BEFORE THE HON'BLE NATIONAL GREEN TRIBUNAL, CENTRAL ZONE, BHOPAL (M.P.)

ORIGINAL APPLICATION NO. 03 OF 2024

IN THE MATTER OF :

"SUO MOTO CASE IN RE: NEWS ITEM APPEARING IN THE HINDU DATED 03.12.2023 TITLED "BATTLING WATER WOES IN LAND OF TRAGEDY"

I N D E X

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6.	Special Study Report, Exploring the Heavy Metals Contamination and Basic Water Quality Parameters around Union Carbide India Limited (UCIL), Bhopal	**R-4**	22-38

Date: 08.07.2024
Place: Bhopal

Through Counsel
Prashant M. Harne
Standing Counsel
State of Madhya Pradesh

BEFORE THE HON'BLE NATIONAL GREEN TRIBUNAL, CENTRAL ZONE, BHOPAL (M.P.)

ORIGINAL APPLICATION NO. 03 OF 2024

IN THE MATTER OF :

"SUO MOTO CASE IN RE: NEWS ITEM APPEARING IN THE HINDU DATED 03.12.2023 TITLED "BATTLING WATER WOES IN LAND OF TRAGEDY"

FACTUAL AND ACTION TAKEN REPORT ON BEHALF OF PRINCIPAL SECRETARY (ENVIRONMENT) IN COMPLIANCE OF ORDER DATED 20.03.2024

IT IS MOST RESPECTFULLY SUBMITTED HEREINUNDER :

1. That in the present matter, this Hon'ble Tribunal took cognizance of the News Article dated 03.12.2023; Titled : "*Battling Water Woes In Land Of Tragedy*" published in the Hindu, and thereafter the Hon'ble Tribunal directed to submit a further factual and action taken report of for remedial actions and to take necessary action according to rules. That for the convenience of this Hon'ble Tribunal the relevant extract from Order dated 20.03.2024 is reproduced hereinbelow :

> *"In view of the above report, Secretary (Environment) and Member Secretary, State Pollution Control Board is directed to*

take further necessary actions. The Principal Secretary may call a report from competent expert body for remedial actions and to take necessary action according to rules and submit the factual and action taken report within three weeks."

2. That in compliance of the aforementioned directions, it is submitted that Dated 01.05.2024 has been issued by Member Secretary, MPPCB, Bhopal to Director, Bhopal Gas Tragedy, Relief and Rehabilitation Department, Bhopal (hereinafter referred as "**BGTRRD**") for specific compliance of eight-point directions issued by this Hon'ble Tribunal vide Order dated 20.03.2024. Furthermore, Letter dated 29.05.2024 addressed BGTRRD, regarding the disposal of 337 MT of waste in accordance with the rule of law at the earliest. The copies of letter dated 01.05.2024 and 29.05.2024 are marked and annexed herewith as **Annexure R-1 (Colly.)**.

3. Thereafter, BGTRRD vide its letter dated 21.05.2024 has stated that the tender for disposal of 337 MT of chemical waste material stored in the Union Carbide premises and

that the Letter of Acceptance has been issued in favor of M/s Pithampur Industrial Waste Management Pvt Ltd vide letter dated 13.07.2023, and the Agreement has also been executed on 07.10.2023. It is stated that the funds for disinfection of chemical substances have been also received by Government of India on 05.03.2024 and that the process of disposal of chemical waste at Union Carbide premises will proceed in accordance with the rule of law. A copy of letter dated 21.05.2024 is marked and annexed herewith as **Annexure R-2.**

4. It is further stated that an amount of INR 21,37,03,453/- [Rupees-Twenty-one crores, thirty-seven lacs, three thousand and four hundred and fifty-three only] as 20% advance based on condition no 6.3 of the Tender has already been paid in favor of M/s Pithampur Industrial Waste Management Pvt Ltd, Distt Dhar for disposal of stored waste lying in UCIL premises, vide Order dated 29.05.2024. A copy of Order dated 29.05.2024 is marked and annexed herewith as **Annexure R-3**.

5. It is stated that the process of remediation of contaminated area as per Government of India, Ministry

of Environment, Forest and Climate Change, New Delhi's letter dated 19.06.2023, the Oversight Committee, regarding underground water testing in the Union Carbide areas to National Environmental Engineering Research Institute (NEERI), Nagpur and National Geophysical Research Institute (NGRI), Hyderabad and that the funds for the same has been received by BGTRRD and will be disbursed accordingly.

6. Furthermore, vide letter dated 21.05.2024 [Annexure R-2], from Director, Bhopal Gas Tragedy, Relief and Rehabilitation Deptt, Bhopal, an amount of Rs 50.00 Cr has been provided to Bhopal Municipal corporation for the provision of drinking water in the areas around the union carbide premises. The Municipal corporation has constructed 10 water tanks in 22 settlements of the gas affected areas around the union carbide complex and provided 10,124 free tap connections Drinking water [Narmada River water) is being supplied regularly through water supply network.

7. It is stated that initially the matter was taken up as suo moto by the Hon'ble National Green Tribunal, Principal

Bench, New Delhi and the same was registered as OA 732/2023. That a Special Study Report, Exploring the Heavy Metals Contamination and Basic Water Quality Parameters around Union Carbide India Limited (UCIL), Bhopal was submitted before Hon'ble National Green Tribunal, Principal Bench, New Delhi, wherein detailed ground water quality analysis was conducted in areas within a 5-kilometer radius of Union Carbide Premises. A copy of Special Study Report, Exploring the Heavy Metals Contamination and Basic Water Quality Parameters around Union Carbide India Limited (UCIL), Bhopal is marked and annexed herewith as **Annexure R-4.**

8. That an affidavit in support of the Action Taken Report is filed herewith.

Date: 08.07.2024
Place: Bhopal

Through Counsel
Prashant M. Harne
Standing Counsel
State of Madhya Pradesh

BEFORE THE NATIONAL GREEN TRIBUNAL

CENTRAL ZONAL BENCH BHOPAL

Original Application No. 04/2024

IN THE MATTER OF:

NEWS ITEM APPEARING IN THE HINDU DATED 03.12.2023 TITLED BATTLING WATER WOES IN LAND OF TRAGEDY **APPLICANT(S)**

VERSUS

STATE OF MP & ORS. **RESPONDENT(S)**

AFFIDAVIT

I, Brijraj Singh Sengar S/o Late Shri M.S. Sengar, Executive Engineer, Bhopal Office Address Capital Project, Division No. 2, PHE Department, do hereby state on oath and solemnly affirm as under :

1. That, I have been appointed as the Officer In-Charge to represent this case on behalf of State of MP and as such I am well conversant with the facts of the case and therefore, competent to swear this affidavit.
2. That, the accompanying Reply has been prepared and filed as per my instructions and has also been explained to me.
3. That, the contents of the accompanying Reply/ATR are true to my knowledge based upon official records and legal averments made therein are true on the legal advice and believed to be true.

08/7/24

DEPONENT

VERIFICATION

I, above-described deponent do hereby verify that the contents of para 1 to 3 of the affidavit are true to my personal knowledge and belief.

Verified and signed on this 08th day of July 2024 at Bhopal (M.P.)

08/7/24

DEPONENT

Brijraj Singh
आत्मज श्री M.S. Sengar
निवासी Division 2 PHE Dept. Bhopal.
आज दिनांक 8/7/24
को मेरे समक्ष शपथ ग्रहण की है
Executive Engineer
शपथ पत्रित की पहचान

शपथ आयुक्त, भोपाल
प्रमाणित किया जाता है के शपथ पत्रित को मेरे समक्ष, सपथ पत्र सुनाया समझाया गया उसे सही मानकर हस्ताक्षर / अंगूठा मेरे समक्ष अंकित किया

श्रीमती किरण उपाध्याय
शपथ आयुक्त

IDENTIFY BY ME

H1 109

Annexure R-1 (Colly.)

Madhya Pradesh Pollution Control Board
Paryawaran Parisar, E-5, Arera Colony, Bhopal-462 016 (M.P.)
Phone : 0755-2466735 (O) Fax: 0755-2463742, EPBX: 0755-2517600, 2466191
email: it_mppcb@rediffmail.com. Website: www.mppcb.mp.gov.in

LiFE Lifestyle for Environment

No. 2310 /HSMD/UCIL/MPPCB/2024 Date: 01-05-2024

To,

The Director,
Bhopal Gas Tragedy, Relief and Rehabilitation Department,
01, Shivaji Nagar,
Bhopal (M.P.)

Subject :- Disposal of hazardous waste lying in union carbide premises and remediation of contaminated areas, regarding.

Reference:- Compliance of Hon NGT [CZ] Bhopal order dated 20/03/2022 in OA No. 03/2024 (CZ) OA No. 732/2023 (PB).

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With reference to the above subject, the matter of the disposal of UCIL waste and remediation of site is pending in Hon'ble National Green Tribunal [CZ], Bhopal in matter of OA 03/2024 (CZ) wherein directions have been issued by Hon'ble NGT on dated 20/03/2024, which are as follows:-

"Immediate actions are required to be taken by the authorities concerned on following points:-

I. *Disposal of chemical waste which is approximately 337 mt and is lying in union carbide campus.*
II. *Contamination of ground water.*
III. *Shortage of piped water.*
IV. *Status of nitrate concentrations exceeding the maximum permissible limits and remedial measures required to be taken.*
V. *Status of chloride contamination in comparison to reports submitted in 2011 and the present study and the present status. Sodium and potassium concentrations exceeding the WHO limits.*
VI. *Iron concentrations exceeding the BIS permissible limit in 7 places.*
VII. *The Union Carbide India Limited surrounding area is affected with partially manganese pollution.*

Secretary (Environment) and Member Secretary, SPCB is directed to take further necessary action. Principal Secretary may call a report from competent expert body for remedial actions and to take necessary action according to rules and submit the factual and action taken report within three weeks."

Whereas, as per Rule 3[21] of the Hazardous and Other waste [Management and Transboundary Movement] Rules, 2016, the "occupier" in relation to the factory premises, means

Madhya Pradesh Pollution Control Board
Paryawaran Parisar, E-5, Arera Colony, Bhopal-462 016 (M.P.
):Phone : 0755-2466735 (O) Fax: 0755-2463742, EPBX: 0755-2517600, 2466191
email: it_mppcb@rediffmail.com. Website: www.mppcb.mp.gov.in

a person who has, control over the affairs of the factory or the premises and includes in relation to any hazardous and other wastes, the person in possession of the hazardous or other waste and as per Rule 4(2) the occupier shall be responsible for safe and environmentally sound management of hazardous and other waste and BGTR&R is the occupier of M/s UCIL.

NOW, considering the facts & aforesaid observations, you are directed as to take immediate action on following issues as directed by Hon'ble NGT vide its order dated 20/03/2024 as follows :-

I. *Disposal of chemical waste which is approximately 337 mt and is lying in union carbide campus.*
II. *Contamination of ground water.*
III. *Shortage of piped water.*
IV. *Status of nitrate concentrations exceeding the maximum permissible limits and remedial measures required to be taken.*
V. *Status of chloride contamination in comparison to reports submitted in 2011 and the present study and the present status. Sodium and potassium concentrations exceeding the WHO limits.*
VI. *Iron concentrations exceeding the BIS permissible limit in 7 places.*
VII. *The Union Carbide India Limited surrounding area is affected with partially manganese pollution.*
VIII. *Obtain a report from competent expert body for remedial action and take necessary action according to rules and submit a factual action taken report.*

Status of action taken so far as well proposed to be taken in compliance of Hon NGT orders as above for disposal of stored waste and decontamination of soil and ground water in and around union carbide premises to be submitted to MPPCB within 10 days, so that compliance can be submitted before Hon'ble NGT in the given time frame.

Encls- [NGT directions dated 20/3/2024]

[A. A. Mishra]
Member Secretary

Endt. No /HSMD/UCIL/MPPCB/2024 Date:

Copy to :

1. Secretary, Environment, Government of India, Ministry of Environment, Forest & Climate Change, New Delhi.
2. Secretary, Government of India, Ministry of Chemical & Petro-Chemical, New Delhi.
3. Additional Chief Secretary, Bhopal Gas Tragedy, Relief and Rehabilitation Department, Government of MP for information & necessary action please.
4. Principle Secretary, Environment Department, Government of MP for information & necessary action please.

Madhya Pradesh Pollution Control Board
Paryawaran Parisar, E-5, Arera Colony, Bhopal-462 016 (M.P.)
):Phone : 0755-2466735 (O) Fax: 0755-2463742, EPBX: 0755-2517600, 2466191
email: it_mppcb@rediffmail.com, Website: www.mppcb.mp.gov.in

5. Chairman, Central Pollution Control Board, Delhi.
6. Regional Director, Ministry of Jalshakti, Department of Water Resources, River Development and Ganga Rejuvenation, Central Ground Water Board, North Central Region, Block-1, 4th Floor, Paryawas Bhawan, Arera Hills, Jail Road, Bhopal for information & necessary action please.
7. Collector, District Bhopal for information & necessary action please.

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मध्यप्रदेश प्रदूषण नियंत्रण बोर्ड

पर्यावरण परिसर, ई-5, अरेरा कालोनी, भोपाल (म.प्र.) - 462016
☎(0755)2464428, 2466191 Fax : 0755 - 2463742 e-mail:it_ mppcb@rediffgmail.com, www.mppcb.nic.in

क्रमांक 2661 /मुप्रनिबो/तक/एनजीटी-804/2024 भोपाल, दिनांक 29/05/2024

प्रति

संचालक,
संचालनालय,
गैस राहत एवं पुनर्वास विभाग,
01, शिवाजी नगर, भोपाल (म.प्र.)

विषयः- यूनियन कार्बाइड परिसर संग्रहित 337 मीट्रिक टन रासायनिक अपशिष्ट पदार्थो के विनिष्टीकरण के संबंध में ।

संदर्भः- केन्द्रीय प्रदूषण नियंत्रण बोर्ड का पत्र क्रमांक CP/26/3/2021-WM-1- HO- CPCB-HO/ 938 दिनांक 30/04/2024

उपरोक्त विषय के बारे में लेख है कि माननीय राष्ट्रीय हरित अधिकरण द्वारा प्रकरण क्रमांक 804/2017 में दिये गये निर्देशानुसार दिनांक 02.04.2024 को 11वीं रिव्यू कमेटी की बैठक सम्पन्न हुई। इस बैठक का कार्यवाही विवरण संदर्भित पत्र दिनांक 30.04. 2024 को प्राप्त हुआ है। सुलभ संदर्भ हेतु पत्र की छायाप्रति संलग्न है। यूनियन कार्बाइड परिसर में संग्रहित अपशिष्टों के निपटान हेतु आपके विभाग द्वारा समयसीमा में कार्यवाही अपेक्षित है।

एतद् द्वारा निवेदन है कि यूसीआईएल परिसर में संग्रहित परिसंकटमय अपशिष्टों का निपटान तत्काल करने का कष्ट करें व प्रकरण में हुई प्रगति की जानकारी इस कार्यालय को भेजने की कृपा करें।

संलग्नः- उपरोक्तानुसार।

(ए.ए. मिश्रा)
सदस्य सचिव

प्रतिलिपि :-
डॉ. आलोक सक्सेना, मुख्य रसायनज्ञ एवं प्रभारी अधिकारी (यूसीआईएल), केन्द्रीय प्रयोगशाला, म.प्र. प्रदूषण नियंत्रण बोर्ड, भोपाल की ओर सूचनार्थ एवं आवश्यक कार्यवाही हेतु प्रेषित।

केन्द्रीय प्रदूषण नियंत्रण बोर्ड
CENTRAL POLLUTION CONTROL BOARD
पर्यावरण, वन एवं जलवायु परिवर्तन मंत्रालय, भारत सरकार
MINISTRY OF ENVIRONMENT, FOREST & CLIMATE CHANGE, GOVT. OF INDIA

LiFE Lifestyle for Environment

HON'BLE NGT MATTER

April 30, 2024

CP-26/3/2021-WM-I-HO-CPCB-HO

To

The Member Secretary
SPCBs
(As per the list)

Sub: Minutes of eleventh meeting with SPCBs held on 02.04.2024 to review the action taken reports as per in compliance to the directions of Hon'ble NGT order dated 29.01.2021 in O.A. No. 804 of 2017 in the matter of Rajiv Narayan & Anr. Vs. Union of India & Ors; w.r.t Contaminated Sites – reg

Sir/Madam,

Central Pollution Control Board has conducted 11th review meeting with SPCBs on 02.04.2024 through VC in compliance to the directions of Hon'ble NGT in the matter of OA No. 804 of 2017. Minutes of meeting is enclosed herewith for further necessary action.

Yours faithfully,

(V. P. Yadav)
Director & Head,
Waste Management Division-I

Encl.: As above

'परिवेश भवन' पूर्वी अर्जुन नगर, दिल्ली-110032
Parivesh Bhawan, East Arjun Nagar, New Delhi - 110032
दूरभाष/Tel: 43102030, 22305792, वेबसाईट/Website : www.cpbc.nic.in

Minutes of the Eleventh Review Meeting with 03 SPCBs for compliance to the directions of Hon'ble NGT (PB) order dated 29.01.2021 in OA No. 804 of 2017 in the matter of Rajiv Narayan & Anr. Vs. Union of India & Ors; w.r.t, Contaminated sites held on 02.04.2024

In compliance to Hon'ble NGT order dated 29.01.2021 in OA No. 804 of 2017, the matter of Rajiv Narayan & Anr. Vs. Union of India & Ors., eleventh review meeting with 03 SPCBs was held through VC on 02.04.2024 to discuss about the action plans and its implementations regarding assessment of contaminated/probable contaminated sites and its remediation. The meeting was chaired by Sh. V. P. Yadav, Director & Head, Waste Management Division-I, CPCB, Delhi. The meeting was attended by officials of SPCBs, namely Madhya Pradesh, Odisha, & West Bengal, concerned RDs of CPCB and dealing officials of CPCB, HO. List of the participants is given at **Annexure-I**.

At the outset, Sh. V. P. Yadav, Director and Head, Waste Management Division-I, welcomed all the participants and briefed the agenda of the meeting. Thereafter, Sh. G. Rambabu, Scientist-E, CPCB, made the presentation on detailed action points to comply with various directions passed by Hon'ble NGT in aforesaid matters regarding identification, assessment and remediation of contaminated sites followed by status of on-going DPR preparations and execution of remediation works by the Responsible parties. Accordingly, State wise status was discussed, as given at **Annexure-II** and its deliberations is given as below:

1. **Madhya Pradesh:** There are 21 sites in MP, Out of which;

a) Following 8 sites are proposed for delisting, and it was requested MPPCB to carry on periodically GW sampling in & around the sites and accordingly, MPPCB has submitted action taken reports:

1) Indo Zinc, Plot-79, Sector -3, Pithampur, Dist-Dhar, MP
2) Kainchi Chhola colony, Bhopal-462001
3) Garib Nagar, Bhopal-462001
4) Blue Moon & Nawab Colony, Bhopal-462001
5) New Arif Nagar, Bhopal-462001
6) Shiv Nagar, near Hindustan Petroleum depot, Bhopal—462001
7) Mandideep Industrial area, Mandideep, Raisan-462040
8) M/s Beta Napthol-village Maksi, Shajapur Dist, MP-465106

Analysis result of soil and groundwater, carried on periodically, reveals no contamination. Hence, no further action is required.

b) For remaining 13 sites, 6 sites identified as PCS and other 7 sites are as CS. Out of 13 sites,

i) MPPCB has submitted action taken reports for following **4 sites** located at UCIL area.

1) M/s Union carbide (UCIL), J.P. Nagar, Bhopal, Madhya Pradesh 462001 (CS)
2) Solar Evaporation Ponds outside UCIL premises, Bhopal (CS)
3) Atal Ayub Nagar, Near UCIL factory, Bhopal-462001 (PCS)
4) Shakti Nagar, Near Arif Nagar, Near Union Carbide factory, Bhopal (PCS)

In this regard, it is submitted that during 5th review meeting held on 13.10.2022, MPPCB was requested to follow-up or coordinate with State Govt. to initiate disposal of the hazardous waste stored at UCIL premises through TSDF at the earliest, as the matter is heard by Hon'ble NGT in OA No. 362 of 2021 and OA No. 804 of 2017. Further, it is submitted that the matter is also heard by Hon'ble NGT (CZ) in OA No. 3 of 2024 and vide order dated 20.03.2024, it is directed to take immediate actions by the authorities concerned on Disposal of hazardous waste (about 337 MT) lying at M/s Union Carbide Ltd. premises.

CPCB suggestion: MPPCB may follow-up with Bhopal Gas Tragedy Relief and Rehabilitation Department (BGTRRD) regarding disposal of HW from the UCIL premises as per directions of Hon'ble NGT. For 3 more adjoining sites of UCIL area, CPCB-RD, Bhopal is requested to follow-up the matter with MPPCB for early submission of action taken report as per recommendation **given at Annexure-II.**

ii) For **5 sites** (4 CS & 1 PCS) in Ratlam area, MPPCB is requested to expedite assessment of waste quantity from the Plot 54-E, for disposal through secured landfill.

CPCB suggestion: Out of the 5 sites in Ratlam area, 01 site i.e. waste quantification of Plot 54-E report is underway. Upon receipt of the report, MPPCB may initiate disposal of the waste through secured landfill. For following 02 sites, Joint sampling by MPPCB and CPCB-RD Bhopal may be carried out as per CPCB reference document followed by Soil & GW sampling from 5-6 locations and submit report to CPCB with 2 months.

- Ratlam Industrial Area-457001
- M/s Boarulia Chemicals Pvt Ltd. Ratlam, Madhya Pradesh-457001

iii) Further, it is submitted that no fresh report of action taken is submitted by MPPCB for the following **3 sites:**

1) Dabli, Mangliya, Indore, MP;
2) M/s Grasim Chemical, Grasim Nagar, Nagda, MP;
3) Post Vindhyan Nagar, Dist. Sangruli, MP-486885;

CPCB suggestion: MPPCB may submit action taken reports supported with adequate number of samples (5-6) and analysis results of CoCs with general parameters & heavy metals and site visit/sampling photographs **within 2 months** as per observation & suggestions, given at **Annexure-II.** In this regard, CPCB-RD, Bhopal is requested to follow-up the matter with MPPCB for early submission of action taken report.

iv) The site namely - 'Deoguradiya (Municipal landfill Site), Near Devguradia, Indore, MP', is a MSW dumpsite, therefore, is it is proposed that the site may be de-listed from the hazardous waste contaminated sites.

2. **Odisha:** There are 32 sites in Odisha; wherein, 09 sites identified as PCS and other 23 sites are as CS. In this regard, OSPCB has informed the following:

a) For **03 mercury contaminated sites** at Ganjam, remediation work is underway as per the DPR. Further, it is proposed that the 03 sites (i.e. JCI-I, JCL-II & JCL-III) may be considered as single site (i.e. GIL sites, Ganjam)

b) For **01 chromium contaminated** site at M/s Orichem, Talcher, regarding disposal of hexavalent chromium hazardous wastes from the site, OSPCB has informed that only 700 MT of waste has been disposed through TSDF.

CPCB suggestion:

(i) Since slow progress has been observed in disposal of hazardous waste from **chromium contaminated site at Orichem, Talcher,** OSPCB should issue necessary directions within a month to the party responsible for lifting and disposal of hazardous waste through TSDF or SLF. In case of failure to comply, as per the Hon'ble NGT order dated 26.08.2019 in OA No. 804/2017, environmental compensation may be imposed to Odisha SPCB at the rate of Rs. 10 lakh per site.

(ii) For site **at INDAL-III (located outside the unit premises of M/s Indian Aluminum Company Limited), Hirakud, Sambalpur,** OSPCB should issue the following necessary directions to the unit:

a) To assess the waste characterization,

b) To estimate the quantity of hazardous waste to be disposed through Secure Landfill (SLF),

c) To dispose of hazardous waste lying at the site after scientific stabilization through SLF.

d) Once all the waste has been disposed of through SLF, the unit should carry out a detailed assessment of the site by engaging reputed consultant/institute. In this regard, the unit may submit the sampling and analysis plan to the CPCB and OSPCB.

(iii) For remaining sites, OSPCB may submit action taken reports supported with adequate sampling (i.e. 4-5 samples) of different matrix and analysis results of CoCs with general parameters & heavy metals and site visit/sampling photographs **within a month** as per observation & suggestions, given at **Annexure-II.**

3. **West Bengal: There are 07 sites in WB; wherein, 06 sites are identified as PCS and 01 site is as CS.**

i) In case of one (01) chromium contaminated site at Nibra for which DPR was prepared under National Clean Energy Fund (NCEF) project, it is observed that no action has been taken for execution of remediation works.

Further, it is to inform that CPCB has received a Legal Notice dated 07.09.2023 from the Advocate of the Consultant (i.e. M/s ERM India Pvt. Ltd.) for release of pending payment along with 18% interest for delay in payment (copy of the legal notice is enclosed for ready reference). In this regard, CPCB vide letter dated 13.11.2023 requested to your Board for release State's share payment for Project on "Remediation of hazardous waste contaminated dumpsites" under NCEF. However, state share is still awaited.

Therefore, the proportionate State share of Rs. 33,97,701/- for preparation of aforesaid DPR may be arranged to CPCB at the earliest, so that pending payment can be released to the Consultant i.e. M/s ERM India Pvt. Ltd.

CPCB suggestion: WBPCB should initiate remediation work at the earliest as per the DPR prepared under NCEF project without any further delay.

II) For remaining 06 PCS, WBPCB was requested to submit action taken report (ATR) supported with analysis results and site visit/sampling photographs within a month. However, the ATRs are still awaited.

CPCB suggestion: CPCB asked for joint visit by WBPCB and RD Kolkata and adequate number of sampling may be carry out to conclude the status of the said sites. WBPCB should submit action taken report for remaining 06 PCSs, supported with analysis results and site visit/sampling photographs **within a month** without any further delay. In this regard, CPCB-RD, Kolkata is requested to follow-up the matter with WBPCB.

Recommendations/Action Points:

1. SPCBs need **to update regularly 'Inventory of contaminated sites' and may furnish the updated data to CPCB** for maintaining a national list in public domain from time to time.

2. SPCBs should initiate preliminary investigation of probable contaminated sites followed by detailed investigation and remediation works, if required. **Action taken report should be submitted by the concerned SPCB within a month without any delay.**

   In this regard, who have not yet submitted the aforesaid Action taken reports, may submit the same within one month from the date of issue of this minutes.

3. SPCBs may initiate **immediate remedial measures for priority contaminated sites and wherein DPRs already prepared for remediation of contaminated sites under National Clean Energy Fund (NCEF) project.**

4. States to take responsibility for high risk "Orphan Sites", where there is historic dumping & for which DPRs have already been prepared under NCEF project, and the polluter could not be identified or polluter is not in a position to pay for remediation costs.

   In this regard, SPCBs may follow-up with concerned State Govt.

5. SPCBs should monitor, wherein Remediation work is undertaken by Responsible Party (ies) and wherein DPRs prepared under NCEF project, SPCBs should submit **progress/status report bi-monthly.**

6. As per the directions of NGT, SPCBs/PCC shall ensure that the hazardous waste accumulated/lying at following sites shall be disposed of either through TSDF or SLF on priority to stop further contamination.

In case of failure to comply, as per the Hon'ble NGT order dated 26.08.2019 in OA No. 804 of 2017 and order dated 09.03.2022 in OA No. 362 of 2021, environmental compensation may have to be paid by SPCBs/PCC at the rate of Rs. 10 lakh per site.

7. **All SPCBs also requested to constitute State Level Environmental Monitoring Committee (SLEMC)** having representatives from Dept. of Environment, Industries Dept., SPCB, CGWA/SGWA, relevant Experts, etc., for effective implementation of remediation plans and communicate the SLEMC constitution to CPCB **within 2 weeks.** If constituted, ignored, pls

***

Annexure R-2

संचालनालय, गैस राहत एवं पुनर्वास,
1,शिवाजी नगर,भोपाल

क्रमांक एफ–07 / 38 / लि.शा. / 2023 / 1265   भोपाल,दिनांक 21 / 05 / 2024

To,

Shri A.A. Mishra Ji
Member Secretary
Madhya Pradesh Pillution Control Board
Paryavaran Parisar, E-5 Arera Colony, Bhopal

Sub.: Disposal of hazarduous waste lying in union carbide permises and remediation of contaminated areas, regarding.

Ref.— Your letter No. 2310/HSMD/CIL/MPCB/2024 dated 01.05.2024

Regarding your referred letter the departmental information is as below -

S.N.	Points	Answer
I	Disposal of chemical waste which is approximately 337 MT. and lying in union carbide campus.	The successful bidder has been selected through tender for disposal of 337 MT tonnes of chemical waste materials stored in Union Carbide premises and Letter of Acceptance (LOA) has been issued to M/s Pithampur Industrial Waste Management Private Limited on 13.07.2023. And the agreement has also been executed with the tenderer on 07.10.2023. The amount to be spent for disinfection of chemical substances has been received by the Government of India on 05.03.2024. The process of disposal of chemical waste materials will be started as soon as possible.
II	Contamination of ground water.	Not Related with Directerate gas relief department
III	Shortage of piped water.	An amount of Rs 50.00 crore has been provided to the Municipal Corporation for the provision of drinking water in the areas around the Union Carbide complex. The Municipal Corporation has constructed 10 tanks in 22 settlements of the gas affected

		areas around the Union Carbide complex and provided 10,124 free tap connections. Drinking water arrangements are being made regularly through this. Narmada Jal is being provided to all areas.
IV	Status of nitrate concentrations exceeding the maximum permissible limit and remedial measures required to be taken.	Not Related with Directerate gas relief department
V	Status of chloride contamination in comparison to report submitted in 2011 and the present study and the present status. Sodium and potassium concentrations exceeding the WHO limits.	Not Related with Directerate gas relief department
VI	Iron concentrations exceeding the BIS permissible limit in 7 places.	Not Related with Directerate gas relief department
VII	The union carbide India Limitted surrounding area is affected with partially manganese pollution.	Not Related with Directerate gas relief department

Note :- Government of India, Ministry of Environment, Forest and Climate Change, New Delhi's letter dated 19.06.2023, as per paragraph 5 (ii) mentioned in the proceedings of the Oversight Committee, regarding underground water testing in the Union Carbide areas to National Environmental Engineering Research Institute (NEERI), Nagpur and National Geophysical Research Institute (NGRI), Hyderabad. A notesheet regarding KYC update has been sent to MPPCB, yet it has not been recieved back with updated KYC Signature. As soon as it will be recieved, advance payment to NEERI and NGRI will be done for starting furture proceeding regarding UCIL Survey.

21/05/24

(Rakesh kumar Shrivastava)
Director
Bhopal Gas Tragedy, Relief and
Rehabilitation, Bhopal

E. No. f-07/38/L.sec/2024 Bhopal, Dated /05/2024

Copy to -

1. Staff Officer, Enviroment, Government of India, Minsitry of Environment, Forest & Climate Change, New Delhi.
2- Dupty Secretary, Bhopal Gas Tragedy, Relief and, Rehabilitation, Ministry, Bhopal (M.P.)

Sd

Director
Bhopal Gas Tragedy, Relief and
Rehabilitation, Bhopal

Annexure R-3

संचालनालय, गैस राहत एवं पुनर्वास

01, शिवाजी नगर, भोपाल

भोपाल, दिनांक 29/05/2024

–: आदेश :–

क्रमांक एफ 07/73/UCIL/2024/ :: भारत सरकार, पर्यावरण, वन एवं जलवायु परिवर्तन मंत्रालय द्वारा गठित ओवर साइट कमेटी के निर्णय दिनांक 19/06/2023 के परिपालन में भारत सरकार का पत्र दिनांक 04/03/2024 के अनुक्रम में भोपाल स्थित यूनियन कार्बाइड परिसर में संग्रहित 337 मीट्रिक टन, रासायनिक अपशिष्ट पदार्थों के विनिष्टीकरण हेतु आमंत्रित निविदा में न्यूनतम निविदाकार **मेसर्स–पीथमपुर इंडिस्ट्रीयल वेस्ट मेनेजमेंट प्रायवेट लिमिटेड, पीथमपुर, जिला–धार** को निविदा में उल्लेखित शर्तो की कण्डिका–6.3 के उल्लेखानुसार 20 प्रतिशत अग्रिम के रूप में राशि रू–21,37,03,453/–(राशि रू इक्कीस करोड़ सैंतीस लाख तीन हजार चार सौं तिरेपन मात्र) की राज्य शासन की स्वीकृति दिनांक 24.05.2024 के कम में भुगतान किये जाने की स्वीकृति प्रदान की जाती है।

2. सचिव, भारत सरकार, पर्यावरण, वन एवं जलवायु परिवर्तन मंत्रालय, नई दिल्ली के पत्र दिनांक 04/03/2024 द्वारा आवटित राशि रू–126,08,50,365 (राशि रू एक सौं छब्बीस करोड़ आठ लाख पचास हजार तीन सौं पैंसठ मात्र) वर्तमान में Public Financial Management System (PFMS) के माध्यम से पंजाब नेशनल बैंक, टी.टी.नगर, भोपाल में संचालित खाता क्रमांक–0591000100314985 से उक्त भुगतान विकलनीय होगा।

(राकेश कुमार श्रीवास्तव)
संचालक
गैस राहत एवं पुनर्वास
भोपाल
भोपाल, दिनांक 29/05/2024

पृ. क्रमांक एफ 07/73/UCIL/2024/1321

प्रतिलिपि :–

1. निज सचिव, माननीय मंत्री, मध्यप्रदेश शासन, भोपाल गैस त्रासदी राहत एवं पुनर्वास विभाग, मंत्रालय वल्लभ भवन, भोपाल।
2. स्टॉफ ऑफिसर, अपर मुख्य सचिव, मध्यप्रदेश शासन, भोपाल गैस त्रासदी राहत एवं पुनर्वास विभाग, मंत्रालय वल्लभ भवन, भोपाल।
3. निज सहायक, सचिव, भारत सरकार, रसायन एवं उर्वरक मंत्रालय, रसायन एवं पेट्रोरसायन विभाग, शास्त्री भवन, नई दिल्ली–110001।

निरंतर–2

4. संचालक, भारत सरकार, पर्यावारण, वन एवं जलवायु परिवर्तन (एफएसएम डिवीजन), इंदिरा पर्यावरण भवन, जोर बाग रोड़, अलीगंज नई दिल्ली–110003।
5. सदस्य सचिव, केन्द्रीय प्रदूषण नियंत्रण बोर्ड, परिवेश भवन, ईस्ट अर्जुन नगर, दिल्ली–110032।
6. सदस्य सचिव, मध्यप्रदेश प्रदूषण नियंत्रण बोर्ड, विठ्ठल मार्केट, पर्यावरण परिसर, ई–5, अरेरा कॉलोनी, भोपाल, मध्यप्रदेश–462016।
7. निज सचिव, उप सचिव, मध्यप्रदेश शासन, भोपाल गैस त्रासदी राहत एवं पुनर्वास विभाग, मंत्रालय वल्लभ भवन, भोपाल।
8. मेसर्स–पीथमपुर इंडिस्ट्रीयल वेस्ट मेनेजमेंट प्रायवेट लिमिटेड, पीथमपुर, जिला–धार।

की ओर सूचनार्थ एवं आवश्यक कार्यवाही हेतु प्रेषित।

29/05/24

संचालक
गैस राहत एवं पुनर्वास
भोपाल

Annexure R-4

Special Study Report

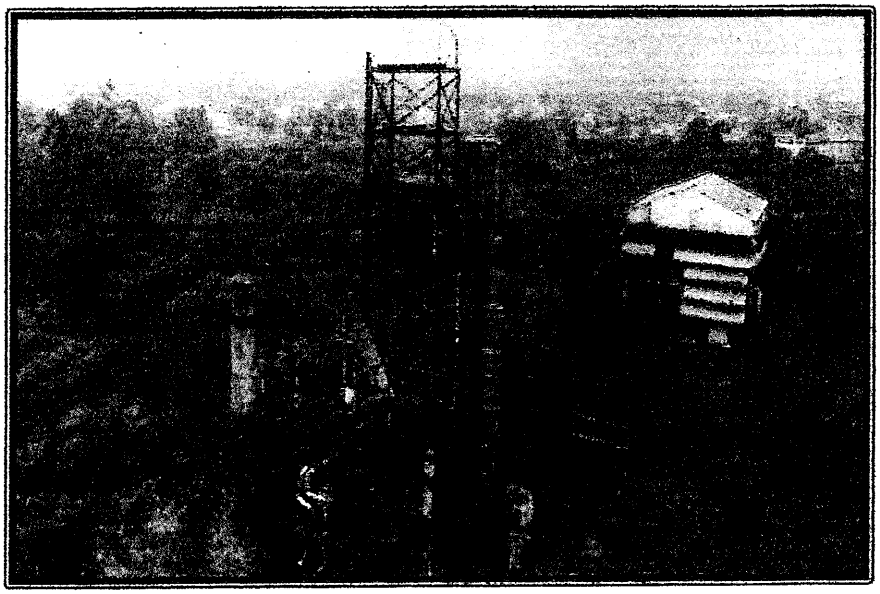
Exploring the Heavy Metals Contamination and Basic Water Quality Parameters around Union Carbide India Limited (UCIL), Bhopal

In the Matter of

ORIGINAL APPLICATION NO. 732/ 2023

w.r.t.

Hon'ble National Green Tribunal (Central Bench) Order dated 07.12.2023



Location: Union Carbide India Limited (UCIL)
District-Bhopal, M.P.
BEFORE THE HON'BLE NATIONAL GREEN TRIBUNAL

Data Analysis, Interpretation and Report writing
by
Dr. V. K. Kulshreshtha, Scientist-C
Mr. Tej Singh, Assist. Chemist

Sample Analysis
by
Mr. Rahul Vashishtha, Assist. Chemist
Mr. Jitendra Kumar, STA-Chem.

Sample Collection
by
Ms. Peshni Patel, Scientist-C
Mr. Jitendra Kumar, STA-Chem.
Ms. Adiba Khan, STA-Chem.

ASHOK KUMAR BISWAL
Regional Director
Government of India
Ministry of Jal Shakti
Department of WR, RD & GR
Central Ground Water Board
North Central Region, Bhopal

I.INTRODUCTION

In the tragic events of 1984, on the fateful night of December 2nd, a catastrophic gas leak occurred at the Union Carbide factory in Bhopal. The released gas, highly poisonous in nature, resulted in the loss of numerous human lives and livestock. Beyond the immediate human toll, the incident had far-reaching consequences, causing substantial environmental damage and adversely affecting the quality of flora and fauna in the surrounding areas.

Quantifying the extensive losses incurred by natural resources, including air and water in the city of Bhopal, due to the release of these poisonous gases has proven to be an intricate challenge. Despite this difficulty, various governmental entities, including state and central agencies, non-governmental organizations (NGOs), and autonomous bodies, have diligently undertaken efforts to comprehensively study both the immediate and long-term effects of the gas leakage. These studies aimed to provide a basis for future planning, enabling effective measures to overcome the adverse consequences of the gas leak.

A crucial aspect of post-gas tragedy investigation focuses on the examination of water quality in and around the affected area, notably the Union Carbide factory in Bhopal. The Madhya Pradesh State Pollution Control Board, Bhopal has been actively engaged in the routine monitoring of groundwater quality across various locations in Bhopal, with special attention to areas closely adjacent to the Union Carbide facility. This monitoring involves the collection of groundwater samples from representative hand pumps, dug wells, and tube wells.

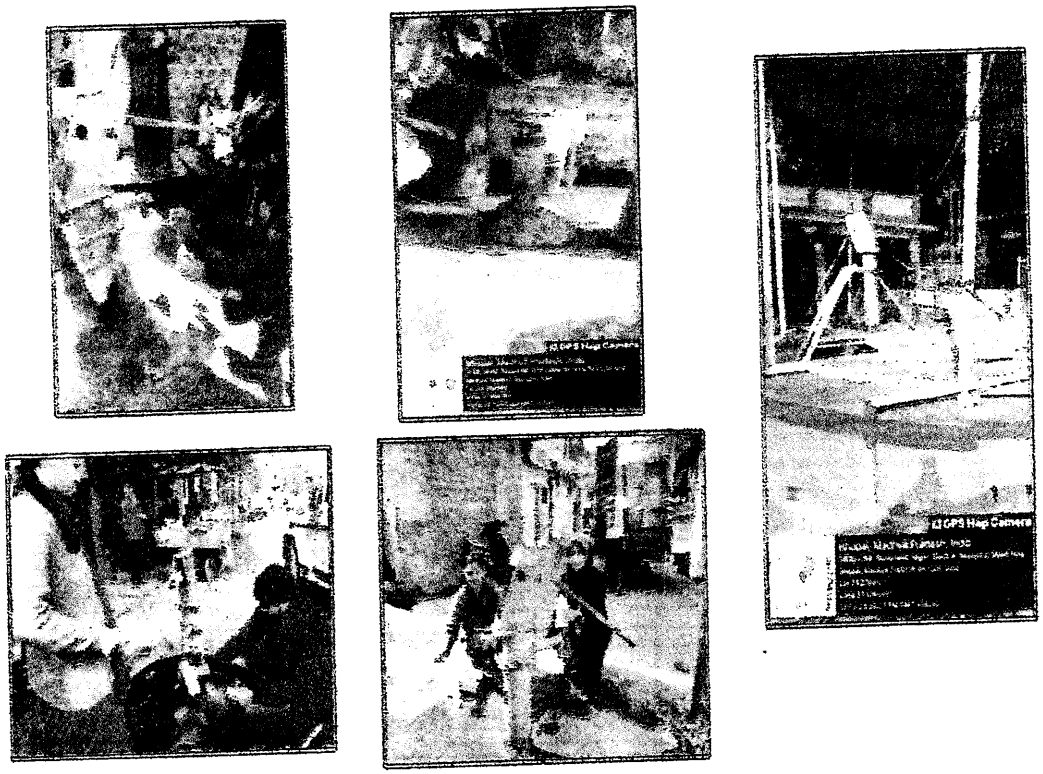
In 2011, the Central Ground Water Board (CGWB), NCR, Bhopal, conducted a study around the Union Carbide factory area to assess groundwater quality. Samples were meticulously collected from hand pumps, tube wells, and dug wells at 12 different locations during July 2011. The study reported that the study area had saline groundwaters due to the inherent geogenic mineral dissolution from parental material.

A recent newspaper article dated 03.12.2023, published in ***"The Hindu"*** under the title ***"Battling Water Woes in the Land of Tragedy,"*** spotlights the critical issue of groundwater contamination. The article drew attention to the substantial volume of inadequately managed toxic wastes within the UCIL premises, highlighting the potential risk of contaminants seeping into the groundwater from the poorly contained toxic waste.

Prompted by this article, the National Green Tribunal (NGT), Principal Branch, New Delhi, took Suo Motu action, recognizing the urgent need for attention and remediation of toxic waste within the UCIL premises. Subsequently, the Hon'ble Tribunal summoned the

dots. Detailed geographical coordinates of these sampling points can be found in **Annexure-I.**

Figure 1: Illustrates the collection of groundwater samples from the study area.



b. Analysis of Samples: The collected samples, adhering to proper handling protocols, underwent analysis at the Regional Chemical Laboratory, CGWB, Bhopal. The analysis included basic parameters such as pH, electrical conductivity (EC), total dissolved solids (TDS), temperature (Temp. ^0C), carbonate (CO_3), bicarbonate (HCO_3), sulphate (SO_4), chloride (Cl), phosphate (PO_4), silica (SiO_2), nitrate (NO_3), total hardness (TH), calcium (Ca), magnesium (Mg), sodium (Na), and potassium (K). Additionally, 18 specific heavy metals—namely, iron (Fe), zinc (Zn), manganese (Mn), cadmium (Cd), nickel (Ni), chromium (Cr), lead (Pb), aluminum (Al), boron (B), selenium (Se), silver (Ag), mercury (Hg), molybdenum (Mo), copper (Cu), Barium(Ba), Strontium(Sr), Arsenic (As) and uranium (U)—were analyzed. The determination of basic parameters followed Standard Methods (APHA, 2022) employing various volumetric methods, Flame-photometer (Systonics-128), and Spectrophotometer (Shimadzu, UV-1201). The analysis of heavy metals was conducted using ICP-MS (ThermoFisher Scientific, model icap RQ).

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क्षेत्रीय निदेशक/Regional Director
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उत्तर मध्य क्षेत्र, भोपाल/North Central Region, Bhopal

the WHO recommended permissible level of 1.0 mg/l at only two locations namely HP_5 (Mangalwara) with a maximum level of 2.33 mg/l and Golghar Museum (BW_{11}) with a level of 1.09 mg/l. Increasing phosphate levels, can be attributed to human activities such as farming and the disposal of sewage.

There are no agreeable primary or secondary contaminants limits of silica for drinking water prescribed either by the Bureau of Indian Standards (BIS) or any other slimier agency like US-EPA & WHO. The results of silica analysis in the study area revealed a non-uniform distribution, ranging from 8 mg/l (**DW_1, Gufa Mandir**) to 74 mg/l (**BW_9, RGPV University**), with an average concentration of 32 mg/l. This variation may be attributed to factors such as the water saturation deficit of the aeration zone, seasonal fluctuations in precipitation and temperature, bedrock reactivity, and mineral stability, as described by **Dobrzynski (2005).**

According to the classification provided by **Sawyer & McCarty (1996),** nearly 99% of the water samples were categorized as hard or very hard for household use. The hardness values ranged from 193 to 827 mg/l, with an average of 364 mg/l (*See* **Tables 1 & 3**); further three locations namely Bhopal Railway Junction (**HP_4; shallow Aquifer),** Geetanjali College (**BW_4; Deep Aquifer**), and Badwai(**HP_{10}; shallow Aquifer**) showed the hardness greater than BIS permissible limit (600 mg/l) respectively as 827,683 and 634 mg/l. Calcium content in water samples only from one location namely Bhopal Railway Junction (**HP_4; shallow Aquifer**) marginally exceeded the BIS maximum permissible limit of 200 mg/l, with concentrations reported as 212 mg/l. Around 27.77% of the locations recorded magnesium concentrations that exceeded the BIS acceptable limit of 30 mg/l, although they remained below the permissible limit of 100 mg/l(**Tables 1 & 3**).

The BIS did not provide specific limits for sodium; therefore, WHO standards were applied. The analysis revealed that sodium concentrations at two locations, namely Badwai (HP_{10}) and Bhopal Memorial Hospital (BW_{18}), exceeded the WHO limit of 200 mg/l, with an average concentration of 102 mg/l (**Tables 1 & 3**).

Similarly, no numerical BIS guideline exists for potassium, so WHO standards were followed. 27.77 locations (10 out of 36) recorded potassium concentrations above the WHO limit of 10 mg/l, with maximum, minimum, and average values of 40, 2.2, and 9.4 mg/l, respectively (**Tables 1 & 3**).

B. Appraisal of Ground Water Quality Based on Heavy Metals

The upcoming text describes the concentrations of eighteen environmentally significant heavy metals were investigated. These heavy metals include iron (Fe), manganese (Mn), aluminum (Al), zinc (Zn), arsenic (As), silver (Ag), boron (B), molybdenum

discretion of the origin of the lithology has been explained by the following assumptions **(Day *et. al.*, 1998)**:

(1) Atmospheric precipitation dominance waters should come from rocks which contain dominantly Na^+ and K^+, which are less soluble and producing only small quantities of TDS with a moderate to high Na/Ca+Na ratio.

(2) Rocks dominance waters (mineral weathering processes) show high concentrations of Ca^{2+}, Mg^{2+}, and HCO_3^- resulting in moderate TDS and moderate Na/Ca+Na ratio.

(3) Evaporation dominance waters show high concentrations of Na^+ and Cl^- ions and low concentrations Ca^{2+} and Mg^{2+} ions due to calcite precipitation resulting in high TDS and high Na/Ca+Na ratio.

Gibbs used two ratios in his diagrams, representing the **Ratio-I** for cations [(Na+K)/(Na+K+Ca)] and **Ratio-II** for anions [Cl/ (Cl+ HCO_3)] as a function of TDS which are widely employed to assess the functional sources of dissolved chemical constituents in waters either through precipitation-dominance, rock-dominance and evaporation dominance.

One of the major shortcomings with **Gibbs's (1970)** diagram is that no place for waters have been affected by domestic/industrial contamination or other sources of hydrochemical enrichment outside of the three sources outlined above since a lot of studies have shown the origin of the lithology away from the three major factors, namely, precipitation dominance, rock-water interaction, and evaporation-crystallization. It is probably on account of this reason that the diagram is often used together with other hydrochemical assessment diagrams such as Piper, Wilcox, etc. integrated with multivariate statistical analyses.

Lastly, to know the mechanisms controlling groundwater chemistry and the relationship of the chemical components of water from their respective aquifers, the chemical data about UCIL of Bhopal was plotted on Gibb's diagram (*See* **Figures 3a & 3b).** **Gibbs's ratio-1 (Cation)** ranged from 0.183 to 0.839 with an average of 0.513 whereas **Gibbs's ratio-2 (Anions)** varied from 0.144 to 0.258 with an average of 0.285 respectively.

Figures 3a and 3b indicate that all samples are situated within the zone characterized by rock dominance indicating that rock weathering is the primary source that controls groundwater chemistry and its evolution. Parent rock weathering facilitates the process by which dissolvable salts and minerals become incorporated with groundwater. Moreover, the long residence time of rock-water interaction also aids mineral dissolution **(Selvakumar *et. al.*, 2017).**

अशोक कुमार बिसवाल/ASHOK KUMAR BISW
क्षेत्रीय निदेशक/Regional Director
भारत सरकार/Government of In
जल संसाधन मंत्रालय/Ministry of Jal S
जल संसाधन, नदी विकास और गंगा
Department of WR, RD &
केन्द्रीय भूमि जल बोर्ड/Central Ground W
उत्तर मध्य क्षेत्र, भोपाल/North Central Reg

concentrations below the permissible guideline set by the Bureau of Indian Standards (BIS) of 0.01 mg/l. The sole exception is the **DW_3** location (Golghar Museum), where the arsenic concentration was slightly elevated at 0.012 mg/l **(Tables 2 & 3)**.

The application of the Gibbs diagram in the analysis suggested that rock weathering played a pivotal role as the primary source influencing groundwater chemistry. This process, in turn, contributed to the presence of saline groundwaters in the study area.

अशोक कुमार बिसवाल/ASHOK KUMAR BISWAL
क्षेत्रीय निदेशक/Regional Director
भारत सरकार/Government of India
जल शक्ति मंत्रालय/Ministry of Jal Shakti
जल संसाधन, नदी विकास और गंगा संरक्षण विभाग
Department of WR, RD & GR
केन्द्रीय भूमि जल बोर्ड/Central Ground Water Boa
उत्तर मध्य क्षेत्र, भोपाल/North Central Region, Bho

Figure 3 Gibb's Diagram Illustrating the Mechanism Controlling Ground Water Chemistry for Sample Sites Belonging to UCIL, Bhopal.

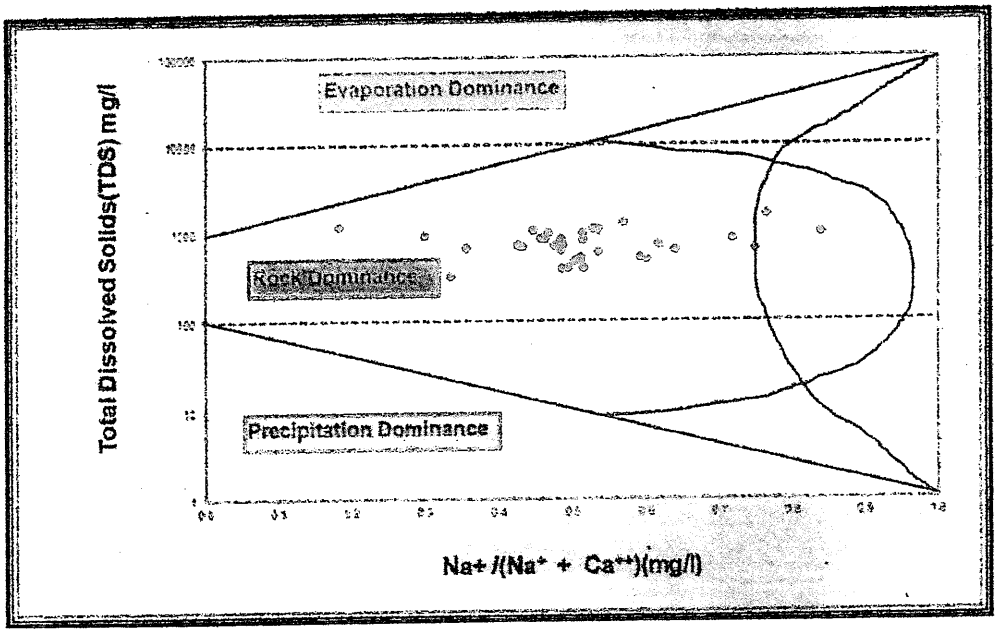

Figure 3 a (Ratio-II Cation)

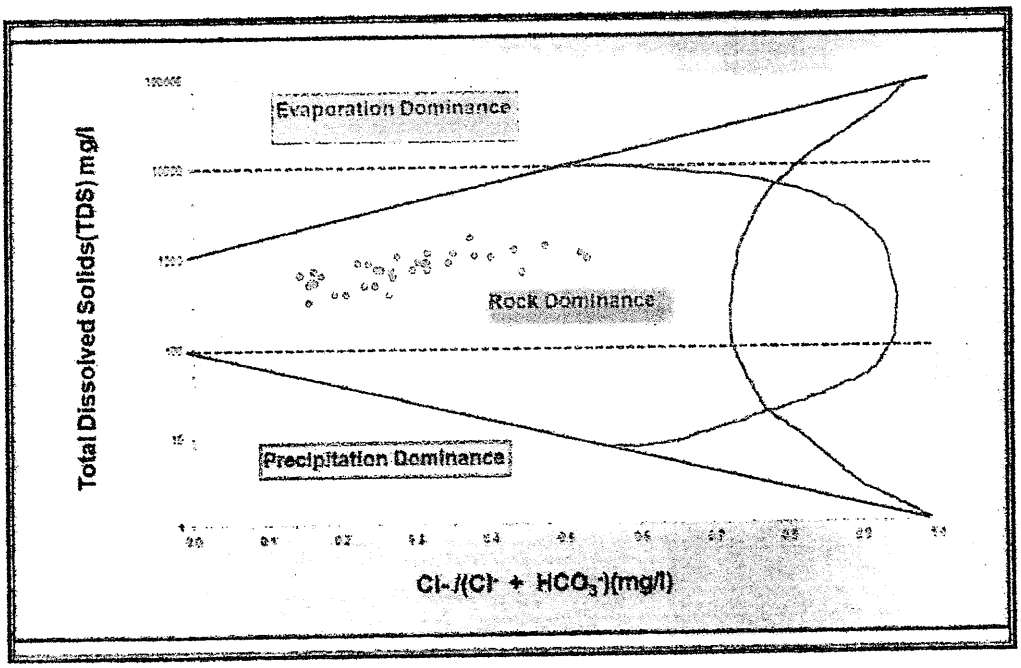

Figure 3 b (Ratio-II Anion)

Table 1: Presentation of Major Ions Concentrations in the Study Area.

S. No.	Parameters Analysed		Type of Aquifer	pH	EC	CO_3	HCO_3	ALKT	Cl	SO_4	NO_3	F	PO_4	SiO_2	TH	Ca	Mg	Na	K
	Desirable and Permissible limits of BIS standards			6.5 - 8.5	750 to 3000*	120 to 360**	244 to 732***	200 to 600	250 to 1000	200 to 400	45 to NR	1.0 to 1.5	0.1 to 1.0		200 to 600	75 to 200	30 to 100	200 (WHO)	10 (WHO)
	Location	Sources		at 25°C	µS/cm at 25°C	mg/l													
1	Subhash Nagar	HP_1	S	7.1	1106	0	421	345	82	40	13	0.41	0.03	13	342	107	18	57	40
2	Govindpura	BW_1	D	7.25	1544	0	378	310	252	44	36	0.34	0.04	35	480	119	45	117	8.4
3	Semra Kalan	HP_2	S	6.98	1554	0	470	385	178	52	[illegible]	0.39	0.02	28	460	156	17	134	2.9
4	Railway Coach Factory	BW_2	D	7.11	1332	0	378	310	198	72	8	0.1	0.03	23	351	137	2	126	2.2
5	Chhola	HP_3	S	7.02	1354	0	494	405	141	36	11	0.31	0.04	20	421	135	20	109	6.8
6	Bhopal Railway Junction	HP_4	S	6.94	1845	0	378	310	287	95	142	0.57	0.02	22	827	212	72	45	2.6
7	Mandaiwara	HP_5	S	7.13	745	0	275	225	89	18	9	0.05	2.33	43	262	87	23	45	23.1
8	Khanugaon	HP_6	S	6.86	938	0	268	220	99	20	[illegible]	0.16	0.21	26	257	83	12	69	26.5
9	Laighat	HP_7	S	6.86	502	0	214	175	40	18	5	0.05	0.09	68	203	53	17	24	2.9
10	Gufa Mandir	DW_1	S	6.74	605	0	201	165	72	44	8	0.05	0.11	8	203	61	12	51	7
11	Gitanjali College (S)	BW_3	S	6.91	812	0	378	310	72	14	8	0.3	0.08	17	243	85	7	87	2.3
12	Geetanjali College (D)	BW_4	D	6.93	2051	0	519	425	465	34	8	0.44	0.08	22	[illegible]	136	84	176	2.5
13	DIG Bunglow	DW_2	S	7.54	972	0	397	325	67	26	1	0.7	0.25	29	238	55	24	92	6.1
14	JP Nagar	BW_5	D	7.04	1301	0	519	425	161	12	1	0.41	0.08	24	406	113	30	116	3.4
15	Kanchi Chhola	BW_6	D	6.86	1669	0	458	375	248	48	184	0.22	0.07	23	545	182	22	142	4.8
16	Shankar Nagar	BW_7	D	6.9	1332	0	403	330	186	36	44	0.22	0.84	20	421	133	22	108	6.3
17	Bhanpur	BW_8	D	7.16	1126	0	409	335	139	18	10	0.28	0.1	25	351	131	6	93	3.5
18	Daamkheda	HP_8	S	7.17	1358	0	415	340	181	20	114	0.44	0.09	27	465	146	28	106	15.5
19	Nabibagh	HP_9	S	7.33	1074	0	354	290	129	20	24	0.52	0.1	48	351	99	25	71	4.3
20	Panna Nagar	HP_{10}	S	7.3	1155	0	415	340	136	34	11	0.4	0.09	38	307	81	25	126	4
21	Badwai	BW_9	D	7.14	2487	0	683	560	406	88	84	0.56	0.15	66	[illegible]	103	92	314	19.6
22	RGPV University	BW_{10}	D	7.33	612	0	220	180	57	30	14	0.35	0.16	74	193	55	13	50	4.4
23	Navri	BW_{11}	D	6.75	1056	0	256	210	203	28	4	0.16	0.09	25	366	143	2	75	3.8
24	Golghar Museum	DW_3	S	7.37	745	0	275	225	82	22	15	0.31	1.09	20	228	71	12	58	16.2
25	Shahjahanabad	BW_{12}	D	7.07	615	0	262	215	82	18	2	0.19	0.31	24	198	61	11	47	18.1
26	Sunder Nagar	BW_{13}	D	7.1	1685	0	336	275	384	36	3	0.91	0.1	18	475	131	36	145	5.2
27	Ashoka Garden	HP_{11}	S	7.61	1126	0	342	280	144	38	32	0.42	0.08	23	322	113	10	98	4.7
28	Jhangirabad	BW_{14}	D	6.97	777	0	336	275	62	9	2	0.31	0.09	24	208	59	14	69	19.8
29	Bharat Talkies	BW_{15}	D	7.1	983	0	390	320	82	10	3	0.12	0.34	37	297	83	22	60	18.2
30	Murli Nagar	BW_{16}	D	7.39	1030	0	409	335	69	32	9	0.76	0.13	56	223	40	30	112	5.2
31	Pelsai Village	BW_{17}	D	7.17	1731	0	488	400	225	32	87	0.36	0.1	48	485	133	37	142	6.4
32	Karond	BW_{18}	D	7.31	1322	0	415	340	188	36	21	0.52	0.12	56	332	61	43	151	4.9
33	Bhopal Memorial Hospital	BW_{19}	D	7.57	1563	0	415	340	252	46	6	0.11	0.09	44	262	44	37	222	8.3
34	Bhanpur	BW_{20}	D	7.07	1126	0	354	290	163	26	36	0.32	0.11	30	351	109	19	98	5.5
35	Khajda	BW_{21}	D	7.04	1456	0	275	225	307	34	32	0.31	0.11	38	515	194	7	78	5.2
36	Barkhedi	BW_{22}	D	6.97	812	0	342	280	87	12	6	0.34	0.18	16	213	67	11	75	22.1

* Derived value determined from BIS limits given for TDS, ** Derived value determined from BIS limits given for Alkalinity & ***Derived value determined from BIS limits given for Alkalinity.

Table 3 : The Summary of Water Quality Data of the Study Area Surrounding UCIL Compared with BIS (2012).

S. No.	Parameters	Min	Max	Avarage	Bureau of Indian Standards (IS 10500:2012)	
					Acceptable Limit	Permissible limit in the absence of alternate sources
1	pH	6.74	7.61	7.11	6.5	8.5
2	Electrical Conductivity (ECw)	502	2497	1209	750*	3000*
3	Carbonate (CO_3)	0	0	0	120†	360†
4	Bi-carbonate (HCO_3)	201	683	376	244†	732†
5	Alkalinity	164.96	559.88	318.30	200	600
6	Chloride (Cl)	40	465	165	250	1000
7	Sulphate (SO_4)	9	95	33	200	400
8	Nitrate (NO_3)	1	142	27	45	No relaxation
9	Fluoride (F)	0.05	0.91	0.34	1	1.5
10	Phosphate (PO_4)	0.02	2.33	0.21	0.10#	1.0#
11	Silica (SiO_2)	8	74	32		
12	Total Hardness (TH)	193	827	364	200	600
13	Calcium (Ca)	40	212	104	75	200
14	Magnesium (Mg)	2	92	25	30	100
15	Sodium (Na)	24	314	102	200#	
16	Potassium (K)	2.2	40	9.4	10#	
17	Total Dissolve Solids (TDS)	326	1623	786	500	2000
18	Boron (B)	0.00	0.228	0.066	0.5	1
19	Aluminium (Al)	0.00	0.133	0.020	0.03	0.2
20	Chromium (Cr)	0.00	0.001	0.000	0.05	No relaxation
21	Manganese (Mn)	0.00	0.581	0.102	0.1	0.3
22	Iorn (Fe)	0.00	11.664	1.453	1	No relaxation
23	Nickel (NI)	0.00	0.007	0.001	0.02	No relaxation
24	Copper (Cu)	0.00	0.012	0.003	0.05	1.5
25	Zinc (Zn)	0.001	8.373	0.315	5	15
26	Arsenic (As)	0.00	0.012	0.001	0.01	No relaxation
27	Selenium (Se)	0.00	0.006	0.000	0.01	No relaxation
28	Molybednum (Mo)	0.00	0.011	0.003	0.07	No relaxation
29	Silver (Ag)	0.00	0.042	0.010	0.1	No relaxation
30	Cadmium (Cd)	0.00	0.001	0.000	0.003	No relaxation
31	Barium (Ba)	0.013	0.190	0.096	0.7	No relaxation
32	Mercury (Hg)	0.000	0.000	0.000	0.001	No relaxation
33	Lead (Pb)	0.000	0.020	0.002	0.05	No relaxation
34	Uranium	0.000	0.014	0.004	0.03	No relaxation
35	Stromcium	0.000	0.006	0.0005	Not Mentioned	Not Mentioned

* = Drived fron BIS' TDS value, †= Derived form BIS' Alkalinity vaue & # = WHO Values

Summary of Monitoring conducted by Regional Directorate, GoI, Ministry of Jal Shakti Deptt of WR, RD&GR , CGWB, Bhopal

Preamble: CGWB, Bhopal has collected about 72 samples [36 samples for basic parameters and 36 for heavy metals] from locations within 5 km radius of union carbide premises during 12 to 14 December, 2023.

The parameters analyzed were :

Physico-chemical parameters such as - pH, TDS, carbonates, bicarbonates,sulphate, chlorides, phosphate, silica,nitrate, hardness, sodium and potassium .

Heavy metals such as- Fe, Zn, Mn, Cd, Ni, Cr, Pb, Al, B, Se, Ag, Hg, Mo, Cu, Ba, Sr, As and U.

The results indicated that concentrations of physico-chemical parameters like nitrates, phosphates, sodium, potassium and metals like iron and manganese are exceeding the limits at some locations as prescribed in standards of BIS10500 [2012] and WHO -1999 guidelines.

Conclusion of the study reveals that , high concentrations of nitrate may be due to utilization of fertilizers and discharge of domestic sewage, whereas, occurrence of high concentration of iron may be due to dissolution of components from ferrous bore holes and hand pumps. Occurrence of other heavy metals are due to rock weathering influencing ground water chemistry.

Comments:- Scientific journals reveals that , availability of high concentrations of nitrate in ground water may be due to agricultural activities and improper sewage disposal [1] . One of the press release in November 2021 from Ministry of Jal Shakti , GoI that *Water quality data of the country on a regional scale as part of its ground water quality monitoring program and various scientific studies indicate occurrence of contaminants such as iron, salinity and nitrate beyond the permissible limits as per BIS for human consumptions in number of states including M.P*[2] . Elevated concentrations of nitrate in ground water may be due to on site sanitation, sewage sludge disposal and agriculture activities [3].

Similarly metals like iron and manganese in ground water are predominant and their occurrence are mainly due to weathering of minerals and rocks. Several trace metals occur naturally in certain rock formations and can enter in the environment from natural processes such as weathering. However, industrial activities such as mining, metallurgy, solid waste disposal etc. can lead to elevated concentrations . of toxic metals including lead, cadmium and chromium. These contaminants have the potential to make their way into groundwater[3]

References:- [1] Nitrate concentration in ground water and associated health risk assessment for indo-gangetic plain, India: Anurag Verma et.al., Ground Water For Sustainable Development, ELSEVIER, Vol 23, November2023, 100978

[2] Press release , GoI, Ministry of Jal Shakti ,dated 29/11/2021

[3] Integration of ground water management into transboundary basins organizations in South Africa : Ground water hazards-a manual by AGW-Net,BGR,IWMI

Monitoring of ground water in and around the Union Carbide premises by MPPCB

In this context , MPPCB has also collected ground water samples from the following locations around union carbide premises on 22/04/2024 [with in 5 km radius of union carbide]

1. Ground water at JP nagar
2. Surface water solar evaporation pond
3. Ground water at atal ayub nagar
4. Ground water at New arif nagar
5. Ground water at garib nagar
6. Ground water at blue moon & nawab colony
7. Ground water at shakti nagar near new arif nagar
8. Ground water at shiv nagar
9. Ground water at kanchi chola colony
10. Ground water at DIG bunglow

The analysis results revels that concentration of total dissolved solids , nitrate, hardness and metals like iron and manganese observed beyond the permissible limits of drinking water standards IS 10500:2012, pesticides are not detected in collected samples. [Annex-4]

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Surface Water

Date of Sample Collection:- 22/04/2024
Date of Start analysis:- 22/04/2024
Date of End analysis:- 30/4/2024
Sampling By:- Central Laboratory, MP Pollution Control Board Bhopal.

S. No.	Parameter	Unit	Method	M/s.Union Carbide (UCIL) J.P. Nagar Bhopal.	Solar Evaporation Pond outside UCIL Premises, Bhopal
1.	pH	pH units	**4500 PH + B APHA, 23rd Edition, 2017**	8.18	7.00
2.	D.O.	mg/l	**4500 - O - C APHA, 23rd Edition, 2017**	4.5	1.4
3.	B.O.D	mg/l	**IS 3025[Part 44]:1993[First Revision]**	5.2	12.4
4.	TDS	mg/l	**2540-C APHA, 23rd Edition, 2017**	306	914
5.	COD	mg/l	**5220-B APHA, 23rd Edition, 2017**	29.64	39.52
6.	Conductivity	µMho/cm	**2510-B APHA, 23rd Edition, 2017**	557.5	1362
7.	Color	Hazen	**2120-B APHA, 23rd Edition, 2017**	30	30
8.	Fluoride	mg/l	**4500-F-D APHA, 23rd Edition, 2017**	BDL	BDL
9.	Chloride	mg/l	**4500-Cl B APHA, 23rd Edition, 2017**	33.50	311.42
10.	Nitrate	mg/l	**4500- No_3 B APHA, 23rd Edition, 2017**	9.80	18.29
11.	Sulphate	mg/l	**4500 So_4^{-2}E APHA, 23rd Edition, 2017**	4.82	8.96
12.	Phosphate	mg/l	**4500 – PD APHA, 23rd Edition, 2017**	0.72	0.02
13.	Total Hardness	mg/l	**2340 C APHA, 23rd Edition, 2017**	220	320
14.	Ca Hardness	mg/l	**3500 CaB APHA, 23rd Edition, 2017**	172	248
15.	Mg Hardness	mg/l	**2340 B APHA, 23rd Edition, 2017**	48	72
16.	Oil and Grease	mg/l	**5520-B APHA, 23rd Edition, 2017**	0.3	0.2
17.	Cyanide	mg/l	**4500 -CNE APHA, 23rd Edition, 2017**	ND	ND
18.	Chromium VI	mg/l	**3500-Cr B APHA, 23rd Edition, 2017**	BDL	BDL
19.	Sodium	mg/l	**4500-B B APHA, 23rd Edition, 2017**	21.96	87.5
20.	Potassium	mg/l	**3500 Na B APHA, 23rd Edition, 2017**	10.05	3.7

Remark:- BDL-Below Detection Limit, MDL-Minimum Detection Limit, Flouride- MDL (0.1 mg/l); Phosphate- MDL- (1.0 mg/l), Chromium VI - MDL - 0.2 mg/l

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Ground Water

Date of Sample Collection:- 22/04/2024
Date of Start analysis:- 22/04/2024
Date of End analysis:- 30/4/2024
Sampling By:- Central Laboratory, MP Pollution Control Board Bhopal.

S. No.	Parameter	Unit	Method	Atal Ayub Nagar, Near UCIL Factory ,Bhopal	New Arif Nagar, Bhopal	Garib Nagar, Bhopal	Blue Moon & Nawab Colony, Bhopal	Shakti Nagar Near Arif Nagar, Near Union Carbide Factory, Bhopal	Shiv Nagar near Hindustan Petroleum depot, Bhopal	Kanchi Chhola colony, Bhopal	DIG Banglow P.G.B.T College Road, Bhopal.	IS 10500: 2012 RA 2021
1.	pH	pH units	4500 PH + B APHA, 23rd Edition, 2017	6.75	7.04	6.93	7.11	6.90	7.11	6.93	6.83	6.5-8.5
2.	D.O.	mg/l	4500 - O - C APHA, 23rd Edition, 2017	1.0	3.0	1.5	3.8	1.5	4.1	1.8	1.2	-
3	TDS	mg/l	2540-C APHA, 23rd Edition, 2017	1098	724	820	1120	924	946	998	688	500
4.	COD	mg/l	5220-B APHA, 23rd Edition, 2017	9.88	9.88	9.88	9.88	9.88	9.88	9.88	9.88	-
5.	Conductivity	µMho/cm	2510-B APHA, 23rd Edition, 2017	1723	1001	1535	1696	1437	1388	1639	1080	-
6.	Color	Hazen	2120-B APHA, 23rd Edition, 2017	20	10	20	20	20	10	20	20	5
7.	Fluoride	mg/l	4500-F-D APHA, 23rd Edition, 2017	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1.0
8.	Chloride	mg/l	4500-Cl B APHA, 23rd Edition, 2017	220.75	88.69	161.62	203.01	130.08	126.14	161.62	88.69	250
9.	Nitrate	mg/l	4500- No_3 B APHA, 23rd Edition, 2017	30.98	7.78	32.93	15.95	11.00	23.34	51.92	16.12	45
10.	Sulphate	mg/l	4500 So_4^{-2}E APHA, 23rd Edition, 2017	55.35	32.75	39.93	48.21	19.85	57.94	82.95	40.25	200
11.	Phosphate	mg/l	4500 – PD APHA, 23rd Edition, 2017	0.11	BDL	0.19	0.57	0.09	0.04	0.07	BDL	-
12.	Total Hardness	mg/l	2340 C APHA, 23rd Edition, 2017	440	332	408	360	352	344	548	384	200
13.	Ca Hardness	mg/l	3500 CaB APHA, 23rd Edition, 2017	204	228	284	196	248	260	252	220	-
14.	Mg Hardness	mg/l	2340 B APHA, 23rd Edition, 2017	236	104	124	164	104	84	296	164	-
15.	Oil and Grease	mg/l	5520-B APHA, 23rd Edition, 2017	0.2	0.1	0.2	0.2	0.2	0.1	0.2	0.2	-
16.	Cyanide	mg/l	4500 -CNE APHA, 23rd Edition, 2017	ND	ND	ND	ND	ND	ND	ND	ND	0.05
17.	Chromium VI	mg/l	3500-Cr B APHA, 23rd Edition, 2017	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	-
18.	Sodium	mg/l	4500-B B APHA, 23rd Edition, 2017	102.5	70.33	165.6	126.7	109.9	75.52	100.47	77.95	-
19.	Potassium	mg/l	3500 Na B APHA, 23rd Edition, 2017	1.4	2.02	1.6	7.0	1.1	2.26	2.01	1.24	-

Remark:- BDL-Below Detection Limit, MDL-Minimum Detection Limit, ND- Not Detected,Flouride- MDL (0.1 mg/l); Phosphate- MDL- (1.0 mg/l), Chromium VI - MDL - 0.2 mg/l

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Surface Water

Date of Sample Collection:- 22/04/2024
Date of Start analysis:- 22/04/2024
Date of End analysis:- 03/05/2024
Sampling By:- Central Laboratory, MP Pollution Control Board Bhopal.

S. No.	Parameter	Unit	Method	M/s.Union Carbide (UCIL) J.P. Nagar Bhopal.	Solar Evaporation Pond outside UCIL Premises, Bhopal
1.	Copper	mg/l	**3111B APHA, 23rd Edition, 2017**	BDL	0.06
2.	Chromium	mg/l		BDL	BDL
3.	Zinc	mg/l		0.04	0.064
4.	Manganese	mg/l		0.13	0.62
5.	Iron	mg/l		0.08	1.57
6.	Lead	mg/l		BDL	BDL
7.	Cobalt	mg/l		BDL	BDL
8.	Nickel	mg/l		BDL	BDL
9.	Cadmium	mg/l		BDL	BDL
10.	Mercury	µg/l	**3112 B APHA, 23rd Edition, 2017**	BDL	BDL

Remark:- BDL-Below Detection Limit, MDL-Minimum Detection Limit, ND- Not Detected.
Cu - MDL - 0.018 mg/l, Zn - MDL - 0.008 mg/l, Pb - MDL – 0.031 mg/l Fe - MDL – 0.119 mg/l, Mn - MDL – 0.02 mg/l, Ni - MDL – 0.26 mg/l, Co - MDL – 0.004 mg/l,Cr - MDL – 0.030 mg/l, Cd - MDL –0.053 mg/l.Hg- MDL- 1 µg/l

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Ground Water

Date of Sample Collection:- 22/04/2024
Date of Start analysis:- 22/04/2024
Date of End analysis:- 03/05/2024
Sampling By:- Central Laboratory, MP Pollution Control Board Bhopal.

S. No.	Parameter	Unit	Method	Atal Ayub Nagar, Near UCIL Factory, Bhopal	New Arif Nagar, Bhopal	Garib Nagar, Bhopal	Blue Moon & Nawab Colony Bhopal	Shakti Nagar Near Arif Nagar, Near Union Carbide Factory, Bhopal	Shiv Nagar near Hindustan Petroleum depot, Bhopal	Kanchi Chhola colony, Bhopal	DIG Banglow P.G.B. College Road, Bhopal.	IS 10500:2012 RA 2021
1.	Copper	mg/l	**3111B APHA, 23rd Edition, 2017**	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.05
2.	Chromium	mg/l		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.05
3.	Zinc	mg/l		0.010	0.041	BDL	0.07	0.03	0.013	0.017	0.04	05
4.	Manganese	mg/l		0.11	BDL	0.01	0.08	BDL	0.05	0.01	0.01	0.1
5.	Iron	mg/l		0.49	0.05	0.02	0.62	0.08	0.02	BDL	0.01	0.3
6.	Lead	mg/l		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.01
7.	Cobalt	mg/l		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	-
8.	Nickel	mg/l		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.02
9.	Mercury	µg/l	**3112 B APHA, 23rd Edition, 2017**	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.001

Remark:- BDL-Below Detection Limit, MDL-Minimum Detection Limit,
Cu -MDL - 0.018 mg/l, Zn - MDL - 0.008 mg/l, Pb - MDL – 0.031 mg/l Fe - MDL – 0.119 mg/l,
Mn - MDL – 0.02 mg/l, Ni - MDL – 0.26 mg/l, Co - MDL – 0.004 mg/l,Cr - MDL – 0.030 mg/l,
Cd - MDL –0.053 mg/l.Hg- MDL- 1 µg/l

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Surface Water

Date of Sample Collection:- 22/04/2024
Date of Start analysis:- 22/04/2024 & 03/05/204
Date of End analysis:- 24/04/2024 & 05/05/2024
Sampling By:- Central Laboratory, MP Pollution Control Board Bhopal.

S. No.	Parameter	Unit	Method	M/s.Union Carbide (UCIL) J.P. Nagar Bhopal.	Solar Evaporation Pond outside UCIL Premises, Bhopal
1.	α –BHC	µg/l	**6630B APHA, 23rd Edition, 2017**	ND	ND
2.	β- BHC	µg/l		ND	ND
3.	γ- BHC	µg/l		ND	ND
4.	δ- BHC	µg/l		ND	ND
5.	Endosulphan α	µg/l		ND	ND
6.	Endosulphan β	µg/l		ND	ND
7.	Aldrin	µg/l		ND	ND
8.	Di-eldrin	µg/l		ND	ND
9.	DDE	µg/l		ND	ND
10.	DDD	µg/l		ND	ND
11.	DDT	µg/l		ND	ND
12.	Chloroform	µg/l		ND	ND

Remark:- ND- Not Detectable. Method Detection Limit- 0.025 µg/l

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Ground Water

Date of Sample Collection:- 22/04/2024
Date of Start analysis:- 22/04/2024 & 03/05/2024*
Date of End analysis:- 24/04/2024 & 05/05/2024*
Sampling By:- Central Laboratory, MP Pollution Control Board Bhopal.

S. No.	Parameter	Unit	Method	Atal Ayub Nagar, Near UCIL Factory, Bhopal	New Arif Nagar, Bhopal	Garib Nagar, Bhopal	Blue Moon & Nawab Colony, Bhopal	Shakti Nagar Near Arif Nagar, Near Union Carbide Factory, Bhopal	Shiv Nagar near Hindustan Petroleum depot, Bhopal	Kanchi Chhola colony, Bhopal	DIG Banglow P.G.B.T College Road, Bhopal.	IS 10500:2012 RA 2021
1.	α –BHC	µg/l	**6630B APHA, 23rd Edition, 2017**	ND	ND	ND	ND	ND	ND	ND	ND	0.01
2.	β- BHC	µg/l		ND	ND	ND	ND	ND	ND	ND	ND	0.04
3.	γ- BHC	µg/l		ND	ND	ND	ND	ND	ND	ND	ND	02
4.	δ- BHC	µg/l		ND	ND	ND	ND	ND	ND	ND	ND	0.04
5.	Endosulphan α	µg/l		ND	ND	ND	ND	ND	ND	ND	ND	0.4
6.	Endosulphan β	µg/l		ND	ND	ND	ND	ND	ND	ND	ND	
7.	Aldrin	µg/l		ND	ND	ND	ND	ND	ND	ND	ND	0.03
8.	Di-eldrin	µg/l		ND	ND	ND	ND	ND	ND	ND	ND	
9.	DDE	µg/l		ND	ND	ND	ND	ND	ND	ND	ND	01
10.	DDD	µg/l		ND	ND	ND	ND	ND	ND	ND	ND	
11.	DDT	µg/l		ND	ND	ND	ND	ND	ND	ND	ND	
12.	Chloroform *	µg/l		ND	ND	ND	ND	ND	ND	ND	ND	200

Remark:- ND- Not Detectable. Method Detection Limit- 0.025 µg/l

(Dr. Alok Saxena)
Authorized Signatory
Chief Chemist
Central Laboratory MPPCB Bhopal