

## 6.1 PHOSPHATE (APATITE)

### Introduction

Apatite is the most abundant crystalline phosphate mineral found as an accessory mineral in practically all kinds of igneous rocks. Sometimes, it is concentrated in pegmatites, metallic veins and magmatic deposits. It also occurs in metamorphic rocks and as a secondary mineral in phosphatic rocks of sedimentary origin. Fluorapatite  $\text{Ca}_5(\text{PO}_4)_3\text{F}$  is the most common variety of apatite and also a secondary sources of fluorine. It is chiefly used in fertilizer industry and also used in chemical, elemental phosphorus and sugar industries. In powdered form, it is directly applied for soil reclamation. India has inadequate resources of apatite especially of chemical/fertilizer grade.

### Basis of Grade Classification

The following grade classification has been adopted for apatite in National Mineral Inventory as on 01.04.2020.

1. Chemical/Fertilizer (+) 30 %  $\text{P}_2\text{O}_5$
2. Blendable 25 to 30%  $\text{P}_2\text{O}_5$
3. Soil Reclamation (+) 16%  $\text{P}_2\text{O}_5$
4. Beneficial (+) 5 to 10%  $\text{P}_2\text{O}_5$
5. Low/Non-Beneficial (-) 5%  $\text{P}_2\text{O}_5$
6. Unclassified Where the minimum and maximum values of chemical constituents are too wide to classify the resources under any grades.
7. Not Known Such estimation about which information/data is not available/reported to be classified under any of the grades.

### Basis of Categorisation of Resources

As per United Nations Framework Classifications (UNFC), the total resources of apatite are broadly categorised into 'reserves' and 'remaining resources' category.

According to the norms of this system, the reserves of apatite have been placed under proved (111) and probable (122) categories.

The remaining resources have been placed under feasibility (211), measured (331), indicated (332), inferred (333) and reconnaissance (334) categories.

### Salient Features of the Inventory

The total resources of apatite in the country as on 01.04.2020 are estimated at 21,110,299 tonnes, of these only 29,395 tonnes (0.1%) fall under reserves category, and the balance 21,080,904 tonnes (99.9%) are remaining resources.

All India scenario of apatite reserves, remaining resources and total resources as on 01.04.2020 vis-a-vis 01.04.2015 have been given in Tables - 1 and 2. These tables give an idea about the significant changes in terms of increase or decrease of resources as per lease status, grades and states. In Table-3, district wise reserves/resources as on 01.04.2020 have been given.

Out of the total resources, 20,578,530 tonnes (97.48%) are in freehold and the balance 499,149 tonnes (2.36%) are in leasehold public sector and 32,620 tonnes (0.15%) are in leasehold private sector. .

The high grade resources of apatite containing (+) 30%  $\text{P}_2\text{O}_5$ , used in fertilizer/chemical industries, constitute only 1.2% of the total resources. Soil reclamation grade constitutes 45%, beneficial grade 32.2%, low/non-beneficial grade 14.6% and the remaining 7% resources are accounted together by blendable/unclassified/not known grades.

The known resources of apatite in India are mostly confined to West Bengal (50.4%) and Jharkhand (34.4%) with minor quantities in Meghalaya (6.1%) and Rajasthan (5%). Small quantity of resources are also estimated in Tamil Nadu & Andhra Pradesh (4%).

An analysis of district wise resources in the states reveals that about 96% of the total resources in the country is concentrated in only four districts. The largest share is held by Purulia district, West Bengal (50.4%), followed by Singhbhum East district, Jharkhand (34.4%), Jaintia Hills district, Meghalaya (6.1%) and Udaipur district, Rajasthan (4.8%). The remaining 4% resources are estimated in Visakhapatnam district, Andhra Pradesh, Panchmahal district, Gujarat, Dharmapuri & Vellore districts, Tamil Nadu and Sikar district, Rajasthan.

A net decrease of resources of about 2,935,178 tonnes has been recorded in the current inventory as compared to the previous inventory as on 01.04.2015.

## National Mineral Inventory - An Overview

**Table - 1 : Reserves/Resources of Phosphate (Apatite) as on 01.04.2020 vis-à-vis 01.04.2015**  
(By Lease Status/Grade)

Lease status/Grade	Reserves		Remaining resources		Total resources		(In Tonnes)
	01.04.2020	01.04.2015	01.04.2020	01.04.2015	01.04.2020	01.04.2015	
	Net change		Net change		Net change		
<b>All India : Total</b>	<b>29,395</b>	<b>29,395</b>	<b>21,080,904</b>	<b>24,016,082</b>	<b>21,110,299</b>	<b>24,045,477</b>	<b>(-)2,935,178</b>
Chemical Fertilizer	29,395	29,395	230,163	230,163	No change	259,558	No change
Soil Reclamation	-	-	9,513,002	12,710,827	(-)3,197,825	12,710,827	(-)3,197,825
Low/Non-Beneficiable	-	-	3,083,006	3,083,006	No change	3,083,006	No change
Beneficiable	-	-	6,799,902	6,799,902	No change	6,799,902	No change
Blendable	-	-	264,831	2,184	262,647	2,184	262,647
Unclassified	-	-	1,000,000	1,000,000	No change	1,000,000	No change
Not Known	-	-	190,000	190,000	No change	190,000	No change
<b>Freehold</b>	<b>-</b>	<b>-</b>	<b>20,578,530</b>	<b>20,578,530</b>	<b>No change</b>	<b>20,578,530</b>	<b>No change</b>
Chemical Fertilizer	-	-	226,938	226,938	No change	226,938	No change
Soil Reclamation	-	-	9,276,500	9,276,500	No change	9,276,500	No change
Low/Non-Beneficiable	-	-	3,083,006	3,083,006	No change	3,083,006	No change
Beneficiable	-	-	6,799,902	6,799,902	No change	6,799,902	No change
Blendable	-	-	2,184	2,184	No change	2,184	No change
Unclassified	-	-	1,000,000	1,000,000	No change	1,000,000	No change
Not Known	-	-	190,000	190,000	No change	190,000	No change
<b>Leasehold (Private)</b>	<b>29,395</b>	<b>-</b>	<b>3,225</b>	<b>-</b>	<b>(+)3,225</b>	<b>32,620</b>	<b>(+)32,620</b>
Chemical Fertilizer	29,395	-	3,225	-	(+)3,225	32,620	(+)32,620
<b>Leasehold (Public)</b>	<b>-</b>	<b>29,395</b>	<b>499,149</b>	<b>3,437,552</b>	<b>(-)2,938,403</b>	<b>499,149</b>	<b>(-)2,967,798</b>
Chemical Fertilizer	-	29,395	-	3,225	(-)3,225	32,620	(-)32,620
Soil Reclamation	-	-	236,502	3,434,327	(-)3,197,825	3,434,327	(-)3,197,825
Blendable	-	-	262,647	-	(+)262,647	262,647	(+)262,647

figures rounded off.

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The decrease in resources was due to re-estimation of resources of Beldih mine (lease hold public sector mine) Purulia district, West Bengal

Out of the total resources of apatite, about 6,818,984 tonnes (32.30%) have been estimated under inferred(333) and reconnaissance (334) categories. These resources are based on a limited and

preliminary exploration. If these areas are examined for further detailed exploration, the confidence level of resource estimation of apatite in the country may improve.

A total 20 deposits have been covered in the inventory as on 01.04.2020; of which 18 deposits are in freehold areas and one deposit each in leasehold Private & Public Sector .

**Table – 2 : Total Resources of Phosphate (Apatite) as on 01.04.2020 vis-à-vis 01.04.2015 (By States)**

State	Total Resources		Net Change
	(In Tonnes)		
	As on 01.04.2020	As on 01.04.2015	
<b>All India : Total</b>	<b>21,110,299</b>	<b>24,045,477</b>	<b>(-)2,935,178</b>
Andhra Pradesh	229,558	229,558	No Change
Gujarat	351,000	351,000	No Change
Jharkhand	7,270,000	7,270,000	No Change
Meghalaya	1,300,000	1,300,000	No Change
Rajasthan	1,067,521	1,067,521	No Change
Tamil Nadu	240,000	240,000	No Change
West Bengal	10,652,220	13,587,398	(-)2,935,178

Figures rounded off.

**Table - 3 : District wise Reserves/Resources of Phosphate (Apatite) as on 01.04.2020**

State	District	(In Tonnes)		
		Reserves	Remaining Resources	Total Resources
<b>All India : Total</b>		<b>29,395</b>	<b>21,080,904</b>	<b>21,110,299</b>
<b>Andhra Pradesh</b>	Visakhapatnam	29,395	200,163	229,558
<b>Gujarat</b>	Panchmahals	-	351,000	351,000
<b>Jharkhand</b>	Singhbhum (East)	-	7,270,000	7,270,000
<b>Meghalaya</b>	Jaintia Hills	-	1,300,000	1,300,000
<b>Rajasthan</b>	Sikar	-	1,067,521	1,067,521
	Udaipur	-	37,521	37,521
		-	1,030,000	1,030,000
<b>Tamil Nadu</b>	Dharmapuri	-	240,000	240,000
	Vellore	-	50,000	50,000
		-	190,000	190,000
<b>West Bengal</b>	Purulia	-	10,652,220	10,652,220
		-	10,652,220	10,652,220

figures rounded off.

## 6.2 PHOSPHATE (PHOSPHORITE)

### Introduction

Rock Phosphates are sedimentary phosphatic deposits comprising fine grained mixture of various calcium phosphates, most important being hydroxyl-apatite, carbonate-apatite, fluor-apatite and their solid solutions. About 80% phosphate production in the world is derived from phosphate rocks (phosphorite) containing one or more phosphatic minerals.

Rock phosphate is used primarily as a plant nutrient, either by direct application to the soil as a powdered product or in the manufacture of super-phosphate, triple super phosphate, or diammonium phosphate (DAP) fertilizers. Elemental phosphorus and phosphoric chemicals derived from phosphate rock are also used in detergents, insecticides, matches, fireworks, military smoke screen, incendiary bombs, and any other products.

### Basis of Grade Classification

The following grade classification has been followed in National Mineral Inventory as on 01.04.2020:

1. Chemical/Fertilizer (+) 30%  $P_2O_5$
2. Blendable 25 to 30%  $P_2O_5$
3. Soil Reclamation (+) 16%  $P_2O_5$
4. Beneficial (+) 5-10%  $P_2O_5$
5. Low/Non-beneficial (-) 5%  $P_2O_5$
6. Unclassified Where range of maximum and minimum values of chemical constituents are too wide to be fitted in to any of the above grades.
7. Not known Such estimation about which information/data is not available/report to be classified under any of the grades.

### Basis of Categorisation of Resources

As per United Nations Framework Classification (UNFC), total resources are broadly classified into 'reserves' and 'remaining resources' category.

According to the norms of this system, reserves of rock phosphate have been placed under proved (111) and probable (122) categories.

The 'remaining resources' have been placed under feasibility (211), pre-feasibility (221) & (222), measured (331), indicated (332) inferred (333) and (334) categories.

### Salient Features of the Inventory

The total resources of rock phosphate in the country as on 01.04.2020 are estimated at 311.25 million tonnes; of these 30.88 million tonnes (10%) fall under reserve category and the balance 280.38 million tonnes (90%) under 'remaining resource' category.

All India scenarios of rock phosphates reserves, remaining resources and total resources as on 01.04.2020 vis-a-vis 01.04.2015 have been given in Tables - 1 and 2. These tables give an idea about the significant changes in terms of increase or decrease of resources as per lease status, grades and states. In Table-3, district wise reserves/resources as on 01.04.2020 have been given.

Out of the total resources, about 232.27 million tonnes (75%) are in freehold, 65.54 million tonnes (21%) in leasehold public and 13.45 million tonnes (4%) in leasehold private.

Out of the total resources of rock phosphate, about 28.45 million tonnes (9.1%) constitutes chemical/fertilizer grade, 32.40 million tonnes (10.4%) blendable grade, 46.85 million tonnes (15.1%) soil reclamation grade, 67.65 million tonnes (21.71%) beneficial grade, 115.55 million tonnes (37.10%) low grade, 16.78 million tonnes (5.4%) resources are in unclassified and 3.58 million tonnes (1.10%) in not known grade.

Resources of rock phosphate have been estimated in seven states. Jharkhand is credited with 107.37 million tonnes (34.50%), followed by Rajasthan 93.85 million tonnes (30.15%), Madhya Pradesh 58.46 million tonnes (18.78%), Uttar Pradesh 25.77 million tonnes (8.28%), Uttarakhand 24.18 million tonnes (7.77%) and minor resources (less than 1%) reported from Meghalaya and Gujarat. The entire resources estimated in Jharkhand is of low grade.

An overall decrease of about 1.43 million tonnes of resources have been recorded in the inventory as on 01.04.2020 in comparison to the earlier inventory as on 01.04.2015. About 1.8 million tonnes resources decreased in Rajasthan due to downward revision of resources in

**Table - 1 : Reserves/Resources of Phosphate (Phosphorite) as on 01.04.2020 vis-à-vis 01.04.2015**  
(By Lease Status/Grade)

Lease status/Grade	Reserves		Remaining resources		Total resources		(In Tonnes)	
	01.04.2020	01.04.2015	01.04.2020	01.04.2015	01.04.2020	01.04.2015		
	Net change		Net change		Net change			
<b>All India : Total</b>	<b>30,876,093</b>	<b>45,807,485</b>	<b>(-14,931,392)</b>	<b>280,377,392</b>	<b>266,871,131</b>	<b>312,253,485</b>	<b>312,678,616</b>	<b>(-1,425,131)</b>
Chemical/ Fertilizers	22,442,415	9,056,829	(+13,385,586)	6,005,357	16,918,245	28,447,772	25,975,074	(+2,472,698)
Blendable	-	10,923,537	(-10,923,537)	32,399,429	24,350,429	(+8,049,000)	35,273,966	(-2,874,537)
Soil Reclamation	-	-	-	46,851,282	26,260,082	(+20,591,200)	26,260,082	(+20,591,200)
Beneficial	5,978,874	25,827,119	(-19,848,245)	61,674,385	63,899,385	(-2,225,000)	89,726,504	(-22,073,245)
Low Grade	-	-	-	115,547,549	115,547,549	No change	115,547,549	No change
Unclassified	2,454,804	-	(+2,454,804)	14,324,390	16,320,441	(-1,996,051)	16,320,441	(+458,753)
Not Known	-	-	-	3,575,000	3,575,000	No change	3,575,000	No change
<b>Freehold</b>	-	-	-	<b>232,265,642</b>	<b>220,747,745</b>	<b>(+11,517,897)</b>	<b>220,747,746</b>	<b>(+11,517,897)</b>
Chemical/ Fertilizers	-	-	-	2,431,213	2,431,213	No change	2,431,213	No change
Blendable	-	-	-	22,239,429	21,696,029	(+543,400)	21,696,029	(+543,400)
Soil Reclamation	-	-	-	25,277,226	20,932,729	(+4,344,497)	20,932,729	(+4,344,497)
Beneficial	-	-	-	49,701,928	43,071,928	(+6,630,000)	43,071,928	(+6,630,000)
Low Grade	-	-	-	115,547,549	115,547,549	No change	115,547,549	No change
Unclassified	-	-	-	13,493,298	13,493,298	No change	13,493,298	No change
Not Known	-	-	-	3,575,000	3,575,000	-	3,575,000	No change
<b>Leasehold (Public)</b>	<b>28,421,289</b>	<b>34,883,948</b>	<b>(-6,462,659)</b>	<b>37,120,657</b>	<b>41,185,242</b>	<b>(-4,064,585)</b>	<b>76,069,190</b>	<b>(-10,527,244)</b>
Chemical/Fertilizers	22,442,415	9,056,829	(+13,385,586)	3,574,144	14,487,032	(-10,912,888)	23,543,861	(+2,472,698)
Blendable	-	-	-	-	543,400	(-543,400)	543,400	(-543,400)
Soil Reclamation	-	-	-	21,574,056	5,327,353	(+16,246,703)	5,327,353	(+16,246,703)
Beneficial	5,978,874	25,827,119	(-19,848,245)	11,972,457	20,827,457	(-8,855,000)	46,654,576	(-28,703,245)
Unclassified	-	-	-	-	-	-	-	-
Not Known	-	-	-	-	-	-	-	-
<b>Leasehold (Private)</b>	<b>2,454,804</b>	<b>10923537</b>	<b>(-8,468,733)</b>	<b>10,991,092</b>	<b>4,938,143</b>	<b>(+6,052,949)</b>	<b>15,861,680</b>	<b>(-2,415,784)</b>
Blendable	-	10,923,537	(-10,923,537)	10,160,000	2,111,000	(+8,049,000)	13,034,537	(-2,874,537)
Unclassified	2,454,804	-	(+2,454,804)	831,092	2,827,143	(-1,996,051)	2,827,143	(+458,753)

figures rounded off.

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existing leasehold deposits. However, resources of Madhya Pradesh has reported an increased of 0.41 million tonnes due to re-assessment of resources in a existing leasehold deposit.

A total 46 deposits have been covered in the inventory as on 01.04.2020 of which 35 deposits are in freehold, 9 deposits are in leasehold public and 2 deposits in leasehold private.

**Table – 2 : Total Resources of Phosphate (Phosphorite) as on 01.04.2020 vis-à-vis 01.04.2015 (By States)**

State	Total Resources		Net Change
	As on 01.04.2020	As on 01.04.2015	
<b>All India : Total</b>	<b>311,253,485</b>	<b>312,678,615</b>	<b>(-)1,425,131</b>
Gujarat	314,820	314,820	No Change
Jharkhand	107,370,000	107,370,000	No Change
Madhya Pradesh	58,457,031	58,050,825	(+)406,206
Meghalaya	1,311,035	1,311,035	No Change
Rajasthan	93,848,769	95,680,106	(-)1,831,337
Uttarakhand	24,178,386	24,178,386	No Change
Uttar Pradesh	25,773,444	25,773,444	No Change

figures rounded off.

**Table - 3 : District wise Reserves/Resources of Phosphate (Phosphorite) as on 01.04.2020**

State	District	Total Resources		
		Reserves	Remaining Resources	Total Resources
<b>All India : Total</b>		<b>30,876,093</b>	<b>280,377,392</b>	<b>311,253,485</b>
<b>Gujarat</b>		-	<b>314,820</b>	<b>314,820</b>
	Panchmahals	-	314,820	314,820
<b>Jharkhand</b>		-	<b>107,370,000</b>	<b>107,370,000</b>
	Garwah	-	107,370,000	107,370,000
<b>Madhya Pradesh</b>		<b>9,031,093</b>	<b>49,425,938</b>	<b>58,457,031</b>
	Chhatarpur	4,659,568	13,642,232	18,301,800
	Jhabua	3,774,110	34,446,073	38,220,183
	Khargon(West Nimar)	-	50,625	50,625
	Sagar	597,415	1,287,008	1,884,423
<b>Meghalaya</b>		-	<b>1,311,035</b>	<b>1,311,035</b>
	Garohills (East)	-	111,035	111,035
	Jaintia Hills	-	1,200,000	1,200,000
<b>Rajasthan</b>		<b>21,845,000</b>	<b>72,003,769</b>	<b>93,848,769</b>
	Alwar	-	6,400,000	6,400,000
	Banswara	-	6,650,750	6,650,750
	Jaipur	-	67,250	67,250
	Jaisalmer	-	8,738,150	8,738,150
	Udaipur	21,845,000	50,147,619	71,992,619
<b>Uttarakhand</b>		-	24,178,386	24,178,386
	Dehradun	-	24,178,373	24,178,373
	Tehri Garhwal	-	13	13
<b>Uttar Pradesh</b>		-	<b>25,773,444</b>	<b>25,773,444</b>
	Lalitpur	-	25,773,444	25,773,444

figures rounded off.

## 6.3 POTASH

### Introduction

Potash is an essential nutrient for protein synthesis and help plants to use water more efficiently. There are no commercially exploitable resources of potash in the country and the entire requirements of potash for direct application as well as for production of complex fertilizers are met through imports. Bedded marine evaporite deposits and surface and sub-surface potash-rich brines are the principal source of potash. The principal mineral is sylvinite, a mixture of sylvite (KCl) and rock salt (NaCl).

### Basis of Grade Classification

The potash resources in the NMI as on 01.04.2020 have been classified in the following four grades:

- |                 |  |
|-----------------|--|
| 1. Glaucanite   | As occurring in parts of Madhya Pradesh, Rajasthan and Uttar Pradesh |
| 2. Polyhalite   | As occurring in Ganganagar basin of Rajasthan                        |
| 3. Sylvite      | As occurring in Ganganagar basin of Rajasthan                        |
| 4. Unclassified | Those types which cannot fit into above types.                       |

Sylvite and evaporites are reported in terms of potassium (K), glaucanite is reported in terms of  $K_2O$ .

### Basis of Categorisation of Resources

As per United Nations Framework Classification (UNFC), total resources are broadly classified into 'reserves' and 'remaining resources' category.

According to norms of this system, the entire estimation of potash has been placed under remaining resources in indicated (332), inferred (333) and reconnaissance (334) categories.

### Salient Features of the Inventory

The total resources of potash in the country as on 01.04.2020 are reported in 21 freehold deposits and have been estimated at 23,091 million tonnes under remaining resources category. In NMI as on 01.04.2020 the total quantity of remaining resources has increased

by 583 million tonnes (2.5%) as compared to NMI as on 01.04.2015. The entire increase of 583 million tonnes of Potash resources are due to addition of 10 new deposits i.e. 2 in Rohtas district of Bihar, 3 in Singrauli district of Madhya Pradesh, 2 in Bikaner district of Rajasthan, one deposit each in Karauli district of Rajasthan, Garwah district of Jharkhand and Sonabhadra district of Uttar Pradesh.

All India scenario of potash mineral resources as on 01.04.2020 vis-a-vis 01.04.2015 has been given in Tables - 1 and 2. The tables give an idea about the significant changes in terms of increase or decrease of resources as per lease status, grade and states. In Table-3 district wise reserves/resources as on 01.04.2020 has been given.

Major quantity of the potash resources (89%) are located in Rajasthan, followed by Madhya Pradesh (5%) and Uttar Pradesh (4%). The remaining 2% resources are in Bihar, Gujarat and Jharkhand. Occurrences of Potash are also reported from Tirap districts of Arunachal Pradesh, Rohtas district of Bihar, Kutch district of Gujarat, Rohtak and Sirsa districts of Haryana, Leh district of Jammu & Kashmir, Sidhi district of Madhya Pradesh, Bhatinda district of Punjab, Bhilwara and Nagaur district of Rajasthan, Tanjavur district of Tamil Nadu, Banda, Chitrakut, Sonbhadra and Etah districts of Uttar Pradesh.

Of the total resources as on 01.04.2020, polyhalite grade constitutes 16,164 million tonnes (70%), Sylvite grade 2,572 million tonnes (11%), Glaucanite grade 3149 million tonnes (14%) and unclassified resources 1,206 million tonnes (5%).

The entire estimation of resources of potash in India are based on the exploration work done by GSI. Resources estimated in all states are of glaucanite mineral except in Rajasthan where resources of polyhalite & sylvite minerals have also been estimated.

The feasibility of economic exploitation of entire resources reported in NMI have not yet been established, therefore, the resources have been placed under UNFC codes (332), (333) and (334) categories. Out of total 23,091 million tonnes of resources, about 4,940 million tonnes have been estimated under inferred and reconnaissance categories.





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**Table – 2 : Total Resources of Potash as on 01.04.2020 vis-à-vis 01.04.2015  
(By States)**

(In Million Tonnes)

State	Total Resources		Net Change
	As on 01.04.2020	As on 01.04.2015	
<b>All India : Total</b>	<b>23091</b>	<b>22509</b>	<b>(+)582</b>
Bihar	230	-	(+)230
Jharkhand	152	-	(+)152
Madhya Pradesh	1,244	1,206	(+)38
Rajasthan	20,572	20,419	(+)153
Uttar Pradesh	893	883	(+)10

*figures rounded off.***Table - 3 : District wise Reserves/Resources of Potash as on 01.04.2020**

(In Million Tonnes)

State	District	Reserves	Remaining Resources	Total Resources
<b>All India : Total</b>		-	<b>23,091</b>	<b>23,091</b>
<b>Bihar</b>		-	230	<b>230</b>
	Rohtas	-	230	230
<b>Jharkhand</b>		-	<b>152</b>	<b>152</b>
	Garwah	-	152	152
<b>Madhya Pradesh</b>		-	<b>1,244</b>	<b>1,244</b>
	Panna	-	1,206	1,206
	Singrauli	-	38	38
<b>Rajasthan</b>		-	<b>20,572</b>	<b>20,572</b>
	Bikaner	-	96	96
	Jaisalmer	-	22	22
	Karauli	-	57	57
	Nagaur	-	20,397	20,397
<b>Uttar Pradesh</b>		-	<b>893</b>	<b>893</b>
	Chitrakut	-	50	50
	Sonbhadra	-	843	843

*figures rounded off.*

## 6.4 PYRITE

### Introduction

Pyrite is an iron sulphide having chemical formula,  $FeS_2$ . It is also known as fool's gold. It is used for manufacture of sulphuric acid, and as direct feed for soil conditioning. Marcasite and pyrrhotite are the other iron sulphide minerals.

After native sulphur, pyrite is the common source of sulphur. It is a common constituent of many metaliferous veins but also occurs as disseminated crystals in sedimentary and metamorphosed rocks and coal. Marcasite usually occurs in low temperature metasediments and sedimentary rocks. Pyrrhotite occurs usually in magmatic or contact metasomatic deposits associated with basic igneous rocks and high temperature sulphide veins and is often nickeliferous.

### Basis of Grade Classification

The Expert Group on classification of minerals with regard to their possible optimum industrial use (December, 1989) in its report observed that the minimum grade which can be beneficiated for production of sulphuric acid is 22% S. The Pyrite, Phosphate and Chemicals Ltd., was marketing pyrite with an average of 30% S and which was more suitable for direct use as a conditioner for alkaline soil. The basis for resource classification of pyrite adopted in present inventory as on 01.04.2020 is given below :

1. Soil Reclamation 30-38% S
2. Beneficiable 22-30% S
3. Low (-) 22% S
4. Unclassified The range of minimum and maximum values is too wide to fit into any of the above grades.
5. Not known Where the relevant data is not available for determination of grade.

### Basis of Categorisation of Resources

As per United Nations Framework Classification (UNFC), resources are broadly classified into 'reserves' and 'remaining resources'.

According to the norms of this system, the entire

estimation of pyrite has been placed under 'remaining resources' which has further been classified under feasibility (211), pre-feasibility (222), measured (331), indicated (332) and inferred (333) categories.

### Salient Features of the Inventory

All India scenario of pyrite resources as on 01.04.2020 vis-a-vis 01.04.2015 have been given in Tables - 1 and 2. These tables give an idea about the significant changes in terms of increase or decrease of resources as per lease status, grades and states. District wise resources of pyrite as on 01.04.2020 have been given in Table-3.

The total resources of pyrite in the country as on 1.4.2020 have been estimated at 1,674,401 thousand tonnes under remaining resources category. Of the total resources, 60,383 thousand tonnes (3.6%) are in freehold and the balance 1,614,018 thousand tonnes (96.4%) is under leasehold public sector.

Out of the total resources, soil reclamation grade constitutes 6,024 thousand tonnes (0.4%), beneficiable grade 61,628 thousand tonnes (3.7%), low grade 1,555,330 thousand tonnes (92.9%) and unclassified 51,419 thousand tonnes (3.0%).

Of the total resources, Bihar is credited with 1,574,561 thousand tonnes (94%) followed by Rajasthan 90,876 thousand tonnes (5.4%). The balance 8,964 thousand tonnes (0.6%) resources have been accounted by Karnataka, Himachal Pradesh, West Bengal, Andhra Pradesh and Tamil Nadu.

About 99% of the total resources of pyrite are confined only in two districts viz. Rohtas in Bihar (94%) and Sikar in Rajasthan (5%).

There is no production of pyrite in the country since the last many years, therefore the resources in inventory as on 01.04.2010 have not changed as compared to previous inventory as on 01.04.2015.

About 1,527,356 thousand tonnes (91%) of the total resources of pyrite have been estimated under inferred category. These resources have been estimated based on a very limited and preliminary exploration. If these

## National Mineral Inventory - An Overview

**Table - 1 : Reserves/Resources of Pyrite as on 01.04.2020 vis-à-vis 01.04.2015**  
(By Lease Status/Grade)

(In '000 Tonnes)

Lease status/Grade	Reserves		Remaining resources		Total resources	
	01.04.2020	01.04.2015	01.04.2020	01.04.2015	01.04.2020	01.04.2015
		Net change		Net change		Net change
<b>All India : Total</b>	-	-	<b>1,674,401</b>	<b>1,674,401</b>	<b>1,674,401</b>	<b>1,674,401</b>
Soil Reclamation	-	-	6,024	6,024	6,024	6,024
Beneficiable	-	-	61,628	61,628	61,628	61,628
Low	-	-	1,555,330	1,555,330	1,555,330	1,555,330
Unclassified	-	-	51,419	51,419	51,419	51,419
<b>Freehold</b>	-	-	<b>60,383</b>	<b>60,383</b>	<b>60,383</b>	<b>60,383</b>
Soil Reclamation	-	-	3,024	3,024	3,024	3,024
Beneficiable	-	-	880	880	880	880
Low	-	-	5,060	5,060	5,060	5,060
Unclassified	-	-	51,419	51,419	51,419	51,419
<b>Leasehold (Public)</b>	-	-	<b>1,614,018</b>	<b>1,614,018</b>	<b>1,614,018</b>	<b>1,614,018</b>
Soil Reclamation	-	-	3,000	3,000	3,000	3,000
Beneficiable	-	-	60,748	60,748	60,748	60,748
Low	-	-	1,550,270	1,550,270	1,550,270	1,550,270

figures rounded off.

areas are examined for further detailed exploration, the confidence level of resources position of pyrite in the country may improve.

In the inventory as on 01.04.2020 only 8 deposits have been reported. Of these, 5 deposits are in freehold areas and the balance 3 deposits in leasehold public sector areas.

**Table – 2 : Total Resources of Pyrite as on 01.04.2020 vis-à-vis 01.04.2015  
(By States)**

(In '000 Tonnes)

State	Total Resources		Net Change
	As on 01.04.2020	As on 01.04.2015	
<b>All India : Total</b>	<b>1,674,401</b>	<b>1,674,401</b>	<b>No Change</b>
Andhra Pradesh	880	880	No Change
Bihar	1,574,561	1,574,561	No Change
Himachal Pradesh	2,560	2,560	No Change
Karnataka	3,000	3,000	No Change
Rajasthan	90,876	90,876	No Change
Tamil Nadu	24	24	No Change
West Bengal	2,500	2,500	No Change

*figures rounded off.*

**Table -3 : District-wise Reserves/Resources of Pyrite as on 01.04.2020**

(In '000 Tonnes)

State	District	Reserves	Remaining Resources	Total Resources
<b>All India : Total</b>		-	<b>1,674,401</b>	<b>1,674,401</b>
<b>Andhra Pradesh</b>		-	<b>880</b>	<b>880</b>
	Kurnool	-	880	880
<b>Bihar</b>		-	<b>1,574,561</b>	<b>1,574,561</b>
	Rohtas	-	1,574,561	1,574,561
<b>Himachal Pradesh</b>		-	<b>2,560</b>	<b>2,560</b>
	Simla	-	2,560	2,560
<b>Karnataka</b>		-	<b>3,000</b>	<b>3,000</b>
	Chitradurga	-	3,000	3,000
<b>Rajasthan</b>		-	<b>90,876</b>	<b>90,876</b>
	Sikar	-	90,876	90,876
<b>Tamil Nadu</b>		-	<b>24</b>	<b>24</b>
	Vellore	-	24	24
<b>West Bengal</b>		-	<b>2,500</b>	<b>2,500</b>
	Purulia	-	2,500	2,500

*figures rounded off.*

## 6.5 SULPHUR (NATIVE)

### Introduction

Sulphur is an essential raw material for many chemical industries and is essentially used for the production of sulphuric acid which in turn is used for the production of chemical fertilizers, textiles, dyestuffs, pickling and galvanising of steel, storage batteries, refining of petroleum, explosives and other acids. Sulphur is used as vulcanising agent, for the production of sulphur dioxide used in paper industry, for refining sugar in sugar industry and in bleaching industry for the manufacture of carbon disulphide which are used for manufacturing rayon. It is also used as a fumigant for stored grain and as a pesticide, etc.

Commercial deposits of native sulphur occur either in salt domes or in bedded deposits associated with gypsum, limestone or as surface deposits associated with some phase of volcanism.

Native sulphur deposit has been reported in Puga Valley of Leh district in Jammu & Kashmir. The grade of the deposit ranges from 9% to 24% of sulphur. Small occurrences of native sulphur are also reported from Barran Island of Bay of Bengal. Sulphur along with hot springs were reported from various parts of Chamoli, Rudraprayag, Uttarkashi, etc. districts in Garhwal & Kumaon divisions of Uttarakhand. In Andhra Pradesh, native sulphur occurs in granular form with clay and silt in coastal areas of Krishna and East Godavari districts. Occurrences are also reported from Alleppy district of Kerala and Kangra district of Himachal Pradesh.

### Basis of Grade Classification

There are no BIS specifications of sulphur for use in industries. The available resources in the inventory have been classified

as 'Sulphur (Native)'.

### Basis of Categorisation of Resources

As per United Nations Framework Classification (UNFC), the resources are broadly classified into 'reserves' and 'remaining resources'. According to the norms of this system, the entire resources of sulphur have been placed under inferred (333) category of remaining resources.

### Salient Features of the Inventory

The total resources of sulphur (native) in the country as on 01.04.2020 have been estimated at 210 thousand tonnes. There are no mineable reserves of elemental sulphur in the country. The entire estimation has been made in freehold areas and has been placed under inferred category of remaining resources.

All India scenario of sulphur reserves, remaining resources and total resources as on 01.04.2020 vis-a-vis 01.04.2015 have been given in Tables - 1 and 2. The tables give an idea about the significant changes in terms of increase or decrease of resources as per lease status, grade, and state. In Table-3, district wise reserves/resources as on 01.04.2020 have been given.

These resources of native sulphur have been estimated from a single deposit in Puga valley of Leh district in Jammu & Kashmir.

There is no change in the inventory as on 01.04.2020 as compared to earlier inventory as on 01.04.2015.

A total 02 freehold deposits of sulphur (Native) have been covered in the National Mineral Inventory as on 01.04.2020. Out of which resources have been estimated in one deposit only.

**Table – 2 : Total Resources of Sulphur (Native) as on 01.04.2020 vis-à-vis 01.04.2015 (By States)**

State	Total resources		Net Change
	As on 01.04.2020	As on 01.04.2015	
	<b>All India /Jammu &amp; Kashmir</b>	<b>210</b>	

figures rounded off.

**Table - 1 : Reserves/Resources of Sulphur (Native) as on 01.04.2020 vis-à-vis 01.04.2015  
(By Lease Status/Grade)**

Lease status/Grade	Reserves		Remaining resources		Total resources	
	01.04.2020	01.04.2015	01.04.2020	01.04.2015	01.04.2020	01.04.2015
		Net change		Net change		Net change
<b>All India/Freehold</b>	-	-	<b>210</b>	<b>210</b>	<b>210</b>	<b>210</b>
Sulphur(Native)	-	-	210	210	210	210

*figures rounded off.*

**Table - 3 : District wise Reserves/Resources of Sulphur (Native) as on 01.04.2020**

State/District	Reserves		Remaining resources		Total resources	
	01.04.2020	01.04.2015	01.04.2020	01.04.2015	01.04.2020	01.04.2015
<b>All India : Total</b>	-	-	<b>210</b>	<b>210</b>	<b>210</b>	<b>210</b>
<b>Jammu &amp; Kashmir</b>	-	-	210	210	210	210
Leh	-	-	210	210	210	210

*figures rounded off.*