ACWA Power SolarReserve Redstone Solar Thermal Power Plant (RF) Proprietary

DOCUMENT

Heliostat and Plant Material Disposal Plan

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1 TABLE OF CONTENTS

2 Purpose

The purpose of this document is to present to stakeholders the ACWA Power SolarReserve Redstone Solar Thermal Power Plant (RF) Proprietary Limited (hereinafter referred to as "Project Company")disposal plan for both the Balance of Plant and their respective Ends of Life.

3 Scope

This procedure is applicable to all material and components associated with the heliostats and the balance of plant for the ACWA Power SolarReserve Redstone Solar Thermal Power Plant (RF) Proprietary Limited (hereinafter referred to as "Redstone").

4 Applicable Laws and Reference Document

South Africa has very strict regulations regarding waste management. These are clearly defined and this disposal plan is subject to those regulations

This plan is governed by the following applicable laws:

National Environmental Management Act, 1998 (Act 107 of 1998) (as amended) National Environmental Management Waste Act (59/2008)
Waste Classification and Management Regulations

- Norms and Standards for the Assessment of Waste to Landfill
- Norms and Standards for the Disposal of Waste to Landfill

Minimum Requirements for the Handling, Classification and Disposal of Hazardous Waste
Department of Water Affairs and Forestry
Republic of South Africa
Second Edition 1998

5 Overview of End of Life Disposal Process

At the end of life of every component or product the following different work flows are applicable to the material generated out of the disposal :

- Recycling of Material;
- Disposal of Non Hazardous Material as General waste and
- Disposal of Hazardous Material as Hazardous waste.

It is a policy decision of Project Company and a requirement of the Regulations to maximize the recycling of all component materials. As the definition of non-recyclable material (hazardous and non-hazardous waste) is clearly defined in the Regulations these process are not repeated further in this document.

The balance of this plan is to highlight the recycling of the material that will be disposed of during the operational and end of life phase of the project.

6 Material Breakdown of Materials

The Redstone project comprise of the following different material classifications:

6.1 Solar Field

The Solar Field consisting of the heliostatfield, power distribution and communication network comprise of the following material groups as presented below:

- Concrete;
- Cementitious products (grout, crack repairers);
- Concrete Steel Reinforcing;
- Building Material (Brick Plastering, Steel Roof Sheeting);
- Galvanised Steel Heliostat Structures;
- Mirrors;
- Structural Organic Adhesives and Fillers;
- PVC or other Plastomer Coated Copper Cabling;
- Electronic Circuits Boards and
- Other Materials.

6.2 Balance of Plant

The Balance of Plant consisting of the solar tower with receiver, molten salt system, water treatment plant, steam generation system, steam turbine and generator, electrical systems and buildings comprise of the following material groups as presented below:

- Concrete;
- Cementitious products (grout, crack repairers, etc);
- Concrete Steel Reinforcing;
- Building Material (Brick, Plastering, Steel Roof Sheeting, etc);
- Ferrous Steel Structures and Piping;
- Ceramic Insulation Materials;
- Aluminium Sheeting (Cladding);
- Copper Electrical Cables;
- Steel Pumps, Vessels, Turbines and other rotating equipment;
- Stainless Steel Vessel (Hot Molten Salt);
- Copper wound motors;
- Organic insulation materials (PVC and other Plastomers);
- Aluminium Cable;
- Hydrocarbons (Fuels and Lubricants);
- Water Treatment Chemicals;
- Electrical steel panels;
- Electronic Waste and

Other Materials.The above materials represent the bulk of materials on site. The materials identified as other are estimated to be less than 2% by weight.

7 Recycling of Main Material Groups

South Africa has developed an extensive recycling industry. However, some materials such as polyurethane (a possible component in the heliostat mirrors) is recyclable in Europe, but as of yet no known capacity of this type of recycling exists in South Africa. All other disposal methods presented below are available in South Africa. Again the material groups are presented separately for the heliostat and Balance of Plant.

Material Group	Disposal Method	Final Material
Concrete	Crushing and reuse as building aggregate	Aggregate
Cementitious products (grout, crack repairers, etc)	Crushing and reuse as building aggregate	Aggregate
Concrete Steel Reinforcing	Steel mill recycling	Steel
Building Material (Brick Plastering, Steel Roof Sheeting)	Crushing and reuse as building aggregate	Aggregate
	Steel mill recycling	Steel
Galvanised Steel Heliostat Structures	Steel mill recycling	Steel
Mirrors	Crush and Re-melt	Glass
Structural Organic Adhesives and Fillers	Hazardous Waste Disposal	Hazardous Waste
	Polyurethane Recycling	Polyurethane
PVC or other Plastomer Coated Copper Cabling	Micronisation for use as shoe sole filler	PVC Filler
Electronic Circuits Boards	E Waste Recycling	Gold
		Copper
		Plastics

Table 1Heliostat Disposal Pathways

Material Group	Disposal Method	Final Material
Concrete	Crushing and reuse as building aggregate	Aggregate
Cementitious products (grout, crack repairers)	Crushing and reuse as building aggregate	Aggregate
Concrete Reinforcing	Steel mill recycling	Steel
Building Material (Brick, Plastering, Steel Roof Sheeting, etc.)	Crushing and reuse as building aggregate	Aggregate
	Steel mill recycling	Steel
Ferrous Steel Structures and Piping	Steel mill recycling	Steel
Ceramic Insulation Materials	Hazardous Waste Disposal	Hazardous Waste
Aluminium Sheeting (Cladding)	Aluminium Smelter	Aluminium
Copper Electrical Cables.	Copper Recycling	Copper
Steel Pumps, Vessels, Turbines and other rotating equipment.	Steel mill recycling	Steel
Stainless Steel Vessel (Hot Molten Salt).	High Value Stainless Steel Recycling	Stainless Steel
Copper wound motors.	Copper Recycling	Copper
Organic insulation materials (PVC and other Plastomers).	Micronisation for use as shoe sole filler	PVC Filler
Aluminium Cable.	Aluminium Smelter	Aluminium
Hydrocarbons (Fuels and Lubricants)	Recycle / Hazardous Waste Disposal	Hazardous Waste
Water Treatment Chemicals.	Hazardous Waste Disposal	Hazardous Waste
Electrical steel panels.	Steel mill recycling	Steel
	Copper Recycling	Copper
Electronic Waste	E Waste Recycling	Gold
		Copper
		Plastics
Molten Salt	Reprocessing	Soluble Fertilizer

Table 2Balance of Plant Disposal Pathways

8 Conclusion

The Redstone project consists of traditional non - exotic construction materials and non - hazardous material. As highlighted in this document, the materials used during the construction phase will be highly recyclable. The main working fluids, water and molten salts, are both natural material; these natural materials are not only harmless but are critical elements in the biological lifecycle as an example molten salt as a soluble fertilizer. Thus the project, apart from being a sustainable energy resource, has a limited impact of the greater environment.