OTC 20817

API Bulletin 2HINS – Guidance for Post-hurricane Structural Inspection of Offshore Structures

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This paper was prepared for presentation at the 2010 Offshore Technology Conference held in Houston, Texas, USA, 3–6 May 2010.

Abstract

Timely and cost effective inspection of offshore structures following a hurricane is critical in order to safely re-man the facilities and bring production back on-line. Recent hurricanes Ivan, Rita, Katrina and Ike in the Gulf of Mexico (GoM) resulted in thousands of above and below water structural inspections of offshore structures to determine if they sustained damage. Several of the API Recommended Practices (RPs) for offshore structures provide guidance for such "special" inspections, but the guidance is limited and general in nature. API Bulletin 2HINS (2HINS, short for Hurricane INSpection) complements those publications and provides additional guidance specific to structural inspection following hurricanes. The document is applicable to permanent fixed and floating structures in the Gulf of Mexico.

Background

Regular structural inspections are a part of the in-service operating procedure for all offshore structures. The API RPs for the different types of fixed and floating structures provide guidance to develop In-Service Inspection Plans (ISIPs) to meet this need. These documents also typically identify the need for "special" inspections following major events such as extreme storms like a hurricane or an accident like a severe collision. The goal of these special inspections is to determine if a structure sustained damage that affects the safety of personnel working on the structure, the primary structural integrity of the asset and its ability to perform the purpose for which it was intended. However, within these documents the guidance for special inspections is limited and generally up to the discretion of the owner or regulatory authority, particularly where and what to inspect.

Recent experience in the Gulf of Mexico has shown many structures exposed to hurricane level winds did not sustain damage [Energo 2006, 2007 & 2010]. As a result some structures did not require inspection. Alternative methods such as comparisons of the hurricane conditions at a site to the structure's environmental design conditions can be used on a case-by-case basis to provide adequate basis and justification when inspections on a structure are needed or not needed, especially below water inspections. The use of engineering assessments in lieu of an inspection is particularly useful for deep water fixed structures or floating structure where below water inspections, or internal hull inspections for floating structures, can be dangerous, time consuming and costly.

Post-hurricane inspections must be performed in a focused manner given the large number of inspections that must be completed, perhaps thousands, with limited inspection resources. Hurricanes Rita (2005) and Ike (2008) in particular passed through thousands of GOM structures, with many requiring a post-hurricane inspection according to government regulations. Hurricane Ike alone required the inspection of 3,185 offshore structures per MMS NTL No. 2008 G-18 [Energo, 2010]. At the time, there was no API or other industry document available to guide post-hurricane inspections, and as a result, numerous inspections were often performed inefficiently with the wrong focus. For example, marine growth, cathodic protection measurements and other ISIP type inspections were performed that provide little or no value when the concern is identification of hurricane induced damage. In other cases, post-hurricane inspection reports would mention a broken brace or cracked joint, but there were no photos, measurements, or other supplemental information to help engineers determine if the damage required repair, necessitating the need for a costly re-inspection of the damage.

It was therefore clear that additional guidance was required to help prioritize and focus post-hurricane inspections on the structures most likely to sustain damage, as well as provide guidance on how to safely plan and execute the inspections. API Structural Committee 2 (SC2), which controls and maintains the API guidance documents for offshore structures, therefore decided in early 2009 to develop a post-hurricane structural inspection bulletin. An API Task Group (TG) was formed containing industry personnel with experience in inspection planning and execution and fixed and floating structure hurricane assessments. The TG also included participation from the regulatory authorities that oversee the post-hurricane recovery effort, specifically the Minerals Management Service (MMS) and the United States Coast Guard (USCG). The 2HINS bulletin was developed and published prior to the start of the 2009 hurricane season on June 1.

This paper focuses on the primary aspects of 2HINS and provides additional information and insight on the development of the document as well as supplemental information and examples of how the document can be used. The reader should refer to 2HINS for complete information.

General Approach

Bulletin 2HINS provides post-hurricane inspection guidance for both fixed and floating permanent oil and gas offshore structures. This created a challenge for the TG from the onset since certain aspects of the inspection of these two types of offshore structures are fundamentally different. It was desired to keep the approach as simple and easy to use as possible, but also allow the user to quickly determine the specific structures to be inspected as well as where and what to inspect. The approach must not be overly prescriptive given the large variability and vintage of the offshore structure designs, which impacts how each structure performs in a hurricane. A focused and well planned post-hurricane inspection plan for one structure may be inappropriate for another structure and may in fact miss post-hurricane damage. Finally, existing company practices, regulatory requirements and classification society requirements (for floaters) needed to be considered as much as possible.

Figure 1 shows the overall post-hurricane inspection approach contained in the Bulletin. The TG developed several versions of this chart from simpler to more complex but felt that this version provides the correct level of guidance and flexibility without being overly prescriptive.

The first part of the post-hurricane approach is determining if an inspection is required for a particular structure. Historically, post-hurricane inspections have been driven by the path of the eye of the hurricane and the region of maximum winds that extend a particular distance to the right or left of the path. The particular wind speed to initiate or "trigger" an inspection was debated by the TG, but it was decided that a structure exposed to "hurricane" wind speeds, defined as a named tropical cyclone that exposes the structure to a sustained one minute surface wind of 74 mph (64kt) or greater, would be the initiator for a post-hurricane inspection. Setting the wind speed as the initiator makes determining the swath of affected structures simple and rapid, since this information is often readily available shortly after the storm. The TG recognized that wind speed is not always a good indicator of the level of exposure to the structure during a hurricane, since there can be a great variation in other factors such as current and waves, that can influence the performance of a structure. However, since the vast majority of the offshore structures are designed for loading conditions in excess of the minimum level hurricane, the wind speed of 74 mph initiator is sufficiently low enough to capture structures that could be damaged..

The first inspection will be a "special" above-water inspection with the overall intent of an initial understanding of the condition of the structure after the hurricane. This "special" inspection differs from a normal API RP 2A Level 1 inspection and includes elements associated with safe re-boarding of the structure, survey of above water damage (if any) and any damage indicators such as large objects that have fallen overboard that may have damaged the structure below water. All of the 2HINS inspections are labeled as "special" in order to differentiate them form ISIP inspections. Additional detail on the above-water inspection is provided below.

If there are no damage indicators from the above-water inspections, than an engineering check can be used to determine if a below-water inspection is required. In simple terms, if the structure has sustained hurricane metocean conditions (wind, wave, current or surge) that may have damaged the structure as determined by an engineering-based technical evaluation, than a below-water inspection is required. This is one of the unique features and advantages of using 2HINS. The Engineering Check is described below in more detail.

While portions of the 2HINS can be useful for other types of post-event inspections, such earthquakes or ship collisions, the primary focus and intent is for extreme storms, particularly hurricanes. Post-hurricane inspections of temporary facilities such as jackups, mobile offshore drilling units (MODUs), lift boats or other offshore industry are not covered in 2HINS. Post-hurricane structural inspections are not as comprehensive as, or intended to replace, scheduled in-service inspections as defined in the structure's ISIP. However, if post-hurricane inspections are conducted, credit can be given those items of the ISIP that are inspected.

Special Above-water Inspection

This is the initial inspection and involves a determination if the structure is safe for boarding, a General Visual Inspection (GVI) of the above-water structures, and a determination if any large objects have fallen overboard or other indications that the below-water structure may be damaged. The above-water inspection is similar for both fixed and floating platforms and it was therefore decided to make the guidance general and in the same Section 5 of 2HINS, with any differences noted as necessary. In all cases, safety and environmental concerns are paramount and should be addressed prior to any structural inspections.

Re-Boarding the Structure.

This is often an overlooked issue and perhaps the most important. Damaged or missing boat landings, walkways, handrails, stairways, deck grating, structural members as well as damaged process piping and equipment and debris can make re-boarding the structure hazardous following a hurricane. The structure must first be viewed from afar by boat, plane or helicopter to ensure it appears safe to re-board. There have been several incidents of helicopters landing on damaged helidecks or landing on a four leg fixed structure only to find out later that one of the deck legs was damaged or missing and the deck was on verge of collapse - the helicopter should never have landed. Likewise, several personnel have been injured in post-hurricane work by slip, trip and fall incidents, including falling through holes in deck grating that were not properly identified. All of these are avoidable by proper planning and training.

Prior to any work or significant boarding of personnel, the structure's safety and emergency evacuation systems such as lifeboats should be operating. This may mean in some cases that a standby boat is available at all times to evacuate personnel until other means of evacuation can be arranged. There should also be a preset-plan to evacuate personnel in the event someone is injured.

Above-water General Visual Inspection (GVI).

This is the primary part of the structural inspection and is focused on identifying damage to the structure. It is conducted by surveying the entire above-water structure, visually looking for any signs of damage or something out of place compared to before the hurricane. One useful method is to take plenty of photos or plots of the deck and deck areas prior to a hurricane, maintain these on file, and then use theses after the hurricane to confirm any changes.

For a fixed structure, the GVI should include all major structural members in the jacket near the water, the deck legs and all the deck structural framing including deck trusses, girders, beams and columns. All members should be viewed from above and from below where possible. If there are signs that hurricane waves impacted the deck then the deck girders should be checked to see if they are bent. If a member is found damaged or bent, then the member connections should be checked to ensure there are no cracks. There are several cases of a partially or fully failed leg-pile connection at the top-of-jacket [Energo, 2010] and these connections should be viewed carefully to ensure they are still intact.

For a floating structure, the GVI is similar to the fixed structure in the main deck areas though a different approach below deck with focus on the hull to deck connections is employed. Visible portions of the hull should be reviewed for signs of damage including possible impact from debris. Hull access such as hatches, doors and other openings should be inspected to ensure they remained watertight in the hurricane. Mooring systems should be visually inspected for damage or signs of extreme stress or failure. Operation of mooring systems as well as other critical systems, such as ballast and bilge should be verified.

Indicators for Special Below-water Inspection.

A critical component of the above-water inspection is that it will help establish the need for a below-water inspection. There are three key indicators as described below. Note that in addition to these indictors, the Engineering Check may show that a below-water inspection is required.

The first is above water structural or other damage that indicates possible below water damage. Examples include bent or broken deck girders indicating wave crest impact on the deck which normally results in high loads on the below water structure (and possible damage). Deformation of the above water hull portion of the floating structure is an indicator of possible below water damage.

The second is that a large object such as the drill rig or portion of the deck structure has fallen overboard, possibly damaging the below water structure. The specific definition of "large" should be handled on a case-by case basis for each structure and the particularly situation. For example, missing handrails may not cause a great concern of below water damage but a missing stairway may be a concern based upon its size, where it fell from the topsides and the location and geometry of the structure below. The trajectory of the fallen object should also be considered and can be used later to determine the portions of the structure that should be inspected, as well as the portion of the structure unlikely to be damaged, not requiring below-water inspection.

The third is a special case for floating structures that includes unexpected changes in draft, offset, list or trim. Additionally, changes in compartment status including soundings or bilge alarms are other indicators there may be leakage and below water damage. Unexpected change in mooring line tensions is also an indicator. Additional discussion is provided below related to floating structure below-water inspections.

Engineering Checks

Studies of post-hurricane damage [Energo 2007 and 2010] show that a good portion was predictable, since metocean conditions at the structure location were larger than those used for design. It was therefore apparent in the early stages of the development of 2HINS that guidance was needed for some form of engineering evaluation that can be used to determine whether a below-water inspection is required. For example, if a fixed structure experienced hurricane winds of 78 mph, then a post-hurricane inspection may be required. However, if engineering records indicate that the structure is designed for a 70 ft wave height, and the estimated hindcast hurricane maximum wave height at the platform location is 55 ft, then the platform experienced conditions much less than design and it is most likely undamaged. If the Special Above-water inspection shows no below-water damage indicators, then there is no reason to inspect the platform below water. Instead, these below water inspection resources are better spent on other structures with below water damage indicators or where the structure design conditions have been exceeded.

There was considerable debate in the TG on the types of Engineering Checks and also the extent of guidance to be provided. The goal was to make the checks quick and simple to use but also realistic in terms of accuracy. After all, the Engineering Check is intended to provide the basis on whether a structure should be inspected below water and it can be dangerous to leave a structure in a damaged condition. The Engineering Check must also be "generic" due to the various types of fixed and floating structures and the TG wanted to avoid a prescriptive approach that may not work for all structures. In fact, earlier drafts of the 2HINS had more detailed guidance for the Engineering Check, but this was eliminated in the final version in order to allow additional flexibility for the user.

Four methods are described in 2HINS and each is summarized below including additional background information. The engineering checks are listed in order of increasing complexity, but any of the methods can be used in any order. Each method is applicable to fixed or floating structures, unless noted otherwise. Additional methods may be applicable if they can be demonstrated to accurately determine the hurricane conditions at which structural damage is expected. The Engineering Check should use the platform configuration (e.g., deck payload, with or without rig, etc.) and structural condition (e.g., known damage such as corrosion) at the time of the hurricane.

Note that in lieu of these engineering checks the structure owner can just perform the below-water inspection of the structure. In addition, some fixed and floating structures have specific owner or regulatory requirements following hurricanes that require partial or full structural inspection following hurricanes. This may include below-water inspection of prior repairs or in the case of polyester mooring lines the removal and evaluation of test segments.

Metocean Condition Comparison.

This is the simplest check and involves comparing the maximum *metocean conditions* during the hurricane including wind speed, wave height, current and surge compared to the structure's design environmental criteria. The hurricane conditions should be based upon measurements at the platform location or a site specific hindcast using accepted industry procedures. If all of the maximum hurricane conditions, in any given direction, were less than the structure's design conditions then the structure passes the Engineering Check. Since it is sometimes unclear if waves, wind or current control the structure design it was necessary to make this simplest of checks reflect maximum conditions. This is because if any metocean parameter is larger than that used for design, for example current of 3 knots when the maximum used for design in any direction was 2 knots, then there is a chance the higher current combined with the wave condition in the hurricane may have put more load on the structure than it was designed for. In this example case, the platform would not pass the Metocean Condition Comparison, but it may pass one of the other Engineering Checks. This Metocean Condition Comparison is meant to easily identify structures that have experienced hurricane conditions, but these conditions were well below the structures design conditions and therefore most likely not damaged. There is actually minimal "engineering" that needs to be performed for this check and the owner needs to only maintain a list of the metocean criteria used for the design of each structure, if available, and then compare this to the hindcast hurricane conditions at the location after the hurricane. Discussions with metocean experts indicate that preliminary hindcast data can be made available 1 to 2 weeks after the hurricane and perhaps even a shorter timeframe.

Load Comparison.

This is the next more complex Engineering Check and involves comparison of the *metocean loads* that acted on the structure during the hurricane to the design loads for the structure. The approach depends on if the structure is fixed or floating, with floating structures also having to consider motions. The calculated environmental loads should account for direction and occurrence of maximum values of key metocean conditions during the hurricane.

Fixed Structures.

The Load Comparison is typically made using the global mudline metocean base shear acting on the structure. There are two basic approaches depending on the structures' API category. If the structure is categorized as high consequence L-1 or A-1 or if the structure is manned-evacuated (any category), then the design load, including all of the API factors of safety normally used for design of new structures, is used for the comparison. The inclusion of API factors of safety in the check for these high consequence and manned structures provides a conservative estimate of possible damage to the structure and was felt appropriate by the TG. For unmanned medium and low consequence structures, a less conservative approach can be used that applies the type of ultimate strength assessment approach found in API RP 2A Section 17 or the new API RP 2SIM. In this case, the comparison would be made using 80 percent of the base shear that causes first component failure. Technically in these types of assessments, the first damage (which is the focus of inspections) is predicted at 100 percent of the base shear, but the TG wanted to include a factor to account for uncertainty in such analysis. The 80 percent value was selected because studies following hurricane Andrew determined that these types of ultimate strength analysis have an accuracy plus or minus about 20 percent [Puskar, et.al., 1994; Digre, et.al. 1994].

Floating Structures.

The determination of maximum loads acting on a floating structure is more complex than for fixed structures since it involves not only the complex loads acting on the hull and topsides but also the motions of the structure including inertia and the effects of the mooring system and risers. A "simple" mudline base shear that is used for fixed platform is not possible, although more complex analysis can be used as discussed below. Therefore for floating structures the TG determined the Load Comparison be conducted by comparing the measured structural response from motions, offsets, mooring line tensions or tendon tensions during the hurricane, where available, to the structure design including all applicable API factors of safety. If the structure's response is less than the structure's design, then the structure passes the Engineering Check. Obviously the floating structure would need to have these types of load monitoring systems installed, maintained and calibrated in working order and also operating throughout the entire hurricane to ensure that the maximum responses are recorded.

Stress Comparison.

This check involves structural analysis using detailed computer models of the fixed or floating structure, and then applying metocean conditions equal to or greater than those observed during the hurricane to determine the component stresses in the structure. This check is a more detailed analysis investigation of specific components of the structure (braces, piles, hull scantlings, mooring lines, etc.) than the prior Engineering Checks that focus more on global response. If the hurricane imposed stresses are less than defined by API for the type of structure, including all applicable factors of safety, the structure passes the Engineering Check. Since the objective of this analysis is to determine if a below-water inspection is required, the goal of the analysis is to determine if a component failure may have occurred and not the ultimate strength of the structure as is typical in most storm analysis, particularly for fixed structures. Numerous fixed and floating GoM structures have existing structural computer models and these can be used for this check. For floating structures, this check may involve a complex coupled hull-mooring analysis that imposes the hindcast hurricane conditions on structure to determine if any structure components may be damaged including the hull, topsides, moorings and risers.

Structural Natural Frequency Measurement (fixed structures only).

This check compares measured pre-hurricane natural frequencies of the fixed structure with measured post-hurricane natural frequencies. If these are the same then the structure passes the Engineering Check. If the frequencies are different then there is possible damage to the primary structure. The ability of this method to predict damage on a specific structure needs to be very carefully established for each structure using a combination of engineering study and field measurements prior to the hurricane. The key concern of this type of check is that it may not always find damage, especially issues like cracks or dents that do not completely sever the load path. This is especially true for redundant bracing structures where the alternative load paths may not detectable. The technologies for this approach are still evolving and it should only be used when there is sufficient confidence it will determine below water damage for a particular structure.

Caissons.

Single unbraced caissons do not typically require an Engineering Check if the above-water inspection does not indicate any major damage and the structure does not lean or have any significant post-hurricane motion (indicators of below water damage). Note that braced caissons or guyed caissons should be treated as fixed structures.

Special Below-water Inspection

A Special Below-water Inspection should be performed when there are indications of possible below water damage as determined by the Above-water Inspection or the Engineering Check. Bulletin 2HINS provides significant discussion on below-water inspections as contained in Section 6 for fixed structures and Section 7 for floating structures. Additional guidance for these inspections can be found in the relevant API RPs for fixed structures. The post-hurricane below-water inspection is not intended to measure cathodic protection levels, measure marine growth, gauge anode wastage and other inspection items that are typical of an ISIP but not related to potential hurricane damage. All inspections should be performed by qualified personnel.

Fixed Structures.

The inspection should include a GVI focused on the major structural members for signs damage. The inspections can be performed by diver or remotely operated vehicle (ROV) as appropriate considering safety as well as depth of the structure to be inspected and safety. Diver use should be limited, or not used at all, for heavily damaged or leaning structures until the full extent of damage is surveyed and the work can be carried out in a safe manner. Loose or missing marine growth is an indicator of strain or deformation in the structure and further local inspection is warranted. If a large object has fallen overboard, then the inspection should focus on the expected trajectory and potential area of impact.

Conductor guide framing located at the first elevation below the water line has been a consistent area of damage following hurricanes. The damage is caused by vertical wave loads acting on the conductor tray bracing, particularly when there are large plated areas. These areas are sometimes not always inspected since the bracing may be considered as secondary, but this type of damage can ultimately result in the conductor tray falling out completely, damaging lower conductor trays and necessitating a major repair. This damage may also extend into the major horizontal bracing. Conductor guide framing can normally be quickly checked using flooded member detection (FMD) and should be part of any post-hurricane inspection.

For risers, caissons and individual conductors, excessive movement or vibration observed above water may be an indicator of below water damage. The damage is often a broken clamp (or clamp bolts) or a broken guide member and this can normally be found by visual inspection at the clamp locations or guide framing elevations.

Floating Structures.

The below-water inspection for floating structures involves two key aspects – 1) external inspection (i.e., hull/mooring/riser) by diver or ROV and 2) internal hull (tank) inspection. One of the key objectives of the TG was to provide improved guidance for below-water inspection of floating structures since these inspections require considerable resources, time and cost. Additionally, tank entry can be a potentially dangerous activity and should only be performed when necessary. The TG felt that additional guidance was therefore necessary to help focus these inspections, splitting the guidance into two parts depending upon whether the inspection is for the external or internal structure. Note that the ISIP for the floating structure may also provide additional guidance for external or internal structure post-hurricane inspections.

External Structure.

The Special Below-water Inspection of the external structure consists of a GVI conducted by divers or ROV. There are several key damage indicators as discussed below that identify the need and extent of external structure inspections. If damage to the hull is discovered, an internal structure inspection may be required. For large fallen objects, a GVI should be conducted covering the expected fall zone for the fallen object including the uncertainty in the trajectory of the falling object. The top and the sides of the hull, mooring fairleads and platform chain, riser porches and risers, and hull appurtenances (i.e., caissons) should be inspected within the limits of the fall zone for indications of impact, such as dents or scrapes in the marine growth, coatings or hull steel. Production risers and pipeline risers should also be inspected below the structure in way of the object fall zone.

In addition to fallen objects, moorings and risers should be inspected below-water based on the following indicators:

- Engineering Check. The Engineering check may show that moorings or risers have sustained loading or displacements in excess of design and may therefore require an inspection.
- Mooring Damage Indicators. Unexpected offset after the hurricane or an unexpected change in mooring line tensions (or tendon tensions for TLPs). The inspection should include a GVI of all mooring lines, fairleads and their foundations and piles. Guidelines for mooring system inspections can be found in API RP 2I. For a TLP, the GVI should include the tendon porches, tendon top connections, tendons, tendon load measurement units, fairings or strakes (if so equipped), tendon couplings and tendon bottom connector for any signs of damage or unexpected tendon movement. Flooded member detection may be used to help identify leaks in buoyant tendons. Tendon fairings should be inspected for damage and for loss of free rotation. Tendon bottom connectors should be inspected for indications of vertical or rotational movement at the pile plus intrusion of debris into the tendon receptacle.
- Riser Damage Indicators. Damage to riser piping in the splash zone, evidence of excessive stresses or movement from riser instrumentation measurements or evidence of excessive movement. The GVI should include inspection of the clamps and attachments, connection points (flexible element, titanium stress joint, etc.), riser porches or pull tubes, the pipe suspended span in the water column and pipe in the seabed touchdown area. For direct vertical access risers, this GVI should include tensioners or buoyancy cans, keel joints (where applicable), couplings and seafloor stress joints.

Internal Hull Structure.

This is a GVI of the internal hull tanks or compartments focused on confirming the existence or extent of damage to the primary structure and to the hull watertight integrity. The internal inspections should be targeted to specific regions or compartments within the hull based on the following damage indicators:

- The Special Above-water Inspections or Special Below-water Inspections of external structure indicate potential internal hull damage or loss of watertight integrity.

- Unexpected change in draft, list or trim indicating possible leakage.
- Unexpected change in compartment soundings (void, ballast, etc.), or bilge alarm status from before and after hurricane passage indicating possible leakage.

The GVI should be conducted within the compartments of the hull where the leak or damage is anticipated based on the damage indicator. The GVI should include the compartment watertight boundaries, watertight penetrations and any backup structure in way of external structural connections such as riser porches or mooring fairlead supports.

In addition to the above damage indicators, the Engineering Check may indicate that internal structural components or systems were exposed to loading conditions in excess of their design/assessment criteria which could cause internal structure damage. In these cases, an internal structure inspection should be conducted, focusing on these components or systems.

Documentation

The structure owner should develop in advance a written plan, policy or procedure for addressing post-hurricane inspection of their facilities. This should include not only the approach and procedures for the inspection, but also procedures related to safe initial re-boarding following the hurricane. A damaged platform without power and the normal safety systems can be potentially dangerous and re-boarding should be planned carefully and be carried out by trained personnel.

Results of the inspection should be documented and made part of the overall records for the structure. Guidance on the type of information is provided in the Bulletin as well as the associated API RPs for the type of structure. The documentation may also be needed for regulatory authorities.

If the structure is damaged, extra care should be made to document the location and extent of the damage as this information will be required for engineering evaluations to determine the impact of the damage on the structure's performance and if a repair is necessary. Details of the damage are required in order to design repairs or implement some other form of mitigation. As part of the pre-planning activities, the owner should have a procedure in-place for documenting any damage found.

The owner may decide to inspect additional areas of the structure and use the post-hurricane inspection opportunity to conduct required in-service inspections early. This can be a cost and time savings advantage compared to waiting for the regular scheduled inspection since mobilization and de-mobilization costs have already been incurred as part of the post-hurricane inspection. In this case, the documentation of the inspection should follow that contained in the ISIP for the structure.

Summary

API Bulletin 2HINS focuses on special structural above-water and below-water inspections for offshore oil and gas facilities that may be needed following a hurricane. The document provides guidance on safely boarding the structure as well as a multi-step process to determine what inspections are needed such that they are focused and well planned. Recommended inspections are described with specific focus areas and inspection methods identified. Use of engineering analysis to determine whether an underwater inspection is required and to help guide the inspections is discussed. Preplanning and documentation of the inspection results are included. This document should be used in conjunction with the applicable API RPs for the structure as well as any structure-specific owner, regulatory, or class requirements.

Acknowledgements

The authors wish to thank the entire 2HINS Task Group for their diligence and care in attending meetings, developing the bulletin, and conducting the necessary reviews and editing to complete the effort. The Task Group members included: Frank Puskar, Energo Engineering (Chair); Randy Abadie, Shell; Gwen Arcardo, Keystone; Paulo Biasotto, BV; Mark Day, Devon; Sid Falk, MMS; Dave Forsythe, ABS; Mike Gann, Anadarko; Grant Johnson, BP; Rob Keister, USCG; Lance Labiche, MMS; Alain Lignieres, ExxonMobil; Rick Meyer, Shell; Robert Spong, Energo Engineering; Shell; Steve Sutton, USCG; Merih Unuvar, ABS; Allen Verret, OOC; and Jay Welsch, Chevron.

The API TG would also like to thank in particular the Offshore Operators Committee (OOC) for its support and assistance. The OOC had its own work group looking into the general issues of inspection for offshore floating structures and this OOC group greatly assisted the API TG in completing 2HINS. Thanks in particular to Allen Verret, OOC Executive Director for his support and guidance.

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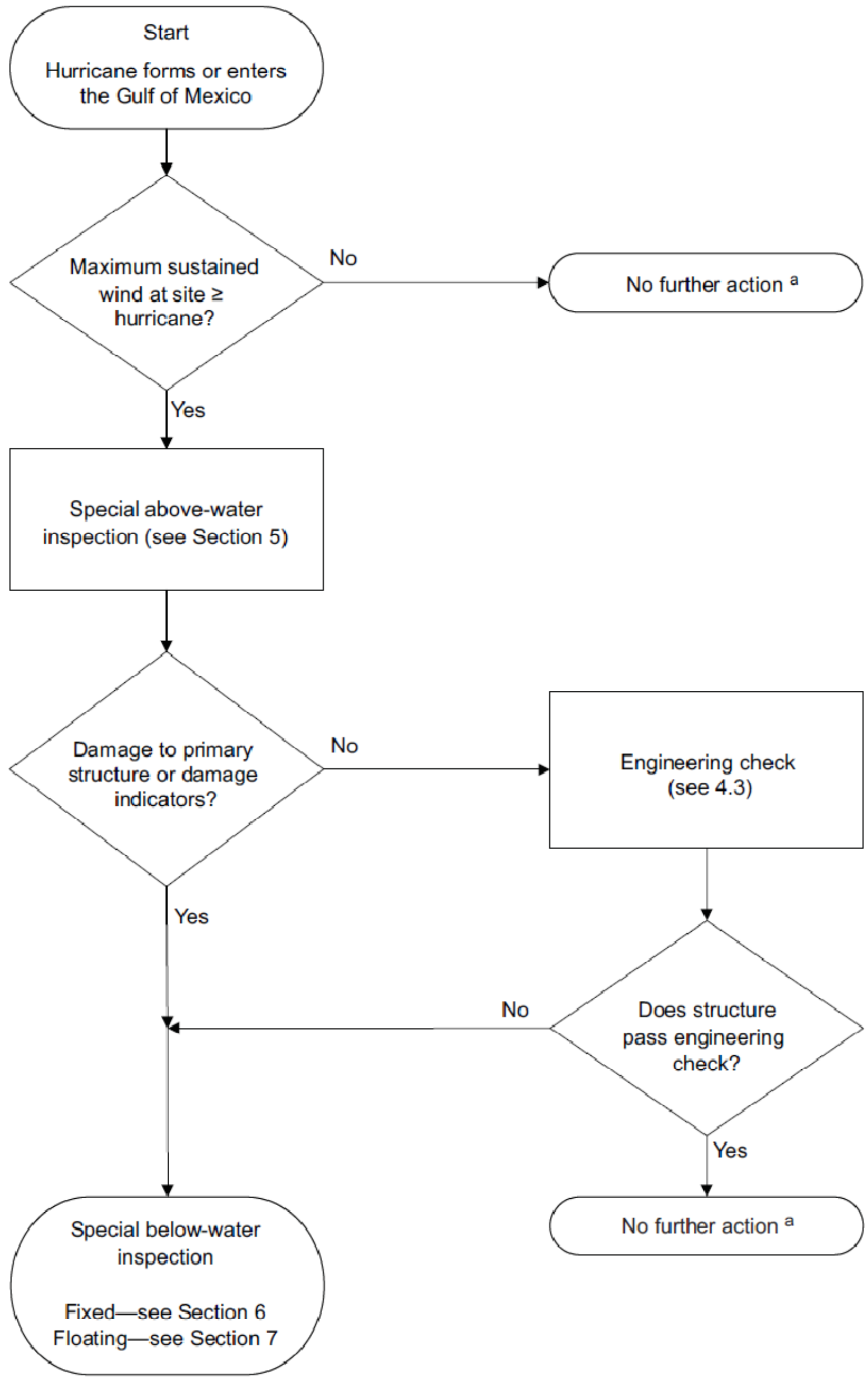

[a] Unless structure-specific inspections required by owner or regulator.

Figure 1 Inspection Initiator Process for Fixed and Floating Structures

(The indicated Sections refer to API Bulleting 2HINS)