

STATE REVIEWS



Indian Minerals Yearbook 2012

(Part- I)

51st Edition

STATE REVIEWS
(Madhya Pradesh)

(FINAL RELEASE)

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MADHYA PRADESH

Mineral Resources

Madhya Pradesh is the only diamond producing State in the country and is the leading producer of copper conc., pyrophyllite, manganese ore, diaspore and clay (others). The State hosts the country's 90% diamond, 63% diaspore, 61% laterite, 56% pyrophyllite, 41% molybdenum, 29% dolomite, 17% each of rock phosphate & fireclay resources.

Important mineral occurrences in the State are: **bauxite** in Balaghat, Guna, Jabalpur, Katni, Mandla, Rewa, Satna, Shahdol Shivpuri, Sidhi & Vidisa districts; **calcite** in Barwani, Jhabua, Khandwa & Khargone districts; **china clay** in Betul, Chhatarpur, Chhindwara, Gwalior, Hoshangabad, Jabalpur, Khargone, Narsinghpur, Raisen, Satna, Shahdol & Sidhi districts; **copper** in Balaghat, Betul & Jabalpur districts; **coal** in Betul, Shahdol & Sidhi districts; **diamond** in Panna district; **diaspore & pyrophyllite** in Chhatarpur, Shivpuri & Tikamgarh districts; **dolomite** in Balaghat, Chhindwara, Damoh, Dewas, Harda, Hoshangabad, Jabalpur, Jhabua, Katni, Mandla, Narsinghpur, Sagar and Seoni districts; **fireclay** in Betul, Chhindwara, Jabalpur, Katni, Narsinghpur, Panna, Sagar, Shahdol & Sidhi districts; **iron ore (hematite)** in Betul, Gwalior, Jabalpur & Katni districts; **limestone** in Balaghat, Chhindwara, Damoh, Dhar, Hoshangabad, Jabalpur, Jhabua, Khargone, Katni, Mandasaur, Morena, Narsinghpur, Neemach, Rewa, Sagar, Satna, Sehore, Shahdol & Sidhi districts; **manganese ore** in Balaghat and Jhabua districts;

ochre in Dhar, Gwalior, Jabalpur, Katni, Mandla, Rewa, Satna, Shahdol & Umaria districts; **pyrophyllite** in Chhatarpur, Sagar, Shivpuri & Tikamgarh districts; **quartz/silica sand** in Balaghat, Dewas, Dhar, Jabalpur, Khandwa, Khargone, Morena, Rewa & Shahdol districts; **talc/steatite/soapstone** in Dhar, Jabalpur, Jhabua, Katni, Narsinghpur & Sagar district and **vermiculite** in Jhabua district.

Other minerals that occur in the State are: **barytes** in Dewas, Dhar, Shivpuri, Sidhi & Tikamgarh districts; **calcareous shales** (used in slate pencil) in Mandasaur district; **felspar** in Jabalpur & Shahdol districts; **fuller's earth** in Mandla district; **gold** in Jabalpur and Sidhi districts; **granite** in Betul, Chhatarpur, Chhindwara, Datia, Jhabua, Panna, Seoni & Shivpuri districts; **graphite** in Betul & Sidhi districts; **gypsum** in Shahdol district; **lead-zinc** in Betul district; **molybdenum** in Balaghat district; **potash** in Panna district; **quartzite** in Sehore district; **rock phosphate** in Chhatarpur, Jhabua & Sagar districts; and **sillimanite** in Sidhi district (Table - 1). The reserves/resources of coal along with various coalfields in Madhya Pradesh are given in Table - 2.

Exploration & Development

ONGC carried out its seismic survey and drilling for exploration of petroleum & natural gas. One exploratory well with metreage of 3,150 were drilled during 2011-12. The details of exploration activities conducted by various agencies for coal and other minerals during 2011-12 are furnished in Table - 3.

Table – 1 (Concid.)

Mineral	Unit	Reserves				Remaining resources					Total resources (A+B)			
		Proved STD 111	Probable		Total (A)	Feasibility STD211	Pre-feasibility		Measured STD331	Indicated STD332		Inferred STD333	Reconnaissance STD334	Total (B)
			STD121	STD122			STD221	STD222						
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Lead-zinc														
Ore	000 tonnes	-	-	-	129	117	-	1510	4006	5930	3150	14841	14841	
Lead metal	000 tonnes	-	-	-	-	-	-	26.12	5.13	5.04	-	36.29	36.29	
Zinc metal	000 tonnes	-	-	-	5.2	4.71	-	114.76	41.93	186.02	101.12	453.74	453.74	
Limestone	000 tonnes	460445	1166513	24865	1651823.09	204089	88311	514783	560472	3971168	264247	5890703	7542526	
Manganese ore	000 tonnes	30094	1944	2954	34992	3934	1719	2179	943	4190	-	20733	55725	
Molybdenum														
Ore	tonne	-	-	-	-	-	-	-	-	8000000	-	8000000	8000000	
Contained														
MOS ₂	tonne	-	-	-	-	-	-	-	-	5020	-	5020	5020	
Ochre	tonne	486269	128178	41027	655474	1549706	1094108	267721	2141616	3732142	749250	9787788	10443262	
Potash	Million tonnes	-	-	-	-	-	-	-	1206	-	-	1206	1206	
Pyrophyllite	tonne	6779943	5239637	2622217	14641797	585596	3451594	2407790	3753640	4418648	248405	16928276	31570073	
Quartzite	000 tonnes	-	-	-	-	-	-	-	-	832	-	832	832	
Quartz/														
silica sand	000 tonnes	144	11	14	169	51	86	47	316	2191	-	2692	2861	
Phosphorite/Rock														
Phosphate	tonne	6589894	1763187	9787162	18140243	3131683	13700000	5990814	2730000	5725000	-	31277497	49417740	
Sillimanite	tonne	-	-	-	-	-	-	-	-	-	101600	101600	101600	
Silver														
Ore	tonne	-	-	-	-	-	-	-	2096000	1120000	-	3216000	3216000	
Metal	tonne	-	-	-	-	-	-	-	150.61	9.25	-	159.86	159.86	
Talc/steatite/														
soapstone	000 tonnes	-	-	-	-	4	375	-	1679	6107	-	9119	9119	
Vermiculite	tonne	-	-	-	-	197	66	-	-	66	-	329	329	

Figures rounded off.
Resources of coal bed methane (CBM) of Madhya Pradesh are included in the western offshore areas of India and are not available separately.

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Table – 2 : Reserves/Resources of Coal as on 1.4.2012 : Madhya Pradesh

(In million tonnes)

Coalfield	Proved	Indicated	Inferred	Total
Total	9308.70	12290.65	2776.91	24376.26
Johilla	185.08	104.09	32.83	322.00
Umaria	177.70	3.59	-	181.29
Pench-Kanhan	1405.24	789.61	692.13	2886.98
Pathakhera	290.80	88.13	68.00	446.93
Gurgunda	-	47.39	-	47.39
Mohpani	7.83	-	-	7.83
Sohagpur	1725.91	4987.62	199.18	6903.71
Singrauli	5516.14	6270.22	1793.77	13580.13

*Source: Coal Directory of India, 2011-12.***Table – 3 : Details of Exploration Activities in Madhya Pradesh, 2011 - 12**

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated
		Scale	Area	No. of	Metreage		
GSI Coal Singrauli	Sarai (East)	-	-	-	-	-	Reconnaissance stage (G-4) exploration was taken up to assess the coal development pattern and resource potentiality, establishing stratigraphic set up of the area and to generate CBM baseline data. Seven regional Barakar coal seams (I to VII in ascending order) ranging in thickness from 0.69 m to 3.78 m were intersected at relatively shallow depth between 229.20 m and 597.36 m. Out of these, Seam II, IV, VI & VII are relatively thicker (1.39 m to 3.78 m). Apart from these, two regional Raniganj coal seams (R-II and R-III) ranging in thickness from 0.78 m to 0.92 m were intersected at very shallow depths between 18.27 m and 62.03 m. The coal seams of Raniganj Formation are high rank low volatile bituminous coal. During the period, regional continuity of coal seams was established 5 km along strike and 1.5 km along down-dip direction. The work is in progress.
-do-	Hatta-Dudhmaniya area	-	-	-	-	-	Spillover work was carried out to assess the development pattern and resource potentiality of coal horizons in Raniganj and Barakar formations. Exploration for coal by scout drilling (G-4 stage) has revealed four regional Barakar coal seams (I to IV in ascending order) ranging in thickness from 1.36 m to 3.07 m in between depths of 542.19 m and 676.77 m. Seams II (2.80 m) and IV (3.07 m) are important for their thickness and regional persistency. The work was concluded on 05.05.2011.

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Table - 3 (Contd.)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated
		Scale	Area	No. of	Metreage		
-do- Shahdol (Sohagpur Coalfield)	Devanitola	-	-	-	-	-	Regional exploration under G-2 stage was continued during this period for establishing developmental pattern of superior grade Barakar coal seams at shallow depth, to decipher major structural setup of the area, and to evaluate additional coal resources. Exploration reveals occurrence of four regional seams (I to IV in ascending order) and two local seams (L1 and L2) within Barakar Formation varying in thickness from less than a metre to 8.20 m (cumulative) in the depth range from 156.85 m to 287.13 m. Seam III is the thickest (maximum cumulative thickness 8.20 m), composite in nature and characteristically shows two split sections. The seam is very significant and is used as a key horizon for correlation purpose. During the period, regional continuity of coal seams was established 1.5 km along both strike and down-dip direction. The work has been completed.
-do- Umaria (Sohagpur Coalfield)	Amiliha block	-	-	-	-	-	Regional exploration under G-2 stage continued, to establish developmental pattern of superior grade Barakar coal seams at moderate depth, to decipher major structural set up of this area, to evaluate additional coal resources and to assess CBM potentiality. The area of exploration is covered mostly by Raniganj Formation associated with frequent basic intrusives (dolerite), and partly by Barren Measures occurring in southern and western parts. Four regional Barakar coal seams (I to IV in ascending order) ranging in thickness from less than a metre to 3.60 m have been intersected between 206.95 m and 370.15 m depths. Coal seams III and I are important for their thickness and regional persistency. During the period, regional continuity of coal seams was established 1.5 km along both strike and down-dip direction. The work has been completed.

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Table - 3 (Contd.)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated
		Scale	Area	No. of	Metreage		
-do- Shahdol (Sohagpur Coalfield)	Pachri block	-	-	-	-	-	Regional exploration under G-2 stage continued to establish developmental pattern of superior grade Barakar coal seams at shallow depth, to decipher major structural setup of the area and to evaluate additional coal resources. Exploration in Pachri Block revealed occurrences of four regional seams (I to IV in ascending order) and one local Barakar coal seam ranging in thickness from less than a metre to 3.3 m were intersected between 139.85 m and 309 m. Seam III is the thickest coal seam (1.05 m to 3.35 m) with two split sections and used as a key horizon for correlation of coal seams. The work is in progress.
-do- Umaria (Johilla Coalfield)	Naurazabad	-	-	-	-	-	Reconnaissance stage (G-4) exploration was initiated to delineate potential area of high rank superior grade coal, evaluation of additional coal resources, to decipher structural set up of the area and to assess CBM potentiality. The drilling continued during this period and indicated lithoassemblages akin to Barren Measures.
-do- Shahdol (Sohagpur Coalfield)	Maiki (North) block	-	-	-	-	-	Regional exploration under G-2 stage for coal was carried out to a) establish developmental pattern of superior grade Barakar coal seams at shallow depth; b) decipher major structural set-up of the area and c) evaluate additional coal resources. One dolerite body of around 90 m thickness has intruded Barren Measures Formation. Exploration has revealed occurrences of four regional seams (I to IV in ascending order) and two local Barakar coal seams (LI and L2) ranging in thickness from less than a metre to 6.23 m between 389.40 m and 604.15 m depths. Seam no. III (3.05 m to 6.23 m) is the thickest with two split sections and is a key horizon for correlation of coal seams. Apart from these, six Raniganj coal seams/bands ranging in thickness from 0.50 m to 2.90 m were intersected at very shallow depths between 9 m to 62.65 m. The work is in progress.

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Table - 3 (Contd.)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated
		Scale	Area	No. of	Metreage		
GSI Diamond	Parts of Chhattarpur, Sagar, Tikamgarh & Lalitpur	-	-	-	-	-	Regional ground evaluation of Aero Geophysical anomalies (G-4) was continued to delineate priority block to locate possible KCR bodies and other type of mineralisation. The study area is mostly covered by the sandstones of Kaimur Formation of Vindhyan Supergroup. At places Deccan Traps and Lametas were noticed. Study of heavy concentrates of stream sediments indicated that three grains as chrome bearing diopside (Cr_2O_3 -0.96% to 1.15%). The samples have been studied in detail with SEM-EDX. The elemental concentration obtained by EDX study reveal the presence of chrome bearing diopside. This find confirms the possible presence of source rock in an area of about 1.50 sq km. Further work did not reveal presence of any KCR body. The work has been completed.
GSI Manganese	Parts of Meghnagar	-	-	3	-	18	Reconnaissance stage investigation (G-4) was taken up to delineate the manganese ore bearing quartzite-phyllite sequence. This area represents the southern and southeastern extension of Aravalli fold belt in Jhabua district of Madhya Pradesh. The major litho-units are phyllite, quartzite, and dolomite of Lunawada Group of Aravalli Supergroup, which are unconformably overlying the granite gneiss, granite, and amphibolite lith-ounits of Archaean basement. Mn bands were identified in Naganwat, Phuleri, Guvali - Patra, and Doter areas. Five Mn bands were traced during the large-scale mapping. The longest manganese band in Mandali area is almost 700 m in length with average width of 5 m. Manganese ore bands in Rampura and Doter area have a length of around 30 m and width of around 4 m. Out of five manganese

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Table - 3 (Contd.)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated
		Scale	Area	No. of	Metreage		
GSI							
Manganese Jhabua (Contd.)	Parts of Meghnagar	-	-	-	-	-	ore bands, three are located in Mandali-Tunia block and one each in Rampura (Anas river block) and Village Doter. A total of three test boreholes were drilled (2 boreholes in Mandali-Tuniya block and 1 borehole in Anas river block). Analytical results of 18 samples of BH-1 indicated Mn value of 0.5% to 23.3% with an average grade of 7.5%. Analytical results of samples of second borehole reveals Mn 0.49 % to 25.82% with an average grade of 5.06%. In the third borehole, value of Mn is 0.33 % to 7.16% with an average grade of 1.69%. The average value of Mn in 45 surface samples is 14%. The work has been completed.
Phosphorite Jhabua	Piploda and Dhanpura- Khatamba	-	1.0	-	-	-	Reconnaissance stage investigation (G-4) was taken up to locate and assess phosphorite bands associated with dolomitic limestone and chert sequence within Lunavada Group of rocks belonging to Aravalli Supergroup. The areas expose the rocks of Tandladara and Kelkua formation of Lunawada Group of Aravalli Supergroup. The stromato-lytic dolomitic limestone, cherty dolomite and brecciated chert of Kelkua Formation are the host rocks of phosphorite in this area and the bands are with NNE-SSW trend and steep dip on either side. Based on the surface geochemical sampling a zone of 340 m strike length in Piploda Block and a zone of 130 m strike length in Khatamba Block for phosphorite have been delineated. Subsurface data of drilling indicates presence of several bands of phosphorite parallel to the main band. A tentative resource of 2,79,625 tonnes of phosphorite with average 16.44% P ₂ O ₅ (cut off 5% P ₂ O ₅) has been estimated in Piploda Block. Analytical results of Khatama Block and Kachaldara-Kalikhhet Block are awaited. The investigation has been completed.

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Table - 3 (Contd.)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated
		Scale	Area	No. of	Metreage		
GSI							
Phosphorite							
Chhatarpur and Sagar	Lukri-Akrotha- Raipura-Surajpura	-	-	-	-	-	Reconnaissance stage investigation (G-4) has been taken up to assess the extent and grade of phosphorite in Bijawar Group. Phosphorite is associated with ferruginous sandstone and ferruginous shale as irregular bands and lenses varying in thickness from 3 m to 20 m. The different types of phosphatic ore are massive ferruginous phosphatic sandstone, ferruginous phosphatic chert breccias, laminated phosphorite and reworked phosphorite. These phosphorite ore bodies (ferruginous phosphatic sandstone and ferruginous phosphatic chert breccia) are confirmed to Hirapur Formation of Bijawar Group of rocks and lithologically (predominantly) as well as structurally controlled. Chemical analysis of bed rock and trench samples indicate P ₂ O ₅ % values ranging from 10.15% to 33.51% in Surajpura Block, 19.32% to 30.50% in Raipura-Akrotha Block and 20.75% in Lukri Block. Surajpura occurrence has twelve detached lensoidal bodies of massive, laminated, reworked and brecciated phosphorite bodies located around Surajpura. The dimension of the ore bodies and analytical results are very much encouraging. The investigation has been completed.
MOIL							
Manganese Ore							
Balaghat	Balaghat	-	-	02	1391.6	-	The strike length of the deposit was found to be 2.8 km. The average true thickness is 10 m and the deposit is thick at its central part and thin on either side. Brunite is the principle mineral associated with secondary minerals of oxide & dioxide origin. As on 1.4.2012, the total manganese ore resources were estimated at 24.28 million tonnes, which is of 30-50% Mn grade.

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Table - 3 (Concl.)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated
		Scale	Area	No. of	Metreage		
-do-	Sitapalore/Sukli	-	-	-	-	-	Strike length & depth of the deposit was found to be 1.5 km and 330 m. Average width is 3.5 m. As on 1.4.2012 the total manganese ore resources were estimated at 0.40 million tonnes which is of 25% - 42% Mn grade.
-do-	Tirodi	-	-	03	460	-	As on 1.4.2012 the total manganese ore resources were estimated at 1.40 million tonnes of 25% - 38% Mn grade.
-do-	Ukwa	-	-	-	-	-	Strike length of the deposit was found to be 5.5 km and depth 260 m. As on 1.4.2012 the total manganese ore resources were estimated at 8.70 million tonnes.

Production

The value of mineral production in Madhya Pradesh at ₹ 11,257 crore in 2011-12 decreased by 9% as compared to the previous year. It was mainly due to decrease in the unit value of coal and bauxite and decrease in the production of limestone (2%), clay (others) (3%), manganese ore 9 (%) and iron ore (37%). Madhya Pradesh contributed 4% in the total value of mineral production among states and claims eighth position in the country. The State was the sole producer of diamond. The State was also leading producer of pyrophyllite with a share of 87%, copper concentrates 58%, clay (others) 57% and diasporite 51% and also the second leading producer of manganese ore with a share of 28% and phosphorite with 10% to total output of the respective minerals.

During 2011-12, the production of phosphorite increased by 83% and that of diamond 65%, fireclay 44%, dolomite 29%, laterite 25% and diasporite 11% as compared to the previous year. However, decline in production was observed in copper ore (7%), copper concentrates (5%) and shale 9% compared to that of the previous year (Table - 4).

The production value of minor minerals was estimated at ₹ 1,688 crore for the year 2011-12.

The number of reporting mines in Madhya Pradesh was 367 in 2011-12 as against 317 in the previous year.

The index of mineral production in Madhya Pradesh (base 2004-05=100) was 133.61 in 2011-12 as compared to 134.35 in the previous year.

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**Table – 4 : Mineral Production in Madhya Pradesh, 2009-10 to 2011-12
(Excluding Atomic Minerals)**

(Value in ₹ '000)

Mineral	Unit	2009-10			2010-11			2011-12 (P)		
		No. of mines	Quantity	Value	No. of mines	Quantity	Value	No. of mines	Quantity	Value
All Minerals		287		112878992	317		123469521	367		112572321
Coal	'000t	75	74074	84933100	71	71104	93673600	71*	71123	83305500
Bauxite	t	17	1056847	365097	19	616319	262437	18	617146	205571
Copper Ore	t	-	1975938	-	-	2233523	-	-	2081959	-
Copper Conc.	t	1	64913	1926362	1	78778	2477950	1	75240	2959609
Iron Ore	'000t	5	1058	359750	8	1762	785316	13	1102	719850
Manganese Ore	t	25	607148	4094882	29	716285	4226787	35	648283	4030020
Phosphorite	t	5	212168	122007	5	133378	76946	3	243960	151284
Clay (others)	t	-	235027	20453	-	434722	48025	-	421653	30058
Diamond	crt	2	16891	116279	2	11222	106776	2	18489	198242
Diaspore	t	**	11042	8540	**	11165	9251	**	12399	11660
Dolomite	t	42	277017	36190	43	279859	41788	57	360907	51785
Fireclay	t	8	34704	3193	11	44519	4199	11	64158	7303
Kaolin	t	3	17350	1209	3	6106	484	2	6950	426
Laterite	t	4	133080	7269	5	132539	9995	14	166247	10634
Limestone	'000t	72	28967	3795849	85	33276	4785685	103	32658	3940056
Ochre	t	7	39201	4990	13	44897	5593	13	35060	4397
Pyrophyllite	t	21	209127	53123	20	207521	73945	20	209421	65384
Quartz	t	-	-	-	2	1754	173	2	435	43
Shale	t	-	637088	5734	-	598912	5349	2	543054	5270
Talc/soapstone/ steatite	t	-	-	-	-	-	-	-	66	7
Minor Minerals@		-	-	17024965	-	-	16875222	-	-	16875222

Note: The number of mines excludes minor minerals.

* Relates to coal mines as on 31.03.2011.

** Associated with pyrophyllite.

@ Figures for earlier years have been repeated as estimates wherever necessary, because of non-receipt of data.

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Mineral-based Industry

The important large and medium-scale mineral-based industries in organised sector in the State are furnished in Table-5.

Table – 5 : Principal Mineral-based Industries in Madhya Pradesh

Industry/plant	Capacity ('000 tpy)
Asbestos Products	
Everest Building Products Ltd, Kymore.	NA
Kalani Industries Pvt. Ltd, Pitampur, Dhar.	NA
Ramco Industries Ltd, Maksi, Dist. Sajapur.	66
Cement	
ACC Ltd, Kymore, Dist. Katni.	2200
Birla Corpn. Ltd (Satna Cement Works), Satna.	2200
CCI Ltd, Mayagaon, Dist. Neemuch.	1400
Diamond Cement, Narsingarh, Dist. Damoh.	1525
Jaypee Rewa Cement, Dist. Rewa.	3500
Jaypee Cement, Bela.	2200
Maihar Cement, Maihar, Dist. Satna.	3800
Prism Cement Ltd, Satna.	2510

(Contd.)

Table-5 (Concltd.)

Industry/plant	Capacity ('000 tpy)
Vikram Cement, Khor, Dist. Neemuch.	4500
Ceramic	
EID Parry India Ltd, Dewas.	9
H&R Johnson India Ltd, Dewas.	6.7
Govind Tiles Pvt Ltd, Garra, Dist. Balaghat.	758 million nos.
Fertilizer	
Khaitan Chemical & Fertilizers Ltd, Nimrani, Dist. Khargone	400 (SSP) 115.5 (H ₂ SO ₄)
NFL-Vijaipur, Dist. Guna.	1452 (Urea)
Ferro-alloys	
Crescent Alloys Pvt. Ltd, Seoni.	4.5
Jalan Ispat Castings Ltd, Meghnagar, Dist. Jhabua.	12
MOIL Ferro Manganese Plant, Bharveli, Dist. Balaghat.	10
Petroleum Refinery	
Bharat Oman Refineries Ltd, Bina, Dist. Sagar.	6000
Refractory	
ACC Refractories, Katni.	65
Premier Refractories India Pvt. Ltd, Katni.	12.9