



# Participant Handbook

Sector  
**Mining**

Sub-Sector  
**Open Cast and Underground Mines**

Occupation  
**Mining Operations**

Reference ID: **MIN/ Q 0428, Version 1.0**  
**NSQF Level 4**



**Shot Firer / Blaster**





**Shri Narendra Modi**  
Prime Minister of India

“ Skilling is building a better India.  
If we have to move India towards  
development then Skill Development  
should be our mission. ”



## Certificate

### COMPLIANCE TO QUALIFICATION PACK – NATIONAL OCCUPATIONAL STANDARDS

is hereby issued by the

**SKILL COUNCIL FOR MINING SECTOR**

for the

### SKILLING CONTENT: PARTICIPANT HANDBOOK

Complying to National Occupational Standards of  
Job Role/Qualification Pack: '**Shot Firer/ Blaster**' QP No. '**MIN/Q 0428 NSQF Level 4**'

Date of Issuance: **August 24<sup>th</sup>, 2016**

Valid up to: **March 31<sup>st</sup>, 2018**

\* Valid up to the next review date of the Qualification Pack

Authorised Signatory  
(Skill Council for Mining Sector)

## Acknowledgements

SCMS has become operational since January, 2014 with a mandate to support the mining sector through a range of skill development initiatives that includes development of National Occupational Standards and Qualification Packs (NOS/QP) in line with National Skill Qualification Framework (NSQF) with reference to the sectorial job roles to begin with and thereafter to roll out the skill development programs in partnership with accredited Training Providers leading to assessment and certification by SCMS, the objective thus being to ensure adequate availability of skill trained and certified workforce through sound system and process of training, assessment and certification.

The key factors affecting the human resources and skill requirement in the Indian Mining Industry are technology up-gradation, increase in productivity stringent environment and sustainable development framework, globalization and aging profile of workforce and long gestation period for skill acquisition.

Considering the specialization & complexity of job roles in mining sector, a systematic and analytical approach was required for development of the contents corresponding to specified QP/NOS in line with the guidelines of NSQF. Accordingly taking benefit of the available in house competency along with the support of domain experts, SCMS has developed this "**Participant Handbook**" for **Shot Firer/ Blaster**.

I am sanguine that this handbook will lead to successful roll out the skill development initiatives in this area, helping greatly our stakeholders particularly trainees, trainers and assessors etc.

I, gratefully acknowledge support and contribution received from various mining companies in compiling this Handbook without which this would not have been possible.

Further, I wish to place on record our appreciation for the contribution made by entire team of SCMS and the support extended by NSDC team.

It is expected that this publication would meet the complete requirements of QP/NOS based training delivery of **Shot Firer/ Blaster** job role, I would indeed welcome suggestions from users, mining companies, experts and other stakeholders for any improvement in future.

27th June 2016  
New Delhi

(A.K. Bhandari)  
Chief Executive Officer

## About this Book

Blasting and shot firing is an important component of any mining operation. A Blaster is person equipped with substantial skills that are used in blasting in the mines sometimes series blasting, heavy blasting with various kinds of detonators either in large quantities or small quantities to obtain minerals or other such material. Blaster plays an extremely important role in the mining operation from shot firing to health and safety as he deals in the business of explosions and explosives. Increase in mining activity will lead to creation of more jobs for blasters who are well versed with the shot firing skills or have prior knowledge of the skills.

This participant's hand book is designed to acquaint you with the different aspects of the Job role of blaster covering the National Occupational Standards of this specific Qualification Pack. This hand book will equip you to discharge your duties in a better, safe and efficient manner. Key Learning Objectives for the specific NOS mark the beginning of the Unit(s) for that NOS. The symbols used in this book are described below.

- MIN/ N0479 (Receive and Handle Explosive Materials On -Site)
- MIN/ N0480 (Charge Blast Holes, Blast to Specification and deal with misfires)
- MIN/ N0901 (Health and Safety)

Apart from this, there is an additional unit on basic communication and employability skills.

Key Learning Objectives for the specific NOS mark the beginning of the Unit/s for that NOS. The symbols used in this book are described below.

## Symbols Used



Key Learning  
Outcomes



Steps



Time



Tips



Notes



Unit  
Objectives

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**SCMS**

# 1. Introduction

Unit 1.1 – About the mines

Unit 1.2 – Duties & Responsibilities of blaster

Unit 1.3 – Basic electricity

Unit 1.4 – Types of explosives

Unit 1.5 – Properties of explosives

Unit 1.6 – Blasting Accessories



## Key Learning Outcomes

**At the end of this unit, you will be able to :**

1. Follow workshop norms
2. Understand program expectation
3. Safely use the mine explosives
4. Identify the main classes of explosives and their use

## UNIT 1.1: About the Mines

### Unit Objectives

**At the end of this unit, you will be able to:**

1. Describe the mining industry in India
2. Describe the growth expected in the mining industry
3. Explain the various kinds of minerals available in various parts of India
4. Describe the key workforce requirement in the mining sector
5. List various mining acts, legislation and key bodies in India

### 1.1.1 The Mining Industry

Minerals are valuable natural resources. They are available in limited quantities on Earth. They provide the raw materials for many basic industries and are a major resource for our development.

Mining and mineral extraction in India go back to ancient times. The wide availability of the minerals in India in the form of abundant rich reserves made it very conducive for the growth and development of the mining sector in India. The following shows mining operations in progress.



*Fig. 1.1.1. A View of Mining Operations*

India has huge resources of many metallic and non-metallic minerals and mining remained a key sector since India's independence. India produces as many as 87 minerals, including:

- 4 Fuel
- 10 metallic minerals
- 47 non-metallic minerals
- 3 atomic minerals
- 23 minor minerals (including building and other materials)

## 1.1.2 Growth of the Mining Industry

Overall, mineral production in India has been growing. The Indian Mining sector registered a growth of 2.6% during the 9 year period 2004-05 to 2013-14 and contributed approximately 1.9% (1.07 lakh crore) to the national GDP.

The Indian mining industry is characterized by a large number of small operational mines. These include mines for mineral production, minor minerals, petroleum (Crude), natural gas and atomic minerals and others. The states which have the most number of mines includes the following as shown in the following figures:

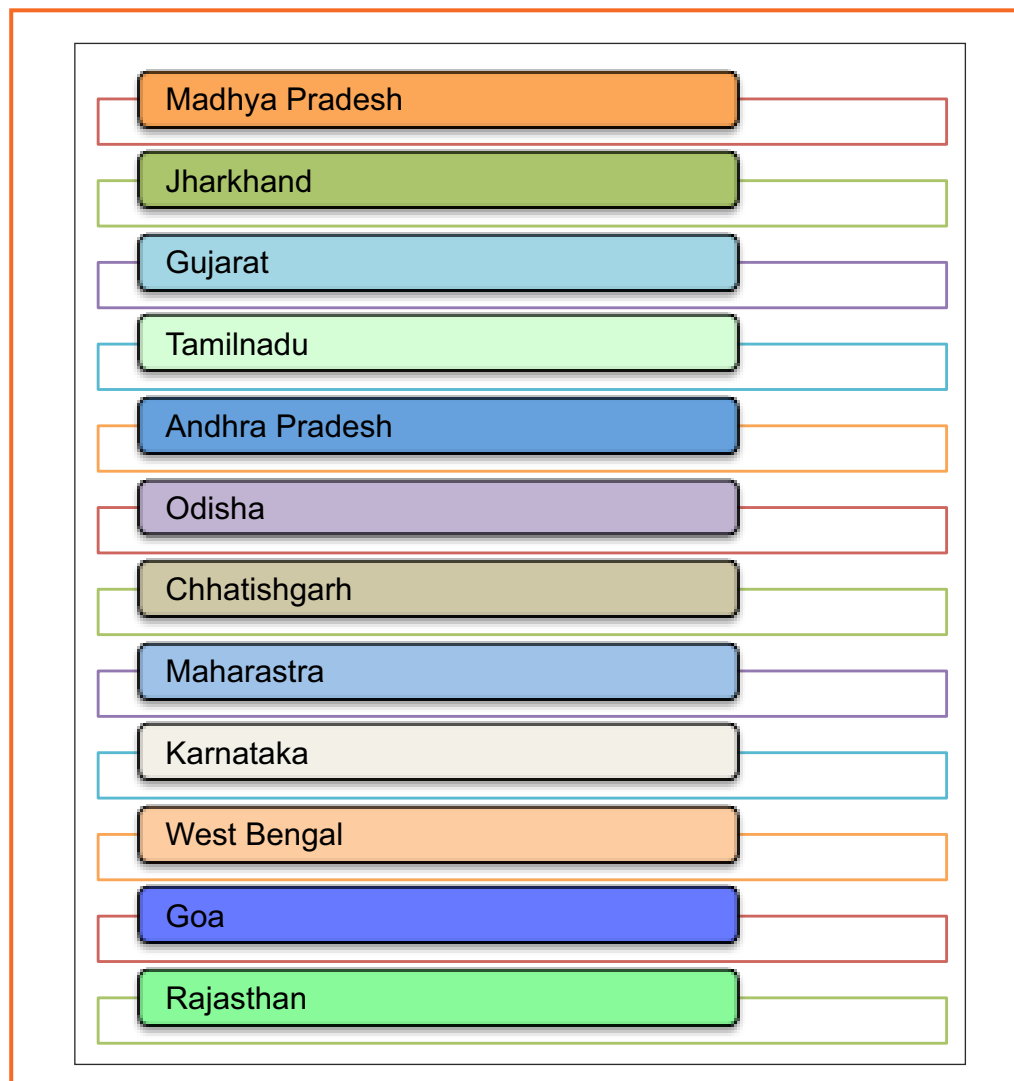


Fig. 1.1.2. The key mining states in India

These 12 states together accounted for 95% of total number of mines in the country in 2015-16.

The major strength of the mining sector in India include following:

1. Vast availability of mineral deposit: India currently produces 89 minerals
2. **High Production of mineral and metal together:** In 2012, India ranked 3rd in the world in production of coal, lignite and Chromite production, 5th in iron ore, 6th in Bauxite; in terms of metal production, the country ranked 3rd in Zinc (slab) and 4th in Steel (crude/liquid) Production.

3. **Self-sufficiency in key minerals for domestic consumption:** India is wholly self-sufficient in minerals such as Bauxite, Chromite, Limestone, Zinc etc.
4. **Beneficial Policy / regulatory frameworks for the mineral sector:** Various policies for exploration, mining, mineral processing and metallurgy for all non-fuel and atomic minerals encourage growth of the mining sector in India.
5. **Availability of financial incentives:** These include concessions on export profits from specified minerals and ores, which further encourage mining.

### 1.1.3 Minerals in India

The following figure indicates the key mines in India and their location in various states of India:

Mineral	States	Mineral	States
Asbestos	Andhra Pradesh	Iron Ore	Andhra Pradesh
	Odisha		Chattishgarh
Bauxite	Chattishgarh		Goa
	Goa		Jharkhand
	Gujarat		Karnataka
	Jharkhand		Kerala
	Karnataka		Madhya Pradesh
	Kerala		Maharashtra
	Madhya Pradesh		Odisha
Odisha	Rajsthan		
Chromite	Tamilnadu	Lead & Zinc	Andhra Pradesh
	Karnataka		Madhya Pradesh
	Maharashtra		Odisha
	Manipur	Rajsthan	
	Odisha	Maganese Ore	Andhra Pradesh
Copper Ore	Gujarat		Goa
	Jharkhand		Gujarat
	Karnataka		Karnataka
	Madhya Pradesh		Madhya Pradesh
	Rajsthan		Maharashtra
Sikkim	Odisha		
Diamond	Madhya Pradesh	Rajsthan	
Gold	Andhra Pradesh	Ruby*	Karnataka
	Jharkhand		Odisha
	Karnataka	Sappire*	Jammu & Kashmir
Rajsthan			

\* Precious Stone

Fig. 1.1.3. The key minerals in India

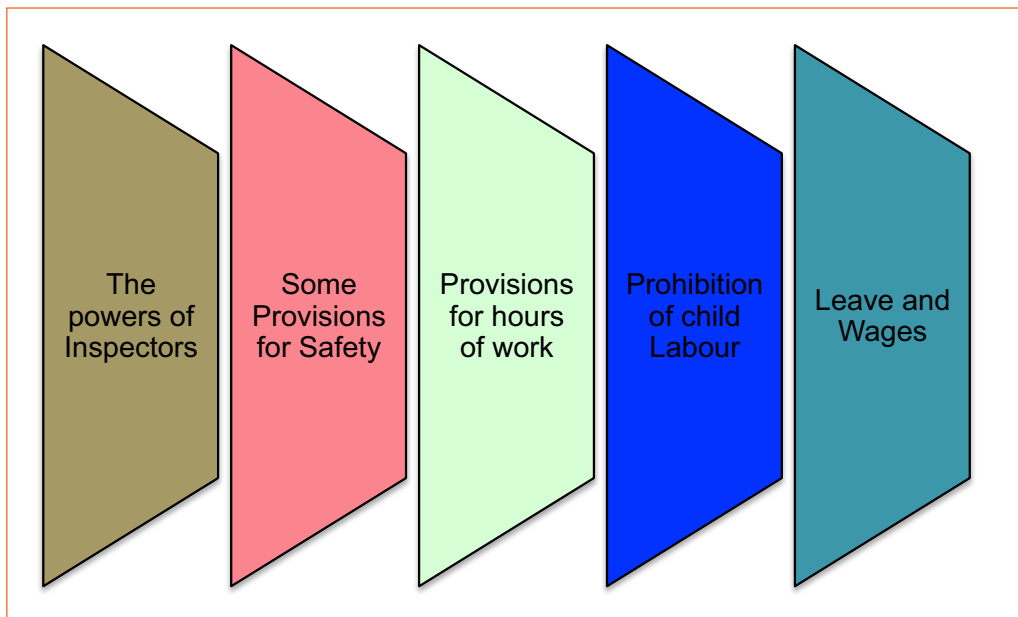
The Indian mining sector employed approximately 23.25 lakh people in 2011-12 across the organised and unorganised sector (including self-employed). The estimated demand in mining sector over the period 2014-22 is anticipated to be approximately 2.59 lakh people.

## 1.1.4 Mining Acts, Legislations and Bodies

The Government of India has multiple legal provisions and laws to protect the rights of mine workers and ensure proper mining processes and procedures.

### 1.1.4.1 The Mines Act, 1952

The Mines Act, 1952 is a Central Government Act. The following figure shows the provision defined by the Mine Act, 1952:



*Fig. 1.1.4. Provisions in the mines act*

The Mines Act {Section 2 (I)} defines a mine as “any excavation where any operation for the purpose of searching for or obtaining minerals has been or is being carried on and includes:

- i. All borings, bore holes, oil wells and accessory crude conditioning plants, including the pipe conveying mineral oil within the oilfields.
- ii. All shafts, in or adjacent to and belonging to a mine, where in the course of being sunk or not.
- iii. All levels and inclined planes in the course of being driven.
- iv. All opencast workings.
- v. All conveyors or aerial ropeways provided for the bringing into or removal from a mine of minerals or other articles or for the removal of refuse therefrom.
- vi. All adits, levels, planes, machinery works, railways, tramways and sidings in or adjacent to and belonging to a mine.
- vii. All Protective works being carried out in or adjacent to a mine.
- viii. All workshop and store situated within the precincts of a mine and the same management and used primarily for the purpose connected with that mine or a number of mines under the same management.

ix. all power stations, transformer sub-stations converter stations, rectifier stations and accumulator storage stations for supplying electricity solely or mainly for the purpose of working the mine or a number under the same management;

x. any premises for the time being used for depositing sand or other material for use in a mine or for depositing refuse from a mine or in which any operations in connection with such and refuse or other material is being carried on, being premises exclusively occupied by the owner of the mine.

### 1.1.4.2 Mine Rescue Rules

The mine Rescue rules, 1985 were framed in order to provide for rescue of worker in the event of explosion, fire etc. in mines. These apply to coal and metalliferous underground mines. The rescue Rules provide for the establishment of rescue stations and conduct of rescue work in mines affected by an explosion or fire, an inrush of water or influx of gases to operate under these conditions, services of specially trained men with special rescue apparatuses are required.

### 1.1.4.3 The Directorate General of Mines Safety (DGMS)

The Directorate General of Mines Safety, DGMS in short, is a Regulatory Agency under the Ministry of labour and employment, Government of India. The responsibility for enforcement of occupational safety, health provisions and welfare of workers in mines, as provided in the Mines Act with the Directorate General of Mines Safety (DGMS).

### 1.1.4.4 International Labour Organisation (ILO) and world Organisation (WHO) Standards

The ILO and WHO have a common definition of occupational health of employees. they recommend that organisations are required to provide a healthy, safe and secure working environment for the following causes as shown in the following figure:

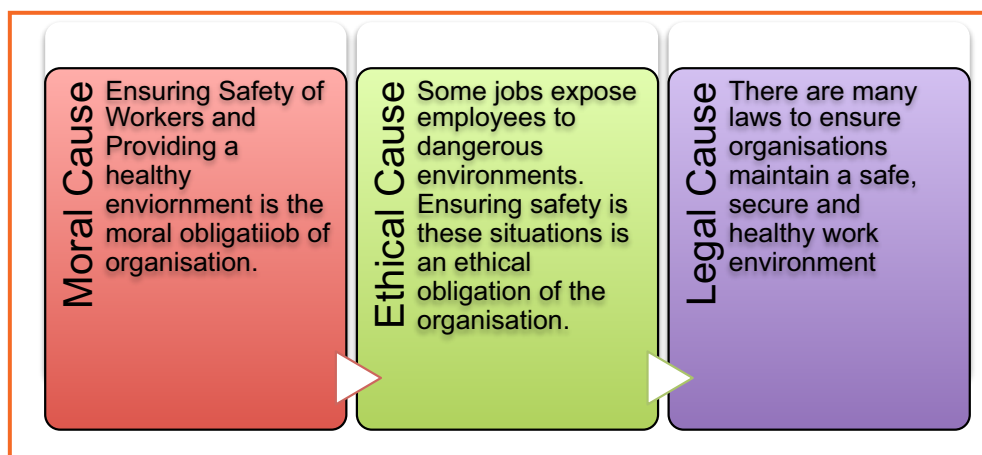


Fig. 1.1.4.4 Causes for organisations to ensure a safe and healthy work environment

The main focus in occupational health is in three different objectives:

1. The maintenance and promotion of worker's health and working capacity.
2. The improvement of working environment and work to become conducive to safety and health.
3. The development of work organisations and working cultures in direction which supports health and safety at work, and in doing so also promotes a positive social climate and smooth operations, and may enhance productivity of the undertakings.

Working culture here means a set of essential value systems adopted by an organisation to ensure a healthy and safe environment to its employees by improving its managerial systems, personnel policy, principles for participation, training policies and quality management systems.

#### **1.1.4.5 Indian Bureau of Mines (IBM)**

IBM is the principal governing agency responsible for compiling exploration data and mineral maps, and for providing latest information regarding mineral resources in India.

#### **1.1.4.6 The Department of Mines and Geology**

The Department of Mines is responsible for survey and exploration of all minerals (other than natural gas and petroleum) for mining and administration of the Mines and Minerals and (Development and Regulation) Act, 1957, in respect of all mines and minerals, other than coal, natural gas and petroleum.

#### **1.1.4.7 Geological Survey of India (GSI)**

The GSI is the key agency for assessment of geological and regional mineral resources in India. It was established in 1851.

#### **1.1.4.8 Central Mine Planning & Design Institute Limited**

Central Mine Planning & Design Institute Limited (CMPDI) is a Government of India enterprise having its corporate headquarters at Ranchi in India. It is fully owned subsidiary of Coal India Limited (CIL).

The function of CMPDI is the consultancy and support for mineral exploration, mining, infrastructure engineering, environmental management, and management systems, especially to the mineral, mining and allied sectors.



### 1.1.4.9 The Marble Development and Conversion Rules, 2002

These rules cover the conservation, systematic development and scientific mining to conserve the marble resources in India, and to provide a uniform framework for systematic and scientific exploitation of marble in India. It also provides provisions for employment in mines and adopting environment-friendly mining methods.

There are several other bodies and laws which ensure smooth operation of mining activities in India.

### 1.1.4.10 Skill Council for Mining (SCMS)

The Skill Council for Mining Sector (SCMS), promoted by the federation of Indian Mineral Industries (FIMI) and supported by Ministry of Mines, was established to develop skill competency standards and qualifications in Mining sector, benchmark it with national and international standards and to work with the mining industry.

SCMS aims at training and up-skilling approximately 4.50 lakh people for mining industry including 50 thousand new inductees to make them employable within a period of 10 years.

## 1.1.2: Basic knowledge about mining

### Mining Basics

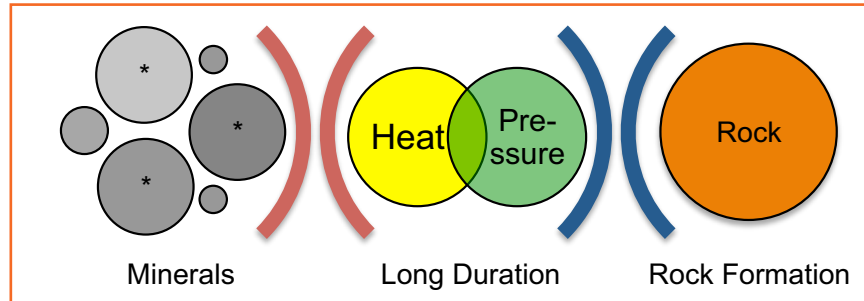
Let us get familiar with some basic terms:

- **Minerals:** Naturally occurring chemical elements. The following shows examples of minerals.



Fig. 1.1.1.2. Minerals

- **Rocks:** Compounds of minerals. The following shows the process of forming rocks.



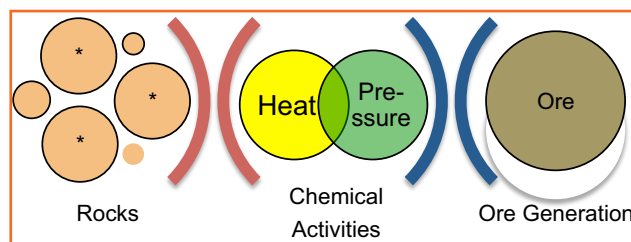
*Fig. 1.1.2.2 Formation of rocks*

The following figure shows examples of rocks.



*Fig. 1.1.2.3 Example of Rock*

- **Ores:** Rocks containing minerals or metals which can be recovered and used as resources. The following shows the process of forming ores.



*Fig. 1.1.2.4 Formation of ores*

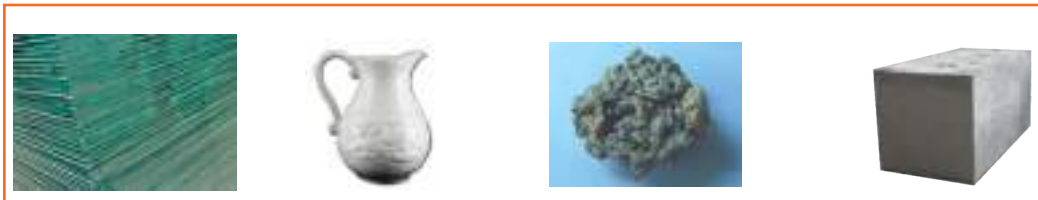
The following picture shows examples of ores.



*Fig. 1.1.2.5 Example of Ores*

- **Artificial Minerals:** Created by people in industries. These are not technically minerals but are treated similarly during processing in factories. The following show some examples of artificial minerals.

Following figure show some examples of artificial minerals:



*Fig. 1.1.2.6 Example of artificial minerals*

## Types of Mines

Mining operations can broadly fall under one of the below two categories:

- Surface Mining
- Underground Mining

## Surface Mining

Surface mining is conducted on the surface of the ground. Surface mining can be of the following kinds:

### **Open-Pit Mining**

Open-pit mining is a type of strip mining in which the ore deposit extends very deep in the ground. Here, the top layer of overburden is removed leaving a large pit to extract deposits such as coal. following picture shows an open-pit mine.



*Fig. 1.1.2.7 Open pit mine*

### **Strip Mining**

Here, the overburden is stripped and placed onto an area which has already been mined out. The following shows strip mining.



*Fig. 1.1.2.8 Strip mining*

### **Quarrying/Cutting**

This is an open-pit mine to extract stones or rocks such as marble or granite. The following shows a quarry.



*Fig. 1.1.2.9 Quarry*

### **Mountaintop Removal Mining**

This is the removing of overburden on a mountain-top to an adjacent valley. The following shows a mountaintop removal mining.



*Fig. 1.1.2.10 Mountain top removal mining*