</p>

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7.3 History of Changes

Date	Description of change	Changed by (name)
2017-06-07	Transfer of NX3-00572 to Nexperia	Annette Bunk
2018-11-13	Review and Update of Test Methods	Annette Bunk
2019-09-20	Review and Update of Test Methods	Annette Bunk
2021-09-07	Review and Update of Test Methods and Requirements: New Test method for Halogens (IEC62321-3-2) New PFOA/PFOS analysis requirement for Coatings	Annette Bunk
2022-04-22	<i>Interim revision: changed document owner from Marc Bollmann to Timo Stein</i>	<i>NMS Admin</i>
2022-09-26	Review and Update of Test Methods and Requirements: 5.1.3: Added Material Test Requirements Matrix 5.1/5.3: Removed test requirements for PAHs and phthalates DNOP/DINP/DIDP/DnPP 5.3: Removed Test Methods US EPA 3540C, US EPA 3541, US EPA 3546.	Annette Bunk
2023-07-20	General revision of wording and coherence of content. 3.1 and 4 were reworked to properly reflect the roles of Applicants, ECO-Products, customers, and customer representatives with regards to CoAs. 5.1: Added F test report requirement; TLVs were removed; specified the relationship between Sb and Sb2O3; Be only required for Cu (alloys) and beryllia ceramics; requirements matrix was updated; 5.3: Requirements for test reports of packaging materials were specified; specified Nexperia's stance on pre-plated lead frames; pre-treatment and test methods were updated; 5.4: Reports must be in the form of original, unaltered PDF files	Annette Bunk
29-Nov-2023	<i>Interim rev. removed "Nexperia" from document title</i>	<i>Timo Stein</i>
2023-12-12	Correction: 5.3 Table 1: MDL ≤ 25 ppb is required for PFOS/PFOA instead of PBB/PBDE	Annette Bunk

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7.4 Document Release

Function	Name	Organisation and Role
Approver	Timo Stein	Manager ECO-Products
Author	Annette Bunk	Officer Chemical Content, ECO-Products
Co-Author	-	
Reviewer	-	

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