

## ASH AND SLAG HANDLING

## 3.7. Analytics

## 3.7.26. Analysis of legislation in the field of coal ash handling in India\*

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**ABSTRACT**

R&D and technology development are not sufficient in themselves for large scale adaption. Development and adaption of standards and specifications by statutory empowered bodies as well as putting in place the facilitating and guiding policy and legislative framework are the essential requirement for sustainable adaption of new materials, products and technologies.

Turn around of fly ash from “an industrial waste material” to “a resource material” is strongly supported by development of standards and specifications by statutory empowered bodies and also conducive guidelines, policy frame work and legislation over last 20 years, since commencement of Fly Ash Mission during 1994.

The impact is very visible. Ash utilization has increased from 1 million tonne per year during 1994 to about 130 million tonne during the year 2013,

**Key Words:** Fly ash, pulverized fuel ash, coal ash, legislation, policy, India.

**1. INTRODUCTION**

Coal is pre dominating the energy scenario in India. Over the decades electricity generation in the country has remained coal dependant to the extent of 60-67% as compared to global average of about 30%.

With Indian coal resources of about 300 billion tonne, and limited resources of other forms of energy, the dependence of power sector on coal is destined to continue for foreseeable future. Current annual generation of about 235 Mn. tonne fly ash from about 120 utility and 80 captive coal /lignite based thermal power plants of 1,40,000 MW (approx) capacity is projected to grow to around 1000 Mn. T/year by 2031-32 with expanding power sector.

It was during early 1991 that fly ash caught the attention of Department of Science & Technology, Government of India. Appreciating the overall concern for environment and the need for safe disposal and gainful utilization of fly ash, the Government of India commissioned Fly Ash Mission during 1994 as a joint activity of Ministry of Environment and Forests, Ministry of Power and Department of Science & Technology with Department of Science & Technology (DST) as the Nodal Agency. The focus was on Technology Demonstration Projects for developing confidence in fly ash technologies towards large scale adaptation.

The overall complexity of technology development, transfer, infrastructure support, inter-institutional linkages, development of market, orientation of Government policies to promote and support fly ash utilization were the challenge.

Fly ash utilization technologies have been developed for wide range of applications such as

manufacture of bricks, blocks, tiles, light weight aggregates, concretes, cements, light weight blocks, wood substitute for panels, composites, coatings, catalysts, bio fertilizers, bio pesticides, etc. and for use in agriculture, waste land development, mine fills, construction of roads, embankments, dams and infrastructure projects etc. Large numbers of technology development and demonstration projects were undertaken to build the confidence of potential user and decision makers, especially to develop a critical mass for replication. Capacity building and development of human resources was undertaken in a planned manner. A network of laboratories and facilitators has also been developed to provide technical guidance and support to large number of project execution agencies across the country for use of fly ash technologies.

In addition, formulation of national standards, code of practices / guidelines, conducive policy frame work and legislations have been developed concurrently towards wider acceptance of fly ash and its products on self sustaining principle. Salient features are summarized in the subsequent sections of this paper.

**2. GOVERNMENT POLICY AND LEGISLATIVE FRAME WORK IN FIELD OF COAL ASH****2.1. Prior to 1994 i.e. Pre-Fly Ash Mission**

Prior to 1994, large numbers of efforts have been made to develop and commercialize technologies for use of fly ash. Ministry of Environment & Forests (MoEF), Ministry of Power (MoP) and a few other agencies took initiatives. National Waste Management Council (NWMC) and a few other groups/committees consisting of senior officials of various Ministries/Departments, State Governments, Research and Development Institutions, Social Workers etc. were formed. Thermal Power Plants were directed to take actions to enhance ash utilizations. There were very few directives or legislative frame work to promote or facilitate use of fly ash.

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\*The views expressed are that of the authors and not necessarily of the organization to which the authors have affiliation.

The salient ones are:

1.	IS 3812: 1981	Fly ash for use as pozzolona and admixture (very wide & general specifications)
2.	IS 13757: 1982	Standard for clay fly ash burnt bricks
3.	Environment Protection Act 1996	Mandates control of Suspended Particulate Matter (SPM), SO <sub>2</sub> , NO <sub>x</sub> & effluent discharge. But no specific mention about coal ash
4.	IS 12894:1990	Pulverized fuel ash –lime bricks - specification
5.	IS 1489 (Part-1): 1991	Portland pozzolona cement Part 1 Fly ash based (with content of min.10%, max.25%)

## 2.2.Legislative developments during the Mission period and till date

Fly Ash Mission was operative from August 1994 to 31<sup>st</sup> March 2002 with it's original mandate, though with requisite navigation and moderations based on learning values and market conditions. Thereafter it is continuing with same broad objectives and new thrust under the names Fly Ash Utilization Programme (up to

2007) and then as Fly Ash Unit (FAU), Department of Science and Technology (DST), Govt. of India, New Delhi.

The salient interventions and support provided by statutory bodies, Govt. policies and legislative frame work since 1994 are summarized below in a chronological order:

1.	Ministry of Power, Govt. of India directive dated 27 <sup>th</sup> May, 1996 that all thermal power plants shall install dry fly ash collection & disposal systems.
2.	Ministry of Environment & Forests (MoEF), Government of India notification no. S. O. 763 (E) dated 14 <sup>th</sup> September, 1999 making the following provisions mandatory:  (i) All clay brick/block/tile manufacturing units with in a radius of 50 km of a coal/lignite based thermal power plant to mix at least 25 per cent of coal ash in soil on weight to weight basis. (ii) Thermal power plants to make available coal ash free of any charges/cost for a period of 10 years. (iii) All power plants to achieve 100% ash utilization within 12/15 years based on year of commissioning. (iv) Potential user agencies & regulatory bodies to prepare & issue the specifications & guidelines for manufacture & use of fly ash based products as well as fly ash.
3.	IS 456: 2000 Use of fly ash incorporated in "Plain and Reinforced Concrete- Code of Practice"
4.	IS 1489 (Part-1):2000 Specification for Portland Pozzolona cement: Part 1 Fly ash based [Fly ash content enhancement to 15% (min.) & 35% (max.)]
5.	SP 58 (IRC): 2001 For use of fly ash in road embankments
6.	Industrial Policy Odisha-2001 dated 3.12.2001 Fly ash based industry is identified as "Priority Sector" being eligibility for special concessions
7.	IS 784:2001 Incorporated use of fly ash in "Specification for prestressed concrete pipes (including specials) (second revision)
8.	IS 12894: 2002 Fly Ash lime bricks
9.	IS 3872:2002 Incorporated use of fly ash in "Lining of canals with burnt clay tiles - Code of practice (first revision)"
10.	IS 12894:2002 Incorporated use of fly ash in "Specification for pulverized fuel ash lime bricks (first revision)"
11.	IS 4926: 2003 Ready-Mixed Concrete- Code of Practice (with fly ash)
12.	IS 3370 (Part-1): 2003 Use of fly ash incorporated in "Concrete structures for the storage of liquids- Code of practice: Part 1 General requirements"
13.	IS 3370 (Part-2): 2003 Use of fly ash incorporated in "Concrete structures for the storage of liquids- Code of practice: Part 2 Reinforced concrete structures"
14.	IS 3812 (Part-1): 2003 Pulverized Fuel Ash – Specification for use as pozzolona in Cement, Cement Mortar and Concrete (Second Revision)
15.	IS -3812 (Part-2): 2003 Pulverized Fuel Ash – Specification for use as Admixture in Cement Mortar and concrete (Second Revision)
16.	MoEF Notification No. S. O. 593(E) dated 20 <sup>th</sup> May, 2003 Hazardous Wastes (Management & Handling) amended rules 2003, Fly Ash removed from the list of Hazardous Wastes
17.	Ministry of Environment and Forest (MoEF), Govt. of India, notification no. S.O.979 (E) dated 27 <sup>th</sup> August 2003 made the following amendments to its earlier notification no. S.O. 763 (E) dated 14 <sup>th</sup> September 1999. (i) All constructions with in 50 /100 kilometers of a power plant shall be constructed only with fly ash based products. (ii) All road embankments and filling of low lying areas within radies of 100 kilometers shall be done only with coal ash. (iii) All user agencies / regulatory bodies to prepare and issue specifications and guidelines for manufacture and use of fly ash based products. (iv) The implementation and monitoring Committee is constituted.
18.	IS 458:2003 Incorporated use of fly ash in "Precast concrete pipes (with and without reinforcement) Specification (fourth revision)
19.	IRC: SP: 63-2004 Interlocking concrete block pavement (with fly ash)
20.	Ministry of Road and Surface Transport & Highways (MoRTH), Government of India manual for 4 laning of National Highways (2005) included use of fly ash as embankment material.

21.	IS 2185(Part 1):2005	Incorporated use of fly ash in “Specification for concrete masonry units: Part 1 Hollow and solid concrete blocks (third revision)”
22.	IRC: SP: 68-2005	Roller compacted concrete pavement (with fly ash)
23.	IS 15648: 2006	Pulverized Fuel Ash for lime pozzolana mixture applications
24.	Research, Design & Standards Organization (RDSO) report (2006) includes use of fly ash case studies for construction of railway embankments	
25.	IS 15648:2008	Incorporated use of fly ash in “Specification for pulverized fuel ash for lime pozzolana mixture applications”
26.	IS 2185(Part 4):2008	“Concrete masonry units - Specification: Cellular concrete blocks using preformed foam” with fly ash
27.	IS 10262: 2009	Use of Fly ash incorporated in “Guideline for concrete mix design proportioning”
28.	IS 457:2009	Incorporated use of fly ash in “Code of practice for general construction of plain and Jul 2009 reinforced concrete for dams and other massive structures”
29.	IS 3115:2009	Incorporated use of fly ash in “Specification for lime based blocks (second revision)”
30.	IS 4098:2009	Incorporated use of fly ash in “Specification for lime-pozzolana mixture (first revision)”
31.	IS 5817:2009	Incorporated use of fly ash in “Code of practice for preparation and use of lime-pozzolana mixture concrete in buildings and roads (first revision)”
32.	IS 10049:2009	Incorporated use of fly ash in “Code of practice for manufacture of lime based blocks”
33.	IS 10359:2009	Incorporated use of fly ash in “Code of practice for manufacture and use of lime-pozzolana concrete blocks for paving”
34.	IS 10360:2009	Incorporated use of fly ash in “Specification for lime-pozzolana concrete blocks for paving”
35.	IS 10772:2009	Incorporated use of fly ash in “Specification for quick setting lime pozzolana mixture”
36.	<p>Ministry of Environment and Forest (MoEF), Govt. of India, notification no. S.O.2804 (E) dated 3<sup>rd</sup> November 2009 stipulated the following amendments to its earlier Notification Nos. S.O. 763 (E) dated 14<sup>th</sup> September 1999 and S.O. 979 (E) dated 27<sup>th</sup> August 2003.</p> <p>(i) All constructions within a radius of 100 kilometers from a coal or lignite based thermal power plant shall use only fly ash based products for construction.</p> <p>(ii) Permission to establish fly ash based building product manufacturing unit be generated by the concerned Govt. agencies within 30 days of receipt of application.</p> <p>(iii) All power plants shall make available 20% ESP ash to above said manufacturing units as a priority, without any hindrances and free of any charge.</p> <p>(iv) All power plants shall constitute a dispute settlement Committee.</p> <p>(v) All mines within 50 kilometers of thermal power plant shall use fly ash at least equal to 25% of materials (by volumes) used for filling of underground or opencast mine as well as for external dumps created for overburden.</p> <p>(vi) All power plants shall utilize 100% of coal ash within 4/5 years based on year of commencement of generation.</p> <p>(vii) All power plants permitted sale of ESP ash and money generated by sale of fly ash is to be used only for the purposes of promotion and facilitation of use of fly ash.</p> <p>(viii) All financial institutions to make a special condition in their Sanction Letter to follow and implement the provisions of above said notification dated 3<sup>rd</sup> November 2009 of Ministry of Environment and Forest (MoEF).</p> <p>(ix) Constitution of Implementation Monetary Committee at different levels with an overall Monetary Committee at level of Central Govt. of India.</p>	
37.	IRC: SP -89-2010	Guidelines for Soil and Granular Material Stabilization using Cement, Lime and Fly ash.
38.	Use of fly ash incorporated in “Guidelines of Central Water Commission (CWC), Government of India for submission, approval and clearance of Irrigation and multipurpose projects, 2010”	
39.	Use of fly ash incorporated in “Guidelines of Central Water Commission (CWC), Government of India for integrated water resource development & management, 2010”	
40.	Use of fly ash incorporated in “Technical specifications & Guidelines of Central Water Commission (CWC), Government of India for designing & cost estimates of canal linings, overflow spillways, earthen dams, mass concrete dams, tunnels, reservoirs and major water resources projects-2010”.	
41.	Use of fly ash incorporated in “Concrete manual of Central Water Commission (CWC), Government of India-2010”.	
42.	IS 1626(Part 1):2010	Incorporated use of fly ash in “Specification for asbestos cement building pipes and pipe fittings, gutters and gutter fittings and roofing fittings Part 1 Pipe and pipe fittings (second revision)
43.	IS 1626(Part 2):2010	Incorporated use of fly ash in “Specification for asbestos cement building pipes and pipe fittings, gutters and gutter fittings and roofing fittings Part 2 Gutter and gutter fittings (second revision)
44.	IS 1626(Part 3):2010	Incorporated use of fly ash in “Specification for asbestos cement building pipes and pipe fittings, gutters and gutter fittings and roofing fittings: Part 3 Roofing fitting (second revision)
45.	IS 2185(Part 2):2010	Incorporated use of fly ash in “Specification for concrete masonry units: Part 2 Hollow and solid light weight concrete blocks (first revision) (superseding IS 3590)”
46.	IS 2185(Part 3):2010	Incorporated use of fly ash in “Specification for concrete masonry units Part 3 Autoclaved cellular Aerated concrete blocks (first revision) (Superseding IS 5482)”
47.	IS 5758:2010	Incorporated use of fly ash in “Specification for precast concrete kerbs channels, edgings, quadrants and gutter aprons (first revision)”

48.	IRC: 112-2011	Use of fly ash in cement for concrete structures (culverts, bridges)/use of blended cement
49.	IS 7861(Part 1):2011	Incorporated use of fly ash in “Code of practice for extreme weather concreting: Part 1 recommended practice for hot weather concreting”
50.	IS 9142:2011	Incorporated use of fly ash in “Specification for artificial light weight aggregates for concrete masonry units”
51.	IS 2096:2012	Incorporated use of fly ash in “Specification for asbestos cement flat sheets (first revision)”
52.	IS 2098:2012	Incorporated use of fly ash in “Specification for asbestos cement building boards (first revision)”
53.	IS 6908:2012	Incorporated use of fly ash in “Specification for asbestos cement pipes and fittings for sewerage and drainage(first revision)”
54.	IS 1343:2013	“Code of practice for prestressed concrete (second revision)” with fly ash use
55.	IS 459:2013	Incorporated use of fly ash in “Specification for unreinforced corrugated and semi-corrugated asbestos cement sheets (third revision)”
56.	IS 2174:2013	Incorporated use of fly ash in “Specification for reinforced concrete dust bins”
57.	IS 6523:2013	Incorporated use of fly ash in “Specification for precast reinforced concrete door and window frames (first revision)”
58.	IS 3873:2013	Incorporated use of fly ash in “Laying cement concrete/stone slab lining on canals - Code of practice (second revision)”

### 3. DISCUSSION

Development of fly ash utilization technologies since 1994 have been actively and regularly supported by formulation of National Standards and Specifications on continuous basis. In addition, considering the chemical composition of Indian fly ashes, it has been removed, by Ministry of Environment and Forest (MoEF), Govt. of India from the list of hazardous materials during the year 2003. Further, to facilitate maximum utilization of fly ash all power plants are mandated to collect and supply dry fly ash.

Notifications of September 1999, August 2003 and November 2009 have mandated duties and responsibilities of various agencies including ash producers, ash users, regulators and statutory bodies.

### 4. OVER ALL IMPACT

The legislation and Govt. Policies have facilitated to a great extent the large scale adaption of fly ash use technologies. The overall impact since 1994 when Fly Ash Mission was commissioned is summarized in the table below:

Sl. No	Select Indicator	1994 (Start of Fly Ash Mission)	2013
1.	Fly ash Utilization	1.0 million tonne /year [3% of 40 million tonne generation]	130 million tonne / year [55% of 235 million tonne generation]
2.	Number of centers / agencies working on fly ash with a thrust	Very few (less than 10)	Quite a large number (hundreds)
3.	Number of persons working in fly ash utilization / R&D area	A few (tens)	Thousands
4.	Linkages between labs & user agencies	Were practically missing	Strong linkages have been established data & experience sharing has become common.
5.	Confidence in fly ash technologies	Was missing	Has been established in demonstrated technologies, others are in progress / planned and standardization done.
6.	Technologies commercialization status	Practically there was no commercialization effort or large scale use	Commercialization and large scale utilization have started. Hundreds of multiplier effects have come up, generating economic wealth more than US\$ 3 billion, employing more than 1 million people and saving more than 75 MnT CO <sub>2</sub> per annum.
7.	Status of standards / protocols (crucial for sustainable use)	Outdated & were not available for many applications.	Exercise to update the existing standards / make new standards is in full swing. More than 50 stds updated /prepared.

### 5. CONCLUSION

Technology development, scale up, confidence building and human resource development are the key requirements for large scale utilization of fly ash. However, the legislation, Govt. Policy frame work and issuance of standards and specifications by statutory

body are essential for large scale adoption on sustainable basis.

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