Report on
Water quality of river Yamuna
Pre and Post Idol Immersion
(Durga Puja)

(Follow-up action as per Minutes of the Meeting held on 12.10.2018 by the Monitoring Committee constituted by Hon'ble NGT in the matter of O.A. 06 of 2012 in the matter of Manoj Mishra Vs Union of India & Ors.)

Central Pollution Control Board
(Ministry of Environment, Forest & Climate Change, Govt. of India)
Parivesh Bhawan, East Arjun Nagar,
Delhi – 110032

Year - 2018

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In compliance of Hon'ble Monitoring Committee constituted by Hon'ble NGT in the matter of O.A. 06 of 2012 in the matter of Manoj Mishra Vs Union of India & Ors held on 12.10.2018, CPCB conducted water quality assessment of Upstream and Downstream of 7 Ghats on river Yamuna for pre and post Durga Puja Idol immersion activity on 18.10.2018 and 20.10.2018, respectively.

Water quality with respect to physicochemical parameters and heavy metals were assessed. Assessment revealed that before Immersion activity, water quality was not conforming to the Primary Water Quality Criteria for Bathing. Post immersion activity, water quality remained as non-conforming to the criteria; however no significant deterioration in water quality was observed. The locational site details are given in **Annexure I**.

Pre Idol Immersion (18.10.2018)

i. Analysis results of Physicochemical parameters are in the range of DO (NIL - 7.1 mg/l); pH (7.1 - 7.4); Conductivity (269 - 1278 µmho/cm); TDS (162 - 830 mg/l), Turbidity (1 - 40NTU), COD (14 - 60mg/l), BOD (2 - 21 mg/l).

ii. Analysis results of Heavy Metals are in the range of As (BDL), Cd (BDL), Cr (BDL - 0.19 mg/l), Cu (BDL - 0.03 mg/l), Fe (1.36 - 20.79 mg/l), Ni (BDL - 0.03 mg/l), Pb (BDL-0.01mg/l), Zn (0.01 - 0.07mg/l) and Hg (BDL).

Post Idol Immersion (20.10.2018)

iii. Analysis results of Physicochemical parameters are in the range of DO (NIL - 7.4 mg/l); pH (7.3 - 7.5); Conductivity (258 - 835µmho/cm); TDS (156 - 520 mg/l), Turbidity (2 – 32 NTU), COD (12 – 67 mg/l), BOD (2 – 23 mg/l).

iv. Analysis results of Heavy Metals are in the range of As (BDL - 0.01 mg/l), Cd (BDL), Cr (0.02 - 0.6 mg/l), Cu (BDL - 0.04 mg/l), Fe (1.86 – 21.69 mg/l), Ni (BDL -0.04 mg/l), Pb (BDL - 0.03 mg/l), Zn (0.01 - 0.15 mg/l), Hg (BDL)

Assessment of Water Quality in the pre and post immersion of Idols revealed that pH did not change significantly and remain complying at all the ghats. Dissolved Oxygen was not complying on pre immersion at 10 locations covering 5 Ghats while post immersions activity indicating the same, except 3 locations where DO was found within the Primary Water Quality Criteria for Bathing. Biochemical Oxygen Demand (BOD) did not meet the criteria on pre immersion at 10 locations (covering 7 ghats) and post immersion at 11 locations (covering 6 ghats).

During Pre Idol Immersion, no exceedance observed for 6 Heavy metals such as As, Cd, Cu, Pb, Zn & Hg. During Post immersion, no exceedance observed for 5 Heavy metals such as As, Cd, Cu, Zn & Hg. However, during post immersion lead (Pb) was exceeding marginally against the BIS Standard at 2 locations (U/s of Qudeshia ghat and D/s of Kalindi Ghat). During Pre immersion period, the exceedance of total Cr was found at 2 locations whereas, post immersion, total Cr was found exceeding at 4 locations. It was revealed that Fe has exceeded at all locations during pre and post event of idol immersion. During Pre event, Ni was exceeding at Qudeshia ghat D/s and post immersion at Kalindi Ghat D/s. Refer **Annexure II** for comparison of pre and post analysis (Fig 1-6) and **Annexure III** is given at plate no 1-14. The analysis results of samples collected for Physico-chemical and Heavy metals are given in **Annexure IV**.

Findings

i) During pre and post idol immersion of Durga Puja, the organic pollution such as BOD is overall increased due to human influence and puja ingredients.

ii) Concentration of heavy metals increased in the river due to immersion of painted/polished idols with metallic ornaments and shiny materials. During post

immersion, Chromium increased from the BIS limit (0.05 mg/l) by 11 times; Iron concentration increased from BIS limit (0.3 mg/l) by 71 times; Nickel increased from BIS limit (0.02 mg/l) to 1 time and Lead increased from BIS limit (0.01 mg/l) by two times in the River Yamuna.

The above findings revealed that the Yamuna River water is not fit for drinking and bathing purposes in Delhi stretch

Recommendations

i) Plaster of Paris (PoP) based idols should be discouraged.

ii) Proper collection of flowers and other Pooja material after idol immersion activity should be taken up.

iii) Temporary ponds having earthen bunds along river bank should be created as idol immersion spots.

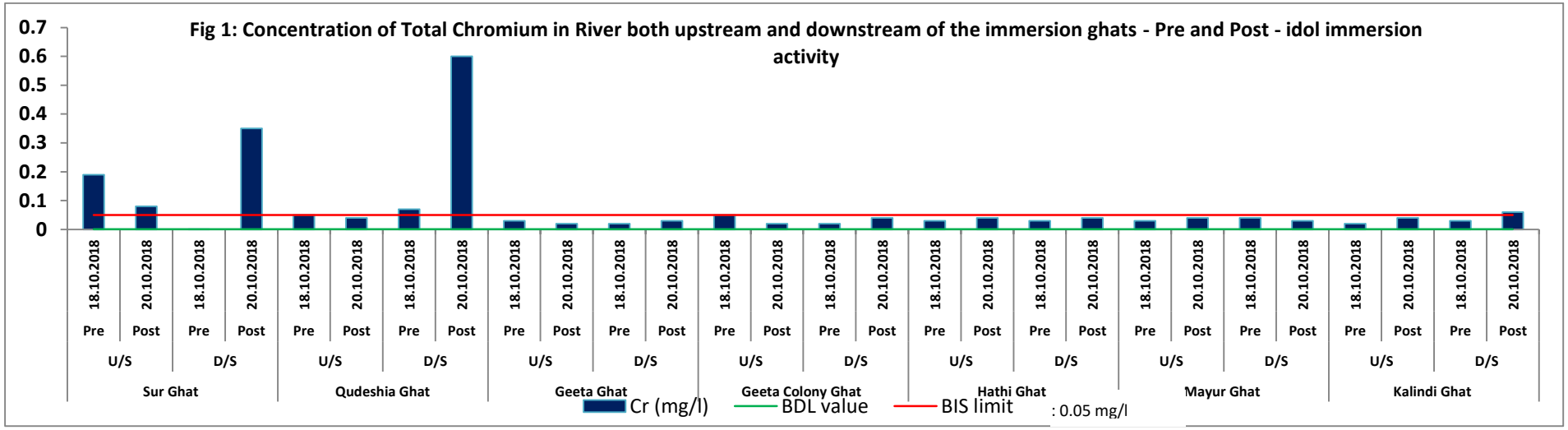
iv) Removable synthetic liner may be placed well in advance in bottom of pond. The said liner along with remains of idols should be removed from the point within 48 hours of immersion of idols.

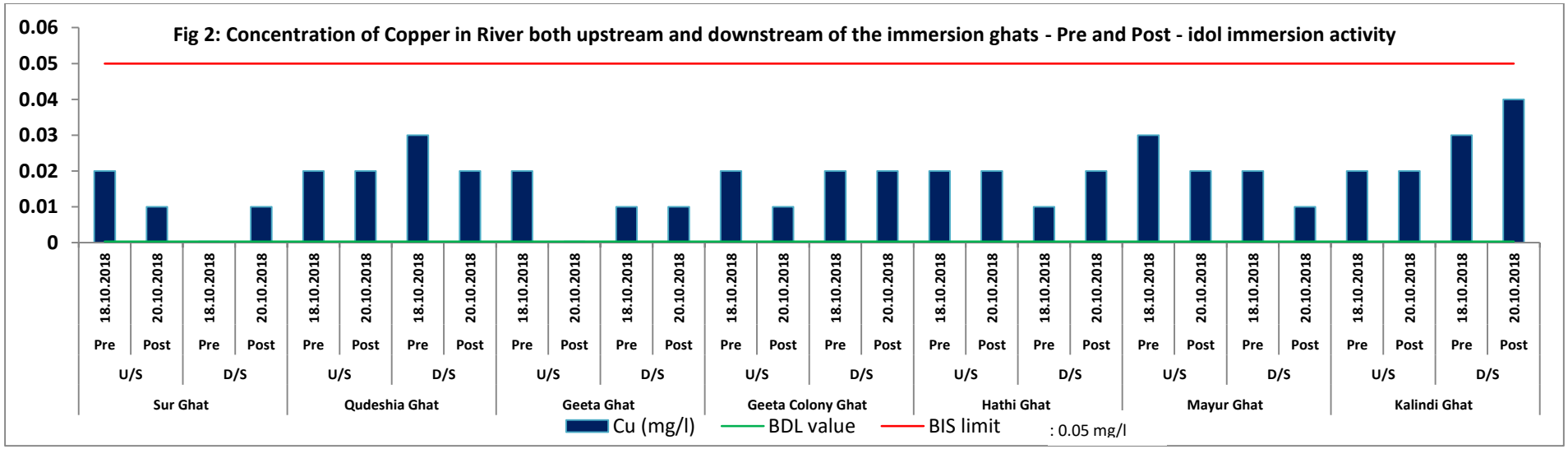
The above recommendations shall be followed by Urban local bodies (ULBs)/ Authorities as per the CPCB guidelines on Idol immersion, June 2010.

Sampling locations & Co-ordinates----------Annexure I

S.No	Location	Latitude	Longitude	Dates of Monitoring		Parameters monitored
				Pre-immersion	Post-immersion	
1	Sur Ghat	28.7393084 N	77.2269857 E	18th Oct, 2018	20th Oct, 2018	pH, Conductivity, µmho/cm Turbidity, NTU COD, mg/L BOD, mg/l Total Dissolved Solids, mg/L Total Fixed Dissolved Solids, mg/L Total suspended Solids, mg/L Total Solids, mg/L DO, mg/l Arsenic, mg/L Cadmium, mg/L Copper, mg/L Lead, mg/L Chromium (Total) , mg/L Nickel, mg/L Zinc, mg/L Iron (Total) , mg/L Mercury, mg/L
2	Qudeshia Ghat	28.672393 N	77.232467 E			
3	Geeta Ghat	28.652827 N	77.263333 E			
4	Geeta Colony Ghat	28.650566 N	77.264114 E			
5	Hathi Ghat	28.627534 N	77.253431 E			
6	Mayur Vihar Ghat	28.5843163 N	77.2877548 E			
7	Kalindi Ghat	28.5439313 N	77.3129293 E			

Heavy metals – trend in Pre and post immersion results----------Annexure II





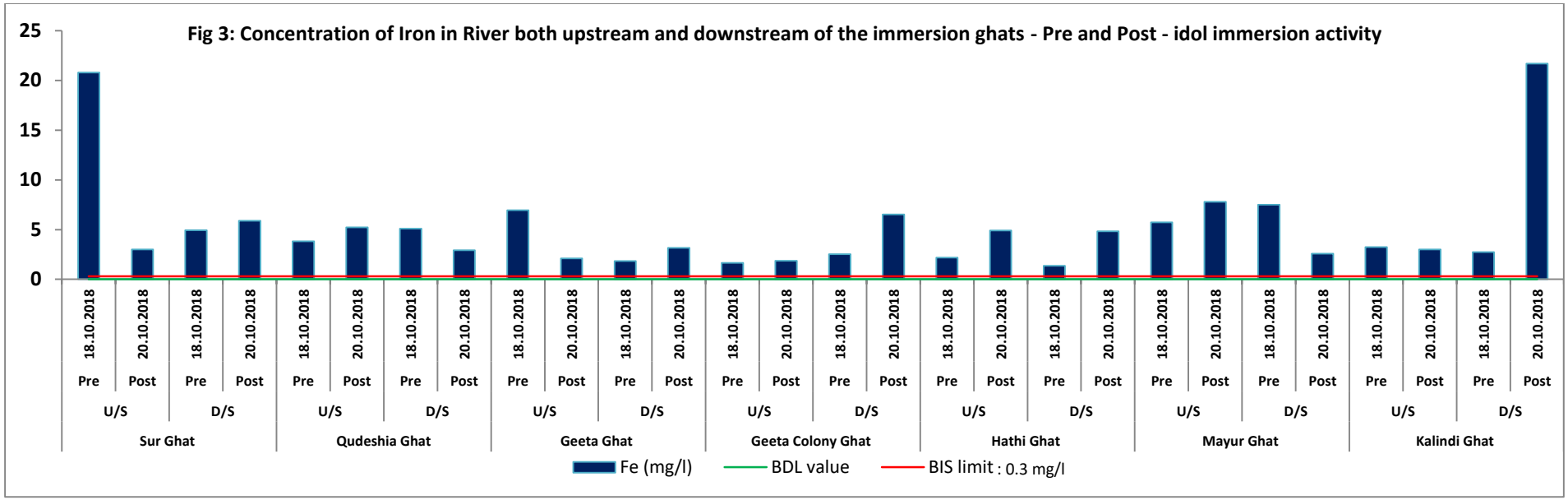


Fig 3: Concentration of Iron in River both upstream and downstream of the immersion ghats - Pre and Post - idol immersion activity
25
20
15
10
5
0
18.10.2018 Pre
20.10.2018 Post
U/S
D/S
Sur Ghat
Qudeshia Ghat
Geeta Ghat
Geeta Colony Ghat
Hathi Ghat
Mayur Ghat
Kalindi Ghat
Fe (mg/l)
BDL value
BIS limit : 0.3 mg/l

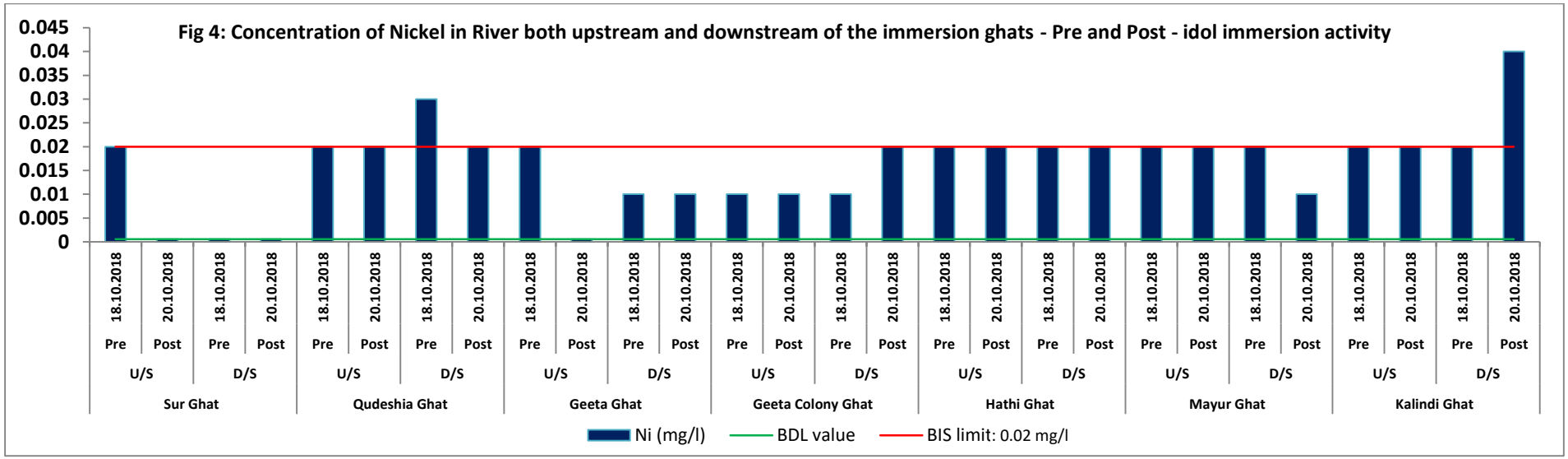


Fig 4: Concentration of Nickel in River both upstream and downstream of the immersion ghats - Pre and Post - idol immersion activity
0.045
0.04
0.035
0.03
0.025
0.02
0.015
0.01
0.005
0
18.10.2018 Pre
20.10.2018 Post
U/S
D/S
Sur Ghat
Qudeshia Ghat
Geeta Ghat
Geeta Colony Ghat
Hathi Ghat
Mayur Ghat
Kalindi Ghat
Ni (mg/l)
BDL value
BIS limit: 0.02 mg/l

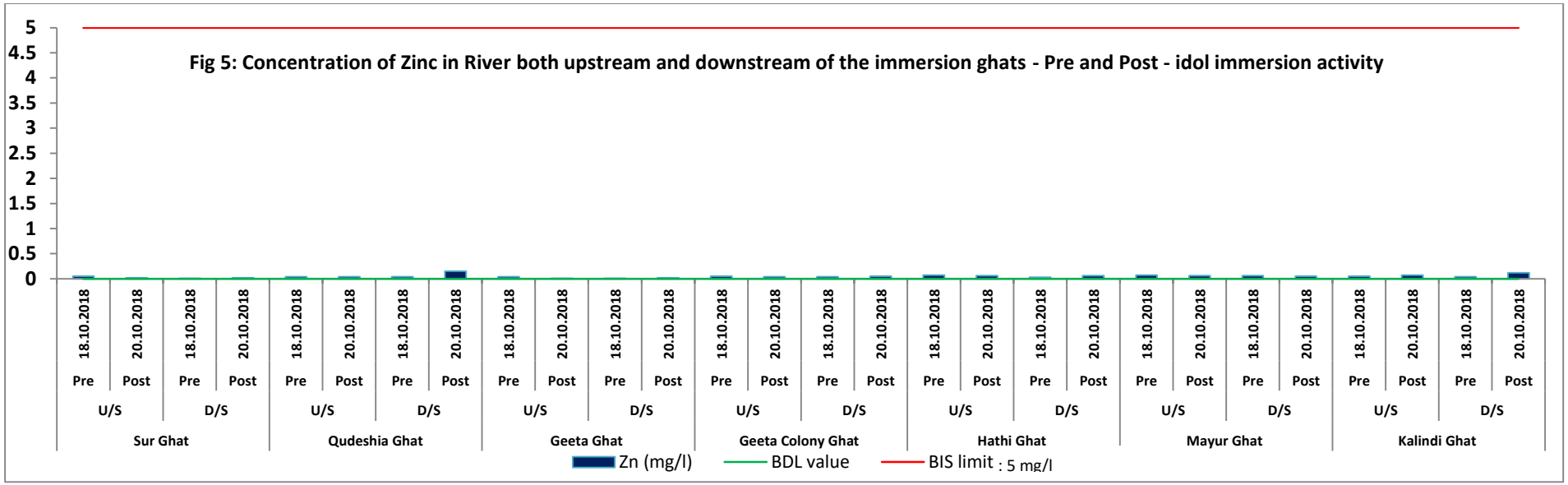


Fig 5: Concentration of Zinc in River both upstream and downstream of the immersion ghats - Pre and Post - idol immersion activity
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
18.10.2018 Pre
20.10.2018 Post
U/S
D/S
Sur Ghat
Qudeshia Ghat
Geeta Ghat
Geeta Colony Ghat
Hathi Ghat
Mayur Ghat
Kalindi Ghat
Zn (mg/l)
BDL value
BIS limit : 5 mg/l

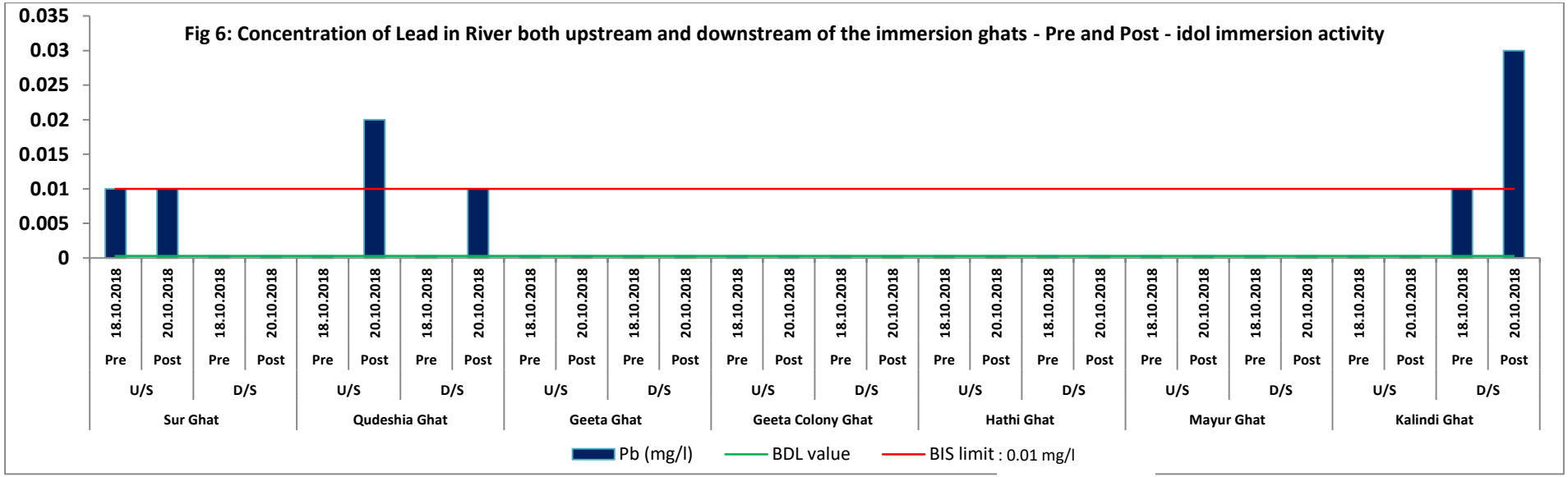


Fig 6: Concentration of Lead in River both upstream and downstream of the immersion ghats - Pre and Post - idol immersion activity
0.035
0.03
0.025
0.02
0.015
0.01
0.005
0
18.10.2018 Pre
20.10.2018 Post
U/S
D/S
Sur Ghat
Qudeshia Ghat
Geeta Ghat
Geeta Colony Ghat
Hathi Ghat
Mayur Ghat
Kalindi Ghat
Pb (mg/l)
BDL value
BIS limit : 0.01 mg/l

Pictures of sampling locations----------Annexure III

Sur Ghat U/s 	**Sur Ghat D/s** 
Qudeshia Ghat U/s 	**Qudeshia Ghat D/s** 
Geeta Ghat U/s 	**Geeta Ghat D/s** 

Geeta Colony Ghat U/s 	**Geeta Colony Ghat D/s** 
Hathi Ghat U/s 	**Hathi Ghat D/s** 
Mayur Ghat U/s 	**Mayur Ghat D/s** 
Kalindi Ghat U/s 	**Kalindi Ghat D/s** 

Analysis Results----------Annexure IV

Analysis results of samples of River Yamuna water for both on upstream and downstream of the immersion ghats carried out during pre and post idol immersion activity in Oct, 2018 are tabulated in table 1 (i & ii) for Physicochemical parameters and 2 (i & ii) for Heavy metals.

Analysis results (Physico-chemical parameters) of samples of River water both upstream and downstream of the immersion ghats of pre and post idol immersion activity

Table 1 (i) - Analysis results (Physico-chemical parameters) of samples of River water both upstream and downstream of the immersion ghats of pre - idol immersion activity (18.10.2018)													
Water Quality parameters				Dissolved Oxygen (mg/l)	pH	Conductivity (µmho/cm)	TDS (mg/l)	TSS (mg/l)	TFDS (mg/l)	TS (mg/l)	Turbidity (mg/l)	COD (mg/l)	BOD (mg/l)
S No	Sampling point	U/S or D/S	Date										
Primary water quality criteria for Bathing:				>5 mg/l	6.5-8.5								<3 mg/l
BIS IS 10500 : 2012 Drinking water Standards:							<500 mg/l						
1	Sur Ghat	U/S	18.10.2018	6.2	7.1	270	162	107	154	269	2	14	4
2		D/S	18.10.2018	7.1	7.3	269	164	152	158	316	1	15	2
3	Qudeshia Ghat	U/S	18.10.2018	0	7.2	1278	830	70	780	900	40	41	15
4		D/S	18.10.2018	0	7.1	830	548	110	540	658	30	60	21
5	Geeta Ghat	U/S	18.10.2018	2.3	7.2	540	334	59	322	393	22	19	5
6		D/S	18.10.2018	2.2	7.3	495	300	52	290	352	20	18	3
7	Geeta Colony Ghat	U/S	18.10.2018	1.5	7.3	535	318	44	300	362	18	20	5
8		D/S	18.10.2018	1.6	7.3	537	328	78	302	398	22	18	6
9	Hathi Ghat	U/S	18.10.2018	1	7.3	605	360	53	340	413	25	29	8
10		D/S	18.10.2018	1.1	7.4	615	370	66	350	436	28	19	3
11	Mayur Ghat	U/S	18.10.2018	1.4	7.3	550	324	102	306	426	24	23	3
12		D/S	18.10.2018	1	7.3	553	326	421	308	747	26	31	8
13	Kalindi Ghat	U/S	18.10.2018	5.2	7.3	570	340	58	310	398	26	23	6
14		D/S	18.10.2018	7	7.3	556	332	101	306	433	20	21	6

Pre Immersion (18.10.2018):

- No exceedance observed in pH
- TDS not meeting the criteria at 2 locations
- DO not meeting the criteria at 10 locations
- BOD not meeting the criteria at 10 locations

Table 1 (ii) - Analysis results (Physico-chemical parameters) of samples of River water both upstream and downstream of the immersion ghats of post - idol immersion activity (20.10.2018)													
Water Quality parameters				Dissolved Oxygen (mg/l)	pH	Conductivity (µmho/cm)	TDS (mg/l)	TSS (mg/l)	TFDS (mg/l)	TS (mg/l)	Turbidity (mg/l)	COD (mg/l)	BOD (mg/l)
S No	Sampling point	U/S or D/S	Date										
Primary water quality criteria for Bathing:				>5 mg/l	6.5-8.5								<3 mg/l
BIS IS 10500 : 2012 Drinking water Standards:							<500 mg/l						
1	Sur Ghat	U/S	20.10.2018	7.4	7.4	265	160	161	152	321	2	14	2
2		D/S	20.10.2018	7.4	7.3	258	156	128	140	284	4	12	3
3	Qudeshia Ghat	U/S	20.10.2018	0	7.3	827	516	174	490	690	24	43	8
4		D/S	20.10.2018	0	7.5	835	520	44	486	564	24	48	9
5	Geeta Ghat	U/S	20.10.2018	1.4	7.5	545	330	36	310	366	26	34	7
6		D/S	20.10.2018	1.6	7.4	543	334	152	316	486	24	32	5
7	Geeta Colony Ghat	U/S	20.10.2018	0	7.5	540	328	42	312	370	20	21	3
8		D/S	20.10.2018	2.0	7.4	605	366	154	340	520	24	24	5
9	Hathi Ghat	U/S	20.10.2018	1.5	7.4	590	350	102	310	452	30	51	14
10		D/S	20.10.2018	1.2	7.4	620	372	176	330	548	32	67	23
11	Mayur Ghat	U/S	20.10.2018	1.5	7.5	548	336	99	320	435	20	24	7
12		D/S	20.10.2018	2	7.4	565	342	38	324	380	26	22	5
13	Kalindi Ghat	U/S	20.10.2018	5.2	7.5	616	384	47	360	431	25	28	5
14		D/S	20.10.2018	3.9	7.4	547	322	444	300	766	23	43	12

Post Immersion (20.10.2018):

- No exceedance observed in pH
- DO not meeting the criteria at 11 locations
- TDS not meeting the criteria at 2 locations
- BOD not meeting the criteria at 11 locations

Analysis results (Heavy metals) of samples of River water both upstream and downstream of the immersion ghats of pre and post idol immersion activity

Table 2 (i) - Analysis results (Heavy metals) of samples of River water both upstream and downstream of the immersion ghats of pre - idol immersion activity (18.10.2018)												
Water Quality parameter				As (mg/l)	Cd (mg/l)	Cr (mg/l)	Cu (mg/l)	Fe (mg/l)	Ni (mg/l)	Pb (mg/l)	Zn (mg/l)	Hg (mg/l)
S. no.	Sampling point	U/S or D/S	Date									
BIS IS 10500 : 2012 Drinking water Standards:				0.01	0.003	0.05	0.05	0.3	0.02	0.01	5	0.001
1	Sur Ghat	U/S	18.10.2018	BDL	BDL	0.19	0.02	20.79	0.02	0.01	0.05	BDL
2		D/S	18.10.2018	BDL	BDL	BDL	BDL	4.93	BDL	BDL	0.01	BDL
3	Qudeshia Ghat	U/S	18.10.2018	BDL	BDL	0.05	0.02	3.83	0.02	BDL	0.04	BDL
4		D/S	18.10.2018	BDL	BDL	0.07	0.03	5.09	0.03	BDL	0.04	BDL
5	Geeta Ghat	U/S	18.10.2018	BDL	BDL	0.03	0.02	6.94	0.02	BDL	0.04	BDL
6		D/S	18.10.2018	BDL	BDL	0.02	0.01	1.84	0.01	BDL	0.01	BDL
7	Geeta Colony Ghat	U/S	18.10.2018	BDL	BDL	0.05	0.02	1.64	0.01	BDL	0.05	BDL
8		D/S	18.10.2018	BDL	BDL	0.02	0.02	2.52	0.01	BDL	0.04	BDL
9	Hathi Ghat	U/S	18.10.2018	BDL	BDL	0.03	0.02	2.17	0.02	BDL	0.07	BDL
10		D/S	18.10.2018	BDL	BDL	0.03	0.01	1.36	0.02	BDL	0.03	BDL
11	Mayur Ghat	U/S	18.10.2018	BDL	BDL	0.03	0.03	5.72	0.02	BDL	0.07	BDL
12		D/S	18.10.2018	BDL	BDL	0.04	0.02	7.5	0.02	BDL	0.06	BDL
13	Kalindi Ghat	U/S	18.10.2018	BDL	BDL	0.02	0.02	3.25	0.02	BDL	0.05	BDL
14		D/S	18.10.2018	BDL	BDL	0.03	0.03	2.73	0.02	0.01	0.04	BDL

BDL- Below Detection Limit

Detection limit (µg/l): As-0.49, Cd-0.42, Cr-0.56, Cu-0.35, Fe-0.67, Ni-0.54, Pb-0.31, Zn-0.59 & Hg-1.0

Pre Immersion:

- No exceedance observed in 6 Heavy metals - As, Cd, Cu, Pb, Zn, Hg
- Exceedances (in 4 metals): Cr- 2 locations
  Fe- all locations
  Ni- 1 location

Table 2 (ii) - Analysis results (Heavy metals) of samples of River water both upstream and downstream of the immersion ghats of post - idol immersion activity (20.10.2018)											
Water Quality parameter				As (mg/l)	Cd (mg/l)	Cr (mg/l)	Cu (mg/l)	Fe (mg/l)	Ni (mg/l)	Pb (mg/l)	Zn (mg/l)	Hg (mg/l)
S. no.	Sampling point	U/S or D/S	Date									
BIS IS 10500 : 2012 Drinking water Standards:				0.01	0.003	0.05	0.05	0.3	0.02	0.01	5	0.001
1	Sur Ghat	U/S	20.10.2018	BDL	BDL	0.08	0.01	3.01	BDL	0.01	0.02	BDL
2		D/S	20.10.2018	BDL	BDL	0.35	0.01	5.88	BDL	BDL	0.02	BDL
3	Qudeshia Ghat	U/S	20.10.2018	BDL	BDL	0.04	0.02	5.22	0.02	0.02	0.04	BDL
4		D/S	20.10.2018	BDL	BDL	0.6	0.02	2.91	0.02	0.01	0.15	BDL
5	Geeta Ghat	U/S	20.10.2018	BDL	BDL	0.02	BDL	2.11	BDL	BDL	0.01	BDL
6		D/S	20.10.2018	BDL	BDL	0.03	0.01	3.15	0.01	BDL	0.02	BDL
7	Geeta Colony Ghat	U/S	20.10.2018	BDL	BDL	0.02	0.01	1.86	0.01	BDL	0.04	BDL
8		D/S	20.10.2018	BDL	BDL	0.04	0.02	6.53	0.02	BDL	0.05	BDL
9	Hathi Ghat	U/S	20.10.2018	BDL	BDL	0.04	0.02	4.92	0.02	BDL	0.06	BDL
10		D/S	20.10.2018	BDL	BDL	0.04	0.02	4.82	0.02	BDL	0.06	BDL
11	Mayur Ghat	U/S	20.10.2018	BDL	BDL	0.04	0.02	7.78	0.02	BDL	0.06	BDL
12		D/S	20.10.2018	BDL	BDL	0.03	0.01	2.58	0.01	BDL	0.05	BDL
13	Kalindi Ghat	U/S	20.10.2018	BDL	BDL	0.04	0.02	2.99	0.02	BDL	0.07	BDL
14		D/S	20.10.2018	0.01	BDL	0.06	0.04	21.69	0.04	0.03	0.12	BDL

BDL- Below Detection Limit

Detection limit (µg/l): As-0.49, Cd-0.42, Cr-0.56, Cu-0.35, Fe-0.67, Ni-0.54, Pb-0.31, Zn-0.59 & Hg-1.0

Post Immersion (20.10.2018):

- No exceedance observed in 5 Heavy metals – As, Cd, Cu, Zn, Hg
- Exceedances (in 6 metals): Cr - 4 locations
  Fe - all locations
  Ni - 1 location
  Pb - 2 locations