RESOURCE AND WASTE SOLUTIONS PARTNERSHIP

2019 Review of TPH and Lead Concentrations in Screenings from Heavy Melting Scrap

CELSA Steel

Final Report
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Summary

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. Approximately half the scrap input is heavy melting steel (HMS), which is the predominant source of the foreign materials (known as fines or 'sweepings') delivered with the 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.

In July 2016, Resource and Waste Solutions (RWSP) reported on a detailed sampling programme to characterise these fines / 'sweepings'. This concluded that the waste was non-hazardous. This classification was agreed by Natural Resources Wales (NRW) who subsequently issued a Compliance Assessment Report requiring the following actions to be completed by Celsa every 18 months to ensure that there is no overall change to the waste classification over time:

- Ensure the levels of TPHs in the scrap screenings remain at a level that supports a non-hazardous classification;
- Lead levels are assessed to ensure no significant deterioration; and
- Where high TPH levels are identified as associated with specific scrap suppliers appropriate action is taken.

The current sampling and analysis exercise is the second 18 month check and has been designed specifically to meet these requirements.

RWSP drafted a sampling strategy and statement setting out the background and the broad principles of the input sampling. This was followed up with a detailed sampling plan, which follows the principles set out in Appendix D of WM3. The vast majority of deliveries of HMS1 & 2 are from five suppliers. The sampling plan reflected this with multiple samples taken from the largest suppliers.

The sampling took place on 17th and 18th September 2019. As on previous occasions, a mobile screener was used to screen a total of 17 different loads and the fines produced by the screener were sampled, weighed, further screened to 10mm and sent for analysis.

Overall the concentrations of TPHs and lead have further reduced since the 2016 sampling exercise. The levels of TPHs in the HMS1 & 2 screenings are still at a level that supports the previous non-hazardous assessment. The results show the average concentrations in 2018 and 2019 were consistent, with 9,033 mg/kg in 2018 and 9,179 mg/kg in 2019, (both being below the 10,612 mg/kg reported in 2016).

The results for lead show an improvement, with the average lead concentration reducing from the average of 923 mg/kg in 2016 to 448 mg/kg and 368 mg/kg in 2018 and 2019 respectively.

1. Introduction

Resource and Waste Solutions (RWSP) has been commissioned by CELSA Steel to provide on-going support with 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 the 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.

Between February and July 2016, RWSP carried out a detailed sampling programme to characterise the fines / 'sweepings' and determine the most appropriate List of Wastes (LoW) code. There was dialogue with Natural Resources Wales (NRW) throughout the sampling programme and particularly following the submission of the detailed waste classification assessment (26th July 2016), NRW made the following observation in a Compliance Assessment Report (CAR_NRW0023809):

- the report was comprehensive and represented an appropriately detailed assessment of the stockpiled and recently produced screenings.
- NRW was satisfied that there is no evidence presented in the report that indicated the waste is hazardous based on the assessment undertaken.
- NRW concurred, based on the information in the report, that the most appropriate LoW coding for the waste is 19 12 12.

However, given the nature of the waste stream and to ensure that there is no overall change to the waste classification over time, NRW required the following actions to be completed every 18 months:

- Ensure the levels of TPHs in the scrap screenings remain at a level that supports a non-hazardous classification;
- Lead levels are assessed to ensure no significant deterioration; and
- Where high TPH levels are identified to be associated with specific scrap suppliers appropriate action is taken.

The current sampling and analysis exercise is the second designed specifically to meet these requirements from the Compliance Assessment Report.

Review of specific components in scrap screenings

The original sampling campaign in 2016, considered both stockpiled screenings and the screenings from input material. RWSP proposed to NRW that the review of the specific components in scrap screenings focused solely on the current input, as the stockpile sampling was originally undertaken because there was little or no analysis of the historical deposits.

NRW has previously confirmed that they are satisfied with the approach and that the main purpose of the exercise should be to ensure that there has not been an increase in those components of specific interest i.e. TPHs and lead. The new data can then be compared directly with the previous sets of results.

2. Sampling

Previous Hazardous Waste Assessment and check sampling

The 2016 hazardous waste assessment concluded for the incoming material, that 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 for this test. Therefore HP7 Carcinogenic was discounted and this waste was classified as non-hazardous and assigned List of Wastes (LoW) code 19 12 12.

Based on the Compliance Assessment Report and subsequent communications with NRW the objectives of the review sampling should be:

- to ensure that there has not been an increase in those components of specific interest i.e. TPH and lead; and
- to compare the new results for these components directly with the previous ‘input’ results.

In March 2018, in accordance with the requirements of the Compliance Assessment Report, RWSP carried out a sampling exercise over two days and sampling 18 individual loads. These samples were analysed for lead and TPHs. Overall the results showed that concentrations of both lead and TPHs had decreased significantly since 2016, although levels of TPHs were very variable.

2019 Incoming Material Sampling Plan

RWSP drafted a sampling strategy and 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), which followed as closely as possible the 2018 sampling plan, in line with the principles set out in Appendix D of WM3.

2019 Sampling

The sampling took place on 17th and 18th September 2019. Scrap steel is received both by road and rail from 06:00 to 18:00 each day. The exercise used a mobile screener in order to achieve minimum of 16 loads representing one day's loads but spread over two days. The sampling exercise began at approximately 12:00, with the first sample taken at 12:18 on the first day and continued until approximately 17:10. On the second day, sampling began at approximately 07:30 and was completed by 14:00. On both days the weather conditions were dry and sunny, with a slight to moderate breeze.

Sampling Process, Screening and Weighing

The sampling was undertaken by the same RWSP personnel who carried out the April 2016 Sampling Campaign and the 2018 review, following the same method.

Concrete hardstanding 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 1 .

Figure 1 Labelling of buckets and trugs

Celsa supplied RWSP with weights and suppliers of HMS1 & 2 from September 2018 to August 2019. There were 51 suppliers of HMS1 & 2 in the year to the end of August 2019 but over 80% of this input came from the top six and 95% from the top 20 companies. RWSP produced a representative list of scrap steel suppliers to be sampled in approximate proportion to their annual input for the year and the list was given to Celsa staff and vehicles carrying HMS1 & 2 were selected by the weighbridge operator on arrival.

Selected vehicles were directed to a separate area where they unloaded. The load was then transferred to the screener hopper using a 360 degree excavator with a bucket, assisted by a wheeled loading shovel and occasionally by a 360 degree excavator with a grab. The screener operated to remove metals and large objects and to screen out the fines.

When the load had been screened, pointed shovels were used to take representative samples from the pile of fines that had been discharged from the screener in a bucket. When each bucket contained sufficient waste, generally between 3kg and 8kg, it was taken to the concrete pad. The number of the bucket used for each sample was recorded, the bucket of waste weighed using scales that weighed to the nearest gram, 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 letter of the trugs were recorded, along with the gross weights of each container of fines and oversize.

After weighing, a portion of fines was transferred to laboratory containers and each sealed and labelled. The oversize was weighed and, following a visual assessment, see Section 3, the oversize was discarded.

The integrity of the screening and weighing 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. These figures are provided in Annex B.

Over the two days a total of 17 individual samples from different loads was taken. This represented approximately 5% of the HMS1&2 loads received over the two days.

3. Assessment of Oversize

Oversize material screened from samples

As for previous sampling exercises, 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, aluminum, 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 2

Figure 2 Oversize material from incoming loads

Container base diameter = 34 cm

4. Laboratory Analysis

Chemical analysis of samples was undertaken by i2 Analytical Ltd, who have undertaken the analyses on previous occasions. All seventeen samples were analysed for lead and TPH C10 - C40.

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.

In addition to the samples from individual loads, RWSP made up four composite samples by combining the undersize fraction that remained from every four samples after the sample containers for land and TPH analysis had been filled for each load. These plus the seventeenth individual sample analysed for the full hazardous waste suite.

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

The laboratory has MCERTS accreditation for the analyses undertaken but this requires 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 results were corrected to an '*as received*' figure by adjusting for any 'stone' material and moisture content and then further adjusted to take account of the weight of the oversize material (greater than 10mm) which was not sent to the laboratory.

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

Waste sample as taken – Oversize content	=	Sample sent to laboratory
Sample sent to laboratory – 'Stone' material	=	Sample for analysis
Sample for analysis – Moisture content	=	Dry weight (for MCERTS reporting)

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

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

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

$$V(lab\ received) = V(wet) \times (1 - (\% \ > 10\, mm\ content/100))$$

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

$$V(waste) = V(lab\ received) \times (1 - (\%\ \mathrm{oversize}/100))$$

For the composite samples, the weight of sample received by the laboratory was subtracted from the net weight of the undersize sample and this weight adjusted to take into account the weight of oversize and the moisture and stone content in each case.

The full analytical results are provided in Annex C

5. Comparison of 2019 Lead and TPH results with 2018 and 2016 results

The main purpose of the sampling exercise is to comply with NRW's requirement to ensure that there has not been an increase in those components of specific interest, (TPHs and lead), and to allow new data to be compared directly with the previous results. **Error! Reference source not found.** and 2 provide the comparison of lead and TPH concentrations from the three sampling campaigns.

Assessment of lead concentrations

In the April 2016 and the March 2018 sampling campaigns, five and 18 samples respectively were analysed for lead; in this exercise, 17 samples were taken and all have been tested for lead to address NRW's requirements to ensure that there has been no significant increase in the lead concentrations.

Comparison of Lead Concentrations					
April 2016 Sampling Campaign		March 2018 Sampling Campaign		September 2019 Sampling Campaign	
Sample Reference	Lead (mg/kg)	Sample Reference	Lead (mg/kg)	Sample Reference	Lead (mg/kg)
IN1	350	CS07/IN/001	2,151	CS08/IN/001	189
IN2	318	CS07/IN/002	172	CS08/IN/002	195
IN3	1,663	CS07/IN/003	406	CS08/IN/003	277
IN4	n/a	CS07/IN/004	760	CS08/IN/004	232
IN5	n/a	CS07/IN/005	554	CS08/IN/005	723
IN6	n/a	CS07/IN/006	703	CS08/IN/006	47
IN7	1,324	CS07/IN/007	404	CS08/IN/007	213
IN8	n/a	CS07/IN/008	304	CS08/IN/008	412
IN9	n/a	CS07/IN/009	384	CS08/IN/009	260
IN10	n/a	CS07/IN/010	310	CS08/IN/010	117
IN11	1,219	CS07/IN/011	138	CS08/IN/011	453
IN12	n/a	CS07/IN/012	66	CS08/IN/012	458
IN13	n/a	CS07/IN/013	355	CS08/IN/013	781
IN14	n/a	CS07/IN/014	260	CS08/IN/014	669
IN15	n/a	CS07/IN/015	140	CS08/IN/015	585
IN15	n/a	CS07/IN/016	365	CS08/IN/016	170
R1	664	CS07/IN/017	305	CS08/IN/017	473
R2	n/a	CS07/IN/018	285		
R3	n/a				
Min	**318**	**Min**	**66**	**Min**	**47**
Max	**1,663**	**Max**	**2,151**	**Max**	**781**
Average	**923**	**Average**	**448**	**Average**	**368**

Table 1 Comparison of 2019, 2018 and 2016 Sampling Campaigns results for Lead

The results show the improvement in the lead concentrations has been maintained:

- In 2016, 3 of the 5 samples showed lead levels in excess of 1,200 mg/kg, in 2018 only one of the 18 samples showed lead levels in excess of 1,200 mg/kg.
- In 2018 the average lead concentration had reduced from 923 mg/kg to 448 mg/kg, less than half the previous average concentration.
- In 2019 none of the samples showed a lead level in excess of 800 mg/kg and the average lead concentration had reduced further to 368 mg/kg. This is a reduction on the previous level but, if the outlier from 2018 is ignored, the average is not significantly different from the adjusted 2018 value (348 mg/kg).

Assessment of TPH concentrations

Comparison of TPH C10 - C40 Concentrations					
April 2016 Sampling Campaign		March 2018 Sampling Campaign		September 2019 Sampling Campaign	
Sample Reference	TPH C10-C40 (mg/kg)	Sample Reference	TPH C10-C40 (mg/kg)	Sample Reference	TPH C10-C40 (mg/kg)
IN1	6,684	CS07/IN/001	7,757	CS08/IN/001	2,997
IN2	6,361	CS07/IN/002	6,320	CS08/IN/002	1,653
IN3	3,780	CS07/IN/003	9,612	CS08/IN/003	10,687
IN4	18,900	CS07/IN/004	19,555	CS08/IN/004	3,948
IN5	7,623	CS07/IN/005	10,728	CS08/IN/005	2,248
IN6	8,060	CS07/IN/006	9,370	CS08/IN/006	1,310
IN7	12,176	CS07/IN/007	18,333	CS08/IN/007	11,227
IN8	15,450	CS07/IN/008	17,066	CS08/IN/008	26,826
IN9	7,817	CS07/IN/009	10,190	CS08/IN/009	21,031
IN10	15,387	CS07/IN/010	10,327	CS08/IN/010	178
IN11	21,479	CS07/IN/011	6,641	CS08/IN/011	17,658
IN12	13,787	CS07/IN/012	2,688	CS08/IN/012	13,077
IN13	16,273	CS07/IN/013	9,278	CS08/IN/013	8,226
IN14	6,458	CS07/IN/014	3,891	CS08/IN/014	8,918
IN15	6,570	CS07/IN/015	4,379	CS08/IN/015	13,646
IN15	7,508	CS07/IN/016	5,653	CS08/IN/016	5,527
R1	5,590	CS07/IN/017	8,265	CS08/IN/017	6,879
R2	8,806	CS07/IN/018	2,547		
R3	12,922				
Min	**3,780**	**Min**	**2,547**	**Min**	**178**
Max	**21,479**	**Max**	**19,555**	**Max**	**26,826**
Average	**10,612**	**Average**	**9,033**	**Average**	**9,179**

Table 2 Comparison of 2019, 2018 and 2016 Sampling Campaigns results for TPHs

In both previous sampling campaigns, all samples were analysed for TPHs. NRW required Celsa to establish that levels of TPHs in the scrap screenings remain at a level that supported the previous assessment.

The results show the previous levels of TPHs have been maintained:

- The proportion of samples in excess of 10,000 mg/kg: in 2016, 8 of the 19 samples showed TPH levels in excess of 10,000 mg/kg, in 2018 6 the 18 samples showed TPH levels in excess of 10,000 mg/kg and in 2019 the proportion was 7 of 17 samples – a marginal increase on 2018 levels. 5 of the 17 samples in 2019 had TPH concentrations in excess of 12,500 mg/kg compared to only 3 of the 2018 samples and 7 samples in 2016.
- The minimum was lower in 2019 compared to 2016 and 2018. However, the maximum concentration was higher (26,826 mg/kg compared to 19,555 mg/kg in 2018).
- The average concentration was 9,179 mg/kg, slightly higher than the 2018 value of 9,033 mg/kg in 2018 but below the 2016 value of 10,612 mg/kg.

Scrap suppliers TPH levels

As outlined above, the sampling of HMS1 & 2 suppliers was designed to be as representative as possible of the number of loads received from Celsa's different suppliers during 2018. Table 3 provides a summary of the number of samples by supplier and the minimum, maximum and average TPH concentrations.

Supplier	Number of Samples	Minimum TPH Concentration	Maximum TPH Concentration	Average TPH Concentration
Supplier A	2	2,248	2,997	2,622
Supplier B	2	1,653	21,031	11,342
Supplier C	3	8,226	17,658	12,190
Supplier D	2	1,310	3,948	2,629
Supplier E	2	11,227	26,826	19,027
Supplier F	1	n/a	n/a	178
Supplier G	1	n/a	n/a	13,077
Supplier H	1	n/a	n/a	8,918
Supplier I	2	6,879	13,646	10,262
Supplier J	1	n/a	n/a	5,527

Table 3 September 2019 Sampling Campaign: TPH results by Supplier

In the year to the end of August 2019, 65% of HMS1 & 2 came from just four suppliers. The sampling reflected this with multiple samples taken from the largest suppliers. There was more variability in the results in 2019 with four of the larger suppliers for whom two or more loads were sampled having average TPH concentrations in excess of 10,000 mg/kg, whereas the lowest value recorded was 178 mg/kg.

Hazardous Waste Assessment

Five samples (four composite and one individual sample) were analysed for the full hazardous waste assessment suite.

The samples showed no significant differences from the original assessment of the waste as non-hazardous (See Annex D). As previously, the samples showed as nominally hazardous by HP7, HP11 and HP14 due to levels of TPHs, which on further analysis as to the nature of the TPHs have been shown not to produce these hazardous properties. Concentrations of zinc, copper and (in one sample) chromium also resulted in an apparent HP14 hazardous classification and one sample contained iron in sufficient concentration to show as hazardous due to HP4 & HP8 and HP5. These again have previously been discounted due to the contamination being in metallic form.

6. Conclusions and Recommendations

Conclusions

The levels of TPHs in the HMS1 & 2 screenings remain at a level that supports the previous non-hazardous assessment. The results show the average concentration increased slightly over the 2018 average of 9,033 mg/kg to 9,179 mg/kg, although it was still below the 10,612 mg/kg in 2016.

The results show a further improvement in the lead concentration, with the average lead concentration reducing from 923 mg/kg (2016), 448 mg/kg (2018) to 368 mg/kg in 2019.

There is more substantial variation in concentrations of TPHs than there is in the lead concentrations. Comparing 2018 and 2019 figures, this does not appear to be associated with a particular supplier, although it could be due to activities by a few companies further up the supply chain.

The full hazardous waste assessments on the five samples confirm that there is no reason to change the non-hazardous classification of the fines from HMS1 and HMS2.

Recommendations

Subject to NRW's response to this report, a follow-up sampling exercise should be carried out between March and May 2021 to confirm the levels of lead and TPHs.

Annex A: Sampling Strategy, Statement and Plan for Incoming Waste

Sampling strategy and statement – current input

Introduction

The purpose of this statement is to set out the principles to be adopted for the development of the sampling plan and subsequent sampling for the incoming HMS 1&2 scrap that gives rise to the fines/sweepings at Celsa Steel, Cardiff.

Background

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 in the scrap steel. The steel is separated from each load leaving the fines/'sweepings' which then undergo further physical processing to recover steel and non-ferrous metals.

A flow diagram of the HMS 1&2 scrap screening process is shown in Figure 1, which highlights how the sweepings are generated.

In 2016, RWSP undertook a major sampling exercise to characterise the sweepings. This assessment resulted in a non-hazardous classification for the waste. This assessment was confirmed in 2018 by the results of a second sampling exercise carried out on the HMS1 and 2 inputs only. By agreement with Natural Resources Wales (NRW) the analysis focussed on lead and total petroleum hydrocarbons (TPHs) as these were the determinands of principal concern.

Technical Guidance WM3 states that: '*The sampling plan often has to balance achievable reliability and the cost of sampling.* Therefore, given that approximately 30,000 tonnes of sweepings are received in the 1.2 million tonnes of scrap delivered to CELSA Steel each year, the sampling plan will be designed to balance the level of analysis and its reliability against on-going costs.

7. Outline of the plan and sampling

This sampling statement and the subsequent plan will comply with the principles set out Annex D of the Technical Guidance WM3. The technical goals will be to:

- confirm whether the waste is mixture of two or more subpopulations;
- determine the concentration of any hazardous substance present; and
- assess the relevant hazardous properties of the waste.

In the sampling plan each of these technical goals will be further broken down into detailed instructions and technical specifications that will cover:

- define the population(s) to be sampled;
- the sampling approach;
- the constituents to be studied;
- the scale; and
- the statistical approach chosen.

Every working day Celsa Steel receives approximately 150 loads, each containing approximately 25 tonne of scrap steel including some contaminants/foreign materials. Sampling will take place over two consecutive days. The intention is to sample the sweepings from these two days as they are produced. Sampling will cover all scrap inputs that contain fines/sweepings that are eventually stockpiled ready to be sent for further recovery.

The sampling will be designed to obtain incremental samples of each load sampled that represent the load. Samples will be taken from one or both of the undersize fraction from the Lagun Artea fixed screener and the fines from a mobile screener, depending on which is used for the selected loads.

8. Dealing with oversize material in samples

Although they are the product of screening, the sweepings almost invariably contain larger items which the laboratory cannot deal with. These are part of the waste and need to be accounted for. Samples will therefore be weighed on site and any oversize material that will not fit into the sample containers removed and both parts reweighed to determine the difference.

9. Combining samples

The incremental samples will be combined into between 16 and 24 samples (one sample for each load) for analysis of the two key components: lead and TPHs.

10. Analysis

Both the initial sampling exercises have shown that the only potential problems appears to lie with TPH and lead contamination. It is therefore proposed that all samples sent to the laboratory will be analysed for TPHs and lead.

Depending on the levels found, composite samples may be further subjected to a GC-MS scan to determine the petroleum groups present and/or analysed for DMSO extract.

These approaches allow the hazardous waste assessment to use the criteria in WM3 related to the use of 'marker compounds' to confirm or discount the carcinogenic and mutagenic properties of the TPHs present.

One in four samples (up to a maximum of six) will also be analysed for the full hazardous suite (e.g. cyanide, metals, asbestos etc.).

11. Statistics

Analysis of the previous results shows the following results for lead and TPHs.

Lead

Year	Number of samples	Minimum	Maximum	Average	Standard deviation	90% Confidence Interval	
2016	6	318	1,663	923	558	464	1,382
2018	18	66	2,151	448	449	264	632

TPHs

Year	Number of samples	Minimum	Maximum	Average	Standard deviation	90% Confidence Interval	
2016	19	3,780	21,479	10,612	5,045	8,605	12,619
2018	18	2,547	19,555	9,033	4,861	7,040	11,026

These are analytical results from each sample, adjusted for oversize and moisture but not adjusted to take into account the nature of the oil etc. Given that we do not know whether the waste has changed, we will endeavour to take 16 or more samples to be analysed for lead and TPHs. Part of these samples will also be combined into between 4 and 6 composites that will be analysed for a full hazard suite plus asbestos.

Depending on the levels founds, some or all of the composites may subsequently be analysed using GC-MS to type the TPHs and subsequently a DMSO extract.

Sampling Plan

Sampling plan for updated waste classification and assessment of fines/sweepings/steriles	
Reference: CS/08/001 Date prepared: 5 September 2019 Prepared by: Terry Coleman Reviewed by: Nigel Naisbitt Prepared for: Celsa Steel, Cardiff and Natural Resources Wales	
Involved Parties	Celsa Steel, Natural Resources Wales
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 fines/sweepings are 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/ sweepings arise from the processing of 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 the 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	The main focus will be on lead and TPHs but some samples will also be analysed for BTEX, PAHs, PCBs, heavy metals including Hg, As, Sb and Se, pH, acidity/alkalinity and CN.
Health and Safety Precautions/Access restrictions	Trained screener operator. PPE including safety helmets (with chin straps), boots, gloves, eye-protection and high visibility jackets. Loads selected by sampling to be directed to screener by a member of Celsa Steel staff.
Technical Assessment	
Populations and subpopulations	There are several potential sub-populations in the input due to the different suppliers/sites delivering HMS 1 and 2; While they are expected to be broadly similar, because they come from similar origins, we will structure our sampling to include the suppliers who provide the majority of the annual inputs, so that we are able to relate the sampling to the input.
Variability and causes	The fines arise from different suppliers, albeit from similar processes and so could vary.
Scale of sampling	Ultimately this will be determined by the ability to screen loads to produce fines. It is proposed to sample

	approximately 16 to 24 loads spread over two days. Each initial sample will be approx. 5kg.
Practical Instructions and sampling method	
Name of organisation and sampler	Resource and Waste Solutions, Terry Coleman and Nigel Naisbitt
Other parties present	
Identify sampling place and points	Celsa Steel, 82 Seawall Road, Cardiff, CF24 5TH.
Date of sampling	17 and 18 September
Statistical approach to be used	Structured, systematic sampling.
Sampling pattern and approach	Incoming loads to be divided into subpopulations by origin. Sampling of each for a regular number of loads.
Sampling equipment	See Appendix 1.
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, coned, quartered 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 sample will be weighed and then screened to separate any oversize materials (approx. >10mm). Each portion will then be weighed and the total checked. A photograph will be taken of the oversize in each case.
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. Appropriate laboratory containers will be filled with the fines portion, labelled and recorded.
Sample ref number methodology	CS08/IN /XXX

Anticipated restrictions or limitations that may impact on sample reliability	May need to depart from sampling pattern, e.g. for operational or safety reasons.
Subsampling method	Each sample will be coned and quartered to reduce to laboratory size.
Packaging	Laboratory sample jars packed in closed cardboard boxes.
Preservation	Closed containers dispatched to analytical laboratory by 13:00 next day.
Transport method	Courier/overnight delivery
Transport company	TBA
Analytical Laboratory	I2 laboratories, Watford
Contact name	James Dent

Annex A1: Equipment used

RWSP personnel have been given an intensive safety briefing by Celsa staff and instructed on the use of the two-way radio system.

The equipment to be used will be as follows:

- Mobile screener
- Four 14 litre plastic buckets;
- Four 40 litre plastic trugs;
- Electronic scales, capable of weighing up to 50kg to $\pm$ 1 g.
- Small pointed shovels
- 10mm sieves
- Tarpaulins
- Marker pen
- Sample containers and jars
- Appropriate safety equipment, including hi-visibility jackets, protective footwear and gloves, safety helmet and safety glasses.

Annex B: Sample numbers, weights, percentage over and undersize and errors

Sample Ref	Net total (g)	Net oversize (g)	Net undersize (g)	Proportion of oversize	Proportion of undersize	Check total (g)	Difference
CS08/IN/001	9187	5403	3708	58.8%	40.4%	9752	0.77%
CS08/IN/002	5934	4735	1219	79.8%	20.5%	6595	-0.30%
CS08/IN/003	6736	4294	2415	63.7%	35.9%	7350	0.37%
CS08/IN/004	5165	3645	1529	70.6%	29.6%	5815	-0.16%
CS08/IN/005	7538	4174	3357	55.4%	44.5%	8172	0.09%
CS08/IN/006	5592	4994	557	89.3%	10.0%	6192	0.66%
CS08/IN/007	8469	4699	3739	55.5%	44.1%	9079	0.34%
CS08/IN/008	8847	2489	6342	28.1%	71.7%	9472	0.17%
CS08/IN/009	6659	4043	2585	60.7%	38.8%	7269	0.42%
CS08/IN/010	7035	1994	5037	28.3%	71.6%	7672	0.05%
CS08/IN/011	7882	4243	3635	53.8%	46.1%	8519	0.05%
CS08/IN/012	4813	3194	1617	66.4%	33.6%	5452	0.04%
CS08/IN/013	8083	4624	3053	57.2%	37.8%	8318	4.65%
CS08/IN/014	4894	2953	1975	60.3%	40.4%	5569	-0.61%
CS08/IN/015	6507	3168	3334	48.7%	51.2%	7143	0.07%
CS08/IN/016	6247	3450	2791	55.2%	44.7%	6882	0.09%
CS08/IN/017	7866	4359	3501	55.4%	44.5%	8501	0.07%

Annex C: Analytical Results and Corrections for Moisture and Oversize

Samples details		Analytical Parameter	Units	Limit of detection	Accreditation Status	i2 Analytical analysis	i2 Analytical analysis corrected for moisture	Moisture corrected i2 Analytical analysis corrected for oversize
Lab Sample Number	1319970	Oversize	%	N/a	N/a	58.8		
Sample Reference	CS08/IN/001	Stone Content	%	0.1	NONE	< 0.1		
Supplier		Moisture Content	%	N/A	NONE	4.3		
Photographs	4877 to 4879	Total mass of sample received	kg	0.001	NONE	0.51		
Date Sampled	17/09/2019	Lead (aqua regia extractable)	mg/kg	1	MCERTS	480	459	189
Time Taken	12:18	TPH C10 - C40	mg/kg	10	MCERTS	7,600	7,273	2,997
Lab Sample Number	1319971	Oversize	%	N/a	N/a	79.8		
Sample Reference	CS08/IN/002	Stone Content	%	0.1	NONE	< 0.1		
Supplier		Moisture Content	%	N/A	NONE	3.7		
Photographs	4880 to 4881	Total mass of sample received	kg	0.001	NONE	0.43		
Date Sampled	17/09/2019	Lead (aqua regia extractable)	mg/kg	1	MCERTS	1,000	963	195
Time Taken	12:48	TPH C10 - C40	mg/kg	10	MCERTS	8,500	8,186	1,653
Lab Sample Number	1319972	Oversize	%	N/a	N/a	63.7		
Sample Reference	CS08/IN/003	Stone Content	%	0.1	NONE	< 0.1		
Supplier		Moisture Content	%	N/A	NONE	8.0		
Photographs	4882 to 4883	Total mass of sample received	kg	0.001	NONE	0.46		
Date Sampled	17/09/2019	Lead (aqua regia extractable)	mg/kg	1	MCERTS	830	764	277
Time Taken	13:20	TPH C10 - C40	mg/kg	10	MCERTS	32,000	29,440	10,687
Lab Sample Number	1319973	Oversize	%	N/a	N/a	70.6		
Sample Reference	CS08/IN/004	Stone Content	%	0.1	NONE	< 0.1		
Supplier		Moisture Content	%	N/A	NONE	21		
Photographs	4884 to 4885	Total mass of sample received	kg	0.001	NONE	0.36		
Date Sampled	17/09/2019	Lead (aqua regia extractable)	mg/kg	1	MCERTS	1,000	790	232
Time Taken	13:46	TPH C10 - C40	mg/kg	10	MCERTS	17,000	13,430	3,948

Samples details		Analytical Parameter	Units	Limit of detection	Accreditation Status	i2 Analytical analysis	i2 Analytical analysis corrected for moisture	Moisture corrected i2 Analytical analysis corrected for oversize
Lab Sample Number	1319974	Oversize	%	N/a	N/a	55.4		
Sample Reference	CS08/IN/005	Stone Content	%	0.1	NONE	< 0.1		
Supplier		Moisture Content	%	N/A	NONE	10		
Photographs	4887 to 4889	Total mass of sample received	kg	0.001	NONE	0.43		
Date Sampled	17/09/2019	Lead (aqua regia extractable)	mg/kg	1	MCERTS	1,800	1,620	723
Time Taken	14:55	TPH C10 - C40	mg/kg	10	MCERTS	5,600	5,040	2,248
Lab Sample Number	1319975	Oversize	%	N/a	N/a	89.3		
Sample Reference	CS08/IN/006	Stone Content	%	0.1	NONE	< 0.1		
Supplier		Moisture Content	%	N/A	NONE	32		
Photographs	4890 to 4892	Total mass of sample received	kg	0.001	NONE	0.34		
Date Sampled	17/09/2019	Lead (aqua regia extractable)	mg/kg	1	MCERTS	650	442	47
Time Taken	15:30	TPH C10 - C40	mg/kg	10	MCERTS	18,000	12,240	1,310
Lab Sample Number	1319976	Oversize	%	N/a	N/a	55.5		
Sample Reference	CS08/IN/007	Stone Content	%	0.1	NONE	< 0.1		
Supplier		Moisture Content	%	N/A	NONE	13		
Photographs	4893 to 4894	Total mass of sample received	kg	0.001	NONE	0.43		
Date Sampled	17/09/2019	Lead (aqua regia extractable)	mg/kg	1	MCERTS	550	479	213
Time Taken	15:55	TPH C10 - C40	mg/kg	10	MCERTS	29,000	25,230	11,227
Lab Sample Number	1319977	Oversize	%	N/a	N/a	28.1		
Sample Reference	CS08/IN/008	Stone Content	%	0.1	NONE	< 0.1		
Supplier		Moisture Content	%	N/A	NONE	9.0		
Photographs	4895 to 4897	Total mass of sample received	kg	0.001	NONE	0.39		
Date Sampled	17/09/2019	Lead (aqua regia extractable)	mg/kg	1	MCERTS	630	573	412
Time Taken	16:25	TPH C10 - C40	mg/kg	10	MCERTS	41,000	37,310	26,826
Lab Sample Number	1319978	Oversize	%	N/a	N/a	60.7		
Sample Reference	CS08/IN/009	Stone Content	%	0.1	NONE	< 0.1		
Supplier		Moisture Content	%	N/A	NONE	2.7		
Photographs	4899 to 4900	Total mass of sample received	kg	0.001	NONE	0.45		
Date Sampled	17/09/2019	Lead (aqua regia extractable)	mg/kg	1	MCERTS	680	662	260
Time Taken	17:10	TPH C10 - C40	mg/kg	10	MCERTS	55,000	53,515	21,031

Samples details		Analytical Parameter	Units	Limit of detection	Accreditation Status	i2 Analytical analysis	i2 Analytical analysis corrected for moisture	Moisture corrected i2 Analytical analysis corrected for oversize
Lab Sample Number	11229	Oversize	%	N/a	N/a	28.3		
Sample Reference	CS08/IN/010	Stone Content	%	0.1	NONE	< 0.1		
Supplier		Moisture Content	%	N/A	NONE	4.4		
Photographs	4904 to 4905	Total mass of sample received	kg	0.001	NONE	0.49		
Date Sampled	18/09/2019	Lead (aqua regia extractable)	mg/kg	1	MCERTS	170	163	117
Time Taken	07:42	TPH C10 - C40	mg/kg	10	MCERTS	260	249	178
Lab Sample Number	11230	Oversize	%	N/a	N/a	53.8		
Sample Reference	CS08/IN/011	Stone Content	%	0.1	NONE	< 0.1		
Supplier		Moisture Content	%	N/A	NONE	2.0		
Photographs	4906 to 4907	Total mass of sample received	kg	0.001	NONE	0.42		
Date Sampled	18/09/2019	Lead (aqua regia extractable)	mg/kg	1	MCERTS	1,000	980	453
Time Taken	08:27	TPH C10 - C40	mg/kg	10	MCERTS	39,000	38,220	17,658
Lab Sample Number	11231	Oversize	%	N/a	N/a	66.4		
Sample Reference	CS08/IN/012	Stone Content	%	0.1	NONE	< 0.1		
Supplier		Moisture Content	%	N/A	NONE	2.7		
Photographs	4909 to 4910	Total mass of sample received	kg	0.001	NONE	0.34		
Date Sampled	18/09/2019	Lead (aqua regia extractable)	mg/kg	1	MCERTS	1,400	1,362	458
Time Taken	09:30	TPH C10 - C40	mg/kg	10	MCERTS	40,000	38,920	13,077
Lab Sample Number	11232	Oversize	%	N/a	N/a	57.2		
Sample Reference	CS08/IN/013	Stone Content	%	0.1	NONE	< 0.1		
Supplier		Moisture Content	%	N/A	NONE	3.9		
Photographs	4911 to 4912	Total mass of sample received	kg	0.001	NONE	0.43		
Date Sampled	18/09/2019	Lead (aqua regia extractable)	mg/kg	1	MCERTS	1,900	1,826	781
Time Taken	10:12	TPH C10 - C40	mg/kg	10	MCERTS	20,000	19,220	8,226
Lab Sample Number	11233	Oversize	%	N/a	N/a	60.3		
Sample Reference	CS08/IN/014	Stone Content	%	0.1	NONE	< 0.1		
Supplier		Moisture Content	%	N/A	NONE	6.4		
Photographs	4913 to 4914	Total mass of sample received	kg	0.001	NONE	0.36		
Date Sampled	18/09/2019	Lead (aqua regia extractable)	mg/kg	1	MCERTS	1,800	1,685	669
Time Taken	11:40	TPH C10 - C40	mg/kg	10	MCERTS	24,000	22,464	8,918

Samples details		Analytical Parameter	Units	Limit of detection	Accreditation Status	i2 Analytical analysis	i2 Analytical analysis corrected for moisture	Moisture corrected i2 Analytical analysis corrected for oversize
Lab Sample Number	11234	Oversize	%	N/a	N/a	48.7		
Sample Reference	CS08/IN/015	Stone Content	%	0.1	NONE	< 0.1		
Supplier		Moisture Content	%	N/A	NONE	5.0		
Photographs	4915 to 4916	Total mass of sample received	kg	0.001	NONE	0.35		
Date Sampled	18/09/2019	Lead (aqua regia extractable)	mg/kg	1	MCERTS	1,200	1,140	585
Time Taken	12:32	TPH C10 - C40	mg/kg	10	MCERTS	28,000	26,600	13,646
Lab Sample Number	11235	Oversize	%	N/a	N/a	55.2		
Sample Reference	CS08/IN/016	Stone Content	%	0.1	NONE	< 0.1		
Supplier		Moisture Content	%	N/A	NONE	5.1		
Photographs	4917 to 4918	Total mass of sample received	kg	0.001	NONE	0.35		
Date Sampled	18/09/2019	Lead (aqua regia extractable)	mg/kg	1	MCERTS	400	380	170
Time Taken	13:00	TPH C10 - C40	mg/kg	10	MCERTS	13,000	12,337	5,527
Lab Sample Number	11236	Oversize	%	N/a	N/a	55.4		
Sample Reference	CS08/IN/017	Stone Content	%	0.1	NONE	< 0.1		
Supplier		Moisture Content	%	N/A	NONE	3.6		
Photographs	4919 to 4920	Total mass of sample received	kg	0.001	NONE	0.43		
Date Sampled	18/09/2019	Lead (aqua regia extractable)	mg/kg	1	MCERTS	1,100	1,060	473
Time Taken	13:32	TPH C10 - C40	mg/kg	10	MCERTS	16,000	15,424	6,879
Lab Sample Number	1319979	Oversize	%	N/a	N/a	66.9		
Sample Reference	CS08/IN/00A	Stone Content	%	0.1	NONE	< 0.1		
Supplier	Composite sample of CS08/IN/001 to CS08/IN/004	Moisture Content	%	N/A	NONE	4.3		
Photographs	4886	Total mass of sample received	kg	0.001	NONE	1.0		
Date Sampled	17/09/2019	Lead (aqua regia extractable)	mg/kg	1	MCERTS	790	756	250
Time Taken	14:00	TPH C6 - C40	mg/kg	10	MCERTS	19,000	18,183	6,019
Lab Sample Number	1319980	Oversize	%	N/a	N/a	53.7		
Sample Reference	CS08/IN/00B	Stone Content	%	0.1	NONE	< 0.1		
Supplier	Composite sample of CS08/IN/005 to CS08/IN/008	Moisture Content	%	N/A	NONE	8.0		
Photographs	4989	Total mass of sample received	kg	0.001	NONE	1.2		

Samples details		Analytical Parameter	Units	Limit of detection	Accreditation Status	i2 Analytical analysis	i2 Analytical analysis corrected for moisture	Moisture corrected i2 Analytical analysis corrected for oversize
Date Sampled	17/09/2019	Lead (aqua regia extractable)	mg/kg	1	MCERTS	820	754	349
Time Taken	16:40	TPH C6 - C40	mg/kg	10	MCERTS	32,000	29,440	13,631
Lab Sample Number	11237	Oversize	%	N/a	N/a	55.1		
Sample Reference	CS08/IN/00C	Stone Content	%	0.1	NONE	< 0.1		
Supplier	Composite sample of CS08/IN/009 to CS08/IN/012	Moisture Content	%	N/A	NONE	3.2		
Photographs	n/a	Total mass of sample received	kg	0.001	NONE	1.3		
Date Sampled	18/09/2019	Lead (aqua regia extractable)	mg/kg	1	MCERTS	490	474	213
Time Taken	09:45	TPH C6 - C40	mg/kg	10	MCERTS	33,000	31,944	14,343
Lab Sample Number	11238	Oversize	%	N/a	N/a	55.2		
Sample Reference	CS08/IN/00D	Stone Content	%	0.1	NONE	< 0.1		
Supplier	Composite sample of CS08/IN/013 to CS08/IN/016	Moisture Content	%	N/A	NONE	4.4		
Photographs	4919	Total mass of sample received	kg	0.001	NONE	1.1		
Date Sampled	18/09/2019	Lead (aqua regia extractable)	mg/kg	1	MCERTS	1,200	1,147	514
Time Taken	13:15	TPH C6 - C40	mg/kg	10	MCERTS	18,000	17,208	7,709

Annex D: Hazardous Analysis Results (Corrected for Moisture and Oversize)

				Assessment 1	Assessment 2	Assessment 3	Assessment 4	Assessment 5
Sample Ref				CS08/IN/00A	CS08/IN/00B	CS08/IN/00C	CS08/IN/00D	CS08/IN/00E
Laboratory				i2	i2	i2	i2	i2
Lab Sample Number				1319979	1319980	11237	11238	11239
Date Sampled				17/09/2019	17/09/2019	18/09/2019	18/09/2019	18/09/2019
Test Certificate No.				19-60408	19-60408	19-62002	19-62002	19-62002
Analytical Parameter	**Units**	**Limit of detection**	**Accreditation Status**	Composite sample of CS08/IN/001 to CS08/IN/004	Composite sample of CS08/IN/005 to CS08/IN/008	Composite sample of CS08/IN/009 to CS08/IN/012	Composite sample of CS08/IN/0013 to CS08/IN/016	Pot sample of CS08/IN/017 only, for full hazard assessment
Moisture Content	%	N/a		4.3	8	3.2	4.4	3.1
Adjustment factor for composites (moisture and oversize)				0.329	0.513	0.520	0.432	Single sample
Whole Sample Crushed								
Asbestos in Soil Screen/Identification Name	Type							
Asbestos in Soil Screen	Type							
Asbestos Quantification	mg/kg							
General Inorganics								
pH	pH Units	N/A	MCERTS	10.5	8.3	8	8	7.9
Total Cyanide	mg/kg	1	MCERTS	1.6	1.3	0.9	0.9	1.3
Complex Cyanide	mg/kg	1	MCERTS	1.6	1.3	0.9	0.9	1.3
Free Cyanide	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total Sulphate as SO4	mg/kg	50	MCERTS	3,157.4	3,848.9	2,598.1	3,453.2	3,587
Water Soluble Sulphate (Soil Equivalent)	g/l							
Water Soluble Sulphate (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.7	1.0	0.6	0.9	0.95
Sulphide	mg/kg	1	MCERTS	8.9	3.8	< 1.0	< 1.0	< 1.0
Total Chloride	mg/kg	5	NONE	493.3	472.1	368.9	276.3	367

				Assessment 1	Assessment 2	Assessment 3	Assessment 4	Assessment 5
Sample Ref				CS08/IN/00A	CS08/IN/00B	CS08/IN/00C	CS08/IN/00D	CS08/IN/00E
Total Sulphur	mg/kg	50	MCERTS	1,184.0	1,693.5	935.3	1,499	1,340
Ammonium as NH4	mg/kg	0.5	MCERTS	3.3	26.2	0.3	< 0.5	< 0.5
Total Organic Carbon (TOC)	%	0.1	MCERTS	2.1	3.5	2.3	1.8	2.8
Total Phenols								
Total Phenols (monohydric)	mg/kg	1	MCERTS	0.7	< 1.0	< 1.0	< 1.0	< 1.0
Speciated PAHs								
Naphthalene	mg/kg	0.05	MCERTS	0.3	1.0	0.7	1.2	0.9
Acenaphthylene	mg/kg	0.05	MCERTS	<0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	0.2	< 0.05	0.5	0.5	0.4
Fluorene	mg/kg	0.05	MCERTS	0.2	0.6	0.6	0.8	0.6
Phenanthrene	mg/kg	0.05	MCERTS	1.7	3.7	3.4	8.6	3.03
Anthracene	mg/kg	0.05	MCERTS	0.4	0.7	0.7	0.8	0.43
Fluoranthene	mg/kg	0.05	MCERTS	2.2	3.7	4.5	7.8	3.07
Pyrene	mg/kg	0.05	MCERTS	2.0	3.4	4.3	6.0	2.85
Benzo(a)anthracene	mg/kg	0.05	MCERTS	1.1	1.8	2.1	2.9	1.60
Chrysene	mg/kg	0.05	MCERTS	1.0	2.0	2.6	3.2	1.43
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	1.1	2.5	2.4	4.2	1.94
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	0.6	1.0	1.4	1.3	0.99
Benzo(a)pyrene	mg/kg	0.05	MCERTS	0.7	1.6	1.9	2.6	1.47
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	0.3	0.9	0.9	1.6	0.78
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	<0.05	< 0.05	0.3	0.5	0.3
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	0.39	1.08	1.20	1.90	0.99
Total PAH								
Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	12.0	24.1	27.4	44.5	20.7

				Assessment 1	Assessment 2	Assessment 3	Assessment 4	Assessment 5
Sample Ref				CS08/IN/00A	CS08/IN/00B	CS08/IN/00C	CS08/IN/00D	CS08/IN/00E
Heavy Metals / Metalloids								
Aluminium	mg/kg	1.00	ISO 17025					
Antimony	mg/kg	1.00	MCERTS	19.1	23.6	24.9	39.3	8.2
Arsenic	mg/kg			5.3	13.9	14.5	13.4	
Barium	mg/kg							
Beryllium	mg/kg	0.06	MCERTS	0.1	0.1	0.1	0.1	0.1
Boron (total)	mg/kg	1	MCERTS	46.0	107.8	57.2	77.7	90.8
Cadmium	mg/kg	0.2	MCERTS	3.0	3.6	2.7	5.2	4.1
Chromium	mg/kg	1	MCERTS	260	164	317	319	648
Cobalt	mg/kg	0.15	MCERTS	6.2	9.8	34.3	14.2	14.3
Copper	mg/kg	1	MCERTS	1,316	924	1,871	2,849	1,426
Iron	mg/kg	40.00	MCERTS	111,826	128,297	254,615	107,912	112,365
Lead	mg/kg	1	MCERTS	260	421	255	518	402
Magnesium	mg/kg							
Manganese	mg/kg	1	MCERTS	2,368	1,232	1,351	1,511	778
Mercury	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	0.86	< 0.3
Molybdenum	mg/kg	0.25	MCERTS	10.5	13.3	36.9	16.8	28.5
Nickel	mg/kg	1	MCERTS	65.8	92.4	223.4	177.0	475
Selenium	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Silver	mg/kg							
Tellurium	mg/kg	10.00	NONE	< 10	< 10	< 10	< 10	< 10
Tin	mg/kg							
Thallium	mg/kg	5.00	NONE	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Vanadium	mg/kg	1	MCERTS	29	17	23	19	20.7
Zinc	mg/kg	1	MCERTS	3,947	6,671	5,144	3,885	5,186

				Assessment 1	Assessment 2	Assessment 3	Assessment 4	Assessment 5
Sample Ref				CS08/IN/00A	CS08/IN/00B	CS08/IN/00C	CS08/IN/00D	CS08/IN/00E
Monoaromatics								
Benzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	13.4
Ethylbenzene	µg/kg	1	MCERTS	121.7	< 1.0	7.8	1.9	42.8
p & m-xylene	µg/kg	1	MCERTS	276.3	472.1	7.3	5.2	43.2
o-xylene	µg/kg	1	MCERTS	< 1.0	681.5	26.0	7.3	276.6
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Petroleum Hydrocarbons - only enter by Aliphatic & Aromatics or TPH5								
TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	0.001	MCERTS	< 0.001	0.4	< 0.001	< 0.001	0.3
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	1	MCERTS	8.2	31.3	22.9	9.9	32.8
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	125.0	508.1	311.8	237.4	311
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	624.9	1,744.8	1,299.1	906.5	1,124
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	8	MCERTS	3,946.8	10,263.8	9,872.8	4,316.5	5,618
TPH-CWG - Aliphatic (EC5 - EC35)	mg/kg	10	MCERTS	**4,604.6**	**12,316.5**	**11,431.7**	**5,611.4**	**6,915**
TPH-CWG - Aromatic >EC5 - EC7	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	0.0
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	0.001	MCERTS	1.3	1.7	0.1	0.0	0.5
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	1	MCERTS	0.9	15.9	16.1	17.3	25.1
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	46.0	215.5	124.7	138.1	125.3
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	157.9	564.5	431.3	401.4	350
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	10	MCERTS	822.2	2,001.4	3,273.6	1,294.9	1,383
TPH-CWG - Aromatic (EC5 - EC35)	mg/kg	10	MCERTS	**1,019.6**	**2,822.5**	**3,845.2**	**1,856.1**	**1,858**
TPH Total Aliphatic & Aromatics (EC5 - EC35)	mg/kg			**5,624**	**15,139**	**15,277**	**7,468**	**8,773**

				Assessment 1	Assessment 2	Assessment 3	Assessment 4	Assessment 5
Sample Ref				CS08/IN/00A	CS08/IN/00B	CS08/IN/00C	CS08/IN/00D	CS08/IN/00E
PCBs by GC-MS								
PCB Congener 28	mg/kg	0.001	MCERTS	1.2	1.0	2.2	0.6	0.22
PCB Congener 52	mg/kg	0.001	MCERTS	0.2	0.2	0.3	0.1	0.038
PCB Congener 101	mg/kg	0.001	MCERTS	0.1	0.0	0.1	0.0	0.013
PCB Congener 118	mg/kg	0.001	MCERTS	0.1	0.0	0.1	0.0	0.027
PCB Congener 138	mg/kg	0.001	MCERTS	0.0	0.0	< 0.001	0.034	0.022
PCB Congener 153	mg/kg	0.001	MCERTS	0.0	0.0	0.1	< 0.001	< 0.001
PCB Congener 180	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Total PCBs	mg/kg			**1.63**	**1.36**	**2.78**	**0.78**	**0.32**