JSW Energy Limited

Works :
P.B. No.9, Toranagallu
Dist. Ballari - 583 123, Karnataka, India.
CIN. : L74999MH1994PLC077041
Phone : 08395 - 282 200
Website : www.jsw.in

Ref. No. JSWEL/ Ash/ Auth/8261
Date.: 28.04.2025

To
The Addl. Principal Chief Conservator of Forests (C),
Ministry of Environment, Forests and Climate Change,
Regional Office (South Zone),
Bangaluru.

Sub: Ash Notification S.O. 5481(E), 31st December 2021 Statutory Compliance Report of **2 x 130MW & 2 x 300 MW JSW Energy limited** for the period 01.04.2024 to 31.03.2025.

Dear Sir,

This has reference to the subject cited under reference above, we hereby submitting the compliance reports of ash generation and utilization for the period April 2024 to March 2025 in the prescribed format.

Kindly acknowledge the receipt of the same.

Thanking you.

Yours faithfully,
for **JSW Energy Limited**

Kartikeya Misra
Vice President & Head of Plant

Copy to:

KSPCB, Divisional office, Ballari
CPCB, Bangaluru
CPCB, New Delhi.
Director, MoE&FCC, New Delhi

KSPCB, Bengaluru.

JSW Energy Limited

Works :
P.B. No.9, Toranagallu
Dist. Ballari - 583 123, Karnataka, India.
CIN. : L74999MH1994PLC077041
Phone : 08395 - 282 200
Website : www.jsw.in

Ref. No. JSWEL/ Ash/ Auth/8261
Date.: 28.04.2025

To

The Addl. Principal Chief Conservator of Forests (C),

Ministry of Environment, Forests and Climate Change,

Regional Office (South Zone),

Bangaluru.

Sub: Ash Notification S.O. 5481(E), 31st December 2021 Statutory Compliance Report of **2 x 130MW & 2 x 300 MW JSW Energy limited** for the period 01.04.2024 to 31.03.2025.

Dear Sir,

This has reference to the subject cited under reference above, we hereby submitting the compliance reports of ash generation and utilization for the period April 2024 to March 2025 in the prescribed format.

Kindly acknowledge the receipt of the same.

Thanking you.

Yours faithfully,
for **JSW Energy Limited**

Kartikeya Misra
Vice President & Head of Plant

Copy to:

KSPCB, Divisional office, Ballari
CPCB, Bangaluru
CPCB, New Delhi.
Director, MoE&FCC, New Delhi

Ash Compliance report for the period 01.04.2024 to 31.03.2025

Please attach necessary documents regarding the utilization and status of the Ash ponds of legacy ash

Sl.No	Details	FY : 2024-25		
1	Name of Power Plant	**JSW Energy Ltd, Toranagallu**		
2	Name of the company	**JSW Energy Ltd**		
3	District	Bellary		
4	State	Karnataka		
5	Postal address for communication:	Post Box No. 9, JSW Energy Ltd.		
6	E-mail:	kartikeya.misra@jsw.in		
7	Power Plant installed capacity (MW):	**860 (2x130 MW & 2x300 MW)**		
8	Plant Load Factor (PLF):	58.68%		
9	No. of units generated (MWh):	4420468 MWthr		
10	Total area under power plant (ha):	95.78 Ha		
	(including area under ash ponds)			
11	Quantity of coal consumption during reporting period (Metric Tons per Annum):	1530742 MT		
12	Average ash content in percentage (per cent):	15.6%		
13	Quantity of current ash generation during reporting period	239414		
	(Metric Tons per Annum):			
	Fly ash (Metric Tons per Annum):	224167		
	Bottom ash (Metric Tons per Annum):	15247		
14	Capacity of dry fly storage silo(s) (Metric Tons):	1710		
15	Details of utilisation of current ash generated during reporting period	**FY 2024-25**		
a	Total quantity of current ash utilised (MTPA) during reporting period:	239414		
b	Quantity of fly ash utilised (MTPA):	224167		
	I. Fly ash based products (bricks or blocks or tiles or fibre cement sheets or pipes or boards or panels	21653		
	II. Cement manufacturing	149480		
	III. Ready mix concrete:	0		
	IV. Ash and Geo-polymer based construction material:	0		
	V. Manufacturing of sintered or cold bonded ash aggregate:	0		
	VI. Construction of roads, road and fly over embankment:	32349		
	VII. Construction of dams:	0		
	VIII. Filling up of low lying area:	0		
	IX. Filling of mine voids:	0		
	X. Use in overburden dumps:	0		
	XI. Agriculture:	0		
	XII. Construction of shoreline protection structures in coastal districts;	0		
	XIII. Export of ash to other countries:	0		
	XIV. Others (please specify): MT	20686	(Recirculated in boiler)	
c.	Quantity of bottom ash utilised (MTPA):	15247		
	I. Fly ash based products (bricks or blocks or tiles or fibre cement sheets or pipes or boards or panels):	0		
	II. Cement manufacturing	0		
	III. Ready mix concrete:	0		
	IV. Ash and Geo-polymer based construction material:	0		

	V. Manufacturing of sintered or cold bonded ash aggregate:	0		
	VI. Construction of roads, road and flyover embankment:	533		
	VII. Construction of dams:	0		
	VIII. Filling up of low lying area:	0		
	IX. Filling of mine voids:	0		
	X. Use in overburden dumps:	0		
	XI. Agriculture:	0		
	XII. Construction of shoreline protection structures in coastal districts:	0		
	XIII. Export of ash to other countries:	0		
	XIV. Others (please specify): MT	14714	(Recirculated in boiler)	
	Total quantity of current ash utilised (MTPA) during reporting period:	239414		
16	Percentage utilisation of current ash generated during reporting period (per cent):	100%		
17	Details of disposal of ash ponds			
	a. Total quantity of ash disposed in ash pond(s) (Metric Tons) as on 31st March (excluding reporting period):	0		
	b. Quantity of ash disposed in ash pond(s) during reporting period (Metric Tons):	0		
	c. Total quantity of water consumption for slurry discharge into ash ponds during reporting period (m3):	Not applicable		
	d. Total number of ash ponds:	1		
	I. Active:	1		
	II. Exhausted (yet to be reclaimed):	0		
	III. Reclaimed:	0		
	e. Total area under ash ponds (ha):	3.495 Ha		
18	Individual ash pond details			
	Ash pond-1.2,etc (please provide below mentioned details separately, if number of ash ponds is more than one)	1		
	a. Status: Under construction or Active or Exhausted or reclaimed	Active		
	b. Date of start of ash disposal in ash pond (DD/MM/YYYY or MMYYYY):	30.04.2011		
	c. Date of stoppage of ash disposal in ash pond after completing its capacity (DD/MM/YYYY or MMYYYY):	Not applicable		
	(Not applicable for active ash ponds)			
	d. Area (hectares):	3.495 Ha		
	e. Dyke height (m):	1 mtr free board above ground level and 7 mtr below ground (GL)		
	f. Volume (m^3):	2.004 lac cum		
	g. Quantity of ash disposed as 31st March (Metric Tons):	0		
	h. Available volume in percentage (per cent) and quantity of ash can be further disposed (Metric Tons):	100% & 2.4048 lac MT (ash density considered as 1.2 g/cc)		
	i. Expected life of ash pond (number of years and months):	25 years (constructed in 2011)		
	j. Co-ordinates (Lat and Long): (please specify minimum 4 co-ordinates)	Latitude / Longitude 15° 11' 24" N, 76° 40' 23" E 15° 11' 26" N 76° 40' 25" E 15° 11' 23" N 76° 40' 30" E 15° 11' 22" N 76° 40' 28" E		

	k. Type of lining carried in ash pond: HDPE lining or LDPE lining or clay lining or No lining	HDPE lining		
	l. Mode of disposal: Dry disposal or wet slurry (in case of wet slurry please specify whether HCSD or MCSD or LCSD)	Dry disposal		
	m. Ratio of ash: water in slurry mix (1:___):	Not applicable		
	n. Ash water recycling system (AWRS) installed and functioning: Yes or No	Not Applicable		
	o. Quantity of wastewater from ash pond discharged into land or water body (m3)	Not applicable		
	p. Last date when the dyke stability study was conducted and name of the organisation who conducted the study:	(p) The ash pond is designed in 2011. The ash dyke stability study was conducted by CPCB authorised auditor for FY 2024-25, and report is attached as Annexure-1.		
	q. Last date when the audit was conducted and name of the organisation who conducted the audit:	Last audit was conducted on 17.09.2024 by CPCB authorized auditor from IIT(ISM), Dhanbad		
19	Quantity of legacy ash utilised (MT):in the reporting period	0		
	I. Fly ash based products (bricks or blocks or tiles or fibre cement sheets or pipes or boards or panels):	0		
	II. Cement manufacturing	0		
	III. Ready mix concrete:	0		
	IV. Ash and Geo-polymer based construction material:	0		
	V. Manufacturing of sintered or cold bonded ash aggregate:	0		
	VI. Construction of roads, road and flyover embankment:	0		
	VII. Construction of dams:	0		
	VIII. Filling up of low lying area:	0		
	IX. Filling of mine voids:	0		
	X. Use in overburden dumps:	0		
	XI. Agriculture:	0		
	XII. Construction of shoreline protection structures in coastal districts:	0		
	XIII. Export of ash to other countries:	0		
	XIV. Others (please specify):	0		
20	Summary			
	Details	Quantity generated (MTP)	Quantity utilised (MT) and (%)	Balance quantity (MTP)
	Current ash during reporting period	239414	239414 (100%)	0
	Legacy ash	0	0	0
	Total	239414	239414 (100%)	0
21	Any other information: Soft copy of the annual compliance report, and share files of power plant and ash ponds may be e-mailed to:- moefcc- coalash@gov.in	Soft copy of the annual complaince report for FY 2023-24 was submitted on 26.04.2024 through e-mail.		
22	Signature of Authorised Signatory			

Addendum to Annual Implementation Report (AIR) format for FY 2024-25 (01.04.2024 to 31.03.2025) onwards for submission of ash data by TPPs to concerneed SPCB/PCC, CPCB, CEA, IRO-MoEF&CC in compliance to Ash Notification dated 31.12.2021 (amended on 30.12.2022 and 01.01.2024) and Ministry of Power's guidelines dated 15.03.2024

1	**Name of Thermal Power Plant (Capacity in MW)**	**JSW Energy Ltd, Vijayanagar plant, ballari, KA. Capacity 860 MW (2*130MW & 2* 300MW)**
2	Total annual issuable ash - To be declared prior to start of the annual ash disposal process as per para 5(A-i) of MoP Guidelines 2024 (LMT) FY25-26 (tentative value)	3.06257
3	Total ash available for utilisation (Current + Legacy) at the beginning of FY 2024-25 = Carryover of Current + Legacy ash (if available and to be used in progressive manner) from the closing stock of last FY year i.e. 2023-24 (LMT)	Nil
4	Total ash generation during FY 2024-25 (LMT)	2.3941414
5	Ash quantity sold to MSE through limited auction during FY 2024-25 (LMT) **[As per Para 5(B) i.e Step 1]**	0.2165293
6	Revenue earned during FY 2024-25 (**in Rs. Crores**) **[As per Para 5(B) i.e Step 1]**	Rs. 0.021661 cr.
7	Ash quantity sold through through open auction during FY 2024-25 (LMT) **[As per Para 5(C-i) i.e Step 2]**	1.4339353
8	Revenue earned during FY 2024-25 (**in Rs. Crores**) **[As per Para 5(C-i) i.e Step 2]**	Rs. 3.294635 cr.
9	Ash quantity supplied free of cost through open EOI during FY 2024-25 (LMT) **[As per Para 5(C-ii) i.e Step 3]**	0.3845037
10	Ash quantity supplied under direct Notice free of cost and bearing its transportation cost during FY 2024-25 (LMT) **[As per Para 5(C-iii) i.e Step 4]**	Nil
11	Cost borne by TPP during FY 2024-25 (**in Rs. Crores**) **[As per Para 5(C-iii) i.e Step 4]**	Nil
12	Ash quantity supplied/disposed **beyond** Steps 1-4 by applying best business practices/financial prudence during FY 2024-25 (LMT) **[As per Para 5(C-iv) i.e Step 5]**	0.3591731
13	Cost borne by TPP during FY 2024-25 (**in Rs. Crores**) **[As per Para 5(C-iv) i.e Step 5]**	Rs. 0.9866 cr.
14 ={(3+4) - (5+7 +9+10+12)}	Ash quantity remained unutilized at the end of FY 2024-25 (LMT)	Nil

Annexure-I

ANNUAL CERTIFICATION OF ASH PONDS AND DYKES AND ANNUAL COMPLIANCE AUDIT OF ASH GENERATION, UTILIZATION & DISPOSAL

1. General

Ash Notification 31.12.2021 (as amended by amendment notification 30.12.2022) mandates power plants to ensure **Annual Certification of the operational as well as stabilized and reclaimed ash pond and dyke** on its safety, environmental pollution, available volume, mode of disposal, water consumption or conservation in disposal, ash water recycling and green belt etc., according to the specification and procedures laid down by Central Pollution Control Board (CPCB) in consultation with Central Electricity Authority (CEA), and submit annual implementation report about the compliance of provisions in the notification by the 30th day of April, every year to CPCB and concerned State Pollution Control Board (SPCB) or Pollution Control Committee (PCC), CEA, and concerned Integrated Regional Office of Ministry of Environment, Forest and Climate Change by the coal or lignite based thermal power plants.

Ash Notification 31.12.2021 also mandates that **Annual Compliance Audit of Ash Utilization and Disposal** by power plants as well as user agencies shall be conducted by auditors, authorized by CPCB and audit report shall be submitted to CPCB and concerned SPCB or PCC by 30th November every year. CPCB and concerned SPCB or PCC shall initiate action against non-compliant thermal power plants within fifteen days of receipt of audit report.

1.1 Annual Certification of ash pond and dykes

Design and construction specifications and operation and maintenance procedures for ash ponds and dykes have been described in previous chapters. Annual certification of ash ponds and dykes shall be carried out by a qualified professional engineer for structural stability and safety assessment and to ensure that the construction, operation, and maintenance of the ash pond and ash dykes is consistent with recognized and generally accepted good engineering standards.

1. Annual certification shall be carried out once in every year and annual implementation report about the compliance of provisions in the notification shall be submitted by the 30th day of April, every year
2. TPP shall make available any kind of record/Data etc. required at the time of certification.
3. Certifying Expert shall examine the Compulsory Periodic Maintenance Inspection Checklist for the Ash Pond provided by TPP
4. Certifying Expert shall submit the report which shall cover the following: -

a) Structural stability as per IS 7894 construction drawings, quality control documents, monitoring reports etc., to establish that the constructed ash dykes are technically sound and structurally sustainable.

b) Slope Protection as per relevant IS code

c) Adequate Spillway Capacity

d) Dykes compaction

e) Downstream erosion protection

f) Environmental pollution,

g) Available volume

h) Mode of disposal, water consumption or conservation in disposal, ash water recycling

i) Green belt

j) Check list for Annual Safety Audit and Check list for Fly Ash generation and utilization

k) Interpretations from the compulsory maintenance inspections check lists on the overall safety of the Ash Pond

l) Details of the actions taken on the deficiencies noted during the maintenance inspections and annual certification inspection

5. Report of the annual certification shall inter alia include observations on points mentioned in Para A (6) of the notification as well as details of the actions taken on the deficiencies noted during the safety audit.

Sarat Kumar Das
Professor
Department of Civil Engineering
IIT (ISM) Dhanbad
Dhanbad, Jharkhand - 826004

27/04/2025

Sarat Kumar Das
Professor
Deptt. of Civil Engineering
Indian Institute of Technology
(Indian School of Mines), Dhanbad
Jharkhand-826004, India

1.2 **Check List for Annual Certification of Ash Ponds and Dykes (for the period 1st April – 31st March) to be submitted on or before 30th April**

Sr. No.	Component	Observation/Remarks
1.	Name of Power Plant	JSW Energy Limited, Post Box No.9, Toranagallu, Sanduru taluka.
2.	Name of the company	JSW Energy Limited
3.	District	Ballari
4.	State	Karnataka
5.	Postal address for communication:	583123
6.	E-mail:	kartikeya.misra@jsw.in
7.	Power Plant installed capacity (MW):	860MW
8.	No. of units generated (MWh):	4404914 MWh.
9.	Total area under power plant (ha): (including area under ash ponds)	95.78 Ha
10.	Method of slurry discharge water consumption or conservation in disposal, ash water recycling	Dry disposal
11.	TSS of decant Water (Going outside/for recirculation)	Not applicable
12.	Maintenance of Dyke. 1. Top Width 2. Top level of dyke 3. Adequate Spillway Capacity 4. Free board 5. Available volume 6. Earth covering and turfing 7. U/S slope protection 8. WBM Road 9. Rock Toe, toe drain, berm, rock, pitching 10. Dyke compaction 11. D/S erosion control	1. Top width : 4.0 meter 2. Top level of dyke : Top level of Dyke (RL) on four sides Side (A) - RL473.70 mts, Side (B) - RL475. 14 mts, Side (C) - RL 472.01 mts Side (D) - RL 475.24 mts. 3. Spill way is not applicable as there is no excess water to be removed. 4. Free board: 1 meter 5. Available volume: 2,00,400 cum (Approx) 6. Earth cover with boulder packing on the downstream. 7. High-Density Polyethylene (HDPE) with boulder packing on the upstream slope. 8. Cement Concrete (CC) road provided at 3 sides and another side Water Bound Macadam (WBM) road 9. Rock toe has been provided on the downstream at certain section. Other sections it`s not provided as embankment`s top level of the dyke is same with that of natural ground/other facilities. Earth cover on stone pitching on the U/S slope over HDPE. 10.Static compaction and kneading compaction has been done. But no written document available. 11. Rock toe has been provided on the downstream at certain section. Other

		sections it`s not provided as dyke`s (embankment) top level is same with that of natural ground/other facilities
13.	Instrumentation a) Piezometer, b)surface settlement	a) 4 nos. Piezometer has been installed b) 2 nos. surface settlement stations have been installed.(Marked as Settlement 1 and Settlement 2 in the attached drawing)
14.	Wet patches/softening on down Slope	Not observed
15.	Gully Formation	Not observed
16.	Rat holes/animal burrows	Not observed
17.	Growth of plants	Outside the embankment area
18.	Toe drain and surface drainage system.	Not provided as with HDPE system is there and no seepage of water from the ash pond was observed.
19.	Facilities for inspection and maintenance of the dyke	CC roads and WBM roads all around the ash pond. Protected area for safety and security with restricted access. High mast light on south side of the ash pond
20.	Flooding Lighting.	High mast light on south side of the ash pond
21.	Seepage or leakage	Not observed
22.	Monolith Joints -	There is no raising of the dyke. Hence this joint issue does not applicable here.
23.	Foundation should be examined for damage or possible undermining of the downstream toe	Not observed during inspection
24.	Slope Stability dyke: 1. Dyke Slope stability, as per IS 7894: Dyke structural stability to be examined as per construction drawing, quality control document monitoring reports etc. 2. Dyke slopes should be examined for irregularities in alignments and variances from smooth uniform slopes, unusual changes from original crest alignment and elevation, evidence of movement at or beyond the toe, and surface cracks which	1.The slope stability and the seepage analysis through the ash dyke was done using the geotechnical data collected from the field and laboratory and commercial software MIDAS GTS NX. Based on the analysis in the worst scenario, the minimum factor of safety (FoS) was found to be 2.66. Based on the field observation during visit, and the analysis, the ash dyke is found to be stable and safe. There is also no seepage through the ash dyke, hence not affecting the soil and water environment. 2. No irregularities in alignment of dyke was observed. However due to filling of some excavated earth and construction debris on the upstream side of the dyke, the layout of the ash pond is changed at certain points. The uniformity of the slope is not available at certain section. There are few filled up places in the upstream side also. There is no filling of ash in the pond since last 8 to 10 years as generated ash being utilized. As per the measurement of surface settlement no settlement of the top embankment was observed. There is not any crack on the

		surface of either on CC embankment or on the WBM embankment.
25.	Condition of Drainage Systems	Not applicable
26.	Condition of Slope Protection	HDPE was found to be in good condition without any crack or puncture. At certain points there is growth of trees on the earth cover over HDPE. So, the roots of the tree might have penetrated through the HDPE. However, as these points are above the water level of the lagoon. So there is least chance of water percolation through these punctures. The trees on the downstream side helped in the stability of dyke.
27.	Environmental Pollution	It was observed during inspection that there is peripheral pipe network with sprinkler system for the dust control. However as there is no filling of ash since 8 to 10 years. Due to provision of HDPE in the ash pond the percolation of the water from the pond is restricted. There is no environmental pollution.
28.	Green belt	There is greenbelt close to the ash pond outside the embankment area.
29.	Any other information: Soft copy of the annual compliance report, and shape files of power plant and ash ponds may be e-mailed to:- moefcccoalash@gov.in	Attached
30.	Signature of Authorized Signatory	

Sarat Kumar Das
Professor
Department of Civil Engineering
IIT (ISM) Dhanbad
Dhanbad, Jharkhand - 826004

27/04/2025
Sarat Kumar Das
Professor
Deptt. of Civil Engineering
Indian Institute of Technology
(Indian School of Mines), Dhanbad
Jharkhand-826004, India

ANNEXURE-A

CHECK LIST OF ASH DYKE INSPECTION

1) Name of the Project: JSW Energy Limited, P.B.No.9, Toranagallu, Ballari district, Karnataka
2) Inspection Date: 10th & 11th March, 2025
3) Name of the Inspection officer: 1. Professor Sarat Kumar Das, IIT (ISM), Dhanbad
2. Srinivas Amjuri, AGM (Environment), JSW Energy ltd.
4) Season of Inspection Pre-monsoon/Monsoon/Post-Monsoon: Post-Monsoon

Sr. no	A) Ash Lagoon Details	LAG 1	Remarks
1.	Water level in the operation lagoon	468.887 mts. (RL)	(During inspection period).
2.	TSS of Water effluent (Going outside/for recirculation)	Not applicable	
3.	Whether any ash surface is exposed above water	No	
4.	If ash surface is exposed above water level whether ash is flying anywhere	No	
5.	Whether water flowing through all the opening of the WES	Not applicable	
6.	Approximate head of water flow over the well slabs, 150mm	Not applicable	
7.	Approximate depth of water flow over ash surface around/near the operating water escape structure(WES)	Not applicable	
8.	Whether any inter slab leakage of ash of present in the water escape wells	Not applicable	
9.	Whether water flow is obstructed by floating plants or any other floating bodies near the vents in the WES	Not applicable	
B)	**DYKE**	LAG1	
a)	Top level of Dyke	Top level of Dyke (RL) on four sides Side (A) - RL473.70 mts, Side (B) - RL475. 14 mts, Side (C) - RL 472.01 mts Side (D) - RL 475.24 mts.	
b)	Whether there is any signs of settlement on the top of dyke	Not observed based on record	
c)	Whether any sign of sinking/Caving-in/bulging/boiling on i) Upstream slopes ii) Downstream slope iii)On the foundation very near to the downstream toe:	No	
d)	Whether any seepage is observed on i) Upstream slopes ii) Downstream slope iii)On the foundation very near to the downstream toe:	Not observed	

e)	Whether any wet spots/areas are present i) Downstream slope ii) On the foundation very near to the downstream toe:	No	
f)	Whether any longitudinal cracks are observed on: i) On the top of dyke ii) The upstream slope iii) The downstream slope	No	
g)	Whether any transverse cracks are observed in: i) On the top of dyke ii) The upstream slope iii) The downstream slope	No	
h)	If any cracks are observed on the tip and the slopes i) Whether the cracks on the top & Slopes are continuous. ii) Whether the cracks are lengthening with time iii) Whether the cracks are widening with time if seepage is observed on the slope or near the d/s toe.	Not applicable	
	DUMPING PATTERN IN ASH POND	No dumping	There is some occasional dumping of excavated earth and construction and demolition wastes.
	SIGNATURE OF INSPECTION OFFICERS		

Sarat Kumar Das
Professor
Department of Civil Engineering
IIT (ISM) Dhanbad
Dhanbad, Jharkhand - 826004

27/04/2025

Sarat Kumar Das
Professor
Deptt. of Civil Engineering
Indian Institute of Technology
(Indian School of Mines), Dhanbad
Jharkhand-826004, India

REPORT OF THE ASH DYKE STABILITY

1. Introduction

The site visit for the ash pond was made on 10th and 11th March 2025. This report is based on the field visit, study of the available drawings, collection of the bore log soil samples and the analysis for slope stability and seepage analysis using available commercial software. In overall it was found that the fly ash pond is without any fly ash. The ash pond is filled with rainwater of around 1.67 m of rainwater.

2. Desk study and Field Inspection

As per the available record of the drawing the layout of the ash pond is redrawn and shown in Figure 1. The cross section of the ash pond is shown in Figure 2. However, other engineering aspects of the ash pond is not available. Hence, other data were generated based on the geotechnical investigation and observation during the field visit.

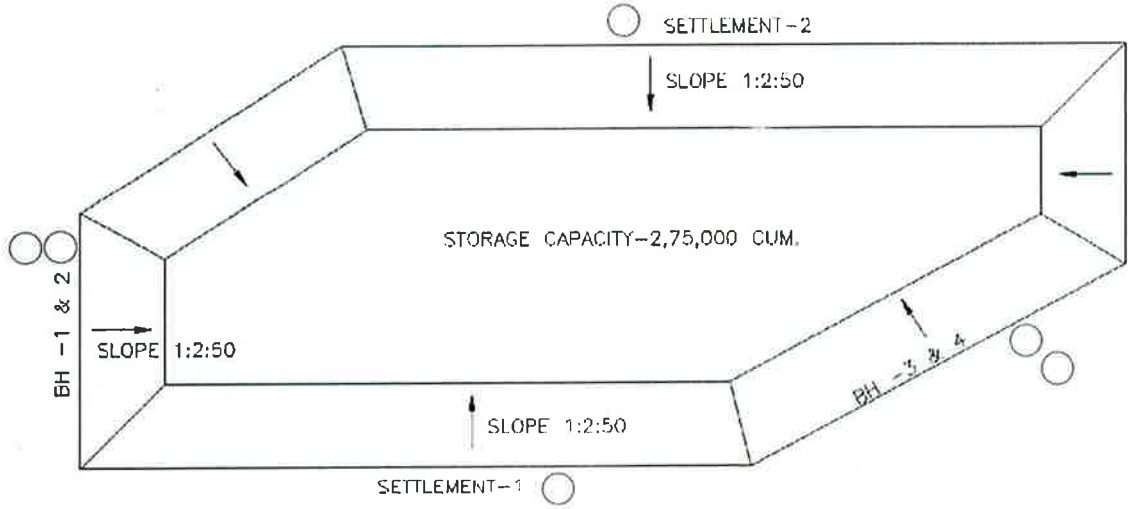


Figure 1. The layout of the ash pond with position of the Settlement measurement stations (S1 and S2) and the seepage water monitoring point BH1, BH2, BH3 and BH4

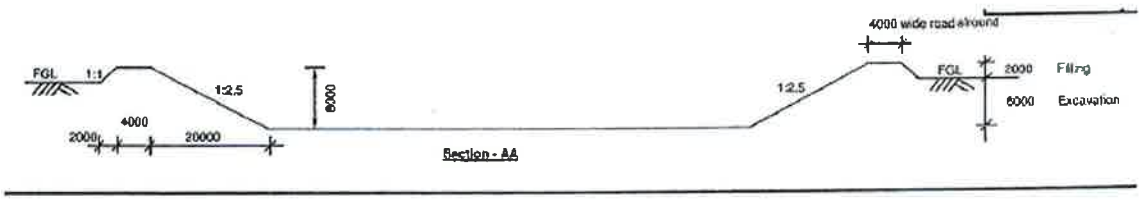


Figure 2. The cross section of the ash pond

Hence, the soil samples were collected as per the borehole constructed for monitoring of the seepage. During field visit it was observed that HDPE membrane has been provided for storage pond. The membrane has been covered with soil and boulders of 1.0 to 1.2 m depth. At certain points it has been exposed, hence it was advised to cover it with soil and boulders (Figure 3). However, no puncture or crack was observed in the HDPE sheet.

Figure 3. Exposed impermeable HDPE membrane around the ash pond

The ash pond was found to be well engineered with CC road of 4.0 m width all around the pond. The ash pond is also provided with water sprinkler system to supress the fly ash and they are connected with ring water supply pipe lines all around the ash pond. This is evident from the concrete stand with pipes (Figure 4).

Figure 4. The sprinkler system stand pipe adjacent to the CC road

As the ash pond is without any fly ash and stores mostly with rainwater of approximate 1.67 m depth (Figure 5). There is also a high mast light for the lighting of the ash pond as shown in the figure. There are green vegetation of the downstream side of the ash pond on 3 sides, which helps the environment. It was also observed that there is a pipe network system (seem not being used for some time) to bring extra rainwater from nearby pond to store the rainwater as evident from Figure 6.

Figure 5. A general view of the ash pond with water level of approximate 1.67 m during the visit

Figure 6. Pipe network for using the ash pond for the storage of rain water

Though the ash pond is provided with HDPE sheets, but as per the standard guiding seepage monitoring is being done with 4 monitoring well made on the crest and downstream of the slope as shown in Figure 1. Two typical monitoring boreholes are shown in Figure 7.

Figure 7. Two seepage monitoring well

Similarly, two settlement monitoring stations have been put to measure the settlement of the top of the ash dyke as shown in Figure 8.

Figure 8. Settlement monitoring point

The water level at 4 monitoring wells were recorded during visit and it was observed that there is a variation of 0.1 m in the water level taken at an interval of 1 months. As there was no information about the geotechnical properties of the ash dyke, samples were collected from the borehole at two depths and the average value on downstream side of the ash pond.

3. Laboratory Investigation and analysis of ash dykes

The in-situ soil collected from the ash dyke was brought to the laboratory for the determination of geotechnical properties required for the seepage and strength analysis.

The average geotechnical properties of the samples collected from the site are presented in Table 1. These properties are used for the analysis using commercial software MIDAS GTS NX. The comprehensive results are presented in subsequent section.

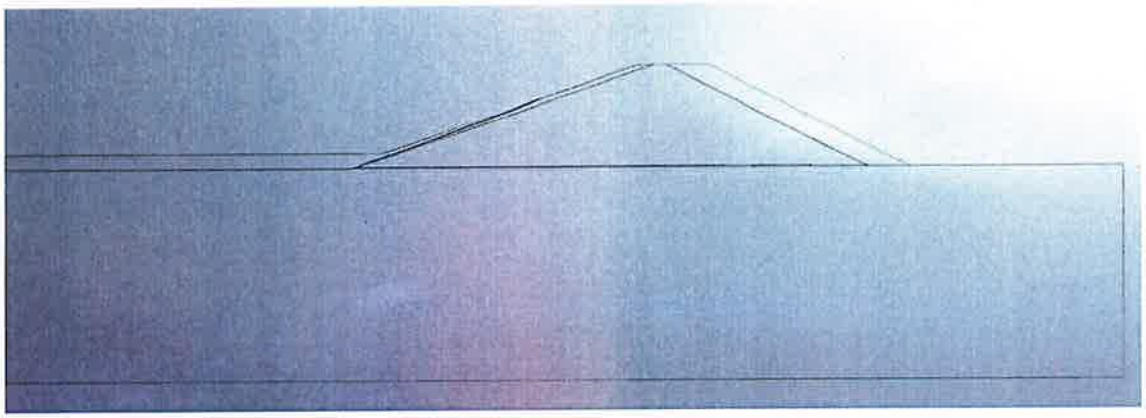
Table 1. Geotechnical properties of the material

Parameter	Value
Cohesion (C)	0.23 kg/cm^2 (22.57 kPa)
Bulk Density	1.95 g/cc (19.1 kN/m^3)
Dry Density	1.77 g/cc (17.4 kN/m^3)
Friction Angle (φ)	36.48°
Permeability (k)	3.45×10^{-3} cm/s (2.98×10^{-5} m/s)

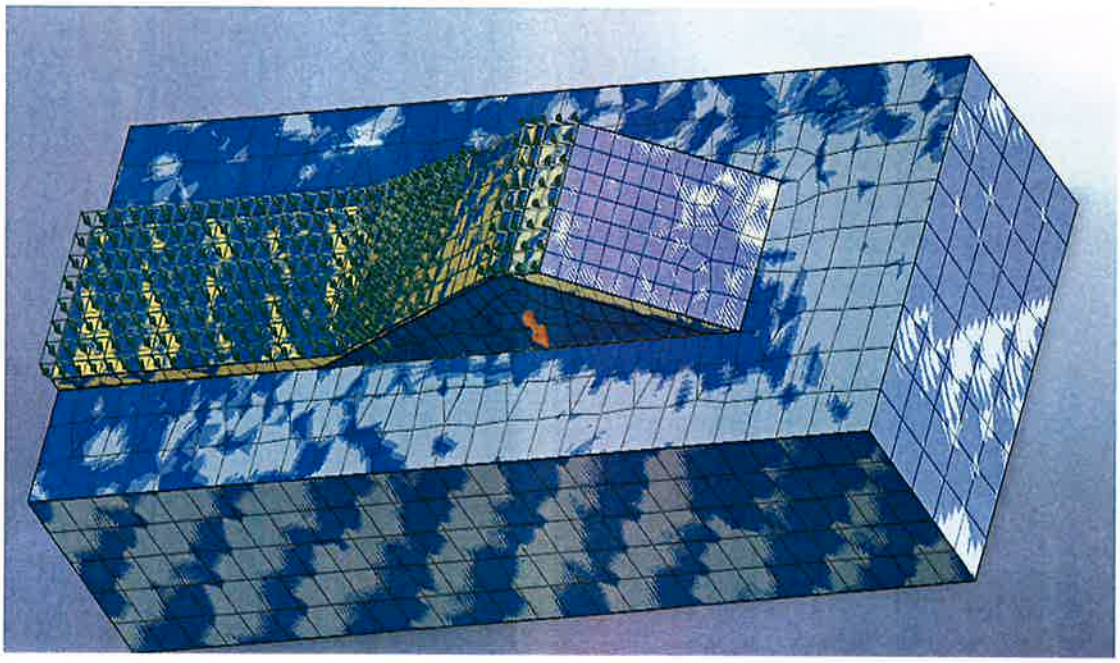
4. Analysis and Results

4.1. Seepage Analysis

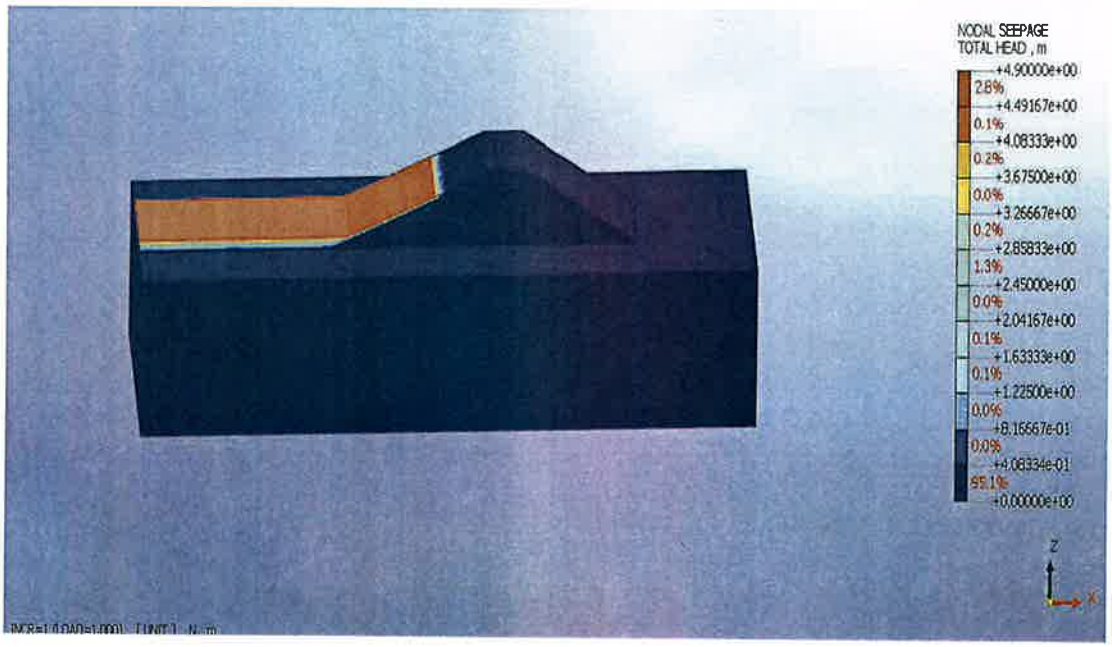
As there may be variation in the water level throughout the year, a variation of water depth of 1.7 m, 4m, 6m are used for both seepage analysis and stability of slope analysis. It was observed that there is negligible discharge of 4.78×10^{-8} m^3/sec. During visit and as per record no discharge was observed around the ash dyke as there is HDPE as liner.



(a)

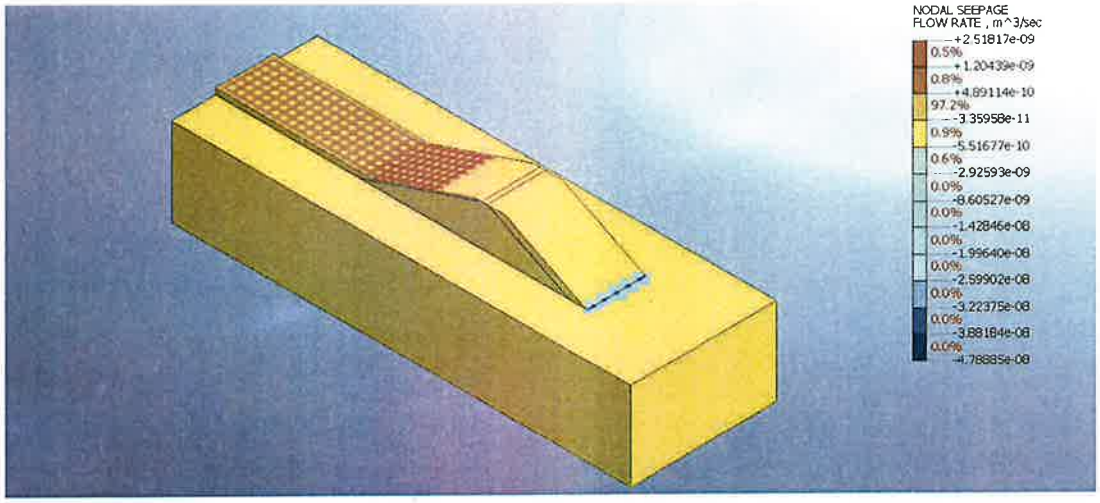


(b)

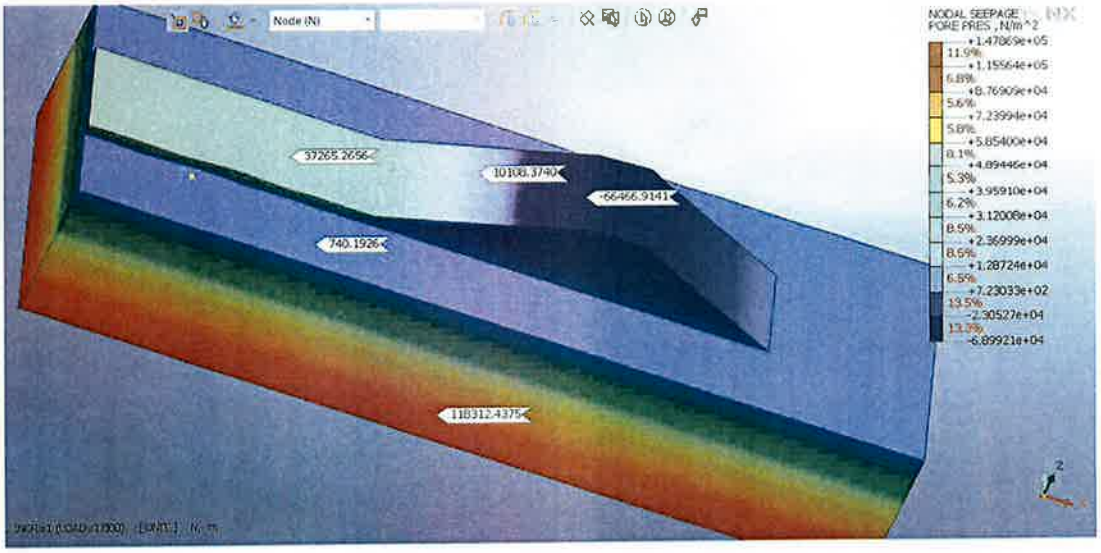

NODAL SEEPAGE
TOTAL HEAD , m
+4.90000e+00
2.6%
+4.49167e+00
0.1%
+4.08333e+00
0.2%
+3.67500e+00
0.0%
+3.26667e+00
0.2%
+2.85833e+00
1.3%
+2.45000e+00
0.0%
+2.04167e+00
0.1%
+1.63333e+00
0.1%
+1.22500e+00
0.0%
+8.16667e-01
0.0%
+4.08334e-01
95.1%
+0.00000e+00
Z
X

(c)

Sman



(d)



(e)

Figure 9. The flow through the ash dyke as per MIDAS GTS NX analysis

Note: Flow through embankment is very negligible.

4.2. Slope stability Analysis

The slope stability analysis was made as per the geotechnical properties shown in Table 1 and considering a vehicle wheel load on the top of dyke as 2.5 kN/m^2. The Factor of Safety (*FoS*) was found to 2.66 as shown in Figure 10. After Application of all these loads it was also observed that the deflection only 42 mm (Figure 11), hence, the ash dyke is safe.

Figure 10. The *FoS* of the slope as per MIDAS GTS NX analysis with *FoS* value as 2.66

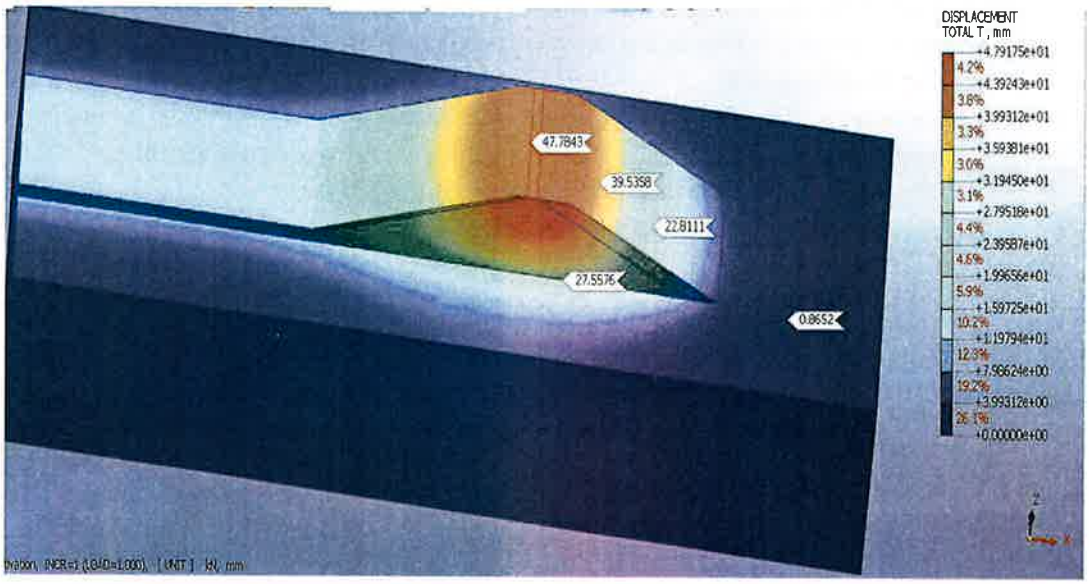


Figure 11. Maximum vertical deflection is 47.9 mm as per MIDAS GTS NX analysis

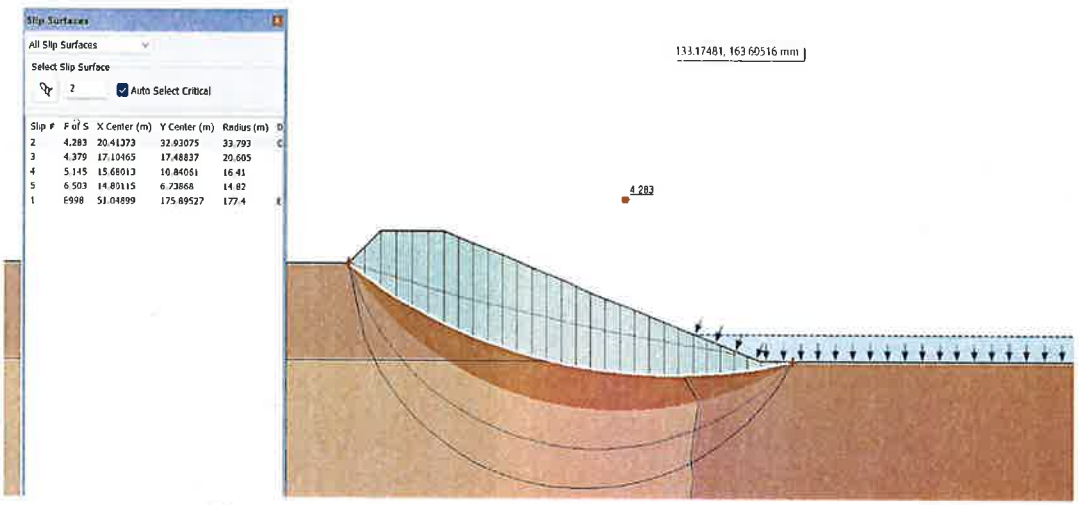


Figure 12. Model for the calculation of *FoS* and slip surface

5. Conclusions

Based on the available drawing, field study and desk study during and further testing of the samples in the laboratory and computer analysis of the dyke for seepage and slope stability following conclusions can be made:

- The ash pond is engineered with proper HDPE liner to avoid seepage from the ash pond to the ground water. There is water circulation sprinkler system to avoid the dust problem. The ash dyke is with CC road around for proper monitoring of the ash dyke.
- Four monitoring well are in place to monitor the seepage water through the ash dyke, however, due to the HDPE no seepage was observed. The slope embankment was found to be intact without any cracks or depression. The water level in the monitoring well was showing that of the groundwater level outside the pond. Two settlement measuring stations does not show any variation with time, based on few available data.
- The laboratory geotechnical properties soil is generally silty sand. The slope stability analysis in the worst case with vehicular load on the embankment of ash dyke showed a *FoS* of 2.66. Hence, the ash dyke is safe.
- It was also observed that the original volume of the ash pond has shrink by approximately 40,000 cum due to filling of excavated earth and demolition wastes. As the filling is on both sides of the ash dyke it is not going to reduce the *FoS* of the dyke.
- It is recommended that the seepage and settlement should be monitored regularly.

Sarat Kumar Das
Professor
Department of Civil Engineering
IIT (ISM) Dhanbad
Dhanbad, Jharkhand - 826004

27/04/2025
Sarat Kumar Das
Professor
Deptt. of Civil Engineering
Indian Institute of Technology
(Indian School of Mines), Dhanbad
Jharkhand-826004, India