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Environmental Results

Part of the work carried out by ISQ and INASMET in Workpackage 3: Lead-Free Technology Industrial Implementation aimed to research the environmental impact associated with the wave and reflow soldering processes.

The goal of the task 3.4: Environmental and Health & Safety Assessment was the evaluation of pollutant emissions due to the use of lead based solders and Lead Free Solder (LFS) during the assembly processes. The following activities were carried out in order to obtain data for the comparison of the two scenarios (lead-based solder and LFS):

- Sampling and analysis of flue gas emissions;
- Occupational Exposure Measurements;
- Leaching tests of soldered printed circuits and slags of wave process.

Flue Gas Emission, occupational exposure, PCBs and Slag leaching tests were performed for two scenarios: Lead-based solder and LFS. Both scenarios were studied for Wave and Reflow soldering processes, in two Spanish and two Portuguese SME of the LEADOUT consortium and also one Spanish PCB manufacturer. LFS Wave and Reflow technology were not implemented in one company and LFS Wave technology was not implemented in another one therefore the analysis of these processes were not performed in those particular cases.

The main objective was the development of a quantitative analysis program to identify the environmental emissions of the industrial plants being studied. For achieving this goal, the first step was a detailed analysis of the effluent emissions throughout the industrial processes - wave and reflow soldering, and identification of critical environmental variables, such as flue gas emissions, liquid effluents, and solid wastes. A quantitative work plan was then designed. This plan has detailed information about environmental variables to be measured and the definition of the technical specifications. These specifications defined: quantitative analysis steps, sampling and analytical methods, units, and type of final results.

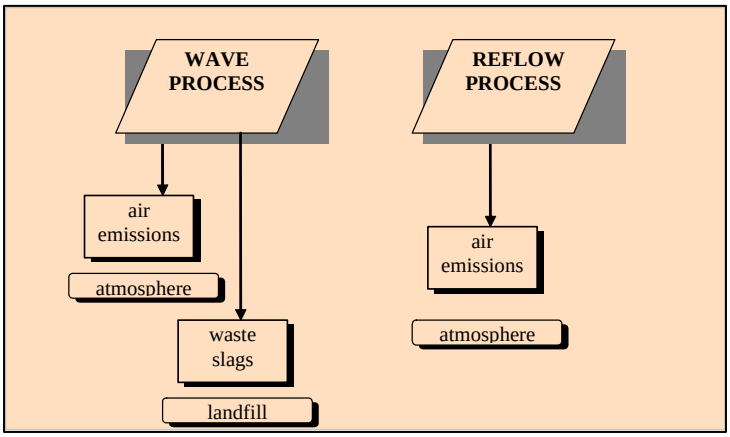

Figure 1 - Emissions from wave and reflow processes with potential impacts to the environment.

The main objective of the emission analysis was to know what kind of emissions is generated along the assembling process of electronic circuits, like fumes and slags.

Occupational exposure measurements were performed by ISQ and INASMET teams at LEADOUT SMEs to evaluate the workers occupational exposure to the chemical agents emitted during the soldering processes (Reflow, Wave and Manual), and PCB manufacturing. Personal sampling pumps were used to collect samples from the breathing zone of the employees working with Lead-based and LFS solders.

Detailed information can be found in project deliverables (e.g.D3.4.1) as well as in the 3rd Leadout on the Road available at the project website.

Conclusions from the flue gas emissions and leaching studies

Flue Gas Emissions

Emission results obtained at LEADOUT SME facilities using Lead-Free solder/pastes are lower than those obtained with Lead containing alloys.

Leaching tests

Comparing the results with the limit values of the Council Decision 2003/33/CE, the following conclusions can be made:

• PCBs leaching tests: All blank samples can be considered as inert waste. Nevertheless, it is not recommended their disposal at landfill.

Lead Scenario: no metals and sulphates were found in eluates, apart from Lead. Lead is the metal in higher concentration on the eluates. The PCBs soldered with Pb alloys should, depending on lead concentration, be classified as:

- Non-hazardous waste (Reflow soldered PCBs)

- Hazardous Waste (Reflow soldered PCB) acceptable only at landfills for Hazardous waste.

Figure 2 – Leaching test apparatus

Lead-Free scenario: lead was found in the eluate in just one case and thus the waste was considered as hazardous. This was due to hand soldering finishing using lead solders. The concentration of Copper implies that this waste could be considered as Hazardous Waste, but acceptable at non-Hazardous landfills.

•Slag leaching results:

Lead-based solder scenario (Spanish assemblers), the lead content values implies that those slags should be considered as Hazardous Waste acceptable only at landfills for Hazardous waste.

Due to high values the eluate of the residues from the Portuguese assemblers does not fulfil the limit established in the European Decision for the criteria of hazardous waste for lead (Pb) and thus they cannot be accepted in landfills for hazardous waste.

Lead-Free scenario (only Spanish assemblers), all values are below the detection limits and all are below the limits of the Decision to be considered as Inert waste.

From leaching results point of view, we can conclude that Lead-Free processes are cleaner than the traditional Lead-based solder soldering processes.

If you are interested or you have a question about these measurements, do not hesitate to contact:

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Please visit the project website for more information: www.leadoutproject.com

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