

**Revised**

**TECHNOLOGY AND METHODOLOGY  
MANUAL  
FOR  
RECLAMATION OF LOW LYING AREAS/ ABANDONED  
QUARRIES/ LATERITE MINES ETC. WITH  
PULVERIZED FUEL ASH**

**PREPARED BY**

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**In Association and Guidance of**

**STATE POLLUTION CONTROL BOARD, ODISHA  
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**JULY, 2010**

## **FOREWORD**

Land is a precious and non stretchable asset of a country and its society. In today's world of global brotherhood the idea of extending one country's land ownership into another's is practically not conceivable. However, a viable and sustainable mode to enhance the productive land asset of a nation is to reclaim and put to use the low lying areas/ abandoned quarries with fly ash. The use of fly ash for this purpose would circumvent the necessity of borrowing the good earth from another location and creation of new low lying areas.

Fly ash, by virtue of its properties is a good substitute of soil for this purpose. This aspect has been proved and demonstrated successfully across the globe including good amount of work done by Fly Ash Mission (FAM), Government of India, along with other stakeholder agencies. Centre for Fly Ash Research and Management (C-FARM), has also taken major initiative in this area over last 3 years and has been instrumental for acceptance of this concept and its implementation in the field at Kalinga Nagar Industrial Area, Jajpur, Orissa.

State Pollution Control Board, Odisha has also taken major initiatives to guide and facilitate use of fly ash for reclamation of low lying areas / abandoned mines.

This document, "Technology and methodology manual for reclamation of low lying areas/ abandoned quarries/ laterite mines etc. with pulverized fuel ash" is a culmination of research and experience in the country with Indian fly ashes as well as the expertise of C-FARM and SPCB, Odisha including the field projects executed by C-FARM in the state of Odisha with due advice and guidance of SPCB, Odisha.

The document is intended to facilitate and guide large scale utilization of fly ash for reclamation of low lying areas/ abandoned quarries/ laterite mines etc. in the country and especially in the state of Odisha, which would put in productive use, the unutilized two national assets: low lying barren lands and the fly ash.

**Date: 22<sup>nd</sup> July 2010**

**Chairman  
C-FARM**

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**1.0 Preamble:**

Generation of large volumes of pulverized fuel ash (PFA) by thermal power plants (TPPs) has become a subject of serious concern. The ash generation by coal/ lignite thermal power plants has increased from 40 MnT/yr. during 1993-94 to 160 MnT during 2009-10 and is projected to increase to 275 MnT/yr. by 2016-17 and 600 MnT/yr. by 2031-32.

On one hand management of such a huge quantum of PFA is a challenge and on the other hand there are a large number of low lying areas, abandoned quarries/ laterite mines etc. in the vicinity of thermal power plants. These land areas are non-usable, give a barren look and generally become a source of health hazard due to dumping of municipal waste and accumulation of rain/ sewage water. Excavation of good earth from other locations to reclaim the existing low lying areas/ quarries/ laterite mines etc. would lead to creation of new low lying areas of similar void capacity and thus, to a large extent defeating the objective.

PFA provides a sustainable solution. PFA is a good substitute of soil for geotechnical applications including reclamation of low lying areas/ abandoned quarries/ laterite mines etc.

Ministry of Environment and Forests (MoEF) notification No. S.O. 763 (E) dated 14<sup>th</sup> September 1999 duly amended vide notification No. S.O. 979 (E) dated 27<sup>th</sup> August 2003 and notification No. S.O. 2804 (E) dated 3<sup>rd</sup> November 2009 mandates that “No agency, person or organization shall within a radius of hundred kilometers of a coal or lignite based thermal power plant undertake or approve or allow reclamation and compaction of low-lying areas with soil; only fly ash shall be used for compaction and reclamation”.

However, there are no specific guidelines available for use of fly ash for reclamation of low lying areas. The loose fly ash fill or the un-engineered fills can jeopardize the activity. The guidelines now have been prepared by C-FARM based on the in-depth study of the subject including behavior and properties of fly ash and the field experience of reclaiming a number of low lying sites over last 3 years with fly ash. Appendix 1 provides details of low lying areas reclaimed during last 3 years with fly ash under technical advice and guidance of C-FARM. Orissa Pollution Control Board (OPCB) also mandates/ has decided as per the decisions of its meeting held on 17<sup>th</sup> July 2008, under the chairmanship of

Shri S. P. Nanda, Chairman, OPCB, that only fly ash shall be used to reclaim low lying areas.

Thus, these guidelines are prepared to guide and facilitate engineered reclamation of low lying areas/ abandoned quarries/ laterite mines with fly ash.

## **2.0 Definitions:**

- i) Pulverized fuel ash (PFA) and fly ash (FA), the both terms refer to and include all group/ types/ kind of ash generated at coal/ lignite fired thermal power plants. These include ESP dry fly ash, economizer ash, pre-heater ash, bottom ash, pond ash, mound ash.
- ii) ESP dry fly ash (ESP DFA): The ash that is collected from the flue gases by means of electrostatic precipitator (ESP) or bag filters or other means and is in a dry condition.
- iii) Economizer ash (EA): The ash collected in the economizer at ESP area of a Thermal Power Station.
- iv) Pre-heater ash (PHA): The ash collected in the pre-heater at ESP area of a Thermal Power Station.
- v) Bottom ash (BA): The ash that is collected at the bottom of the boiler of a Thermal Power Station.
- vi) Pond ash (PA): The PFA (or FA) i.e. ESP-DFA, EA, PHA, BA etc. mixed together, transported to ash pond area through water slurry or otherwise and deposited in ash pond in the mix condition is known as pond ash (PA).
- vii) Mound ash (MA): The PFA (or FA) i.e. ESP-DFA, EA, PHA, BA etc. mixed together, transported to ash deposition area in dry or moist condition through conveyer belt or other means and deposited together in the mixed condition in the form of a mound is known as mound ash.

ESP-DFA is the finest by its particle size and the BA is the coarsest among seven categories of PFA (FA) listed above. EA and PHA are generally not available separately at a Thermal Power Plant. Being coarser these (EA and PHA) are mixed with bottom ash for disposal. Particle size of ESP-DFA ranges from a few micron to about 150 micron. The percentage of +100 micron size particles is generally around 5 and that of particles finer than 25 micron is around 15. BA generally consists of particles of 200 to 2000 micron size. A small proportion of +2000 micron and some percentage of -200 micron size particles are also present. BA is a granular material like coarse sand/ muharam. EA and PHA are finer than BA and coarser than ESP-DFA. PA and MA, both are mixer of ESP-DFA, BA,

EA and PHA. PA is transported to ash pond area in water-slurry form and MA is transported and deposited in moist condition.

Coarser material with good particle size distribution is generally the best material for geotechnical applications but ESP-DFA is also a good material for this purpose and gives very good compaction by virtue of excellent packaging due to good range of particle size distribution. The compaction is to be done with proper moisture content and as detailed in this document.

### 3.0 PFA a Substitute of Soil for Geotechnical Applications:

PFA, by virtue of its physical and geotechnical properties, is a better or at least a competing material to soil for geotechnical applications. The comparative properties of two materials are given below in table 1 (physical and geotechnical properties) and table 2 (chemical properties). Fly ash is easier to consolidate and settles much faster. There are no subsequent settlements. It's lighter in weight and thus can be comfortably used on weak soils. It has higher angle of internal friction and thus is more stable even with steeper slopes.

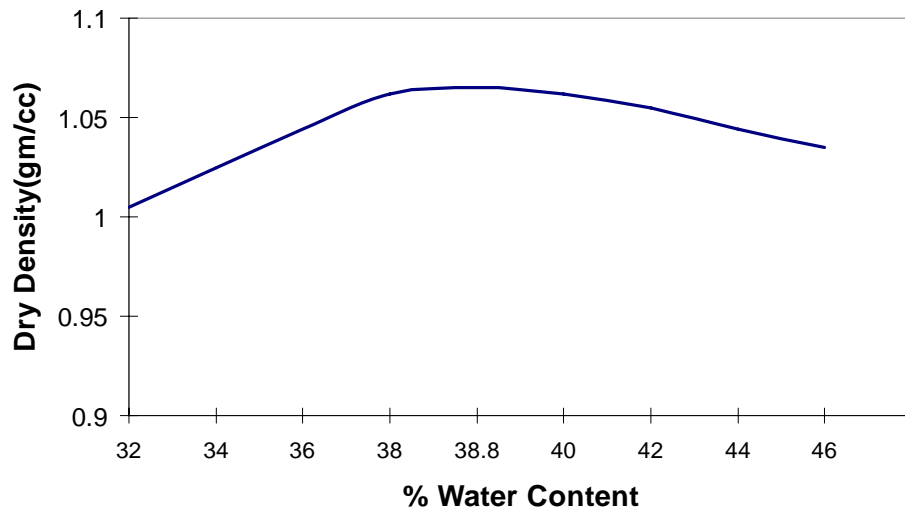
**Table 1: Physical and Geotechnical Properties of Indian Fly Ash Vs Soil**

Properties	Fly Ash	Natural Soil
Bulk Density (gm/cc)	0.9 – 1.5	1.3 – 1.8
Specific Gravity	1.6 – 2.6	2.50 – 2.80
Maximum Dry Density (gm/cc)	0.9 - 1.6	1.6-2.0
Optimum Moisture Content (per cent)	18.0 – 40.0	12-22
Cohesion (kN/m <sup>2</sup> )	Negligible	0-50
Angle of Internal Friction (ϕ) (degrees)	28 - 42	26-36
Coefficient of Consolidation C <sub>v</sub> (cm <sup>2</sup> /sec)	1.80 X 10 <sup>-5</sup> - 2.00 X 10 <sup>-3</sup>	10 <sup>-3</sup> – 10 <sup>-5</sup>
Compression index C <sub>c</sub>	0.05 - 0.40	0.05-1.0
Permeability (cm/sec)	8 X 10 <sup>-6</sup> – 7 X 10 <sup>-4</sup>	1 – 10 <sup>-7</sup>
Particle size Distribution (per cent of materials)		
Clay size fraction	1 – 10	Varies
Silt size fraction	15 – 75	
Sand size fraction	10 – 80	
Gravel size fraction	0 – 5	
Coefficient of Uniformity	3.1 - 10.7	1 – 20
Plasticity	Non-Plastic	Low to high
Shrinkage Limit	Very low	low to high
Grain size	Silty/Sandy	Varies according to type of soil
Clay content	Negligible	Depend on type of soil
Free Swell Index	Very low	Variable
Classification	Sandy silt to silty sand	Variable

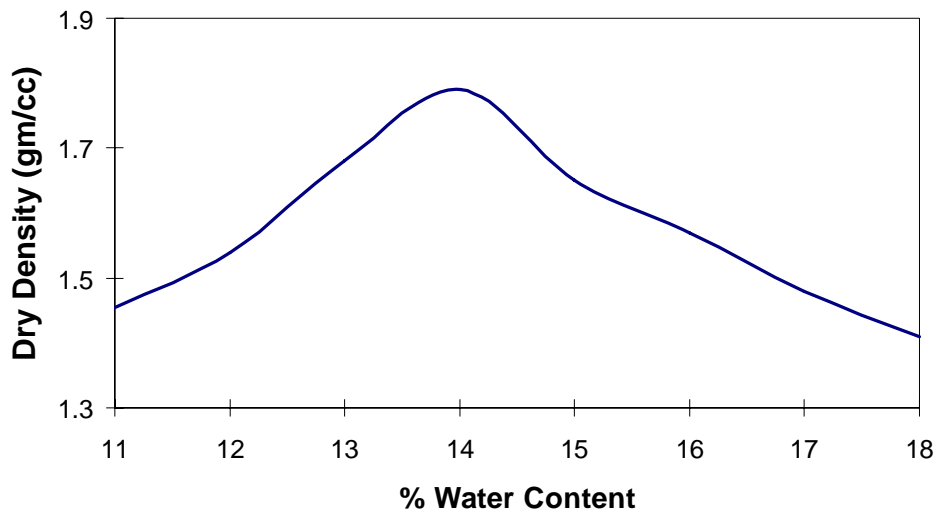
**Table 2: Chemical Properties of Indian Fly Ash Vs Soil**

Constituents	per cent	
	Fly Ash	Natural Soil
SiO <sub>2</sub>	35 – 70	40 – 65
Al <sub>2</sub> O <sub>3</sub>	10 – 35	10 – 30
TiO <sub>2</sub>	0.2 – 2.0	0.2 – 2.0
Fe <sub>2</sub> O <sub>3</sub>	2.0 – 7.0	1 – 14
MnO	0.1 – 0.5	0 – 0.1
MgO	0.01– 4.5	0.2 – 3.0
CaO	0.2 – 20	0 – 7.0
K <sub>2</sub> O	0.05 – 0.9	0.4 - 0.2
Na <sub>2</sub> O	0.05 – 2.0	0.2 – 2.5
LOI	0.1 – 8.0	5 – 15

Proctor compaction test curve for PFA is flatter than that for soil (see figure I & II). Thus, desired compaction can be achieved on fly ash over a wide range of moisture. Further, fly ash being a free draining material, work can be restarted much faster than on soils in rainy season. In case of fly ash compaction is complete in the initial stages itself and subsequent settlement is practically nil.



**Figure I: Typical Proctor Test on Pond Ash**



**Figure II: Typical Proctor Test on Soil**

Chemically, Indian fly ashes are quite safe from leaching point of view for use as a fill material. Chemical analyses of water filtrate from fly ash dump and near by surface water resources given in table 3 makes the point more clear. However, leaching test be conducted on the fly ash to be used for reclaiming the low lying area and it should meet the criteria of water disposal in inland surface water as per the Pollution Control Board norms.

#### **4.0 Protection from Leaching**

As mentioned in the proceeding paragraph, fly ashes to be used for reclamation of low lying should be subjected to leaching test as per standard procedure.

**4.1** The fly ashes for which leaching test results are found to be within the “Pollution Control Board norms for discharging in inland surface water” as given in table 3 and amended by PCB from time to time, such fly ashes can be used for reclamation of low lying areas without any protection measures for leaching.

**4.2** The fly ashes whose leaching test results show higher concentration than PCB norms referred under para 4.1, the following shall prevail:

- (i) If the underneath strata of the low lying area is like impervious / clayey and there is no water body / aquifer nearby, the tested fly ash can be used for reclamation of the low lying area under consideration without any protection measure for leachettes.



**Table 3: Characteristics of Ash Pond effluent and well water collected from Ash bund Area of Chandrapur STPP and Bhusawal TPS**

Parameters	A	B	C	D	E	F	G	H	Pollution Control Board norms * (for discharge in inland surface water)
pH	8.28	8.14	8.19	8.11	8.23	8.30	8.10	8.35	5.5-9.0
TSS (mg/l)	218.00	362.00	219.10	348.40	349.0	360.00	140.00	75.00	100.00
TDS "	610.00	467.30	587.90	451.70	531.0	535.00	519.00	458.00	2100
Ca "	65.40	54.20	62.80	51.50	33.50	32.50	37.60	32.50	75.00
Mg "	31.00	18.90	29.70	15.30	31.20	29.20	32.80	28.60	30.00
N-NO <sub>3</sub> "	3.43	2.21	3.39	2.12	3.70	3.69	2.20	2.39	50.00
F "	0.89	1.45	0.97	1.52	0.82	0.81	1.09	1.21	2.00
I "	0.029	0.032	0.026	0.043	0.017	0.020	0.048	0.029	-
Fe "	0.15	0.09	0.11	0.07	0.08	0.08	0.03	0.02	1.00
Pb "	0.02	0.05	0.01	0.03	0.05	0.04	0.05	0.05	0.10
Cd "	0.003	0.001	0.004	0.001	0.004	0.004	0.002	0.002	2.00
Ni "	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	3.00
Cr(As Cr +6) "	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.10
Total Cr as (Cr) "	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	2.00
Co "	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	-
As "	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.20
Hg "	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.01
<b>Radioactivity (Bq/kg)</b>									
α- emitters	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-
β- emitters	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	-

**A** : Water sample from Farmer's well Village- Chargaon collected on 15.02.97, Chandrapur

BDL –Below detection limit

**B** : Drain water (Ash Effluent), well no. 5 discharge point collected on 15.02.97, Chandrapur

**C** : Water from Farmer's well near ash bund area collected on 19.08.97, Chandrapur

**D** : Water from ash pond effluent outlet, lagoon no. 1 collected on 19.08.97, Chandrapur

**E** : Velhala Ash pond percolation well No. 3 collected on 10.12.98, Bhusawal

**F** : Velhala Ash pond percolation well No. 4 collected on 10.12.98, Bhusawal

**G** : Farmer's (Mr. Prahlad Patil) well water Village-Pimpalgaon Khurd collected on 08.02.99, Bhusawal

**H** : Farmer's (Mr. V.M. Rane) well water Village: Pimpalgaon Khurd collected on 08.02.99, Bhusawal

\* <http://www.dpcc.delhigovt.in/waterstdhtm>

- (ii) If the underneath strata is pervious and there is no water body nearby, the tested fly ash can be used for reclamation of the low lying area under consideration without any protection measure for leachettes.
- (iii) If the underneath strata is not impervious and there is a water body nearby the tested fly ash can be used for reclamation of low lying area, only if the amount of fly ash to be deposited is not more than 100 tonne per pit and the total number of pits around that area / water body should not exceed 5.

If the pit / pits are larger in size or number than stated above, a protective liner of HDPE / clay bentonite / fly ash – clay / fly ash – bentonite or any other suitable material is to be provided.

- (iv) When the underneath strata is impervious and even if there is a water body / aquifer near by, the tested fly ash can be used for reclamation of low lying area.

## **5.0 Transportation and Handling of PFA (FA):**

Transportation of PFA to the site of low lying area/ abandoned quarry/ laterite mine for reclamation is to be done in an environmentally friendly manner. It should not pollute the environment en-route. The trucks/ trolleys/ dumpers be closed as far as possible or be properly covered with tarpaulin which is tied properly. The PFA be filled/ loaded in the truck/ trolley/ dumper etc. only to the extent that it does not spill over en-route. The ash to be carried shall be adequately moistened with water, so, that minimum 15% moisture is maintained at the destination.

At the worksite PFA is to be managed in such a manner that it does not get airborne even in dry season and should not get inundate with water during rainy season. It should be placed/ stockpiled in well-drained area during rainy season and be kept wet or covered with tarpaulin or two inch layer of soil during summer season, as may be possible.

## **6.0 Excavation and Supply of PFA from Ash Pond:**

The surface of the ash pond be stripped to a depth of at least 20 cm at the area from where pond ash is to be excavated for use, to remove the foreign materials and biomass. Deeper roots, if any, of plants/ bushes may also be removed.

The pond ash be excavated in layers 1.5 to 2.0 meters and not by scrapping. This is to ensure removal of PFA as it was deposited in layers and with proper particle size distribution. The area from which ash will be excavated, loaded and unloaded shall be conditioned by water sprinkling. The agency shall ensure installation of adequate numbers of water sprinklers for this purpose to avoid any fugitive dust emission.

The industry shall develop the haulage road and shall provide adequate water spraying arrangements in the haul roads when ash is taken from ash pond to suppress any fugitive dust generated during working period.

## 7.0 Management of Ash Pond Area/ Silo Area

The source point of fly ash i.e. ash pond or the silo area as the case may be, should also be managed in environment friendly manner.

The ash pond area from where the PFA is being excavated be kept moist to avoid air pollution. The silo area, if the PFA is being taken from silo area, may be maintained in dust free condition with proper working of humidifier and PFA dispensing system.

The vehicle body and especially the wheels be washed with pressure water using hose-pipe before rolling out to the main carriage.

## 8.0 Preparation of Low Lying Area/ Abandoned Quarry/ Laterite Mine Site for Reclamation with PFA:

### i) Stripping and grading:

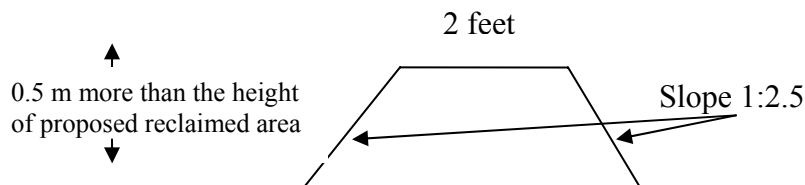
If the site is covered with vegetation, the entire area be stripped to a minimum of 20 cm depth to remove all vegetation including deep seated roots, rubbish and other organic matter. Grading be done if small size but deep ditches/ areas are present, wherein, otherwise compaction of fly ash would be difficult.

### ii) Water logged area:

If the entire area that is to be reclaimed or part of it is water logged or is slushy, dewatering may be done first, followed by removal of slushy soil and/ or filling and compacting the area with gravel and boulders.

### iii) Protection of a pond or water body adjoining or within the working site:

An earthen embankment of the cross-section given below in figure III be constructed around the pond or water body to protect it from fly ash spilling into it.

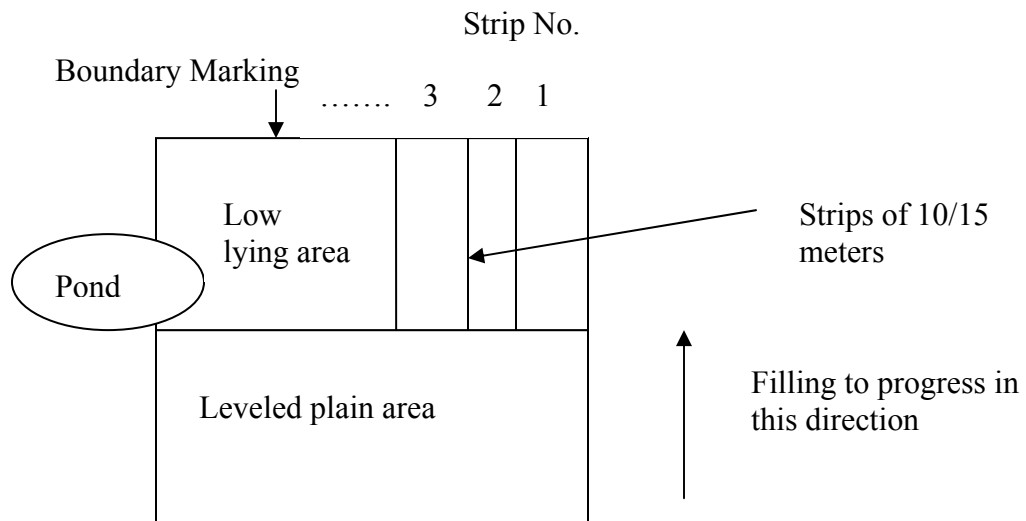


**Figure III: Cross-section of water body protection embankment**

The soil used for the embankment should neither be granular nor black cotton soil. It should be a good soil for geo-technical applications. Soil should be compacted to 95% proctor by vibratory roller of 15T min capacity, in the layers of 25-30 cm in optimum moisture condition. After reaching the desired filling height, the disposal area should be thoroughly compacted, graded followed by soil cover at least 15 cm for proper reclamation of the land and appropriate plantation (choosing the local species with at least 80% survival rate) will be carried out.

## 9.0 Spreading and Compaction of PFA in the Low Lying Area/ Abandoned Quarry/ Laterite Mine etc.

- i) The PFA be spread uniformly by means of earth moving equipments like dozers, tractors, spreader etc. of appropriate size commensurate to the working site size/ configuration. Uniform spreading be done in the layers of 250-300 mm loose thickness in the entire area or in the strips of about 15 meter width which ever is less (Refer figure IV). The length of each strip may also be restricted maximum up to 150 meters. The compaction be done with vibratory rollers of at least 15 tonne and to 95 % proctor. Optimum moisture content be maintained during compaction. The moisture content may vary in the PFA and especially during dry season. Addition of some water with sprinklers may be required to adjust the moisture content to achieve best results.

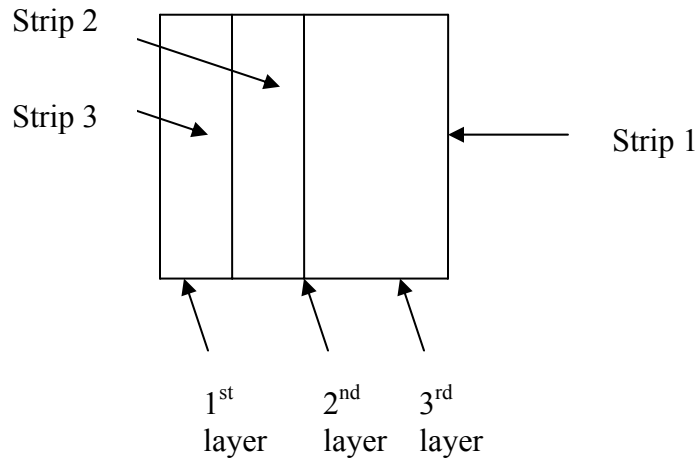


**Figure IV: Schematic arrangement of reclamation of low lying area**

Spreading and compaction to move from strip (1) to (2) to (3) and so on and from level land to the boundary marking as indicated by the arrow in Figure IV.

- ii) Two or three layers be laid on strip (1) and then one or two layers can be laid on strip no (2) and progressively subsequent strips can be taken up while

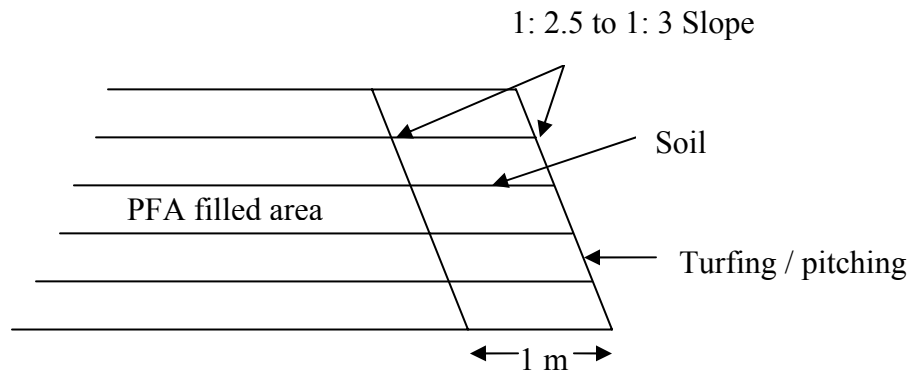
raising the height of preceding strips. Over lap of 2m be maintained from strip to strip in different layers as shown below in Figure V.



**Figure V: Overlapping layers**

- iii) Similarly, 5 to 10 meter lengthwise overlap may also be maintained from layer to layer, when the length of the area is more than 150 m.
- iv) At the boundary limits, where the fill material would be exposed to air and water, needs to be protected / confined with soil and pitching / turfing on the soil layer as for soil embankments.

Soil cover of one meter be provided and be compacted along with fly ash in each layer as shown below.



**Figure VI: Exposed boundary configuration**

- v) Vibratory rollers are generally not to be operated with in 1 meter of concrete and masonry structure as well as at the edges. In location near to concrete/ masonry structure compaction be done by hand held compactors or small rollers.

For the exposed boundary conditions of filled material (figure VI), spreading, rolling and compaction of soil layer be done for 1 meter extra length (total 2

meters) and the extra last 1 meter which is not properly compacted be removed by cutting and scrapping. Thereafter, the slope surface be compacted with hand compactor or other means.

#### **10.0 Soil Cover:**

The area reclaimed with PFA should be provided with soil cover of 400 to 500 mm to protect exposure of fly ash to air or water.

The soil required for the cover, be either excavated from the low lying area to be reclaimed, if good earth is available there and be stored aside for this purpose. Otherwise, the required quantity of soil can be excavated from a borrow pit and the borrow pit is also to be filled up/ reclaimed with PFA as per the procedure and system laid in this document and be provided with a soil cover of 400- 500 mm.

#### **11.0 Environment Protection:**

Air and water quality tests be done at the proposed site before start of work and data as on start of work be recorded. Thereafter, the environmental quality monitoring (of air and surface water) shall be carried out regularly in the disposal area and reported to the Board on quarterly basis. Water quality monitoring is to be done from start of the work to six months after completion of work. Air monitoring is to be done upto the completion of the work including putting of the soil cover.

Further, the surface slope of the completed site should be such maintained that water should neither accumulate around the site nor at the site. The exposed sides of the site, if any, shall be covered with soil with gentle gradient to prevent fly ash getting air borne during dry windy days or contamination of natural nalah or stream during rainy season.

#### **12.0 Quality Control:**

The procedures prescribed in the foregoing paragraphs be strictly adhered to while borrowing, transporting, spreading and compacting the PFA in the low lying area/ abandoned quarry/ laterite mine. The following may specifically be observed/ controlled and recorded in quality supervisors daily book at the respective point of activity every four hours of the working shift say first after 2 hrs of start of shift and then during 6<sup>th</sup> hours of start of the shift.

- i) No biomass or biodegradable material be buried under the PFA in the area being reclaimed. The area may be completely scrapped of bio-degradable and such materials be disposed of outside the working area.

- ii) Fly ash filling, spreading and compaction be done in layers of not more than 30 cm and compaction be done at optimum moisture content with vibratory roller of at least 15 tonne to 95% proctor.
- iii) Filling be done strip by strip and with recommended overlap side by side as well as length wise.
- iv) No biodegradable material be present in the PFA being used to fill/ reclaim the low lying area.
- v) Two numbers of core should be cut of the compacted material, one in the forenoon and another in the afternoon at regular intervals to check the quality of compaction and immediate corrective action be taken, as may be required, in terms of maintaining optimum moisture content or number of passes of roller to get the required proctor compaction.
- vi) The PFA surface at the reclaimed/ filled area be either kept moist or be covered with soil to avoid fly ash getting airbase.
- vii) Constant vigil be kept at the PFA loading point, vehicles carrying the PFA and en-route to ensure that no spilling of PFA and pollution takes place during handling and transportation of PFA.
- viii) During summer month extra care shall be taken to control fugitive dust.
- ix) The quarry pits have to be filled up only by following the progressive land filling methods from bottom to top with proper compaction and water sprinkling instead of haphazard dumping in the proposed disposal site. In no case industry shall dump ash out side the quarry pit areas.

### **13.0 Usage of Reclaimed Areas:**

The low lying areas/ abandoned quarries/ laterite mines reclaimed with PFA in a manner described in this document can be safely used for habitat construction, parking lots, play-grounds and other purposes including agriculture, floriculture, horticulture, forestry etc. Wherever plantation is done, preferably local species be selected and 80 percent survival rate achieved.

However, proper investigations and foundation design be done before heavy construction/ usage. After completely reclaiming the site, signboards shall be put up showing that the land was reclaimed by filling fly ash in a low lying area to popularize fly ash utilization in reclaiming low lying areas.

#### **14.0 General Instructions:**

- (i) All the tippers and trucks responsible for carrying ash shall obtain Pollution Under Control (PUC) certificate and certificate from appropriate authority. All the vehicle drivers shall have required valid driving license issued by appropriate authority.
- (ii) In case of any accidental spillage on the way while transporting the ash; the agency shall ensure that the spilled ash is collected and transported to the disposal / usage site.
- (iii) Speed limits shall be strictly enforced. In no case the same shall exceed 40 km/h.
- (iv) Appropriate measures be taken to prevent any entry of cattle/livestock inside the disposal area during working period.
- (v) Attempt shall be made to avoid any kind of nuisance to the public due to proposed activities.
- (vi) After completely reclaiming the site, signboards shall be put up showing that the land was reclaimed by filling fly ash in a low lying area. That will help sending the message of fly ash utilization in reclaiming low lying areas.



## Appendix 1

**Low lying areas/ abandoned quarries/ laterite mines etc. reclaimed with fly ash under technical advice, guidance and support of C-FARM from July, 2007 to March, 2010**

### **Completed Sites:**

1.	IDCO, Common Facility Centre, Jajpur	:	25, 000 m <sup>3</sup>
2.	Saraswati Shishoo Mandir, Jajpur	:	65, 000 m <sup>3</sup>
3.	S. P's Parade Ground	:	1, 00, 000 m <sup>3</sup>
4.	Site of Mr. Nayak, Jajpur Road	:	1, 25, 000 m <sup>3</sup>
5.	Korabandi, Abandoned Laterite Mine	:	1, 50, 000 m <sup>3</sup>

### **Ongoing Sites:**

1.	Ragdi, Abandoned Laterite Mine	:	4, 50, 000 m <sup>3</sup>
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