



Bruce McLean

Developing POPs Analysis and Testing for WEEE



Established in 2000, based in Irvine, Ayrshire.

- Recyclers of WEEE.
- Principally two divisions:
 - Small Domestic Appliances.
 - Secure IT Recycling.



Established in 2005, also based in Irvine.

- Recycler of TV's and computer monitors including CRT's, LCD, LED, Plasma and OLED.
- Processing 1000 - 1500 displays per day.

Background

- What is POPs and why should it concern us?

Friday 20th December 2019 14:57:08.

SEPA Guidance Note on POPs in WEEE.

- We didn't know anything about POPs – but we were concerned!

Plastics

- Traditionally, Restructa had always traded their recovered plastics.
- Plastic casings from TV's and monitors amounted to around 40 Tonnes per month.
- This could be traded at around £210/Tonne giving a revenue stream of £100,800/year.
- Now, we couldn't trade the plastics – in fact, there was going to be a cost.

What to do?

We bought a gun!

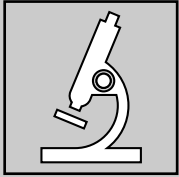


Then we set up a system of testing our bales of plastics prior to shipping.

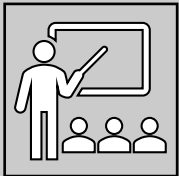


Longer Term Plan

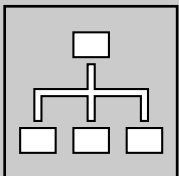
- We decided to engage with University West of Scotland (UWS).
- They recommended a Knowledge Transfer Partnership (KTP).
- We planned to commence the project in March 2020.
- **Then Covid happened.....**



We lost a whole year, but by March 2021 we managed to recruit an Academic Scientist to come and work with us on POPs.



Cecilia Chaine is originally from Uruguay and was working at a University in France when we interviewed her.



The project was of great interest to her, and she agreed to join us.

Next Steps

- The first thing Cecelia did when she joined us 2 years ago, was to tell us that the way we were using the XRF gun was completely **WRONG!**
- In spite of the demonstrations and assurances given by the manufacturer, this was not accurate.
- Also, it was **NOT SAFE!**
- **RESULT:** back to the drawing board and a year's worth of data destroyed.

Getting it Right!

- To achieve accurate results using the handheld XRF, the testing needs to take place under very specific conditions.
- The gun needs to be positioned accurately and consistently.
- The background material that the test piece is located on needs to be neutral – No contaminants.
- The length of time of the x-ray needs to be precise and consistent.
- The area around the gun and test piece should be isolated from the operator.
- To get this right – it took us about another 3 months.

What have we achieved?

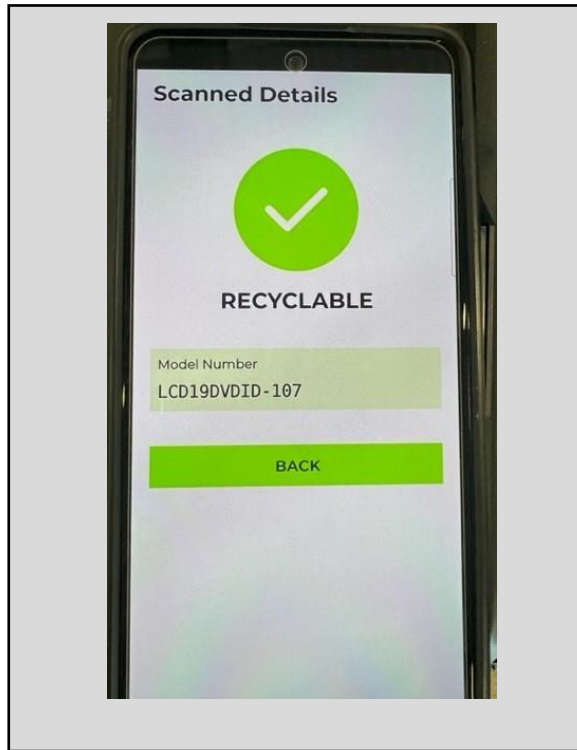
- Over the last 20 months we have carried out thousands of tests.
- This has allowed us to build up a database of the test results for around 6,000 individual makes and models of televisions.
- We continue to add new makes and models every day.
- The next stage was: how do we use this information in our recycling process?

We decided to develop an APP.

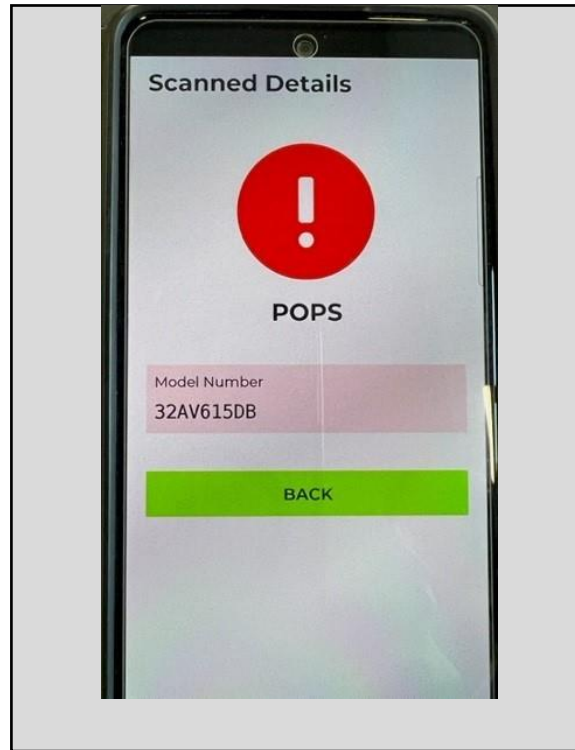
- Our “POPs APP” works on any “Android” product - Mobile phone, tablet etc.
- Using the device’s camera to scan the manufacturers label on the back of the TV or Monitor.
- It identifies manufacturers model number from the printed part of the label.
- This information is electronically checked against our database producing an instant result for the operator.



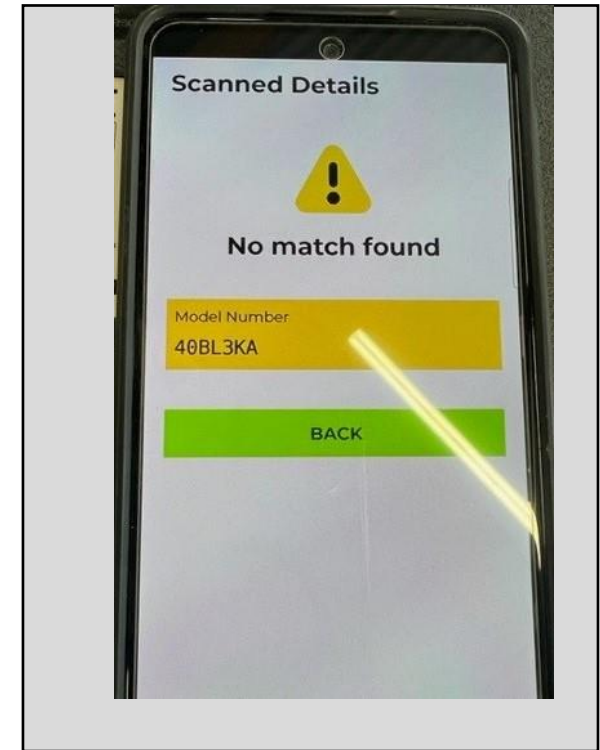
The item can then be routed as:



Sent for Reuse



Sent for Destruction



Routed for POPs analysis

Successful outcomes from this project are...

- 72% of the plastic that we recover, is below the current POPs threshold.
- This means that plastic is again able to be traded = reuse & revenue.
- **Only 28% of our plastics need to be destroyed.**
- We are considering making our app commercially available to other organisations that recycle displays.
- Now developing a new database for small domestic appliances.
- We have opened our POPs testing lab to anyone requiring testing for Brominated Flame Retardants (BFRs).

Challenges

- How do you test that your test for POPs is accurate?
- Verification of POPs analysis results in the UK is very limited.
- Once we had established a test process, we needed a method of verifying that the results we were achieving were correct.
- We tried several organisations within the UK to carry out chemical analysis to confirm our test results, with very limited success.
- Finally, we had to go to a specialist laboratory in Vienna to validate our findings.

During our project, we published two scientific papers.

First Paper

Recycling plastics from WEEE: A review of the environmental and human health challenges associated with Brominated Flame Retardants.

- Explains what Brominated POPs are and why they can be harmful.
- [Link to Paper - https://www.researchgate.net/publication/357760081_Recycling_Plastics_from_WEEE_A_Review_of_the_Environmental_and_Human_Health_Challenges_Associated_with_Brominated_Flame_Retardants](https://www.researchgate.net/publication/357760081_Recycling_Plastics_from_WEEE_A_Review_of_the_Environmental_and_Human_Health_Challenges_Associated_with_Brominated_Flame_Retardants)

Second Paper

Optimised industrial sorting of WEEE Plastics: Development of fast and robust h-XRF Technique for hazardous components.

- Explains the complexities of establishing accurate testing capability with XRF and how to confirm and verify the result.
- [Link to Paper - https://www.sciencedirect.com/science/article/pii/S2666016422001141?via%3Dihub](https://www.sciencedirect.com/science/article/pii/S2666016422001141?via%3Dihub)



Thank you!

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