BLUE WATERS

Newsletter

On Marine Environment Protection

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From the Director General's Desk

The Indian Coast Guard plays a crucial role in safeguarding India's coastal environment from the impact of oil spills. Through a combination of preventive measures, advanced surveillance technologies, and coordinated response efforts, the Coast Guard strives to minimize the ecological and economic consequences of oil spill incidents along the Indian coastline.

In line with the Hon'ble Prime Minister's vision for the environment and *"Swachh Sagar, Surakshit Sagar Abhiyan"* Indian Coast Guard spearheaded the International Coastal Cleanup (ICC) Day 2023 on 16 Sep 23, a landmark event which garnered immense participation and generated massive traction to spread awareness and information towards protecting and preserving the fragile marine environment and coastline in our country.

Indian Coast Guard is now recognized as a credible organization for responding to oil spills quickly and effectively. Qualified ICG Officers and sailors have been uniformly deputed across regions as specialized Pollution Response Teams and also at Regional and District Headquarters to mitigate any eventuality of a developing marine pollution incident. Periodical training to Port Officials and Oil Handling Agencies (OHAs) in oil spill preparedness and educational/ community interaction programmes have further solidified Indian Coast Guard as a force to reckon with in the field of Oil Spill Response.

As the Central Coordinating agency, streamlining operations and initiatives of stakeholders in marine environment conservation and oil spill response continues to be of utmost importance. By working in synergy and having a symbiotic relationship with all stakeholders, our operations and response strategies will further strengthen reaping long term sustainability and cooperation.

With the rising awareness and heartening initiatives taken by stakeholders, I am sanguine that we will achieve a robust mechanism to deal with oil spills and achieve breakthroughs in marine environment conservation.

I wish all the readers and stakeholders 'Happy Reading'.

Vayam Rakshamah. Jai Hind.

(Rakesh Pal)
Director General
Indian Coast Guard

19 Apr 2024
New Delhi

EDITORIAL

The Marine environment is the lifeblood of our planet, yet it is under threat like never before. Preservation of environment is an intergenerational responsibility and we, the present generations hold it as a custodians for our future generations. Presently, wherein climate change and its adverse effects on the entire ecosystem and the planet seem imminent, marine environment protection and conservation and sustainable use of the oceans is the need of the hour for maintaining biodiversity, regulating climate and supporting economies.

The Challenge of marine environment conservation increases manifolds with increase in shipping traffic, Oil exploration and many more pollutants including land based run-offs, illegal fishing activities, plastics and hazardous and noxious substances that are causing marine pollution to an unprecedented extent.

Protecting marine environment is not just about mitigating pollution, but a holistic activity of preserving biodiversity and proactively safeguarding fragile ecosystems. Collaborations and cooperation on a global scale involving governments, organizations and volunteers are the key to succeed in our mission to protect and preserve the marine environment for future generations.

To counter these scenarios and achieve our said mission, a taut system of leadership, command and management aided by relevant policies/rules and regulations are a prerequisite. Such an endeavor also requires seamless synergy and collaboration amongst the stakeholders which the Indian Coast Guard as Central Coordinating Agency has been entrusted upon.

The editorial team conveys a warm gratitude to all the contributors to this edition of “Blue Waters” and wishes happy and informative reading experience to all.

(Utkarsh)
Commandant (JG)
Deputy Director (FE)

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EVENTS

INTERNATIONAL COASTAL CLEANUP (ICC) DAY - 2023

Introduction.

Towards ongoing effort of Government for the *"Swachh Bharat Abhiyan"* in lines with vision of the Hon'ble Prime Minister's appeal for mass cleanliness and sanitation campaign, through *"Swachhata Hi Seva"* Indian Coast Guard (ICG) conducted ICC-2023 in all Coastal States / Union Territories on 16 Sep 23.

Figure 1. Beach cleaned by Coast Guard District Hq No. 15, Okha

The International Coastal Cleanup day is conducted in various parts of the world on third Saturday of September every year under the aegis of United Nations Environment Programme (UNEP) and South Asia Co-operative Environment Programme (SACEP) in the South Asian Region. The Indian Coast Guard has been coordinating this activity in India since 2006.

Figure 2. Beach cleaned by Coast Guard North-West Region

Figure 3. Beach cleaned by Coast Guard District Hq No. 3, New Mangalore

Figure 4. Beach cleaned by Coast Guard North-East Region

Figure 5. Beach cleaned by Coast Guard North-East Region

The event was conducted with an aim to educate and motivate the local populace for maintaining the sea shores neat and clean, and to prevent polluting marine environment through man-made/ human activities.

Figure 6. Beach cleaned by CG Western Region

Civil Support.

Apart from Ministries and other Armed Forces, ICC - 2023 received good support from various civil authorities, Municipal Corporations, NGOs, fisheries associations, School students, College students, NCC/NSS cadets, Marine Police and volunteers from Oil Handling Agencies (OHAs).

25TH NATIONAL OIL SPILL DISASTER CONTINGENCY PLAN (NOS DCP) AND PREPAREDNESS MEETING

The 25th National Oil Spill Disaster Contingency Plan (NOS DCP) and Preparedness meeting was held at Jamnagar on 23 Nov 23. Director General Rakesh Pal, AVSM, PTM, TM, Director General Indian Coast Guard, chaired the meeting. About 85 delegates including representatives of various Ministries, Central and State Govt. departments and agencies, State Pollution Control Board, Ports and Oil Handling Agencies participated in the meeting.

During the inaugural address, Chairperson NOS DCP expressed his views over oil spill incidents and informed that there have been no major oil spill incidents in Indian waters since the last annual meeting on 30 Nov 22. With the rising awareness and heartening initiatives taken by stakeholders, the Chair has been

Figure 7. 25th NOS DCP & Preparedness Meeting

sanguine that we will achieve a formidable mechanism to deal with oil spills. He urged all the stakeholders to expedite the process of PR equipment acquisition as mandated by NOS DCP for Tier-1 capability in respective area of responsibility. He requested all other coastal states to make necessary provisions in their State Disaster Contingency Plans and establish crisis management groups for handling oil spills. He expressed compliments to all the distinguished members for their active participation in the contingency planning process, which is reflected in the action taken report and the agenda proposals.

Figure 8. Director General Rakesh Pal, AVSM, PTM, TM, Director General Indian Coast Guard

The inaugural address was followed by a presentation on 'overview of NOS DCP', covering all activities since the last meeting held in Nov 22, which was presented by Principal Director (Environment),

Figure 9. DIG Rajesh Mittal

Secretary NOS DCP. The presentation highlighted the need for early submission of Contingency Plans and provisioning of Pollution Response equipment at each facility besides timely submission of annual return to meet the obligation of NOS DCP.

Following the overview, a Presentation on 'Preparedness for combating oil and chemical spills' was delivered by Capt. Rakesh Rawat, Senior General Manager, Reliance Jamnagar .

Figure 10. Capt. Rakesh Rawat, Senior General Manager, Reliance

The proceedings of the event went ahead with a presentation on 'Preparedness for combating oil and chemical spills' by Shri Vikash Tola, Senior Manager, IOCL Vadinar.

Figure 11. Shri Vikash Tola, Senior Manager

A presentation on 'Preparedness for coastline cleanup during an oil and chemical spill incident' was delivered by Dr. Ravi DR, Environment Officer, Karnataka State Pollution Control Board.

Figure 12. Dr. Ravi DR, Environment Officer

During the meeting Director General Rakesh Pal, AVSM, PTM, TM, DGICG, Chairperson NOS DCP awarded 'Samudri Paryaavaran Sanrakshan Trophy - 2023' to Jawaharlal Nehru Port Authority, Mumbai for instituting measures for protection of environment in its area of responsibility.

Figure 13. 'Samudri Paryaavaran Sanrakshan Trophy - 2023'

Figure 14. Participant Group photography

In the concluding remarks, The Chairperson urged all the stakeholders to work in unison for the protection and preservation of the marine environment and the effective implementation of the NOS DCP, ensuring a foolproof mechanism to deal with oil spill incidents.

9th NATIONAL LEVEL POLLUTION RESPONSE EXERCISE (NATPOLREX-IX)

The 9th edition of National Level Pollution Response Exercise (NATPOLREX-IX) was conducted on 24-25 Nov 23 which included table-top exercise and technical session on first day at Jamnagar and sea exercise on second day off Vadinar in the Gulf of Kutch. NATPOLREX is a forum where national stakeholders as well as international observers participate and witness the marine oil pollution preparedness and response exercise under the ambit of NOS DCP. A total of 172 representatives including 29 observers from 26 countries, 05 reps from international organizations and stakeholders from Major/Non-Major Ports, Coastal States and Oil Handing Agencies participated in the exercise.

NATPOLREX-IX was inaugurated by Director General Rakesh Pal, AVSM, PTM, TM, Chairperson, NOS DCP.

Figure 15. Director General Rakesh Pal, AVSM, PTM, TM, Director General Indian Coast Guard

A Table Top exercise was conducted on 24 Nov 23 at the venue in Jamnagar. A total of 08 teams each comprising of 10 representatives of stakeholders and international observers participated in the tabletop exercise. One member from each participating team was provided opportunity to witness the aerial surveillance with Virtual Reality (VR) Simulation of the oil spill incidence through VR goggles. Teams were tasked to form and act as Emergency Response Centre (ERC) to deal with the contingencies of oil spill situation as per exercise setting.

Figure 16. Table Top Exercise

Figure 17. Sea Exercise - NATPOLREX-IX

The sea phase of the NATPOLREX-IX exercise towards PR readiness and capabilities demonstration was held in Gulf of Kutch on 25 Nov 23. 14 ICG Ships, 01 Heli-Skimmer, 09 ICG Aircraft, one Super Hercules Aircraft C-130J from Indian Air force and 12 vessels of stakeholders were deployed in the exercise. The sea exercise demonstrated Pollution Response capabilities of stakeholders and coordination for effective response mechanism for oil pollution response.

Figure 18. Sea Exercise - NATPOLREX-IX

ARTICLES

EMERGING TECHNOLOGIES FOR DETECTION AND RESPONSE TO OIL SPILLS

{ Nishikant Yadav, U/ Nvk (RP), CGDHQ-15 }

Introduction. Oil spills at sea pose significant environmental threats, necessitating advanced technologies for timely detection and effective response. Recent years have witnessed the emergence of innovative technologies that enhance the ability to monitor, detect, and respond to oil spills in oceans and seas. This article explores some of the cutting-edge technologies that are making waves in the field of oil spill management.

Remote Sensing and Satellite Technology.

Advancements in remote sensing and satellite technology plays a crucial role in the early detection of oil spills. Satellite imagery enables the monitoring of vast oceanic areas, identifying potential spills quickly and accurately. High-resolution Imagery, coupled with machine learning algorithms, enhances the ability to differentiate between natural phenomena and oil slicks.

Autonomous Vehicles. Unmanned aerial vehicles (UAVs) and autonomous underwater vehicles (AUVs) have become valuable tools in oil spill response efforts. These vehicles can cover large areas swiftly, collecting real-time data on the extent of the spill and the affected marine environment. Equipped with sensors, they provide detailed information on oil concentration, facilitating targeted response strategies.

Oil-Sensing Nanomaterials. Innovative nano-materials designed to detect and interact with oil molecules are gaining prominence. These materials, often incorporated into sensors, can identify oil presence in water with high sensitivity and selectivity. Nanotechnology offers potential for rapid and cost-effective oil spill detection, enabling quicker response times.

Machine Learning and Predictive Modelling. Machine learning algorithms and predictive modelling enhances the efficiency of oil spill response by analyzing historical data and current environmental conditions. These technologies can predict the trajectory of oil spills, aiding in the deployment of response resources to areas most at risk. Additionally, machine learning algorithms improve the accuracy of oil spill detection in satellite imagery.

Oil-Degrading Microorganisms. Bioremediation, the use of microorganisms to break down oil components, has evolved with the identification of naturally occurring oil- degrading bacteria. Researchers are exploring the application of genetically engineered microorganisms to enhance the efficiency of oil degradation, providing a more sustainable and environmentally friendly approach to combating oil spills.

Conclusion. The constant evolution of technology is playing a pivotal role in enhancing our ability to detect and respond to oil spills at sea. Further, from satellite-based monitoring to advanced autonomous vehicles and nanomaterials, these emerging technologies offer a comprehensive toolkit for mitigating the environmental impact of oil spills.

NEW OIL-CAPTURING TECHNOLOGY WITH AN INDUCTION HEATING FOR OIL SPILL RESPONSE

{ S Balakrishanan, U/Nvk (RP), ICGS Ankit }

To combat the extreme environmental toll of major oil spills, researchers at The University of Texas at Austin have created a technology that could significantly improve cleanup capabilities compared with current methods.

The new technology uses a dual-layer mesh roller coupled with an induction heating technique, with material properties that allow it to separate oil from water and then remove that oil from the ocean with high efficiency and throughput. In experiments, the researchers showed the potential to retrieve up to 1,400 kilograms of viscous oil per square meter per hour, which is about 10 times better than the way oil is cleaned up today.

In practice, the rollers could be built to different sizes to deal with oil spills. Boats would pull them across a spill area, where they could complete cleanup operations in a day or two, compared with the weeks long efforts that current techniques require. Oil's viscous nature makes it challenging to separate from water. The gel-coated mesh roller can selectively adhere oil at the interface of the cold seawater on the bottom side and separate viscous oil/water mixtures at the top side of the roller. Then, a device in between the two layers captures the now-separated oil.

The researchers applied non-contact induction heating to the top layer of the roller to supercharge the reaction that separates oil from water. In experiments, the researchers achieved over 99% oil-water separation efficiency. That means the collected oil could also be recycled and reused.

Most of the methods in use today rely on decades-old technology. Therefore, need for a modernized way to efficiently pull oil out of water with much higher throughput is required. And this new technology could have a major impact on the efficiency and sustainability of oil spill response operations.

BIOSORBENTS: A GREEN SURGE IN POLLUTION RESPONSE

(Dy Comdt Pravav Painuly, ICGS Ankit)

Introduction.

The oceans, the life force of our planet, face a constant barrage of threats. Among these, oil spills remain a potent symbol of environmental devastation, wreaking havoc on marine ecosystems and coastal communities. Traditional oil spill response methods are often reliant on chemical dispersants which carry their own ecological burden. Usage of OSD/ dispersants imposes harmful and long-lasting repercussion to the ecosystem.

Several Indian institutes are actively engaged in pioneering research towards reducing the toxicity of dispersants and having biodegradable/ ecologically effective disposal. Here are a few noteworthy examples highlighting the dedication of Indian academia in developing homegrown bio sorbent solutions, tailored to the specific needs of the Indian Ocean Region:-

- **CSIR-National Institute of Oceanography (NIO).**

Researchers at NIO have developed a bio-degradable sorbent made from coconut coir, readily available in coastal regions. This sorbent

demonstrates impressive oil absorption capacity and biodegradability, minimizing environmental impact.

- **Surface Area and Absorption**. The coconut coir is likely processed into a fibrous material with a high surface area. This increased surface area provides numerous "binding sites" for oil molecules to adhere to. Specific modifications to the coir fibres (e.g., chemical treatment) might enhance their hydrophobicity (repelling water) while attracting oil, further improving absorption efficiency.

- **Sorption Mechanisms**.

Physical Entrapment. Oil droplets get trapped within the tangled network of coir fibres due to their size and surface tension.

Van der Waals forces. Weak attractive forces between the molecular structures of the coir and the oil molecules contribute to binding and absorption.

- **Biodegradability**. The natural cellulose and lignin components of coconut coir are readily biodegradable by microorganisms present in the environment. This minimizes the long-term environmental impact of the sorbent compared to synthetic materials.

- **IIT Bombay**. A team at IIT Bombay has devised a novel cellulose-based sorbent using bacteria. This unique material boasts high oil absorption, water repellence, and reusability, making it a versatile tool for spill cleanup.

- **Bio-inspired Design.** The researchers at IIT Bombay took inspiration from nature's own oil absorbers, like feathers and plant leaves. These surfaces exhibit super hydrophobicity, meaning they repel water but readily absorb oil. The IIT Bombay team mimicked this property by utilizing cellulose, a naturally abundant and biodegradable polymer found in plants.

- **Bacterial Synthesis**. Instead of extracting cellulose from plants, the team employed a clever strategy by harnessing the power of bacteria, specifically Acetobacter Xylinum, to produce cellulose nanofibrils. These are incredibly thin fibres, thousands of times smaller than a human hair, offering a vast surface area for oil absorption.

- **Surface Modification.** The produced cellulose nanofibrils are inherently hydrophilic. To achieve super hydrophobicity, the researchers modified the surface using a technique called salinization. This coats the nanofibrils with a thin layer of organosilicon compounds, creating a water-repelling barrier while maintaining oil-attracting properties.

- **Exceptional Performance**. The resulting bio-sorbent exhibits remarkable characteristics as follows: -

High Oil Absorption. It can absorb oil up to 50 times its own weight, far exceeding the capacity of traditional sorbents.

Selective Adsorption. It preferentially absorbs oil while repelling water, minimizing environmental impact and simplifying cleanup.

Reusability. The sorbent can be easily regenerated by washing with a mild solvent, allowing for multiple uses and reducing waste.

- **Anna University**. Researchers here have successfully harnessed the potential of fungal mycelium, the vegetative network of fungi. This

intricate network of fungal filaments, akin to a microscopic root system, offers a targeted and eco-friendly solution to oil spill cleanup.

- **Exploiting Fungal Specificity.** Unlike traditional sorbents that indiscriminately absorb everything, Anna University's mycelium is engineered for selectivity. By manipulating the genes and metabolic pathways of specific fungi, the researchers tailor their oil-absorbing abilities. This allows them to target specific oil types, say crude oil or refined fuels, while leaving beneficial marine life and clean seawater untouched.

- **Enzymatic Absorption**. The secret weapon of this fungal biosorbent lies in its arsenal of enzymes. These specialized proteins act like molecular keys, unlocking the chemical structure of specific oil molecules. Once unlocked, the oil is readily absorbed into the fungal hyphae (filaments), effectively trapping it within the mycelial network.

- **Tailored Growth and Morphology.** The researchers don't stop at tweaking fungal biochemistry. They also manipulate the physical form of the mycelium. By optimizing factors like nutrient flow and temperature, they encourage the growth of dense, three-dimensional mycelial mats with exceptional surface area. This maximizes oil absorption capacity and facilitates easy deployment during spill response.

- **Sustainability at its Core.** One of the biggest advantages of this technology is its inherent sustainability. Fungal mycelium is readily bio-degradable, leaving no harmful residues in the environment. Additionally, many fungi can be grown on readily available agricultural waste or even wastewater, minimizing dependency on virgin resources.

Advantages of Biosorbents over Traditional Oil Spill Dispersants (OSDs)

Biosorbents offer a multitude of advantages over traditional OSDs. Most prominent ones are enumerated below: -

- **Environmental Friendliness.** Unlike chemical dispersants, which can harm marine life and persist in the environment, biosorbents are typically biodegradable and non-toxic. This minimizes their long-term ecological impact.

- **Selectivity.** Certain biosorbents can be engineered to target specific oil types, leaving harmless substances like seawater untouched. This precision reduces collateral damage to the ecosystem.

- **Reusability.** Some biosorbents can be re-generated and reused multiple times, making them a more cost-effective and sustainable solution in the long run.

- **Local Availability.** Utilizing materials like agricultural waste or algae can create readily available and affordable biosorbent options, particularly advantageous for resource-constrained regions.

Conclusion.

The rise of biosorbents marks a pivotal shift in our approach to oil spill response. Moving away from ecologically harmful methods, this technology offers a cleaner, more sustainable path forward. By addressing the existing challenges and fostering collaborative efforts, India can play a leading role in ushering a new era of environmentally responsible pollution response, safeguarding the health of our oceans and the life they sustain.

SMART BUOYS FOR REVOLUTIONIZING MARINE OIL POLLUTION PREVENTION AND ENVIRONMENT PROTECTION

{ Commandant (JG) Deepak Thakur, CGWT(E) }

Introduction.

The world's oceans are vital to the health of our planet, but face an ever-increasing threat from marine oil pollution today. Accidental spills, chronic leakages from offshore activities and illegal discharges pose significant risks to marine ecosystems and biodiversity.

In this critical scenario, the role of smart buoys emerges as a beacon of hope, offering real-time monitoring and preventive measures to protect our oceans. This article explores the multifaceted role of smart buoys in preventing marine oil pollution, their technological capabilities and the impact they have on safeguarding the delicate balance of the marine environment. Marine oil pollution is a pervasive and destructive environmental issue, stemming from various human activities, including shipping, oil exploration and industrial operations. The consequences of oil spills are severe with devastating impacts on marine life, coastal ecosystems and economies that depend on healthy oceans.

Traditional methods of monitoring and preventing marine oil pollution often fall short due to their reactive nature. Prompt detection and effective response to oil spills are paramount, but achieving this in vast and remote oceanic expanses poses substantial challenges. Smart buoys emerge as a cutting-edge solution, offering real-time monitoring and proactive measures to address the dynamic nature of oil pollution.

Smart Buoys: Technological Marvel for Oil Pollution Prevention

A smart buoy is an advanced buoy equipped with various sensors and technologies to collect and transmit data about the marine environment. These buoys play a crucial role in ocean monitoring, research, and environmental management. Smart buoys typically feature sensors that measure parameters such as water temperature, salinity, atmospheric conditions, wave height, and ocean currents. The collected data is transmitted in real-time or at regular intervals to onshore facilities or satellites, allowing researchers, scientists, and authorities to monitor changes in the ocean and make informed decisions. Some smart buoys are also designed to be autonomous, using renewable energy sources like solar power to operate for extended periods without human intervention. These technological capabilities make smart buoys valuable tools for studying oceanography, climate change, and supporting various maritime applications. Salient features of smart buoys are as follows:-

- **Advanced Sensor Technologies**. At the heart of smart buoys lies a suite of advanced sensors designed to detect and analyze various parameters related to oil pollution. These sensors are capable of identifying hydrocarbons and other pollutants in the water, providing real-time data on the presence and concentration of oil. The ability to differentiate between types of oil and assess their impact on the marine environment enhances the effectiveness of response efforts.

- **Early Detection and Rapid Response.** Smart buoys play a crucial role in early detection, alerting authorities to the presence of oil in the water as soon as it occurs. This real-time capability allows for swift and targeted responses, minimizing the spread of oil and reducing the overall impact on marine ecosystems.

Rapid response measures, such as deploying containment booms and skimmers, can be initiated promptly based on the precise information provided by smart buoys.

- **Integration with Satellite and Remote Sensing Technologies.** To extend their reach and effectiveness, many smart buoys are equipped with satellite communication capabilities. This integration enables them to transmit data over large distances to control centers, where it can be analyzed and acted upon. The combination of smart buoys with satellite and remote sensing technologies provides a comprehensive and interconnected approach to monitoring and managing oil pollution on a global scale.

Applications in Marine Oil Pollution Prevention.

Smart buoys play a significant role in marine oil pollution prevention through various applications. Here are some key aspects:-

- **Oil Rig and Platform Monitoring**. Offshore oil exploration and extraction activities are significant contributors to marine oil pollution. Smart buoys strategically placed near oil rigs and platforms continuously monitor the surrounding waters for any signs of oil leakage. Early detection allows operators to take immediate corrective actions, preventing the escalation of spills and minimizing the environmental impact.

Shipping Lanes and Ports. Shipping, a major source of oil pollution through accidental spills and illegal discharges, poses a continuous threat to marine environments. Smart buoys deployed along shipping lanes and near ports act as sentinels, continuously monitoring the water for any signs of oil contamination. Real-time alerts enable authorities to intercept and penalize vessels engaged in illegal dumping, promoting accountability and deterring potential polluters.

- **Coastal and Sensitive Ecosystem Protection.** Coastal areas and sensitive ecosystems are particularly vulnerable to the devastating effects of oil pollution. Smart buoys positioned in these regions provide an additional layer of protection, acting as early warning systems for potential spills that could threaten shorelines, mangroves and coral reefs. Their proactive monitoring ensures that response efforts are initiated swiftly to safeguard these critical environments.

- **Prevention of deliberate Oil Pollution.** Illegal discharges of oil, whether intentional or accidental, continue to pose a significant challenge to marine conservation efforts. Smart buoys, with their real-time monitoring capabilities, contribute to the prevention of deliberate oil pollution by detecting unauthorized discharges and providing evidence for legal action. This serves as a deterrent, discouraging practices that jeopardize marine ecosystems for short-term gains.

Technological Capabilities of Smart Buoys.

Smart buoys demonstrate superior technological capabilities that render them highly suitable for deployment in marine environments for their intended roles. Key attributes are as follows:-

- **Autonomous Operation.** Many smart buoys are designed for autonomous operation, reducing the need for constant human intervention. Solar panels and energy-efficient technologies power these buoys, allowing them to operate for extended periods without the need for regular maintenance. This autonomy enhances their efficiency and reliability in remote or challenging marine environments.

- **Data Transmission and Integration.** Smart buoys are equipped with advanced communication systems that enable them to transmit data in real-time to control centers and relevant authorities. This seamless data transmission facilitates

prompt decision-making and allows for the integration of smart buoy data with other environmental monitoring systems, creating a comprehensive and interconnected network.

- **Multi-Sensor Platforms.** To enhance their capabilities, smart buoys often incorporate multi-sensor platforms. These platforms may include sensors for measuring water quality parameters, identifying marine life and monitoring weather conditions. The integration of diverse sensors provides a holistic understanding of the marine environment, enabling a more informed response to oil pollution events.

- **Machine Learning and Artificial Intelligence.** The implementation of machine learning and artificial intelligence (AI) algorithms further elevates the capabilities of smart buoys. These technologies enable buoys to learn and adapt to changing environmental conditions, improving the accuracy of pollutant detection and reducing false positives. The continuous learning aspect enhances the efficiency of early warning systems and response strategies.

Conclusion.

Prime Minister Sh. Narendra Modi's tweet on the occasion of 48th Raising Day of Indian Coast Guard highlighted the vital role of the service in safeguarding the marine environment. The tweet, posted on the social media platform X, underscores the sensitivity and importance of this subject matter. The Indian Coast Guard, mandated by the Coast Guard Act, 1978, plays a crucial role in managing pollution response within the Indian Area of Responsibility. Early detection of oil spills is paramount for effective containment and cleanup to minimize their impact on marine ecosystems. In the face of escalating marine oil pollution, smart buoys can act as catalysts for positive change. They offer real-time monitoring, early detection, and rapid response capabilities, serving as deterrents to potential polluters. The successful implementation of smart buoy systems globally showcases their transformative potential in ocean safeguarding. Challenges associated with deployment, like cost and standardization, are gradually being addressed through technological advancements and collaborative efforts. As public awareness increases and governments prioritize sustainability, the global adoption of smart buoys as guardians of the seas becomes increasingly feasible. Smart buoys can serve as advanced tools for prompt oil pollution detection and response, significantly mitigating its adverse effects on our oceans. These technological innovations symbolize our commitment to safeguarding marine environments for future generations.

REPORTS

WORLD WATCH

SWEDEN FINES FERRY OFFICERS FOR NEGLIGENCE CULMINATING IN GROUNDING AND OIL SPILL

(Source:https://maritime-executive.com/article/sweden-fines-ferry-officers-for-negligence-causing-grounding-and-oil-spill)

Swedish authorities have imposed fines on the captain and third officer of the ferry Marco Polo, alleging their reckless navigation led to the vessel's grounding and an environmental cleanup operation. This development coincides with the Swedish Coast Guard's mobilization of additional resources to assist in the cleanup efforts, with officials cautioning that complete recovery could extend over a year.

Figure 19. TT-Line ferry Marco Polo remains aground and leaking oil

Operated by TT-Line of Germany, the Marco Polo embarked from Trelleborg, Sweden, on 21 Oct 23, bound for Karlshamn, Sweden. However, on 22 Oct 23, the ferry reported grounding, prompting the Swedish Coast Guard to aid in evacuating 41 passengers and 10 crew members out of the 30 onboard.

Subsequent investigations conducted by the Coast Guard and public prosecutors reconstructed the events leading up to the grounding. Confirming earlier reports, the investigation revealed that the vessel sustained damage upon initially touching ground, likely resulting in leaks. Despite this, the ferry continued under its own power before grounding a second time, causing further damage to the hull and subsequent water ingress. The Coast Guard reported recovering 14 cubic meters of oil waste from the sea and 9 cubic meters from the shoreline, with approximately 3 miles of coastline affected by the oil spill.

The prosecutor highlighted that the third mate was in command of the ferry prior to the first grounding. Despite adverse conditions such as reduced visibility due to fog and darkness, the officer solely relied on the vessel's electronic chart. The Coast Guard suspected a malfunction in the electronic position system and charged the officer with negligence for failing to utilize other navigational aids like radar or assigning a lookout.

Interviews with the crew revealed discrepancies in their awareness of the vessel's location. After the first grounding, the ferry's master assumed command but continued to rely solely on the electronic chart, leading to the vessel's second grounding.

Each of the two officers received fines, with one totaling approximately $3,600 and the other approximately $1,500. The prosecutor noted that Swedish law imposes mild penalties for negligence, as in this case, compared to harsher penalties for intentional acts. Nevertheless, the Coast Guard retains the authority to levy water pollution fees, and other additional charges.

Figure 20. Shoreline clean-up continues with more resources being added to the effort (Swedish Coast Guard)

Emphasizing its responsibility for managing oil pollution, the Coast Guard deployed booms around the stranded ferry. Although aerial assessments indicated dissipation of the oil slick, authorities suspected ongoing leaks beneath the surface. Cleanup efforts were undertaken near the shore, with 24 trainees and 30 personnel from the Home Guard. Additional protective equipment and tools were dispatched to enhance cleanup operations.

Concerns persisted regarding the estimated 300 cubic meters of oil remaining aboard the grounded vessel. The longer the Marco Polo remained aground, the greater the associated risks. Swedish Coast Guard however reported on 02 Nov 23 that the passanger ferry has been towed into Stilleyrd harbor in Karlshamn with no further leaks.

The Coast Guard maintains a presence in Pukavik bay in case previously leaked oil is found. Post mooring the municipal rescue service has taken over the ship at Stilleyrd harbor. Further, Swedish authorities reported that the entire cleanup operation could take over an year to complete.

BALEX: ANNUAL INTERNATIONAL OIL SPILL EXERCISE CONDUCTED IN GULF OF RIGA

Source:https://helcom.fi/annual-international-oil-spill-exercise-balex-takes-place-in-the-gulf-of-riga/

On 31 Aug 2023, alongside BALEX, the European Maritime Safety Agency (EMSA) will conclude the Multipurpose Maritime Operation (MMO) in the central and eastern Baltic Sea region. BALEX, an annual international marine pollution response exercise, aligns with the Helsinki Convention of 1992, fostering cooperation and preparedness among Baltic Sea States for large-scale accidents. Since its inception in 1989, BALEX has been a recurring event.

Figure 21. Havariekommando

The coordination of BALEX rotates yearly among Baltic Sea states, with Latvia's State Environmental Service leading this year's exercise, in collaboration with the Latvian National Armed Forces Coast Guard Service and the State Fire and Rescue Service. Participating agencies from Baltic Sea states seek to bolster cooperation and communication among vessels engaged in oil pollution recovery, explore the utilization of oil recovery equipment for shoreline incidents, and involve volunteers in animal rescue efforts.

BALEX 2023 kicks off with a table-top simulation

mirroring a real-life incident: a container ship's engine room catching fire near Latvia's coast in the Gulf of Riga. The subsequent practical drills on the second day will concentrate on an oil pollution scenario in the Gulf of Riga and along the coast north of the port of Skulte. This fictional scenario depicts oil tanker grounding, resulting in the release of diesel fuel, heavy fuel oil, and marine fuel. BALEX 2023 aims to evaluate the coordinated operations of Baltic Sea response fleet units in addressing pollution incidents at sea. The exercise involves 11 military and civilian vessels from eight Baltic Sea countries-Denmark, Estonia, Lithuania, Poland, Finland, Germany, Sweden, and Latvia-equipped with specialized pollution recovery gear.

JAPAN TRANSPORT SAFETY BOARD RELEASES FINDINGS ON WAKASHIO INCIDENT

Source:https://splash247.com/japan-transport-safety-board-issues-report-on-wakashio-disaster/

The Japan Transport Safety Board has released its findings on the grounding of the Wakashio new castle max, a significant casualty in the maritime industry of this decade. Echoing previous reports on the disaster that devastated Mauritius's ecology, the primary cause of the accident was attributed to the crew's decision to approach the shore in search of a telephone signal. The report reveals that the captain instructed the vessel to deviate from its intended course and approach the coast without obtaining marine charts, resulting in the ship running aground on the evening of 25 July 20, and spilling approximately 1,000 tons of bunker fuel into the area after breaking up on reefs.

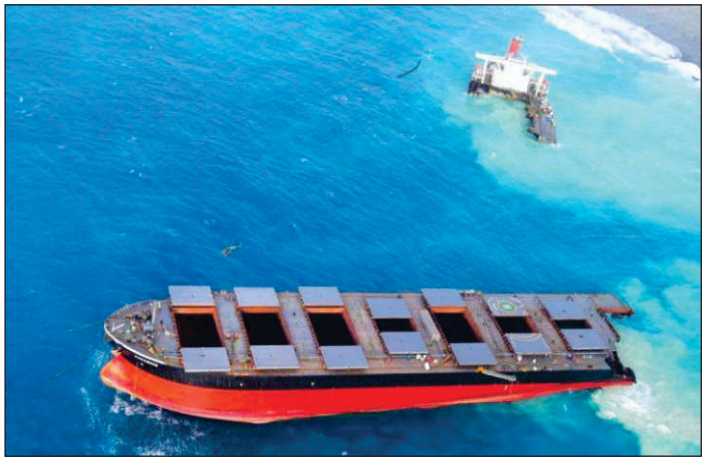

Figure 22. Mobilisation Nationale Wakashio

Furthermore, the investigation uncovered a pattern of the bulk carrier, chartered to Mitsui OSK Lines (MOL), frequently venturing close to coastlines in previous instances to access mobile phone networks. It was also noted that the captain consumed two glasses of whisky and water at a crew member's birthday celebration prior to the accident. Criticism was directed at the delayed response of local authorities, as it took five days after the grounding for a tug to be dispatched to assist the Panamanian-flagged ship.

Panama's final accident report, released in July 23, reiterated that the crew's decision to seek a wifi signal near the shore was the primary contributing factor to the accident. The process of removing the remains of the Wakashio, which split in two near a protected UNESCO World Heritage site, lasted for 18 months.

In response to the incident, MOL announced preventive measures to avoid similar disasters, citing the ship's alteration of its passage plan from maintaining a 22-nautical mile distance from Mauritius to just two nautical miles to access mobile phone communication. MOL disclosed that the crew relied on a nautical chart with inadequate scale to accurately determine their distance from the coast and water depth. Additionally, negligence in watch-keeping, both visually and by radar, was reported among the crew.

STRENGTHENING REGIONAL RESPONSE: SEYCHELLES HOSTS TABLETOP EXERCISE FOR WESTERN INDIAN OCEAN POLLUTION

Source:http://www.seychellesnewsagency.com/articles/19041/

In an effort to bolster regional capabilities in responding to marine pollution incidents, Seychelles is hosting a three-day tabletop exercise titled 'Western Indian Ocean Pollution Regional Exercise (WIOPOLREX)' from 25-27 Jul 23. This exercise, jointly organized by the Regional Coordination Operations Centre (RCOC) and the Regional Maritime Information Fusion Centre (RMIFC), aims to evaluate preparedness to address oil pollution incidents in the region, drawing parallels with the MV WAKASHIO incident on 25 Jul 20, which resulted in a spill of approximately 1,000 metric tonnes of oil off the southeastern coast of Mauritius.

Denis Matatiken, the principal secretary for the environment, emphasized the severe environmental impacts of oil spills, underscoring the urgent need for effective response measures to mitigate ecological damage. Matatiken's statement reflects the critical importance of assessing and enhancing readiness to manage such incidents in the Western Indian Ocean region.

Figure 23. Table Top Exercise

Sam Gonthier, director of the RCOC, highlighted the imperative of testing the existing contingency plan, which he described as an outdated draft. Gonthier stressed the significance of conducting tabletop exercises to validate and refine response strategies, ensuring their efficacy in real-world scenarios. By simulating pollution events and evaluating response protocols, the exercise provides a valuable opportunity to identify strengths, weaknesses, and areas for improvement in the regional response framework.

Participating in the tabletop exercise are regional countries including Comoros, Djibouti, France (Reunion, Mayotte), Kenya, Madagascar, Mauritius, and Seychelles, alongside international partners. Together, they will navigate through simulated pollution scenarios tailored to their respective territories, testing the effectiveness of their response mechanisms. Each country will undergo evaluation based on its ability to coordinate with the RCOC and other stakeholders, demonstrating the capacity to manage both localized incidents and larger-scale catastrophes.

The outcomes of WIOPOLREX are expected to inform the implementation of the regional oil spill contingency plan, strengthen the coordination capacity of the RCOC, and update standard operating procedures to address large-scale pollution events effectively. Additionally, the exercise will contribute to the implementation of national control plans outlined in the agreements among member states of the MASE region, fostering greater resilience and preparedness in the face of environmental challenges.

Indian Coast Guard
Annual Calendar of Pollution Response Training and Exercise - 2024

Date	Venue	Exercise/Training	(a) Coordinator (b) Participants
08-19 Jan 24	CG PRT (E), Chennai	OPRC Level-1 & 2	(a) CG PRT (E) (b) FFCs
05-09 Feb 24	HMS Rehman/ VITS Mumbai	OPRC Level 2	(a) M/s OSCT & CGPRT (W) (b) Ports, OHAs & Stakeholders
07-08 Feb 24	ADTPS Dahanu	Area Level PR Exercise	(a) ICGS Dahanu (b) ICG & Stakeholders
12-16 Feb 24	CG PRT (W), Mumbai	OPRC Level 1	(a) CGPRT (W) (b) Ports, OHAs & Stakeholders
12-16 Feb 24	CGPRT(NW), Vadinar	OPRC Level1	(a) CG PRT (NW) (b) ICG Personnel & Stakeholders
14-15 Feb 24	Visakhapatnam Port Authority	Area Level PR Exercise	(a) CG DHQ-6 (b) ICG, VPA & OHAs
19-23 Feb 24	CG PRT (E), Chennai	OPRC Level-1	(a) CG PRT (E) (b) ICG Officers
19-23 Feb 24	Port Blair	OPRC Level 1	(a) CGPRT (A&N) (b) ICG Personnel
11-22 Mar 24	CG PRT (E), Chennai	OPRCLevel1& 2	(a) CG PRT (E) (b) FFCs
11-15 Mar 24	CG PRT (W), Mumbai	OPRC Level 1	(a) CG PRT (W) (b) ICG Officers, SOs & EPs.
12-13 Mar 24	CG DHQ-1, Porbandar	PR Seminar, Workshop, Mock Drill & Table Top Exercise	(a) CG DHQ-1 (b) ICG & Stakeholders
14 Mar 24	Off GMB Port Trust, Porbandar	Area Level PR Exercise	(a) CG DHQ-1 (b) ICG, Ports & OHAs
18-19 Mar 24	Diglipur	(i) PR Seminar/ Work-shop/Table Top Exercise (ii) PR Exercise (Mock Drill)	(a) CG DHQ-9 (b) ICG & OHAs.
19-20 Mar 24	CG DHQ-5, Chennai	PR Seminar/ Workshop/ Mock Drill	(a) CG DHQ-5 & Adani Port Kattupalli (b) ICG, Ports & OHAs
01-05 Apr 24	CG PRT (W), Mumbai	OPRC Level 2	(a) CG PRT (W) (b) ICG Officers & SOs
09-10 Apr 24	Off Kochi	Mock Drill at Sea	(a) ICGS Kochi (b) ICG Personnel
15-16 Apr 24	JSW Port Jaigad	PR Seminar	(a) ICGS Ratnagiri (b) ICG & Stakeholders
18-19 Apr 24	Kakinada	PR Seminar/ Workshop	(a) ICGS Kakinada (b) ICG, Port & OHAs
22-23 Apr 24	Mundra	PR Seminar, Workshop, Mock Drill & Table Top Exercise	(a) CG DHQ-15 (b) ICG, Port & OHAs.
22-25 Apr 24	HMS Rehman/ VITS Mumbai	OPRC Level 3	(a) CGPRT (W) & M/s OSCT (b) ICG Officers, Ports, OHAs & Stakeholders
22-26 Apr 24	CG PRT (E), Chennai	OPRC Level-1	(a) CG PRT (E) (b) Stakeholders
23-24 Apr 24	MPA/ Off Goa	Area Level Exercise	(a) Mormugao Port Authority (b) ICG & Stakeholders
24-25 Apr 24	Off Paradip Port	Area Level PR Exercise	(a) CG DHQ-7 (b) ICG, PPA & OHAs
01-02 May 24	Off New Mangalore	Area Level PR Exercise	(a) CG DHQ-3 & NMPA (b) NMPA & OHAs
02-03 May 24	Off Mumbai	Area Level PR Exercise	(a) CG DHQ-2 &MbPT (b) Ports and OHAs

Date	Venue	Exercise/Training	(a) Coordinator (b) Participants
06-10 May 24	CG PRT (E), Chennai	OPRC Level-1	(a) CG PRT (E) (b) ICG Personnel
13-15 May 24	Off Chennai	Regional Level PR Exercise	(a) CG RHQ (E) (b) ICG, Ports, OHAs & Coastal Authorities
13-17 May 24	CGPRT (NW), Vadinar	OPRC Level-1	(a) CG PRT (NW) (b) CG Personnel & Stakeholders
20-21 May 24	CG PRT (W), Mumbai	PR Capsule Course	(a) CG PRT (W) (b) Afloat ICG Units at Mumbai
22-23 May 24	CGDHQ-8, Haldia	PR Seminar/Workshop and Mock Drill & Table Top Exercise	(a) CG DHQ-8 (b) ICG, Port & OHAs.
05-06 Jun 24	Murud Janjira	PR Workshop/ Seminar	(a) ICGS Murud Janjira (b) ICG & Stakeholders
10-14 Jun 24	HMS Rehman/ VITS Mumbai	OPRC Level 2	(a) CG PRT (W)& M/s OSCT (b) ICG Officers, Ports, OHAs & Stakeholders
17-18 Jun 24	CG DHQ-3, New Mangalore	PR Seminar, Workshop and Mock Drill/Table Top Exercise	(a) CG DHQ-3 (b) ICG, Port & OHAs.
13-14 Jun 24	VOC Port Authority, Tuticorin	Area Level PR Exercise at Major Port	(a) CG DHQ-16 (b) ICG & VOC Port
18-19 Jun 24	ICGS Karaikal	PR Seminar/Workshop/ Mock Drill	(a) CGDHQ-13&Karaikal Port (b) ICG, Port & OHAs.
27-28 Jun 24	CG DHQ-6, Vizag	PR Seminar/Workshop/ Mock Drill	(a) CG DHQ-6& VPA (b) Port & OHAs.
01-05 Jul 24	CG PRT (W), Mumbai	OPRC Level 1	(a) CGPRT (W) (b) Ports, OHAs & Stakeholders
01-05 Jul 24	CG PRT (E), Chennai	OPRC Level 2	(a) CG PRT (E) (b) ICG Officers & Stakeholders
01-05 Jul 24	Port Blair	OPRC Level 1	(a) PRT (A&N) (b) ICG Personnel
08-12 Jul 24	ICGS Vadinar	OPRC Level1	(a) CG PRT (NW) (b) CG personnel & Stakeholders
22-26 Jul 24	CG PRT (E), Chennai	OPRC Level 1	(a) CG PRT (E) (b) ICG Officers
05-08 Aug 24	HMS Rehman/ VITS Mumbai	OPRC Level 3	(a) CG PRT (W) & M/s OSCT (b) ICG Officers, Ports, OHAs & Stakeholders
19-30 Aug 24	CG PRT (E), Chennai	OPRC Level - 1 & 2	(a) CG PRT (E) (b) FFCs
21-22 Aug 24	Port Blair	PR Seminar/Workshop/ Mock Drill	(a) CG DHQ-14 (b) ICG & Stakeholders
22-23 Aug 24	Kochi	PR Workshop/ Seminar	(a) CG DHQ-4 (b) ICG, Ports & Stakeholders
23-24 Aug 24	CG Fuel Complex Campbell Bay	PR Seminar/Table Top Exercise/Mock Drill &Workshop	(a) CG DHQ-10 (b) ICG & Stakeholders
02-06 Sep 24	CGPRT (NW), Vadinar	OPRC Level1	(a) CG PRT (NW) (b) CG personnel & Stakeholders
09-13 Sep 24	CG PRT (E), Chennai	OPRC Level-1	(a) CG PRT (E) (b) ICG personnel
09-13 Sep 24	CG PRT (W), Mumbai	OPRC Level 2	(a) CG PRT (W) (b) ICG Officers and SOs
12-13 Sep 24	Beypore/ Kozhikode	PR Seminar/ Mock Drill	(a) ICGS Beypore (b) ICG & OHAs
18-19 Sep 24	CGDHQ-7, Paradip	PR Seminar/Workshop and Mock Drill & Table Top Exercise	(a) CGDHQ-7 (b) Paradip Port Authority

Date	Venue	Exercise/Training	(a) Coordinator (b) Participants
18-19 Sep 24	Haldia Dock Complex	Area Level PR Exercise	(a) CG DHQ-8 (b) ICG & Ports
23-27 Sep 24	CG PRT (E), Chennai	OPRC Level1	(a) CG PRT (E) (b) Stakeholders
30 Sep- 04 Oct 24	Port Blair	OPRC Level1	(a) CGPRT (A&N) (b)
14-16 Oct 24	GoK (Off Mundra)	Regional Level PR Exercise	(a) CGDHQ-15 (b) ICG, OHAs & Stakeholders
15-16 Oct 24	Angre Port, Jaigad Ratnagiri	PR Seminar, Workshop, Mock Drill and Table Top Exercise	(a) ICGS Ratnagiri (b) ICG & Stakeholders
04-05 Nov 24	CG PRT (W), Mumbai	PR Capsule Course	(a) CG PRT (W) (b) Afloat ICG units at Mumbai
04-08 Nov 24	CGPRT (NW), Vadinar	OPRC Level-1	(a) CG PRT (NW) (b) CG personnel & Stakeholders
04-15 Nov 24	CG PRT (E), Chennai	OPRC Level1 & 2	(a) CG PRT (E) (b) FFCs
12-13 Nov 24	CGDHQ-11, Goa	PR Seminar/Workshop/ Table Top Exercise	(a) CG DHQ-11, Goa (b) ICG & Stakeholders
12-14 Nov 24	Paradip	Regional Level PR Exercise	(a) CG DHQ-7 (b) Paradip Port & OHAs
18-22 Nov 24	HMS Rehman/ VITS Mumbai	OPRC Level 2	(a) CG PRT (W)&M/s OSCT (b) ICG Officers, Ports, OHAs & Stakeholders
20-22 Nov 24	Off Goa	Regional Level PR Exercise	(a) CG DHQ-11, Goa (b) ICG & Stakeholders
21-22 Nov 24	Adani Krishnapatnam Port Limited	PR Seminar/Workshop/ Mock Drill	(a) ICGS Krishnapatnam & M/s AKPL (b) Port & OHAs.
26-27 Nov 24	Off Vizhinjam	PR Workshop/ Mock Drill/ Mock Drill at Sea	(a) ICGS Vizhinjam (b) ICG & OHAs
28-29 Nov 24	Kavaratti Island	PR Seminar, Workshop, Table Top Exercise and mock drill	(a) CG DHQ-12 (b) ICG & OHAs
02-06 Dec 24	CG PRT (W), Mumbai	OPRC Level 1	(a) CG PRT (W) (b) ICG Officers, SOs & EPs
09-12 Dec 24	HMS Rehman/ VITS Mumbai	OPRC Level 3	(a) CG PRT (W) & M/s OSCT (b) ICG Officers, Ports, OHAs & Stakeholders
16-20 Dec 24	CG PRT (E), Chennai	OPRC Level2	(a) CG PRT (E) (b) ICG Officers & Stakeholders
18-20 Dec 24	Port Blair	Regional Level PR Exercise	(a) CG PRT (A&N) (b) ICG & OHAs
19-20 Dec 24	CGDHQ-16, Tuticorin/ VOC Port	PR Seminar/Workshop/ Mock Drill	(a) CGDHQ-16& VOC Port (b) ICG & VOC Port

Editorial Office : **Directorate of Fisheries & Environment**
Coast Guard Headquarters, National Stadium Complex,
New Delhi 110 001, India
Tel : (+91)(11) 23115106
E-Mail: dte-fe@indiancoastguard.nic.in
Website : www.indiancoastguard.gov.in