Guidebook

ON SUSTAINABLE ENVIRONMENTAL PRACTICES FOR MARINAS AND BOATYARDS IN TRINIDAD AND TOBAGO

VERSION 1.0

Disclaimer

This document has been prepared to provide guidance on aspects of the siting, design, operation and maintenance of Marinas and Boatyards in Trinidad and Tobago. This guidebook does not apply to the operation of vessels at sea. The coastal zone of Trinidad and Tobago is diverse in its physical, ecological and socio-economic character. Therefore, the applicability of the practices presented in this guidebook may not be suitable for every site. Independent technical advice should be sought on all matters covered by the document. This guidebook is meant to assist developers/operators of marinas and boatyards in meeting, or exceeding, their regulatory responsibilities, but is not a substitute for existing regulations. Questions about specific regulations or regulatory compliance responsibilities should be directed to the relevant competent authority.

List of Abbreviations and Acronyms

CEC	Certificate of Environmental Clearance
EMA	Environmental Management Authority
IBWMC	International Ballast Water Management Convention
IMA	Institute of Marine Affairs
IMO	International Maritime Organization
MARPOL 73/78	International Convention for the Prevention of Pollution from Ships
MSD	Maritime Services Division
PRF	Port Reception Facilities
SAV	Submerged Aquatic Vegetation
TCPD	Town and Country Planning Division
THA	Tobago House of Assembly
UNCLOS	United Nations Convention on the Law of the Sea

Glossary

Bathymetric survey - The measurement of depth of water in oceans, seas, or lakes.

Breakwater - A solid barrier constructed in the water to create a sheltered area for boats.

Riparian buffer strip - An area of vegetation positioned between a water body or watercourse and nearby development

Detention Pond – Also referred to as a "dry basin" is a natural or artificially designed structure that temporarily holds storm water (6 – 8 hours) for the sole purpose of attenuating flooding

Finger float- A floating structure connected to the walkway which provides pedestrian access both to and from a berthed boat.

Porous pavement- A layer of porous top course covering an additional layer of gravel. The runoff infiltrates through the porous asphalt layer and into the underground recharge bed.

Rapid bio-assessment techniques - efficient, cost-effective methods of evaluating the condition of a water body, using surveys and other direct measurements of the biota in the water body.

Retention Pond – Also known as a 'wet basin' is a natural or artificial structure designed to hold storm water runoff for prolonged periods of time to attenuate flooding and remove contaminants (primarily sediments). Retention ponds may also have shallow wetlands to aid the removal of chemical contaminants.

Revetment - A sloped facing of stone or concrete built to protect existing land or newly created embankments (breakwaters, bund walls) against erosion by wave action, currents, or weather.

Riparian - For the purposes of this report, riparian refers to areas adjoining coastal water bodies, including rivers, streams, bays, estuaries, coves, etc.

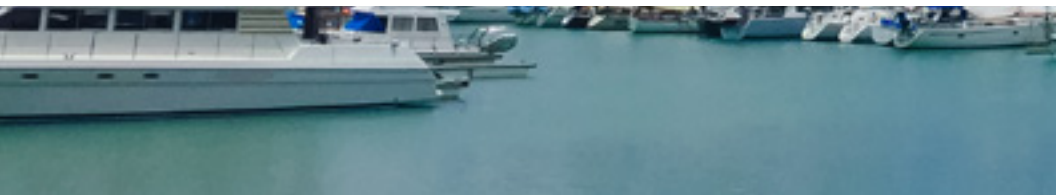
Riprap - Larger facing, or protective mounds of rock placed on embankments and breakwaters to prevent erosion, scour, or sloughing of structure or embankment.

Sand Filters – Also known as 'filtration basins' are engineered structures consisting of layers of sand of varying grain sizes upon a bed of gravel to promote infiltration into the soil, or perforated underdrains for the discharge of treated water.

Shoaling - Deposition of sediment causing a water body or location within a water body to become shallow

Swale - A low or hollow place, especially a marshy depression between ridges.

Wave Attenuator- area floating structure designed and engineered to significantly reduce wave action entering a marina basin.



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Introduction

This document provides guidance and best management practices for the marina and boatyard industry to achieve good environmental stewardship.

Marina and boatyard operators intimately interact with, and benefit from, Trinidad and Tobago's marine and coastal resources. As such, they have a special responsibility to uphold the highest environmental standards and safeguard themselves against natural disasters.

This guidebook contributes to Trinidad and Tobago's sustainable development agenda; providing measures to ensure that economic growth in the Maritime Sector is achieved in a manner that is socially and environmentally responsible. Its formulation is in accordance with the Yachting Policy of Trinidad and Tobago (2017 – 2021), Integrated Coastal Zone Management Policy Framework 2014, and the National Environmental Policy 2018 which call for the protection of environmental and human health through pollution control and sustainable management of natural assets. It is also aligned with the United Nations Convention on the Law of the Sea (UNCLOS) which obligates the State to protect and preserve the marine environment, and the International Convention for the Prevention of Pollution from Ships (MARPOL 73/78), which requires that marinas and boatyards have adequate port reception facilities (PRFs) to facilitate the efficient, environmentally responsible disposal of MARPOL 73/78 residues/wastes. Thus, this guidebook encourages marinas and boatyards to achieve excellence in environmental management, disaster risk reduction, environmental education and safety.

The following environmental best management practices for marinas and boatyards are described for common boatyard activities. The types of marina and boatyard operations that they apply to include:

- Recreational boat docking facilities
- Commercial boat docking facilities
- Boat storage facilities
- Boat building and maintenance facilities

This document is divided into two broad Parts: (A) Siting and Design and (B) Operation and Maintenance. Part A is aimed at persons seeking to develop new marinas or expand existing marinas. It provides best management practices for issues that should be addressed prior to commencing construction or operationalization. Part B applies to marinas and boatyards that have already been established and are operational. It provides guidance on preventing and minimizing environmental impact.

Users of this guidebook should select measures appropriate to the nature, location and scale of their project. The use of this guidebook is not a substitute for adhering to regulations governing marinas and boatyards in Trinidad and Tobago.

PART A

Siting and Design

LEGISLATIVE AND REGULATORY CONSIDERATIONS

By law, there are several permits and approvals that must be attained for marinas and boatyards prior to the commencement of operations. These laws exist to minimize the impact of development on the environment, ensure optimal allocation of land, and minimise risk to built infrastructure. When considering the establishment, expansion, modification, and/or decommissioning of a marina or boatyard, inclusive of associated works[1], developers must apply for:

1. **Outline Permission** from the Town and Country Planning Division (TCPD), if establishing a new facility.
2. **Full Planning Permission** from the TCPD, if outline permission for establishing a new facility is granted.
3. **A Certificate of Environmental Clearance (CEC)** from the Environmental Management Authority (EMA), if the proposed activity is listed in the CEC (Designated Activities) Order, 2001 (as amended).
   For example: Designated Activity 13(a) – *"The establishment, modification, expansion, decommissioning or abandonment (inclusive of associated works) of marinas, piers, slipways, jetties or other coastal features."*
4. **A Source Registration Certificate for Water Pollution** from the EMA, if a facility within, or associated with, the marina/boatyard is anticipated to discharge into the environment pollutants listed in the 1st Schedule of the Water Pollution Rules, 2001 (as amended).
   For example: Designated Activity 2(iii) - *"Transport terminals (sea ports, air ports, bus and rail terminals)"*
5. **A Source Registration Certificate as an Emitter Facility** from the EMA, if a facility within, or associated with, the marina/boatyard is anticipated to emit air pollutants listed in the 2nd Schedule or undertake any of the designated activities listed in the 3rd Schedule of the Air Pollution Rules, 2014.
6. **A Facility Variation**, if requested by the EMA in anticipation that facility operations will cause sound in excess of the prescribed standards in the 1st Schedule of the Noise Pollution Control Rules, 2001.

Good practice also dictates that developers consult with the competent authorities when designing or developing programs of activities related to marinas and boatyards to minimize environmental impact. Consultations should be held with IMA, MSD, EMA or THA where appropriate.

WATER QUALITY MANAGEMENT

Marinas and boatyards may introduce many chemical, physical or biological contaminants into the environment during construction and operations that may diminish water quality, including but not limited to: heavy metals, hydrocarbons, anti-fouling residues, sediments, litter, and sewage. Given that marine pollution is indiscriminate and transboundary in nature, managing the quality of coastal

[1] *This includes activities such as the subdivision of land, grading of hills, clearing of land, development of roads or establishment of supporting facilities (e.g. waste water treatment, concrete batching, etc.)*

waters surrounding the marina/boatyard is important for protecting human and ecological health, maintaining aesthetic appeal, and enabling other uses of the coastal zone. Therefore, it is critical that during the siting and planning phase, developers take stock of the existing water quality, and put measures in place to minimize, or prevent where possible, the pollution of the marine environment. Where practicable, owners/developers of marinas and boatyards should:

1. Develop and execute a pre-development sampling programme[2] for the area surrounding the proposed marina or boatyard with an aim to characterize the:
    a. Baseline of quantity/condition/concentration of the parameters/ substances listed in the *1st Schedule of the Water Pollution Rules, 2001 (as amended);*
    b. Water circulation and flushing time;
    c. Sedimentation, accretion, and erosion rates; and
    d. Influence of fresh-water bodies on water quality of the proposed site.
2. Design the facility so as to prevent the commingling of process (waste) water and sewage with storm water to minimize the discharge of pollutants into the aquatic environment.
3. Utilize the design principles to enhance marina flushing. See the Section on Marina Flushing.
4. Develop and execute a water quality sampling programme[3] during development of the marina/boatyard to monitor the impact of the development on the *quantity/condition/concentrations of the parameters/ substances listed in the 1st Schedule of the Water Pollution Rules, 2001 (as amended).*
5. Use appropriate technologies to ensure that all point-source discharges are compliant with the permissible levels listed in the *1st Schedule of the Water Pollution Rules, 2001 (as amended).*
6. Develop a *Spill Prevention, Control and Counter-measure Plan* to minimize the risk of, and address, accidental releases of chemicals into the aquatic environment.
7. Use sediment control measures such as silt curtains and bunds during dredging activities to protect water quality of adjacent areas during construction and maintenance works.
8. Use alternative materials such as concrete-filled, steel-reinforced polyvinyl chloride (PVC), plastics or other non-conventional materials for piling to reduce the leaching of biocides and anti-fouling agents typically associated with wooden structures.
9. Avoid the use of breakwaters unless it can be demonstrated that there would be sufficient water circulation and flushing to prevent water stagnation and the accumulation of pollutants.

[2]*The sampling programme must contain data from at least one wet-season and one dry season to capture seasonal changes. Numerical modeling may be used in tandem with field sampling to predict rates of flushing, sedimentation or accretion/erosion.*

[3]*Numerical modelling should not be used for monitoring the changes to parameters during construction. Sampling stations should be located at all points of direct discharge as well as at ambient locations.*

MARINA FLUSHING

The movement of water through marinas and boatyards, referred to as 'flushing', is important for the dilution and distribution of contaminants. The rates of flushing depend on, among other things, the basin configuration, orientation to prevailing winds, changes in tide, placement of hard structures, and depth of channels/basins. The stagnation of water contributes to diminished water quality, aesthetic appeal, loss of marine life, and increased sedimentation of the basin. Marinas and boatyards should be located where the site's characteristics naturally promote flushing, and designed to further enable water renewal on a regular basis. Where practicable, owners/developers of marinas and boatyards should:

1. Maintain natural circulation patterns at the site as best as possible.
2. Ensure that the bottom of the marina/boatyard basin and entrance channel(s) are not deeper than the adjacent navigable water, unless it can be demonstrated that the bottom will support a natural population of benthic organisms[4] .
3. Use as few segments as possible to promote circulation within the basin[5].
4. Use curved corners instead of boxed corners to reduce the risk of stagnant corner water build-up and excess sedimentation, particularly in downwind areas. Where square corners cannot be avoided, ensure points of access are available to facilitate easy removal of debris and sediments.
5. Use wave attenuators instead of fixed structures to avoid the restriction of the exchange of water between ambient water and water within the marina/boatyard area.
6. Utilize an aspect ratio (ratio of length to breadth) greater than 0.33 but less than 3.0, preferably between 0.5 and 2.0, to limit the formation of secondary circulation cells that reduce flushing.
7. Utilize mechanical aeration systems to enhance water circulation where basin configuration and channel positioning result in inadequate flushing.
8. Gradually increase the depth of channels towards open water to maximize natural tidal circulation in areas of minimal or no tides.
9. Align channel entrances as closely as possible to the natural channel alignment, and parallel to prevailing winds, to facilitate basin water mixing/flushing via wind-generated currents. Bending to achieve this alignment should be done gradually.
10. Establish 2 openings, where appropriate, at opposite ends of the marina to allow flow-through currents.
11. Use a single, narrow entrance channel in areas where the tidal range is large.
12. Make the channel entrance(s) as wide as possible while still providing adequate protection from waves where the tidal range is small.

[4]These are organisms that live in, on, or near to the bottom of aquatic environments.
[5]Flushing efficiency is inversely proportional to the number of segments. An open design has better flushing than a 1-segment marina; 1-segement marina has better flushing than a 2-segment marina; and so on

STORM WATER RUNOFF MANAGEMENT

Storm water runoff is rainfall that is neither evaporated nor absorbed by the ground but instead travels across impervious surfaces (such as roads, parking lots and roofs) into the environment. It often results in the transport of pollutants absorbed from the air or ground including, but not limited to: litter, debris, sediments, hydrocarbons, heavy metals and other chemicals. Storm water runoff management seeks to attenuate the flow of water into the environment to reduce flooding and/or remove contaminants from storm water before release into the environment. The poor management of storm water runoff can impact marine water quality, impede near-by freshwater streams, and contribute to the flooding of facilities or neighboring areas. Where practicable, owners/developers of marinas and boatyards should:

1. Design the facility such that storm water is not commingled with process water or sewage.
2. Establish appropriate waste water treatment systems for storm water runoff that may be contaminated by process water or sewage before it is released into the environment.
3. Restrict boat building, maintenance, and repairs to areas above dry, impervious surfaces[6] and under shelter to facilitate the proper collection and disposal of debris, residues, solvents, spills, sandings, paint chips, and storm water runoff.
4. Maintain proper functioning of all marina equipment and ensure its proper use to minimize the risk of leaks and spills entering storm water systems.
5. Use of water-based paint rather than toxic oil-based paints for landscaping needs and parking lots to minimize contaminants into drains and eventually into the marine environment.
6. Establish and maintain functional sand filters, also known as 'filtration basins' for drainage areas between 3 – 80 acres in size, or areas with > 65% impervious surfaces.
7. Establish and maintain function retention ponds[7] for drainage areas > 10 acres.
8. Use multiple sump[8] in series to allow oils and suspended materials to settle out and be filtered.
9. Use grassed swales for the conveyance of storm water where maximum flow rates are not expected to exceed 1.5 feet/sec in place of buried storm drains.
10. Design facilities such that impervious surfaces are minimized and vegetation is used to enhance infiltration of storm water into the ground and reduce runoff volumes.
11. Plant vegetated buffer strips such as grass and flowers in areas such as parking lots and marina basins to absorb runoff water effectively.

[6]Tarpaulins may be placed on permeable surfaces prior to the placement of boats for work.
[7]Pond liners are required if underlying soil is permeable or if bedrock is fractured. Shallow wetlands may be established in retention ponds to aid in contaminant removal.
[8]A sump is a pit or reservoir serving as a drain or receptacle for liquids.

SEWAGE FACILITY MANAGEMENT

For marinas and boatyards, sewage is both generated by on-shore users and received from vessels they serve. Proper sewage management ensures that sewage is properly collected, stored and treated in a manner that minimizes risk of entering into coastal waters. The mismanagement of sewage can threaten human health, ecological health and reduce the aesthetic appeal. Where practicable, owners/developers of marinas and boatyards should:

1. Receive ship-originated sewage using one, or a combination, of the following:
   a. One or more centrally located fixed-point pump out system(s)[9] ; and
   b. Portable pump out system(s)[10].
2. Unless otherwise approved, ensure that there is at least 1 pump out facility per 300 boats with holding tanks.
3. Design all sewage treatment systems with a minimum drain field setback of 100 feet from surface water.
4. Set aside 5% of total land area for maintenance with these areas to be located above high tide mark to avoid contamination of incoming tidal water.
5. Surround the maintenance working area with a low height impervious wall or curb to contain the liquid which drains to one or two central points where it can be pumped to a storage tank to allow for treatment of pollutants.
6. Ensure that the discharges from the sewage treatment system are compliant with the permissible levels listed in the 2nd Schedule of the Water Pollution Rules, 2001 (as amended).
7. Develop and implement an Inspection and Maintenance Schedule for all sewage facilities (inclusive of the pump-out systems, public restrooms and sewage treatment systems).
8. Keep maintenance records for all waste treatment facilities and waste manifests for any waste that is being removed from the site to be treated offsite.
9. Ensure that visible, legible signs are placed at appropriate locations throughout the marina or boatyard to convey:
   a. Discharge of sanitary waste into the marina basin is strictly prohibited;
   b. The availability of pump out services;
   c. The procedure for utilizing the pump out service; and
   d. The availability of public restroom facilities.
10. Provide restrooms for both males and females at the marina. Unisex toilet rooms may be provided in lieu of, or in combination with, conventional male/female restrooms, where bins are provided for the proper disposal of sanitary napkins.

[9]A flexible hose is connected to the wastewater fitting in the hull of the boat, and pumps or a vacuum system move the wastewater to an onshore holding tank, a public sewer system, a private treatment facility, or another approved disposal facility.

[10]Mobile units comprised of a pump and small storage tank is connected to the deck fitting of vessels and waste water is removed. When filled, the mobile units discharge its contents into a municipal sewage system or a holding tank for removal by a septic tank pump out service.

11. Restroom should be designed to cater for the physically disabled, and outfitted using the following ratios[11]:

Item	Amenities for every 50 -75 persons	
	Male	Female
Toilets	1	2
Urinals	1	-
Showers	1	1
Basins	1	1

12. Ensure that all toilets have ultra-low flush fixtures with a maximum flow rate of 1.6 gallons per flush.

FUEL STATION DESIGN

A major function of marinas and boatyards is the provision of fuels to vessels. Accidental releases of fuel increase the risk of fires within the facility, and can have detrimental effects to marine life. Given that hydrocarbon tends to be less dense than sea water, it is possible to contain/collect spilt fuels. However, during siting and design, emphasis should be placed primarily on the prevention of spill/releases, with containment considered as a secondary measure. Where practicable, owners/developers of marinas and boatyards should:

1. Design and locate fuelling stations such that:
   a. Containment booms can be effectively deployed in the event of a spill;
   b. Fire fighting vehicles have easy access in the event of an emergency;
   c. Stations are leeward of exits and the prevailing winds to ensure safe evacuation in the event of a fire;
   d. Marina flushing around the station is high to minimize the water quality impact due to spills;
   e. The marina office can be accessed without direct access through the main berthing area;
   f. Above ground storage tanks for fuel have adequate secondary containment; and
   g. Underground storage tanks for fuel are double walled with automatic leak detection.
2. Utilize fuel spillage protection devices[12], flexible fuel supply lines from shore to berth, and automatic fuel cut-off valves.
3. Use vacuum operated pumps, dry break couplings or drip trays at any fuel transfer systems operating within or across the intertidal zone.
4. Ensure that marina operators are present during fuelling, and allowed direct access to emergency shutoff devices.

[11] *Adapted from the Belize Department of Environment National Environmental Guideline for Marinas and Berthing Facilities.*
[12] *Example: fuel nozzles with automatic back pressure shut-offs and no holding clip to keep the nozzle open.*

1. Develop a *Spill Contingency Plan* for fuel storage and dispensation areas that outlines, at a minimum:
   a. Health and safety procedures;
   b. Notification procedures to the competent authorities; and
   c. Spill containment and control procedures.
2. Routinely conduct drills/simulations of the Spill Contingency Plan to ensure all marina/ boatyard personnel are aware of appropriate procedures.
3. Appropriately label and make accessible spill containment equipment[13] at storage and dispensation areas.

BIODIVERSITY PROTECTION

The coastal zone of Trinidad and Tobago encompasses several diverse ecosystems and habitats that contain plants and animals of commercial, aesthetic, ecological and recreational value. Some critical biological resources found in the coastal zone include, but are not limited to: i) submerged aquatic vegetation (SAV); ii) tidal and non-tidal wetlands; iii) coral reefs; iv) rare, threatened, or endangered species; v) fish spawning, nursery, or propagation areas; and vi) bird nesting sites and existing riparian forests or mangrove forests with interior dwelling bird species. Environmentally responsible siting and design of marinas and boatyards avoid the destruction of ecologically significant habitats, and minimize disturbance to the functioning and life cycles of species. Where practicable, owners/developers of marinas and boatyards should:

1. Give preference for redeveloping coastal waterfront sites that have been previously disturbed, or expanding exiting marinas and boatyards instead of establishing new facilities in undisturbed areas.
2. Conduct a baseline assessment[14] of the areas of concern within and around the project site.
3. Assess the historical habitat function[15] of the project site to avoid indirect impacts to populations of species.
4. Ensure that only areas designed for construction are cleared.
5. Minimize the project footprint[16] much as practicably possible.
6. Develop a Communication Plan to facilitate State Authorities in the monitoring and assessment of vessels for compliance with the *International Convention for the Control and Management of Ships' Ballast Water and Sediments (Ballast Water Management Convention).*
7. Establish systems for the treatment of ballast water and management of sediments introduced by ballast waters to minimize the risk of invasive alien species being introduced, unless the vessel has an International Maritime Organization(IMO) approved Ballast Water Management Plan on-board treatment system, and International Ballast Water Management Convention (IBWMC) Certificate.

[13] *These include containment booms, absorbent pads and fire extinguishers.*
[14] *This includes field surveys of the fauna and flora characterization and status present.*
[15] *Habitat functions include: spawning grounds, nursery area, nesting area, and migration pathway.*
[16] *Project footprint is the land or water area covered by a project. This includes direct physical coverage (i.e., the area on which the project physically stands) and direct effects (i.e., the disturbances that may directly emanate from the project, such as noise).*

SHORELINE STABILIZATION

The destabilization and erosion of the shoreline due to waves can have significant environmental implications including, but not limited to: the compromising of pollution mitigation measures and the introduction of debris to the marine environment due to infrastructural damage. The type of technique used to attenuate high-energy waves and stabilize shorelines is dependent on the site's specific characteristics and underpinning cause of erosion. Independent technical advice should be sought for deciding the appropriate measure to use so that unintended environmental impacts (E.g. increased shoreline erosion to unprotected downstream areas) can be avoided. Where practicable, owners/developers of marinas and boatyards should:

1. Establish vegetation[17] along low-wave-energy areas where the underlying soil type provides the stability required for plants and conditions are suitable for plant growth.
2. Utilize appropriate, cost-effective structural methods and techniques[18] to minimize coastal erosion from long-shore drift, storm surge or high-energy waves.
3. Utilize over-dredging, and possible future bypass dredging[19], during preliminary site assessments for the proposed design plan in order to minimize the degree of sedimentation and to ensure that any sedimentation which does occur can be efficiently removed.

CONSIDERATION OF WEATHER AND CLIMATE CHANGE RISKS

As a result of climate change, it is projected that Trinidad and Tobago will experience, among other things: reduced rainfall volumes and increased rainfall intensity, more frequent and intense extreme weather events[20] , and increased sea-level rise. These effects can have negative impacts to the integrity, navigability and aesthetics of marinas and boat yards. Storms and hurricanes may: (i) deposit large volumes of sediment into the marina basin and channels, (ii) damage pollution mitigation infrastructure, and (iii) wreck ships that are inadequately secured in the marina basin. Thus, marinas and boatyards should seek to 'climate proof' their infrastructure and operations during the siting and design phase to reduce the impact of climate change. Where practicable, owners/developers of marinas and boatyards should:

1. Establish marinas or boatyards in an area that is readily sheltered from the prevailing winds and strong surges.
2. Design marinas and boatyards so that access is allowed under adverse weather conditions and provide enough protection to allow vessels to maneuver with minimal threat of collision.

[17]Native species, particularly those historically associated with the area should be used where possible.

[18]These may include, but are not limited to: bulkheads, jetties, breakwaters, gabions, riprap and sloping revetments. The selection of artificial structure should be determined by a qualified coastal engineer.

[19]Dredging is an excavation activity usually carried out underwater, in shallow seas or freshwater areas with the purpose of gathering up bottom sediments and widening. This technique is often used to keep waterways navigable and creates an anti-sludge pathway for boats.

[20]These include floods, droughts and tropical storms.

1. Design all structures, including breakwater and protective works, to withstand a storm with a return period of at least 10 years.
2. Consider sea level rise of at least 3 meters by 2050 in the design of facilities.
3. Develop a procedure for ensuring that vessels left unattended in the marina basin are anchored at four points to prevent unintentional movement during extreme weather events.
4. Incorporate storm water conveyance and retention systems that are able to manage at least 150% of the projected rainfall for the site.

CHEMICAL STORAGE / HANDLING

Marinas and boatyards may use several chemicals during their construction and operations such as: detergents, acetone, solvents, thinners, paints, and hydraulic fluid. If improperly stored and handled, these chemicals may contaminate the soil and marine environment, leading to environmental harm. Where practicable, owners/developers of marinas and boatyards should:

1. Ensure that all chemical tanks are established above ground.
2. Remove/decommission any previously established underground storage tanks in favor of above ground storage.
3. Design above-ground storage to effectively contain released materials in the event of a spill by including:
   a. Adequate containment dikes and shed roofs;
   b. Bunds with a capacity of at least 110% of the maximum volume of the tank; and
   c. A drainage sump with an additional minimum wall height of 150 mm to accommodate rainfall and firefighting foam.
4. Develop a *Chemical Storage, Handling and Housekeeping Plan* that includes at a minimum:
   a. A regular schedule of inspections and preventative maintenance; and
   b. A system for identifying and repairing/replacing damaged fuel/chemical containers.
5. Locate storage and disposal areas for liquid chemicals:
   a. Away from heavily trafficked areas;
   b. Near to the intended repair and maintenance areas;
   c. In areas accessible to emergency services; and
   d. Away from surface water bodies and sensitive ecosystems.
6. Design covered and ventilated temporary storage areas to facilitate collection of potentially hazardous leaks and spills.
7. Ensure that all storage and disposal areas of liquid materials are covered, and systems are in place to avoid the commingling with storm water.
8. Store reactive and incompatible chemicals in separate areas.
9. Use, and make available to patrons, vacuum-type systems for oil changes and bilge[21] water draining.

[21] *A bilge is an area on the outer surface of a ship's hull where the bottom curves to meet the vertical sides.*

10. Prohibit chemical waste discharge into a storm sewer, sanitary sewer or onto the open ground or surface waters.
11. Avoid, as far as practicably possible, the use of highly toxic materials such as surfactant, anti-scaling agents, phosphoric, hydrochloric and sulphuric acid, detergents containing more than 6% by weight of volatile compounds, reactive chloro-compounds and formaldehyde and bioaccumlable preservative classified as H410, H411, R50/53 or R51/53.

SOCIAL AMENITIES AND INFRASTRUCTURE DESIGN

Marinas and boatyards may include social amenities such as restaurants, bars, restrooms and laundromats. It is critical that commercial operations within the marina are properly managed to ensure that there is minimal risk of environmental pollution. Where practicable, owners/developers of marinas and boatyards should:

1. Use marina/boatyard designs with a footprint that has a land-to-water area ratio of between 50:50 and 40:60, depending on the extent of shore-based facilities to enable efficient material and activity flow paths.
2. Make conditional into contracts and lease agreements that all commercial activities must:
    a. Adhere to the marina/boatyard's environmental management procedures including, but not limited to, the appropriate use of waste disposal infrastructure; and
    b. Receive relevant environmental and safety permits before becoming operational.
3. Design facilities to provide for periodic repair and maintenance without loss of safety or amenity.
4. Ensure that construction and maintenance of infrastructure utilize local or environmentally-friendly building materials and products.
5. Ensure that all electric power lines are underground.
6. Ensure that electricity and water is available at berths, and installations must be approved by competent authorities governing utilities.
7. Ensure portable fire extinguishers are located throughout the marinas and clearly labelled. All fire extinguishers should be inspected monthly.
8. Ensure that facilities are designed to minimize energy consumption and utilize best available energy efficiency technology.
9. Ensure that renewable energy and sustainable fuels are incorporated into the design and operation of marinas and boatyard facilities.

GENERAL DISTURBANCE MANAGEMENT

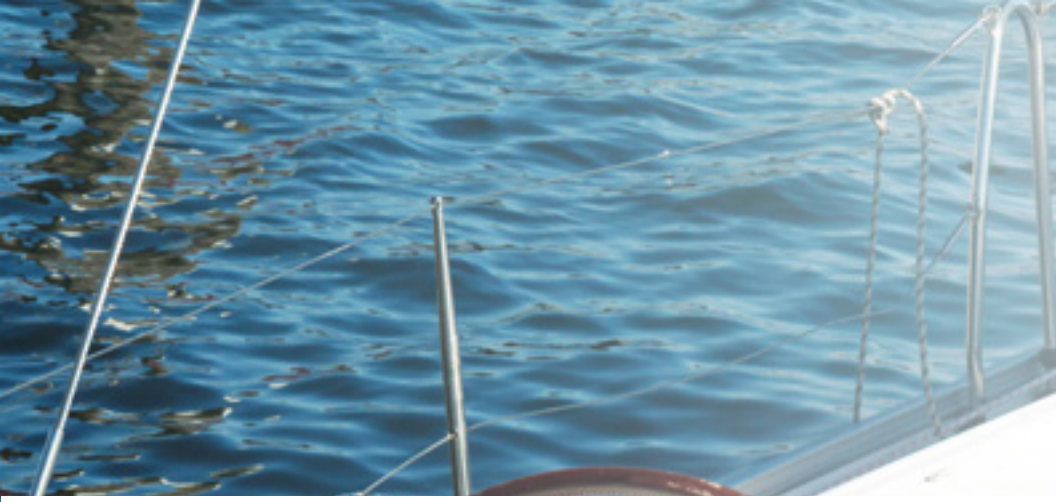
The construction and/or operation of the marina or boatyard may entail periodic disturbances to neighbouring communities, users of the facilities, and the natural environment. These disturbances include the generation of noise, dust or temporary physical obstructions. Where practicable, owners/developers of marinas and boatyards should:

1. Provide and maintain adequate separation distances between marina sites and residential areas.
2. Design buildings to contain noise by incorporating acoustic barriers, damping and insulating materials.
3. Avoid building within known navigational channels.
4. Ensure that the Legislative and Regulatory Considerations listed in this document are adhered to.
5. Communicate with owners of neighboring properties, pipelines and other infrastructure when siting and designing and provide them with the opportunity to comment on the project.

ANCHORAGE DESIGN

An anchorage is an area off the coast used for ship to anchor. Improper siting and designation of anchorages in relation to other aspects of the marina, such as the navigation channel, fairways and waiting berths, may result in increased risk of collision hazards, damage to infrastructure, or adverse impacts to the environment. Without limiting the power and authority of the Harbour Master as prescribed in the Harbours Act 50:06, where practicable, owners/developers of the marinas and boatyards should:

1. Install an anchorage system to provide mooring for all floating structures with the consideration of water depth and exposure to wave and wind action. The system should include dead man or ground stakes.
2. Mark and guard all anchorage systems.
3. Prohibit attaching anchor cables of securing devices to power poles, tree, stumps or guardrail posts.
4. Ensure that anchor cables are fastened with a minimum of three U-bolts of fist grip clamps.
5. Ensure that winches located on docks have cable guards.



PART B

Operations and Maintenance

SOLID WASTE MANAGEMENT

Marina and boatyard operators are responsible for the types of wastes generated at their facilities. They are thus responsible for the contents of their dumpsters and the management of solid waste on their property. Improper disposal can lead to solid waste entering the coastal water and threaten human and ecological health. Where practicable, owners/developers of marinas and boatyards should:

1. Prepare and implement a Waste Management Plan[22] to help prevent the dumping of waste at sea, which must include, at a minimum:
   a. The waste facilities that are available to the marina operators and how those facilities should be used;
   b. The list of procedures, contracts, containers or equipment for various kinds of waste generated in the marina; and
   c. The list of records of hazardous waste manifest and treatment.
2. Ensure hazardous[23] waste is segregated from non-hazardous[24] waste.
3. Hazardous waste should be stored in a manner to:
   a. Prevent the contact between incompatible wastes; and
   b. Allow inspections between containers to monitor leaks or spills.
4. Non-hazardous waste should be:
   a. Sorted into recyclable and non-recyclable components; and
   b. Stored onsite in durable and sturdy plastic or metal containers of adequate capacity with secure covers, until ready for disposal[25] .
5. Prevent mixing liquid waste with solid waste.
6. Separate solid and liquid waste using appropriate technologies[26] .
7. Perform boat maintenance/cleaning above the waterline to prevent debris falling into the water.
8. Clean hull maintenance areas by vacuuming regularly to remove trash[27] .
9. Perform abrasive blasting within spray booths or plastic tarp enclosures to prevent residue from being carried into surface waters. If tarps are used, blasting should not be done on windy days.
10. Provide proper disposal facilities to marina patrons such as covered dumpsters placed stable on the ground to prevent from falling and spilling.
11. While awaiting transfer to a landfill, dumpsters in which items are stored should be covered to prevent rain from leaching material from the dumpster onto the ground.
12. Used lead-acid batteries should be stored upright on an impervious surface, under cover, and sent to or picked up by a licensed recycler.
13. Waste manifests should be retained for inspection.

[22]Refer to Guidelines as outlined in the International Convention for the Prevention of Pollution from Ships, 1973 as modified by the Protocol of 1978 (MARPOL 73/78).

[23]Materials that exhibit these characteristics can include explosives, compressed gases, including toxic or flammable gases, flammable liquids, flammable solids, oxidising substances, toxic materials including carcinogens, pathogens, teratogens and mutagens, radioactive material and corrosive substances.

[24]Non-hazardous solid waste includes scrap metal, aluminum, glass, paper, and cardboard

[25]Disposal of non-hazardous waste shall take place at an appropriate facility operated by the relevant Regional/City/Borough Corporation or a waste disposal firm with the appropriate licenses, permits, trained/certified personnel, facilities, equipment and insurance to handle such waste.

[26]Proper disposal methods include employing filtration and separation techniques

[27]Trash include sandings, paint chips etc.

14. Ensure that a service company/facility with the appropriate licenses, permits, trained/certified personnel, facilities, equipment and insurance to collect and handle solid waste and non-hazardous waste.

FISH WASTE MANAGEMENT

Fish waste results from industrial fish processing operations and improper disposal of it can result in reduced water quality. The management of fish waste is done by using a combination of fish-cleaning restrictions, public education and proper disposal of fish waste. Where practicable, owners/developers of marinas and boatyards should:

1. Designate fish cleaning area(s) at boat launching ramps. Boaters and fishermen should be advised to use only these areas for fish cleaning.
2. Issue rules governing the conduct and location of fish-cleaning operations. Marinas not equipped to handle fish wastes should prohibit the cleaning of fish at the marina.
3. Educate boaters regarding the importance of proper fish-cleaning practices.
4. Display posters along the marina to remind the fishermen of the cleaning area(s) and designated containers for disposal of fish waste.
5. Implement fish waste composting where appropriate.
6. Prohibit the use of fish parts as bait or chum.
7. Encourage catch-and-release[28] to prevent fish waste.

STORM WATER MANAGEMENT

Ineffective storm water management can impact the coastal and near-by fresh water quality which can lead to flooding in nearby areas. Marinas, as well as individual boaters, must play a role in reducing storm water pollution. One way is to incorporate best management practices (BMPs) into daily marina operations and boating activities. Where practicable, owners/developers of marinas and boatyards should:

1. Provide an effective storm water management plan to:
   a. Protect the water quality in the marina basin from being impacted by pollutants in storm water runoff from upland facilities and spills; and
   b. Include use of vegetation and detention ponds, first-flush retention and trapping of wastes from specific problem areas.
2. Direct storm water from roofs, surface lots, and other impervious surfaces to areas where water can infiltrate into the soil, as far as practicable.
3. Avoid direct flows of runoff into surface waters.
4. Implement source control practices which prevent pollutants[29] from coming into contact with runoff.
5. Adopt measures[30] to prevent pollutants, generated from their process or stored on the compound, from mixing with storm water.
6. Source control practices such as vacuum attachments to sanders.

[28]Catch-and-release is a method of fishing in which some or all of the fishes are released after capture, as a conservation measure.

[29]Pollutant include suspended solids and organics (oil and grease)

[30]Measures may include developing and adopting good housekeeping and spill prevention control.

WASTE WATER MANAGEMENT

Waste water includes water commingled with waste fuels, oils, bilge; ballast water; or cleaning solvents generated by marinas and boatyards. Improper management of waste water can reduce the quality of water, aesthetic appeal and impact human and ecological wellbeing. Waste water management practices should incorporate proper operation and maintenance. Where practicable, owners/developers of marinas and boatyards should:

1. Ensure that discharges from any septic tank/soak away system,[31] kitchens and showers are compliant with the permissible levels listed in the *2nd Schedule of the Water Pollution Rules, 2001 (as amended).*
2. Ensure that any collected liquid wastes, inclusive of used cooking oils, are collected and disposed of by a competent organization.
3. Ensure waste water from storage tanks does not overflow into the marina or coastal waters.
4. Adopt measures such as soak-away for proper disposal of waste water from the storage tanks.
5. Adopt measures[32] for proper disposal of sludge from the storage tanks after proper treatment.
6. Collect and store waste water that has been removed from the vessels or used during the cleaning process in tightly sealed and labeled containers located in specially designated areas with secondary containment, to reduce the potential for spills.
7. Storage tanks should be labelled appropriately and any hazardous characteristics should be denoted using pictograms.
8. Ensure proper transportation of waste water disposal in an environmentally safe manner.

CHEMICAL AND FUEL SPILLS MANAGEMENT

Material spills or any spills can have harmful effects to both human and marine life and should be cleaned up promptly when they are detected. Thus management should be placed mainly for prevention of spills and the proper spill clean-up. Where practicable, owners/developers of marinas and boatyards should:

1. Schedule inspections and preventative maintenance regularly, to identify and repair or replace damaged fuel/chemical containers, thereby reducing the risk of a spill.
2. Use absorbents and other mechanical approaches to clean up spills in lieu of detergents.
3. Include a floating containment boom large enough to enclose the area of surface water.
4. Prepare a hazardous materials Spill Response Plan and update it regularly.
5. Material Safety Data Sheet (MSDS) forms should be stored on site, easily available and accessible.

[31] *Soak away system is a drainage system with a pit, typically filled with rubble, into which waste water is piped so that it drains slowly out into the surrounding soil.*

[32] *Measures include incinerate, remove or dispose of, to an appropriate land-fill*

6. Ensure oil and chemical-handling operations are conducted away from natural drainage systems and/or areas where there are environmentally-sensitive areas/receptors.
7. Prepare a Spill Response Kit to help prevent spills at sea, which must include, at a minimum:
   a. A stock of absorbents[33] for emergencies and/or incidents at a readily accessible location in the marina;
   b. Procedures to contain and clean-up any spilled hydrocarbons and other chemicals; and
   c. All personnel involved in the proposed activity shall be trained in the operation of the Spill Response Kit.
8. Install oil/grit separators to treat excess petroleum spills.
9. Promote the use of oil-absorbing materials in the bilge areas of all boats with inboard engines.
10. Fuel and oil should be stored and labelled in covered containers placed on an impermeable surface away from floor drains.
11. Ensure containers are located at designated storage areas in accordance with the Ministry of Energy and Energy Industries (MEEI) and Fire Services requirements.
12. Ensure that the handling and removal of the containers be done by competent service providers that can assure the containers would be treated and disposed of in an environmentally sound manner.
13. Filter waste gasoline for reuse at external remediation facilities when possible.
14. Ensure that waste gasoline is not allowed to evaporate; poured on the ground; disposed of in storm or sanitary sewers, septic systems; or discharged to surface waters.
15. Crush/puncture and hot-drain[34] used oil filters, and placing the filters in a funnel over waste container to allow the excess petroleum product to drain.

[33] *Absorbents include oil absorbent pads, booms, socks or pillows*

[34] *Hot drain is defined as draining the oil filter at or near engine operating temperature but above 60 degrees Fahrenheit.*

BOAT CLEANING, REPAIR, MAINTENANCE & DISMANTLING MANAGEMENT

The cleaning and repairing of boats can lead to leaks and discharges into the marine water reducing the quality of water. In addition, they can result in noise and air pollution from noise- induced machines and emission of harmful dust. This can have detrimental effect on human and ecological life. Thus, boat cleaning, repairs, maintenance and dismantling management should integrate measures to minimise the release of pollutants into the marine environment and the atmosphere. Where practicable, owners/developers of marinas and boatyards should:

1. Conduct pressure washing in a designated area where wash water can be filtered and recirculated.
2. The use of phosphate-free, biodegradable detergents and cleaning products to reduce the amounts of nutrients entering the water from these sources.
3. Prevent the use of detergents containing ammonia, sodium hypochlorite, chlorinated solvents, petroleum distillates, or lye.
4. Prevent in-the-water hull scraping or any process that occurs underwater to remove paint from the boat hull.
5. Use of long-lasting, low-toxicity or non-toxic antifouling bottom paints.
6. Ensure that boat repair and maintenance activities[35] be done upland, away from any body of water, preferably in indoor work spaces.
7. Eliminate the use of copper-based antifouling paints on floats, buoys, and other non-boat surfaces.
8. Prevent the use of tributyltin oxide based paints in any marina or boatyard facility.
9. Ensure marina users and operators use permeable tarps, screens, or filter cloths to capture debris when cleaning, sanding, or painting, and dispose of it in designated containers.
10. Vacuum/sweep service roads, driveways, and parking lots regularly.
11. Inspect and maintain all equipment, machinery and vehicles regularly in accordance with manufacturers' specifications.
12. Tools, machinery and equipment should be fitted with adequate noise-reducing apparatus, wherever possible.
13. Schedule work requiring the use of noise-induced equipment for execution during the day when the effects are minimal.
14. Ensure that particulate matter[36] resulting from the dismantling process are vacuumed, collected, stored in designated containers and properly disposed of.
15. Transport materials to and from the site in vehicles that are securely covered to prevent the entrainment of particulates or spillage along the roadway while in transit.

[35] *Repair and maintenance activities include painting, sand blasting, engine repairs and boat washing*
[36] *Particulate matter includes fibreglass and paint dust*

16. Ensure the use of the proper personal protective equipment (PPE) always, if engaged in the dismantling of yachts and other boats.
17. Follow good industrial hygiene practices, such as utilizing engineering controls, reducing airborne exposures; and good housekeeping to keep dust contained within work areas.

PUBLIC EDUCATION & STAFF TRAINING

Public Education on proper maintenance and impacts of the marinas done regularly and staff training to execute/manage marina services in an environmentally sound manner, is essential. Where practicable, owners/developers of marinas and boatyards should:

1. Place interpretive, instructional and safety signs at marinas and boat-launching sites as a means to broadcast information to the boating public.
2. Develop and *Code of Conduct for Environmental Sustainability* for the Marina or boatyard.
3. Establish a unit or committee to oversee and implement the provisions of this guidebook and lead environmentally sustainable efforts including but not limited to: instituting environmental management systems and conducting regular environmental audits.
4. Implement public education program which provides information to boaters and marina operators about environmentally sound operation and maintenance activities, and the impacts improper practices may have on the coastal ecosystem.
5. Distribute materials[37] on the impacts of boating activities available at the marina and ways they can be minimized.
6. Implement workshops, seminars and presentations at local marinas or other locations in order to discuss issues and the positive aspects relating to the marina and environment with boaters and marina owners and operators.
7. Train staff to handle administrative requirements and problems and properly execute or manage marina services[38] .

[37] *Print materials include maps of pump out facilities, booklets on boat pollution, pamphlets on plastic debris, and articles*
[38] *Marina services include boat launching, fuelling and boat repairs and maintaining the premises in good condition*

MAINTENANCE OF SEWAGE FACILITIES

Sewage if not collected, stored and treated can result to reduced water quality and can threaten human and marine life. Thus if the sewage facilities are not maintained the same effect can occur. Measures are required to aid in preventing failure of pump out and discourages improper disposal of sanitary wastes. Where practicable, owners/developers of marinas and boatyards should:

1. Repair and service pump out facilities by competent contractors.
2. Develop and adhere to regular inspection and maintenance schedules.
3. Maintain a dedicated fund for the repair and maintenance of marina pump out stations.
4. Mandate the use of marina/ boatyard pump out facilities through slip leasing agreements.
5. Place dye tablets in holding tanks to discourage illegal disposal.
6. Inspect and regularly maintain pump out systems, disinfect all suction connections, and ensure that septic receptacles are emptied when full.

BOAT OPERATIONS MANAGEMENT

Boating activities can result in turbidity which can affect the photosynthetic activity of algae and submerged aquatic vegetation and the physical destruction of shallow-water habitats. Thus, boat operation management is put in place to prevent destruction of the marina and human life. Where practicable, owners/ developers of marinas and boatyards should:

1. Prohibit motorized vessels from areas that contain important shallow-water habitat.
2. Restrict boater traffic in shallow-water areas.
3. Enforce no-wake zones[39] near the shorelines and shallow channels to decrease turbidity.
4. Provide a separate area for washing boats on shore away from the water's edge.
5. Educate boaters about sensitive areas containing submerged aquatic vegetation, marine species, and other important aquatic habitat.
6. Display navigation charts showing channel depths, as well as, shallow-water areas and sand bars near the marina that are to be avoided.
7. Place aids to navigation, such as channel beacons, buoys and leads, at entrances to marinas and channels of access.

[39] *No-wake zone is where boats/ vessels must operate at the minimum speed that allows you to maintain steering and make headway.*

ECOLOGICAL CONSIDERATIONS

Marine activities can affect the ecological balance of the water body, if management measures are not put in place there will be harmful effects on ecological health. Where practicable, owners/developers of marinas and boatyards should:

1. Control vessel access and speed to protect banks and marine animals.
2. Consult with appropriate competent authorities prior to engaging in activities that my impact the marine or coastal environment. These Authorities include, but are not limited to: the EMA, IMA, THA, CDA, and MSD.
3. Establish ground maintenance guidelines which include:
    a. Professional landscaping practices;
    b. Conservative use of insecticides, herbicides and fertilizers;
    c. Prevention and clean-up of petroleum spills from upland fuelling stations; and
    d. Maintenance of a regular rubbish/garbage collection schedule.

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Appendix

SECOND SCHEDULE

(Rule 8)

PERMISSIBLE LEVELS

No.	Water Pollutants: Parameters or Substances	Receiving Environment: Inland Surface Water	Coastal Nearshore	Marine Offshore	Environmentally Sensitive Areas and/or Groundwater
		Levels or Conditions			
1.	Temperature	35	40	45	NIAA
2.	Dissolved Oxygen	<4	<4	<4	<4
3.	Hydrogenion (pH)	6-9	6-9	6-9	6-9
4.	Five day Biological Oxygen Demand (BOD_5 at 20°C)	30	50	100	10
5.	Chemical Oxygen Demand (COD)	250	250	250	60
6.	Total Suspended Solids (TSS)	50	150	200	15
7.	Total Oil and Grease (TO&G) or n-Hexane Extractable\ Material (HEM)	10	15	100	No release
8.	Ammoniacal Nitrogen (as NH_3-N)	10	10	10	0.1
9.	Total Phosphorus (as P)	5	5	5	0.1
10.	Sulphide (as H_2S)	1	1	1	0.2
11.	Chloride (as Cl^-)	250	NIAA	NIAA	NIAA
12.	Total Residual Chlorine (as Cl_2)	1	1	2	0.2
13.	Dissolved Hexavalent Chromium (Cr^{6+})	0.1	0.1	0.1	0.01
14.	Total Chromium (Cr)	0.5	0.5	0.5	0.1
15.	Dissolved Iron (Fe)	3.5	3.5	3.5	1.0
16.	Total Petroleum Hydrocarbons (TPH)	25	40	80	No release
17.	Total Nickel (Ni)	0.5	0.5	0.5	0.5
18.	Total Copper (Cu)	0.5	0.5	0.5	0.01
19.	Total Zinc (Zn)	2	2	2	0.1
20.	Total Arsenic (As)	0.1	0.1	0.1	0.01
21.	Total Cadmium (Cd)	0.1	0.1	0.1	0.01
22.	Total Mercury (Hg)	0.01	0.01	0.01	0.005
23.	Total Lead (Pb)	0.1	0.1	0.1	0.05
24.	Total Cyanide (as CN^-)	0.1	0.1	0.1	0.01
25.	Phenolic Compounds (as phenol)	0.5	0.5	0.5	0.1
26.	Radioactivity	NIAA	NIAA	NIAA	NIAA
27.	Toxicity	NATE	NATE	NATE	NATE
28.	Faecal Coliforms	400	400	400	100
29.	Solid Waste	NSD	NSD	NSD	NSD

* all units are in milligrams per litre (mg/L) except for temperature (°C), pH (pH units), faecal coliforms (counts per 100 ml), radioactivity (Bq/L) and toxicity (toxic units)

NIAA—no increase above ambient

NATE—no acute toxic effects

NSD—No solid debris

<—less than

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