

ASH AND SLAG HANDLING**3.7. Analytics****3.7.7. Influence of legislation on utilization of ash from power generating stations – indian experience**

A. K. Mathur,
NTPC Ltd., India

ABSTRACT

Main fuel for about 53 % of power generation in India is coal which produced 130 million tonne of ash during last year. In order to encourage its gainful utilization, Bureau of Indian Standards (BIS) issued standards for fly ash as early as 1966. Standards for fly ash based cement were also framed in 1976. NTPC – the major power utility in the country set up a separate Ash Utilization Division during 1991. During 1999, Government legislation was enacted for ash utilization which asked power utilities to plan for full ash utilization within 15 years time. The construction industry was also asked to use ash for building products, road embankments, land developments etc., in its legislation issued in 2003. These legislation helped to increase ash utilization from 30 % during 2003-04 to 55 % during 2007-08. Use of ash in mining areas is now proposed to be made as part of the legislation to help pit head power stations to achieve the set target of full ash utilization.

INTRODUCTION

Coal continues to be the main source of fuel for power generation in major part of the globe. In India the installed capacity of coal based thermal power station is 77,000 MW (53 %) as against a total installed capacity of 1,45,500 MW. More than 60,000 MW coal based capacity is planned to be added by 2012. NTPC Ltd. is the single largest power generating company in the country with total installed capacity of 29,894 MW (which is 20 % of the earlier installed capacity). With the efficient operating systems, NTPC has been generating more than 29 % of the country's power requirement.

Apart from generating power required for the development of Nation, coal based thermal power stations also generate large quantity of ash as the ash content of coal available for such power generation in India is about 40 %. Last year about 130 million tonne of ash was generated in the country. NTPC's coal based stations generated 43 million tonne of ash.

EARLY DEVELOPEMENTS

In India, during the sixties, research activities on use of fly ash had been taken up. In 1966 Bureau of Indian Standard (BIS) had issued standard specifications for fly ash in three parts –part -1 for use of fly ash as Pozzolana, part -2 as an Admixture for concrete and part -3 –as a fine aggregates for mortar and concrete. In the year 1976 separate standard for fly ash based Portland Pozzolana Cement had been issued by BIS and journey for use of such material in construction sector had started. NTPC Ltd. also took it as a challenge to find avenues of gainful utilization of this ash rather than just dumping in large Ash Dump Areas. A separate Ash Utilization Department was set up as early as 1991 to find and promote gainful utilization of ash. The ash utilization at that time was negligible and

ash was generally being dumped in large ash dykes. After making a thorough study of various ash management systems being followed by different power utilities in the country and abroad, a decision was taken to collect ash in dry condition for its optimum use in cement and concrete industry because of its pozzolanic property. For bulk utilization of fly ash, major thrust also came jointly from Department of Science & Technology, Ministry of Power, and Ministry of Environment & Forests & Power Utilities in the year 1994 and Fly Ash Mission was formed to demonstrate the productive utilization of fly ash in various segments. Under the Mission large numbers of demonstration projects were carried out in construction as well as in building product manufacturing segments. These projects have developed confidence amongst engineers, contractors and policy makers & laid a path, resulting in fly ash utilization in the country reach a threshold. Technology up gradation, fly ash collection facilities, increased efficiency of power plant etc have facilitated availability of good quality fly ash and helped for enhancement of its utilization.

GOVERNMENT'S LEGISLATION

The Ministry of Environment and Forest (MoEF) also realized the problems of dumping large quantum of ash and started working for its gainful utilization. A Government Legislation was thus enacted by MoEF in 1999 for use of ash. This legislation made it mandatory for all clay brick manufacturers within 50 km of power plants to compulsorily use at least 25 % of ash in Brick manufacturing. This legislation also made it mandatory for all power plants to make ash available to all users free of cost and plan for full ash utilization with 15 years time. All new stations were, however, given only 9 years time to plan for 100 % Ash Utilization.

IMPACT OF LEGISLATION

This legislation gave a good impetus to increase Ash Utilization in the country. Considering the need to make fly ash available in dry form for its gainful utilization in cement and concrete industry, many of the power plants developed required infrastructure for dry fly ash collection in large Ash Silos from whereas Dry Fly Ash could be easily loaded into trucks/ wagons. Easy availability of dry fly ash from the Silos encouraged cement manufactures to go in for making Fly Ash based Portland Pozzolana Cement in a big way. More and more cement manufacturers started making Fly Ash based Portland Pozzolana Cement (FAPPC). The production of FAPPC which was 21.3 million tonne (22,6 %) during 1999-00 increased to 111million tonne i.e., 66 % of total cement production. As the FAPPC was superior to OPC in many ways especially

considering durability aspect, construction industry adopted use of this FAPPC in almost all types of construction works.

Many of the large cement manufacturers- as part of their forward integration program- started making Ready Mixed Concrete (RMC) for the benefit of construction industry especially in urban centers and large cities. For manufacturing such RMC, quality ash is being directly mixed along with Ordinary Portland Cement (OPC) for more durable concrete. All such concrete wherein FAPPC has been used or Fly ash has been used along with OPC have shown following enhanced parameters:-

- (i) Reduced heat of hydration and thus reduction of thermal cracks, improved soundness of concrete mass.
- (ii) Improved workability / pumpability.
- (iii) Conversion of free lime released from hydration of OPC into additional binding material thus contributing to additional strength.
- (iv) Reduced permeability due to pozzolanic reaction between liberated free lime and fly ash thus improving pore and grain refinement.
- (v) Reduced permeability also increases resistance against ingress of moisture and harmful gases and thus resulting in more durable concrete.
- (vi) Reduced requirement of cement for the same strength thus reduced cost of concrete.

PROSPECTS OF USING ASH BY CEMENT INDUSTRY

Considering the growth rate of development in the country it is now expected that cement manufacturing in the country shall be about 240 million tonne by 2012 and the FAPPC shall reach a level of 180 million tonne (i.e., 75 % of total cement production. This shall require 45 million tonne of dry fly ash, which shall be 20 % of total ash generated by than. Another 5 % of dry fly ash shall be used for manufacturing Ready Mixed Concrete (RMC) where OPC shall be used.

AMENDMENTS TO THE GAZETTE NOTIFICATION

In order to find use for the balance ash, other avenues of ash utilization needs to be developed urgently. Even though manufacturing bricks and other ash based building products offers a good avenue for ash utilization, but the actual offtake by them has remained very minimal (less than 3 % of ash generated) inspite of mandatory provisions in the gazette notification (Government legislation). Transportation cost of ash to such manufacturing units is one of the major reason for its limited use. Lack of awareness about quality and performance of such products among the construction industry has also been a contributing factor. MoEF – considering the difficulties of Brick and other building product manufacturers came out with certain amendments to the legislation during 2003 whereby making it mandatory for the construction industry to use ash bricks/ ash based products for all construction activities within 100 km of the power plant. Use of at least 25 % of ash in clay brick manufacturing was also made mandatory for all brick manufacturing within 100 kms of power plants. Use of ash was also made compulsory for all road embankment works and low lying area developments within 100 kms of power plants.

Such supporting provisions for ash utilization helped in increasing Ash Utilization Level from 29,6 % during 2003 -04 to

53 % during 2007-08. Predominant areas of ash utilization remained - Cement / concrete manufacturing (20 %), Development of low lying areas (17 %), Ash Dyke Raising (5 %), Brick making (3 %), Road Embankments (5 %), Mine filling (2 %) and Others (1 %).

NEW SEGMENTS FOR LARGE SCALE ASH UTILIZATION

Now to increase this level further, new segments of large scale ash utilization needs to be developed specially for large power projects close to coalmines – where construction activities are otherwise very limited .Logical solution appears to be its use in reclamation of coal mines itself. Ash being inert material is a very good fill material for reclamation of abandoned mines or where all mining activities are over. Abandoned mine pits of South Balenda mines of Eastern Coalfields Ltd (ECL) are being reclaimed using ash from nearby NTPC's plant at Talcher- Thermal. More than 10 million tonne of ash can be used for reclamation of these abandoned mine pits. However, availability of such abandoned mines is limited mainly because of new mining technologies available which allow coal mines of deeper seams even with higher OB ratios up to 1:6 or even more.

Use of ash as stowing material in place of traditionally used sand has also been successfully tried in many of the underground mines. However, potential for its use as stowing material is again limited mainly because of limited (only 10 to 15 %) underground coal mining being undertaken in the country.

Considering the above limiting factors, total ash utilization in Mines sector in the country has been limited to 4.2 million tonne (3,3 %) during 2007-08. New techniques are, therefore, required to be developed for large scale ash utilization in mines - specially operating open cast mines. Taking a clue from successful utilization of large volume of ash for road embankment and low lying area development works - where ash is suitably encapsulated with a soil cover to avoid any environmental problems due to blowing of ash in dry condition - it is easily be conceptualized that ash can also be randomly filled with over burden (OB) of an operating mine. Considering the large OB/coal ratio, most of the open cast mines handles large quantities of OB on daily basis. One of such open cast mine in Singrauli Area of Northern Coalfield Ltd. handles 100,000 tonne of OB daily –whereas the nearby linked power plant of 2,000 MW capacity generates 10,000 tonne of ash every day.

Considering the fact that about 30 % of ash generated shall be gainfully utilized in manufacture of cement and other ash based products, the balance 7,000 tonne of ash can easily be randomly filled along with the OB of nearby operating open cast mine. The ash needs to be handled in moist condition (Moisture content between 15..45 %) and randomly filled along-with external dumps of OB-where each lot of ash needs to be immediately encapsulated with OB to avoid the problem of fugitive dust nuisance. NTPC is taking up pilot project for such proposal in association with Ministry of Coal at 2/3 locations near NTPC's stations at Ramagundam, Singrauli and Korba. Successful completion of these pilot projects will open up a new area of large scale ash utilization for simultaneous reclamation of open cast mines.

REFERENCES:

1. **Government** Legislation on ash utilization issued by Ministry of Environment and Forest on 19.9.1999 and 27.08.2003 (Consolidated)