

**BEFORE THE NATIONAL GREEN TRIBUNAL
WESTERN ZONE PUNE**

ORIGINAL APPLICATION NO. 73 OF 2021

BRACKISH WATER RESEARCH CENTRE & ANR.

..... APPLICANT

Vs.

MOEF & CC and ORS.

..... RESPONDENT

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Pune

Date: 29/02/2024

STATUS REPORT IN O.A. NO. 73 OF 2021- BRACKISH WATER RESEARCH CENTRE VS MINISTRY OF ENVIRONMENT, FOREST & CLIMATE CHANGE & ORS.

1. The matter relates to the formation of tar balls along the west coast of India (*in the States of Gujarat, Maharashtra and Goa*) during monsoon season. The Hon'ble NGT is hearing upon the matter in OA No. 73/2021 (Brackish Water Research Centre Vs. GPCB & Others). The matter was first listed on 27.10.2021 and notice was issued to the respondents, returnable on 02.12.2021. On 02.12.2021, the Hon'ble Tribunal had directed for formation of 4-member joint committee comprising of the following:
 - i) GOI-MoEFCC represented by Secretary;
 - ii) GOI-MoPNG represented by Secretary;
 - iii) CPCB represented by Member Secretary; &
 - iv) Secretaries of Environment and Forest Dept. of State of Maharashtra, State of Gujarat and State of Goa.

2. MoEFCC was directed to be the nodal agency. The committee is directed to suggest a meaningful solution to arrest and abate the "Tar Ball" problem etc.; to look into the details of the pollution due to Tar Ball and other petroleum materials and suggest technical and administrative mechanism to address them effectively.

Action by MoEFCC

Constitution of Joint Committee:

3. In compliance of Hon'ble NGT order, MoEFCC vide order dated 21.03.2022 has constituted a committee with the following members
 - i. Secretary, Ministry of Environment, Forest & Climate Change (MoEFCC)
 - ii. Secretary, Ministry of Petroleum and Natural Gas (MoPNG)
 - iii. Secretary, Environment and Forest Departments, Govt. of Maharashtra
 - iv. Secretary, Environment and Forest Departments, Govt. of Gujarat
 - v. Secretary, Environment and Forest Departments, Govt. of Goa
 - vi. Member Secretary, Central Pollution Control Board

The **Term of Reference of the Committee** is given below:

- i. Look into the details of the problem of pollution due to "Tar Ball" and other petroleum materials.
- ii. Suggest solutions to arrest and abate the "Tar Ball" problem.

- iii. Suggest technical and administrative mechanisms to address the problem
- iv. Suggest requirement and make recommendation with regard to the requirement of a corpus fund for undertaking shore cleaning up activities in the affected states (As directed by the Hon'ble NGT vide order dated 17.04.2023).

Ministry of Ports, Shipping and Waterways and National Institute of Oceanography are also invited as 'Special Invitees to the Committee'.

Constitution of Technical Sub-Committee:

4. The 1st meeting of the NGT constituted Committee was conducted on 12.04.2022 under the Chairmanship of Ms. Leena Nandan, Secretary, MoEFCC wherein it was decided that considering that the handling of the subject requires specific domain expertise, a Technical sub-Committee is constituted to assist the NGT constituted Committee. The major decisions and deliberations of the NGT Constituted Committee were as under:
 - *Being a highly technical matter requiring domain expertise, the CPCB will act as the nodal agency for convening the business of 'Technical sub-Committee', with MoEFCC support.*
 - *The 'Terms of Reference of the 'Technical sub-Committee' would be as follows:*
 - *Identification of the source of tar balls covering all possible scenarios like operation of off-shore oil fields, ship leakages/ discharges, oil spill events etc.*
 - *Review the current mechanism of addressing tar-ball problem at Indian coasts/ beaches and identify gaps, if any*
 - *Suggest preventive measures required at source to minimize leakage of oil/ petroleum materials that eventually lead to formation of tar-balls, covering global best practices*
 - *Suggest mechanisms to arrest tar-balls at Sea, based on global practices*
 - *Suggest administrative and technical frameworks as well as monitoring/ vigil mechanisms that can be introduced under relevant statutes, in line with the Allocation of Business Rules of various nodal agencies*
 - *Prepare Standard Operating Procedures (SOPs) for typical tar-ball sources like offshore Oil field operators, Passenger Ships/ Cargo Vessels, Oil Spill events etc., in alignment with the National Oil-Spill Disaster Contingency Plan (NOS-DCP)*

5. Further, the 1st meeting of the Technical Sub-Committee created to assist the Hon'ble NGT Committee constituted in the matter of Brackish Water Research Centre Vs Gujarat Pollution Control Board & Ors. (OA No.73 of 2021) related to formation of Tar-balls along the coast of Goa, Gujarat and Maharashtra was conducted on 10.05.2022. The major decisions and deliberations of the Committee are as under:

- *The Technical sub-Committee agreed upon the following issues:*
 -
 - *There is no method available to track, quantify and control crude oil seepage and slicks of natural origin.*
 - *Tar ball formations resulting from anthropogenic sources can occur due to offshore oil exploration activities, oil tanker accidents, oil-well blowouts, pipeline leakages, release of bilge and industrial effluent from from ships and tanker washes/ leakage spills along tanker route.*
 - *Considering the busy international shipping route along the west coast, it is very difficult to attribute a single source for tar ball formations with high degree of confidence*
 - *The tar-ball problem formation is a global issue and many countries are grappling with the problem due to location of oil fields, international shipping routes etc.*
 - *In view of the uncertainty associated with tar ball source identification, it would be an appropriate strategy to prepare scenario-specific Standard Operating Procedures for stakeholders*
- *The Technical Sub-Committee decided that a study needs to be conducted with CSIR-NIO as lead agency and CPCB and MoPNG as co-lead. The other key stakeholders like Indian Coast Guard, which has already formulated a National Oil-Spill Disaster Contingency Plan (NOS-DCP), was also requested to provide technical and administrative support to the study.*
- *The broad ToR of the study shall be as follows:*
 -
 - *Identification of various sources of tar balls covering all possible scenarios like operation of off-shore oil fields, ship leakages/ discharges, oil spill events etc.*
 - *Review the current mechanism of addressing tar-ball problem at Indian coasts/ beaches and identification of gaps*
 - *Suggest preventive measures required at source in respect of all scenarios like operation of off-shore oil fields, ship leakages/ discharges, oil spill events etc. to minimize leakage of oil/ petroleum materials that eventually lead to formation of tar-balls*
 - *Study of global best practices on prevention of tar balls formation and measures taken to contain tar ball pollution*

- *Suggest viable mechanisms to arrest tar-balls at Sea, based on global practices*
- *Suggest introducing administrative and technical frameworks for monitoring/ under relevant statutes, in line with the Allocation of Business Rules of various nodal agencies*
- *Prepare detailed Standard Operating Procedures (SOPs) for typical tar-ball sources like offshore Oil field operators, Passenger Ships/ Cargo Vessels, Oil Spill events etc., in alignment with the National Oil-Spill Disaster Contingency Plan (NOSDCP).*

Award of Study to CSIR-NIO, CPCB and MoPNG

6. CSIR-NIO vide mail dated 12.08.2022 which was consulted with other participating agencies, such as CPCB, MoPNG/ONGC, ICG, MoPSW, to invite their comments. Thereafter, MoEFCC awarded a project to CSIR-NIO, CPCB, MOPNG to study the aspects related to tar ball formation and its management vide sanction order dated 01.12.2022. Thereafter, in the intervening period, the MoEFCC asked CSIR-NIO to cover the issue of requirement of a corpus fund for undertaking shore cleaning up activities in the affected states (as directed by the Hon'ble NGT vide order dated 17.04.2023)
8. The CSIR-NIO vide letter dated 29.09.2023 submitted the Project Report on Formation of Tarballs along the Gujarat, Maharashtra and Goa Coasts: Constraints on possible sources and mitigation measures.
9. The 2nd meeting of Technical Sub-Committee created to assist the Joint Committee was held on 07.11.2023 (*Copy of Deliberations of meeting enclosed*).
10. Thereafter, the 2nd meeting of the Joint Committee constituted by the Hon'ble NGT, was conducted on 17.01.2024 under the co-chairing of Secretary, MoEFCC and Secretary, MOPNG (*Copy of Records of Discussion of Meeting enclosed*). The major deliberations of the committee were on the following issues:
 - i. *The origin of tar-balls or source identification be further worked upon to remove any kind of doubt or ambiguity on the source of tar-balls as the area under reference i.e. west coast of India, is an international shipping route as well as an oil-rich area wherein many oilfields and commercial exploration activities are operational.*
 - ii. *The International Oil Pollution Compensation Fund (IOPC) is already operational under the auspices of the International Maritime Organization (IMO) to provide financial compensation for oil pollution damage that occurs in Member States, resulting from spills of persistent oil from tankers.*
 - iii. *Commercial offshore oil exploration operations are industrial processes, and their routine compliance monitoring vis-a-vis applicable environmental regulations needs to be analysed.*

- IV. *Need for identification and fixation of the physical scope of the problem, i.e. the extent of the coastal area impacted by the tar-ball formations.*

Based on the deliberations, the Committee decided that TSC may take up the following issues through further study by the engagement of all relevant stakeholders:

- I. **To find the source of tar-balls by through acceptable scientific source apportionment tools available.**
- II. **To explore the utilization of the IOPC fund as a financing mechanism for management of tar-balls, for which India makes substantial contribution.**
- III. **To assess the environmental compliance of offshore oil exploration operations in general, and oil spill management in particular, through involvement of ICG, MoPNG, PCBs, Maritime Boards and CZMAs of Goa, Gujarat and Maharashtra.**
- IV. **To assess leakages/ spills by shipping lines in the west coast and fix their responsibility in formation of tar balls.**
- V. **To identify and fix the physical extent of the affected area along western coast, covering details of districts, population, commercial and livelihood activities impacted, and enlist typical remedial measures based on which the actual requirement of districts for remedial measures and quantum of corpus fund can be worked out.**

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Deliberations of the 2nd meeting of the Technical Sub-Committee created to assist the Joint Committee constituted by the Hon'ble NGT in the matter of Brackish Water Research Centre Vs Gujarat Pollution Control Board & Ors. (OA No.73 of 2021) related to the formation of Tar-balls along the coast of Goa, Gujarat, and Maharashtra

The 2nd meeting of the above referred Technical Sub-Committee was held on 07-Nov-2023 chaired by Shri Naresh Pal Gangwar, Additional Secretary, MoEFCC. The detailed list of participants is annexed in Annex-I.

2. At the outset, the MoEFCC representatives welcomed all the participants and provided a background of the issue, which is annexed in Annex II. The MoEFCC, on the recommendation of TSC, had awarded a study to CSIR-NIO with specific Terms of Reference. Thereafter, the CSIR-NIO representatives were requested to make a presentation before the TSC on the findings of the report. In line with the TORs given, the NIO team started with a brief background on formation, movement, deposition, tracking of tar balls, etc. The NIO team made a TOR-wise presentation, and the Committee made observations and detailed deliberations on the TORs. The TOR-wise deliberations are presented in Annex II.

3. The summary of report and observations made thereupon are as follows:

<p>ToR Point 1 - Identification of various sources of tar balls covering all possible scenarios like operation of off-shore oil fields, ship leakages/ discharges, oil spill events etc.</p>	<p><u>Observations</u></p> <ul style="list-style-type: none"> • Standard scientific techniques viz. fingerprint analysis, particle tracking or trajectory simulation, and remote sensing utilized for source identification • East Arabian Sea has three oil spill/ slick hot spot zones i.e. near the Gulf of Kutch (Gujarat), Off the Mumbai coast (near Bombay High Oil fields), and off the Karnataka-Kerala coast • Tar ball occurrences in Gujarat in April, and Goa between May to September are indicative of the influence of wind, local tides, surface currents, and the south-westerly monsoon system. • The intensity of events along the timeline indicates that offshore operations in the Bombay High Oil Fields are the major sources of the oil spill and slicks, followed by the movement of ships (passenger and cargo)
<p>ToR Point 2 - Review the current mechanism</p>	<p><u>Observations</u></p>

<p>of addressing tar-ball problem at Indian coasts/ beaches and identification of gaps</p>	<ul style="list-style-type: none"> • Tar ball management is done by the State Government/ District covering their manual or semi-mechanical collection and transportation to Authorized TSDF • 'Polluter pays Principle' needs to be introduced • ONGC recommended the usage of porphyrin compounds chelated with metals for tar ball tracing • Ascertaining nature and source of oil spills is challenging, and may include operational mismanagement in oil fields, pipeline leaks, or natural seepage. • Need for coordination and communication among government agencies, and stakeholders (oil field operators and ship operators) • Strengthening of requisite infrastructure for tar ball cleanup on 'Polluter pays Principle' • Need for public awareness, enforcement of environmental regulations, and adequate reporting mechanisms to initiate actions in a timely manner
<p><u>ToR Point 3</u> - Suggest preventive measures required at source in respect of all scenarios like operation of off-shore oil fields, ship leakages/ discharges, oil spill events etc. to minimize leakage of oil/ petroleum materials that eventually lead to formation of tar-balls</p>	<p><u>Observations</u></p> <ul style="list-style-type: none"> • Detailed list of preventive measures provided in study report w.r.t. oil field operations, movement of ships, and oil spill events. • Manual methods such as a hand rake and shovel, sorbents, or mechanical methods such as maintainers/ road graders and small front-end loaders, skimmers, and vacuum systems can be used to remove oil deposited on a surface
<p><u>ToR Point no.4</u> - Study of global best practices on prevention of tar balls formation and measures taken to contain tar ball pollution</p>	<p><u>Observations</u></p> <ul style="list-style-type: none"> • Globally, tar balls management is addressed through various measures like Oil Spill Cleanup Plans and Expert Teams, implementation of regulations, globally coordinated actions^[1] (by IMO, OPRC, and MARPOL), contingency plans and EIA, spill response equipment and training, improved tanker designs, use of oil spill dispersants, monitoring and research, and suspended oil detection methods

	<ul style="list-style-type: none"> • Further, sensitivity assessment is done considering the presence of natural resources such as birds, shellfish, drinking water intakes, corals, and coastal recreational areas in a geographical region • Advanced technologies, such as remotely operated vehicles (ROV) and automated underwater vehicles (AUV) may be utilized for the detection and management of underwater oil plumes during spill events
<p><u>ToR Point no.5</u> - Suggest viable mechanisms to arrest tar-balls at Sea, based on global practices</p>	<p><u>Observations</u></p> <ul style="list-style-type: none"> • Since tar ball pollution is caused by the oil spills or oil slicks, its management strategy must focus on the prevention of oil spills, and arresting the oil spill • No feasible mechanisms are available to arrest tar ball at high seas • Oil spills and tar ball pollution at sea (near shore) can be contained with the help of shore sealing booms, aerial surveillance and response, and Bioremediation
<p><u>ToR Point no.6</u> - Suggest introducing administrative and technical frameworks for monitoring/ under relevant statutes, in line with the Allocation of Business Rules of various nodal agencies</p>	<p><u>Observations</u></p> <ul style="list-style-type: none"> • Indian Coast Guard (ICG), Ministry of Defence is the central coordinating authority for combating oil spills in Indian waters as per the Government of India (Allocation of Business) Rules, 1961, and has developed a National Oil Spill Disaster Contingency Plan (NOS-DCP) outlining functional responsibilities for various Ministries and Departments of the Government of India, the State Governments and the District Administration in responding to oil spills in Indian maritime zones. • Recommendations considered for further delegation of certain responsibilities in line with NOS-DCP • Provisions of OPRC and MARPOL can be effectively utilized in oil spill management and tar ball formation
<p><u>ToR Point no.7</u> - Prepare detailed Standard Operating Procedures (SOPs) for typical tar-ball sources like offshore Oil field operators, Passenger</p>	<p><u>Observations</u></p> <ul style="list-style-type: none"> • Study report has enlisted Standard Operating Procedures (SOPs) for Offshore Oil fields, Movement of Ships, and other oil spill events that are aligned to the NOS-DCP • Adequate guidance and regulations are also

Ships/ Cargo Vessels, Oil Spill events etc., in alignment with the National Oil-Spill Disaster Contingency Plan (NOSDCP)	<p>available under the OPRC and MARPOL conventions to prevent and manage oil spill incidents</p> <ul style="list-style-type: none"> • Concerned agencies are required to synergize while implementing the provisions • Three response mechanisms viz. Mechanical containment or recovery, Chemical and biological methods, and Physical methods are mentioned
ToR Point no.8 - Suggest requirement and make recommendations with regard to the requirement of a corpus fund for undertaking shore cleaning up activities in the affected states	<p><u>Observations</u></p> <ul style="list-style-type: none"> • In view of the non-feasibility of arresting tar balls on high seas, the focus should be to collect, arrest, and manage tar balls near the shore and along the coast. • Tar ball removal may be done by manual and mechanical methods, and disposal may be done through co-incineration in a cement plant or common incineration in the Treatment, Storage, and Disposal Facility (TSDF). • Based on Polluter pays principle, a mechanism to finance shore cleaning-up activities may be developed with the involvement of industries/ stakeholders engaged in Offshore crude oil production, Oil transport pipeline infrastructure, Coastal Refineries, Ports, Harbors, and Jetties, Wharves and other shipping infrastructures, Coastal oil receiving facility operators, and Ships transiting through the hotspot zones identified in the study report

4. After detailed deliberations, the TSC made following recommendations:

- i. **It is inferred from the report that the main sources of the oil and resulting tar balls are offshore oil rigs/ drilling operations, to a major extent, and shipping lines/ tankers to some extent.**
- ii. **NOS-DCP may be updated to include new and advanced measures like ROVs and AUVs, to detect and manage underwater oil plumes during spill events to effectively tackle the oil spill incidents, which eventually result in the formation of tar balls. Additionally, the responsibilities assigned to key stakeholders are synergized with the provisions stipulated under MARPOL and OPRC.**
- iii. **Coastal State Governments, through the involvement of the State Environment Department and State Coastal Management Authority, should constitute a State Level Crisis Management**

- Group for the management of oil pollution incidents and tarball pollution, and direct the local administration (or authorities) to set up a District Shoreline Response Centers (DSRC)**
- iv. **CPCB to develop a Standard Operating Procedure for the utilization of Tar Balls in the cement industry through co-processing or any other waste-to-energy method, and its disposal in the TSDF**
 - v. **CSIR-NIO (M/o Science and Technology), NIOT (M/o Earth Sciences), INCOIS (M/o Earth Sciences), NCSCM (M/o Environment, Forest and Climate Change) and CPCB may form a consortium and develop an Environmental Sensitivity Index of various coastal areas considering the presence of natural resources, such as birds, shellfish, drinking water intakes, corals, and coastal recreational areas in the geographical region. CPCB may coordinate this activity.**
 - vi. **State Governments may undertake the compilation of time-series data of oil spills and tar ball formation events and tie up with R&D institutes to develop mathematical models to make advanced predictions, and preparations, and have better decision-making.**
 - vii. **MoPNG and M/o Ports, Shipping and Waterways (M/o PSW) to undertake consultation with key stakeholders identified in ToR point no.8. and create a corpus fund for financing the activities of District Shore Cleaning Centers, including purchase and maintenance of equipment for shore cleaning, transport of tarball waste from shore to disposal facility or industry, undertake further research in oil spill and tarball pollution, and other associated expenditures related to the management of oil spill and tarball pollution. MoPNG will also develop a mechanism of continuous monitoring and implementation of the above recommendations, and all prevention and mitigation measures.**
 - viii. **MoPSW and the Directorate General of Shipping may ensure that the guidance, regulations, and Standard Operating Procedures provided under the OPRC and MARPOL convention are implemented rigorously.**

5 . The Chair, while summing up the deliberations, informed that the observations and the recommendations of this TSC shall be placed before the NGT-constituted Joint Committee Co-chaired by by the Secretary (EF&CC) and Secretary (PNG) for consideration and approval. The recommendations, thus finalized, shall be submitted to the Hon'ble NGT. Gist of the NIO report and detailed deliberations on that are annexed below for kind reference.

The meeting ended with a vote of thanks to the Chair.

Annex-I

List of Participants

1. Shri Naresh Pal Gangwar, Additional Secretary, MoEFCC
2. Shri Ved Prakash Mishra, Director, MoEFCC
3. Shri Dinabandhu Gouda, CPCB

4. Shri Surendra Kumar Karwasara, Indian Coast Guard
5. Dr. Suneel Vasimalla, National Institute of Oceanography (CSIR-NIO), Goa
6. Shri Durbar Ray, CSIR-NIO, Goa
7. Dr Prince Prakash Jeba Kumar, National Institute of Ocean Technology, M/o Earth Sciences
8. Shri J Sethil, Director of General of Shipping
9. Shri RB Trivedi, Gujarat Pollution Control Board (GPCB)
10. Shri D.P. Patel, GPCB
11. Shri G.L. Das, DGH, MoPNG
12. Shri Gopal Bansal, DGH, MoPNG
13. Shri R Ranjan, DGH
14. Shri Subhyant Das Gupta, MoPNG
15. Shri V.C. Chaudhary, MoPNG
16. Shri Dinesh Runiwal, Scientist-E, MoEFCC

Annex-II

Gist of the report and deliberations thereupon

Background of the Issue

The Hon'ble NGT is hearing a matter related to the formation of tar ball along the western coast of India, especially in the states of Gujarat, Goa and Maharashtra. As per the directions, MoEFCC had created a Joint committee to delve upon the issue and give recommendations. The Joint Committee met on 12-April-2022 and deliberated on the issue, and considering the technical nature of the subject requiring specific domain expertise, decided to create a TSC. The TSC, created by MoEFCC, met on 10-May-2022 and undertook detailed deliberations wherein it agreed on the following:

- There is no method available to track, quantify and control crude oil seepage and slicks of natural origin
- Tar ball formations resulting from anthropogenic sources can occur due to offshore oil exploration activities, oil tanker accidents, oil-well blowouts, and pipeline leakages, release of bilge and industrial effluent from ships and tanker washes / leakage spills along tanker route.
- Considering the busy international shipping route along the west coast, it is very difficult to attribute a single source for tar ball formations with high degree of confidence
- The problem of tar-ball formation is a global issue and many countries are grappling with the problem due to location of oil fields, international shipping routes etc.
- In view of the uncertainty associated with tar ball source identification, it

would be an appropriate strategy to prepare scenario-specific Standard Operating Procedures for stakeholders

2. Further, the TSC decided to award a study to CSIR-NIO as lead agency and CPCB and MoPNG as co-lead with the following Terms of Reference:

- Identification of various sources of tar balls covering all possible scenarios like operation of off-shore oil fields, ship leakages/ discharges, oil spill events etc.
- Review the current mechanism of addressing tar-ball problem at Indian coasts/ beaches and identification of gaps
- Suggest preventive measures required at source in respect of all scenarios like
- operation of off-shore oil fields, ship leakages/ discharges, oil spill events etc. to minimize leakage of oil/ petroleum materials that eventually lead to formation of tar-balls
- Study of global best practices on prevention of tar balls formation and measures taken to contain tar ball pollution
- Suggest viable mechanisms to arrest tar-balls at Sea, based on global practices
- Suggest introducing administrative and technical frameworks for monitoring/ under relevant statutes, in line with the Allocation of Business Rules of various nodal agencies
- Prepare detailed Standard Operating Procedures (SOPs) for typical tar-ball sources like offshore Oil field operators, Passenger Ships/ Cargo Vessels, Oil Spill events etc., in alignment with the National Oil-Spill Disaster Contingency Plan (NOSDCP)
- Suggest requirement and make recommendations with regard to the requirement of a corpus fund for undertaking shore cleaning up activities in the affected states.

ToR-wise deliberations

- a. *Point no.1 - Identification of various sources of tar balls covering all possible scenarios like operation of off-shore oil fields, ship leakages/ discharges, oil spill events etc.*

The NIO representatives mentioned that for source identification, it has referred to various scientific studies carried out in the past (from 2009 onwards), which had employed three scientific techniques viz. fingerprint analysis, particle tracking or trajectory simulation and remote sensing. The Committee noted that there are three hot spot zones of oil spill in the East Arabian Sea which result in the formation of tarballs i.e. near Gulf of Kutch (Gujarat), Off Mumbai coast (near Bombay High Oil fields) and off Karnataka-Kerala coast. The nature and distribution of oil spills observed through remote sensing near Gulf of Kutch (Gujarat) and off Karnataka-Kerala coast is scattered in a linear manner around the international oil tanker route indicating the source of spills as cargo movements; however, the distribution of spill Off Mumbai coast (near Bombay High Oil fields) is concentrated around the Bombay High Oil fields.

The NIO team also referred to scientific simulation studies to understand the forcing mechanism on tar ball transport between April to July i.e. considering the influence of wind, local tides, surface currents and south westerly monsoon system. It concluded from the studies that the trajectories of the oil particles or tar balls remain southeast bound in April-May; however, due to strong winds of the south-west monsoon in June-July the direction changes under the influence of winds and they reach the western coast. The occurrence of tar ball at Gujarat in April, and Goa between May to September are an example of the same pattern.

In view of the above, the Committee took on record the study finding that the offshore operations the Bombay High Oil Fields appear to be one of the major sources of oil spill and slicks, and the movement of ships (passenger and cargo) within the INDIAN jurisdiction in the eastern Arabian Sea, which eventually result in formation of tar balls and its deposition along the western coast of India.

b. *Point no.2 - Review the current mechanism of addressing tar-ball problem at Indian coasts/ beaches and identification of gaps*

Current Mechanism - NIO Team presented that there is significant research available on tar ball pollution along the Indian coasts, focusing on source identification, transport patterns, and remedial measures. The investigations have utilized standard scientific tools like chemical fingerprinting and biomarkers to trace the source of tar balls. Research also indicate that microorganisms, particularly fungi and bacteria, utilize hydrocarbons in tar balls as a carbon source. Studies have identified diverse microbial genera associated with tar balls, some of which are known hydrocarbon degraders, which is a significant potential of bioremediation. Apart from this, several bacterial consortia have shown promising results in reducing n-alkanes and polycyclic aromatic hydrocarbon compounds in tar balls. The ONGC has recommended to use porphyrin compounds chelated with metals for doing tracing tar ball and oil spill sources. The Committee noted that as of now the tar ball problem is dealt at the level of State Government/ District Administration as and when the tar balls are washed towards the beaches/ coast. The tar balls are collected manually or semi-mechanically and transported to the authorized TSDF for incineration wherein the cost of disposal of tar balls is borne by the State Government. However, considering the 'Polluter pays Principle', there is need to put onus to meet the cost of disposal on the polluter.

Gaps - The Committee noted that there are challenges in understanding the nature and causes of oil spills, whether from operational mismanagement, pipeline leaks, or natural seepage. Non-availability of requisite infrastructure for tar ball cleanup require better coordination and communication among government agencies, and involvement of industry stakeholders involved in production of oil from offshore operations and oil cargo movements and other shipping operations. Additionally, public awareness, enforcement of environmental regulations and adequate reporting mechanisms are need to

allow concerned authorities to take required actions in a timely manner, in case an oil spill has happened.

The Committee was also of the opinion that clean-up infrastructure needs to be strengthened to undertake operations, at the earliest, with a view to save marine ecology.

c. Point no.3 - Suggest preventive measures required at source in respect of all scenarios like operation of off-shore oil fields, ship leakages/ discharges, oil spill events etc. to minimize leakage of oil/ petroleum materials that eventually lead to formation of tar-balls

The Committee took on record the detailed list of preventive measures mentioned in the report w.r.t. various processes and scenarios like oil field operations, movement of ships, and oil spill events. It also noted that the concept of Environmental Sensitivity Index (ESI) for marine or coastal regions are utilized globally wherein a sensitivity assessment is done considering the presence of natural resources, such as birds, shellfish, drinking water intakes, corals, and coastal recreational areas in the geographical region. The report mentioned that depending on the character, type, and sensitivity of the shoreline and the physical and chemical properties of the oil (i.e., amount, type, and degree of weathering), various methodologies may be employed to mitigate an oil spill event. The oil deposited on a surface may be removed by manual methods such as a hand rake and shovel, sorbents, or by mechanical methods such as maintainers/ road graders and small front-end loaders, skimmers, and vacuum systems.

The authorities may develop a similar concept which can be introduced in the country with the help of research institutions to mark the sensitivity of an area, and can be identified as marine protected area. The Committee also noted that preventive techniques like the monitoring and assessment of oil spills through remote sensing and routine monitoring can help authorities to remain better prepared in case the oil spill happens in the sea, and the possibility of formation of tar balls to get washed up to the shore is there. Further, compilation of a time-series data on such scenarios can help developing mathematical models to make preparations in advance, and to have better decision making from policymakers and administrative authorities.

d. Point no.4 - Study of global best practices on prevention of tar balls formation and measures taken to contain tar ball pollution

The study report mentions that the tar balls formation and its deposition on the coast is a common problem faced by many countries globally who are involved in offshore oil drilling operations or are near to the international routes of movement of ships, oil tankers and cargos. Accordingly, various measures have been taken by countries to address the pollution emanating from oil spill incidents and tar ball formation as mentioned below:

- Oil Spill Cleanup Plans and Expert Teams: Countries prone to oil spills have

established response plans, such as the Shoreline Cleanup Assessment Technique (SCAT) programs. Further, multi-agency expert teams, comprising representatives from different stakeholders are constituted to ensure a coordinated and quick response to oil spills.

- Implementing Regulations: Governments have enacted laws and regulations governing shipping, offshore drilling, and petroleum industries to prevent oil spills, which contain safety protocols and measures for prevention of oil spillage.
- Globally coordinated actions: International organizations like the International Maritime Organization (IMO) have set standards and guidelines for preventing and responding to marine oil pollution. It also have conventions viz. International Convention on Oil Pollution Preparedness, Response and Co-operation (OPRC) and the International Convention for the Prevention of Pollution from Ships (MARPOL) to steer globally coordinated efforts for addressing marine pollution. Under the Global Maritime Distress and Safety System (GMDSS), ships are required to report any incidents that may lead to pollution or other environmental hazards.
- Contingency Plans and Environmental Impact Assessment: Companies must conduct environmental impact assessments and develop contingency plans before undertaking offshore drilling or major sea-based operations. In case of India, the National Oil Spill Disaster Contingency Plan (NOS-DCP) prepared by Indian Coast Guards outline responsibilities, resources, and arrangements for rapid response.
- Spill Response Equipment and Training: Organizations involved in marine operations must maintain oil spill response equipment onboard and provide regular training to personnel for spill-related emergencies.
- Improved Tanker Designs: Advancements in tanker design, such as double-hull tankers, aim to minimize the risk of oil spills.
- Use of Oil Spill Dispersants: Responders may use oil spill dispersants to break up oil layers into smaller droplets, reducing the likelihood of tar ball formation.
- Monitoring and Research: Continuous monitoring of oil-spill-prone areas and research on oil-spill impacts help improve response and prevention strategies.
- Suspended Oil Detection Methods: Detection technologies, including remotely operated vehicles (ROVs) and autonomous underwater vehicles (AUVs), assist in tracking submerged oil intrusion layers during spills. In situ measurements provide real-time data on the distribution of submerged oil, aiding response plans. Submarine devices like gliders, deep submerged vehicles, and ship-lowered rosettes with in situ sensors and cameras are also used to detect submerged oil in real time by measuring CDOM (colored dissolved organic matter), PAHs (polycyclic aromatic hydrocarbon), and DO (dissolved oxygen).

The Committee noted that despite taking these measures, the risk of oil spills and tar ball pollution remains, hence, it emphasized the need for a holistic approach that combines prevention with effective response and cleanup strategies. Advanced technologies, such as ROVs and AUVs, play a crucial

role in detecting and managing underwater oil plumes during spill events. It helps in inspection of oil rigs to find the location of the oil released, evaluate its degree of spreading, and identify the composition of the oil.

The Committee opined that the NOS-DCP can be updated to include new and advanced measures to effectively tackle the oil spill incidents, which eventually result in formation of tar balls also. Further, the State Government of a coastal state, which is required to constitute a State Level Crisis Management Group for management of oil pollution incidents, termed SOS-CMG direct the local administration (or authorities) or the concerned industry bodies (in consultation with local authorities) to set up a Shoreline Response Centre (SRC) based on the 'Polluter pays principle'.

The Committee further noted that provisions of OPRC and MARPOL may be effectively implemented by the Ministry of Ports, Shipping and Waterways. The MARPOL regulations aimed at preventing and minimizing pollution from ships are mentioned below:

- Annex I: Regulations for the Prevention of Pollution by Oil
- Annex II: Regulations for the Control of Pollution by Noxious Liquid Substances in Bulk.
- Annex III: Prevention of Pollution by Harmful Substances carried by Sea in Packed Form
- Annex IV: Prevention of Pollution by Sewage from Ships
- Annex V: Prevention of Pollution by Garbage from Ships
- Annex VI: Prevention of Air Pollution from Ships

Similarly, OPRC member states are required to establish measures for dealing with pollution incidents, either nationally or in cooperation with other countries. According to OPRC provisions, following measures are need to be taken:

- Ships are required to carry a shipboard oil pollution emergency plan
- Operators of offshore units are also required to have oil pollution emergency plans or similar arrangements which must be coordinated with national systems for responding promptly and effectively to oil pollution incidents
- Ships are required to report incidents of pollution and details of the actions taken, in case such incidents happen, to coastal authorities and the convention
- Parties are required to assist others in the event of a pollution emergency, and provision is made for the reimbursement of any assistance provided.

e. Point no.5 - Suggest viable mechanisms to arrest tar-balls at Sea, based on global practices

The study report mentions that the tar ball pollution is caused as an after effect of the oil spill or oil slick. Hence, the tar ball management strategy must focus on prevention of oil spills, and arresting the oil spill, in case such

incident happens. The tar ball formation is a delayed process after spillage of oil under the weathering action of atmosphere, sea water, currents, winds and chemical or biological agents. After the formation and movement of tar balls towards the beaches, the process of arresting at sea involves implementing mechanisms and technologies to collect, and remove tar ball pollution from the marine environment before it causes harm to the ecosystem and reach the coast or beaches. **The Committee noted that there are no mechanisms to arrest tar ball at high seas.** However, some of the below-mentioned techniques can help in containing the oil spills and tar ball pollution at sea.

- Shore sealing booms - Air and water-filled booms are used to seal the land and water connection, thus forming a temporary shore. Their deployment at marine sensitive zones or coast or beach can restrict depositions on the shore.
- Aerial Surveillance and Response - Aerial surveillance using choppers or drones can be used to monitor oil spills over large areas in the sea. By implementing advanced monitoring technology, floating tar balls, their movement, and trajectories can be detected, and information can be shared with coastal districts for quick response coordination and timely deployment of containment and clean-up facilities. However, aerial survey has limitations in detection of sunken or suspended tar balls.
- Bioremediation - Bioremediation is the method of introducing microorganisms for breakdown of oil, and facilitate the natural degradation of tar balls in the sea.

f. *Point no.6 - Suggest introducing administrative and technical frameworks for monitoring/ under relevant statutes, in line with the Allocation of Business Rules of various nodal agencies*

The Committee noted that the Indian Coast Guard (ICG), Ministry of Defence is the central coordinating authority for combating oil spills in Indian waters as per the Government of India (Allocation of Business) Rules, 1961. The responsibilities of ICG cover the following:

- a. Coordinating Agency for combating oil pollution in various maritime zones;
- b. Implementation of a national contingency plan for oil spill disasters;
- c. Surveillance of maritime zones for oil spills;
- d. Combating oil spills in various maritime zones except within the jurisdiction of ports and oil installations; and
- e. Undertaking oil spill prevention and control, inspection of ships (except within ports) and offshore platforms in the country.

The ICG has prepared a National Oil Spill Disaster Contingency Plan (NOS-DCP) outlining functional responsibilities for various Ministries and Departments of the Government of India, the State Governments and the District Administration in responding to oil spills in Indian maritime zones. The plan applies to incidents of marine casualties posing severe danger to the Indian coastline, covering deliberate, negligent, or accidental releases of oil,

ballast water, and harmful substances. The plan encompasses incidents in all parts of the sea and inland areas likely to affect India's maritime zones, including territorial waters, the Exclusive Economic Zone (EEZ), and the High Seas.

Based on the roles and responsibilities prescribed to various agencies under the NOS-DCP, the Committee noted that the following specific activities can be further delegated to the authorities:

Agencies	Roles
State Governments and District Administration	<ul style="list-style-type: none"> • Undertake response activities, including cleaning and disposal, through involvement of relevant state level agencies viz. Transport, Coastal Zone Management, Environment and Forest Conservation, Resource Management, Environmental Protection Authorities, Emergency Services, Port/ Harbor Authorities • If required, Local Environmental Conservation and Civil Society Groups may be roped in the process.
Indian Coast Guard (M/o Defence)	<ul style="list-style-type: none"> • Undertake regular air and water surveillance of oil spill hot spots in high seas, and disseminate quarterly report to all relevant agencies, especially State Governments and District Administration • Send immediate emergency alerts on offshore oil spill events/ cases, if any
Central Pollution Control Board (M/o Environment, Forest and Climate Change)	<ul style="list-style-type: none"> • Render technical assistance to State Government and union Territories through the State Pollution Control Boards or Pollution Control Committees, in Accordance with the State-specific Contingency Plan.
Ministry Of Ports, Shipping and Waterways and Directorate General of Shipping	<ul style="list-style-type: none"> • Responsible to undertake or coordinate clean-up activities at ports, jetties, wharves, and other structures constructed within their jurisdiction, and at beach/ shoreline owned by the port authority • Take administrative and legal action for processing claims against expenditure or cost incurred by the Indian Coast Guard and other agencies in managing oil spill incidents • Develop Guidance to advise and facilitate other agencies in submitting claims the expenditure or cost incurred for managing pollution or oil spill from ships, including guidance on collection and submission of requisite evidence
Ministry of Petroleum and Natural Gas through its Offshore Installations	<ul style="list-style-type: none"> • Provide monthly oil leakage or spill incident reports of every installation (up to 500 meters) to ICG, nearby Coastal State Governments, including their State Pollution Control Boards or Pollution Control Committees, and Central Pollution Control Board
National Remote	<ul style="list-style-type: none"> • Undertake analysis on oil pollution around each and

Sensing Agency	every installation up to 500 meters and oil spill hot spots, and provide monthly reports ICG, nearby Coastal State Governments, including their State Pollution Control Boards or Pollution Control Committees, and Central Pollution Control Board
Indian Council of Agricultural Research	<ul style="list-style-type: none"> • Undertake research, and map the risks and consequences of tar ball pollution on fisheries and aquaculture, and compile related scientific evidence • Undertake research on devising measures to reduce the impacts of tar ball pollution on fisheries and aquaculture

- g. Point no.7 - Prepare detailed Standard Operating Procedures (SOPs) for typical tar-ball sources like offshore Oil field operators, Passenger Ships/ Cargo Vessels, Oil Spill events etc., in alignment with the National Oil-Spill Disaster Contingency Plan (NOSDCP)

The Committee took on record the Standard Operating Procedures (SOPs) mentioned in the study report for Offshore Oil fields, Movement of Ships and other oil spill events, and noted that the SOPs are aligned to the NOS-DCP, which is the standard protocol for coordinating oil spill incidents. It also noted that there is adequate guidance and regulations available under the OPRC and MARPOL convention also to prevent and manage oil spill incidences. Hence, the concerned agencies are required to implement the provisions in letter and spirit, and synergize their efforts. It is noted that the NOSDCP provisions on oil pollution preparedness and response requirements are categorized into three 'tiers':

- Tier 1 is concerned with preparedness and immediate response to a small spill within the capabilities of facility operator or port authority (oil spill Qty: <700Ton).
- 'Tier 2' describes a wide range of spill sizes and potential scenarios response assistance for which can come from entities within a port area or from national sources outside the immediate geographic area (oil spill Qty:>700 T - <10,000Ton).
- Tier 3 is concerned with a major spill requiring the mobilization of all available national resources and depending upon the circumstances, will likely involve mobilization of regional and international systems (more than 10,000 tonnes).

The responses are classified into three mechanisms viz. Mechanical containment or recovery, Chemical and biological methods and Physical methods. The mechanical containment is the primary line of defense against oil spills wherein containment and recovery equipment include a variety of booms, barriers, and skimmers, as well as natural and synthetic sorbent materials. Mechanical containment is used to capture and store the spilled oil until its disposal. The chemical and biological methods can be used in conjunction with mechanical means for containing and cleaning up oil spills wherein dispersing agents and gelling agents are useful in helping to keep oil

from reaching shorelines and other sensitive habitats. The biological agents have the potential to assist recovery in sensitive areas such as shorelines, marshes, mangroves etc. The physical methods are used to clean up shorelines wherein natural processes such as evaporation, oxidation, and bio degradation can start the cleanup process, but are generally too slow to provide adequate environmental recovery. It primarily involves physical methods such as wiping with sorbent materials, pressure washing, and raking and bulldozing can be used to assist these natural processes.

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- h. *Point no.8 - Suggest requirement and make recommendations with regard to the requirement of a corpus fund for undertaking shore cleaning up activities in the affected states.*

In view of the facts mentioned in the study report, the Committee unanimously noted and agreed that the formation of tar balls in the high seas is a natural phenomenon; however, its origin depends on the incidences of anthropogenic and natural oil spills and seepages. Accordingly, there is a need to arrest or manage the anthropogenic sources like offshore oil exploration activities, oil tanker accidents, oil-well blowouts, and pipeline leakages, release of bilge and industrial effluent from ships and tanker washes / leakage spills along tanker route. The Committee also noted that the NOS-DCP formulated by the Indian Coast Guard is the most comprehensive action plan available for coordination and management of oil spill incidents. The NOS-DCP not only provides for emergency measures for management of oil spills during an incident, but it also prescribes for adoption of preventive measures in synergy with other instruments like OPRC and MARPOL.

The Committee recommended that in view of the submissions made by the ICG that it is practically not feasible to arrest tar balls in high seas, the focus should be to collect, arrest and manage tar balls near sea shore and along the coast. Accordingly, the primarily responsibility of management of Tar balls should lie with the concerned coastal district authorities, supported by the concerned State Pollution Control Boards/ Pollution Control Committees. The State Coastal Management Authorities should become with State-level coordinating agency and the ICG should become the Central coordinating agency. The Committee also noted that the frequent episodes of tar ball washing ashore are noticed during summer-monsoon season i.e., April-September as the winds and currents are conducive for their transport to the shore, hence, the District-specific action plan for management of tar balls, including clean-up and disposal should prescribe enhance vigil and preparedness during the referred period.

The study report mentioned that tar ball cleaning can be performed in two ways:

- Manual tar ball removal – It involves the usage of hand tools such as shovels, rakes, pitchforks, and polypropylene drum liners. Manual removal is best for minimizing the volume of sand removed from the shoreline, therefore requiring less disposal.

- Mechanical tar ball removal – It involves the use of heavy equipment such as backhoes, excavators, bulldozers, and graders. Tar balls may be loaded into end-dumps, roll-off boxes, or other methods for disposal. However, an extensive care needs to be taken to protect ecology depending on shore sand/ sediment.

Thereafter, tar balls needs be disposed of either through co-incineration in a cement plant or in common incineration in the Treatment, Storage, and Disposal Facility (TSDF). **The Committee members, however, pointed out that considering the combustible nature of tar balls being derived from the oil spills or of petroleum origin, there is a need to further work on the utilization potential of collected tar balls waste. The Chair asked CPCB and NIO to further work on this aspect, and develop an SOP for the utilization of Tar Balls. In this regard, CPCB was asked to take lead and NIO was requested to provide required research and technical support.**

Cost of managing tar ball, including cleanup, collection and disposal

The Committee delved on the issue of bearing cost towards management of tar balls, as and when it happens, in detail and agreed that the ‘Polluter pays principle’ is required to be applied on such incidents. As evident from the finding of the study report, the major polluters in case of tar ball formation are offshore oil exploration activities covering oil-well blowouts, pipeline leakages, and movement of ships covering release of bilge and industrial effluent, tanker washes/ leakage/ spills along tanker routes, besides natural sources.

The Committee also noted that Hon’ble NGT had asked the Committee to deliberate on this issue, accordingly, the Committee made detailed deliberations and concluded that there is a need to provide support to relevant agencies in meeting the remediation cost of tar ball pollution. **The agencies that need to provide financial support for management of tar ball pollution are industries/ stakeholders engaged in the below-mentioned operations and activities with the jurisdiction of INDIA:**

- **Offshore crude oil production**
- **Oil transport pipeline infrastructure**
- **Coastal Refineries**
- **Ports, Harbors and Jetties, Wharves and other shipping infrastructures**
- **Coastal oil receiving facility operators, and operators of other ancillary activities**
- **Ships transiting through the hotspot zones identified in the study report, in general and Oil tanker ships, in particular**

Considering that there are many industries operating within the ecosystem of the offshore oil production, and that the movement of ships (passengers and cargo) within the INDIAN jurisdiction involves domestic as well as international ships, the Committee is of the view that MoPNG and MoPSW is best placed to devise a mechanism to

develop a corpus fund. The mechanism may address issues like criteria, admissibility, share of burden and utilization of funds. Since the tar ball pollution problem is limited to west coast, the stakeholders and operations limited to Gulf of Kutchh, Gulf of Khambat, off Mumbai and western offshore, coastal refineries operating at Jamnagar, Vadinar, Mumbai, Mangalore, and Kochi, Major shipping companies (e.g. Shipping Corporation of India, Essar Shipping Limited, Great Ship India Limited etc.) and other relevant stakeholders.

The Committee emphasized the need to set up Shore Cleaning Centers in each coastal district, duly administered by the District Administration wherein the basic infrastructure required for managing tar ball pollution, including collection, transport and disposal, and manpower can be financially supported from the corpus fund.

[1] *IMO - International Maritime Organization, MARPOL - International Convention for the Prevention of Pollution from Ships, and OPREC - International Convention on Oil Pollution Preparedness, Response and Co-operation*

‘Records of Discussion’ of the 2nd meeting of the Committee constituted by Hon’ble NGT in the matter related to the formation of Tar-balls along the coast of Goa, Gujarat, and Maharashtra

The 2nd meeting of the Committee constituted by Hon’ble NGT in the matter of Brackish Water Research Centre Vs Gujarat Pollution Control Board & Ors. (OA No.73 of 2021) related to the formation of tar balls near the coast/ beaches of Goa, Gujarat, and Maharashtra was held on 17 January 2024. The meeting was co-chaired by Ms. Leena Nandan, Secretary, Ministry of Environment, Forest and Climate Change (MoEFCC), and Shri Pankaj Jain, Secretary, Ministry of Petroleum and Natural Gas (MoPNG). The members of the Technical Sub-Committee (TSC) formed in this regard were also invited to the meeting. The list of participants is annexed.

2. At the outset, the Director (HSMD) welcomed all the participants and informed them that the issue under reference was related to an NGT case on tar-balls pollution. The Committee was updated that in line with the decision of the NGT Committee during its first meeting, a Technical Sub-Committee (TSC) was constituted which undertook deliberations with research institutes with domain expertise and relevant stakeholders and a study was conducted by NIOS with help of other expert Institutions. . The ToRs and study report covered the following aspects:

- Source identification
- Review of current mechanism and gaps
- Suggesting preventive measures
- Studying Global Best Practices
- Suggesting viable mechanisms for arresting tar-balls
- Administrative and Technical frameworks required to address the problem
- Standard Operating Procedures (SOPs) to address tar-ball sources
- Requirement of a corpus fund for tar-ball management

3. The Committee was informed that the TSC had worked upon a solution-oriented approach keeping in mind the principle of ‘no-fault liability’. Hence, it has undertaken probabilistic source assessment using fingerprint analysis, remote sensing, Bio-markers and particle tracking simulation. Further, the report also touched upon the aspect of global best practices, current mechanisms of the National Oil Spill Disaster Contingency Plan (NOS-DCP), Gaps in the management of tar-balls, detailed preventive measures, and Standard Operating Procedures for various operations (*like oilfield operations, oil spills and ship movements*), additional responsibilities to stakeholders, etc.

4. The Committee undertook detailed deliberations on the issue, and noted the following:

- The origin of tar-balls or source identification needs to be further worked upon to remove any kind of doubt or ambiguity on the source of tar-balls as the area under reference i.e. west coast of India, is an international shipping route as well as an oil-rich area wherein many oilfields and commercial exploration activities are operational. The scientific tools utilized for tar-ball source assessment may be again investigated to arrive at conclusions that are scientifically acceptable in similar scenarios.
- The International Oil Pollution Compensation Fund (IOPC) is already operational under the auspices of the International Maritime Organization (IMO) to provide financial compensation for oil pollution damage that occurs in Member States, resulting from spills of persistent oil from tankers. Considering that the tar-ball formation is also an after-effect of the oil spills or leakages, it would be appropriate to explore whether the issue of tar-ball formation along the west coast of INDIA can be taken up with the IMO and IOPC, and expenditure towards management of tar-balls, including its cleanup, can be claimed thereunder.
- Commercial offshore oil exploration operations are industrial processes, and their routine compliance monitoring vis-a-vis applicable environmental regulations needs to be analyzed on a historical basis. Accordingly, the Pollution Control Boards (PCBs), Maritime Boards, and Coastal Zone Management Authorities (CZMAs) of Goa, Gujarat, and Maharashtra may be asked to share details for analysis. The Indian Coast Guard (ICG) may share their regular surveillance and monitoring observations about sources of oil spill incidences in the West Coast region. If required, additional ground-truthing can also be undertaken.
- There is a need for identification and fixation of the physical scope of the problem, i.e. the extent of the coastal area impacted by the tar-ball formations, no. of districts affected, tentative population impacted, broad assessment of the commercial and livelihood activities impact, and typical measures required to remedy the situation, monetary requirements of districts, before working upon the quantum of the proposed corpus fund.

5. Based on the deliberations, the Committee decided that TSC may take up the following issues through further study by the engagement of all relevant stakeholders:

- **To find the source of tar-balls by removing doubt or ambiguities through**

acceptable scientific source apportionment tools available.

- To explore the utilization of the IOPC fund as a financing mechanism for management of tar-balls, for which India makes substantial contribution.
- To assess the environmental compliance of offshore oil exploration operations in general, and oil spill management in particular, through involvement of ICG, MoPNG, PCBs, Maritime Boards and CZMAs of Goa, Gujarat and Maharashtra. Additional ground-truthing can also be undertaken, if required.
- To assess leakages/spills by shipping lines in the west coast and fix their responsibility in formation of tar balls
- To identify and fix the physical extent of the affected area along western coast, covering details of districts, population, commercial and livelihood activities impacted, and enlist typical remedial measures based on which the actual requirement of districts for remedial measures and quantum of corpus fund can be worked out.

The meeting ended with a vote of thanks to the Chair(s).
