الشركة الليبية للحديد والصلب

LIBYAN IRON AND STEEL COMPANY

BY-PRODUCTS CATALOGUE

2020

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Introduction

This catalogue covers types, characteristics & end uses of LISCO byproducts generated during processing of its main iron and steel products namely sponge iron, semi finished & finished steel products.

The accumulative rate of generation of byproducts is estimated to be 7 % of LISCO total iron & steel product.

Steel slag from the 2 steel melt shops is the highest generated byproducts which accounts for over 40 % of total byproducts , followed by iron ore fines from direct reduction plant with 36 %.

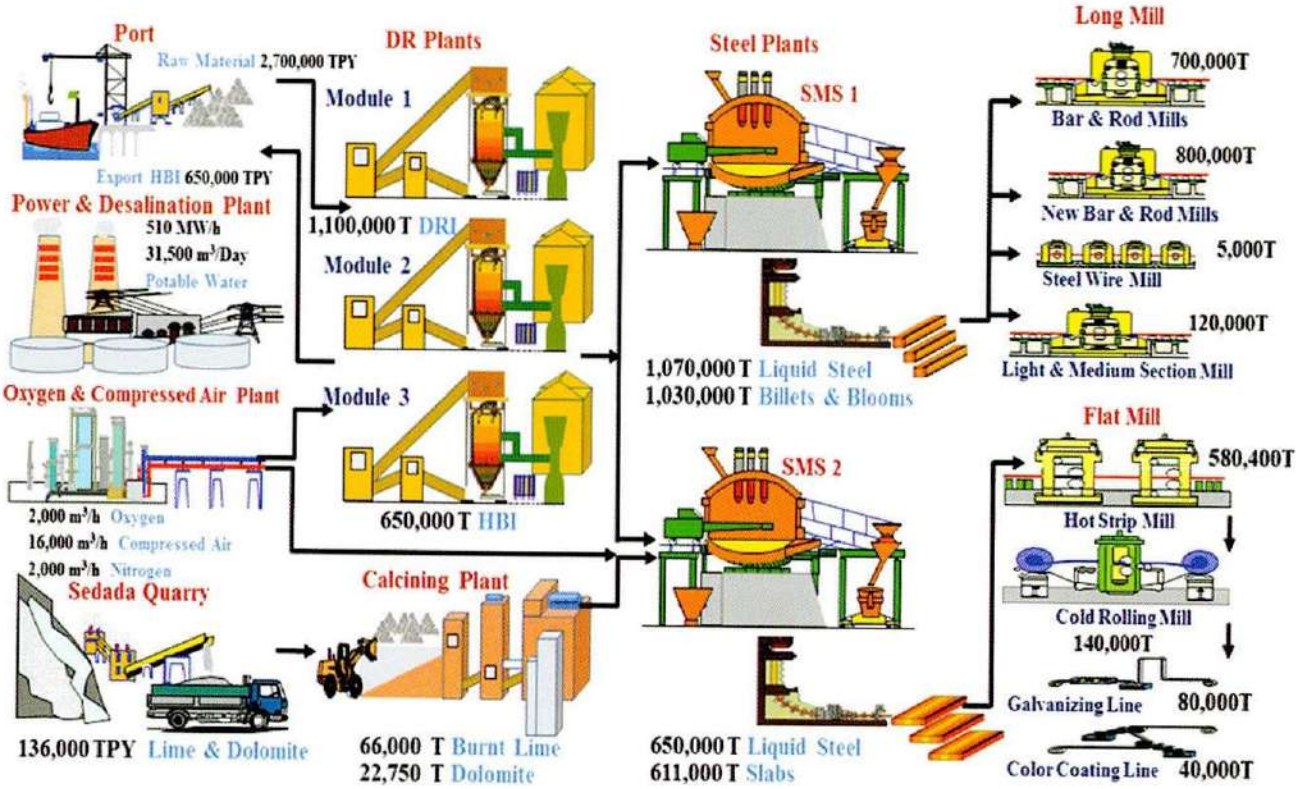
LISCO has made great strides in its commitment to utilize byproducts by allocating great resources to research on its utilization with economical & environmental benefits.

Additionally LISCO set up an administrative body to oversee the management of byproducts & assigned technical committees that coordinate with local and international centers in search for opportunities to utilize the product on commercial scale. LISCO efforts were rewarded with the acquiring of ISO 14001 in 2007.

Most byproducts are widely used as building material where slag is used as aggregate for road base material & in asphalt , iron ore fines is used in cement & iron production.

This catalogue is furnished as a reference that may facilitate and assist in enriching the knowledge of the end users and promote the use of the byproducts.

LISCO Production & Auxiliary Facilities



Iron Ore Pellets Fines

Product Description: Dark red powder generated from screening of iron ore pellets prior to charging to direct reduction furnaces.

Generation Rate 30 kg/t of ore pellets

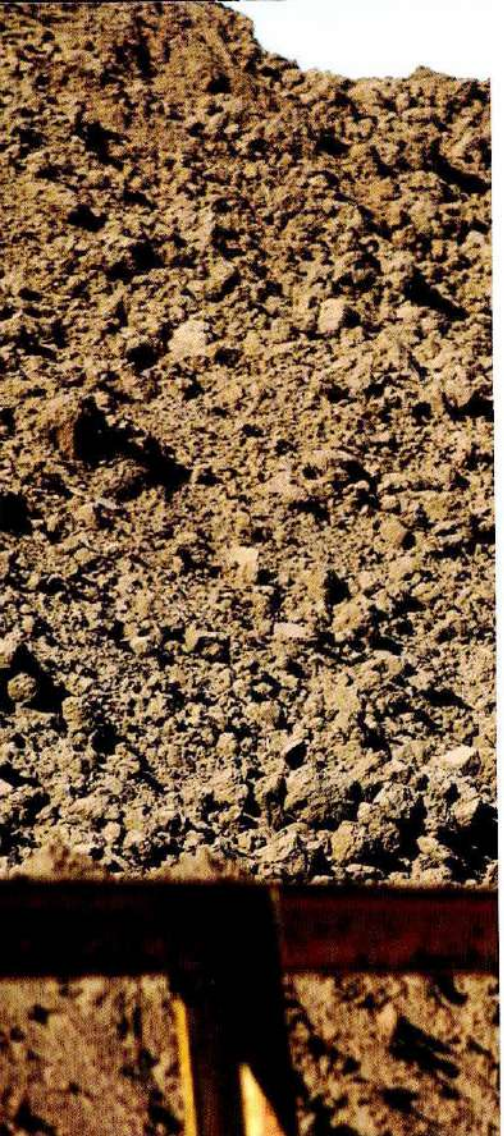
Iron Ore Fines Physical Properties & Main Chemical Constituents

Physical Properties		Main Chemical Constituents (%)					
Grain Size (mm)	Bulk Density (t/m3)	Total Fe	CaO	Al_2O_3	SiO_2	S max	P max
- 6	2.2	62 - 67	0.5 - 1.5	0.2 – 1.0	1.5 – 3.0	0.04	0.04

End Uses

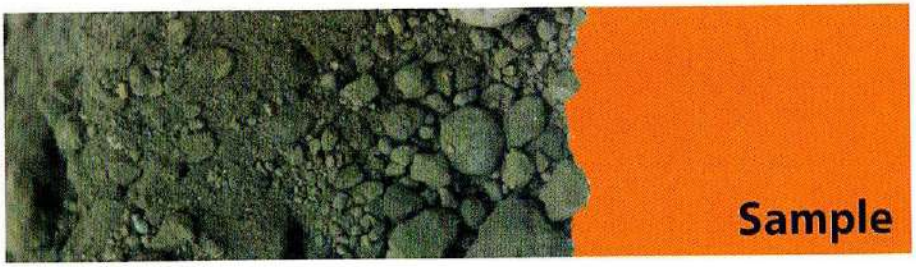
- Blast furnace sinter.
- Pelletizing and briquetting to be used as raw material for direct reduction & blast furnace.
- Part of cement raw material.
- Source of oxygen in EAF molten steel.

Material CAS no. 1309-37-1



Sludge

Product Description: Dark grey fine iron oxide dust emitted from DR furnaces , screens & conveyors which collected as slurry in settling pond to be dried and shipped to stocking area.



Generation rate 30 kg/ t DRI & HBI

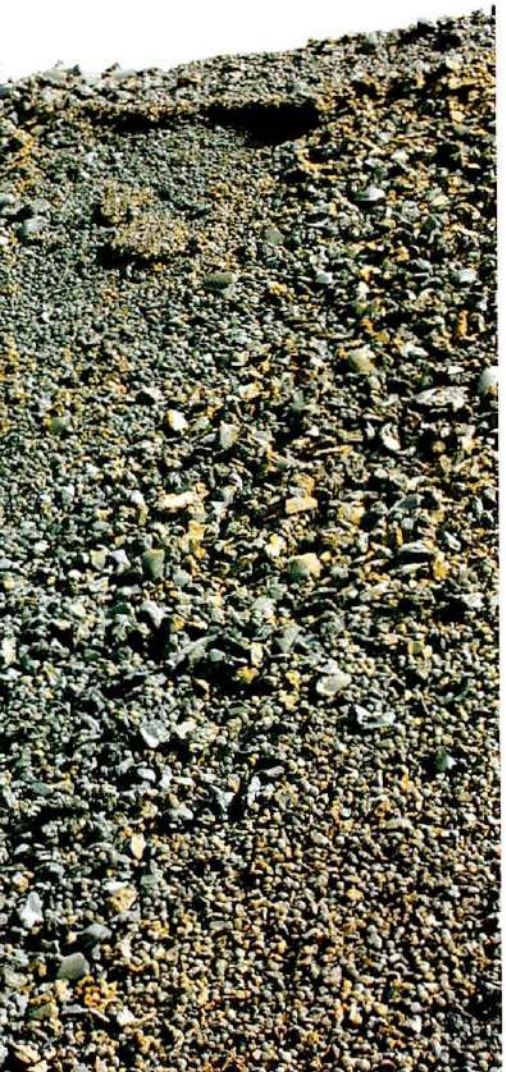
Sludge Physical Properties & Main Chemical Constituents

Physical Properties		Main Chemical Constituents (%)					
Grain Size (mm)	Bulk Density (t/m3)	Total Fe	CaO	Al_2O_3	SiO_2	S max	P max
- 2	2.2	62 - 67	0.5 - 1.5	0.2 – 1.0	1.5 – 3.0	0.04	0.04

End Uses

- Blast furnace sinter.
- Pelletizing and briquetting to be used as raw material for direct reduction & blast furnace.
- Part of cement raw material.
- Source of oxygen in EAF molten steel.

Material CAS no. 1309-37-1



Hot Briquetted Iron (HBI) Chips

Product Description: Broken pieces of screened HBI briquettes.

Sample

Generation rate 70 kg /t HBI

HBI Chips Physical Properties & Chemical Composition

Physical Properties		Main Chemical Constituents (%)						
Bulk Density (t/m3)	Grain Size (mm)	Fe Metallic	C	SiO_2	CaO	Al_2O_3	P max	S max
6 - 25	2.8	80 - 88	0.8 - 1.5	1.5 - 2.5	0.5 - 1.0	0.4 - 0.8	0.04	0.03

End Uses

- Raw material for iron and steel making .

Material CAS no. 7439-89-6

Hot Briquetted (HBI) & Sponge Iron Pellets (DRI) Fines

Product description: Black colored fines of screened HBI & DRI products.

Specific generation rate 10 kg/t HBI & DRI

HBI & DRI Fines Physical Properties & Chemical Composition

Physical Properties		Main Chemical Constituents (%)						
Bulk Density (t/m3)	Grain Size (mm)	Fe Metallic	C	SiO_2	CaO	Al_2O_3	P max	S max
2.8	-3	80 - 88	0.8 - 2.0	1.5 - 2.5	0.5 - 1.0	0.4 - 0.8	0.04	0.03

End Uses

- Raw materials for cast iron and steel making in cold briquetted form or by direct injection in powder form .

Material CAS no. 7439-89-6

EAF Steel Slag

Product Description: Light grey lumps & fines resulting from melting of DRI & scrap in EAF with lime and dolomite.

Sample

Generation Rate 100 kg/t of molten steel

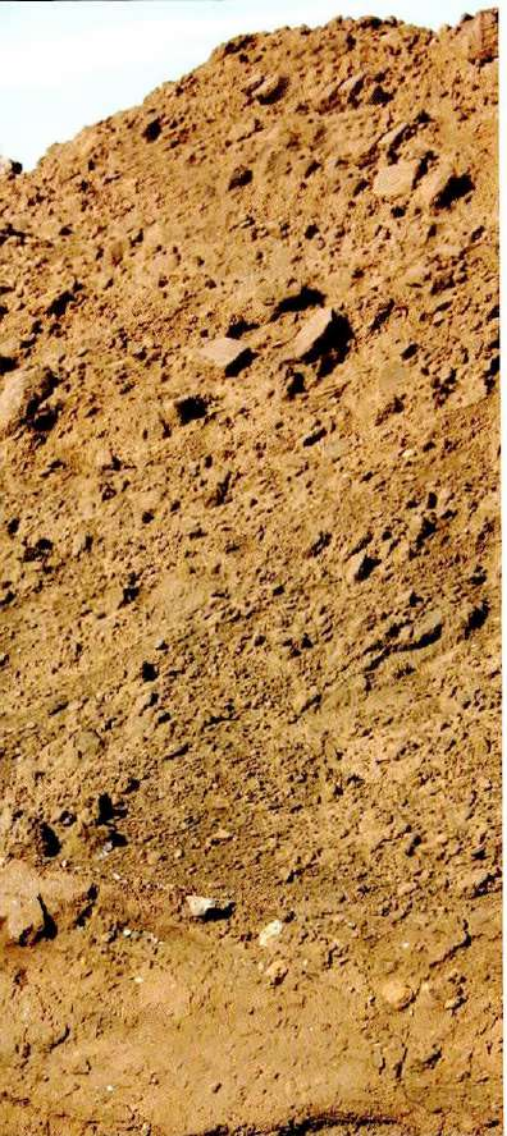
EAF Steel Slag Physical Properties & Chemical Composition

Physical Properties			Main Chemical Constituents (%)					
Steel Scrap (%)	Bulk Density (t/m3)	Grain Size (mm)	CaO	MgO	SiO_2	Al_2O_3	Fe_2O_3	MnO
2 - 5	3.5	1.0 - 300	30 - 45	4 - 10	15 - 25	5 - 10	15 - 25	1 - 3

End Uses

- Base aggregate for roads , parks and soil stabilization (ASTM D 2940) .
- Aggregate in concrete & asphalt mixes (ASTM D 5106) .
- Railway ballast .
- Steel scrap extraction by magnetic separation .
- Raw material addition for cement making .

Material CAS no. 65996-69-2



Electric Arc Furnace (EAF) Dust

Product Description: Brown colored fines emitted from EAF steelmaking processes.

Generation Rate 15 kg/t of molten steel

EAF Dust Physical Properties & Chemical Composition

Physical Props		Main Chemical Constituents (%)						
Bulk Density (t/m3)	Grain Size (mm)	CaO	MgO	SiO_2	Al_2O_3	Fe Total	C	Zn
1.6	-1.0	10 - 20	5 - 10	2 - 4	0.5 - 1.5	25 - 35	1.5 - 3	5 - 12

End Uses

- Source of iron ,lime & carbon that can be injected in powder form or briquettes into EAF molten steel.
- Part of Portland cement raw materials.
- Source of Zn metal.

Material CAS no. CaO :1305-78-8 , Fe2O3: 1332-37-2 , MgO: 1309-48-4 , SiO2: 7631-86-9 , Al2O3: 1344-28-1 ZnO: 1314-13-2 Mn: 7439-96-5

DRI Dust

Product Description: Light grey fines generated from DRI/lime belt conveyor unit .

Generation Rate 10 kg/t of molten steel

DRI Dust Physical Properties & Chemical Composition

Physical Properties		Main Chemical Constituents (%)					
Bulk Density (t/m3)	Grain Size (mm)	Total Fe	MgO	SiO_2	Al_2O_3	CaO	C
1.6	- 1.0	45 - 65	5 - 10	2 – 4	0.5 – 1.5	10 - 20	2 - 4

End Uses

- Source of iron ,lime & carbon that can be injected in powder form or briquettes into EAF molten steel.

Material CAS no. CaO :1305-78-8 , Fe2O3: 1332-37-2 , MgO: 1309-48-4 , SiO2: 7631-86-9 Al2O3: 1344-28-1 ZnO: 1314-13-2 Mn: 7439-96-5

Ladle Skulls

Product Description: Cup cake shaped solid pieces mainly of steel from remaining molten steel ladles.

Skull main Constituents

Steel scrap	60 – 80 %
Ladle slag	20 – 40 %

Physical Description

Weight(t)	: 6 – 20
Height	0.5 – 1.5 m
Large Dia.	2.0 – 2.5 m
Small Dia.	1.0 – 1.5 m

End Use

Scrap material for iron and steelmaking.

Materials CAS no. Fe :7429-89-6 , Mn:7439-96-5 , CaO:1305-78-8 SiO:7631-86-9

Refractory Bricks

Product description: Pieces of used refractory brick from steel furnaces & ladles mainly alumina and magnesia bricks.

Generation Rate

Brick Type	Generation Rate (Kg/t molten steel)
Magnesia	1.0
Alumina	1.1

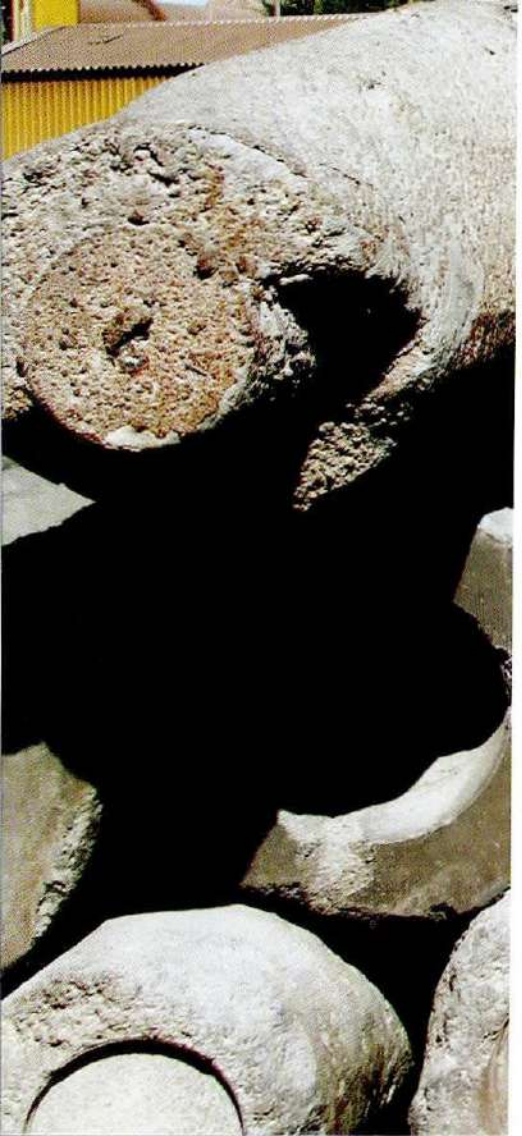
Used Refractories Bricks Physical Properties & Chemical Composition

Brick Type	Physical Properties		Main Chemical Constituents (%)				
	Bulk Density (t/m3)	Size (mm)	CaO	MgO	SiO_2	Al_2O_3	Fe_2O_3
Magnesia	2.8 - 3.0	100 - 300	1.0 - 2.0	90 - 95	0.2 - 5	0.1 - 0.5	0.5 - 5
Alumina	2.5 - 2.9	100 - 300	0.1 - 0.5	0.2 - 5.5	1.5 - 15	75 - 95	0.2 - 1.5

End Uses

- Refractory material for batch repair of furnaces and ladles lining .
- Crushed powder for batch repair of furnaces and ladles lining (gunning & ramming material).
- Paving & surface bricks in public places (Parks & yards).

Material CAS no. MgO : 1309-48-4, C : 7782-42-5 , Al2O3 : 1344-28-1



Graphite Electrodes Scrap

Product Description: Pieces of used EAF graphite electrodes.

Physical Properties

- Dimensions : Pole diameter approx. 506 mm
- Specific density: 2.2 t/m3
- Bulk density : 1.5 t/m3
- Ash content : 1 % max

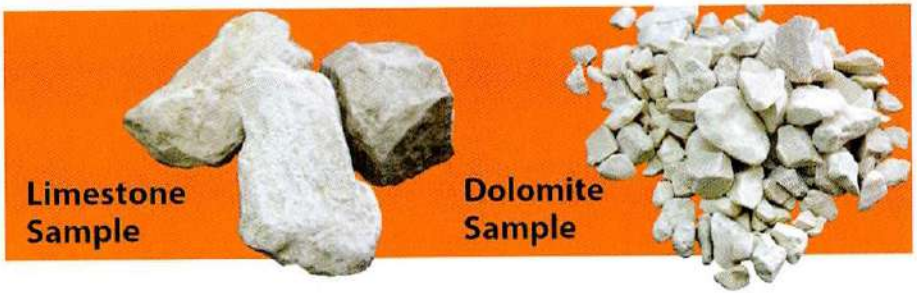
End Uses

- Source of carbon in iron & steel making.
- Machining to smaller electrodes.

CAS no. 7782-42-5

Limestone & Raw Dolomite

Product Description: White & beige colored fines and lumps of screened limestone & raw dolomite prior to calcining to produce burnt lime & dolomite.



Generation rate 60 kg/t of limestone & raw dolomite

Limestone & Raw Dolomite Physical Properties & Chemical Composition

Material Type	Physical Properties		Main Chemical Constituents (%)				
	Bulk Density (t/m3)	Size (mm)	CaO	MgO	SiO_2 max	Al_2O_3 max	Fe_2O_3 max
Limestone	0.9 - 1.1	-25	48 - 56	0.1 - 1.5	1.5	1	1
Dolomite	0.8 - 1.0	-5	25 - 33	17 - 22	1.5	1	1

End Uses

- Main raw material for Portland cement.
- Aggregate in asphalt for roads, pavements & building roofs.
- Fine aggregate in concrete mixes.
- Part of poultry feed.
- Refractory material.
- Filtration material for polluted water.
- Glass making.

CAS no. Limestone : 1317-65-3 , Dolomite :16389-88-1, SiO2: 14808-60-7

Burnt Lime & Dolomite Fines

Product Description: White & beige colored powder generated from screening of burnt lime and dolomite products.

Generation rate 60 kg/ t of burnt lime & dolomite produced

Burnt Lime & Dolomite Physical Properties & Chemical Composition

Material Type	Color	Physical Properties		Main Chemical Constituents (%)				
		Bulk Density (t/m3)	Size (mm)	CaO	MgO	SiO_2 max	Al_2O_3 max	Fe_2O_3 max
Lime	White	0.8 - 1.0	-25	92 min	3 max	1.5	1	1
Dolomite	Beige	0.7 - 0.9	-5	52 - 59	35 - 40	1.5	1	1

End Uses

- Added to cement mortar mixes as per (ASTM 5, ASTM 207, ASTM 1489).
- Disinfecting material for livestock & poultry barns.
- Added to asphalt to improve its properties.
- Filtration material for polluted water.
- Waste acid neutralization.
- Paint making.

CAS no. Lime : 1305-78-8 , Dolomite : 37247-91-9

Mill Scale

Product Description: Light grey fines & pieces of iron oxides formed at high temperature on the surface of semi finished & finished steel products during processing.

Sample

Generation Rate 10 - 20 kg/t of steel products

Mill Scale Physical Properties & Chemical Composition

Physical Properties		Chemical Analysis (%)					
Grain Size (mm)	Bulk Density (t/m3)	Total Fe	CaO	Al_2O_3	SiO_2	P max	S max
-50	4.5 - 5.5	65 - 71	0.2 - 0.5	0.2 - 1.0	0.2 - 1.0	0.04	0.04

End Uses

- Part of Asphalt material.
- Welding electrodes flux.
- Part of cement raw materials as source of iron oxide.
- Source of oxygen in steel melting process (EAF & BOF).
- Part of raw material for blast furnace feed material (sinter).
- Magnets making.
- Glass & mineral wool making.

Material CAS no. 65996-74-9

Pickling Red Scale

Product description: Red colored scale fines resulting from removal of surface scale from hot rolled steel strips by pickling in hydrochloric acid.

Generation rate 10 – 20 kg/t of HR steel strip in Pickling line

Pickling Red Scale Physical Properties & Chemical Composition

Physical Properties		Chemical Analysis (%)					
Grain Size (mm)	Bulk Density (t/m3)	Total Fe	CaO	Al_2O_3	SiO_2	P max	S max
-2	0.8 - 1.0	92 - 95	0.1 - 0.3	0.1 - 0.3	0.1 - 0.3	0.04	0.04

End Uses

- Magnets making.
- Part of cement raw materials as source of iron oxide.
- Source of oxygen in steel melting process (EAF & BOF).
- Part of raw material for Blast furnace feed material (sinter).
- Part of raw material for direct reduction furnace as pellets & briquettes.
- Paint making.

Material CAS no. 7758-94-3

Iron & Steel Rolls Scrap

Product description: Cylindrical shaped discarded steel and cast iron rolls used in long and flat steel rolling mills.

Types

Various types alloyed with Cr, Ni, Mo & W:

- Chilled double poured cast iron rolls
- Admite & cast steel rolls
- Forged steel rolls

End Uses

- Machining to smaller rolls.
- High quality scrap for iron and steel making (cast rolls and parts).

Material CAS no. Fe:7439-89-6, C: 7440-44-0, Si:7440-21-3
Cr:7440-47-3, Ni :7440-02-0

Used Oils

Product Description: Dark grey viscous fluid of used lubrication & hydraulic oils.

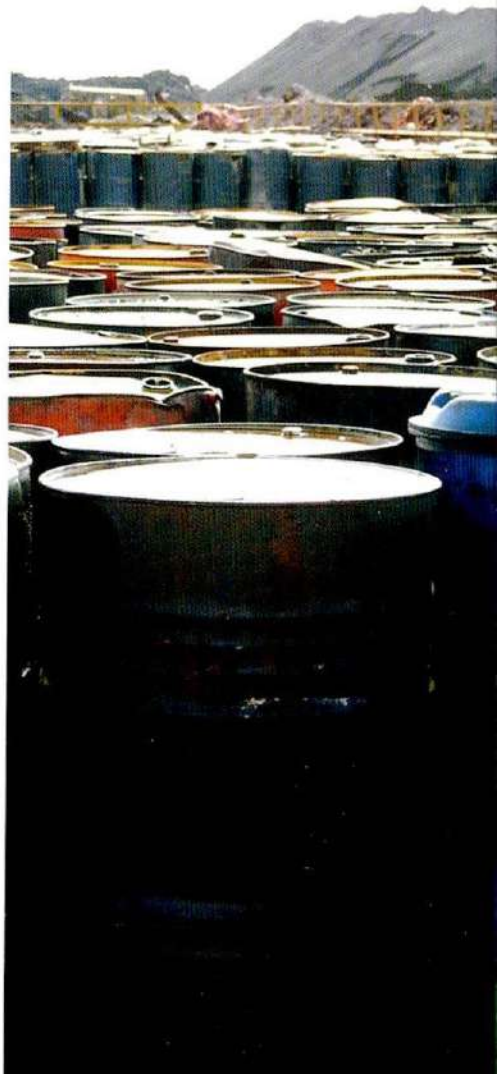
Generation Rate 0.23 kg/t of finished products

Specific gravity 0.9 t/m^3

End uses

- Recycling to base oil for producing machinery oils.
- Recycling to produce fuel oils for ships , cement plants & power stations.

CAS no. 70514-12-4



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