Product-Category Rules (PCR)

for Preparing an Environmental Product Declaration (EPD) for

TFT-LCD Televisions

Prepared by AU Optronics Corporation,

Taiwan, ROC

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Valid until 2013-02

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1. General Information

This document is to be used as the product category rules (PCR) for TFT-LCD Televisions. The requirements specified in this PCR are intended to be used for EPDs certified in accordance with ISO 14025 standard. This document shall be valid until January 14, 2012.

This PCR is jointly prepared by AU Optronics Corp. (AUO) and Taiwan Electrical and Electronic Manufacturers Association (TEEMA). Representatives from major Taiwanese manufacturers of similar products and stakeholders were invited to the open consultation meeting on January 14, 2010, which approved of this PCR.

For further information concerning this PCR, please contact Ms. Lynda Chang of AUO (Tel: +886-3-500-8899, ext: 3935; Fax: +886-3-577-2658; email: lynda.chang@auo.com).

2. Company and product description

The EPD shall include information about the manufacturing company/organization. The information may include manufacturing process related information, and environmental related information, such as the environmental management system information. The information may also include special issues which the company/organization would like to emphasize, such as the product meeting certain environmental criteria, or environmental safety and health related information.

This PCR covers the TFT-LCD television products, and the products denoted here also include their packaging.

2.1 Product function

The TFT-LCD television in this PCR denotes an electronic product capable of converting received electronic signals into visible video signals. The formation of the visible video signals in the TFT-LCD television is due to the conversion of external electronic signals in the television's internal control circuits and then presented as the image on the TFT-LCD panel.

The tuner is a modular component in the television which is used for receiving signals for television programs. Multiple video and broadcasting channels may be transmitted simultaneously in different frequencies within the same cable without interfering with each other, and the tuner is capable of separating the desired channels from the mixed signals.

Digital tuners denote tuners capable of receiving digital television signals transmitted by television stations; while analog tuners denote tuners capable of receiving analog television signals transmitted by television stations.

2.2 Product components

The TFT-LCD television is consisted of the following main components: power board, interface board, TFT-LCD panel, bezel, back cover, stand, chassis, keypad board, tuner, packing material, IR board and remote controller, but excludes the battery for remote controller.

The data quality requirements for the main components are described in Section 9 on calculation rules and data quality requirements. The EPD shall also include the other components of the TFT-LCD television, but their data quality requirements are different from those of the main components.

2.3 Product technical description

The product technical description part of the EPD shall include the following information:

1. resolution
2. diagonal size
3. contrast ratio
4. LCD TV total weight
5. response time
6. signal input (e.g., VGA, DVI, HDMI)
7. power consumption
8. viewing angle
9. brightness
10. back light type
11. outline dimension
12. display area
13. thickness
14. display colors

3. List of parts and banned substances

The contents of the following parts and substances in the product shall be declared:

- All parts with weigh ratio (part weigh/product weight) ≥ 0.5%; this is the criterion used to determine if a part/component is considered main component;

- All banned substances regulated by legal and customer requirements;
- The following materials in the main components: flame retardants, lead content in solder, lead and flame retardant content in solder mask, and substances regulated by RoHS Directive (2002/95/EC).

The declaration of halogen-free flame retardants, lead-free solders and no RoHS-regulated substances may only be made when appropriate evidences are available (for example, test reports from accredited laboratories/testing facilities). The following organizations may provide accreditation for certification organizations: Taiwan Accreditation Foundation (TAF), (Asia Laboratory Accreditation Cooperation (APLAC), International Laboratory Accreditation Cooperation (ILAC) or ILAC Mutual Recognition Arrangement (ILAC MRA). For definitions of testing methodology and confirmations of regulated hazardous substances based on the accredited laboratories' product testing methods, please refer to the IEC 62321 Standard.

4. Functional unit

The functional unit is defined as one unit of TFT-LCD television, as the TFT-LCD televisions are marketed and sold in such units.

5. System boundaries

The system boundaries of the product system are presented as follows:

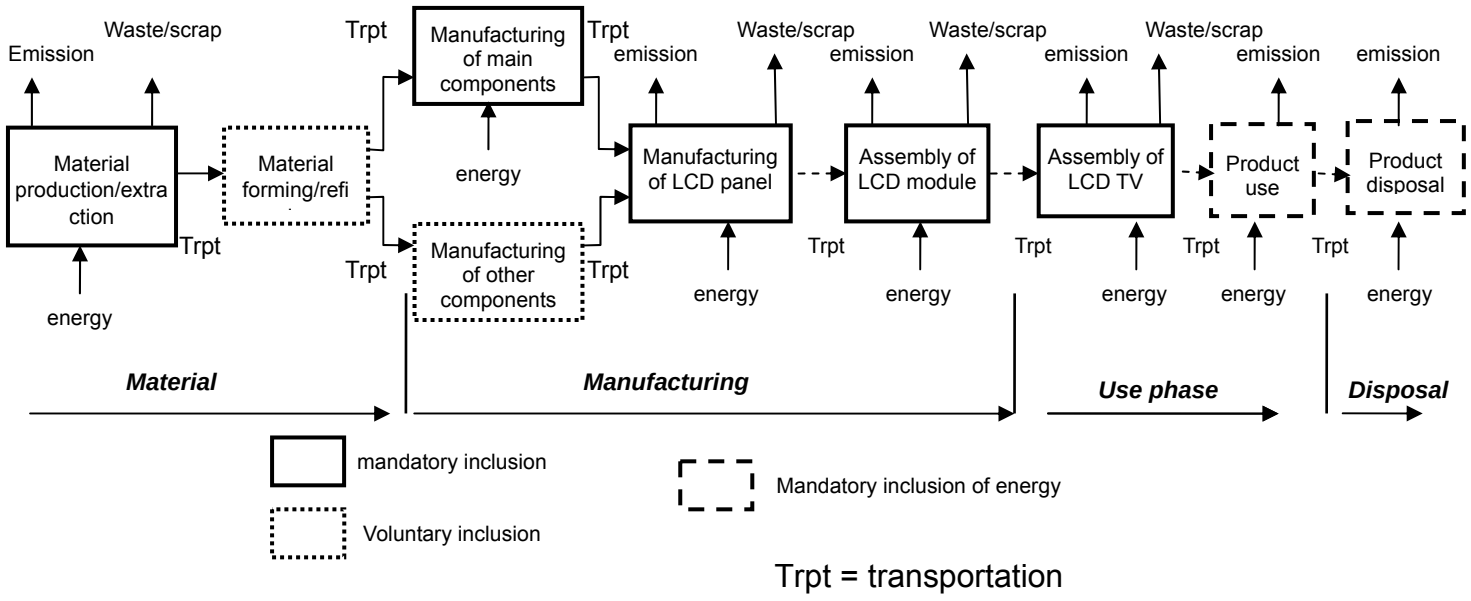

Figure 1 System boundary of the main product system

As described in the Figure 1 above, the life cycle of a TFT-LCD television covers the

product manufacturing, use and waste disposal phases. Provision of recycling information is of the voluntary declaration nature (see Section 11).

Manufacturing Phase

The LCA shall include information for the following unit processes:

- Manufacturing of main components means the material extraction and manufacturing subjected to mandatory inclusion.
- The central manufacturing process includes the TFT-LCD panel (array, cell and color filter) manufacturing, LCD module assembly and LCD TV assembly;
- Product packaging;
- Transportation of main components to component assembly plants;
- Transportation of main assemblies to product manufacturers.

The inclusion in the LCA the information on the material forming and refining and manufacturing of smaller parts is of the voluntary reporting nature. When voluntarily reported information is included, they shall be explained in the EPD.

Use Phase

The recommended standard scenario for the usage of a TFT-LCD television is as follows:

(1) On Mode

The On-Mode power consumption is as defined in the Energy Star Program Requirements for Televisions, based on test conducted in accordance with IEC 62087. During the On Mode state, the TFT-LCD television is connected to a main power source and produces sound and image.

- On Mode time: 5 hours/day
- Annual days in use: 365 days

Annual power consumption: On Mode power consumption (W) × daily hours in On Mode × Annual days in use = On Mode power consumption (W) × 5 × 365 ÷ 1000 …… ❶

(2) Sleep Mode/Standby Power

As defined in the Energy Star Program Requirements for Televisions, the Sleep Mode/Standby Power state is a reduced power state that the TFT-LCD television

enters after receiving instructions from a remote controller or via other functions, when the television is connected to a normal external power source, and power consumption measured in accordance with the IEC 62087. A blank screen and reduction in power consumption characterize this mode.

- Sleep Mode/Standby Power time: 19 hours/day
- Days of use: 365 days/year

Annual power consumption: Sleep Mode power consumption (W) × daily hours in On Mode × Annual days in use = Sleep Mode power consumption (W) × 19 × 365 ÷ 1000 …… ❷

(3) Off Mode

The Off Mode power consumption is as defined in the Energy Star Program Requirements for Televisions, and tested in accordance with the IEC 62087. The Off Mode state is the power off state when the TFT-LCD television is connected to a main power source, but does not offer any functions for the On Mode and Sleep Mode.

(4) Life of the television set: 7.2 years

(5) Carbon footprint (carbon dioxide equivalent) due to total use phase total power consumption = (❶ +❷) × 7.2 × emission factor for local power grid

Recycling/end of life

The reporting of recycling information (such as recycling and dis-assembly report and information on recycling channels) is mandatory in the EPD.

5.1 Specification of different boundary settings

Boundary in time

The validity period for the LCA results presented in the LCA report shall be defined. The validity period for the LCA results shall be defined based on consideration of the changes in manufacturing process.

Boundary towards nature

If the manufacturing processes are located within Taiwan, the waste categories as defined in Taiwan's Waste Disposal Act shall be adopted. If the processes are located in other countries, equivalent legal requirements shall be considered.

The natural boundary of the system shall describe the boundary where the materials and energy resources flow from nature into the system, and where the water and air emissions and waste are released out of the system.

Only the waste which is required to be disposed of needs to be considered; the landfilling process does not need to be included. If the waste will be treated through water treatment or incineration, these processes need to be included.

Boundaries in the life cycle

The boundaries in the product life cycle are described in the Figure 1. The construction of the site and infrastructure, as well as the production of manufacturing equipment and activities of the workers, does not need to be included.

Boundaries towards other technical systems

Boundaries towards other technical systems describe the inputs of material and other components towards other systems, as well as outputs of materials towards other systems. For the inputs of recycled materials and energy towards the product manufacturing phase, the transportation between the recycling process and use of recycled materials shall be included in the data set. For the production of recyclable products during the manufacturing phase, the transportation towards the recycling process shall be included.

(Note: Further explanations are provided in Section 7 on open-loop recycling)

Boundaries regarding geographical coverage

The manufacturing phase may cover manufacturing processes located on any sites around the world. For processes located in a specific region, the data used should be representative of the region. The data for the main components shall be the specific regional data for the region where the process takes place (see Section 9). For ease of comparison, no matter where the emissions are generated, the same parameters should be used for life cycle impact assessment (see Section 10).

6. Cut-off rules

For any impact category, if the sum of various impacts from a specific process/activity is less than 1% of the impact equivalent in that category, such a process/activity may be neglected during the inventory analysis. However, the total of neglected impact equivalent shall be less than 5%. Parts and materials omitted from the LCA shall be documented.

(Note: This judgment for this “1% Rule” is based on the environment relevance assessment of material input to the system, and does not consider special and exceptional environmental impacts.

7. Allocation rules

While selecting allocation rules, the following principles are recommended:

- Multi-output: The allocations are based on the changes in the resource consumption and pollutant emissions (for example, adopted quantity allocation for some main component, or surface allocation for some components), following the changes in the studied system's output product or function or economical relationship.
- Multi-input: The allocation is based on actual relationship. For example, the manufacturing process's emissions may be affected by the change in waste flow input.
- Open loop recycling: For the input of recycled materials or energy during the manufacturing phase of the product system, the transportation between the recycling process and the recycling to material use shall be included in the dataset. For the product which shall be recycled during the manufacturing phase, the transportation towards the recycling process shall be included.

Notes:

- *The main allocation rules shall be valid for the entire product system. For other secondary processes, other allocation rules may be defined; however, the use of these rules should be justified.*
- *Product-specific information should be preferentially collected in order to avoid the need for allocation.*
- *Allocation may be avoided through avoidance of dividing processes, for example as described in Section 6.3 of ISO/TR 14049; or through expansion of system boundary (for example as described in Section 6.4), so that the amended system shares the same product exchanges as the original system.*

8. Units

The following units shall be used:

SI units (Système International d'unités)

Preferentially used power and energy units:

- power units use kW or W;
- energy units use kWh.

9. Calculation rules and data quality requirements)

- Site-specific data (for example, specific factory data or transportation data for a specific manufacturing process) shall be used for the production of main components and main assembly.
- Generic data may be used in the manufacturing process for the TFT-LCD television's smaller (not main) components. Generic data may also be used for the production of bulk materials (see Appendix I for sources of generic data).
- When suppliers refuse to provide specific data, the general rule is that if that generic data are used in place of specific data, their combined contribution for all life cycle phases shall not greater than 10% of the total impact for any impact category. For example, if the emission arising from upstream input in carbon footprint (life cycle global warming potential) that is greater than 10% emission of the product or input, then site-specific data shall be requested from such upstream suppliers.
- The data shall be representative for the average of a specific year.

Data quality requirements for the main components/assembly manufacturing phase

Site-specific data shall be used for the manufacturing of the product's main assembly and main components.

The electricity mix for the manufacturing phase should be site-specific data. If site-specific data can not be obtained, the official electricity mix for the country where the site is located may be used as approximate value. The electricity mix should be documented.

For the definition of hazardous waste, the definition as defined in Taiwan's Waste Disposal Act should be used for sites located in Taiwan. For sites located outside Taiwan, legal requirements for the host country shall be observed.

For the transportation, the transportation modes and distances shall be considered.

10. Parameters to be declared in the EPD

For the manufacturing phase, the following parameters shall be declared:

Resource Use

Use of non-renewable resources:

- without energy content

- with energy content

Use of renewable resources:

- without energy content
- with energy content

Electricity consumption for the main assembly and assembly of main components (optional declaration information, as energy for production of electricity are already listed under renewable and non-renewable resources).

Impact equivalents expressed as potential environmental impacts

-Global warming	kg CO_2 equivalent
-Acidification	kg SO_2 equivalent
-Photochemical oxidant formation	kg ethylene equivalent
-Eutrophication	kg P_2O_5 equivalent

Use Phase

If the products are used by the users, the power consumption during On Mode and Sleep Mode shall be provided.

If the product is equipped with a main switch, the power consumption from the power supplier during the power off mode shall be considered.

The following power and energy units shall be preferentially used: power units, kW or W; energy unit, kWh. (Describe mode of usage and any revision.)

Additional information

Recyclable materials (optional)

Information on secondary materials (optional)

Waste (classification):

- Hazardous waste as defined in Taiwan's Waste Disposal Act. Follow host countries' laws for sites outside Taiwan.
- Other waste.

(Note: The declared waste include both solid and semi-solid waste)

11. Recycling information

The recycling information shall include information such as dis-assembly instructions, which parts/components are suitable for recycling (such as metal cases) or not suitable for recycling (for example, the information requirements for the final product manufacturers contained in the WEEE Directive may also be included in the

TFT-LCD television's EPD).

Information for the parts which can not be recycled and therefore should be disposed of properly during the end-of-life phase may also be included.

12. Other environmental information (Optional)

The EPD may cover information including technology adopted, site of product manufacturing and assembly, as well as information on other working environment, health and risk-related aspects. The declaration may also include information which the manufacturers possess and customers are interested in (such as on risk related issues), proper handling of products during usage and maintenance, reduction of environment impacts during product use, and environmental information systems (such as eco-labeling) products are in conformance with.

The decoration shall include most commonly seen emission information.

13. Information about the certification

The information on PCR review, EPD verification and verification organization shall be included.

EPD Certification is valid until 20__-__-__

This PCR document is developed based on requirements from the General Program Instructions, International EPD System, version 1 (2008), www.environdec.com

The PCR review for **TFT - LCD Televisions** (PCR 2010：) was administered by the Environment and Development Foundation and carried by an LCA expert panel chaired by Dr. Ning Yu (ningyu@edf.org.tw)

Independent verification of the declaration, according to ISO 14025：2006

□ Internal ■ External

Third party verifier：Environment and Development Foundation in Taiwan.

Verifiers:

Name: .....

Title: .....

Organization: ..... Signature: _____

Name: .....

Title: .....

Organization: ..... Signature: _____

Name: .....

Title: .....

Organization: ..... Signature: _____

Environmental declarations from different programmes may not be comparable.

14. References

The EPD shall make reference to the following documents:

- EPD General Program Instructions, Version 1.0 (2008-02-29), The International EPD Cooperation, downloadable from http://www.gednet.org;

- Relevant PCR documents;

- The underlying LCA report.

When available, the following documents shall also be referenced:

- Other documents and recycling instructions which verify and complement the EPD.

Appendix I – Generic Data Sources to Refer to

For processes located within Taiwan, the Taiwan generic data or the data published by the commercial, industrial and energy competent authorities of the Republic of China (ROC) government, may be used. However, for other regions (such as EU), if there are more relevant generic data available, these data should be used instead. When data from the following generic databases are used, the most current and updated data should be used:

Material	Database	Published
Steel	IISI (International Iron and Steel Institute)	1998
Copper	ICA (International Copper Association)	1998
Copper semi products	ICA (International Copper Association) + IME (Institut für Metallhüttenwesen und Elektrometallurgi, Aachen)	1998 1995
Electricity	ETH (Eidgenössische Technische Hochschule) Data combined with IEA (International Energy Agency) statistics 1998	1996
Aluminum	EAA (European Aluminum Association)	2000
Plastics (and some chemicals)	APME (Association of Plastics Manufacturers in Europe)	1993-1998
Electronic components	EIME (Environmental Information and Management Explorer) EcoBilan	1998-2000
Energy	Boustead model 5.0	2007
Industrial processes	Ecoinvent 2nd edition	2007
Energy	ETH ESU 96	2004
Packaging materials, transport, waste treatments	BUwAL 250, 2nd edition	2004

Appendix II – Reporting Format for the EPD

This appendix provides guidance information for the titles of sections, types of data and required information to be reported in the mandatory reporting part of the EPD. As a generic reporting template, the following titles and sub-titles are recommended:

(Refer to the PCR manual for the section numbering, the information in Italics are the recommended data/information for inclusion)

Introductory part

Each EPD should have an introduction part on the top part of the EPD which includes the following information:

- *Company/organization name*
- *Product name*
- *EPD registration number*

Description of the company/organization and product/service

Company/Organization

- *Description of company/organization*
- *Description of overall working environment, existing quality system and environmental management system*

Product and services (see Section 2)

- *Product's main application*
- *Description of product specification, manufacturing process, manufacturing sites (if there are several sites)*
- *For product's environmental performance aspects, characteristics which may improve the usefulness of product*
- *Other types of relevant information, for example, special manufacturing processes with special advantages*

List of materials and chemical substances

- *Content declaration (see Section 3)*

Presentation of the environmental performance

- *Declaration for the EPD outline shall be included of the LCA methodology, for example, period of LCA, functional units, system boundaries (graphical presentation), cut-off and allocation rules, and data sources.*

Manufacturing phase *(see Section 10)*

Use phase *(see Section 10)*

-Geographical region for product delivery
-Transportation data
-End-of-life information

Information about Company and Certification Organization

Recycling information *(see Section 11)*

Other environmental information *(see Section 12)*

Information regarding certification

- Names of certification and verification organizations

- Validity of certification certificates

- Compliance with legal and relevant requirements

References *(see Section 13)*

- relevant PCR documents

- EPD Requirements, 2-29, 2008

- underlying LCA study

- other supporting documents for LCA information

- other relevant documents regarding company/organization's environmental activities

Notes on Comments from Expert Review

1. The reason why the battery for the remote controller is not considered as a main component is that even though remote controllers are shipped with the television sets to the consumers, the type of battery used in the remote controller is decided by the consumer, not the manufacturer.

2. The reason why ozone destruction potential is not listed as an impact category is because the use of ozone depleting chemicals has been well under control in recent years in Taiwan.

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The PCR review for **TFT - LCD Televisions** (PCR 2010：1.0) was administered by the Environment and Development Foundation and carried by an LCA expert panel chaired by Dr. Ning Yu (ningyu@edf.org.tw)

Name: Dr. Ning Yu

Title: President

Organization: Environment and Development Foundation *Signature:*

Name: Dr. Yung - Shuen Shen

Title: Associate Professor

Organization: National Taipei University of Technology *Signature:*

Name: Mr. Yiing – Bin Reu

Title: Marketing Manager

Organization: Industrial Technology Research Institute *Signature:*

Environmental declarations from different programmes may not be comparable.