Milestone 44
LCA Case Study Input to WP2
Date 25.08.2022

Dissemination level: Public

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This project has received funding from the Euratom research and training programme 2019-2020 under grant agreement No 945098.

Project acronym PREDIS	Project title PRE-DISposal management of radioactive waste	Grant agreement No. 945098
Milestone No. MS44	Milestone title LCA Case Study Input to WP2	
WP No 6	Date version 25.08.2022	Due date M24
Lead beneficiary Galson Sciences Limited		
Main author Callum Eldridge	Reviewed by Thierry Mennecart, WP6 leader (SCK CEN)	Accepted by Maria Oksa, Coordinator (VTT)
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Abstract

Description of the input data for the PREDIS WP2 Life-Cycle Assessment (LCA) case study provided by WP6 on the treatments of IRIS ashes.

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Acknowledgement

This project has received funding from the Euratom research and training programme 2019-2020 under grant agreement No 945098.

1 Milestone Description

Milestone 44, associated with Work Package 6 'Innovations in solid organic waste treatment and conditioning' has been completed on 25.08.2022.

The justification for the readiness is described below and complies with the Grant Agreement Description of Action noting verification by the M6.6 Report.

The readiness of the milestone was reviewed and agreed upon by Thierry Mennecart (SCK CEN) as WP6 Leader.

2 Milestone Content

The topic of Work Package 6 (WP6) of the PREDIS project is Innovations in solid organic waste treatment and conditioning. This Work Package includes participation in Life-Cycle Assessment (LCA) case study being undertaken in Task 2.5 as part of Work Package 2. The purpose of this Milestone, MS44, is to provide input from WP6 to the LCA case study being undertaken as part of Task 2.5.

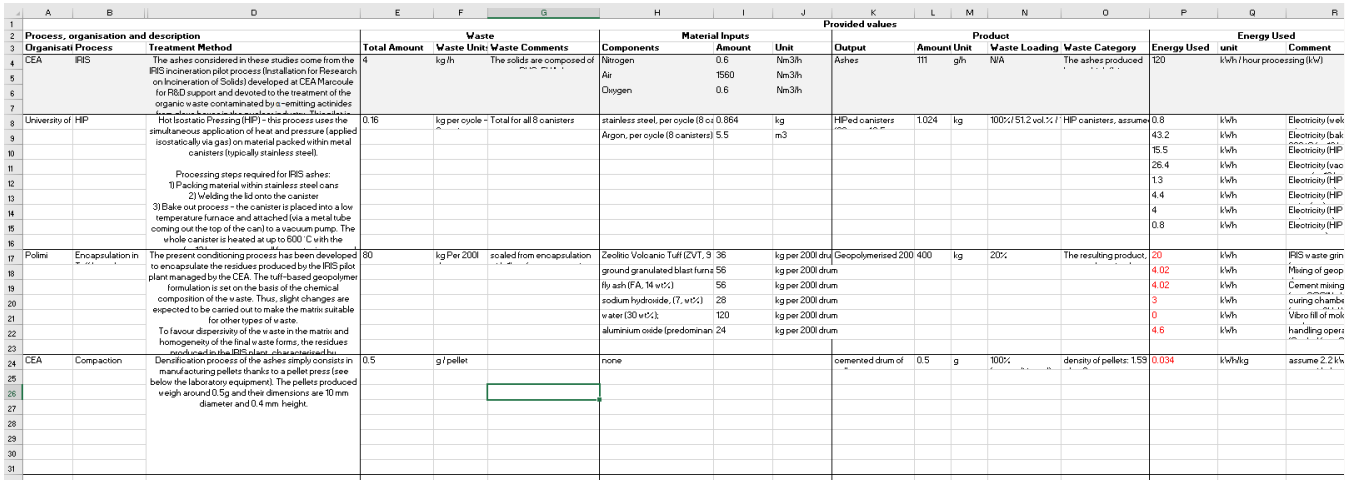
A meeting between the respective leads for WP6, the LCA case study and this Milestone was held to identify which processes to target for the case study. The outcome was the decision to focus on treatment of ashes arising from the IRIS process, which is being pursued within WP6 with three technologies:

- Hot-Isostatic Pressing (HIP) at the University of Sheffield
- Encapsulation in Geopolymer at Politecnico di Milano
- Compaction at CEA

Within the PREDIS project, each of these conditioning technologies is being developed using the same reference waste – inactive ashes from the IRIS process developed at CEA. The common starting point enables the processes to be compared against each other from an LCA perspective which is not possible for the full range of technologies pursued in WP6 due to the diversity of input waste types.

A questionnaire was developed to collect information salient to the LCA case study and circulated to the groups developing treatment technologies and to CEA for information about the IRIS process. The questionnaire collected data about the values for raw material inputs, energy inputs, waste loadings, secondary waste streams and final product characteristics. To help explain the questionnaire, increase uptake and discuss any key issues, a meeting was held between participants of the questionnaire.

The returned questionnaires were synthesised into a spreadsheet recording the data provided by the experimentalists, an excerpt of this sheet is shown in Figure 2.1. In some places the required data were not available and assumptions needed to be made to derive representative values. Where this occurred, the source and derivation of the presented values was recorded. Part of the sheet was also used to scale the processes to equivalent volumes to make them comparable. The spreadsheet and underlying questionnaires were shared with the LCA case study team lead as well as being made available in the PREDIS Teams group for Task 6.7.



	A	B	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1										Provided values							
2	Process, organisation and description			Waste			Material Inputs			Product					Energy Used		
3	Organisati	Process	Treatment Method	Total Amount	Waste Unit	Waste Comments	Components	Amount	Unit	Output	Amount	Unit	Waste Loading	Waste Category	Energy Used	unit	Comment
4	CEA	IRIS	The ashes considered in these studies come from the IRIS incineration pilot process (Installation for Research on Incineration of Solids) developed at CEA Marcoule for R&D support and devoted to the treatment of the organic waste contaminated by α-emitting actinides	4	kg/h	The solids are composed of	Nitrogen	0.6	Nm3/h	Ashes	111	g/h	N/A	The ashes produced	120	kWh / hour processing (kW)	
5							Air	1560	Nm3/h								
6							Oxygen	0.6	Nm3/h								
7																	
8	University of	HIP	Hot Isostatic Pressing (HIP) – this process uses the simultaneous application of heat and pressure (applied isostatically via gas) on material packed within metal canisters (typically stainless steel).	0.16	kg per cycle – Total for all 8 canisters		stainless steel, per cycle (8 ca	0.864	kg	HIPed canisters	1.024	kg	100% / 51.2 vol.% /	HIP canisters, assume	0.8	kWh	Electricity (wel
9							Argon, per cycle (8 canisters)	5.5	m3						43.2	kWh	Electricity (bak
10															15.5	kWh	Electricity (HIP
11															26.4	kWh	Electricity (vac
12															1.3	kWh	Electricity (HIP
13															4.4	kWh	Electricity (HIP
14															4	kWh	Electricity (HIP
15															0.8	kWh	Electricity (HIP
16																	
17	Polimi	Encapsulation in	The present conditioning process has been developed to encapsulate the residues produced by the IRIS pilot plant managed by the CEA. The tuff-based geopolymer formulation is set on the basis of the chemical composition of the waste. Thus, slight changes are expected to be carried out to make the matrix suitable for other types of waste. To favour dispersivity of the waste in the matrix and homogeneity of the final waste forms, the residues	80	kg Per 200l	scaled from encapsulation	Zeolitic Volcanic Tuff (ZVT, 9	36	kg per 200l dru	Geopolymerised 200	400	kg	20%	The resulting product,	20	kWh	IRIS waste grin
18							ground granulated blast furna	56	kg per 200l drum						4.02	kWh	Mixing of geop
19							fly ash (FA, 14 wt%)	56	kg per 200l drum						4.02	kWh	Cement mixing
20							sodium hydroxide, (7, wt%)	28	kg per 200l drum						3	kWh	curing chambe
21							water (30 wt%)	120	kg per 200l drum						0	kWh	Vibro fill of mol
22							aluminium oxide (predominan	24	kg per 200l drum						4.6	kWh	handling opera
23																	
24	CEA	Compaction	Densification process of the ashes simply consists in manufacturing pellets thanks to a pellet press (see below the laboratory equipment). The pellets produced	0.5	g / pellet		none			cemented drum of	0.5	g	100%	density of pellets: 1.59	0.034	kWh/kg	assume 2.2 kW
25																	
26																	
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Figure 2.1: Excerpt from the LCA case study input spreadsheet.