

MANGANESE ORE



Indian Minerals Yearbook 2017

(Part- III : Mineral Reviews)

56th Edition

MANGANESE ORE

(ADVANCE RELEASE)

**GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES**

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20 Manganese Ore

Manganese occurs as silvery grey in colour and is very hard and brittle in nature. It is always available in combination with iron, laterite and other minerals. Manganese in alloy form is an essential input in steel making and steel is one of the most important key indicator in the industrial economy of any country. In the recent years the trade volume of manganese ore has grown world over and also in India. Presently India is one of the major importers of manganese ore in the world. Manganese ores of major commercial importance are: (i) pyrolusite (MnO_2 , Mn about 63.2%); (ii) psilomelane (manganese oxide, containing water and varying amounts of oxides of Ba, K and Na as impurities; Mn commonly 45-60%); (iii) manganite ($Mn_2O_3 \cdot H_2O$, Mn about 62.4%); and (iv) braunite ($3Mn_2O_3 \cdot MnSiO_8$, Mn about 62% and SiO_2 about 10%).

Indian manganese ore deposits occur mainly as metamorphosed bedded sedimentary deposits associated with Gondite Series (Archaean) of Madhya Pradesh (Balaghat, Chhindwara & Jabua districts), Maharashtra (Bhandara & Nagpur districts), Gujarat (Panchmahal district), Odisha (Sundergarh district) and with Kodurite Series (Archaean) of Odisha (Ganjam & Koraput districts) and Andhra Pradesh (Srikakulam & Visakhapatnam districts).

RESERVES/RESOURCES

The total reserves/resources of manganese ore in the country as on 1.04.2015 have been placed at 495.87 million tonnes as per NMI database, based on UNFC system. Out of these, 93.47 million tonnes are categorised as reserves and the balance 402.40 million tonnes are in the remaining resources category. Gradewise, Ferro-manganese grade accounts for 7%, Medium grade 11%, BF grade 28% and the remaining 54% are of Mixed, Low, Others, Unclassified, and Not-known grades including 0.17 million tonnes of battery/chemical grade.

Statewise, Odisha tops the total reserves/resources with 44% share followed by Karnataka 22%, Madhya Pradesh 12%, Maharashtra & Goa 7% each, Andhra Pradesh 4% and Jharkhand 2%. Rajasthan, Gujarat, Telangana and West Bengal together shared the remaining about 2% resources (Table- 1).

EXPLORATION & DEVELOPMENT

The exploration and development details are given in the review on "EXPLORATION AND DEVELOPMENT" in "GENERAL REVIEWS".

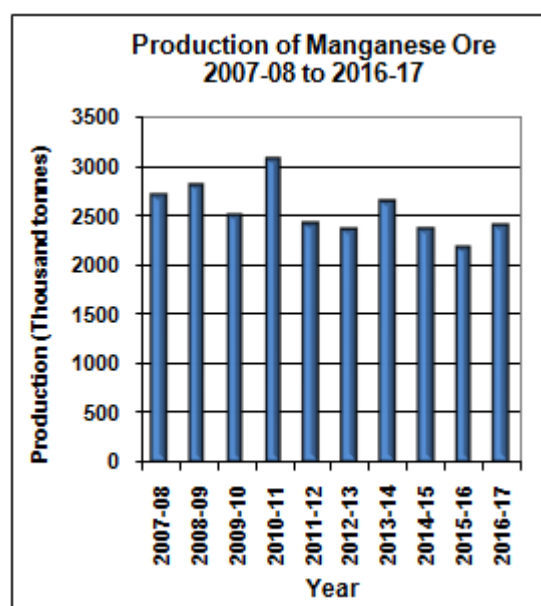
PRODUCTION AND STOCKS

The production of manganese ore 2,393 thousand tonnes during 2016-17 increased by 10% as compared to that in the previous year.

There were 142 reporting mines during 2016-17 as against 146 in the previous year. Besides, manganese ore production was reported by seven mines of iron ore, three mines of laterite and one each of quartz and limestone in 2016-17 as against six mines of iron ore, one each of laterite limestone and quartz in 2015-16. In all, 71 producers reported production of manganese ore in 2016-17. About 69% of the total production was reported by 12 mines including 2 associate mine, each producing more than 40,000 tonnes per annum, while 18% was contributed by 13 mines (including one associate mine) each falling in the production range of 20,001 to 40,000 tonnes. The remaining 13% production was reported by 117 manganese ore and 9 associate mines each producing up to 20,000 tonnes.

In 2016-17, twenty four Public Sector mines jointly accounted for 44% of the total production. The contribution of captive mines was 10% of the total production.

As regards gradewise composition of production in 2016-17, 66% of the total production was of lower grade (below 35% Mn), 23% of medium grade (35-46% Mn) and 10% was of high grade (above 46% Mn). Production of manganese dioxide was 27,950 tonnes (1%) during the year as against 20,161 tonnes (1%) in the previous year.



MANGANESE ORE

Table – 1 : Reserves/Resources of Manganese Ore as on 01.04.2015
(By Grades/States)

State/Grade	Reserves										Remaining Resources					Total Resources (A+B)						
	Proved		Probable		Total		Feasibility		Pre-feasibility		Measured		Indicated		Inferred		Reconnaissance		Total			
	STD111	STD121	STD121	STD122	STD121	STD122	STD211	STD221	STD221	STD222	STD331	STD332	STD332	STD333	STD334		STD333	STD334	STD333	STD334	STD333	STD334
All India : Total	62982	19715	10778	93475	70742	44606	73823	18189	42803	135722	16513	402399	495874									
By Grades																						
Battery/Chemical	-	-	-	-	4	9	12	4	26	112	-	167	167									
Ferro-manganese	7069	1740	2428	11237	4241	3219	4230	1288	5236	6602	466	25282	36520									
Medium	2299	-	975	3274	11545	2053	12489	448	1333	21424	116	49409	52683									
BF	8195	873	2167	11235	29841	7823	21114	3011	10853	51731	5288	129662	140897									
Mixed	1199	3	310	1512	224	495	3361	2262	62	11988	1126	19518	21030									
Medium & BF mixed	6812	1506	1482	9800	4571	2367	4199	5215	5353	16032	221	37957	47757									
Ferro-manganese, medium & BF mixed	25038	12515	291	37844	5952	4497	11255	414	9532	10195	33	41878	79723									
Ferro-manganese & BF	580	1402	636	2618	137	8185	4811	1358	912	3317	4560	23280	25898									
Low (<)25% Mn	1087	349	469	1905	8575	743	6483	3916	4040	3547	82	27386	29291									
Beneficiable	1389	974	1423	3786	680	8401	226	-	260	1437	4560	15565	19531									
Others	8456	166	176	8798	2810	1459	1390	188	87	2845	-	8780	17578									
Unclassified	802	147	421	1370	2094	5353	4184	84	4953	5384	62	22115	23484									
Not-Known	56	39	-	95	68	-	68	-	156	1108	-	1400	1495									
By States																						
Andhra Pradesh	2235	637	2086	4958	675	387	773	188	3220	6987	457	12687	17645									
Goa	-	-	-	-	13954	1511	9177	48	262	9464	-	34416	34416									
Gujarat	708	-	-	708	-	-	-	-	-	2180	-	2180	2888									
Jharkhand	1840	-	328	2168	1710	795	1476	-	178	4177	1126	9461	11629									
Karnataka	9196	-	150	9346	14003	10225	11430	1498	7306	54333	2923	101718	111064									
Madhya Pradesh	20227	6760	2904	29891	5802	2779	6421	325	10481	2015	-	27823	57713									
Maharashtra	10867	1787	1055	13710	1974	4966	7207	-	5350	3369	43	22910	36619									
Odisha	16703	10528	3413	30643	32622	23942	37292	16130	15119	48764	11889	185760	216403									
Rajasthan	1051	-	647	1697	-	-	-	-	-	4030	-	4030	5727									
Telangana	156	3	196	355	2	-	46	-	886	203	76	1214	1568									
West Bengal	-	-	-	-	-	-	-	-	-	200	-	200	200									

Figures rounded off.

MANGANESE ORE

Madhya Pradesh being the leading manganese ore producing State accounted for 27% of the total production in 2016-17. Next in the order of production were Maharashtra and Odisha (25% each). The remaining production was reported from Andhra Pradesh, Gujarat, Jharkhand, Karnataka, Rajasthan and Telangana (Tables- 3 to 7).

The mine-head closing stock for the year 2016-17 was at 1,214 thousand tonnes as against 1,317 thousand tonnes in the previous year (Tables - 8 (A) and 8 (B)).

The average daily employment of labour in manganese ore mines was 12,465 in 2016-17 as against 12,990 in the previous year.

Table – 2 : Principal Producers of Manganese Ore, 2016-17

Name & address of Producer	Location of mine	
	State	District
MOIL Ltd, MOIL Bhavan, 1A, Katol Road, Chhaoni, Nagpur- 440 013.	Madhya Pradesh Maharashtra	Balaghat 1. Bhandara 2. Nagpur
Tata Steel Ltd, Bombay House, 24, Homi Mody Street, Fort, Mumbai- 400 001. Maharashtra.	Odisha	1. Kendujhar 2. Sundargarh
The Sandur Manganese & Iron Ores Ltd, No. 9, Ballari Road, Sadashiv Nagar, Bengaluru- 560 080 Karnataka.	Karnataka	Ballari
RBSSD & FN Das Garividi- 535 101, Shreeram Nagar, Distt. Vizianagaram, Andhra Pradesh.	Andhra-Pradesh	Vizianagaram
Mangilal Rungta, Rungta office, Main Road, Barbil, Dist. Kendujhar, Odisha-758 035.	Odisha	Kendujhar

(Contd.)

Table-2 (Concl.)

Name & address of Producer	Location of mine	
	State	District
Orissa Manganese & Minerals Ltd, Lansdowne Towers, 6 th floor, 2/1A Sarat Bose Road, Kolkata-700 020. West Bengal.	Odisha	Sundargarh
S.K. Sarawagi & Co. Private Limited, 10/1/13, Signature Towers, Level-4, Waltair Uplands, Dist.- Visakhapatanam, Andra Pradesh-530 003.	Andhra Pradesh	Vizianagaram
Aryan Mining & Trading Corp. Private Ltd, P1, Hide Lane, Aryan House, 8 th Floor, Kolkata West Bengal- 700 073.	Odisha	Sundargarh
Gujarat Mineral Development Corp. Ltd., Khanij Bhavan, 132 Ft Ring Road, University Ground, Vastrapur, Ahmedabad, Gujarat-380 052	Gujarat	Panchmahals Vadodara

MANGANESE ORE

Table – 3 : Principal Producers of Manganese Dioxide, 2016-17

Name & address of Producer	Location of mine	
	State	District
Tata Steel Ltd, 24, Homi Mody Street, Fort, Mumbai- 400 001, Maharashtra.	Odisha	Kendujhar
Mangilal Rungta, Rungta Office, Main Road, Barbil-758 035, Kendujhar, Odisha.	Odisha	Kendujhar
Orissa Manganese & Minerals Ltd, Landsdowne Tower, 6th floor, 2/1A, Sarat Bose Road, Kolkata- 700 020, West Bengal.	Odisha	Sundargarh
Rungta Mines Ltd, 8A, Express Tower, 42A, Shakespeare Sarani, Kolkata-700 017, West Bengal.	Odisha	Sundargarh
MOIL Ltd, MOIL Bhavan, 1A-Katol Road, Nagpur-440 013, Maharashtra.	Maharashtra	Bhandara

**Table – 4 : Production of Manganese Ore, 2014-15 to 2016-17
(By States)**

(Quantity in tonnes; Value in ₹'000)

State	2014-15		2015-16		2016-17(P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	2369481	13661799	2166947	8545510	2393182	16026609
Andhra Pradesh [#]	253746	516842	186632	328949	232488	770941
Gujarat	15564	10179	46153	19633	43059	20581
Jharkhand	4448	20508	509	3161	510	3562
Karnataka	206700	933894	145623	410733	261374	1189857
Madhya Pradesh	877994	5219983	766776	3334907	648132	5051691
Maharashtra	670238	5150230	620672	2803625	604301	5248937
Odisha	326106	1765655	390233	1616875	587511	3667350
Rajasthan	7910	23501	3457	10350	2545	7567
Telangana [#]	6775	21007	6892	17277	13262	66123

[#] Figures mentioned against 2013-14 are of districts which are part of present Andhra Pradesh and Telangana.

MANGANESE ORE

**Table – 5 (A) : Gradewise Production of Manganese Ore, 2015-16
(By Sectors/States/Districts)**

(Quantity in tonnes; Value in ₹'000)

State/ District	No. of mines	MnO ₂	Production By Grades: Mn Content				Total	
			above 46%	35%-46%	25%-35%	below 25%	Quantity	Value
India	146(9)	20438	276634	470139	1002738	396998	2166947	8545510
Public Sector	23	172	193863	340591	503776	60317	1098719	5187937
Private Sector	123(9)	20266	82771	129548	498962	336681	1068228	3357573
Andhra Pradesh	23	-	-	10006	118141	58485	186632	328949
Vizianagaram	23	-	-	10006	118141	58485	186632	328949
Goa*	5	-	-	-	-	-	-	-
South Goa*	5	-	-	-	-	-	-	-
Gujarat	2	-	-	-	-	46153	46153	19633
Panchmahal	1	-	-	-	-	38089	38089	14359
Vadodara	1	-	-	-	-	8064	8064	5274
Jharkhand	5	-	-	-	509	-	509	3161
Singbhum (West)	5	-	-	-	509	-	509	3161
Karnataka	11(1)	-	-	4879	108028	32716	145623	410733
Ballari	2(1)	-	-	4879	108028	26652	139559	401219
Chitradurga	4	-	-	-	-	4864	4864	7247
Davanagere	2	-	-	-	-	250	250	375
Tumakuru	3	-	-	-	-	950	950	1892
Madhya Pradesh	45(5)	-	201132	103192	288253	174199	766776	3334907
Balaghat	33(1)	-	168332	91476	241620	40808	542236	2728380
Chhindwara	5	-	32800	11716	9043	6268	59827	328695
Jabalpur	6(4)	-	-	-	-	123765	123765	181811
Jhabua	1	-	-	-	37590	3358	40948	96021
Maharashtra	18	172	27358	280963	288814	23365	620672	2803625
Bhandara	2	172	7700	185182	187446	-	380500	1666463
Nagpur	16	-	19658	95781	101368	23365	240172	1137162
Odisha	31(3)	20266	48144	71099	195536	55188	390233	1616875
Kendujhar	18(2)	19740	47771	66038	146370	18256	298175	1275193
Sundargarh	13(1)	526	373	5061	49166	36932	92058	341382
Rajasthan	1	-	-	-	3457	-	3457	10350
Banswara	1	-	-	-	3457	-	3457	10350
Telangana	5	-	-	-	-	6892	6892	17277
Adilabad	5	-	-	-	-	6892	6892	17277

Figures in parentheses indicate associated mines of iron ore, laterite, limestone and quartz.

* Only labour reported.

MANGANESE ORE

Table – 5 (B) : Gradewise Production of Manganese Ore, 2016-17 (P)
(By Sectors/States/Districts)

(Quantity in tonnes; Value in ₹'000)

State/ District	No. of mines	Production By Grades: Mn Content					Total	
		MnO ₂	above 46%	35%-46%	25%-35%	below 25%	Quantity	Value
India	142(12)	27950	228188	554264	1174530	408250	2393182	16026609
Public Sector	24	535	158254	345283	503181	44659	1051912	9059571
Private Sector	118(12)	27415	69934	208981	671349	363591	1341270	6967038
Andhra Pradesh	23	-	-	11914	118400	102174	232488	770941
Vizianagaram	23	-	-	11914	118400	102174	232488	770941
Goa	6*	-	-	-	-	-	-	-
South Goa	6*	-	-	-	-	-	-	-
Gujarat	2	-	-	-	-	43059	43059	20581
Panchmahal*	1	-	-	-	-	38487	38487	18295
Vadodara	1	-	-	-	-	4572	4572	2286
Jharkhand	4	-	-	-	504	6	510	3562
Singhbhum (West)	4	-	-	-	504	6	510	3562
Karnataka	9(1)	-	-	16858	182301	62215	261374	1189857
Ballari	1(1)	-	-	16858	165966	49692	232516	1067011
Chitradurga	4	-	-	-	-	7654	7654	15512
Davangere	2	-	-	-	16335	4069	20404	106258
Tumkur	2	-	-	-	-	800	800	1076
Madhya Pradesh	42(7)	-	141578	106875	299858	99821	648132	5051691
Balaghat	31(1)	-	131502	89308	265444	21766	508020	4350874
Chhindwara	4	-	10076	17567	10866	2732	41241	486248
Jabalpur	6(6)	-	-	-	-	75323	75323	135496
Jhabua	1	-	-	-	23548	-	23548	79073
Maharashtra	19	535	27411	288708	273351	14296	604301	5248937
Bhandara	2	535	2888	188947	181969	-	374339	3237373
Nagpur	17	-	24523	99761	91382	14296	229962	2011564
Odisha	31(4)	27115	59199	129909	294825	76463	587511	3667350
Kendujhar	17(2)	25139	59037	81631	165780	20084	351671	1791890
Sundergarh	14(2)	1976	162	48278	129045	56379	235840	1875460
Rajasthan	1	-	-	-	2545	-	2545	7567
Banswara	1	-	-	-	2545	-	2545	7567
Telangana	5	300	-	-	2746	10216	13262	66123
Adilabad	5	300	-	-	2746	10216	13262	66123

Figures in parentheses indicate associated mines of iron ore, laterite, limestone and quartz.

* Only labour reported.

MANGANESE ORE

**Table – 6 : Production of Manganese Ore, 2015-16 and 2016-17
(By Frequency Groups)**

(Quantity in tonnes)

Production Group	No. of mines		Production		Percentage in total Production		Cumulative %	
	2015-16	2016-17 (P)	2015-16	2016-17 (P)	2015-16	2016-17 (P)	2015-16	2016-17 (P)
Total	146(9)	142(12)	2166947	2393182	100.00	100.00	-	-
Up to 1000	81(2)	77(1)	14255	12772	0.66	0.53	0.66	0.53
1001 - 5000	24(3)	21(5)	69483	70604	3.20	2.95	3.86	3.48
5001 - 10000	10(1)	10(2)	71527	88383	3.30	3.69	7.16	7.17
10001 - 20000	8(1)	9(1)	118032	134147	5.45	5.61	12.61	12.78
20001 - 30000	4(1)	7	112001	167944	5.17	7.02	17.78	19.80
30001 - 40000	3(1)	6(1)	140179	260023	6.47	10.87	24.25	30.67
40001 - 50000	3	2(1)	128117	136216	5.91	5.69	30.16	36.36
50001 and above	13(1)	10(1)	1513353	1523093	69.84	63.64	100.00	100.00

Figures in parentheses indicate associated mines of iron ore, laterite, limestone and quartz.

**Table – 7 (A) : Mine-head Closing Stocks of Manganese Ore, 2015-16
(By States and Grades)**

(In tonnes)

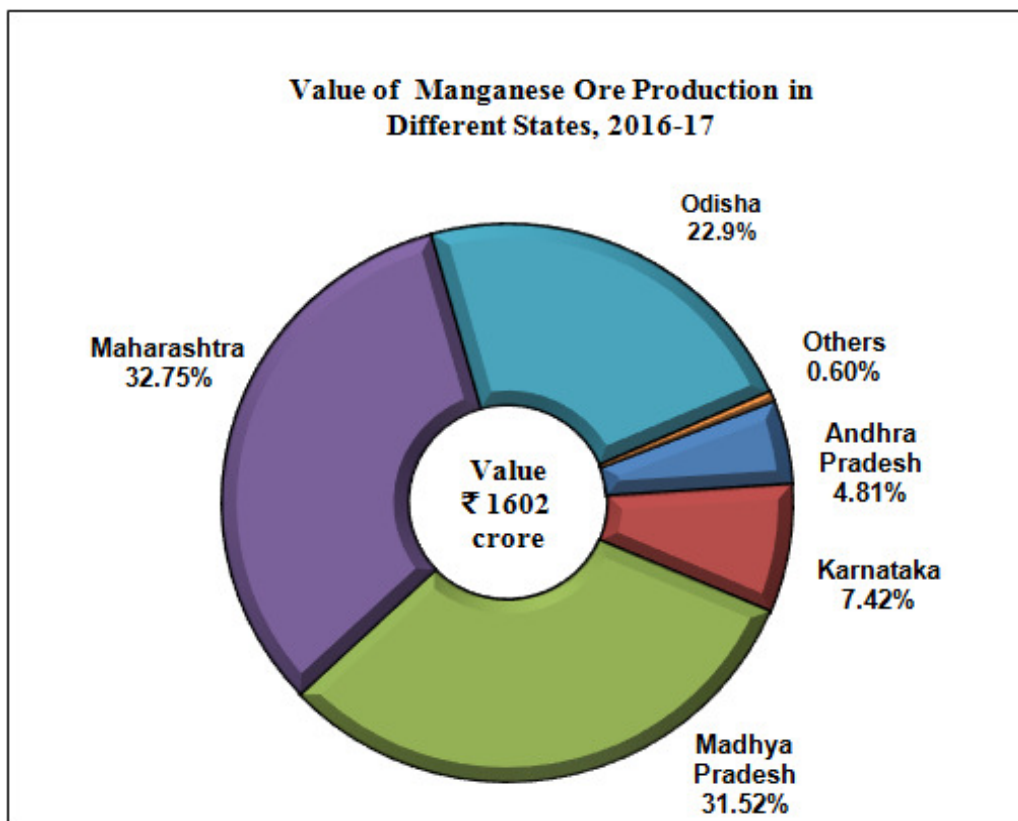
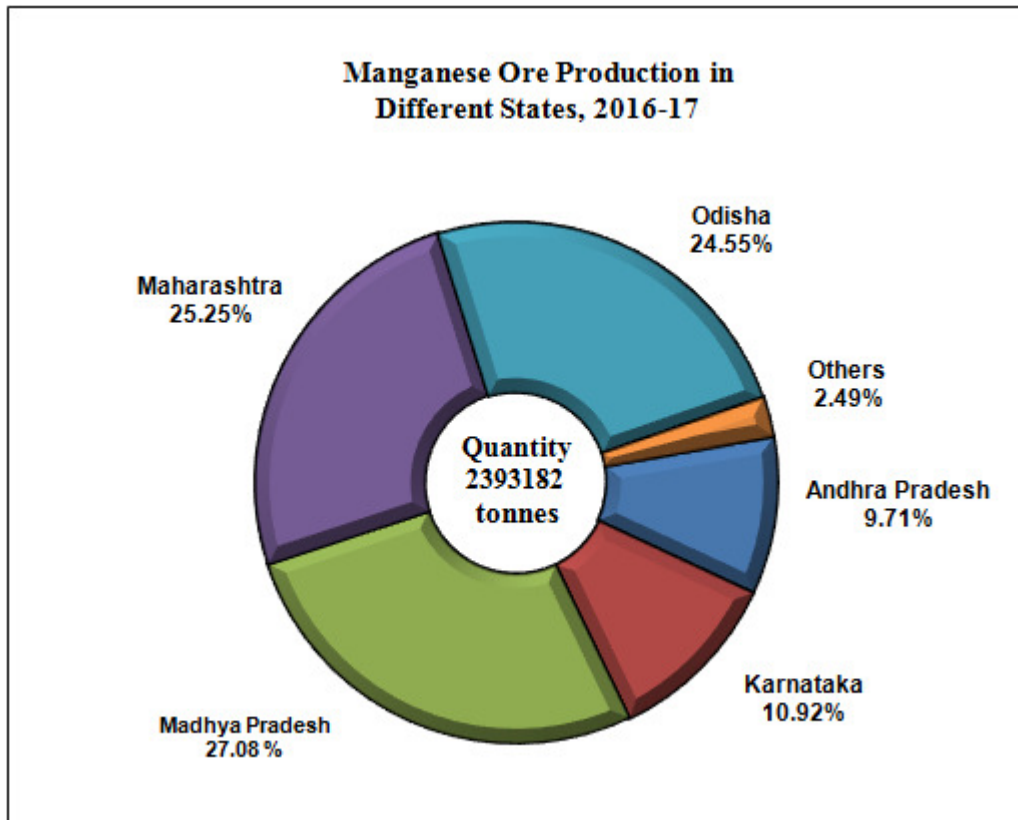
State	Grades : Mn content					Total
	MnO ₂	above 46%	35% - 46%	25% - 35%	below 25%	
India	8193	52451	123920	557149	575656	1317369
Andhra Pradesh	-	-	126	56213	17019	73358
Goa	-	-	-	100	-	100
Jharkhand	-	24	22	5377	168	5591
Karnataka	-	-	5367	66238	154691	226296
Madhya Pradesh	-	44140	13404	111964	282954	452462
Maharashtra	1405	2804	31242	108350	18924	162725
Odisha	6788	5483	73759	208196	97392	391618
Rajasthan	-	-	-	697	-	697
Telangana	-	-	-	14	4508	4522

**Table – 7 (B) : Mine-head Closing Stocks of Manganese Ore, 2016-17 (P)
(By States and Grades)**

(In tonnes)

State	Grades : Mn content					Total
	MnO ₂	above 46%	35% - 46%	25%-35%	below 25%	
India	3052	44166	106073	495290	565504	1214085
Andhra Pradesh	-	-	1099	53350	17179	71628
Goa	-	-	-	-	-	-
Jharkhand	1	23	16	4788	1013	5841
Karnataka	-	-	2562	90396	165550	258508
Madhya Pradesh	-	34372	14520	52662	257233	358787
Maharashtra	757	3151	41164	25668	15687	86427
Odisha	2294	6620	46712	265702	104338	425666
Rajasthan	-	-	-	1207	-	1207
Telangana	-	-	-	1517	4504	6021

MANGANESE ORE



MINING, PROCESSING, MARKETING & TRANSPORT

Manganese ore mining in the country is carried out by opencast as well as by underground methods. Of the 142 mines, 8 are underground (3 in Madhya Pradesh and 5 in Maharashtra). Seven underground mines were operated by MOIL Ltd, a Public Sector company, and one by M/s J.K. Minerals, Balaghat (Madhya Pradesh), a private company. All the underground mines are mechanised or semi-mechanised and adopt cut and fill method of stoping. In Kandri mine, hydraulic sand stowing has been introduced in place of manual filling system. This system is faster, cheaper and requires less manpower. Conventional timber supports are replaced by cable bolting pre-mining support to increase safety and productivity. In Balaghat underground mechanised mine, overhand flat back cut and fill method with rock bolting support and sand stowing is being practised to fill up the voids with a level interval of 30 m and size of stope block as 30 m x 30 m to 60 m x 30 m. Side Dump Loaders (SDL) of 0.66 cu m bucket capacity were also deployed in underground levels for mechanised loading of run of mine (r.o.m.) in stopes. Tyre mounted Rocker shovel was also introduced in Balaghat mine for mechanised loading of ore from ore drive at stripping area. Deepening of vertical shaft up to 435m was completed in Balaghat, up to 169 m in chikla mine, upto 245 m in Kandri mine and up to 160 m in mansar mine of MOIL. Sinking of vertical shafts is in progress at Mansar and Ukwa mines.

The open-pits are usually worked manually by benching method, using portable compressors, jackhammers and dumper trucks. Tirodi mine of MOIL is worked by opencast mechanised method. Height of the benches in overburden is kept at 7.5 m and that in the ore at 6 m. Drills of 100 mm dia. with 0.9 to 1.7 m³ capacity of shovels and 20-25 tonnes dumpers are used for production, loading & transport.

The workings vary from shallow depth in lateritoid-type deposits in Odisha, Karnataka and Goa to deep operations in deposits of a more regular

nature found in Madhya Pradesh, Maharashtra and Andhra Pradesh. Bulldozers are used where the overburden is soft. In a few cases, tramways are laid up to the working face and loaded tubs are pushed manually to the dumping ground. In Odisha, Goa and Karnataka, ore is worked by loosening the ground either with crowbars or by blastings. After picking up manganese ore, the waste is removed to the dumping ground. Mining of bedded ore in Madhya Pradesh and Maharashtra is generally carried out by drilling and blasting.

Hand sorting and visual grading are adopted widely to upgrade the ore. Scrubber is also used for washing the ore at some mines. Manual as well as mechanised jigging is done in a few mines.

MOIL has set up an integrated manganese ore beneficiation plant at Dongri Buzurg mine in Bhandara district, Maharashtra, with 4 lakh tonnes annual capacity to process r.o.m. The plant is equipped with handling, crushing, wet screening, drying and magnetic separation facilities in one complex. MOIL has installed a manganese ore beneficiation plant of 5,00,000 tonnes per annum capacity at Balaghat mine in order to conserve mineral and profitably utilise the low/medium grade ore. The plant facilities include crushing, wet screening, classification and jigging operations.

The plant upgrades the low/medium grade fines into high grade and the value addition is around 3-4 times, in case of low grade fines. The company is planning to set up a sintering plant for agglomeration of these fines. After agglomeration, these fines will be utilised in ferro-alloys production.

Most of the producers market manganese ore directly to the industrial units. In a few cases, especially in case of supplies of special type of ore or a semi-processed product, middlemen are found to be involved in marketing. Ore from mines is usually sold to the domestic consumers, either at the rail-head or ex-plant. In the cases of Integrated Iron & Steel and Ferro-manganese Industry, the units draw their supplies largely from captive mines. However, special ore types for specific purposes are obtained from other producers. In case of ore

meant for exports, producers other than MOIL Ltd supply it to MMTC, the canalising agency, either at rail-head or at the port. MOIL Ltd did not export manganese ore in the year 2015-16.

Transport of manganese ore from mines to rail-head is generally done by trucks from where it is transported to ports by rail wagons. From the mine of MOIL in Balaghat district, Madhya Pradesh, the ore is transported by aerial ropeways to the loading bins at the rail-heads. Battery loco was introduced for underground transport of r.o.m. tub from ore pass chute to skip bunker. In Goa, ore, in bulk is carried by road-cum-river routes up to Mormugao harbour and in a few cases by rail where the mines are close to the railways. The ore loading at river-head into barges is carried out mechanically.

ENVIRONMENTAL PROTECTION

MOIL carried out mass afforestation work and planted 7,300 saplings during 2016-17 to maintain the ecological balance at area closer to the mines. The cumulative plantation as on 31.03.2017 is about 19.23 lakh saplings. The Company has also set up a wind energy farm of 20 MW capacity at Dewas Madhya Pradesh. The company has also plans to install 10.5 MW capacity solar power plant at its mines. R&D work was taken up by MOIL for reclamation of old mined out areas and to ascertain the impact of manganese mining on ecology, including air and water pollution. Ventilation reorganisation studies for deeper levels have been conducted at Gumgaon and Chikla mines by IIT, Kharagpur. Recommendations are implemented at Gumgaon mines and in progress at Chikla mines.

Various energy saving projects are under process such as, Installation of solar roof top at administrative buildings at all mines. Five MW solar power projects in mine areas in Maharashtra and 5.5 MW solar power projects in Madhya Pradesh. Installation of small size compressors in underground mines for energy saving.

Manganism - a health condition attributed to manganese poisoning - has been reported to be detected in case of five persons working with BHP Billiton's Metalloys, a manganese alloy plant in South Africa. Manganism shows symptoms similar

to Parkinson's disease and psychotic behaviour but conditions of development of the disease are not properly understood.

USES & SPECIFICATIONS

Classification of manganese ore, ferruginous manganese ore, siliceous manganese ore, dioxide manganese ore, and manganiferous iron ore is laid down by BIS vide specification no. IS: 11895-2006 (Reaffirmed 2008). Manganese ore is an important material in iron and steel metallurgy, where it is used both in the ore form as such and as ferro-manganese. Manganese improves strength, toughness, hardness and workability of steel, acts as a deoxidiser and desulphuriser and also helps in getting ingots free from blowholes. About 90 to 95% world production of manganese ore is used in metallurgy of iron and steel. High amount of phosphorous makes the manganese ore unsuitable for its metallurgical use, whereas, high phosphorous and high iron content makes it unsuitable for battery industry. Manganese has no satisfactory substitute in its major applications. The specifications of manganese ore by different industries are detailed below:

In Iron and Steel Industry, the BIS:11281-2005 (Reaffirmed 2008) specification is laid down for manganese ore. However, specifications based on the user industry indicate that normally manganese ore containing 28 to 35% Mn is used. Ore size generally varies from 10 to 40 mm. For other constituents general stipulations are Fe: 16 to 22%, SiO₂: 2 to 8%, Al₂O₃: 5 to 8% and P: 0.3% maximum.

For manganese ore used in Ferro-manganese Industry, besides manganese content, other important considerations are high manganese to iron ratio and a very low content of deleterious phosphorus. Specifications of manganese ore for ferro-manganese are prescribed by the Bureau of Indian Standards vide IS: 4763-2006, (Second Revision, Reaffirmed 2010). BIS has also laid down the specifications of manganese ore sinters for blending for ferro-manganese production vide IS:12596-1989 (Reaffirmed 2009). User's specifications of manganese ore for Ferro-manganese/Silico-manganese industries are furnished in Table- 8.

MANGANESE ORE

Table – 8 : User's Specifications of Manganese Ore in Different Ferro-manganese/Silico-manganese Units

Name and location of plant	Specifications of ore consumed
Andhra Pradesh	
Ferro-Alloys Corp. Ltd, Shreeram Nagar, Dist. Vizianagram.	Mn: 70-75% C: 6-8%
Nav Bharat Ferro-Alloys Ltd, Paloncha, Khammam.	Mn: 28-50%, P: 0.1-0.3%, SiO ₂ : 8-30% Fe :5-8%
Chhattisgarh	
Sarda Energy & Minerals Ltd Raipur.	Mn: 28-30% (Low P) Mn: 37-40% , 42-44% , 46% (High P)
Monnet Ispat & Energy Ltd, Raipur	Mn: 28-46% Fe : 5-16% SiO ₂ : 6-34% S & P: 0.05-0.28% Size: 0-100% (lumps & fines)
Hira Power & Steel Ltd, Raipur	
i) Jain Carbides & Chemicals Ltd, Raipur (Unit-I).	Mn: 32-35%
ii) Jain Carbides & Chemicals Ltd, Raipur (Unit-II).	Mn: 32-35%
Karnataka	
S. R. Chemicals & Ferro Alloys, Belgaum. Thermit Alloys Ltd, Shivamogga.	Mn: 38-40%, Fe: 18-23% Mn: 48-54%
Kerala	
INDSIL Hydro Power and Manganese Ltd, Pallatheri Palakkad.	Fe-Mn ratio 1:3 to 5% (50%) 1:5 to 8% (50%) P: 0.05% max. Al ₂ O ₃ : 3 to 5% max.
Madhya Pradesh	
MOIL, Ferro-manganese Plant, Bharveli, Dist. Balaghat.	Mn: 46-48%
Maharashtra	
Chandrapur Ferro Alloys Ltd, (Formerly Maharashtra Electro-Smelt Ltd) Chandrapur.	Mn: 38-46%, Fe: 6-17% SiO ₂ +Al ₂ O ₃ : 10-16% P: 0.5-0.25% max. +100 mm, 10% max. +10-100 mm, 80-85% min. +5-10 mm, 10% max.
Nagpur Power & Industries Ltd, Nagpur.	Mn: 42-46%, Fe: 7-8%, SiO ₂ : 3.6%, Al ₂ O ₃ : 6-7%, P: 0.10-0.12% Size: 5-25 mm
Natural Sugar & Allied Ind. Ltd, Sai Nagar Ranjani, Dist. Osmanabad	Size: 10-80 mm
Odisha	
Tata Steel Ltd, Joda, Kendujhar.	Mn: 43%, min. (for FeMn) 36% min. (for SiMn), Size: 10-75 mm (for FeMn & SiMn)
	Captive Mn Ore Size (mm)
	Below 35% (10-75) + 5%
	35% to 46% (10-75) + 5%
	46% to 49% (10-75) + 5%
	Dioxide + 49% (10-75) + 5%
	MOIL, Mn Ore
	Below 35% (10-75) + 5%
	Imported Mn
	46 to 49% (10-75) + 5%
Tamil Nadu	
Silcal Metallurgical Ltd, Ramanuja Nagar, Coimbatore.	Mn: 35-40% & above Size: 35 mm
West Bengal	
Cosmic Ferro Alloys Ltd, Bankura.	Size: 75 mm

MANGANESE ORE

Manganese dioxide is used for manufacturing dry cell batteries in which it functions as a depolariser of hydrogen. For use in dry cell battery, BIS has prescribed Specification No. IS:11153-1996 (First Revision, Reaffirmed 2010) for manganese dioxide. Suitability of ore depends not only on manganese dioxide content but also on its crystallographic structure. Ore having predominant gamma structure is required. The ore must have high manganese dioxide and low iron content, a certain degree of porosity and moderate hardness. It should be free from metallic compounds such as copper, nickel, cobalt, arsenic, lead and antimony, which are electronegative to zinc (container). The user industry specifications are MnO₂ 70% (min.), Fe 6% (max.), moisture 4% (max.), Cu 0.02% (max.) and Ni 0.02% (max.). The size requirement lays down that 90% material should pass through 300 mesh and 100% through 100 mesh. User industry specifications for electrolytic manganese dioxide (EMD) used in dry cell battery are MnO₂ 90% (min.), Fe (as oxide) 0.05% (max.), moisture 4% (max.), Pb 0.15% (max.) and pH 4.5 to 5.6. The size requirements are same as those for manganese dioxide ore.

Manganese ore is also used in the manufacture of various chemicals such as potassium permanganate, hydroquinone, manganese sulphate, manganese chloride, manganese phosphate etc. In chemical industry, generally high-grade material is used for potassium permanganate. Ore containing MnO₂ 80% (min.), SiO₂ 5% (max.), Fe₂O₃ 5% (max.) and 200 to 250 mesh ore size is used. In glass industry, ore analysing MnO₂ 80% (preferably 86% min.), Fe₂O₃ 5% (preferably 0.75% max.), SiO₂ 2.8% (max.), Al₂O₃ 1.1% (max.), BaO 1.3% (max.), CaO 0.4% (max.) and MgO 0.4% (max.) is consumed.

Requirement of manganese dioxide for Explosive and Pyrotechnic industries as laid down in IS : 5713-1981 (First Revision, Reaffirmed

2011) by BIS is as follows: MnO₂ 80% by mass (min.), moisture 1% (max.), matter soluble in water 0.2% (max.) and water soluble chlorides (as NaCl) 0.05% (max). There are three types of material with above composition which show variation in their particle size: Type A, Type B and Type C. Particle size (max.) is 600 micron for Type A, 150 micron for Type B and 74 micron for Type C ore. In addition, grit content should be 1% (max.) for Type A ore. For Match Industry, the MnO₂ content shall be 50% (min.).

Pyrolusite is used generally to impart glaze to the pottery and to make coloured bricks. It also finds use as driers for oils, varnishes and paints. Manganese sulphide is used in the manufacture of salts and in calico printing. Manganese chloride is used in cotton textile as a bronze dye. Manganese salts are used in photography and in leather and matchbox industries.

CONSUMPTION

The consumption of manganese ore in all industries was about 2.71 million tonnes in 2016-17 as against 3.33 million tonnes in 2015-16. Ferro-alloys industries accounted for about 93% consumption followed by Iron & Steel (6%). The remaining (1%) was shared by Battery, Electrode, Chemical, Zinc Smelter and Alloy Steel industries (Table- 9).

The consumption of ferro-manganese in 2015-16 increased slightly to 131 thousand tonnes from 122 thousand tonnes in the previous year. Iron & steel industry was the bulk consumer of ferro-manganese accounting for about 92% consumption in 2015-16. The remaining 8% was consumed in alloy steel, foundry and electrode industries. Consumption of silico-manganese which was 225.8 thousand tonnes in 2014-15 increased to 258.2 thousand tonnes in 2015-16 (Tables- 10 & 11).

MANGANESE ORE

**Table – 9 : Estimated Consumption of Manganese Ore^{1/}, 2014-15 to 2016-17
(By Industries)**

(In tonnes)			
Industry	2014-15	2015-16 (R)	2016-17 (P)
All Industries	4439300	3334000	2714100
Ferro-alloys	3904300 ^(e)	3193400	2530400
Iron & steel	517300	125600	170300
Others: (Alloy steel, chemical, zinc smelter, Battery & electrode)	17700	15000	13400

Figures rounded off.

* Includes actual reported consumption and/or estimates made wherever required. Paucity of data ,hence coverage may not be complete.

^{1/} Apparent consumption of manganese ore is about 2,742,861 tonnes during 2016-17.

**Table – 10 : Consumption* of Ferro-manganese, 2013-14 to 2015-16
(By Industries)**

(In tonnes)			
Industry	2013-14	2014-15 (R)	2015-16 (P)
All Industries	124800	122400	131000
Alloy steel	6400	5800	9100
Electrode	1300	1000	1200
Foundry	500	500	500
Iron & steel	116600	115100	120200

Figures rounded off.

* Includes actual reported consumption and/or estimates made wherever required; Paucity of data has posed restriction to the data coverage on consumption.

**Table – 11 : Consumption* of Silico-manganese, 2013-14 to 2015-16
(By Industries)**

(In tonnes)			
Industry	2013-14	2014-15 (R)	2015-16 (P)
All Industries	219600	225800	258100
Alloy steel	2000	2300	10400
Electrode	100	100	100
Foundry	100	100	100
Iron & steel	217400	223300	247500

Figures rounded off.

* Includes actual reported consumption and/or estimates wherever required; Paucity of data has posed restriction to the data.

INDUSTRY

Manganese alloys are the largest produced ferro-alloys in the world with a share of about 41% of the global production of ferro-alloys. For production of one tonne of ferro-manganese, about 2.6 tonnes of manganese ore, 0.5 tonne of reductant and 3 MWh of electricity inputs are required. As per Indian Ferro Alloys Producers' Association (IFAPA), the total installed capacity of manganese alloys including ferro-manganese/silico-manganese in the country was estimated to be around 3.16 million tonnes per annum.

MOIL had set up a High Intensity Magnetic Separation Plant and 1,000 tpy Electrolytic Manganese Dioxide (EMD) Plant at Dongri Buzurg mine. The plant is under expansion to 1,500 tpy capacity. In 2015-16, about 612 tonnes of EMD was produced as against 950 tonnes in 2014-15. Ferro-manganese plant of 10,000 tonnes per annum capacity has been set up at Bharveli, Balaghat. In 2015-16, 6,519 tonnes of ferro-manganese was produced as compared to 10,045 tonnes in the previous year.

Ferro-manganese

The total production of various types of manganese alloys (high carbon ferro-manganese, medium carbon ferro-manganese and low carbon ferro-manganese) was about 4.72 lakh tonnes in 2015-16 (up to February 2016), as per Monthly Statistics of Mineral Production (February, 2016). It is to be noted that the data coverage is partial and does not reflect the actual production.

Silico-manganese

Silico-manganese is a combination of 60-70% Mn, 10-20% silica and about 20% carbon. As per Monthly Statistics of Mineral Production (March, 2016), production of silico-manganese was reported at 2,69,920 tonnes in 2015-16 from 2,49,691 tonnes in 2014-15. It is to be noted that the data coverage is partial and does not reflect the actual production. MOIL was considering setting up ferro-manganese and silico-manganese plants through joint venture companies with RINL and SAIL, namely, 31,000 tpy ferro-manganese and 75,000 tpy silico-manganese plants at Nandini near

Bhilai, Chhattisgarh and a 20,000 tpy ferro-manganese and 37,000 tpy silico-manganese plants at Bobbili, Vizianagaram district, Andhra Pradesh with RINL. These projects are not viable at present especially on account of the present power tariffs of the State Electricity Boards. activities in respect of both these joint venture companies have been put on hold.

The major factor driving the production of manganese alloys is high production growth of low nickel austenitic stainless steel. India is emerging as the largest producer of this steel where manganese is added substituting the expensive nickel.

Iron & Steel

Iron & Steel Industry was the second major consumer of manganese ore wherein manganese ore is used directly as a blast furnace feed. Details on consumption, specifications and source of supply of manganese ore to major iron & steel plants in the country in 2014-15 and 2015-16 are furnished in Table-12.

Dry Battery

Consumption of manganese dioxide ore in Dry Battery Industry was 14,600 tonnes in 2015-16, [excluding Electrolytic Manganese Dioxide EMD)]. The demand was met through imports, supported by indigenous production of manganese dioxide and EMD.

Dry battery Industry also consumes EMD along with natural manganese dioxide ore. The only one plant of 1,000 tpy capacity producing EMD is owned by MOIL and is located in Bhandara district.

SUBSTITUTES

Cost and technology militate substitution in major applications. However, for economic reasons, there is only limited substitution in minor applications in Chemical and Battery industries. The Steel Industry has, however, made great strides in economising the use of manganese, largely through changes in steel-making techniques.

MANGANESE ORE

Table – 12 : Consumption, Specifications and Source of Supply of Manganese Ore in Different Iron and Steel Plants, 2014-15 and 2015-16

Plant	Production of pig iron/hot metal (tonnes)		Consumption of Mn-ore (tonnes)		Specifications of ore consumed	Source
	2014-15	2015-16 (P)	2014-15	2015-16 (P)		
Bhilai Steel Plant, Ramtek Chhattisgarh.	Hot metal Bhilai Nagar, Durg 5072258	Hot metal 5317127	25656 4995	NA 6735	Size: 25 to 85 mm Mn: 30% min. SiO ₂ : 30% max. Al ₂ O ₃ : 5% max. P: 0.3% max.	MOIL/ Goberwahi, Gua Mines SAIL, RMD
Bokaro Steel Plant, Bokaro, Jharkhand.	Hot metal 4253271	Hot metal 3700004	NA	NA	Mn: 30% max. SiO ₂ +Al ₂ O ₃ : 20.5% max. -10 mm -15% max. +40 mm -10% max.	-
Durgapur Steel Plant, Durgapur, West Bengal.	Hot metal 2296707	Hot metal 2170498	NA	NA	Mn: 30% min. Fe: 15-28% SiO ₂ : 3.3% max. Al ₂ O ₃ : 7.5% max.	-
Rourkela Steel Plant, Rourkela, Odisha.	Hot metal 2538322	Hot metal 2591417	NA	NA	-	-
IISCO Steel Plant, Burnpur, Dist. Burdwan, West Bengal- 713 325.	Hot metal 219641	Hot metal 566244	NA	NA -	Mn (dry) 30% (min.) -10 mm - 10.0% max. +40 mm - 15% max.	-
Visvesvaraya Iron and Steel Ltd, Bhadravati, Shivamogga, Karnataka.	Hot metal 20986	Hot metal 67603	NA	NA	-	-
KIOCL Ltd, Pellet Plant, Mangaluru, Dakshina Kannada, Karnataka.	Hot metal NA	Hot metal NA	NA	NA	Fe: 25-50% min. MnO ₂ : 44% min. SiO ₂ +Al ₂ O ₃ : 12% max.	Milan Minerals, Karnataka
Visakhapatnam Steel Plant, Visakhapatnam, Andhra Pradesh.	NA	NA	11400	NA	Mn: 28%, (min.) Fe: 16% SiO ₂ : 25% max.	Garividi, Andhra Pradesh Size: 10-60
IDCOL, Kalinga Iron Works Ltd, Barbil, Kendujhar, Odisha.	Hot metal 7793	Hot metal -	338 68	68 -	(-) 10 mm (SP) Size: 10-40 mm	From own/ local mines
Gordan Steel India Ltd, Jaonbulapadu, Anantapur, Andhra Pradesh.	Hot metal 30427	Hot metal 30427(e)	728	2292	Mn 28-35% Mn	-
Tata Steel Ltd, Jamshepur, Jharkhand.	Hot metal 9898502	Hot metal 10162917	NA	NA	NA	-

(Contd.)

MANGANESE ORE

Table - 12 (Contd.)

Plant	Production of pig iron/hot metal (tonnes)		Consumption of Mn-ore (tonnes)		Specifications of ore consumed	Source
	2014-15	2015-16 (P)	2014-15	2015-16 (P)		
Kirloskar Ferrous Industries Ltd, Berinahalli, 583 234, Koppal, Karnataka.	Pig iron 277026	Pig iron 324053	6721	7163	Mn: 28% min. Fe: 20% min. SiO ₂ : 8% max. Alkalies: 1% max. Size: 10 to 40 mm 90% min. under & over size: 5% max. each	SMIORE, Adarsha Mining Co., Omkaramma
LANCO Industries Ltd, Chittoor, Andhra Pradesh.	Pig iron+ (molten metal) 198036	Pig iron+ (molten metal) 198036(e)	NA	NA	NA	NA
Visa Steel Ltd, Kalinganagar, Jajpur, Odisha.	Hot metal NA	Hot metal NA	302	NA	below 35% Mn Mines	Siljoda
Sunflag Iron & Steel Co. Ltd, Bhandara, Maharashtra.	Hot metal 208224	Hot metal 208224(e)	NA	NA	-	-
Jaiswal Neco Industries Ltd, Siltara, Raipur, Chhattisgarh.	Hot metal 548753	Hot metal 524575	2170	1871	Mn:26-28% Size:10-60 mm	-
Jaiswal Neco Industries Ltd, Bellari, Karnataka.	Hot metal 8492000	Hot metal 9029390	-	-	NA	NA
Tata Metalliks Ltd, Kharagpur, Medinipur, West Bengal.	Hot metal 302999	Hot metal 292575	7048	10502	NA	NA
JSW Steel Ltd, Salem, Tamil Nadu- 636 453.	Hot metal 860000	Hot metal 914000	- 14	- -	NA	NA
JSW Steel Ltd, Vidyanagari, Bellari, Karnataka.	Hot metal 9029390	Hot metal 9683092	-	-	NA	NA
Rashmi Metaliks Ltd, Gokulpur, West Midnapur, West Bengal.	Hot metal 163911	Hot metal 136832	1494	852	NA	NA
Sona Alloys P. Ltd, Lonad, Pune, Maharashtra.	Hot metal 250000	Hot metal 250000(e)	NA -	3640 -	NA -	NA -
Aparant Iron & Steel Pvt.Ltd, Goa.	Pig Iron 20237	Pig Iron 20237(e)	1380	334	NA	NA
Uttam Galva Metallics Ltd, Bhugaon- 442001, Wardha, Maharashtra.	Hot metal 487	487(e)	30	118	NA	NA

(Contd.)

MANGANESE ORE

Table - 12 (Concl.)

Plant	Production of pig iron/hot metal (tonnes)		Consumption of Mn-ore (tonnes)		Specifications of ore consumed	Source
	2014-15	2015-16 (P)	2014-15	2015-16 (P)		
Vedanta Ltd, Navelim Amona, Marcela, Goa.	620984	665869	348	16	-	-
Neelachal Ispat Nigam Ltd, Kalinga Nagar, Duburi, Jajpur, Odisha.	602680	616570	NA	NA	-	-
Suraj Products Ltd Barpali, Rajgangpur, Sundargarh, Odisha.	12151	13689	594	1139	-	-

TECHNICAL POSSIBILITIES

The deep-sea nodules can be a potential resource of manganese in the next decades to come. There is a trend towards using lower grades of ores in ferro-manganese production. New steel-making practices and techniques are reducing the amount of manganese consumed in the process. However, counterbalancing this to some extent is a trend towards higher manganese specifications for modern steels.

TRADE POLICY

Export Policy

The Foreign Trade Policy, 2015-20 and the policy on export puts restrictions on exports of manganese ore as follows:

HS Code	Item description	Policy	Nature of restriction
2602 0000	Manganese ores excluding the following: Lumpy/blended manganese ore with more than 46% Mn	State Trading Enterprise	Exports through (a) MMTC (b) MOIL for manganese ore produced in MOIL mines
2602 0010	Lumpy/blended manganese ore with more than 46% Mn	Restricted	Export permitted under licence

Import Policy

Imports of manganese ore and concentrates including ferruginous manganese ores and concentrates containing 20% or more manganese (calculated on dry weight basis), agglomerated manganese ore sinters, etc. are freely allowed.

WORLD REVIEW

The total world reserve of manganese ore is approximately 680 million tonnes of metal content which is unevenly distributed (Table-13). Reserves are located in South Africa (29%), Ukraine (21%), Brazil (18%), Australia (14%), China (7%) and India (5%). Only a small fraction of global manganese reserves is clearly economic. This fact continues to support interest in deep-sea manganese nodules, which constitute an enormous untapped resource. Most nodules are found in areas of deep-sea floor at water depths of 5 to 7 km. The Pacific Ocean alone is estimated to contain about 2.5 billion tonnes nodules containing about 25% Mn, making them similar in abundance to low-grade land-based deposits. Most major steel-making nations lack manganese resources. North America had less than 1% world reserves. Besides, United States have lean grade reserves and potentially high extraction cost. This situation has created an active global trade in manganese ore and manganese alloys.

World production of manganese ore in 2015 was estimated to be around 53.2 million tonnes as compared to 54.5 million tonnes in 2014. South Africa was the leading producer contributing about 30% followed by China (28%), Australia (12%), Gabon (8%), India (4%) and Kazakhstan (3%) (Table-14). The production of manganese ore is linked with the production of steel. The Steel Industry consumes it in the form of ore and manganese alloys.

MANGANESE ORE

Table – 13 : World Reserves of Manganese Ore (By Principal Countries)

(In '000 tonnes of metal content)

Country	Reserves
World: Total (rounded)	680000
Australia	94000
Brazil	120000
China	48000
Gabon	20000
Ghana	13000
India*	34000
Kazakhstan	5000
Mexico	5000
South Africa	200000
Ukraine	140000
Other countries	small

Source: Mineral Commodity Summaries, January, 2018.
** India's total resources of manganese ore as on 1.4.2015 are estimated at 496 million tonnes.*

Table – 14 : World Production of Manganese Ore (By Principal Countries)

(In '000 tonnes)

Country	2013	2014	2015
World: Total	53023	54469	53193
Australia	7426	7587	6281
Brazil	2833	2723	2700
China ^(e)	15000	15000	15000
Gabon	4091	4000 ^e	4000 ^e
Ghana	1998	1531	1563
India*	2626	2369	2148
Kazakhstan	2852	2609	1626
Malaysia	1125	835	502
South Africa ^e	10952	13857	15979
Ukraine	1525	1526	1525 ^e
Other countries	2595	2432	1869

Source: World Mineral Production, 2011-2015.

** India's production of manganese ore in 2013-14, 2014-15 and 2015-16 was 2.63 million tonnes 2.37 million tonnes and 2.15 million tonnes, respectively.*

FOREIGN TRADE

Exports

Exports of manganese ore was 245 tonnes in 2016-17. More than 61% of exports were to Netherlands and 36% exports to Turkey. Exports of

manganese ore decreased drastically to about 444 tonnes in 2015-16 from 11 thousand tonnes in 2014-15. Out of the total exports in 2015-16, 93 tonnes of manganese ore having +46% Mn were exported. There were no exports of ore having 30 to 35% Mn. Exports of manganese ore (others) were 351 tonnes. More than 78% of exports were to Netherlands and 21% exports to Nepal. Exports of manganese oxide (total) increased to 21,850 tonnes in 2015-16, as against 16,449 tonnes in the previous year. Manganese oxide exports in 2015-16 comprised manganese dioxide 2,679 tonnes and other than manganese oxides 19,171 tonnes. Exports were mainly to Russia (10%), Spain (8%), Indonesia and Germany (6% each) Canada and Vietnam (5% each). In 2015-16, exports of manganese and alloys (including waste & scrap) increased to 190 tonnes as compared to 134 tonnes in the previous year. Exports of manganese & alloys (wrought/un-wrought) in 2015-16 were at 180 tonnes as compared to 114 tonnes in the previous year (Tables- 16 to 23).

Imports

Imports of manganese ore was 1.91 million tonnes in 2016-17. South Africa (55%), Australia (22%) and Gabon (11%) were the main suppliers of manganese ore in 2016-17. Imports of manganese ore decreased to about 2.22 million tonnes in 2015-16 from 3.17 million tonnes in 2014-15. South Africa (50%), Australia (24%) and Gabon (20%) were the main suppliers of manganese ore in 2015-16. Out of the manganese ore (total) imported, manganese ore having +46% Mn contributed 5,88,896 tonnes, manganese ore having 35 to 46% Mn were 13,85,986 tonnes, manganese ore having 30 to 35 % Mn were 1,99,508 tonnes and manganese ore (others) were 15,112 tonnes. In 2015-16, imports of manganese dioxide were 8,225 tonnes. Imports were mainly from China (82%), Indonesia (13%) and South Africa (3%). Imports of manganese oxide and other than manganese dioxides were 4,966 tonnes. During 2015-16, imports of manganese & alloys (including waste and scrap) were 29,045 tonnes, out of which manganese & alloys (unwrought) comprised 20,839 tonnes. Imports of manganese & alloys NES were 195 tonnes mostly from China (76%) and Spain (16%) (Tables- 25 to 35).

MANGANESE ORE

**Table – 15 : Exports of Manganese Ore : Total
(By Countries)**

Country	2016-17 (P)	
	Qty (t)	Value (₹'000)
All Countries	245	12377
Netherlands	150	7690
Turkey	87	4500
Nepal	7	35
Other countries	1	152

**Table – 16 : Exports of Manganese Ore : Total
(By Countries)**

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	11026	65399	444	18946
Netherlands	25	1310	346	18526
Nepal	-	-	93	191
Saudi Arabia	-	-	1	103
Malaysia	-	-	3	69
Bhutan	-	-	1	55
Brunei	1	1	++	1
Pakistan	11000	64088	-	-
Other countries	-	-	++	1

**Table – 17 : Exports of Manganese Ore
(46% or more Mn)
(By Countries)**

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	-	-	93	317
Nepal	-	-	91	159
Saudi Arabia	-	-	1	103
Bhutan	-	-	1	55

MANGANESE ORE

**Table – 18 : Exports of Manganese Ore (Others)
(By Countries)**

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	11026	65399	351	18629
Netherlands	25	1310	346	18526
Malaysia	-	-	3	69
Nepal	-	-	2	32
Brunei	1	1	++	1
Pakistan	11000	64088	-	-
Other countries	-	-	++	1

**Table – 19 : Exports of Manganese Oxide : Total
(By Countries)**

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	16449	642153	21850	805057
Russia	1043	39165	2259	78763
Spain	1553	60873	1797	64164
Canada	953	44006	1083	49068
Indonesia	641	27211	1281	47733
Germany	1181	44705	1303	45972
Vietnam	606	25605	1104	41516
Thailand	868	29999	1073	34893
Turkey	550	22574	855	31672
Australia	659	27547	810	30629
Belgium	700	27843	850	29749
Other countries	7695	292625	9435	350898

MANGANESE ORE

**Table – 20 : Exports of Manganese Dioxide
(By Countries)**

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	3261	105170	2679	91517
Iran	750	28413	700	20635
Saudi Arabia	88	3396	120	8496
Poland	150	8413	123	6760
Kenya	154	5535	179	6736
Italy	37	2031	125	4943
Bangladesh	352	9042	174	4358
Netherlands	25	1355	75	3668
Thailand	243	4105	248	3657
Malaysia	105	5483	74	3369
Sri Lanka	113	2523	131	3072
Other countries	1244	34874	730	25823

**Table – 21 : Exports of Manganese Oxide
(Other than Manganese Dioxide)
(By Countries)**

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	13188	537072	19171	713740
Russia	1043	39165	2235	78161
Spain	1508	57652	1771	62190
Canada	929	43070	1083	49068
Indonesia	640	27183	1281	47733
Germany	1181	44705	1303	45918
Vietnam	605	25566	1029	39995
Turkey	550	22574	853	31589
Thailand	625	25894	825	31236
Australia	659	27547	810	30629
Belgium	675	26666	800	27253
Other countries	4773	197050	7181	269968

MANGANESE ORE

**Table – 22 : Exports of Manganese & Alloys
(Incl. Waste & Scrap)
(By Countries)**

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	134	110433	190	150383
France	-	-	40	35411
China	-	-	23	20238
Korea, Rep. of	33	48329	10	14554
Slovenia	8	11206	9	11708
Chinese Taipei/ Taiwan	7	11416	6	9843
Malaysia	5	5074	36	9831
Korea Dem. P. Rep.	-	-	6	9134
Italy	4	6005	4	7298
Brazil	8	3563	4	6329
Romania	2	4378	2	3644
Other countries	67	20462	50	22393

**Table – 23 : Exports of Manganese & Alloys :
(Wrought/Unwrought)
(By Countries)**

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	114	107093	180	148371
France	-	-	40	35411
China	++	931	23	20238
Korea, Rep. of	33	48329	10	14554
Slovenia	8	11206	9	11708
Chinese Taipei/ Taiwan	7	11385	6	9843
Malaysia	5	4881	34	9417
Korea Dem. P. Rep.	-	-	6	9134
Italy	4	6005	4	7224
Brazil	3	2450	4	6329
Romania	2	4378	2	3644
Other countries	52	17528	42	20869

**Table – 24 : Imports of Manganese Ore : Total
(By Countries)**

Country	2016-17 (P)	
	Qty (t)	Value (₹'000)
All Countries	1908257	24028137
Argentina	24050	249590
Australia	426001	6757034
Brazil	17684	200802
Cote D' Ivoire	75733	913035
Gabon	205026	2258074
Egypt	13209	134055
Malaysia	77134	447955
South Africa	1046820	12724937
Other countries	22600	342655

**Table – 25 : Imports of Manganese Ore : Total
(By Countries)**

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	3173158	34669120	2216864	17413687
South Africa	2043506	19932204	1118790	8102080
Australia	748671	9900465	535431	4760456
Gabon	263274	3314330	447388	3620290
Ivory Coast/ Cote d' Ivoire	75124	931846	48200	380360
Malaysia	14710	92041	54410	253989
Singapore	6350	233138	5170	189483
France	-	-	4554	52598
Peru	929	15768	1177	18481
Colombia	480	7958	320	14953
Indonesia	-	-	438	7295
Other countries	20114	241370	986	13702

MANGANESE ORE

**Table – 26 : Imports of Manganese Ore
(46% or more Mn)
(By Countries)**

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	892093	11730476	588896	5376549
Australia	595815	8212297	422527	3884653
South Africa	216394	2222393	119430	882415
Gabon	55164	779168	39315	373706
Singapore	6350	233138	5170	189483
Peru	929	15768	1177	18481
Colombia	180	7958	320	14953
UAE	-	-	349	5410
Tanzania Rep.	-	-	377	4250
Zambia	2853	47818	136	2244
Nigeria	28	378	75	587
Other countries	14380	211558	20	367

**Table – 27: Imports of Manganese Ore
(35% or more but below 46% Mn)
(By Countries)**

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	2090849	21380159	1385986	10479876
South Africa	1697148	16606003	973510	7049910
Gabon	191444	2394448	248147	2137984
Australia	126965	1489494	108147	848682
Ivory Coast/ Cote d' Ivoire	64199	774199	46238	362731
France	-	-	4554	52598
Malaysia	-	-	5363	27682
Nigeria	353	4362	27	289
Morocco	4727	52651	-	-
Turkey	4315	37719	-	-
Senegal	577	7234	-	-
Other countries	1121	14049	-	-

MANGANESE ORE

**Table – 28 : Imports of Manganese Ore
(30% or more but below 35%)
(By Countries)**

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	170570	1426501	199508	1358838
Gabon	16666	140714	159926	1108600
South Africa	125329	1063871	25850	169754
Malaysia	-	-	7013	35734
Australia	25891	198674	4757	27121
Ivory Coast/ Cote d' Ivoire	-	-	1962	17629
Morocco	2094	19824	-	-
Georgia	590	3418	-	-
Other countries	-	-	-	-

**Table – 29 : Imports of Manganese Ore (Others)
(By Countries)**

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	1	2373	15112	78204
Malaysia	-	-	14672	70354
Indonesia	-	-	438	7295
Kazakhstan	-	-	1	549
Germany	-	-	1	6
South Africa	++	2367	-	-
Ivory Coast/ Cote d' Ivoire		1	6	- -
Other countries	-	-	-	-

**Table – 30 : Imports of Manganese Dioxide
(By Countries)**

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	7847	651539	8225	743183
China	5760	528860	6731	661884
Belgium	53	11957	162	29589
Indonesia	1244	30868	1090	20199
South Africa	760	71196	232	18886
Japan	1	770	6	9256
USA	24	6262	1	2067
Germany	5	1524	3	1234
UK	++	102	++	60
Canada	-	-	++	6
Singapore	-	-	++	2

**Table – 31 : Imports of Manganese Oxide
(Other than Manganese Dioxide)
(By Countries)**

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	4653	275496	4966	218769
Belgium	810	122591	740	102647
South Africa	2011	45900	3122	72581
Indonesia	1328	33549	950	20547
China	415	61960	56	8962
USA	49	5766	82	8949
Germany	9	2846	14	4462
Japan	-	-	++	468
Australia	-	-	2	88
UK	5	784	++	65
Canada		1364	-	-
Other countries	26	736	-	-

MANGANESE ORE

**Table –32: Imports of Manganese & Alloys
(Incl. Waste & Scrap)
By Countries**

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	30932	4232257	29045	3606506
China	30197	4019763	28565	3364240
France	135	131602	213	160162
USA	11	13500	66	48130
South Africa	506	36438	153	10656
Germany	20	3176	12	9412
Spain	-	-	31	8669
Sweden	18	16230	5	4436
UK	20	9808	++	449
Switzerland	-	-	++	238
Japan	-	-	++	82
Other countries	25	1740	++	32

**Table – 33 : Imports of Manganese & Alloys Unwrought
By Countries**

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	20226	2806722	20839	2539220
China	19534	2602832	20406	2319401
France	135	131602	209	156566
USA	10	12740	66	48115
South Africa	464	29484	153	10656
Sweden	18	16201	4	3445
Germany	20	3169	1	926
Japan	-	-	++	82
Singapore	-	-	++	29
UK	20	9594	-	-
UAE	5	667	-	-
Other countries	20	433	-	-

**Table – 34: Imports of Manganese : Wrought
(By Countries)**

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	9634	1281601	8011	1024855
China	9592	1274647	8011	1024855
South Africa	42	6954	-	-

**Table – 35: Imports of Manganese & Alloys, NES
(By Countries)**

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	1072	143934	195	42461
China	1071	142284	148	19985
Spain	-	-	31	8669
Germany	++	7	11	8486
France	-	-	4	3596
Sweden	++	29	1	991
UK	++	214	++	449
Switzerland	-	-	++	238
USA	1	760	++	45
Belgium	-	-	++	2
Italy	++	622	-	-
Other countries	++	18	-	-

FUTURE OUTLOOK

India's per capita steel consumption is about 60 kg as against the world's per capita consumption of 214 kg. This difference in the per capita consumption of steel in itself reflects opportunities that are bound to occur for Steel Industry which in turn would positively impact the demand for manganese ore. Production of crude steel is the single most important factor that influences the demand for manganese ore. Steel Industry accounts for approximately 90% of the world demand for manganese. India's steel production grew from 89.03 million tonnes in 2015 to 95.62 million tonnes in 2016 registering a growth of 7.40 per cent whereas the world's steel production growth was only 0.80 % over the same period. This indicates strong growth of steel industry in the country as steel is the principal market accounting for 65 to 70% manganese consumption.

India has set a capacity target of 300 million tonnes of steel by 2030. The demand for manganese ore is expected to commensurately raised to about 10 million tonnes per year in the coming years.