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(Part- III : Mineral Reviews)

52nd Edition

MANGANESE ORE

(ADVANCE RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

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34 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 is one of the most important metals in an industrial economy. Manganese ores of major commercial importance are: (i) pyrolusite (MnO_2, Mn 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. H_2O, Mn 62.4%); and (iv) braunite ($3Mn_2O_3$, $MnSiO_3$, Mn about 62% and SiO_2 about 10%).

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

RESOURCES

The total resources of manganese ore in the country as on 1.04.2010 are placed at 430 million tonnes as per UNFC system. Out of these, 142 million tonnes are categorised as reserves and the balance 288 million tonnes are in the remaining resources category. Grade-wise, ferro-manganese grade accounts for 8%, medium grade 11%, BF grade 34% and the remaining 47% are of mixed, low, others, unclassified, and not-known grades including 0.35 million tonnes of battery/chemical grade.

State-wise, Odisha tops the total resources with 44% share followed by Karnataka 22%, Madhya Pradesh 13%, Maharashtra 8%, Andhra Pradesh 4% and Jharkhand & Goa 3% each. Rajasthan, Gujarat and West Bengal together shared the remaining about 3% resources (Table - 1).

EXPLORATION & DEVELOPMENT

Details of exploration carried out for manganese ore by various agencies during 2012-13 are given in Table - 2.

PRODUCTION, STOCKS AND PRICES

The production of manganese ore at 2,322 thousand tonnes during 2012-13 decreased by 4% as compared to that in the previous year.

There were 165 reporting mines during 2012-13 as against 155 in the previous year. Besides, manganese ore production was reported by nine mines of iron ore and one mine each of laterite, limestone and quartz in 2012-13 and eight mines of iron ore and one mine each of quartz in 2011-12. In all, 78 producers reported production of manganese ore in 2012-13. Five principal producers operating 25 mines contributed 81% of the production. About 79% of the total production was reported by 17 mines, each producing more than 40,000 tonnes per annum, while 6% was contributed by 5 mines (including two associate mines) each falling in the production range of 20,001 to 40,000 tonnes. The remaining 15% production was covered by 145 manganese ore and 10 associate mines each producing upto 20,000 tonnes.

In 2012-13, twenty three public sector mines jointly accounted for 49% of the total production. The contribution of captive mines was 14% of the total production.

With regard to grade-wise composition of production in 2012-13, 64% of the total production was of lower grade (below 35% Mn), 22% of medium grade (35-46%Mn) and 12% was of high grade (above 46% Mn). Production of manganese dioxide was 45,653 tonnes (2%) during the year as against 43,862 tonnes (2%) in the previous year.

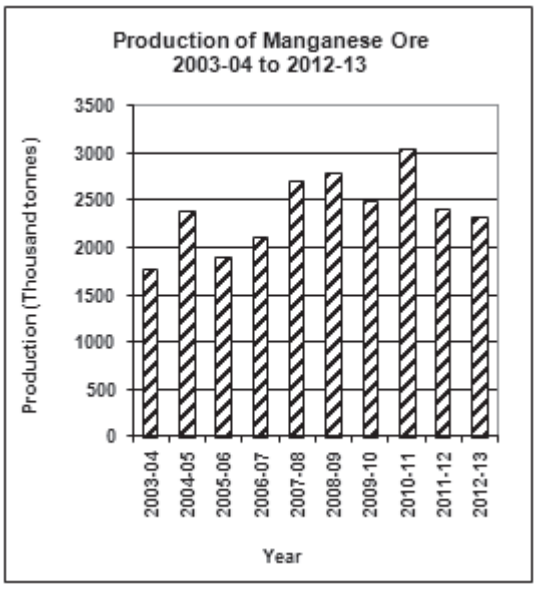


Table – 1 : Reserves/Resources of Manganese Ore as on 01.04.2010

(By Grades/States)

(In '000 tonnes)

State/Grade	Reserves				Remaining resources								Total resources
	Proved	Probable		Total	Feasibility	Pre-feasibility		Measured	Indicated	Inferred	Reconnsaissance	Total	
	STD111	STD121	STD122	(A)	STD221	STD221	STD222	STD331	STD332	STD333	STD334	(B)	(A+B)
All India : Total	**97427**	**11591**	**32961**	**141979**	**23530**	**27593**	**51075**	**5732**	**23726**	**151703**	**4644**	**288003**	**429982**
By Grades													
Battery/Chemical	67	–	45	112	–	8	–	4	26	202	–	240	352
Ferro-manganese	9985	1053	1832	12870	692	3349	2214	3703	3031	9267	330	22586	35456
Medium	4736	194	3764	8694	8482	1356	9595	388	1333	18382	498	40034	48728
BF	33282	3076	13536	49894	5680	8975	11338	360	10835	58109	664	95961	145855
Mixed	1214	188	361	1763	–	66	51	–	–	9400	2100	11617	13380
Medium & BF mixed	6346	900	5017	12263	101	1432	4665	548	1087	23441	750	32024	44287
Ferro-manganese, medium & BF mixed	28879	1998	3665	34542	5928	5751	11387	80	1862	6099	55	31162	65704
Ferro-manganese & BF	1604	253	569	2426	77	320	7678	189	1506	4132	–	13902	16328
Low (-)25% Mn	1505	2	140	1647	464	349	764	237	3713	1925	54	7506	9153
Others	4763	1055	2053	7871	1082	1767	384	223	14	2554	28	6052	13923
Unclassified	3762	1617	1788	7167	191	4212	2348	–	29	13271	165	20216	27383
Not-Known	1284	1255	191	2730	833	8	651	–	290	4921	–	6703	9433
By States													
Andhra Pradesh	1719	596	1841	4156	412	130	251	188	4176	7877	410	13444	17600
Goa	420	32	222	674	156	1674	3814	48	261	6968	–	12921	13595
Gujarat	–	–	–	–	–	–	–	–	–	2954	–	2954	2954
Jharkhand	1250	620	1586	3456	396	211	3053	–	–	6594	–	10254	13710
Karnataka	11455	1827	2820	16102	6056	3730	7523	2227	7385	52893	270	80084	96186
Madhya Pradesh	30094	1944	2954	34992	7769	3934	1719	2179	943	4190	–	20734	55726
Maharashtra	10000	2210	108	12318	497	3010	12001	–	1589	4655	84	21836	34154
Odisha	41354	4361	22784	68499	8244	14906	22714	1090	9371	61343	3880	121548	190047
Rajasthan	1134	–	647	1781	–	–	–	–	–	4030	–	4030	5811
West Bengal	–	–	–	–	–	–	–	–	–	200	–	200	200

Figures rounded off.

Table – 2 : Details of Exploration Activities for Manganese Ore, 2012-13

Agency/ State/ District	Location Area/ Block	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
GSI							
Odisha							
Kendujhar	Bolani NE Block	-	-	8	500	81	Exploration was carried out on the basis of encouraging analytical results of the samples collected during 2008-09. All the boreholes intersected the mineralised zones at expected depth. The investigation has been completed.
Karnataka							
Tumkur	Chikknayakanhalli	1:25,000	-	-	-	-	Reconnaissance stage (G-4) investigation was carried out to delineate the manganese bearing zones in four free hold blocks. The investigation was carried out in association with DMG, Karnataka. The manganese ore horizon occurs as inter-bedded sequence in argillite and meta-chert. The manganese oxide mineralisation is of syngenetic type. The occurence of sulphides is shear controlled. The samples are submitted for assessment of manganese sulphide. The investigation is completed.
MOIL							
Madhya Pradesh							
Balaghat	Bharveli Mine	-	-	04	1617	-	As on 01.04.2013, total manganese ore resources were estimated at 23.98 million tonnes with grade 30-50% Mn.
-do-	Sitapatore/ Sukli Mine	-	-	-	-	-	0.40 million tonnes of reserves were estimated as on 1.4.2012.
-do-	Ukwa Mine	-	-	-	-	-	As on 01.04.2012, 8.63 million tonnes reserves were estimated.
-do-	Tirodi Mine	-	-	01	410	-	As on 01.04.2012, 1.40 million tonnes reserves were estimated.
Maharashtra							
Bhandara	Dongri Buzurg Mine Teh. Tumsar	-	-	03	402	-	As on 01.04.2012, about 11.90 million tonnes in-situ manganese ore resources were estimated.
-do-	Chikla Mine Post - Sitasaongi Teh. Tumsar	-	-	13	1636.30	-	As on 01.04.2012, about 5.10 million tonnes of manganese ore resources were estimated.
Nagpur	Gumgaon Mine Vill. Teghai Teh. Saoner	-	-	04	829	-	As on 01.04.2012, about 4.11 million tonnes of manganese ore resources were estimated.
-do-	Kandri Mine Teh. Ramtek	-	-	3	769	-	As on 01.04.2012, about 5.53 million tonnes of manganese ore resources were estimated.
-do-	Mansar Mine Teh. Ramtek	-	-	1	160	-	As on 01.04.2012, about 4.64 million tonnes of manganese ore resources were estimated.
-do-	Beldongri	-	-	-	-	-	0.37 million tonnes of reserves were estimated.

Madhya Pradesh & Maharashtra being the leading manganese producing states accounted for 30% and 29% respectively of the total production in 2012-13. Next in the order of production were Odisha (23%), Andhra Pradesh (16%) and Karnataka (1%). Goa, Jharkhand and Rajasthan contributed very nominal production (0.40%) during the year (Tables - 3 to 7).

The mine-head stocks were 849 thousand tonnes at the end of 2012-13 as against 963 thousand tonnes at the beginning of the year (Tables - 8(A) and 8 (B).

The average daily employment of labour strength in manganese ore mines was 14,618 in 2012-13 as against 14,587 in the previous year. Prices of manganese ore are furnished in the General Review on "Prices".

Table – 3 : Principal Producers of Manganese Ore, 2012-13

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.	Odisha	1. Kendujhar 2. Sundergarh
RBSSD & FN DAS Garividi 535 101, Shreeram Nagar, Dist. Vizianagaram, Andhra Pradesh	Andhra-Pradesh	Vizianagaram
Mangilal Rungta, Rungta office, Main Road, Barbil, Dist. Kendujhar, Odisha-758 035.	Odisha	Kendujhar
SR Ferro Alloys, Plot No. 101-102, Industrial Area Meghnagar, Distt. Jhabua - 457 779 Madhya Pradesh.	Madhya-Pradesh	Jhabua

Table – 4 : Principal Producers of Manganese Dioxide, 2012-13

Name & address of Producer	Location of mine	
	State	District
Tata Steel Ltd, 24, Homi Mody Street, Fort, Mumbai – 400 001.	Odisha	Kendujhar
MOIL Ltd, MOIL Bhavan, 1A, Katol Road, Chhaoni, Nagpur – 440 013, Maharashtra.	Maharashtra	Bhandara
*Devkabai Velji, Barajamda, District Singhbhum(W) Jharkhand.	Jharkhand	Singhbhum(West)
Orissa Manganese & Minerals (P) Ltd, P.O. Koira – 770 048, District Sundergarh, Odisha.	Odisha	Sundergarh
Mangilal Rungta, P. O. Chaibasa – 833 201, District Singhbhum(W), Jharkhand.	Odisha	Kendujhar
*Rahes Bihari Das, Keuta Sahi, Choudhary Bazar, Cuttack - 753 501,Odisha.	Odisha	Kendujhar
*Prabodh Mohanty, Weighbridge Road, Barbil - 758 035, Distt. Kendujhar, Odisha.	Odisha	Kendujhar

* Associated with iron ore

Table – 5 : Production of Manganese Ore, 2010-11 to 2012-13(P) (By States)

(Quantity in tonnes; value in ₹'000)

State	2010-11		2011-12		2012-13(P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	**3056385**	**14684000**	**2411871**	**11777000**	**2322214**	**12648711**
Andhra Pradesh	290785	526834	327387	588258	369442	524427
Goa	440	1684	1550	2423	50	110
Gujarat	245240	121639	40556	23928	-	-
Jharkhand	44898	62094	19642	37362	4266	25444
Karnataka	413287	929734	199034	496174	31532	156292
Madhya Pradesh	716285	4226787	607968	4033483	706194	4792119
Maharashtra	672828	4984603	646238	4207142	674628	4775282
Odisha	655984	3805668	562013	2373264	531115	2362301
Rajasthan	16638	24957	7483	14966	4987	12736

Table – 6 (A) : Grade-wise Production of Manganese Ore, 2011-12 (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	**155(9)**	**43862**	**252635**	**568720**	**1299724**	**246930**	**2411871**	**11777000**
Public Sector	20	6756	205355	293915	586980	43081	1136087	75759895
Private Sector	135(9)	37106	47280	274805	712744	203849	1275784	4201011
Andhra Pradesh	**39**	**-**	**-**	**7650**	**246434**	**73303**	**327387**	**588258**
Adilabad	10	-	-	-	1465	18245	19710	60729
Vizianagaram	29	-	-	7650	244969	55058	307677	527529
Goa	**4**	**-**	**-**	**-**	**1550**	**-**	**1550**	**2423**
South Goa	4	-	-	-	1550	-	1550	2423
Gujarat	**1**	**-**	**-**	**-**	**-**	**40556**	**40556**	**23928**
Panchmahal	1	-	-	-	-	40556	40556	23928
Jharkhand	**3(2)**	**150**	**150**	**1730**	**15514**	**2098**	**19642**	**37362**
Singbhum (West)	3(2)	150	150	1730	15514	2098	19642	37362
Karnataka	**21**	**-**	**-**	**35442**	**146931**	**16661**	**199034**	**496174**
Bellary	8	-	-	34742	89022	15050	138814	287674
Chitradurga	6	-	-	700	-	1611	2311	3812
Davanagere	3	-	-	-	57909	-	57909	204688
Shimoga*	2	-	-	-	-	-	-	-
Tumkur*	2	-	-	-	-	-	-	-
Madhya Pradesh	**38(2)**	**-**	**170995**	**103839**	**261028**	**72106**	**607968**	**4033483**
Balaghat	27(1)	-	165692	93465	216596	33160	508913	3644960
Chhindwara	5	-	5303	10374	10555	13009	39241	211124
Jabalpur	4(1)	-	-	-	-	3163	3163	6491
Jhabua	2	-	-	-	33877	22774	56651	170908
Maharashtra	**19**	**6756**	**40673**	**232219**	**364547**	**2043**	**646238**	**4207142**
Bhandara	4	6756	13032	165801	255665	584	441838	2877206
Nagpur	15	-	27641	66418	108882	1459	204400	1329936
Odisha	**29(5)**	**36956**	**40817**	**187840**	**256237**	**40163**	**562013**	**2373264**
Kendujhar	14(4)	36954	40079	153349	213915	12408	456705	1866775
Sundergarh	15(1)	2	738	34491	42322	27755	105308	506489
Rajasthan	**1**	**-**	**-**	**-**	**7483**	**-**	**7483**	**14966**
Banswara	1	-	-	-	7483	-	7483	14966

*Figures in parentheses indicate associated mines of iron ore and quartz. * Only labour reported.*

Table – 6 (B) : Grade-wise Production of Manganese Ore, 2012-13 (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	**165(12)**	**45653**	**270491**	**520936**	**1245397**	**239737**	**2322214**	**12648711**
Public Sector	23	1679	206073	314532	620090	450	1142824	8472284
Private Sector	142(12)	43974	64418	206404	625307	239287	1179390	4176427
Andhra Pradesh	**40**	**-**	**-**	**15593**	**230005**	**123844**	**369442**	**524427**
Adilabad	10	-	-	-	1684	12459	14143	51090
Vizianagaram	30	-	-	15593	228321	111385	355299	473337
Goa	**5**	**-**	**-**	**-**	**50**	**-**	**50**	**110**
South Goa	5	-	-	-	50	-	50	110
Gujarat	**1**	-	-	-	-	-	-	-
Panchmahal*	1	-	-	-	-	-	-	-
Jharkhand	**4(1)**	**316**	**109**	**1419**	**1052**	**1370**	**4266**	**25444**
Singhbhum (West)	4(1)	316	109	1419	1052	1370	4266	25444
Karnataka	**15**	**-**	**-**	**3805**	**20714**	**7013**	**31532**	**156292**
Bellary	5	-	-	3805	6965	-	10770	73964
Chitradurga	4	-	-	-	-	3725	3725	7975
Davanagere	3	-	-	-	13728	3184	16912	74015
Shimoga*	1	-	-	-	-	-	-	-
Tumkur	2	-	-	-	21	104	125	338
Madhya Pradesh	**43(5)**	**-**	**181002**	**101833**	**361119**	**62240**	**706194**	**4792119**
Balaghat	33(1)	-	160518	88543	272236	22203	543500	4055574
Chhindwara	4	-	20484	13290	16328	9762	59864	432366
Jabalpur	4(4)					24080	24080	50376
Jhabua	2	-	-	-	72555	6195	78750	253803
Maharashtra	**18**	**1679**	**46893**	**247948**	**369648**	**8460**	**674628**	**4775282**
Bhandara	3	1679	20502	169310	253801	-	445292	3196042
Nagpur	15	-	26391	78638	115847	8460	229336	1579240
Odisha	**38(6)**	**43658**	**42487**	**150338**	**257822**	**36810**	**531115**	**2362301**
Kendujhar	17(5)	43499	42006	131492	228472	33308	478777	2019232
Raygada	2	-	-	-	9	-	9	63
Sundergarh	19(1)	159	481	18846	293417	3502	52329	343006
Rajasthan	**1**	**-**	**-**	**-**	**4987**	**-**	**4987**	**12736**
Banswara	1	-	-	-	4987	-	4987	12736

Figures in parentheses indicate associated mines of iron ore, laterite, limestone and quartz.
** Only labour reported.*

Table – 7 : Production of Manganese Ore, 2011-12 and 2012-13(P) (By Frequency Groups)

(Quantity in tonnes)

Production Group	No. of mines		Production		Percentage in total Production		Cumulative %	
	2011-12	2012-13	2011-12	2012-13	2011-12	2012-13	2011-12	2012-13
Total	**155(9)**	**165(12)**	**2411871**	**2322214**	**100.00**	**100.00**	-	-
Upto 1000	75(1)	92(4)	15022	14594	0.62	0.63	0.62	0.63
1001 - 5000	32(4)	33(3)	80232	91496	3.33	3.94	3.95	4.57
5001 - 10000	9(1)	7(2)	73494	62813	3.05	2.70	7.00	7.27
10001 - 20,000	16(1)	13(1)	258674	181392	10.73	7.81	17.73	15.08
20,001 - 30,000	2(1)	2(1)	77128	70698	3.20	3.04	20.93	18.12
30,001 - 40,000	4(1)	1(1)	188441	69120	7.81	2.98	28.74	21.10
40,001 - 50,000	2	1	90227	48710	3.74	2.10	32.48	23.20
50,001 and above	15	16	1628653	1783391	67.52	76.80	100.00	100.00

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

Table – 8 (A) : Mine-head Stocks of Manganese Ore at the beginning of 2012-13 (By States and Grades)

(In tonnes)

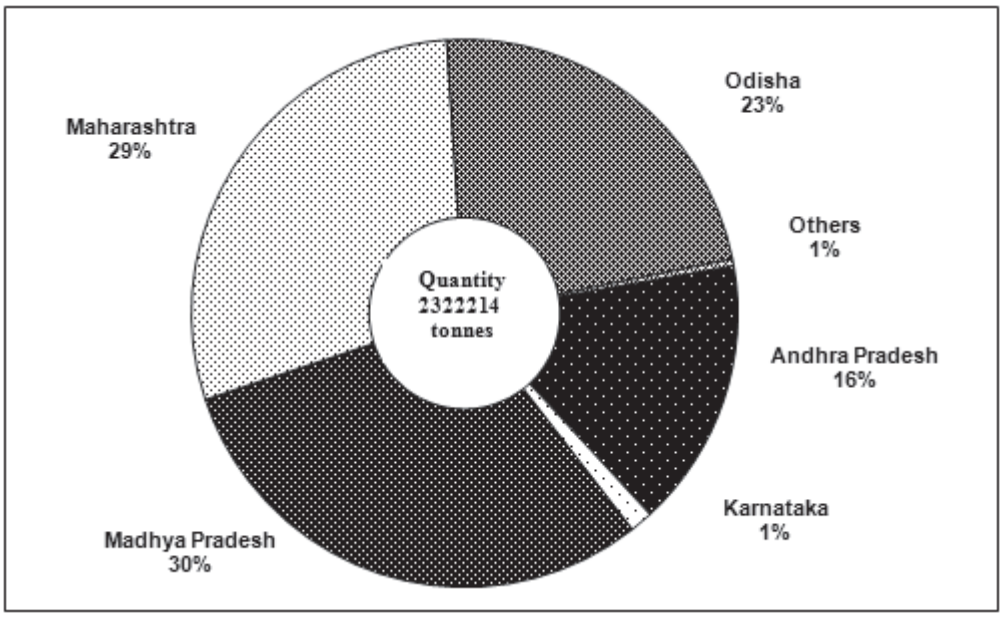
State	Grades : Mn content					
	MnO_2	above 46%	35% - 46%	25% - 35%	below 25%	Total
India	**8201**	**17399**	**179659**	**497196**	**260223**	**962678**
Andhra Pradesh	-	-	107	46112	5332	51551
Goa	-	-	-	1550	50	1600
Jharkhand	-	18	2	3899	1266	5185
Karnataka	-	-	42531	70943	120276	233750
Madhya Pradesh	-	5916	18701	47807	69250	141674
Maharashtra	3130	5102	36836	69508	8989	123565
Odisha	5071	6363	81482	256377	55060	404353
Rajasthan	-	-	-	1000	-	1000

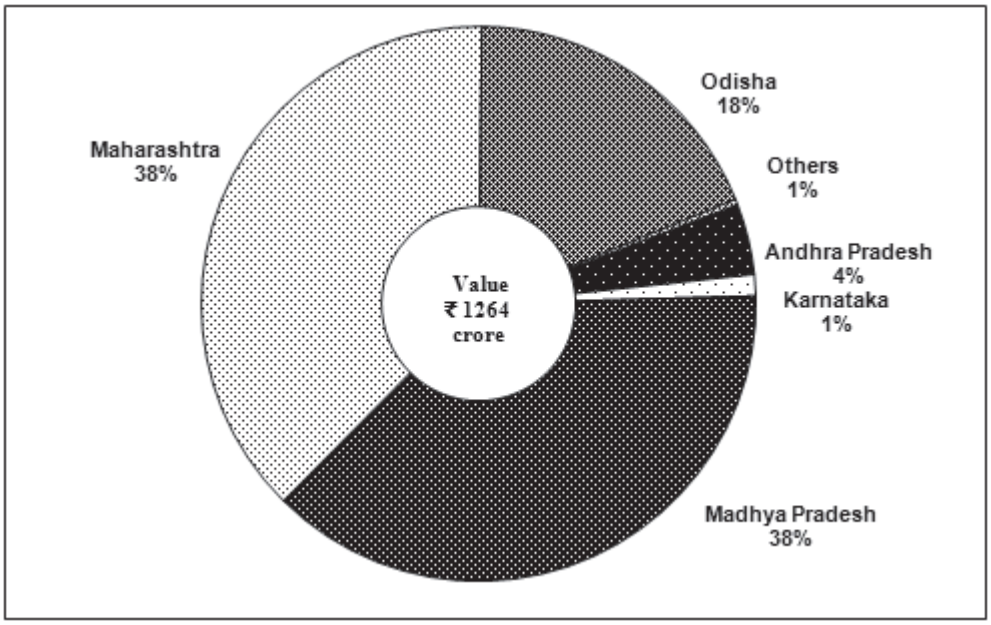
Table – 8 (B) : Mine-head Stocks of Manganese Ore at the end of 2012-13(P) (By States and Grades)

(In tonnes)

State	Grades : Mn content					
	MnO_2	above 46%	35% - 46%	25%-35%	below 25%	Total
India	**11439**	**23160**	**164152**	**361698**	**288974**	**849423**
Andhra Pradesh	-	-	90	31380	14058	45528
Goa	-	-	-	100	-	100
Jharkhand	10	25	8	3883	1283	5209
Karnataka	-	-	30787	44158	127335	202280
Madhya Pradesh	-	6854	16550	33207	55141	111752
Maharashtra	3339	11161	22645	17602	15995	70742
Odisha	8090	5120	94072	231162	75162	413606
Rajasthan	-	-	-	206	-	206

Quantity and Value of Manganese Ore Production in Different States, 2012-13





MINING, PROCESSING, MARKETING & TRANSPORT

Manganese ore mining in the country is carried out by opencast as well as by underground methods. Of the 149 mines, 8 are underground (3 in Madhya Pradesh and 5 in Maharashtra). Seven underground mines were operated by MOIL, 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 is 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 to fill up the voids is being practised 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 was completed in Balaghat and Beldongri mines of MOIL. Sinking of vertical shafts is in progress at Mansar and Ukwa mines.

The open-pits are 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 m^3 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 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 500,000 tonnes per annum capacity at Balaghat mine in order to conserve mineral and profitably utilise low/medium grade ore. The plant facilities include crushing, wet screening, classification and jigging operations.

The plant upgrades the low/medium 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 case of integrated iron and 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 export, producers other than MOIL supply it to MMTC, the canalising agency, either at rail-head or at the port. MOIL exports its own ore.

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 Marmugao 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 both manually and mechanically.

ENVIRONMENTAL PROTECTION

MOIL carried out mass afforestation work to maintain ecological balance at 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. At Gumgaon mine, a sericulture project has been established as a part of socio-economic programme and even on waste debris dumps, a forest has been developed.

Chandrapur Ferro Alloys Plant of SAIL (formerly Maharashtra Electrosmelt Ltd) has continuously taken steps towards gainful utilisation of high MnO slag in silico-manganese production, lumpy silico-manganese slag as rail ballast and for road construction as a step towards solid waste management.

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. 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%, SiO_2: 2 to 8%, Al_2O_3: 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- 9.

Table – 9 : 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, Shimoga.	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_2O_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_2O_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_2O_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 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 contents, 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 MnO_2 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 MnO_2 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.

In chemical industry, generally high-grade material is used for potassium permanganate. Ore containing MnO_2 80% (min), SiO_2 5% (max), Fe_2O_3 5% (max) and 200 to 250 mesh ore size is used. In glass industry, ore analysing MnO_2 80% (preferably 86% min), Fe_2O_3 5% (preferably 0.75% max), SiO_2 2.8% (max), Al_2O_3 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: MnO_2 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 depending upon the 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 MnO_2 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 4.18 million tonnes in 2012-13 as against 4.00 million tonnes in 2011-12. Silico-manganese (63%) and ferro-manganese (30%) industries together accounted for about 93% consumption followed by iron & steel (6%). The remaining (1%) was shared by battery, chemical, zinc smelter, alloy steel and glass industries (Table-10).

The consumption of ferro-manganese in 2012-13 decreased to 124 thousand tonnes from 126 thousand tonnes in the previous year. Iron & steel industry was the bulk consumer of ferro-manganese accounting for about 94% consumption in 2012-13. The remaining 6% was consumed in alloy steel, foundry and electrode industries. Consumption of silico-manganese which was 216 thousand tonnes in 2011-12 increased to 218 thousand tonnes in 2012-13 (Tables - 11 & 12).

Table – 10 : Consumption of Manganese Ore[1/], 2010-11 to 2012-13
(By Industries)

(In tonnes)

Industry	2010-11	2011-12(P)	2012-13(p)
All Industries	**3374200**	**4005600**	**4176900**
Battery[2/]	14600(6)	14600(6)	14600(6)
Chemical	1600(2)	1600(2)	1600(2)
Ferro-manganese	964800[(e)]	1072200[(e)]	1243200[(e)]
Silico-manganese	2235900[(e)]	2661100[(e)]	2661100[(e)]
Iron & steel	155300(23)	254100(26)	254400(26)
Zinc smelters	1700(2)	1700(2)	1700(2)
Others: (Alloy steel electrode glass)	300(2)	300(3)	(300(3)

Figures rounded off.

Figures in parentheses denote the number of units in organised sector reporting consumption.*

** Includes actual reported consumption and/or estimates made wherever required).*

[1/] Besides, there are a number of SSI units manufacturing ferro-manganese and silico-manganese, data for which are not available. Excludes consumption of manganese ore fines which are used in making sinters which are in turn used in the manufacture of ferro-manganese, data for which are not available.

[2/] Excludes consumption of indigenous and imported electrolytic manganese dioxide (EMD) which was estimated at about 6680 tonnes, in each of the last three years (i.e. during 2010-11 to 2012-13, respectively. Also excludes consumption of natural manganese dioxide in the manufacture of EMD.

Table – 11 : Consumption of Ferro-manganese, 2010-11 to 2012-13
(By Industries)

(In tonnes)

Industry	2010-11	2011-12	2012-13
All Industries	**118000**	**126100**	**123900**
Alloy steel	6400(11)	6400(10)	6400(10)
Electrode	900(15)	1000(21)	800(21)
Foundry	600(17)	500(18)	500(18)
Iron & steel	110100(16)	118200(16)	116200(17)

Figures rounded off.

Figures in parentheses denote the number of units in organised sector reporting consumption.*

(Includes actual reported consumption and/or estimates made wherever required).*

Table – 12 : Consumption of Silico-manganese, 2010-11 to 2012-13 (By Industries)

(In tonnes)

Industry	2010-11	2011-12	2012-13
All Industries	**192400**	**215600**	**217700**
Alloy steel	1900(3)	2000(3)	2000(3)
Foundry	200(3)	200(3)	200(3)
Iron & steel	190300(24)	213400(28)	215500(28)

Figures rounded off.
Figures in parentheses denote the number of units in organised sector reporting consumption.*
(Includes actual reported consumption and/or estimates made wherever required).*

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. Manganese is an essential requisite for iron and steel production owing to its capability for sulphur fixing, de-oxidising and good alloying properties. 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 2.75 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 2012-13, about 786 tonnes of EMD was produced as against 714 tonnes in 2011-12. Ferro-manganese plant of 10,000 tonnes per annum capacity has been set up at Bharveli, Balaghat.

Ferro-manganese

The total production of various types of manganese alloys (high carbon ferro-manganese, medium carbon ferro-manganese and low carbon ferro-manganese) in 2012-13, as per Indian Ferro Alloys Producers' Association was about 4.47 lakh tonnes as against 4.02 lakh tonnes in 2011-12.

Silico-manganese

Silico-manganese is a combination of 60-70% Mn, 10-20% silica and about 20% carbon. As per the IFAPA, production of silico-manganese increased to 14.78 lakh tonnes in 2011-12 from 12.42 lakh tonnes in 2010-11. MOIL is considering setting up ferro-manganese and silico-manganese plants through joint venture companies with RINL and SAIL. SAIL & MOIL Ltd will set up 31,000 tpy ferro-manganese and 75,000 tpy silico-manganese plants at Nandini near Bhilai, Chhattisgarh. The other joint venture company RINL and MOIL Ltd will set up a 20,000 tpy ferro manganese and 37,000 tpy silico-manganese plants at Bobbili, Vizianagaram district, Andhra Pradesh.

The major factor driving the production of manganese alloys is high production growth of low nickel austenitic stainless steel with India 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 2011-12 and 2012-13 are given in Table-13.

Table – 13 : Consumption, Specifications and Source of Supply of Manganese Ore in Different Iron and Steel Plants, 2011-12 and 2012-13

Plant	Production of pig iron/hot metal (tonnes)		Consumption of Mn-ore (tonnes)		Specifications of ore consumed	Source
	2011-12	2012-13	2011-12	2012-13		
Bhilai Steel Plant, Bhilai Nagar, Durg Chhattisgarh.	Hot metal 5126000	Hot metal 5202000	25656	NA	Size: 25 to 85 mm Mn: 30% min SiO_2: 30% max Al_2O_3: 5% max P: 0.3% max	MOIL/ Ramtek Goberwahi, Gua Mines SAIL, RMD
Bokaro Steel Plant, Bokaro, Jharkhand.	Hot metal 4012000	Hot metal 4124000	NA	NA	Mn: 30% max SiO_2+Al_2O_3 : 20.5% max -10 mm -15% max +40 mm -10% max	-
Durgapur Steel Plant, Durgapur, West Bengal.	Hot metal 2099300	Hot metal 2241500	NA	NA	Mn: 30.0% min Fe: 15-28% SiO_2: 3.3% max Al_2O_3: 7.5% max	-
Rourkela Steel Plant, Rourkela, Odisha.	Hot metal 2309000	Hot metal 2366000	NA	NA	-	-
IISCO Steel Plant, Burnpur, Dist. Burdwan, West Bengal-713 325	Hot metal 58467	Hot metal 232034	NA 576	NA -	Mn (dry) 30% (min.) -10 mm - 10.0% max +40 mm - 15% max	-
Visvesvaraya Iron and Steel Ltd, Bhadravati, Shimoga, Karnataka.	Hot metal 118000	Hot metal 94000	NA	NA	-	-
KIOCL Ltd, Pellet Plant, Mangalore, Dakshina Kannada, Karnataka.	Hot metal NA	Hot metal NA	NA	NA	Fe: 25-50% min MnO_2: 44% min SiO_2 +Al_2O_3 : 12% max	Milan Minerals, Karnataka
Visakhapatnam Steel Plant, Visakhapatnam, Andhra Pradesh.	3778000	NA	11400	NA	Mn: 28%, (min) Fe: 16% SiO_2: 25% max Size: 10-60 mm(BF) (-) 10 mm (SP)	Garividi, Andhra Pradesh
IDCOL, Kalinga Iron Works Ltd, Barbil, Kendujhar, Odisha.	Hot metal 15714	Hot metal 41088	519	1522	Size: 10-40 mm	From own/ local mines
Gordan Steel India Ltd Jaonbulapadu, Anantapur Andhra Pradesh.	Hot metal 76650	Hot metal 30427	728	2292	Mn 28-35% Mn	-
Tata Steel Ltd, Jamshedpur, Jharkhand.	Hot Metal 7746000	Hot metal 8858000	NA	NA	NA	-

(Contd.)

Table - 13 (Concld.)

Plant	Production of pig iron/hot metal (tonnes)		Consumption of Mn-ore (tonnes)		Specifications of ore consumed	Source
	2011-12	2012-13	2011-12	2012-13		
Kirloskar Ferrous Industries Ltd, Berinahalli, 583 234 Koppal, Karnataka.	Pig iron 240899	Pig iron 290854	3095	5942	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 180026	178707	NA	NA	NA	NA
Visa Steel Ltd, Kalinganagar, Jajpur, Odisha.	Hot metal 46233	Hot metal NA	302	NA	below 35% Mn Mines	Siljoda
Sunflag Iron & Steel Co.Ltd, Bhandara Maharashtra.	Hot metal 193992	Hot metal 208224	NA	NA	-	-
Jaiswal Neco Industries Ltd, Raipur, Chhattisgarh	Hot metal 437108	Hot metal 503177	10620	10842	Mn:26-28% Size:10-60 mm	-
Tata Metalliks Ltd, Kharagpur, West Bengal.	Hot metal 287241	Hot metal 345000	7243	7084	NA	NA
JSW Steel Ltd, Salem, Tamil Nadu. 636 453	Hot metal 756000	Hot metal 737000	- 46	- 13	NA	NA
Rashmi Metaliks, Gokulpur, West Midnapur, West Bengal.	Hot metal 115690	Hot metal 118677	2277	1010	NA	NA
Sona Alloys P. Ltd, Lonad, Pune Maharashtra.	Hot metal NA 250000	Hot metal -	NA -	3640 -	NA -	NA -
Aparent Iron & Steel Pvt.Ltd, Goa.	Pig Iron 86870	Pig Iron 20237	1380	334	NA	NA
Uttam Galva Metallics Ltd Bhugaon-442001 Wardha, Maharashtra.	Hot metal 440	487	30	118	NA	NA

Dry Battery

Consumption of manganese dioxide ore in this industry was reported by six units which together accounted for 14,600 tonnes in 2012-13, (excluding 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. There is only one plant producing EMD owned by MOIL in Bhandara district with 1,000 tpy capacity (under expansion to 1,500 tpy capacity).

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.

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, counter balancing this to some extent is a trend towards higher manganese specifications for modern steels.

TRADE POLICY

Export Policy

The Foreign Trade Policy, 2009-14 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 570 million tonnes of metal content which is unevenly distributed (Table-14). Reserves are located in South Africa (26%), Ukraine (25%), Australia (17%), Brazil and India (9% each). 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 2012 was estimated to be around 48.3 million tonnes as compared to 48.1 million tonnes in 2011. China was the leading producer contributing about 31% followed by South Africa (19%), Australia (15%), Gabon (7%) and India (5%) (Table-15). 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.

China

China was the world's largest consumer of manganese and producer of manganese alloys and electrolytic manganese metal (EMM) in the world. In 2012, China was also leading producer of EMD in the world.

South Africa

Manganese ore production (contained manganese)was increased by 6% in 2012 from that in 2011. This increase was primarily a result of a new mine, Tshipi Kalahari Manganese Mine. Total manganese alloys production in 2012 decreased 14% compared with that of 2011 owing to decrease in silico-manganese production in the country.

Brazil

Vale S A was the leading manganese ore and ferro alloy producer which produced 2.4 million tonnes of manganese ore in 2012(a decrease of about 7%) from previous year.

FOREIGN TRADE

Exports

Exports of manganese ore decreased marginally to about 72 thousand tonnes in 2012-13 from 75 thousand tonnes in 2011-12. Out of the total exports in 2012-13, exports of manganese ore having +46% Mn were only 23 tonnes, ore having 30 to 35% Mn were 5,380 tonnes and manganese ore (others) were 66,796 tonnes. 99% of exports were to China. Exports of manganese oxide (total) increased marginally to 10,888 tonnes in 2012-13, as against 8,972 tonnes in the previous year. Manganese oxide exports in 2012-13 comprised manganese dioxide 2,104 tonnes and other oxides 8,784 tonnes. Exports were mainly to Thailand (11%) and Germany (7%). In 2012-13, exports of manganese and alloys (including waste & scrap) increased drastically to 138 tonnes compared to 57 tonnes in the previous year. Exports of wrought/un-wrought manganese alloys in 2012-13 were at 118 tonnes (Tables - 16 to 26).

Imports

Imports of manganese ore increased considerably to about 2.33 million tonnes in 2012-13 from 1.96 million tonnes in 2011-12. South Africa (43%), Australia (32%), Gabon (9%) and Cote d' Ivore (4%) were the main suppliers of manganese ore in 2012-13. Imports in 2012-13 comprised manganese ore having +46% Mn were 813,712 tonnes, manganese ore having 35 to 46% Mn were 1,319,657 tonnes, manganese ore having 30 to 35 % Mn were 45,851 tonnes and manganese ore (others) were 107,406 tonnes. In 2012-13, imports of manganese dioxides were 6,770 tonnes. Imports of manganese dioxides comprised manganese oxide and other than manganese dioxides 1022 tonnes. Imports were mainly from China (89%) and Belgium (5%). During 2012-13, imports of manganese & alloys (including waste and scrap) were 20,076 tonnes, out of which manganese alloys (unwrought) comprised 11,062 tonnes. Imports of manganese & alloys were mainly from China (94%) (Tables - 27 to 37).

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

(In '000 tonnes of metal content)

Country	Reserves
World : Total (rounded)	**570000**
Australia	97000
Brazil	54000
China	44000
Gabon	24000
India	49000
Kazakhstan	5000
Mexico	5000
South Africa	150000
Ukraine	140000
Other countries	Small

Source: *Mineral Commodity Summaries, 2014.*
** India's total UNFC resources of manganese ore as on 1.4.10 are estimated at 430 million tonnes.*

Table – 15 : World Production of Manganese Ore (By Principal Countries)

(In '000 tonnes)

Country	2010	2011	2012
World : Total	**45300**	**48100**	**48300**
Australia	6474	6961	7172
Brazil	3125	3483	2400
China[(e)]	13000	14000	15000
Gabon	3200	3562	3600[e]
Ghana	1194	1828	1491
India	3056	2349	2294
Kazakhstan	3045	2963	2975
South Africa	7172	8652	8943
Ukraine[@]	1589	1391	1234
Other countries	3445	2911	3191

Source: *World Mineral Production, 2008-2012.*
@ : Marketable

** India's production of manganese ore in 2010-11, 2011-12 and 2012-13 was 290.78 thousand tonnes 327.39 thousand tonnes and 369.44 thousand tonnes, respectively.*

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

Country	2011-12		2012-13	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**75183**	**442306**	**72199**	**269610**
China	71054	370246	71758	259381
Sri Lanka	-	-	78	4513
Japan	86	1132	301	3536
Kuwait	-	-	38	1206
Nepal	982	22808	24	808
USA	-	-	++	134
Kenya	20	228	++	32
Other countries	3041	47892	-	-

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

Country	2011-12		2012-13	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**33051**	**129790**	**23**	**718**
Nepal	982	22785	23	718
Other countries	32069	107005	-	-

Table – 20 : Exports of Manganese Ore (Others) (By Countries)

Country	2011-12		2012-13	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**34013**	**262524**	**66796**	**242896**
China	33554	256466	66378	233385
Sri Lanka	-	-	78	4513
Japan	86	1132	301	3536
Kuwait	-	-	38	1206
USA	-	-	++	134
Nepal	++	23	1	90
Kenya	-	-	++	32
Other countries	373	4903	-	-

Table –18 : Exports of Manganese Ore (35% or more but below 46% Mn) (By Countries)

Country	2011-12		2012-13	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**2250**	**7552**	-	-
China	2250	7552	-	-

Table – 19 : Exports of Manganese Ore (30% or more but below 35% Mn) (By Countries)

Country	2011-12		2012-13	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**8099**	**49763**	**5380**	**25996**
China	7000	31430	5380	25996
Other countries	1099	18333	-	-

Table – 21 : Exports of Manganese Oxide : Total (By Countries)

Country	2011-12		2012-13	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**8972**	**348457**	**10888**	**444917**
Thailand	546	25558	1222	41532
Australia	242	12381	717	33579
Germany	1023	45251	726	33546
Spain	1246	54453	716	29959
Italy	700	27511	634	29914
Indonesia	464	19298	627	28300
Russia	765	30431	602	26677
Canada	166	6709	508	24451
Netherlands	-	-	387	18170
Vietnam	312	14246	375	17029
Other countries	3508	112619	4374	161760

Table – 22 : Exports of Manganese Dioxide (By Countries)

Country	2011-12		2012-13	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**1757**	**45177**	**2104**	**54686**
Thailand	51	3231	571	8896
Italy	75	3720	126	8532
Bangladesh	268	4475	250	6233
Chile	123	1683	326	6092
Kenya	152	2440	279	5289
Kuwait	117	2863	116	4115
Poland	75	3834	45	2851
Indonesia	31	953	51	2336
Saudi Arabia	235	2871	83	1466
Netherlands	-	-	21	1408
Other countries	630	19107	236	7468

Table – 23 : Exports of Manganese Oxide (Other than Manganese Dioxide) (By Countries)

Country	2011-12		2012-13	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**7215**	**303280**	**8784**	**390231**
Australia	221	11416	717	33578
Germany	1023	45103	726	33531
Thailand	495	22327	651	32636
Spain	1173	51311	716	29959
Russia	765	30431	602	26677
Indonesia	433	18345	576	25964
Canada	125	5608	489	23686
Italy	625	23791	508	21382
Vietnam	272	12566	375	17029
Netherlands	-	-	366	16761
Other countries	2083	82382	3058	129028

Table – 24 : Exports of Manganese & Alloys (Incl. Waste & Scrap) (By Countries)

Country	2011-12		2012-13	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**57**	**51592**	**138**	**91884**
Korea, Rep. of	14	19180	21	28585
Indonesia	2	470	50	11463
Austria	-	-	6	8045
Czech Republic	2	2158	5	6887
Philippines	-	-	22	5064
UAE	++	113	8	4891
Kazakhstan	-	-	3	3728
Brazil	2	3139	10	2868
Chinese Taipei/ Taiwan	++	70	2	2642
Germany	1	1247	1	2105
Other countries	36	25215	10	15606

Table – 25 : Exports of Manganese & Alloys : (Wrought/Unwrought) (By Countries)

Country	2011-12		2012-13	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**29**	**42886**	**118**	**80540**
Korea, Rep. of	**14**	18693	21	28585
Indonesia	++	70	43	10076
Czech Republic	2	2158	5	6887
Philippines	-	-	22	5037
UAE	-	-	8	4891
Kazakhstan	-	-	3	3728
Chinese Taipei/ Taiwan	++	70	2	2613
Germany	1	1247	1	1929
Slovakia	++	530	1	1846
China	1	2776	1	1845
Other countries	11	17342	11	13103

Table – 26 : Exports of Manganese & Manganese Base Alloys : (Waste/Scrap) (By Countries)

Country	2011-12		2012-13	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**-**	**-**	**8**	**467**
Malaysia	-	-	8	467

Table – 27 : Imports of Manganese Ore : Total (By Countries)

Country	2011-12		2012-13	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**1961396**	**20632696**	**2326728**	**25622446**
South Africa	935987	8535222	1006525	10096647
Australia	568498	6446763	738829	9155222
Gabon	172879	2208206	212907	2588134
Ivory Coast/ Cote d' Ivoire	43306	588107	93524	1079891
Brazil	70404	806947	79207	943569
Japan	4977	50977	81964	488308
Singapore	12308	225727	7326	213518
Ghana	-	-	24905	193047
China	52253	636768	10978	147808
Zambia	22264	315612	9227	137943
Other countries	78520	818367	61336	578359

Table – 28 : Imports of Manganese Ore (46% or more Mn) (By Countries)

Country	2011-12		2012-13	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**860032**	**10178669**	**813712**	**10396960**
Australia	344830	4116621	628741	7952075
South Africa	254734	2588620	90273	1022742
Gabon	124717	1648813	55865	766355
Singapore	6772	179413	7326	213518
China	17965	248479	7329	103534
Zambia	13284	197756	6489	99837
Indonesia	4162	73811	3681	61441
Ivory Coast/ Cote d' Ivoire	25738	366120	4159	56753
France	-	-	3990	56301
Peru	706	7694	1431	17569
Other countries	67124	751342	4428	46835

Table – 29 : Imports of Manganese Ore (35% or more but below 46% Mn) (By Countries)

Country	2011-12		2012-13	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**1070827**	**10213710**	**1319657**	**13700888**
South Africa	663593	5809124	892938	8849208
Gabon	47212	547599	149632	1729225
Ivory Coast/ Cote d' Ivoire	17568	221987	88037	1007636
Brazil	22657	271390	79207	943569
Australia	223668	2330142	75478	811855
Argentina	-	-	6860	68396
France	-	-	4180	50996
Ghana	-	-	6436	50438
China	33095	377170	3649	44275
Zambia	8980	117855	2738	38105
Other countries	54054	538443	10502	107186

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

Country	2011-12		2012-13	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**10253**	**78138**	**45851**	**307326**
Japan	-	-	22523	133101
Malaysia	-	-	7800	48907
South Africa	4409	35990	5751	48432
Turkey	3787	27898	4059	35125
Ghana	-	-	2808	21566
Oman	1971	13345	1893	11659
Kuwait	-	-	1017	8536
Other countries	86	905	-	-

Table – 31 : Imports of Manganese Ore (Others) (By Countries)

Country	2011-12		2012-13	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**20284**	**162179**	**107406**	**964320**
Australia	-	-	34610	391293
Japan	-	-	31245	191209
South Africa	13251	101488	17563	176265
Gabon	950	11794	7410	92554
Oman	3449	19395	10229	58129
Ghana	-	-	4951	37964
Ivory Coast/ Cote d' Ivoire	-	-	1328	15502
Spain	-	-	17	917
Kenya	-	-	28	286
Nigeria	-	-	25	201
Other countries	2634	29502	-	-

Table – 32 : Imports of Manganese Dioxide (By Countries)

Country	2011-12		2012-13	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**6338**	**491500**	**6770**	**592973**
China	5864	440141	6043	492843
South Africa	142	11367	314	27591
Belgium	55	8087	110	22392
Japan	5	2529	23	13630
USA	74	9514	69	10184
Germany	10	4323	32	6555
Russia	-	-	54	5921
Turkey	-	-	60	5638
Hong Kong	50	4420	50	4700
Indonesia	-	-	4	1934
Other countries	138	11119	11	1585

Table – 33 : Imports of Manganese Oxide (Other than Manganese Dioxide) (By Countries)

Country	2011-12		2012-13	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**941**	**116357**	**1022**	**145636**
Belgium	375	51296	768	107974
China	21	4122	101	16826
Korea, Rep. of	-	-	40	5381
Japan	5	1510	5	3922
USA	152	14982	41	3370
Germany	21	4865	6	3140
Sweden	-	-	17	2364
Unspecified	-	-	24	1448
Chinese Taipei/ Taiwan	-	-	20	1079
UK	1	105	++	117
Other countries	366	39477	++	15

Table –34: Imports of Manganese & Alloys (Incl Waste & Scrap) By Countries

Country	2011-12		2012-13	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**15890**	**2658100**	**20076**	**2803314**
China	13898	2278904	18947	2574461
France	54	41091	92	81350
South Africa	35	11070	395	35136
Vietnam	125	18953	225	32082
USA	67	42997	19	21072
Germany	60	15428	93	14714
Myanmar	24	3725	100	14192
Oman	-	-	50	8664
Thailand	8	7051	25	3422
Hong Kong	456	60522	24	3385
Other countries	1163	178359	106	14836

Table – 35: Imports of Manganese & Alloys Unwrought (By Countries)

Country	2011-12		2012-13	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**11830**	**1937266**	**11062**	**1609231**
China	10723	1690714	10097	1405655
France	54	41091	92	81350
South Africa	35	11070	395	35136
Vietnam	75	11138	200	28055
USA	66	41679	17	20599
Germany	49	7123	92	13189
Oman	-	-	50	8664
Thailand	8	7051	25	3422
Hong Kong	148	24223	24	3385
Malaysia	100	14668	25	3310
Other countries	572	88509	45	6466

Table – 36 : Imports of Manganese : Wrought (By Countries)

Country	2011-12		2012-13	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**3795**	**681923**	**7680**	**1002680**
China	2923	559227	7530	981152
Myanmar	24	3725	100	14192
Vietnam	50	7815	25	4027
Korea, Rep. of	-	-	25	3309
Other countries	798	111156	-	-

Table – 37 : Imports of Manganese & Alloys, NES (By Countries)

Country	2011-12		2012-13	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**265**	**38911**	**1334**	**191403**
China	252	28963	1320	187655
Germany	11	8305	1	1525
Italy	-	-	10	1436
USA	1	1318	2	473
UK	1	324	1	314
Other countries	++	1	-	-

FUTURE OUTLOOK

Production of crude steel is the single most important factor in the demand for manganese ore. Steel industry accounts for approximately 90% world demand for manganese. Carbon steel is the principal market accounting for 65 to 70% manganese consumption.

As per the Report of the Working Group for 12th Plan Period (2012-17), Planning Commission of India estimated production of manganese ore would be about 4.56 million tonnes by 2011-12 and 6.70 million tonnes by 2016-17 at 8% growth rate. The apparent consumption is estimated at 7.31 million tonnes by 2016-17 at 8% growth rate.