RESOURCE AND WASTE
SOLUTIONS PARTNERSHIP

Detail Sampling Programme and Hazardous Waste Assessment Report

CELSA Steel

Final Report
July 2016

Quality Control Sheet

Publication title	Detail Sampling Programme and Hazardous Waste Assessment Report
Client	CELSA Steel
Project number	CS01
Version	Final Report
Date	July 2016
File Reference	CELSA Detailed Sampling Programme And Hazardous Waste Assessment Report Final Draft 22 July

Prepared by:

Nigel Naisbitt and Terry Coleman

Reviewed and approved by:

Anton van Santen – Partner

Client Address:

CELSA Steel
Building 57
East Moors Road
Cardiff
CF24 5NN

Contact Details:

Resource and Waste Solutions LLP
302 Cirencester Business Park
Love Lane
Cirencester
GL7 1XD

Nigel Naisbitt
Tel: 07854 215018
Email: nigel.naisbitt@rwsp.co.uk

Web www.rwsp.co.uk

RESOURCE AND WASTE SOLUTIONS PARTNERSHIP

Contents

Summary 1

1. Introduction 3
   The Screening Processes for HMS 1&2 3

2. Sampling 6
   Previous sampling exercises 6

3. Characterisation Sampling 7
   Incoming Material Sampling Plan 7
   Stockpile Sampling Plan 7
   Sampling 7
   Sampling Process, Screening and Weighing 8
   Incoming Material Samples 9
   Stockpile Samples 9
   Production of samples for analysis 10

4. Assessment of Oversize 11
   Oversize material screened from samples 11
   Lagun Artea material 12

5. Laboratory Analysis 13
   Derivation of determinands levels for the *in situ* waste from the laboratory results 13
   GC-MS Broadscan 15
   TPH Concentrations 16

6. Hazardous Waste Assessments 17
   Step 1: Check if the waste needs to be classified 17
   Step 2: Identify the code or codes that may apply to the waste 17
   Step 3: Identify the assessment needed to select the correct code(s) 18
   Step 4: Determine the chemical composition of the waste 18
   Step 5: Identify if the substances in the waste are 'hazardous substances' or 'Persistent Organic Pollutants' 18
   Step 6: Assess the hazardous properties of the waste 19
   Incoming Material Assessment 20
   HP7 Carcinogenic 20
   HP14 Ecotoxic 22
   Stockpile Assessment 23
   HP7 Carcinogenic 23
   HP14 Ecotoxic 24

7. Conclusions and Recommendations 24
Conclusions 24
Classification of Incoming Material 24
Classification of Stockpile 25
Recommendations 25
Annex A: Sampling Plan for Incoming Waste A1
Annex B: Stockpile Sampling Plan B1
Annex C: Sample numbers, analyses, composites, weights, percentage over and undersize and errors C1
Annex D: The Choice of Chapter 10 or Chapter 19 of the List of Wastes to Classify Input Fines / ‘sweepings’ D1

Summary

Resource and Waste Solutions (RWSP) was commissioned by CELSA Steel to advise on the classification and management of the fines / 'sweepings' from the screening of scrap metal prior to the smelting process at the CELSA Tremorfa Works, Cardiff.

An initial assessment of the fines / 'sweepings' undertaken by Ramboll Environ concluded that the waste was hazardous. This was reviewed by RWSP, which highlighted several errors both in Ramboll's assessment and the conclusion that all the fines / 'sweepings' should be classified as hazardous waste.

In February 2016, RWSP carried out preliminary sampling to allow an initial assessment of the fines / 'sweepings' and to help define the objectives for the detailed sampling plan. The preliminary sampling and subsequent hazardous waste assessment, based on Technical Guidance WM3, was not able to provide a definitive conclusion with regards to the hazardous nature of both the input and stockpiled material.

Based on the preliminary sampling, the objectives of the detailed characterisation sampling were set as:

- To provide estimates of the key determinands and their levels to allow hazardous waste assessment s to be undertaken;
- If possible, to identify the petroleum groups in the fines / 'sweepings' in the incoming loads, as this material will have not be subjected to the same degree of processing / weathering as the stockpiled material; and
- To assess the variability of the TPHs concentrations in the incoming loads with 95% confidence levels, to allow the TPHs concentration in the overall fines / 'sweepings' waste as produced to be calculated from the proportions of material received from different suppliers.

GC-MS Broadscan was used to identify the petroleum group and the laboratory concluded for all samples screened that the contamination consisted of a mixture of lubricating oil and weathered diesel in an approximate ratio of 80:20.

The hazardous waste assessment concluded that:

- **Incoming Material -** As the petroleum groups were identified as lubricating oil and diesel in a ratio of 80:20, the diesel content is below the concentrations that would make it hazardous. For the lubricating oil, the relevant marker, a DMSO extract for the five input samples tested, gave results in the range 0.12% to 0.53% relative to the TPH concentration, below the 3% threshold. Therefore HP7 Carcinogenic can be discounted and this waste should be classified as non-hazardous and assigned List of Wastes (LoW) code 19 12 12.

- **Stockpile** - The stockpile is from the input material which is non-hazardous and the contamination will also be lubricating oil and diesel. A sample of the worst case (most processed and weathered) waste from the stockpile gave a DMSO extract result of 1.9% of the total TPH concentration. Three composite samples each gave a DMSO extract of 0% of the total TPH concentration. It is considered that the relative concentration of DMSO extract to total TPHs will be less than 3% throughout the stockpile. Therefore, the stockpile should be classified as non-hazardous and also assigned the LoW code 19 12 12.

1. Introduction

Resource and Waste Solutions (RWSP) has been commissioned by CELSA Steel to provide advice on the classification and management of the fines / 'sweepings' from the screening of scrap metal prior to the smelting process at the CELSA Tremorfa Works, Cardiff.

CELSA Steel operates an electric arc furnace (EAF) based steel-making process at the Cardiff plant, taking in approximately 1.2M tonnes of scrap steel each year. This scrap comes from a range of different sources and approximately half is heavy melting steel (HMS), which is the predominant source of foreign materials delivered to the plant as part of the delivery of scrap steel. The steel is separated from each load, leaving the fines / 'sweepings' that are then further physically processed to recover steel and non-ferrous metals. An initial assessment of the fines / 'sweepings' undertaken by Ramboll Environ concluded that the waste was hazardous. This was reviewed by RWSP, which highlighted several errors both in Ramboll's assessment and the conclusion that all the fines / 'sweepings' should be classified as hazardous waste.

The Screening Processes for HMS 1&2

CELSA Steel operates two different processes to separate the steel from other material, principally the fines / 'sweepings', in HMS loads. The first is known as the 'contrast load' process and is carried out to determine the average weight of fines / 'sweepings' in each supplier's loads; this determines the deductions made under the supply contracts. In the contrast load process, the entire selected load is mechanically screened and the fines / 'sweepings' fraction weighed. All other loads are run through the second operation that involves several mechanical screening processes designed to minimise the steriles entering the steel-making process in the EAF. The primary steps are summarised below and present pictorially in Figure 1 .

- Step 1: Visual inspection to ensure the load is broadly consistent with industry standards;
- Step 2: A mechanical grab is used to separate the load and remove large pieces of steel to the furnace ready stockpiles. This process results in a residue of consisting of small pieces of metal (ferrous and non-ferrous), plastic, wood and fines (i.e. stone, dirt, soil, glass etc.).
- Step 3: The residue from the 'grab' sorting of several loads is then screened using a 360^o excavator with riddle bucket, which results in two fractions: an oversize and an undersize.
- Step 4a: The oversize faction is screened using a vibrating screen and rotating drum magnet (the Lagun Artea process). This separates the ferrous material, which is added to the furnace ready stockpiles. The residue consists of undersize / non-ferrous / sterile material.
- Step 4b: The undersize faction is screened using a mobile 70mm screen with an over-band magnet. This results in three fractions:
    - an oversize fraction which is put through Step 4a;

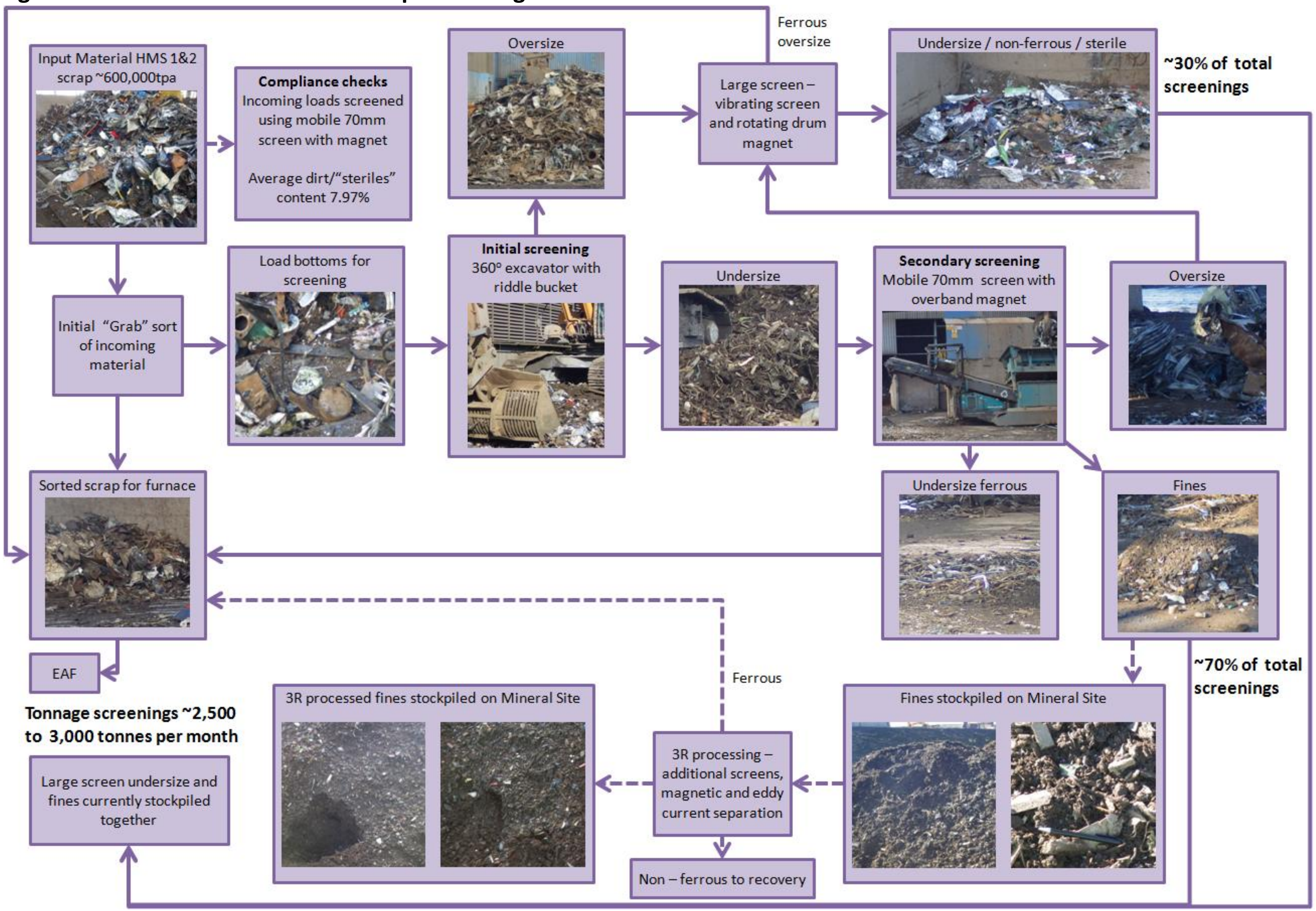
- an undersize ferrous fraction that is added to the furnace ready stockpiles; and
- a fines fraction which is currently combined with the residue from Step 4a.

The fines fraction makes up approximately 70% by weight of the overall screening process residues with approximately 30% coming from the Lagun Artea residues from Step 4a.

During 2015, 3R carried out trials for CELSA Steel to determine if it was possible to recycle / recover a greater proportion of the screening process residues. The additional processes consisted of further ferrous metals extraction by magnetic separation (which was recycled through the plant) and non-ferrous metals removal by eddy-current separation, which was sold for recycling. However, the additional screening resulted in only approximately 4% of screening process residues being recovered, making the process uneconomic.

It should also be noted that CELSA Steel does not add any material to the incoming loads, so any potentially hazardous material must have come from the scrap metal recovery industry. However, both the primary and trial screening processes have the unintended effect of concentrating the low levels of petroleum hydrocarbons from the HMS 1&2 scrap loads with the potential to make the screening process residues hazardous.

Figure 1 CELSA Steel - HMS 1&2 Scrap Screening Processes



2. Sampling

Previous sampling exercises

In February 2016, RWSP carried out preliminary sampling to allow an initial assessment of the fines / 'sweepings' and to help define the objectives and technical goals for the detailed sampling plan. The preliminary sampling and subsequent hazardous waste assessment, based on Technical Guidance WM3[1], was not able to provide a definitive conclusion with regards to the hazardous nature of both the input and stockpiled fines / 'sweepings'. They did, however, provide some initial conclusions and highlighted a number of issues that need to be addressed through detailed sampling.

1. While there are significant quantities of metals present in the fines / 'sweepings', given the nature of the incoming material it is reasonable to assume that the metals present are predominately present in metallic form or as alloys. Nature Resource Wales have accepted this assumption with the proviso that lead levels are kept under review due to the potential hazardous nature of metallic lead.
2. The fines / 'sweepings' have the potential to be hazardous solely as a result of the presence of the petroleum hydrocarbon. However:
    a. The preliminary sampling highlighted some variability in the TPH concentrations;
    b. There are many suppliers of HMS1 & 2, all loads contain fines / 'sweepings'. Therefore there are many sources of the TPHs within the fines / 'sweepings' and these are not well understood, potentially making it difficult to identify the specific petroleum groups;
    c. Although the laboratory was asked to identify the petroleum groups for the TPHs in the stockpile using by GC-MS Broadscan, a specific petroleum group could not be identified due to the extreme weathering of the material over time.
3. It is not possible to analyse the oversize material but any sampling plan should include a visual assessment of the nature of the oversize material

Therefore, the objectives of the detailed characterisation sampling should be:

- To provide estimates of the key determinands and their levels to allow hazardous waste assessment s to be undertaken;
- If possible, to identify the petroleum groups in the fines / 'sweepings' in the incoming loads, as this material will have not be subjected to the same degree of processing / weathering as the stockpiled material; and
- To assess the variability of the TPHs concentrations in the incoming loads with 95% confidence levels, to allow the TPHs concentration in the overall fines / 'sweepings' waste as produced to be calculated from the proportions of material received from different suppliers.

---

[1] Waste Classification: Guidance on the classification and assessment of waste (1st edition 2015)

3. Characterisation Sampling

There are essentially two sources of fines / ‘sweepings’ that need to be sampled and assessed:

- the current input that is delivered with the HMS1 and HMS2 loads; and
- the stockpiled waste, originally delivered from the same sources as above but which has undergone significant further weathering and degradation.

The nature of each of these populations is different and separate plans were developed for each to reflect the different approaches required. The plans were produced followed the principles set out in Appendix D of WM3.

Incoming Material Sampling Plan

RWSP drafted a sampling statement setting out the background and the broad principles of the input sampling. This was followed by the development of a sampling plan (attached at Annex A).

The sampling plan recognises that there were potentially three sub-populations in the input: the HMS scrap suppliers, the fines from the contrast load screening and the fines from the riddle bucket and screening.

The sampling plan proposed sampling 12 loads.

Stockpile Sampling Plan

RWSP similarly drafted a sampling statement in relation to the stockpiled fines / ‘sweepings’. Some of the stockpile was material that had been treated by 3R in the trials that were conducted in 2015. To develop the sampling plan, RWSP arranged for the stockpile to be surveyed by a quantity surveyor, who produced a plan of the stockpile and estimated the volumes of the stockpile and the potential subpopulations.

A grid was overlaid on the scale plan, divided into 10 metre squares. Each square was numbered sequentially for each of the four potential subpopulations and random numbers were generated for each and the appropriate number selected for each subpopulation. The sampling plan for the stockpile is attached at Annex B.

Sampling

The sampling took place on 13 and 14 April 2016. Scrap steel is received both by road and rail from 06:00 to 18:00 each day. The exercise was timed to coincide with a contrast load campaign in order to achieve the proposed 12 loads representing one day’s contrast loads but spread over two days. The sampling exercise began at approximately

12:00 on the first day and continued until approximately 19:00. On the second day, sampling began at approximately 07:00 and was completed by 15:00.

Sampling Process, Screening and Weighing

An existing concrete pad was used as a base for the scales and to carry out the screening/containerisation.

Each of the trugs and buckets were weighed and then labelled with an identification number/letter and its tare weight, see Figure 2 .

Figure 2 Labelling of buckets and trugs

Pointed shovels were used to take representative samples from each mixed pile and place the waste into a bucket. When each bucket contained sufficient waste, generally between 3kg and 5kg, they were taken back to the base pad. The number of the bucket used for each sample was recorded, the bucket of waste weighed and the gross weight recorded. The contents of the bucket were then carefully sieved, a portion at a time, through a 10mm circular sieve into a 40 litre plastic trug. The oversize material (i.e. the material not passing through the 10mm sieve), was placed into another plastic trug, once as much loose material had been removed as practicable. When the screening was complete, any easily identifiable oversize pieces of waste (e.g. copper wire) in the screened material were also transferred to the trug with the oversize material. The identification of the trugs were recorded, along with the gross weights of each.

After weighing, the entire fines portion of the sample was bagged, the air excluded, sealed and labelled ready for subsequent transfer to the laboratory containers. Following a visual assessment, see Section 4. the oversize was discarded.

The process was checked by adding together the net weights of the fines and oversize portions and comparing this total to the net weight of the sample as taken. The figures for these are provided in Annex C.

Over the two days a total of 58 individual samples were taken: 15 input samples from individual loads, three samples that had been screened following initial sorting and processing through the riddle bucket, and 40 samples from the stockpile.

Incoming Material Samples

Celsa's portable two-way radio system was used to alert RWSP to the commencement of screening operations of each contrast load. When RWSP received such notification, one of RWSP's staff went to the screening area with a sample bucket and shovel and took a representative sample from different parts of the fines pile produced by the screener. The sample was then taken back to the concrete pad where the scales had been set up.

Due to the limits on the throughput of the screens, in order to provide the desired number of samples, Celsa used two screens rather than the usual single screen to separate out the steriles on contrast loads. RWSP therefore was able to sample 15 loads screened by Celsa over the equivalent of a day's input spread over two days. This represented approximately 10% of the total input and 20% of the HMS1&2 loads. In addition, three samples were also taken that had been screened following initial sorting and processing through the riddle bucket.

Stockpile Samples

Sampling of the 15,000 cubic metre stockpile was carried out by digging trial pits at the designated locations using the hydraulic excavator. The surveyor's plan of the stockpile overlain with a ten metre grid was used together with the ten metre steel tape and visual identification from the contours of the stockpile to designate locations for trial pits. The locations of the trial pits were initially identified one at a time but later groups of locations were identified individually using the marker spray and the spray also used to mark the location of the sample piles, see Figure 3 .

Figure 3 Identification of trial pits

Two to three samples were taken from each trial pit depending on the depth of the stockpile at that point. The operator of the hydraulic excavator first scraped away the surface layer and then excavated the trial pit, piling most of the waste to one side but also creating separate piles of mixed waste from approximately 0.5 to 1 metre, 2.5 to 3 metres and 5 to 6 metres depth, where this was possible, see Figure 4 .

Figure 4 Trial pits

Although it was possible to obtain the samples from most of the stockpile as planned, the following had to be omitted or adjusted:

- it was not possible to obtain three samples from the 3R fines area due to safety considerations;
- only two samples from one trial pit in the 3R fines area actually contained the fines – the other was similar to the remainder of the stockpile; and
- RWSP sampled the subpopulation referred to as Lagun Artea but considered it impossible to obtain a sample in a bucket that would be sufficiently representative, given the high proportion of oversize and the large size of some of the pieces.

Production of samples for analysis

The laboratory provided 40 sets of three containers for each sample plus additional 500g sealable plastic pots. Three samples were sent for analysis in plastic pots (two for each sample) due to insufficient sets of three containers being available.

For each laboratory sample the fines portion of each sample was thoroughly mixed and part transferred to each of three containers which were completely filled and sealed. For stockpile samples a combination of individual and composite samples were sent for analysis:

- 15 stockpile samples from 6 trial pits were submitted as individual samples;
- composite samples were produced for the other nine trial pits from equal proportions of the 2-3 individual samples from each trial pit.

For the input material all of the 15 input contrast load samples and three samples from the riddle bucket and screen were submitted as individual samples. A full list of the individual samples, composites, analyses, weights and proportions of oversize and undersize is given in Annex C.

4. Assessment of Oversize

Oversize material screened from samples

The nature of the oversize material was very variable in material, items and size. During sample screening considerable effort was made to remove any undersize material adhering to oversize items such that the level of contamination of the oversize was minimal.

The oversize material identified by RWSP consisted of pieces of wood, foam rubber, aluminium, copper, brass, steel, rubber and plastic, with the identifiable items including plastic sheathed copper wire and plumbing fittings, small pieces of printed circuit board, rubber bushes and metal components such as car parts etc., as shown in Figure 5

Figure 5   Oversize material from incoming loads

Container base diameter = 34 cm

Lagun Artea material

In addtion to the oversize material from incoming loads, the waste from the Lagun Artea area was photographed, as it could not be sampled representatively, due the the proportion and large size of the oversize. Figure 6 shows the waste from the Lagun Artea area.

Figure 6 Lagun Artea material

5. Laboratory Analysis

Chemical analysis of samples was undertaken by i2 Analytical Ltd. Fifteen samples were analysed for the full hazard assessment suite which covered the following analytical parameters:

- General Inorganics
- Total Phenols
- Speciated and total PAHs
- Heavy Metals / Metalloids
- Monoaromatics
- Petroleum Hydrocarbons
- PCBs

The remaining 28 samples were analysed solely for total petroleum hydrocarbons (TPHs) and PAHs. Following this, seven of the current input samples were further analysed using GC-MS Broadscan to identify the petroleum group(s).

Subsequently a DMSO extraction and analysis was carried out on five input samples.

The samples taken by RWSP were as representative of the whole waste at each sample point/trial pit as practicable. The samples provided to the laboratory by RWSP were screened on site to remove as much of the oversize material (greater than 10mm) with minimal contamination of the oversize.

Derivation of determinands levels for the *in situ* waste from the laboratory results

The laboratory has MCERTS accreditation for the analyses undertaken but these require reporting relative to the weight of the sample dried to constant weight. To determine whether or not a waste is hazardous, it is the waste as produced or in situ that needs to be evaluated. Therefore the laboratory was asked to report its results based on the as received samples correcting the results for the laboratory screening of the sample for material greater than 10mm and the drying of the samples required for MCERTS reporting. The corrected results cannot be accredited as MCERTS even though the actual analyses did follow the MCERTS accredited methods.

Therefore, the sample preparation process can be summarised as follows:

Waste sample as taken – Oversize content	=	Sample sent to laboratory
Sample sent to laboratory – Material >10 mm	=	Sample for analysis
Sample for analysis – Moisture content	=	Dry weight (for MCERTS reporting)

Thus the analytical results were adjusted by the laboratory to provide the concentrations of the determinands in the material as received by the laboratory.

$$V(wet) = V(dry) \div (1 - (\%\ Moisture\ content/100))$$

Where V is the value of any determinand, followed by:

$$V(as\ recieved) = V(wet) \div (1 - (\%\ > 10\ mm\ content/100))$$

These analytical results then needed to be corrected, by RWSP, for the oversize fraction to give the concentrations of the determinands in the waste sample, as follows:

$$V(waste) = V(as\ recieved) \div (1 - (\%\ \text{oversize}/100))$$

The full analytical results are provided in the follow spreadsheets that accompany this report:

- Celsa April Analysis Results - Input Samples Report
- Celsa April Analysis Results - Stockpile Samples Report

In each spreadsheet there are three tabs

- Laboratory Analysis Results – analytical results as reported by the laboratory with no corrections;
- Laboratory Corrected Results - analytical results corrected by the laboratory to “as received”; and
- Corrected Results-Actual waste – the “as received” results report by the laboratory, corrected for oversize by RWSP.

As discussion in Section 2, the primary purpose of the detail sampling programme was:

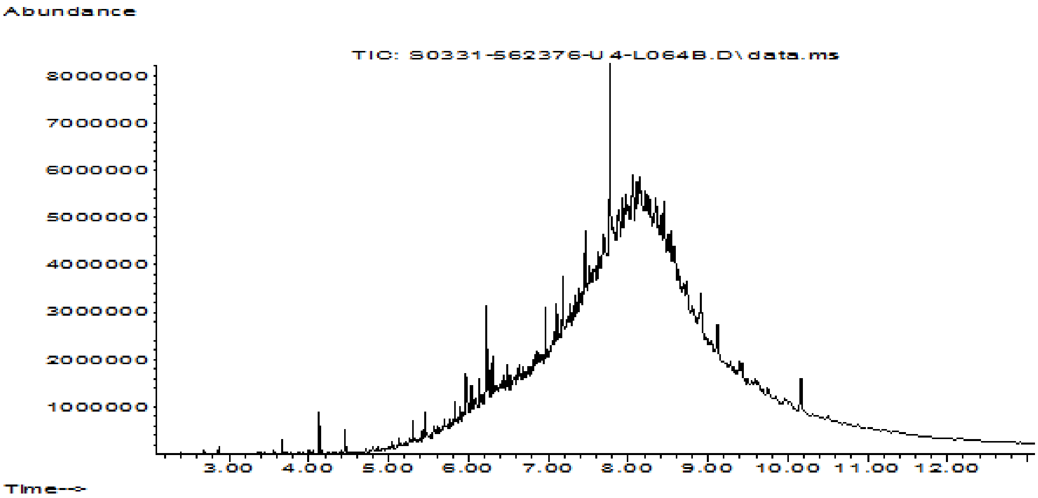
- To provide estimates of the key determinands and their levels to allow hazardous waste assessments to be undertaken.
- If possible, to identify the petroleum groups in the fines / ‘sweepings’ in the incoming loads, as this material will have not be subjected to the same degree of processing / weathering as the stockpiled material. And
- To assess the variability of the TPHs concentrations in the incoming loads with 95% confidence levels, to allow the TPHs concentration in the overall fines / ‘sweepings’ waste as produced to be calculated from the proportions of material received from different suppliers.

Therefore summarised below is the key information from the analytical results related to the TPHs.

GC-MS Broadscan

Seven of the current input samples were analysed using GC-MS Broadscan to try and identify the petroleum group. The resulting GC-MS Broadscan chromatograms were all very similar, an example is provided in Figure 7 [2], and the laboratory originally concluded for all samples that the *"chromatogram exhibits a strong TPH trace ranging from C10 to C35. The amount of degradation and the ratio of aliphatic to aromatic hydrocarbons is indicative of heavily weathered diesel."*

Figure 7   Example GC-MS Broadscan of TPHs in input samples



However, when the laboratory (at NRW's request) was asked to provide more detailed explanation that the GC profiles are indicative of diesel, they retracted the original assessment and concluded that the TPHs are is a mixture of diesel and lubricating oil[3]. The percentages of diesel and lubricating oil in the seven samples is provided in Table 1.

Sample	% Diesel	% Lube oil
562376	17	83
562377	18	82
562378	19	81
562380	14	86
562381	18	82
562395	19	81
562397	19	81

Table 1   Percentage concentration of diesel and lube oil in TPHs

[2] All the chromatograms can be found in i2 Analytical Ltd, Analytical Report Number: 16-15635, Issue Number 4, which accompanies this report.

[3] TPH Interpretation 16-158635, which accompanies this report.

TPH Concentrations

The corrected TPH concentrations for all samples are provided in Table 2.

Stockpile Samples		Input Samples	
Number	% TPH5 (C6 - C40)	Number	% TPH5 (C6 - C40)
3L	0.31%	IN1	0.67%
3M	0.21%	IN2	0.64%
8B	0.35%	IN3	0.38%
8M	0.26%	IN4	1.89%
11H	0.22%	IN5	0.76%
11L	0.41%	IN6	0.81%
11M	0.52%	IN7	1.22%
13C	0.74%	IN8	1.54%
15H	0.43%	IN9	0.78%
15L	0.64%	IN10	1.54%
15M	0.57%	IN11	2.15%
16C	0.69%	IN12	1.38%
18C	0.33%	IN13	1.63%
20C	0.13%	IN14	0.65%
21C	0.47%	IN15	0.75%
25C	0.63%	R1	0.56%
27H	0.67%	R2	0.88%
27L	0.46%	R3	1.29%
27M	0.52%		
F1L	0.28%		
F1M	0.30%		
F6	0.25%		
M1C	0.68%		
M2C	0.04%		

Table 2 Concentration of TPHs, C6 - C40, in the waste (corrected for moisture content, material >10mm and oversize)

The mean, standard deviations and 95% confidence levels for the % TPH5 (C6 - C40) concentrations are:

- Stockpile Samples: Mean 4,213mg/kg; Standard deviation 1,945mg/kg; 95% CI 3,392mg/kg to 5,034 mg/kg.
- Input Samples: Mean 10,785mg/kg; Standard deviation 5,133mg/kg; 95% CI 8,146mg/kg to 13,424mg/kg.

6. Hazardous Waste Assessments

Hazardous waste assessments for both the stockpile and the incoming wastes were carried out using WM3. To align with the guidance, the assessment is summarised below by the steps set out in Section 2 of WM3. Steps 1 to 5 are common to both wastes but they are considered separately in step 6.

Step 1: Check if the waste needs to be classified

Both materials are wastes and are not excluded from classification by virtue of being outside the scope of the Waste Framework Directive or by being covered by other legislation.

Step 2: Identify the code or codes that may apply to the waste

When classifying and coding wastes using the List of Wastes, the Chapter, sub-chapter and description applied to a six figure waste code all have to apply. Based on the process producing the waste, the LoW codes that may apply to the waste are summarised in Table 3.

10	Wastes from thermal processes
10 02	wastes from the iron and steel industry
10 02 99	wastes not otherwise specified
19	Wastes from Waste Management Facilities, Off-Site Waste Water Treatment Plants and the Preparation of Water Intended for Human Consumption and Water for Industrial Use
19 12	wastes from the mechanical treatment of waste (for example sorting, crushing, compacting, pelletising) not otherwise specified
19 12 11*	other wastes (including mixtures of materials) from mechanical treatment of waste containing hazardous substances
19 12 12	other wastes (including mixtures of materials) from mechanical treatment of wastes other than those mentioned in 19 12 11

Table 3 Potential codes for CELSA fines / 'sweepings'

The stockpile is a permitted waste storage and treatment area and therefore the correct code should either be 19 12 11* or 19 12 12. With regard to the input, subchapter 10 02 is the only entry that relates to the iron and steel industry but the only code that matches the waste is a '99' code for 'waste not otherwise specified'. Such codes are regarded as a last resort for correct coding and additionally NRW pointed out that the waste is not from a thermal process and all three levels of description (chapter, subchapter and entry) have to apply. The only other realistic coding option are the codes in Chapter 19 identified in Table 3 but, applying the same logic, the waste has to come from a waste management facility.

Thus the choice of code depends on whether or not the scrap screening process at the Celsa Melt Shop site is a waste management facility. If it is not then the most, appropriate code would be 10 02 99, as there are no alternative codes listed in Chapter 13 to 16 of the LoW, which is an absolute non-hazardous entry. The use of Chapter 10 is discussed further in Annex D. However, the chapter 19 code is applied here as it better describes the waste. Therefore, in accordance with WM3 and to carry out the worst case assessment, for the purposes of this assessment the Chapter 19 codes will be used.

Step 3: Identify the assessment needed to select the correct code(s)

Based on the assumption that the Chapter 19 codes are the most appropriate codes, the assessment needs to determine whether the waste is a '*mirror hazardous*' or '*mirror non-hazardous*' entry.

Step 4: Determine the chemical composition of the waste

Section 2 highlights that, whilst there are significant quantities of metals present in the fines / 'sweepings', given the nature of the incoming material it is reasonable to assume that the metals present are predominately present in metallic form or as alloys. Natural Resources Wales accepted this with the proviso that lead levels are kept under review due to the potentially hazardous nature of metallic lead.

The 'worst case substances' should be considered as those that may reasonably exist in the waste and that are most likely to result in each hazardous property applying. The term 'reasonable' indicates that substances that cannot exist within the waste, because their physical and chemical properties, can be excluded. Therefore, once the metals have been discounted as being present in metallic form or as alloys, the 'worst case' substances present in the waste are the TPHs.

Step 5: Identify if the substances in the waste are 'hazardous substances' or 'Persistent Organic Pollutants'

TPHs is the analytical term for hydrocarbon compounds found in oil. Many of these are hazardous substances above certain concentrations. In accordance with WM3, where the identity of the oil is unknown, all reasonable efforts have been made to identify the oil. This has been done and the laboratory has concluded that the TPHs are a mixture of diesel and lubricating oil in an approximate ratio of 20% diesel : 80% lubricating oil. Therefore the TPHs should be assessed against the potential hazardous properties:

- HP3 Flammable
- HP4 Irritant
- HP5 Specific Target Organ Toxicity/Aspiration Toxicity
- HP6 Acute Toxicity

- HP7 Carcinogenic
- HP14 Ecotoxic

Step 6: Assess the hazardous properties of the waste

The classification of diesel and lubricating oils (baseoil – unspecified)[4] and concentration limits for the hazardous properties identified are summarised in Table 4.

Hazard Class and Category	Hazard Statement Code(s)	Related Hazardous Property	Hazardous properties concentration limits
Diesel			
Flam. Liq. 3	H226	HP3	Insufficient concentration to make this relevant
Skin Irrit. 2	H315	HP4	Total concentration of substances classified as H315 and H319 ≥ 20%
Asp.Tox. 1	H304	HP5	Total concentration of substances classified as H304 ≥ 10%
STOT RE 2	H373	HP5	Concentration of any individual substances classified as H373 ≥ 10%
Acute Tox. 4	H332	HP6	Total concentration of substances classified as H332 ≥ 22.5%
Carc. 2	H351	HP7	Concentration of any individual substances classified as H351 ≥ 1%
Aquatic Chronic 2	H411	HP14	Ecotoxic Equations: 7: $\Sigma((M \times 10 \times H410) + H411) \geq 25\%$ 8: $\Sigma H410 + H411 + H412 + H413 \geq 25\%$ 9: $\Sigma((M \times 100 \times H410) + (10 \times H411) + H412) \geq 25\%$
Lubricating oils			
Carc. 1B	H350	HP7	Concentration of any individual substances classified as H350 ≥ 0.1%

Table 4 Classification of diesel and lubricating oils and the hazardous properties concentration limits

Given that that the highest concentration of TPHs in any individual sample is 2.15%, all hazardous properties, with the exception of HP7 Carcinogenic and HP14 Ecotoxic can be discounted. The assessments for the incoming material and stockpiled material against these two hazardous properties are summarised below.

[4] ECHA Index Number: 649-484-00-0, International Chemical Identification: Lubricating oils, Baseoil – unspecified [A complex combination of hydrocarbons obtained from solvent extraction and dewaxing processes. It consists predominantly of saturated hydrocarbons having carbon numbers in the range C15 through C50.]

Incoming Material Assessment

HP7 Carcinogenic

TPH (C6-C40) concentrations in the samples of the incoming material range from 0.38% to 2.15%. Based on the laboratory assessment that diesel makes up between 14% and 19% of the TPHs, the concentration of diesel in all the incoming samples would be below the ≥ 1% threshold for H351.

However lubricating oil is classified as Carcinogenic 1B, H350, which has a threshold of ≥ 0.1%. If it is assumed that the lubricating oil makes up 85% of the TPHs, all the samples would exceed the ≥ 0.1% threshold for H350.

Although the average TPH concentration of the input samples analysed is in excess of the 0.1% threshold for H350, the concentration in the actual waste reduce because the waste steam produced by Celsa is a combination of all the screenings produced, which is made up of:

- 30% undersize/non-ferrous/sterile from large vibrating screen and rotating drum magnet;
- 70% fines / 'sweepings' from mobile 70mm screen with overband magnet.

The undersize / non-ferrous / sterile from the large vibrating screen and rotating drum magnet is largely uncontaminated. However, no sampling has been undertaken because the large size of some of the pieces, (see Figure 8) made it impossible to obtain a sufficiently representative sample.

Figure 8 Undersize/non-ferrous/sterile from large vibrating screen and rotating drum magnet

However, when the fines / 'sweepings' are combined with the undersize/non-ferrous/sterile from the large vibrating screen and rotating drum magnet, the TPH concentration will still exceed the 0.1% threshold for H350.

WM3 provides criteria by which the carcinogenic and mutagenic properties of TPHs can be discounted based on the presence of certain 'marker compounds'. One set of criteria with regards to 'marker compounds' are for use where the contaminating oil is known and the other criteria are for where the oil is unknown.

WM3 states (page 33) that: '*Where the* ***identity of the contaminating oil is not known, but the petroleum group has been established****, then the appropriate marker for that petroleum group may be used unless the oil is diesel or petrol. Marker compounds must not be used for petrol or diesel'.*

The laboratory has identified that up to 85% of the TPH concentration is from the lubricating oil petroleum group. For oils in petroleum groups, other than as petrol or diesel, the CLP[5] identifies the following three markers for use in determining the carcinogenic or mutagenic nature of the oil contaminating the waste. Only the marker(s) assigned to a particular group by the CLP can be used. The oil would not carcinogenic or mutagenic, where indicated by the CLP note(s) assigned to that group, if the:

1. benzene concentration is less than 0.1% of the of the TPH concentration w/w (mg/kg);
2. 1,3-butadiene concentration is than less 0.1% than of the TPH concentration w/w (mg/kg); and
3. substance contains less than 3 %DMSO extract (relative to TPH concentration) as measured by IP 346 'Determination of polycyclic aromatics in unused lubricating base oils and asphaltene free petroleum fractions — Dimethyl sulphoxide (DMSO) extraction refractive index method', Institute of Petroleum, London.

For lubricating oil, the relevant marker indicated by the CLP[6] is a DMSO extract of less than 3% relative to the TPH concentration.

A DMSO extract was carried out on five of the input and the results showed that the DMSO extracts relative to the TPH concentrations was less than 0.6% for all of the samples, Table 5, with full details provided in i2 Analytical Ltd, Analytical Report Number: 16-15635 Addendum, which accompanies this report.

The BSI method developed by the Institute of Petroleum for the DMSO extraction pre-dates the common use of gas-chromatography and is designed for liquids. The method used by the laboratory for the DMSO extract therefore differed from the BSI method in two important respects:

- the DMSO extraction technique was less specific than the BSI method which uses a DMSO extraction of a liquid oil in solvent; and
- the method of detection used is mass spectrometry rather than refractive index.

[5] Classification, Labelling and Packaging of Substances Regulation (EC 1272/2008)

[6] http://echa.europa.eu/information-on-chemicals/cl-inventory-database/-/discli/details/45390

Samples	% TPH5 (C6 - C40)	DMSO extract as % of the total TPHs
IN2	0.64%	0.23%
IN11	2.15%	0.12%
IN15	0.75%	0.53%
R1	0.56%	0.40%
R3	1.29%	0.22%

Table 5 DMSO extract as % of the total TPHs for five input samples

The extraction procedure used by the laboratory is a combination of ultrasonication and physical shaking. This provides a robust and rigorous method of extraction that is standard practice amongst labs that test for hydrocarbons and PAH-like compounds and is likely to pull out the majority of DMSO extractable matter.

GC-MS is more sensitive that refractive index both in general terms and also in specific terms (the MS equipment used by the laboratory is some of the most sensitive available on the market). The GC method will have a negative bias towards the higher end compounds. The instrument can typically detect compounds with boiling points up to 500°C but compounds with a higher boiling point would be missed. The percentage figures reported are based on the semi-quantification of a deuterated PAH. The results for individual PAHs will therefore differ depending on the relative response of the PAH and the analyte in question. It is assumed that some will be more sensitive than the surrogate PAH and some will be lower, so that the overall net effect is zero.

As an additional check a gravimetric analysis of the sample extracts was undertaken. For this the extracts were transferred to an accurately pre-weighed vial and then the DMSO evaporated under nitrogen. The vial was reweighed and the % extractable matter calculated with the highest value obtained for any sample being 500mg/kg. Looking at each sample in turn, the gravimetric result as a % of the total TPH previously calculated equates to less than 3% for all samples.

Based on the proportion of DMSO extract relative to TPH concentration, the carcinogenic and mutagenic properties of TPHs can be discounted. Therefore HP7 Carcinogenic can be discounted.

HP14 Ecotoxic

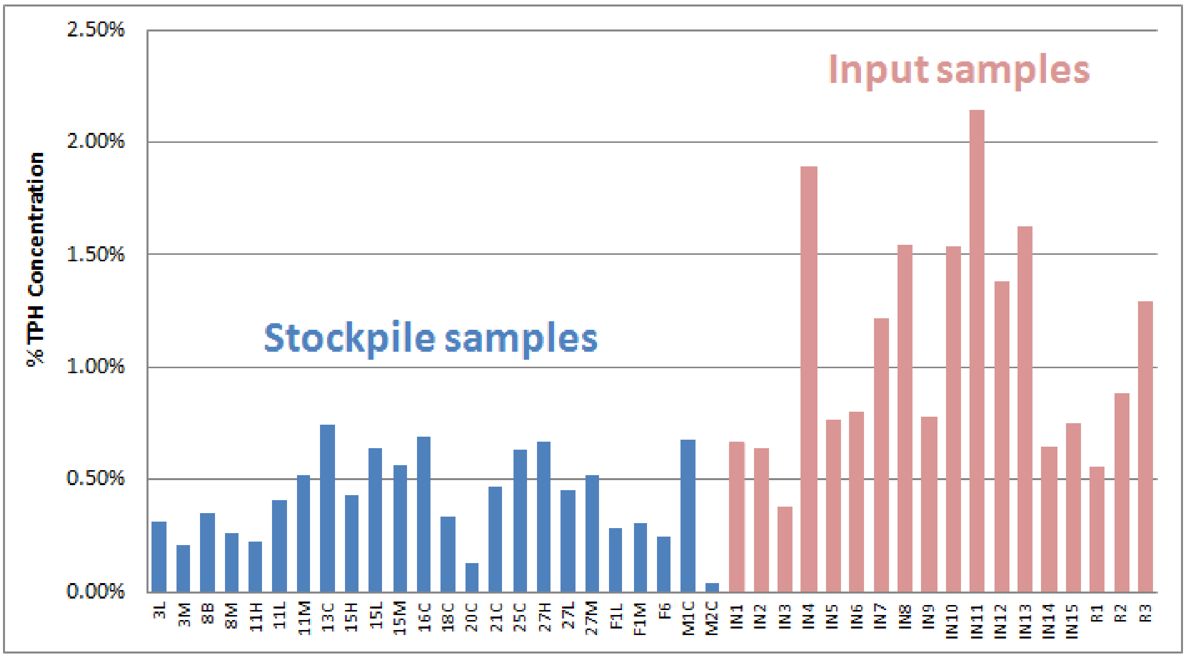
For any of the samples to fail the Ecotoxic Equations 7 to 9, the concentration of TPHs would need to be ≥ 2.5%. Therefore, as the highest TPH concentration (C6-C40) was 2.15%, HP14 Ecotoxic can be discounted.

Stockpile Assessment

HP7 Carcinogenic

Previous sampling and analysis has shown that the stockpile material is too weathered to determine the type of oil that gives rise to the TPH contamination but, given that the stockpile is from the input material, analysis is not considered necessary and it is concluded the contamination will also be lubricating oil and diesel and will therefore initially also be non-hazardous. However, this assessment may change with time due to the effect of weathering preferentially reducing the TPH concentrations in the stockpiled material. This is highlighted by Figure 9 , which compares the TPH concentrations in the stockpile and input samples.

Figure 9 Comparison of the TPH concentrations in stockpile and input samples



TPH (C6-C40) concentrations in the samples of the stockpile material range from 0.04% to 0.74%, with the majority of TPH concentrations in excess of the ≥ 0.1% threshold for H350 for HP7 Carcinogenic.

As for the input samples, if the DMSO extract is less than 3% it would be reasonable to conclude that HP7 Carcinogenic can be discounted. Due to the time that elapsed between the original analysis and the response from NRW, none of the stockpile samples was retained by the laboratory and able to be subjected to DMSO extraction. However, Resource and Waste Solutions retained a composite of all samples taken and also a stockpile sample from the original screen process in February was subjected to DMSO extraction and GC-MS scan. The sample (CE00/002) was from near the surface of the 3R processed fines stockpiled on Mineral Site. This part of the stockpile has been subject to most processing and weathering, and therefore is most likely to have the highest proportion of PAHs to TPHs and would be expected to give the worst case result for DMSO extract test. The percentage DMSO extract relative to TPH concentration in Sample CE00/002 was 1.9%, below the 3% limit. Three sub-samples from the composite sample have also been analysed for TPH concentrations and subjected to DMSO extraction[7].

Samples	% TPH5 (C6 - C40)	DMSO extract as % of the total TPHs
CES01	0.48%	0.0%
CES02	0.51%	0.0%
CES03	0.54%	0.0%

Table 6 DMSO extract as % of the total TPHs for three sub-samples of the composite sample

The results showed that no compounds were detected in the DMSO extract. Therefore, it is reasonable to conclude that the relative concentration of DMSO extract to total TPHs will remain less than 3% throughout the stockpile and HP7 Carcinogenic can be discounted.

HP14 Ecotoxic

For any of the samples to fail the Ecotoxic Equations 7 to 9, the concentration of TPHs would need to be ≥ 2.5%. Therefore, as the highest TPH concentration was 0.68%, or 0.94% if the worst C6-C40:EC5-EC35 ratio is assumed, HP14 Ecotoxic can be discounted.

7. Conclusions and Recommendations

Conclusions

The classification of both the incoming and stockpile material is dependent on the concentration and nature of the TPHs present in the waste.

Classification of Incoming Material

The TPH concentration in the combined fines / ‘sweepings’ and undersize/non-ferrous/sterile from the large vibrating screen and rotating drum magnet, will still be in excess of the 0.1% threshold for H350, which would give rise to the hazardous property HP7 Carcinogenic.

However where the petroleum group can be identified, WM3 allows the use of marker compound to discount carcinogenic and mutagenic properties of TPH.

---

[7] Analytical Report Number: 16-22408, which accompanies this report.

The laboratory identified that up to 85% of the TPH were from the lubricating oil petroleum group, for which the relevant marker is a DMSO extract of less than 3% relative to the TPH concentration. The DMSO extract relative to the TPH concentration for the five input samples tested, were in the range 0.12% to 0.53% and so below the 3% threshold. Therefore HP7 Carcinogenic can be discounted and this waste should be classified as non-hazardous and assigned the LoW code 19 12 12.

Classification of Stockpile

The TPH contamination for the input material has been confirmed as a mixture of lubricating oil and diesel. The stockpile is too weathered to determine the type of oil that gives rise to the TPH contamination but, given that the stockpile is from the input material, it is reasonable to conclude that the contamination will also be lubricating oil and diesel. The input material has been classified as non-hazardous and, although the concentrations of contaminants in the stockpile have been shown to change due to processing and weathering, the most processed and weathered waste from the stockpile gave a DMSO extract result of 1.9% of the total TPH concentration, well within the 3% threshold. Three other samples, taken from a composite sample, all registered DMSO extractable material of 0% of the TPH concentrations. Therefore, it is reasonable to assume that the relative concentration of DMSO extract to total TPHs will remain less than 3% throughout the stockpile and the stockpile should be classified as non-hazardous and assigned the LoW code 19 12 12.

Recommendations

Celsa should develop an ongoing check sampling programme to:

- Ensure levels of TPHs remain non-hazardous;
- Keep track of lead levels within the waste; and
- Establish whether high TPH contamination is associated with particular suppliers/sites.

Annex A: Sampling Plan for Incoming Waste

Sampling plan for waste classification and assessment of current input of fines / sweepings	
Reference: CS/01/001 Date prepared: 11 April 2016 Prepared by: Terry Coleman/Nigel Naisbitt Reviewed by: Anton van Santen Prepared for: Celsa Steel, Cardiff	
Involved Parties	Celsa Steel
Objective	Basic characterisation and hazard assessment
Objectives and Technical Goals	To obtain samples of fines / 'sweepings' from the current input of scrap steel to Celsa for subsequent analysis to determine whether the input is hazardous or non-hazardous waste and also to assess whether there is any undue hazard associated with its further processing.
Background information	Approximately 150 loads of scrap steel are received each day at Celsa Steel's EAF plant, Rover Way, Cardiff. The scrap steel varies in quality and in the amount of contamination. The highest contamination is in approximately half the loads that are classified as heavy melting steel (HMS1 and 2). The fines arise from the processing of HMS 1& 2 scrap steel input. Lorry loads of steel mainly classified as HMS1 and 2 are delivered to Celsa contaminated with non-steel wastes, consisting of earth, rubber, plastic, non-ferrous metal and stones and collectively known as steriles. These steriles are also contaminated with petroleum hydrocarbons (TPHs). Deliveries begin at approx. 6:00 and cease at 18:00 each day. Loads are directed to the appropriate bay according to type of steel, where they are discharged. The scrap is selected by a 360° hydraulic excavator and shaken to loosen and remove dirt etc. adhering to the scrap; this scrap is deposited into the appropriate bay ready for loading into the EAF. The soil/dirt and other contaminants are moved periodically to a second area where larger items (mainly steel) are screened out with by a 360° hydraulic excavator with a riddle bucket. The smaller sized output from this process is then loaded into a screen

	with magnetic separation. The fines from this secondary screen are those that are transported to the stockpile. Additionally, some loads are diverted from the normal loading bay and the whole load is run through screening, theses are known as contrast loads and are designed to check the sterile content of the incoming material. The fines from this process are also stockpiled in the same place.
Level of testing	Basic characterisation
Constituents to be tested	BTEX, TPHs, PAHs, PCBs, heavy metals including Hg, As, Sb and Se, pH, acidity/alkalinity and CN.
Health and Safety Precautions/Access restrictions	Trained excavator operator. PPE including safety helmets, boots, gloves, eye-protection and high visibility jackets. Operation to be supervised by a member of Celsa Steel staff.
Technical Assessment	
Populations and subpopulations	There are several potential sub-populations in the input. These are: • The different suppliers delivering HMS 1 and 2; • The outputs from contrast load screening; and • The outputs from the riddle bucket and screening. While these are expected to be broadly similar, because they come from similar origins, we will endeavour to sample them separately because they have different provenances and have undergone slightly different levels of screening which could affect the concentration of potentially hazardous substances.
Variability and causes	The fines arise from different suppliers, albeit from similar processes and so could vary. Also processing on site may affect the concentration of more volatile components.
Scale of sampling	Ultimately this will be determined by the ability to screen loads to produce fines. It is proposed to sample approximately 12 loads or at approximately 12 intervals spread over two days. Each initial sample will be approximately 5kg.
Practical Instructions and sampling method	
Name of organisation and sampler	Resource and Waste Solutions, Terry Coleman and Nigel Naisbitt
Other parties present	Leigh Edwards
Identify sampling place and points	Celsa Steel, 82 Seawall Road, Cardiff, CF24 5TH.
Statistical approach to be used	Systematic sampling.
Sampling pattern and	Sampling at regular intervals or at a regular number of

approach	loads.
Sampling equipment	See Appendix A1.
Sample details	Several samples will taken from the output from the screening process. These (or part of these after mixing) will be weighed and screened to remove oversize materials and the separate weights recorded. The fines portion will be thoroughly mixed and incremental samples taken from different points until a suitably sized sample for laboratory analysis is obtained. Note that the screening process is required because the waste will contain quantities of materials that are uncontaminated and cannot be analysed due to their size (e.g. ferrous and non-ferrous metals, rubber, plastic, stones). Each incremental sample will be weighed and then screened to separate any oversize materials (approx. >10mm). Each portion will then be weighed and the total checked.
Requirements for sample reduction/on-site determinations	As above, each sample will be screened to remove oversize materials. Both parts will be separately weighed and recorded. The fines portion will be retained for composites and records.
Sample ref number methodology	CS01/Input /[Contrast][Riddle] /Time/Date
Anticipated restrictions or limitations that may impact on sample reliability	May need to depart from sampling pattern, e.g. for operational reasons.
Subsampling method	Each sample will be thoroughly mixed and sub-sampled to reduce it to laboratory size.
Packaging	Laboratory sample jars packed in cool boxes with freezer blocks.
Preservation	See above. Closed containers dispatched to analytical laboratory by 10:00 next day.
Transport method	Courier/overnight delivery
Transport company	TBA
Analytical Laboratory	TBA
Contact name	TBA

Annex A1: Equipment used

Prior to sampling, the safety equipment available to RWSP was checked and RWSP personnel were given an intensive safety briefing by Celsa staff and instructed on the use of the two-way radio system.

The equipment used was as follows:

- 360° hydraulic excavator
- Four 14 litre plastic buckets;
- Four 40 litre plastic trugs;
- Electronic scales, capable of weighing up to 10kg to ± 1 g.
- Small pointed shovels
- 10mm sieves
- Tarpaulins
- Marker spray
- 10 metre extending steel tape
- Rubble sacks
- Sample containers and jars
- Portable two-way radio
- Appropriate safety equipment, including hi-visibility jackets, protective footwear and gloves, safety helmet and safety glasses.

Annex B: Stockpile Sampling Plan

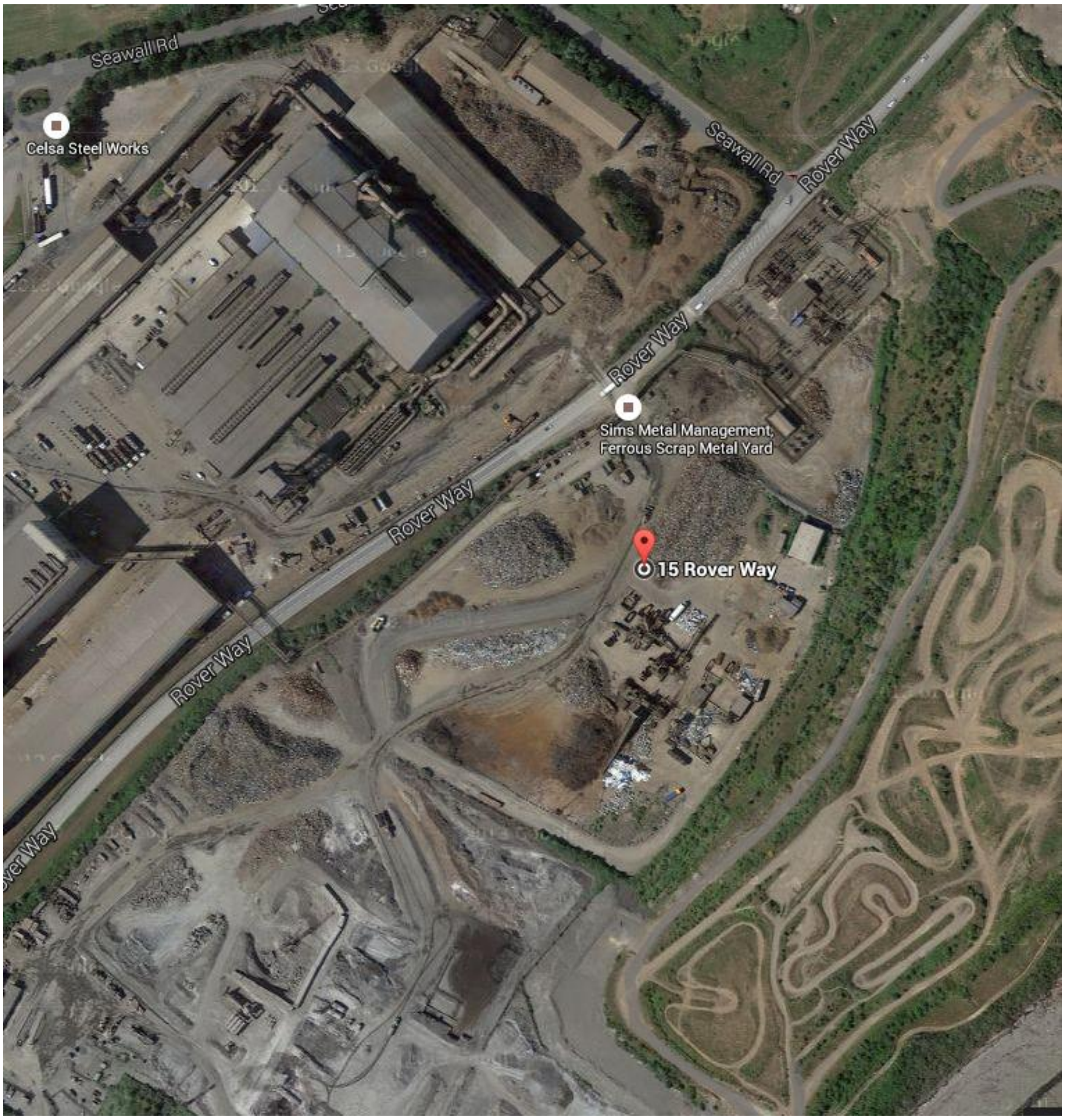
Sampling plan for waste classification and assessment of stockpiles	
Reference: CS/01/001 Date prepared: 11 April 2016 Prepared by: Terry Coleman/Nigel Naisbitt Reviewed by: Anton van Santen Prepared for: Celsa Steel, Cardiff	
Involved Parties	Celsa Steel
Objective	Basic characterisation and hazard assessment
Objectives and Technical Goals	To obtain samples from the stockpile for subsequent analysis to determine whether the piles are hazardous or non-hazardous waste and also to assess whether there is any undue hazard associated with their further processing.
Background information	15,000 cubic metres of waste screenings at Celsa Steel, Rover Way, Cardiff (see attached satellite photograph - from Google – Appendix 1) This stockpile has arisen from the processing of scrap steel input to Celsa Steel's EAF plant. Lorry loads of steel mainly classified as heavy melting steel (HMS1 and 2) are delivered to Celsa contaminated with non-steel wastes, consisting of earth, rubber, plastic, non-ferrous metal and stones and collectively known as steriles. These steriles are also contaminated with petroleum hydrocarbons (TPHs). The stockpile has been surveyed and its volume estimated at approximately 15,000 cubic metres. The material is dry, solid, mainly soil but also includes contamination by other material including rubber, steel, non-ferrous metal, stone and plastic.
Level of testing	Basic characterisation
Constituents to be tested	BTEX, TPHs, PAHs, PCBs, heavy metals including Hg, As, Sb and Se, pH, acidity/alkalinity and CN.
Health and Safety Precautions/Access restrictions	Trained excavator operator. PPE including safety helmets, boots, gloves, eye-protection and high visibility jackets. Operation to be supervised by a member of Celsa Steel staff. Where required, access ramp is to be constructed for excavator to facilitate sampling.

Technical Assessment	
Populations and subpopulations	There are four potential sub-populations on site. Their estimated volumes are as follows: • Mixed waste 11,346 cu.m. • RRR Fines 759 cu.m. • Lagun Artea 2,180 cu.m. • RRR Middlings 758 cu.m. All these are expected to be similar, because they come from similar origins but they will be sampled separately because they have undergone different levels of screening which could affect the concentration of potentially hazardous substances.
Variability and causes	The waste in the stockpile is heterogeneous but appears to be relatively well mixed. There may be spatial variation, for example, due to the level of processing or due to age and weathering.
Scale of sampling	Ultimately this will be determined by health and safety considerations. It is proposed to sample the stockpile at 3 depths from each of approximately 20 trial pits. Each sample will be approximately 5kg.
Practical Instructions and sampling method	
Name of organisation and sampler	Resource and Waste Solutions, Terry Coleman and Nigel Naisbitt
Other parties present	Leigh Edwards
Identify sampling place and points	Sampling points approximately as attached plan. Area located at 51.480214, -3.132429. (See attached satellite view).
Statistical approach to be used	Random sampling for each subpopulation.
Sampling pattern and approach	Points random from grid, sampling at three depths, modified by practical/safety considerations. See attached plan showing 10m grid (Appendix 2). Sampling points will be in grid squares chosen at random (using a random number generator) in 4 sets – one for each subpopulation.
Sampling equipment	See Appendix B3
Sample details	Incremental (approximately 5kg) samples to be taken from each of three depths (approx. 5m, 2.5m and near surface, where available) from approximately 20 trial pits in the stockpile. Part of the incremental samples will be mixed with others that are both physically close and in the same subpopulation to produce each composite sample. The number of composite samples for each subpopulation will be approximately:

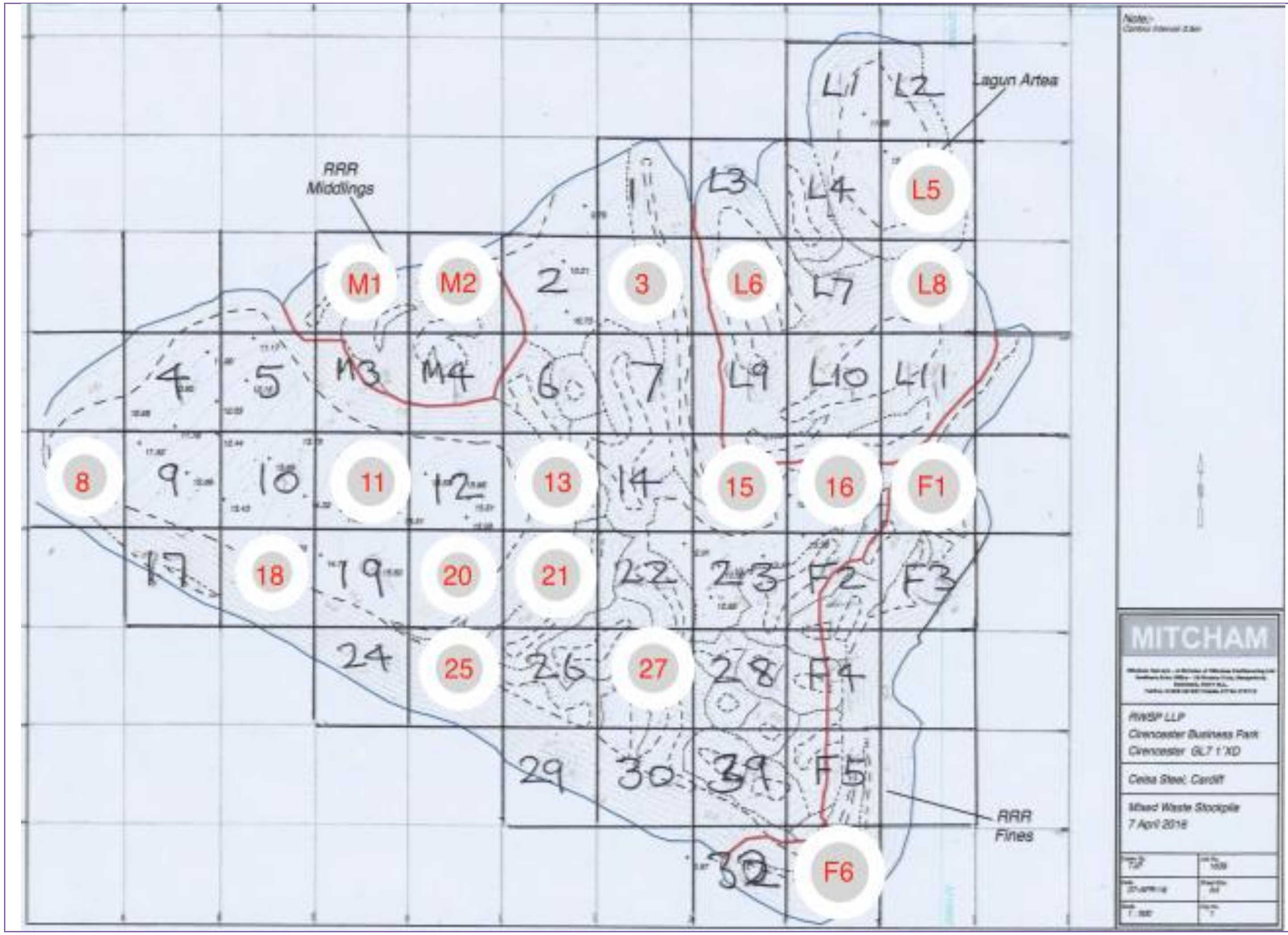
	• Mixed waste 10 to 15 • RRR Fines 2 • Lagun Artea 3 • RRR Middlings 2 The remainder of the incremental samples will be retained securely at the site. Note that we believe the waste will contain quantities of materials that are uncontaminated and cannot be analysed due to their size (e.g. ferrous and non-ferrous metals, rubber, plastic, stones). Each incremental sample will be weighed and then screened to separate any oversize materials (approx. >10mm). Each portion will then be weighed and the total checked.
Requirements for sample reduction/on-site determinations	As above, each incremental sample will be screened to remove oversize materials. Both parts will be separately weighed and recorded. The fines portion will be retained for composites and records.
Sample ref number methodology	CS01/Stockpile/Grid square or Pit number/[H,M,L]/Date
Anticipated restrictions or limitations that may impact on sample reliability	May need to depart from randomised sampling pattern, e.g. due to steep slopes.
Subsampling method	Part of each of incremental sample will be thoroughly mixed with others, coned and quartered to produce each composite.
Packaging	Laboratory sample jars packed in cool boxes with freezer blocks.
Preservation	Closed containers dispatched to analytical laboratory by 10:00 next day.
Transport method	Courier/overnight delivery
Transport company	TBA
Analytical Laboratory	TBA
Contact name	TBA

Annex B1:

CELSA Steel: Approximate Location of Stockpile to be Sampled



Annex B2: Survey plan of CELSA Screenings stockpile



NOTES

Plan is not to scale unless sized at A4 when it is 1:500

Grid squares are 10m

Squares are designated as follows:

L: Lagun Artea

M: RRR Middlings

F: RRR Fines

The grid squares for the remainder (majority) of the stockpile are just numbered.

Grid squares identified for sampling shown with red number.

Grid square 39 should be 31

Annex B3: Equipment used

Prior to sampling, the safety equipment available to RWSP was checked and RWSP personnel were given an intensive safety briefing by Celsa staff and instructed on the use of the two-way radio system.

The equipment used was as follows:

- 360° hydraulic excavator
- Four 14 litre plastic buckets;
- Four 40 litre plastic trugs;
- Electronic scales, capable of weighing up to 10kg to ± 1 g.
- Small pointed shovels
- 10mm sieves
- Tarpaulins
- Marker spray
- 10 metre extending steel tape
- Rubble sacks
- Sample containers and jars
- Portable two-way radio
- Appropriate safety equipment, including hi-visibility jackets, protective footwear and gloves, safety helmet and safety glasses.

Annex C: Sample numbers, analyses, composites, weights, percentage over and undersize and errors

Sample Ref	Sample number	Full Haz Suite	Net total (g)	Net oversize (g)	Net undersize (g)	Proportion of oversize	Proportion of undersize	Oversize in composite	Undersize in composite	Check total (g)	Difference
R1	1	✓	5035	3047	1991	60.5%	39.5%			5038	-0.06%
R2	2		4246	1964	2285	46.3%	53.8%			4249	-0.07%
R3	3		3676	1865	1820	50.7%	49.5%			3685	-0.24%
IN1	21	✓	7335	3164	4194	43.1%	57.2%			7358	-0.31%
IN2	22	✓	6842	4445	2385	65.0%	34.9%			6830	0.18%
IN3	24	✓	6206	3435	2770	55.3%	44.6%			6205	0.02%
IN4	30		4002	1773	2226	44.3%	55.6%			3999	0.07%
IN5	27		5789	1947	3835	33.6%	66.2%			5782	0.12%
IN6	29		6681	2925	3748	43.8%	56.1%			6673	0.12%
IN7	26	✓	6491	2691	3808	41.5%	58.7%			6499	-0.12%
IN8	23		4359	1942	2418	44.6%	55.5%			4360	-0.02%
IN9	28		5214	2063	3151	39.6%	60.4%			5214	0.00%
IN10	43		6146	2558	3579	41.6%	58.2%			6137	0.15%
IN11	5	✓	5574	1950	3624	35.0%	65.0%			5574	0.00%
IN12	4		3594	1904	1692	53.0%	47.1%			3596	-0.06%
IN13	20		4558	1508	3055	33.1%	67.0%			4563	-0.11%
IN14	19		4118	2301	1816	55.9%	44.1%			4117	0.02%
IN15	6		4984	3113	1882	62.5%	37.8%			4995	-0.22%
M2H	39	✓	9556	8306	1216	86.9%	12.7%	86.0%	13.8%	9522	0.36%

Sample Ref	Sample number	Full Haz Suite	Net total (g)	Net oversize (g)	Net undersize (g)	Proportion of oversize	Proportion of undersize	Oversize in composite	Undersize in composite	Check total (g)	Difference
M2M	39		6910	5980	914	86.5%	13.2%			6894	0.23%
M2L	39		7246	6102	1132	84.2%	15.6%			7234	0.17%
M1M	40	✓	6328	2198	4107	34.7%	64.9%	39.5%	60.1%	6305	0.36%
M1L	40		7211	3145	4035	43.6%	56.0%			7180	0.43%
11H	31		4210	1688	2511	40.1%	59.6%			4199	0.26%
11M	33	✓	6313	2733	3547	43.3%	56.2%			6280	0.52%
11L	32		6222	2688	3511	43.2%	56.4%			6199	0.37%
18H	36		5545	3386	2159	61.1%	38.9%	48.9%	50.8%	5545	0.00%
18M	36		5348	2103	3218	39.3%	60.2%			5321	0.50%
18L	36		6734	3125	3572	46.4%	53.0%			6697	0.55%
20H	42		5572	3249	2310	58.3%	41.5%	65.4%	34.5%	5559	0.23%
20M	42		5585	3087	2490	55.3%	44.6%			5577	0.14%
20L	42		6988	5538	1454	79.3%	20.8%			6992	-0.06%
13H	37		4529	2073	2450	45.8%	54.1%	40.2%	59.6%	4523	0.13%
13M	37		3576	1336	2230	37.4%	62.4%			3566	0.28%
13L	37		3946	1439	2502	36.5%	63.4%			3941	0.13%
21H	35		3930	2138	1789	54.4%	45.5%	51.9%	48.0%	3927	0.08%
21M	35		3524	1730	1791	49.1%	50.8%			3521	0.09%
21L	35		5583	2898	2681	51.9%	48.0%			5579	0.07%
27H	8	✓	4741	1938	2799	40.9%	59.0%			4737	0.08%
27M	7		4486	2201	2378	49.1%	53.0%			4579	-2.07%
27L	18		5429	2513	2910	46.3%	53.6%			5423	0.11%

Sample Ref	Sample number	Full Haz Suite	Net total (g)	Net oversize (g)	Net undersize (g)	Proportion of oversize	Proportion of undersize	Oversize in composite	Undersize in composite	Check total (g)	Difference
15H	15		4951	2055	2892	41.5%	58.4%			4947	0.08%
15M	12	✓	4977	1621	3343	32.6%	67.2%			4964	0.26%
15L	17		4580	1237	3335	27.0%	72.8%			4572	0.17%
16H	38		4376	1554	2823	35.5%	64.5%	29.1%	70.8%	4377	-0.02%
16M	38		4591	1300	3281	28.3%	71.5%			4581	0.22%
16L	38		4068	945	3121	23.2%	76.7%			4066	0.05%
25H	34		5554	2228	3311	40.1%	59.6%	42.4%	57.4%	5539	0.27%
25M	34		3835	1446	2386	37.7%	62.2%			3832	0.08%
25L	34		4079	2034	2035	49.9%	49.9%			4069	0.25%
3M	11		4639	2266	2369	48.8%	51.1%			4635	0.09%
3L	10	✓	5057	3149	1901	62.3%	37.6%			5050	0.14%
F1M	13	✓	5924	1359	4554	22.9%	76.9%			5913	0.19%
F1L	16	✓	5140	1151	3986	22.4%	77.5%			5137	0.06%
F6H	41		4538	2178	2354	48.0%	51.9%	51.5%	48.2%	4532	0.13%
F6L	41		5209	2843	2343	54.6%	45.0%			5186	0.44%
8M	9		4943	2338	2599	47.3%	52.6%			4937	0.12%
8L	14	✓	5113	2685	2423	52.5%	47.4%			5108	0.10%
Totals	**58**	**15**	**305936**	**148578**	**157041**	**47.20%**	**52.72%**			**305619**	

Annex D: The Choice of Chapter 10 or Chapter 19 of the List of Wastes to Classify Input Fines / 'sweepings'

Coding waste serves several purposes. Primarily it helps ensure the safe transfer and management of waste from one holder to another and helps to protect the environment by ensuring its management at a facility that is permitted to receive it. However, the List of Wastes is neither a complete list of wastes, nor is it a taxonomy where similar waste materials with similar properties are grouped together in a structured manner. This can present problems in coding some wastes and the example that follows is based on the input waste screenings to Celsa.

Considering the fines/'screenings', these arrive in and arise from the HMS1&2 scrap steel loads bought in by Celsa from different suppliers. These could be legitimately coded 19 10 01 (iron and steel from shredding of metal containing wastes) or 19 12 02 (ferrous metal from mechanical treatment of wastes). Other codes, such as 16 01 17 and 17 04 05, will be used for non-HMS, steel scrap received at Celsa. Neither of the chapter 19 codes used for the waste received is appropriate for the fines /screenings, where ferrous metal is a minor component.

To find an appropriate code, in accordance with the List of Waste guidance, Chapters 1 to 12 and 17 to 20 were researched to reveal a choice between Chapter 10 Wastes from thermal processes and Chapter 19 Waste from Waste Management Facilities. The only Chapter 10 code that could be applied is 10 02 99. As this is a '99' code, the guidance requires the user to check Chapters 13 to 15 and then Chapter 16 for an appropriate code. However, the only other potential codes are 19 12 11* or 19 12 12 (other wastes (including mixtures of materials) from mechanical treatment of wastes).

Neither of these options is entirely satisfactory. With regard to the codes 19 12 11* and 19 12 12, these can only be considered appropriate if the waste is from a waste management facility. While Celsa is handling waste (the scrap steel) and is treating this by screening out contrary materials, the facility is a steel plant and not a Chapter 19 process.

Similarly, with regard to 10 02 99, it has been argued that the fines / 'sweepings' are not produced from a thermal process. Although, it is true they have not been subjected to a thermal process, the waste is produced from the input controls to the EAF which is clearly a thermal process. Other wastes from the input side to other thermal processes but not subjected to any heat are also listed in Chapter 10, for example:

- 10 12 01 waste preparation mixture before thermal processing
- 10 13 01 waste preparation mixture before thermal processing

Additionally, other wastes not subjected to thermal processes are listed:

- 10 09 05* casting cores and moulds which have not undergone pouring containing hazardous substances
- 10 09 06 casting cores and moulds which have not undergone pouring other than those mentioned in 10 09 05

And the following do not even have to be associated with a thermal process:

- 10 11 13 glass-polishing and grinding sludge containing hazardous substances
- 10 13 14 waste concrete and concrete sludge

Ultimately there is no wholly satisfactory solution and the choice of code depends on whether or not the scrap screening process at the Celsa Melt Shop site is a waste management facility and whether the input screening is part of the process. If it is not a waste management facility, then the most, appropriate code would be 10 02 99, as there are no alternative codes listed in Chapter 13 to 16 of the LoW. This is an absolute non-hazardous entry.