iNEMI

International Electronics Manufacturing Initiative

PVC Alternatives - Goal and Scope

APEX

March 31, 2009

Advancing manufacturing technology

5.2.1.1 The Goal of an LCA States

1. **The intended application**
   - **US desktop computer power cord sets**
2. **The reasons for carrying out the study**
3. **The intended audience**
4. **Are the results**
   - **Intended to be used in comparative assertions? Not at this time.**
   - **Intended to be disclosed to the public? Not at this time.**
5. **The scope should be sufficiently well defined to ensure that the breadth, depth and detail of the study are compatible and sufficient to address the stated goal.**

5.2.1.1 The Goal of an LCA States:

2. The reasons for carrying out the study (1/3)

- **Understand how PVC-free alternatives (including additives) compare to existing and state of the art PVC power cords (including additives) from a cradle-to-grave LCA perspective**
  - **Comment that the existing power cords may not be using the latest technology**
- **Understand what the significant environmental aspects & impacts are within the power cord lifecycle (from raw material extraction to end of life disposal), and which are insignificant.**

5.2.1.1 The Goal of an LCA States:

2. The reasons for carrying out the study (2/3)

- **Assess whether LCA can adequately model toxicity impacts across the life cycle.**
  - **This may not be addressed in the initial study and will be discussed further as the team develops the SOW**
  - **May want to push this to a follow-up to the initial LCA**
- **Understand the life cycle inventories used in popular LCA tools (SimaPro and GaBi) and how well these models reflect the current state of the electronics industry.**
  - **If they do not reflect the current state, and this difference makes a difference in our analysis, understand what can be done in the future to make the data more useful.**

5.2.1.1 The Goal of an LCA States:

2. The reasons for carrying out the study (3/3)

- Understand how the LCA tools and LCI address end of life aspects (recycling, incineration, landfill, etc).
- Gain an understanding of data quality issues such as spatial location and how these can be addressed.
- Provide a learning platform from which to address future power cord technology developments
- Provide a learning platform that will help participants create their own LCAs in the future.
- Understand the differences between popular LCA tools.

5.2.1.1 The Goal of an LCA States:

3. Intended Audience

- The audience for this report will be primarily iNEMI members.
  - Project members
  - iNEMI general membership
- Secondary audiences include power cord manufacturers
  - Power cord manufacturers
  - Plastics manufacturers
  - Possibly policy-makers = public? Not at this time.
    - NGOs, etc.
  - iNEMI members to refer to study in CSRs (Corporate Sustainability Reports)?

5.2.1.1 The Goal of an LCA States:

Are the results are intended to be used in comparative assertions intended to be disclosed to the public?

- **The results of the study could be a comparative assertion disclosed to the participants of the study.**
  - **Participants are, in essence, a panel of interested parties including customers, competitors, and LCA experts**
  - **The project will be modeled in two different LCA tools, the participants believe that the requirements for a critical review will be met.**

5.2.1.2 The Scope Includes the Following:

1. The Product System to be Studied;
2. The Functions of the Product System or, in the Case of Comparative Studies, the Systems;
3. The Functional Unit;
4. The System Boundary;
5. Allocation Procedures;
6. Impact Categories Selected and Methodology of Impact Assessment, and Subsequent Interpretation to be Used;
7. Data Requirements;
8. Assumptions;
9. Limitations;
10. Initial Data Quality Requirements;
11. Type of Critical Review, if any;
12. Type and Format of the Report Required for the Study

5.2.1.2 The Scope Includes the Following:

1. The Product System to be Studied

- **Power cord sets to be investigated**
  - **6-foot US desktop computer power cord sets**
    - **UL rated to at least 60 degrees C**
      - **Power cords sets rated to 105 degrees C will be considered as part of the study**
      - **Should power cord sets rated to 90 Degrees C also be considered?**
    - **Should meet VW1 flame test**
    - **ROHS compliant**
    - **NEMA 5-15 Plug**
    - **18/3 SVT (Service Vacuum Thermoplastic) attached to IEC 60320 - C13**
    - **SJT (Service Junior Thermoplastic) power cord sets will not be include in the initial investigation**
      - **SJT power cord sets would have similar characteristics to SVT power cord sets**
    - **Types of cable/plug materials for consideration**
      - **PVC**
      - **PVC – Phthalate free**
      - **PVC Alternatives**
      - **Halogen free**
    - **Thermoplastic Elastomer (TPE)**
      - **Some TPEs are PVC based**
      - **Some TPEs are UL approved, some are not**
      - **Some UL approved TPE's will fail.**
  - **In each case, one PVC containing and one or more PVC-free cord sets will be studied.**

5.2.1.2 The Scope Includes the Following:

2. Functions of the Product System

- **The function of the power cord is to safely provide power from a standard wall outlet (110VAC +/-) to a desktop computer for the life of the computer.**

5.2.1.2 The Scope Includes the Following:

3. Functional Units

- **The functional unit is a 6-foot power cord UL rated to at least 60 degrees C, used in the US for 3 years.**
  - **Should meet VW1 flame test**
  - **Is there any issue with longevity of the cable that is not addressed by the UL rating, longevity is not addressed by UL?**
  - **Can make the assumption that the end of life begins at 3 years**
- **A second functional unit may be included**
  - **A 6-foot power cord set UL rated to 105 degrees C used in the US for 3 years.**
- **Should include analysis of difference for EU if waste has a significant impact?**
  - **WEEE collection schemes may be more widely in place so recycling % may be different?**
- **Take-back is virtually nonexistent in Asia**
  - **Recycling practices may be inconsistent**
  - **This is one of the NGO themes!**

5.2.1.2 The Scope Includes the Following:

4. System Boundaries

- The system boundary will include all life cycle stages with the exception of the use phase which is assumed to be the same for all power cord sets.
  - Is this a valid assumption?
  - Is a power cord set an active or passive component?
- Do we want to model 1 million cord sets and x% that burn during the use phase?
  - The NFPA, as far as I know, does not identify the power cord type, only fires due to power cords in general
- Is there any data to suggest that failure rate of PVC = that of PVC-free (e.g. wire breakage due to different stiffness) in (portable) use phase?
  - Minor differences may impact the end result
- Should we use a preliminary cut-off rule of 1% of impacts across all life cycle stages in all impact categories?
  - This requires further clarification and may come into play in looking at the sensitivity
- The analysis will be a 3rd order assessment, including:
  - Primary flows
  - Material and energy flows including operations
  - Infrastructure
  - Employee commuting and transport beyond the factory gate will be ignored
  - Should shipping from manufacturers (primarily Asia) to OEM's and OEM to sales store be ignored?
- Move end-of life issue to System Boundaries
  - What will be modeled? using US Power cord => US end-of-life

5.2.1.2 The Scope Includes the Following:

5. Allocation Procedures

- **Initial analysis will use mass based allocation using the cut-off approach to recycled material.**
- **We will then use economic allocation and one or more of the economic-based approaches to recycled material (BRE, 50/50, and/or market-based) to test the sensitivity of the results to allocation method.**
  - **Some material systems, PVC and PVC Alternatives may or may not be inherently recyclable**

5.2.1.2 The Scope Includes the Following:

6. Categories Selected and Methods of Assessment, and Subsequent Interpretation to be Used

- **TBD. ReCiPe and USEtox should be considered if toxcity is to be included as part of the investigation.**

5.2.1.2 The Scope Includes the Following:

7. Data Requirements

- Data for the power cord sets will be provided by the cable manufacturers and averaged as necessary to provide confidentiality to the participants.
- Data for the PVC alternatives will be provided by their respective suppliers.
  - This data may be aggregated to maintain confidentiality.
  - Data for PVC will be secondary data, as this data has already been collected and averaged.
- Both European and US PVC data will be considered. Using existing data may not be a good idea. The previous studies included different types of PVC and electrical infrastructures.
- We will attempt to gather primary data for additives.
  - Where primary data is not available, we will use secondary data.
- Data for all other materials (copper, etc.) will be secondary data from available datasets.
  - Should copper be excluded since it would be the same for all power cords?
    - This needs to be determined by the OEM participants
- Data for end of life will be based on US disposal data.
  - This will require some primary data from US recyclers.
  - The first pass will rely on secondary data for incineration and landfill
    - Additional data collection may be required to answer questions concerning end-of-life

5.2.1.2 The Scope Includes the Following:

8. Assumptions

- **The power cord sets are equivalent during the use phase.**
- **Are there any data to suggest that failure rate of PVC = that of PVC-free (e.g. wire breakage due to different stiffness) in (portable) use phase?**
- **For PVC data, data from US and European industry associations will provide sufficient representativeness**
  - **This is an assumption that will need to be validated**
- **Additional assumptions need to be provided by participants**
- **5.2.1.2 #8 - Assumptions that the cord sets are equivalent during the use phase. Another question would be the exposure to unintended use events. For example, if the cables caught fire during the life. Is there a life risk profile that can be included? I am thinking that non-hal vs. PVC response to some scenarios could be impactful.**

5.2.1.2 The Scope Includes the Following:

9. Limitations

- **There will be some limitations based on the availability of data, particularly in the areas of additives, manufacturing processes, and end of life models (which may differ between China, US, and EU).**

5.2.1.2 The Scope Includes the Following:

Initial Data Quality Requirements

- Time period: 2007-2011
- Geography:
  - Power cord set production: Asia (China), US, Europe
  - Plastics production: US, Asia
    - 5.2.1.2 #10 - Can the option for plastics production in China in addition to the US be included?
  - Metals production: Asia
  - Additive production: US
- Technology:
  - Best available technology?
    - PVC and PVC Alternatives are still developing (mass production vs. pilot production) , future technology may be considered
    - 5.2.1.2 #10 - Technology. Future technology may be considered. Does this mean that we are not restricted to commercially available options in this round?
- Representativeness
  - For PVC data, data from US and European industry associations will provide sufficient representativeness
    - This is an assumption that will need to be validated
  - PVC power cord sets and the alternatives should meet UL specs, therefore data from a single supplier should be sufficient

5.2.1.2 The Scope Includes the Following:

11. Type of Critical Review, if any

- **The nature of the project provides for the type of oversight required by ISO 14044 for a comparative assertion.**
- **If the results of the study are to be presented outside of iNEMI, a full panel review may be required.**

5.2.1.2 The Scope Includes the Following:

12. Report Type and Format Required for the Study

- **The study will begin with a screening LCA performed using two LCA tools.**
- **This report will comply with the requirements for ISO 14044 for a screening LCA.**
- **The final report could conform to ISO 14044 requirements for a comparative assertion.**

Comments, Questions, and Issues

- How to maintain confidentiality of competitive information / data, i.e., formulations, manufacturing processes, etc.
- That seems to be a clear agenda item for next week.
- Not sure how "aggregation" solves the problem or if it will be adequate in all cases.
- Point of concern - earlier during this LCA project process we had established conducting LCA on 3 compounds used for making power cords –
  a) 60C rated PVC that could contain phthalate plasticizer as well as brominated flame retardants
  b) 105C rated PVC that was RoHS compliant and did not contain phthalate plasticizer nor brominated flame retardants
  c) Non-PVC that was RoHS compliant and did not contain phthalate plasticizer nor brominated flame retardants
- This would enable comparing the lowest cost PVC that is probably being used today (driven by low cost) along with PVC that did not have the perceived problems / drawbacks (i.e. "green" PVC). Now it appears that EarthShift is wanting to eliminate the "green" PVC - as I was not on the most recent call where this was brought up I don't understand the reasoning behind this.
- I think it would be a serious mistake to do so as it would result in comparing PVC (containing most problematic ingredients) with non-PVC - this is not a valid comparison as much better PVC than what is being proposed for comparison is available commercially and has been for a few years.

Comments, Questions, and Issues

- The Product System to be studied, power cord sets to be investigated.
  - UL Rated to 60C
  - UL Rated to 105C
- It seems like you were recently discussing only doing the 60C?
- Mike Patel at Teknor Apex was the original member that seemed adamant that you really need to look at both temperature ratings as the original Product System. This is how the 105C product came into play in the first place even though almost every computer power cord I have ever seen is 60C. I am guessing Mike might have asked to include this because while the computer cords may only be 60C if you look at PVC cables in general most of them are 105C.
- My personal opinion (which might be shared by others) is that if you limit this study to 60C you chop off a huge part of the general PVC cable business. The 105C might not apply to computer cords but I believe by including 105C the entire study has a lot more value and useable information to all of the members over and above just the computer power cords segment.

Comments, Questions, and Issues

- **"The study has to define how the new PVC Alternative cables will be UL tested/approved or qualified."**
- **I mentioned this earlier but will repeat myself because I do not believe anyone is really taking into consideration how important this is.**
- **The group has agreed that the 18/3 SVT will be the model. We can assume that the logical "PVC Alternative replacements" will ultimately be 18/3 SVE but shouldn't there be testing included in this study to verify that the PVC Alternatives are capable of passing UL "SVE" ?**
- **At some point someone mentioned that we would only consider evaluating UL Approved compounds but that too means little as compounds do not get UL approved to SVE, only cables do.**
- **My fear is that this group can do months of research on a PVC Alternative only to find out it is not capable of passing the UL approval.**
- **This happens all the time and I have had at least 3 occurrences in the past 16 months of compound companies that recommend a compound and it fails at UL.**