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An Update on API RP 2A Section 17 for the Assessment of Existing Platforms

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Abstract

During the late 1980's it became evident that an API process was required for assessing the structural integrity of existing jacket platforms in the US OCS. The approach would be different from the design of new platforms and as such required a new section of API RP 2A. The offshore community then established an API working group that developed the assessment approach and released it in the mid 1990's as "API RP 2A, Section 17 – Assessment of Existing Platforms." The background and assumptions of Section 17 are described in a series of 1994 OTC papers.

Since then, Section 17 has become the worldwide recognized approach for assessing existing platforms. It has been used many times around the world and particularly in the Gulf of Mexico. In August 2003, the MMS released an NTL requiring Gulf of Mexico platform owners to assess their platforms to Section 17 requirements.

This paper provides further background, clarifications and proposed updates to Section 17. The paper is divided into three parts. Part I is a discussion on the background and perspective on why and how Section 17 was originally developed including review of some of the basic premises of the document. Part II is a historical perspective on how Section 17 has been implemented over the past seven years, and how platforms that applied the process have performed, including during Hurricane Lili. Part III presents the planned future of Section 17 and proposed clarifications and updates.

Part I: The Development of Section 17

The offshore industry started in the Gulf of Mexico in the late 1940's. Drilling and production grew steadily into the 1960's. In the frontier environment where little was know about the details of wave heights and wave loadings, land based practices were extrapolated with apparent success. Various oil companies and contractors developed staffs and procedures to design, install and operate the necessary facilities. The industry had continued success until the early 1960's when Hurricanes Hilda in 1964 and Betsy in 1965 swept through the Gulf of Mexico resulting a considerable damage to and loss of a number of platforms. These were the first large scale ("full population") hurricanes that the industry had experienced and it was evident that some guidance was required for platform design.

The First API Recommended Practice

Following Hurricane Hilda, a group of industry leaders met to discuss issues related to design practice (13). Discussions of return periods for design wave height were one of the key topics. Considerable variance, from 25 year to 100 year periods, was confirmed along with a wide variety of techniques and data for determining the height for a given return period. Additional topics of key importance identified were steel design and foundation characteristics. More important than the actual topics discussed, was the long term result of the meeting. This group of more than 60 met in November 1964 and held what became the first meeting that eventually led to the issuance of the first design guidance for offshore facilities, the API Recommended Practice for the Planning, Design, and Construction Fixed Offshore Platforms in 1969, a 16 page document (11).

By the mid-1980's, there were several thousand platforms in the US, mostly in the Gulf of Mexico, platforms from shallow water single well caisson well protectors to complex, multi-well high production platforms in water depths up to 1,200 feet. The offshore infrastructure was rapidly maturing following two decades of broad operating experience, research and the increasing use of digital technology. The focus had been on developing a better understanding of the environment, structural performance in a hostile environment and methods to more adequately design, construct and install offshore platforms. With this work, both in the US and in Northern Europe with the growth of the North Sea oil industry, API RP 2A, focusing on facilities in US waters had been updated 15 times and grown to over 150 pages. Similarly, design guidance documents were being prepared and updated in the North Sea with emphasis on the North Sea environment.

While the US offshore industry was still in the infrastructure developing mode, the civil US infrastructure was coming

under increasing scrutiny as age degradation and obsolescence was occurring. Many American bridges were being described as outdated and under maintained, water and sewerage systems were leaking, undersized for the continued rising load and too frequently failing. The civil infrastructure was under challenge and much work was underway to assess the adequacy as well as upgrading older facilities to extend their life. The US bridge industry comprised of highway commissions, designers, contractors, academics and specialty suppliers were spending increasing amounts of time and energy addressing thousands of bridges across the country.

While the offshore industry was still young by civil infrastructure standards, some efforts were starting to address the aging issue. The AIM (Assessment Inspection and Maintenance) Joint Industry Project (1), Phase I of eventually four phases, was the first significant effort. Over 1,100 platforms were installed prior to 1974 at which time the 100 year wave became the standard design condition. Though many of the 1,100 plus platforms had 100 year criteria and incorporated research and experience findings, there were still many that would not meet mid 1980's new design practice. Hence, the industry starting looking at strategies in assessing the adequacy of aging platforms.

The AIM projects were supported by not only a large number of oil companies, but also by the Minerals Management Service (MMS). The US offshore industry has been substantially self regulating, i.e. the industry has been leading the effort to develop and implement standards and specifications with the cooperation of the regulatory bodies. Though there was no urgent need to develop guidelines for existing structures, the industry and regulators had started to develop a framework.

The Sudden Hurricane

As the industry started to address aging platforms, Hurricane Juan wound through the Gulf of Mexico during the summer of 1985. Classified as a minimal or Category 1 hurricane, Juan produced a fairly significant amount of damage in addition to leaving some personnel stranded in the Gulf waters. Juan was unique in that it was a "sudden hurricane", a storm that spawned in the Gulf of Mexico so quickly that personnel were not able to be evacuated from all the facilities. Compounding the sudden nature of the hurricane was the unusual track, one that crossed over itself more than once. Much of the physical damage was borne by older structures, with several platforms collapsing.

The Influence of Earthquakes

At first, it would appear that the Loma Prieta Earthquake of October 1989 had no relationship to the offshore oil industry. The initial focus was on recovery and then rehabilitation of the infrastructure in the northern California area where the event was centered. Most engineers were spellbound by the pictures of the Cypress Expressway collapse in Oakland. Reactions ranged from fascination to bewilderment as pictures of the exploded lower column connections and subsequent collapse of the upper roadway. Designed to the prevailing codes of the 1950's and 1960's, these structures and the components comprising the load paths were no match for the earthquake forces.

By the spring of 1990, a question, key to the development of the assessment procedure for the offshore industry was asked, "A number of platforms were designed and installed using 1960's technology offshore southern California. Would the same fate be bestowed on these platforms as that bestowed on similar 1960's structures, the Cypress Expressway, if a similar event happened near the platforms?" While the first thoughts were the platforms would not experience the same fate, there were no systematic guidelines or processes in-place to provide rapid assurance such response would not take place.

API Task Group for Earthquakes

In response to the question, the API Subcommittee for Fixed Systems, the subcommittee with the responsibility for API RP 2A, contacted Wilfred Iwan of the California Institute of Technology to head a panel of eminent earthquake engineers to review state of the art practices in seismic assessment and acceptable performance for existing facilities. Coupled with the review was the request they prepare a strategy that could be utilized in assessing the adequacy of existing platforms for earthquakes. The report, known as the THIC (3) report for the panel consisting of Charles Thiel, George Housner, Wilfred Iwan and C. Allin Cornell, provided a foundation for not only assessment of structures in seismic areas also for the subsequent API work that culminated in the issuance of Section 17 as a supplement to the 20th edition of API RP 2A .

It should be noted that the THIC panel was only one of several activities underway within the industry. The AIM projects were continuing to develop additional background information and potential techniques to be used in assessment. A number of joint industry projects, notably at the University of California Berkeley, Stanford University, Lehigh University and Texas A&M, were providing valuable information in the form of analytical tools, reliability processes and strength of damaged and/or degraded tubular components.

The THIC panel discussed several issues that would be instrumental in the API deliberations starting in late 1992. First, the identification of fundamental issues:

- A probabilistic or code based approach?
- What are acceptable performance values?
- How should cost benefit factors be addressed?
- Partitioning of Life Safety, Environmental Safety and Economic Issues
- Adequacy of the then current API RP 2A 19th Edition
- Relationship to land based commercial and industrial facilities.

Key components of the THIC report that have been used to formulate present day approaches include:

- The intent of structural strength, and the procedures to assess the adequacy, is to limit the risk of catastrophic impacts. Total elimination of impacts is not warranted from a comparative standpoint nor is it possible from a physical standpoint. A catastrophic impact is one that has

unacceptably large life and/or environmental safety consequences.
- Life safety and environmental safety can be partitioned since they are essentially different in character and need not, indeed cannot, be measured by a common scale such as dollars.
- The acceptable risk for a worker on an offshore facility can be comparable to that for a worker in a similar facility onshore.
- The panel uncovered no safety or environmental issues associated with the seismic safety assessment process that indicated platforms should be subject to risk criteria more, or less, restrictive than those for land based facilities.
- Public policy accepted a level of performance for older facilities that was less than that of new facilities. Stating another way, facilities designed to older codes that may not be as stringent as current codes did not automatically have to meet the current code to continue to be used. For example, many US bridges are still in service even though they were designed to older codes. There was however, a generally accepted lower threshold below which a facility was deemed unacceptable. For facilities in seismic areas, this level was approximately 75% of the force in current codes required for design.
- The seismic environmental hazard posed by an older facility should be no greater than that posed by other major offshore petroleum release sources such as pipeline leaks/breaks, tanker discharges or natural seepage

It may be noted that when the API task group deliberated, a level higher than land based requirements was chosen. The reduced level was set at the equivalent design level for land which was 75% of the new design level for offshore platforms.

The THIC report was issued in May, 1992. At the June, 1992 API Standardization Conference, discussion was held that started the formation of a task group to address the aging structure questions. Shortly after the conference, in mid-August, Hurricane Andrew stormed through the east central Gulf of Mexico exposing approximately 2,000 platforms, over 50% of the Gulf of Mexico platform inventory, to hurricane force winds. Nearly 800 of these platforms were installed prior to 1972, the year the 100 year design criteria became the recommended practice. Major damage occurred with over 100 platforms exhibiting major damage or collapse. Details of the storm effects on the offshore industry have been well documented in numerous papers contained in OTC and OMAE proceedings as well as US Minerals Management Service reports.

Some early observations of the impact Hurricane Andrew had on the US Gulf of Mexico were reported in a DOE conference held in October, 1992 from which the following is taken (15):

"Two preliminary conclusions can be garnered concerning the structural behavior knowing the basic data on the toppled and leaning structures:
- There were few if any surprises, i.e., the structures in the leaning and toppled category were design to the "25 Year" criteria indicating that waves most likely entered the decks of the structures that weren't caissons;
- There appears to be no substantial structural damage on recent vintage structures with the decks above the crest elevation of storm waves."

The early lessons from Hurricane Andrew are quite encouraging when viewed from the life safety and environmental safety impact.
- There was no loss of life associated with the offshore platforms. All personnel were evacuated well in advance of the storm.
- There was no catastrophic environmental impact. Minimal discharges were evident as a direct consequence of platform damage or failure. Many platforms were totally shut-in while others were on automatic monitoring with subsurface safety systems in-place. Most of the hydrocarbon discharge occurred from damage to pipeline segments independent of platforms.
- There was major dollar infra-structure impact. Additional removal costs associated with collapsed platforms, repalcement costs and repairs, from major structural to appurtenances, were in excess of $1 billion from preliminary reports.
- There was excellent structural performance. As noted above, some 1950-1960's vintage platforms were lost or severely damaged. Modern designs performed very well.
- There was damage to shallow water areas with caissons and timber piled structures that would have been expected to be overtopped by the waves.

In addition to providing an impetus to expedite the API task group work, the occurrence of Hurricane Andrew provided some valuable opportunities:
- Full scale validation test – the performance of platforms versus projected wave height versus installation date. This would be invaluable in calibration any assessment process.
- With a range of platform designs being tested, a benchmark opportunity was available to calibrate analytical tools used in design and assessment.

The industry took advantage of these opportunities through various JIPs and internal company work. Both of these contributed greatly to the API work and the industry understanding of the uncertainties and biases in design and analysis procedures.

API Task Group for Existing Platforms

The API Task Group was organized in the traditional manner, using volunteers from industry. Chaired by Mr. Kris Digre of Shell, the Task Group had 14 members, 20 corresponding members and 7 technical teams. Their charge, starting with a blank sheet of paper, was to develop a recommended process for assessing the adequacy of existing offshore structures that could be included in API RP 2A. Very limited constraints were placed on the group. The charge to the group included:
- Do it quickly.

- Use available information from sources such as the THIC report, public information from JIPs, ongoing work in the North Sea following the Piper Alpha incident including the Lord Cullen report.
- Make it workable.
- Use proprietary studies for information and guidance, but all justification and references had to be public domain.

As a secondary objective, the task group was asked to provide the framework of a process that could be extended to worldwide application, not just US waters. While not the primary objective, this was important since it would provide the underpinnings for a consistent process that could form the basis for the assessment process to be included in the developing ISO Offshore Structures Standards.

Some of the issues addressed by the task group included:

- Can structural types be categorized or grouped based on age, geometry, etc. for first level screening?
- Can a multi-tiered, formally gated process be utilized?
- Can relationships of the type such as design base shear versus ultimate capacity be established for general classes?
- Is it practical to develop a rational procedure for 80-95% of the Gulf of Mexico structures in order that a complete re-evaluation for each structure would not be necessary?
- Should a peer review process be developed for assessment and "requalification", and if so, how should it be incorporated and for what categories of structures?
- What constitutes acceptable life safety and environmental safety standards or thresholds?
- Can economic decisions be left exclusively to the owner/operator?

Section 17 - How it Developed

The work of the task group was eventually going to be Section 17 in API RP 2A. As is typical in work of this type, a single draft is generated with not only the guidance or standards included but also the commentary, references, etc. Following a number of months of work, the first draft prepared by the task group was nearly an inch thick. From many discussions, debates, editing, and compromise, the process was disseminated in a cascaded manner. Section 17 emerged after 8 iterations as 17 pages of guidance and 8 pages of commentary in Supplement 1 to the 20th Edition of RP 2A. Seven key references were provided, those being a series of OTC papers in 1994 (2,4,5,6,7,10,14). These papers, prepared in conjunction with the Section 17 content, contain further references and background information. The documentation for Section 17 was consciously developed in three layers:

- Section 17 and the accompanying commentary
- Seven OTC papers containing direct background further elaborating on the provisions in Section 17
- Numerous technical articles in conference proceedings and workshop to further explain not only the rationale but also supporting technical data behind decisions. Two particular workshop proceedings containing papers, industry panel deliberations and summaries provide substantial reading (8,9)

Two JIPs were structured to provide information directly to the task group. While most JIPs have specific confidentiality periods, these two projects had modified confidentiality provisions to make key findings available to the task group. The first was commonly called the "Trials JIP" and provided for testing of the initial and final provisions of the task groups' recommendations, especially in regards to pushover analysis. The second, the "Andrew JIP" provided calibration for capacity methodologies and Reserve Strength Ratios (RSRs) that are part of the assessment procedure.

Section 17 - Basic Premises

The assessment process contains a series of fundamental elements.

- **"Triggers" are used to identify platforms that need to be addressed.** Until a "trigger" is encountered, there is no need to perform a structural analysis of an existing facility.
- **A multi-tiered process was implemented.** Platform categories were developed based on the observation that there were different life safety and environmental safety risks. And, therefore, different levels of performance were appropriate since a major objective was to mitigate catastrophic impacts. This resulted in different performance expectations for the various levels.
- **Coupled with the multi-tiered designation was a formally gated 3-stage process,** beginning with a conservative, simple assessment criterion. Should a facility not pass this gate, the next level involved a more detailed analysis and finally the third stage was targeted to be a non-linear capacity check using mean values for loads and resistance which involves a considerable amount of effort and expertise. The multi-gated process was implemented in recognition that many platforms would meet current new build design criteria. If so, there is no need to perform any additional analysis. There was a direct and conscious intent to match the level of effort to what was necessary to provide assurance of expected structural performance.
- **Life Safety and Environmental Safety are partitioned,** i.e., each has separate criteria for determining level of performance required. Through partitioning, requirements for each can be not only developed independently, but also adjusted as necessary. The objective of RP 2A is to provide guidance on the acceptable life cycle performance of a structure. This acceptable performance involves not only safety of the personnel working on the facility, either full time or part time, but also safety to the environment.
- **Economic evaluation is left to the discretion of the owner.** Only the owner can determine the value of the asset and the level of importance of a given facility. The assessment process allows an owner to utilize more restrictive criteria if desired. For example, an unmanned platform that is used as a pipeline juncture may be categorized as an unmanned and low consequence but be very valuable commercially to a given company such that

a high consequence assessment be chosen by the owner/operator.

- **Simple, direct measures.** With the inclusion of wave height and crest elevation curves as a function of water depth, the need for site specific studies in most areas of the Gulf of Mexico can be avoided. The included curves are based on best available metocean information and provide an acceptable means to rapidly determine both clearance and force levels for the check conditions. As noted earlier, one objective of the task group was to provide a rapid process to evaluate the adequacy of the majority of structures. Inclusion of wave height curves, RSRs, etc. provided the tools to achieve this objective.

Another significant factor at this time was a conscious move away from the terminology of "requalification" to "assessment." Early versions of the document referred to requalification; however, it was pointed out by the committee that this was not a requalification process where the platform is "not qualified" any more after a certain date. Instead, it is an "assessment" process whereby the platform needs only to be assessed when one of the Section 17 "triggers" activates, damage for example. In the interim the platform should respond in an acceptable manner provide it is inspected and maintained in accordance with a proper integrity management program. Such thinking had already been in place and had worked adequately in the North Sea.

Part II: The Historical Use of Section 17

It has been over seven years since Section 17 was released as a supplement to API RP 2A. In this timeframe, platform owners have used the Section 17 process to assess numerous platforms. This portion of the paper describes how Section 17 has been used by operators – and the MMS – since its introduction.

Initial Use of Section 17

Initially, there were no government requirements to implement Section 17 in terms of "assessment" of the US OCS platform fleet. Instead, platform owners implemented the process for "triggers" primarily associated with changes in the platform configuration, such as additional wells or topsides equipment (increased loading trigger), or damage (decreased resistance trigger). This has occurred on numerous occasions and more than 400 platforms have been assessed to Section 17. Several Section 17 related engineering studies have been published in the literature or discussed at various conferences and workshops (16, 17, 18, 19).

In particular, Hurricane Lili in 2002 demonstrated Section 17 as several platforms that had been checked to its standards performed adequately. The term "performed adequately" includes platforms that were completely destroyed by Hurricane Lili resulting in no loss of life and no damage to the environment. For example, EI 275, was completely toppled by Hurricane Lili even though it had passed the assessment process that was triggered by damage found in the platform in a underwater survey in 1997 (16). The operator and the MMS knew the platform would not withstand storm forces much greater than that expected during a Sudden Hurricane event. Hurricane Lili imposed forces on EI 275 much greater than Sudden Hurricane forces and as a result the platform collapsed. Due to the assessment process the operator was able to sustain production for an additional 5 years, taking the risk of higher removal cost should the platform be destroyed prior to production ceasing and normal removal operations being completed (16).

The MMS and Section 17

The MMS initially worked with platform owners to implement the Section 17 process if upgrades or damage were found and an assessment was required. The MMS had participated in the development of Section 17 and accepted the approach. Since at that time there were no legal requirements to use Section 17, use was on a voluntary basis. However, the MMS still would have to approve any upgrades or modifications and therefore had final say on approval - with the use of a proper Section 17 assessment making such an approval simpler since it used industry developed guidelines.

Some historical facts on using Section 17:

- On average about 50 platforms per year have been assessed by Gulf of Mexico Operators for a total of approximately 400 platforms assessments.
- Most common confusion is the need to document the rational used to define the consequence Level. In particular it is difficult for the structural engineer to gather the data on wells, pipelines and equipment supported by the platform to determine if the platform is a high, medium or low consequence. Not to mention the vague language used in RP 2A to distinguish these categories.
- Application of Section 17 vs. Section 15. Simply put, just because a platform exists at a given location does not mean that is always appropriate for the platform to be assessed under Section 17. Section 17 was developed to allow an existing platform to remain on location and complete the original purpose that the platform was installed for, even though the existing platform will not pass today's new design criteria requirements. However, platform owners have tried to use Section 17 with existing platforms to develop a new lease, to support new major pipeline activity, or other alternative uses for the existing platform. The MMS will not allow this approach in these cases. Instead, per the MMS, these new activities can use existing platforms as long as the existing platform meets the requirements of Section 15, Reuse. Further clarification of this *change of use* for a platform versus *reuse* is one of the issues that will be addressed in the planned update of Section 17, described in Part III.
- Infrastructure importance**.** As part of its role, the MMS is responsible to see that oil & gas resources are available for the use by the public. To this end, the consequence level of some platforms may be increased by the MMS compared to what an operator or right of way holder considers appropriate, depending on how important the platform is in delivering oil & gas to market.

- Most typical analysis under Section 17 is the screening analysis and the design level analysis. Only a few applications have been submitted using the ultimate strength analysis.
- Most typical trigger to date has been the addition of facilities (primarily well additions); however, this is because Operators are taking advantage of using Section 17 rather than using new design criteria to justify modifications to existing platforms. It is expected that inadequate deck height will trigger a couple of hundred assessment analyses.
- Section 17 Assessment of Existing Platforms is a failure criteria where the existing platform passing the assessment criteria is allowed to fail (collapse) under environmental loads that exceed the loading of the determined consequence level. The offshore structural engineer needs to go out of his/her way to point out to the owner/operator that the existing platform that passes the assessment process could collapse if the loading from a storm exceeds the high, medium or low consequence assessment criteria that has been utilized in the assessment.

The MMS chose not to implement Section 17 and require all US OCS platforms to be "assessed" until all owners had the opportunity to understand the use and implications of the assessment process - and the existing condition of the platform. The MMS had initiated a mandatory underwater inspection program for all OCS platforms in 1988 (30 CFR 250.142). The program followed general API guidelines, which allowed for different underwater inspection intervals based upon the exposure level of the platform. "High" Consequence platforms had to have an API Level III inspection (close visual inspection of pre-selected areas including removal of marine growth) on a maximum 10 year basis. "Medium" Consequence platforms had to have a Level III inspection on 15 year maximum intervals. This meant that all platforms in the US OCS will have been inspected by 2003 (15 years after the initial requirement). Hence in August 2003, the MMS released Notice to Leases (NTL) 2003-G16, which required all Gulf of Mexico platforms to undergo an assessment per Section 17 (20).

The MMS NTL sets out a multiyear timetable for operators and pipeline right of way holders to conduct the platform assessments using a "gated" process. Different assessments are required at different times with gates that allow a platform to "pass" the assessment with no further work required. Platforms that "fail" must move on to the next gate with additional assessment work required. A summary of the NTL is as follows according to the MMS required dates:

- **August 15, 2003**. MMS NTL 2003-G16 is issued.
- **June 1, 2004.** The owner must determine the exposure category per Section 1.7 of RP 2A, and also determine if a platform assessment is required based on one of the five platform initiators listed in Section 17.2.
- **June 1, 2005.** For those platforms that initiate a trigger, a design level check is required per Section 17.7.2.
- **June 1, 2006.** For those platforms that fail the design level check, an ultimate strength check is required per Section 17.7.3
- **November 1, 2006.** For those platforms that fail all prior checks, mitigation is required per Section 17.8.

MMS Assessment Workshop

Following the issuance of the NTL, the MMS sponsored a two day workshop in September 2003, featuring presentations and expert panel discussions about development and application of Section 17 (21). The workshop also included questions to the MMS specifically about interpretation and understanding of the NTL and its relation to Section 17.

The consensus among attendees of the Workshop was that Section 17 provided an important and robust process to determine the fitness for purpose of existing platforms that may not meet modern design criteria for new platforms. It was apparent that there was a general lack of familiarity with Section 17 among much of the industry. At the end of each day Workshop attendees were provided the opportunity to address questions to an expert panel. The questions and responses captured several important areas where greater clarity would be beneficial within Section 17. In addition, the MMS made it clear that there were components of Section 17 that needed adjustment following years of experience.

An important recommendation from the Workshop was for API, through Sub-Committee 2, to 1) formerly address the specific concerns of the MMS and to 2) consider the benefits of developing a new separate Recommended Practice for Structural Integrity Management that would capture the existing Sections 14 and 17 in API RP 2A. The need for improved clarity especially in the definition of exposure categories was also recognized.

Feedback from the industry at the workshop indicated a need for a standard reporting format containing the NTL defined data that would be submitted to the MMS. In response, the MMS issued a suggested tabular format as shown in Table 1. The table is divided into three parts. The "MMS Provided Data" part contains key data on the platform, such as location, year installed, and water depth. This information is already contained in the MMS files and will be provided to the platform owner. The MMS intends to use feedback on this part of the table to ensure consistency of their database with owner records. The "Screening Data" part contains information that must be supplied by the owner to the MMS by June 1, 2004, and contains the data necessary to determine the status of the Assessment Initiators contained in Section 17.2. The last column of this section called "Screen" indicates if the platform passes this stage (P) and no further assessment work is required, or if it fails this stage (F) and further work is required. The "Method Data" part contains the other Pass/Fail checks contained within Section 17 such as Design Level, Ultimate Strength, etc. The timeline for feedback to the MMS on the progress of these activities, (for platforms that Fail screening) will be according to the MMS NTL timetable noted above.

If a platform is defined as Medium or Low Consequence, then the MMS may require additional data to make this case. Tables 2 and 3 show one possible approach (18). Table 2 provides a worksheet to determine the Exposure Category. Table 3 helps define the well, pipeline and equipment information that can be used in determining the Consequence of Failure Category portions of Table 2.

Part III: Future Plans for Section 17

As described previously, Section 17 was a significant development with widespread industry participation in its development and testing. Section 17 has also seen widespread use by the industry for various site specific platform issues, with successful results, as demonstrated by platform performance in Hurricane Lili. Section 17 is the basis for the draft ISO guidelines for existing platforms. Finally, the MMS now requires that Section 17 be implemented on all Gulf of Mexico fixed based platforms.

An additional factor not typically associated with fixed jacket platforms has also now come into play – deep water development in the Gulf of Mexico. All of the deepwater fields have the production routed to shore via fixed platforms located on the shelf. Some of these platforms are existing structures that now have a new function. Hence it is important that the industry have an adequate process for managing the integrity of these facilities.

With all of these issues in mind, API convened a Task Group to assess updates in response to feedback from the MMS and industry from the years of experience using Section 17. The Task Group determined that revisions were necessary to Section 17 has recommended that a significant change should be made in the overall character of API RP 2A – in terms of dividing the document into two separate RPs – one for NEW platform design and the other for EXISTING platforms.

The Task Group believes that the industry has an opportunity to not only clarify and improve Section 17, but to also address some of the needed expansions and clarifications of Sections 14, 15 and others in RP 2A that apply to existing fixed base platforms. The Task Group strongly supports the preparation of a new RP for fixed offshore structures relating to Structural Integrity Management (SIM). The Industry now has sufficient mature fields to justify this move and the time may be right to address this important concept. This also provides the opportunity to introduce improved commentary and nomenclature that will make the API assessment process more usable on a worldwide basis, for example, representative RSRs in addition to the Gulf of Mexico wave heights.

A two step process is planned. Phase 1 is to issue as soon as possible a Supplement to API RP 2A to address some specific MMS concerns and provide some clarifications and updates. It was felt by the Task Group that these changes are required immediately to assist operators in responding to the MMS NTL and that the only way for API to issue such changes is a Supplement that can be voted on quickly via the API process. Phase 2 is a longer term initiative to split RP 2A into the two documents previously noted.

Phase 1 – Supplement to API RP 2A

The Supplement is expected to be available in draft form by June 2004. It will then be submitted to API for balloting, with approval and publication expected by the end of 2004.

Key items envisioned for the supplement are as follows:

- **Clarification of the applicability of Section 17 reduced assessment criteria.** Many operators use Section 17 for ALL of the changes that may be associated with an existing platform such as upgrades and damage – but also "change of use". However, in some of the change of use platform revisions, Section 15 related to Reuse is perhaps a more appropriate approach. As previously noted, this has been one of the difficulties that the MMS has had with some of the Section 17 assessments that have been submitted to date. The supplement will clarify when Section 17 should be used versus Section 15.
- **Clarification of risk associated with reduced criteria**. The use of the lower wave heights, shorter wave periods, lower wind and current velocities per Section 17, such as the Sudden Hurricane or Winter Storm, leads to inherently greater risk exposure for a platform owner than the use of 100-yr return period conditions as used in new design (Section 2). This is particularly true when an owner has multiple platforms that are assessed to the lower Section 17 criteria. Some additional clarification of this issue and some cautionary statements will be added.
- **Clarification of the definition and naming of Exposure Categories**. The Section 1 and Section 17 Platform Exposure Categories are called L-1, L-2 and L-3. The Section 14 Survey Levels are called L-I, L-II, L-III and L-IV. This similar but different terminology leads to confusion and a new naming nomenclature will be developed.
- **Include medium consequence environmental risk Exposure Category**. Section 17.3 states that for Section 17 work only ". . . *medium consequence* platforms (L-2) are to be considered *low consequence* (L-3) for assessment criteria selection." This is further illustrated in Table 17.5.2a where only two exposure categories are defined. This effectively eliminates the medium consequence category for Section 17 purposes. The MMS has stated that it does not accept this interpretation and wants API to revisit this logic.
- **Include acceptable RSRs as alternative to reduced criteria.** Section 17 provides specific metocean criteria such as wave heights and current for Gulf of Mexico conditions. This was a conscious decision by the original API Task group to simplify the process. The specific Section 17 metocean criteria were based upon Reserve Strength Ratios (RSRs) as discussed in some of the supporting OTC papers. The supplement would provide further clarification of how the platform RSR can be used in lieu of the Section 17 metocean figures to determine platform acceptance.

- **Guidance on selection of wave criteria for shallow water.** Most of the Section 17 figures used to determine metocean data such as wave height and deck height show values only for 40 ft water depth and greater. Some general guidance (such as the use of site specific studies) is needed for shallow water areas less than 40 ft water depth.
- **Additional guidance on terminology.** Additional wording is required to better define some of the Section 17 terminology such as interpretations of "significant" changes in load and/or platform resistance and definitions necessary for platform Categorization found in Section 1, such as "major oil transport lines" and oil "storage."
- **Others.** Additional clarifications and updates will be made in the supplement to make Section 17 an easier to use and understand document.

Phase 2 – Development of a New API RP for Structural Integrity Management of Fixed Platforms

The second part of the update will be the development of a new RP, separate from RP 2A, that specifically addresses the structural integrity of existing platforms. The tentative working title of the document is "Structural Integrity Management (SIM) for Fixed Offshore Platforms."

The overall document will follow the SIM concept as shown in Figure 1, and as used in ISO (22). The concept is that a platform has a long life – provided that a proper integrity management program is implemented that combines inspection and assessment in an organized manner.

This will be a stand-alone document with a preliminary outline as follows:

- **Section 1- Structural Integrity Management Overview.** This will contain portions of RP 2A Section 1 Planning, as well as build upon the ISO draft text related to SIM and shown in Figure 1.
- **Section 2 – Criteria.** This will contain only the criteria from RP 2A Section 17, leaving the process for assessment in terms of structural analysis to later sections. This will also address some of the issues raised by the use of RP 2A Section 15 related to Reuse versus Change of Use, noted previously as one of the MMS concerns.
- **Section 3 – Inspection.** This will be an updated version of RP 2A Section 14, blending in some of the inspection planning philosophy from the new ISO approaches as well as results from recent industry work on inspections.
- **Section 4 – Assessment.** This will contain the non-criteria portions of the assessment process in Section 17– design level, ultimate strength, etc. and will include the clarifications and updates contained in the Phase 1 Supplement.
- **Section 5 – Accidental Loading**. This will contain extracts from RP 2A Section 18 that pertain to existing platforms in terms of boat damage, etc., including guidance on when a platform does or does not have "significant" damage that needs to be addressed.
- **Commentary.** Detailed discussions will be provided for each of the main sections, in particular additional commentary on the use and understanding of the metocean criteria.

The Phase II work will be conducted throughout 2004, including some work in parallel with development of the Phase I Supplement. The draft version of the RP will be complete in early 2005, with a final verion later in the year.

Conclusions

API RP 2A Section 17 was released over seven years ago and has become the worldwide recognized approach for assessing existing platforms. Some specific conclusions regarding Section 17 and the proposed path forward for the process are as follows.

The Section 17 process works. This was initially demonstrated in the Benchmark and Andrew JIPs conducted in the mid-1990's following the release of Section 17. However, since that time, numerous platforms have used Section 17 and have been exposed to large storms and hurricanes and have performed as expected.

The Section 17 process is now required for all US Gulf of Mexico Platforms. The August 2003 MMS NTL requires all Gulf of Mexico platform owners to implement Section 17, with all platforms assessed and mitigated (if necessary) by November 2006.

The Section 17 process requires some clarification and updating. An API Task Group is working on clarification and updates to Section 17 as well as other sections of API RP 2A that are associated with existing platforms. A two part approach will be implemented:

- *An API RP 2A Supplement*. Short term plans are for an update to Section 17 via a Supplement to API RP 2A issued in draft form mid 2004 and final form by the end of the year. This is an immediate need to assist operators in responding to the MMS NTL.
- *New API RP for Existing Platforms*. Longer term plans are for a new API RP tentatively titled "Structural Integrity Management for Fixed Offshore Platforms," to be published in 2005. This would contain not only Section 17, but also Section 14 (Surveys) and parts of Section 15 (Reuse) and Section 18 (Accidental Loading). In addition, parts of Section 1 (Planning) related to definition of platform exposure categories would be included.

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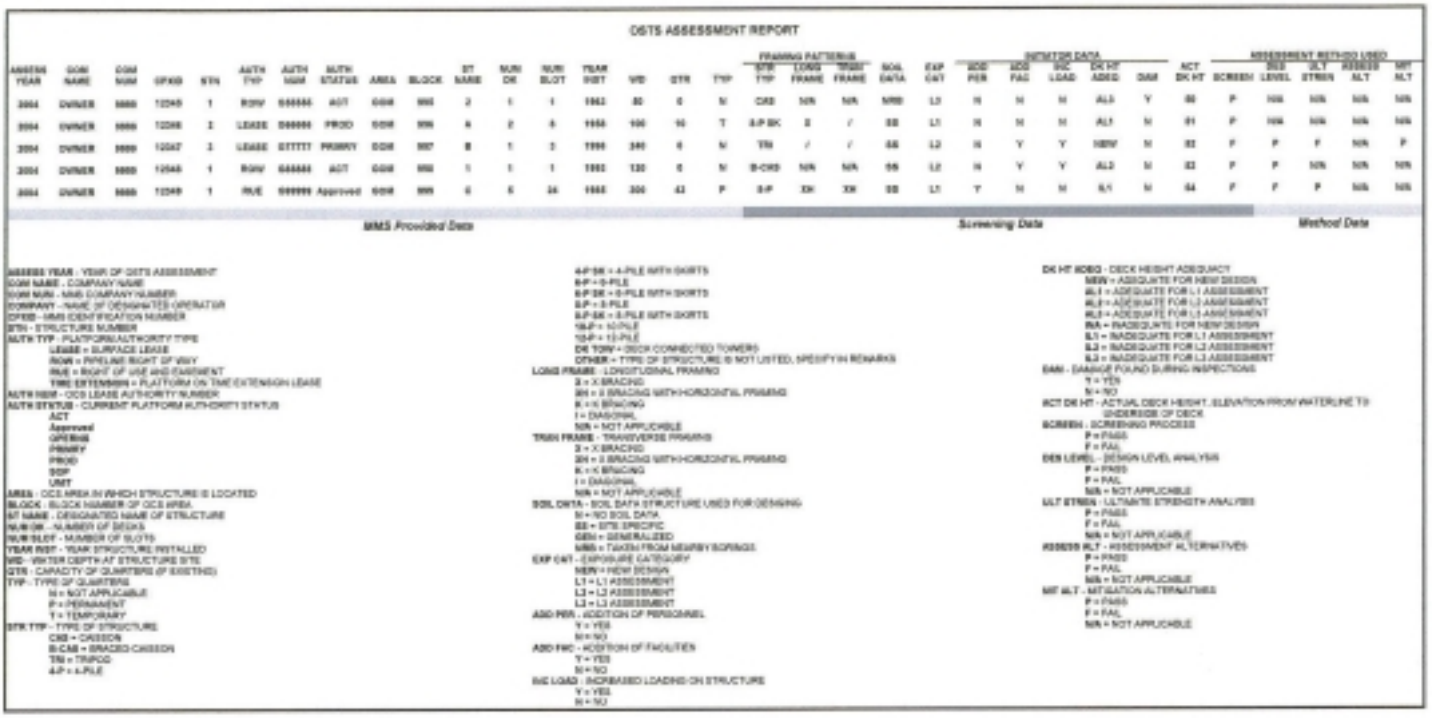


Table 1 – Suggested Submittal Information for MMS NTL - Assessment Report

Environmental and Infrastructure Risk Assessment Matrix
per API RP2A 21th Edition

Operator:
Area:
Block:
Platform:

Section 1.7 Exposure Category Worksheet

Life Safety Issues	Yes/No
1. Is this structure continuously occupied by persons accommodated and living thereon with evacuation prior to the design environmental event either not intended or impractical?	
2. Is this structure continuously occupied by persons accommodated and living thereon with planned evacuation prior to a design environmental event?	

If Item 1 is Yes and Item 2 is No, the Life Safety Category is: L-1 Manned-Nonevacuated
If Item 2 is Yes and Item 1 is No, the Life Safety Category is: L-2 Manned-Evacuated
If Items 1 and 2 are No, the Life Safety Category is: L-3 Unmanned

The Life Safety Category for this structure is:

L-1 High Consequence of Failure Issues	**Yes/No**
1. Does this platform have the potential for well flow of either oil or sour gas in the event of platform failure?	
2. If applicable, is the shut-in of the oil or sour gas production not planned or not practical in the event of occurrence of the design environmental event?	
3. Does the platform support major oil transport lines?	
4. Does the platform support oil storage facilities for intermittent oil shipment?	

If ANY of the above L-1 High Consequence of Failure Issue responses are "Yes", the Consequence of Failure Category is L-1.
If ALL of the above L-1 High Consequence of Failure Issue responses are "No", proceed to L-2 Issues below.

L-2 Medium Consequence of Failure Issues	**Yes/No**
1. Will all production be shut-in during the design environmental event?	
2. Do all wells that could flow on their own in the event of platform failure contain fully functional subsurface safety valves which are manufactured and tested in accordance with the applicable API specifications?	
3. Is oil storage limited to process inventory or "surge tanks" for pipeline transfer?	

If ANY of the above L-2 Medium Consequence of Failure Issue responses are "No", the Consequence of Failure Category is L-1.
If ALL of the above L-2 Medium Consequence of Failure Issue responses are "Yes", proceed to L-3 Issues below.

L-3 Low Consequence of Failure Issues	**Yes/No**
1. Will all production be shut-in during the design environmental event?	
2. Do all wells that could flow on their own in the event of platform failure contain fully functional subsurface safety valves which are manufactured and tested in accordance with the applicable API specifications?	
3. Does this structure only support low volume infield pipelines?	
4. Is oil storage limited to process inventory only?	

If ANY of the above L-3 Low Consequence of Failure Issue responses are "No", the Consequence of Failure Category is L-2.
If ALL of the above L-3 Low Consequence of Failure Issue responses are "Yes", the Consequence of Failure Category is L-3.

Additional MMS Issues	**Yes/No**
1. Does this structure support more than 5 well completions?	
2. Does this structure support more than 2 pieces of process equipment?	

If ANY of the above MMS issue responses are "Yes", the Consequence of Failure Category cannot be L-3. It must be at least L-2.

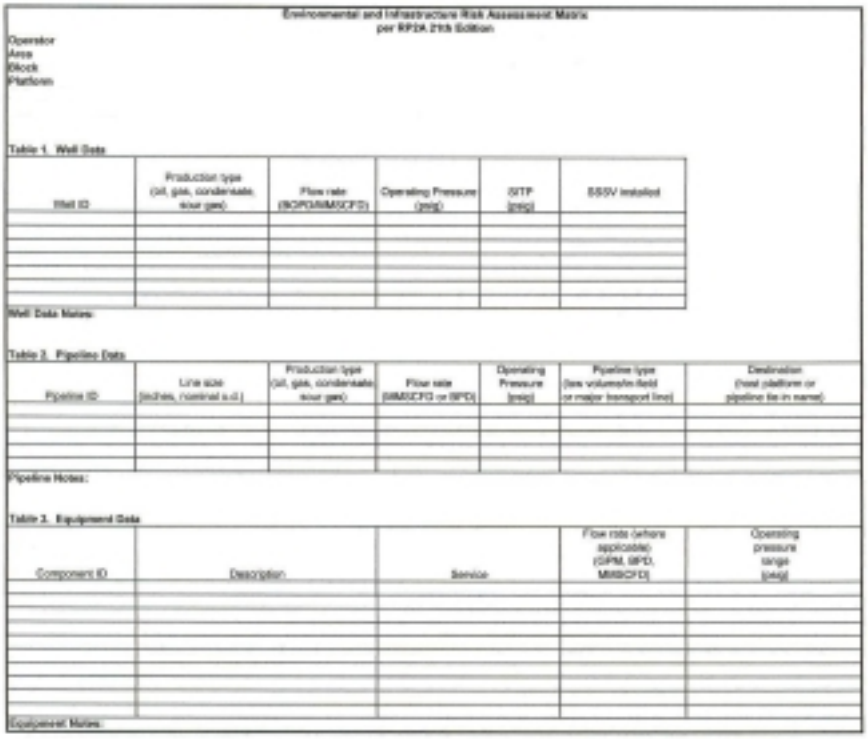
The Consequence of Failure Category for this structure is:

Final Exposure Category Evaluation

The Life Safety Category for this structure is:
The Consequence of Failure Category for this structure is:

Using the worst case of the two categories, this structure is classified as:

Table 2 – Example Exposure Category Worksheet (18)



Environmental and Infrastructure Risk Assessment Matrix
per RP2A 21th Edition

Operator
Area
Block
Platform

Table 1. Well Data

Well ID	Production type (oil, gas, condensate, sour gas)	Flow rate (BOPD/MMSCFD)	Operating Pressure (psig)	SITP (psig)	SSSV installed

Well Data Notes:

Table 2. Pipeline Data

Pipeline ID	Line size (inches, nominal o.d.)	Production type (oil, gas, condensate, sour gas)	Flow rate (MMSCFD or BPD)	Operating Pressure (psig)	Pipeline type (two volume/in-field or major transport line)	Destination (next platform or pipeline tie-in name)

Pipeline Notes:

Table 3. Equipment Data

Component ID	Description	Service	Flow rate (where applicable) (GPM, BPD, MMSCFD)	Operating pressure range (psig)

Equipment Notes:

Table 3 – Example Platform Well, Pipeline and Equipment Data List (18)

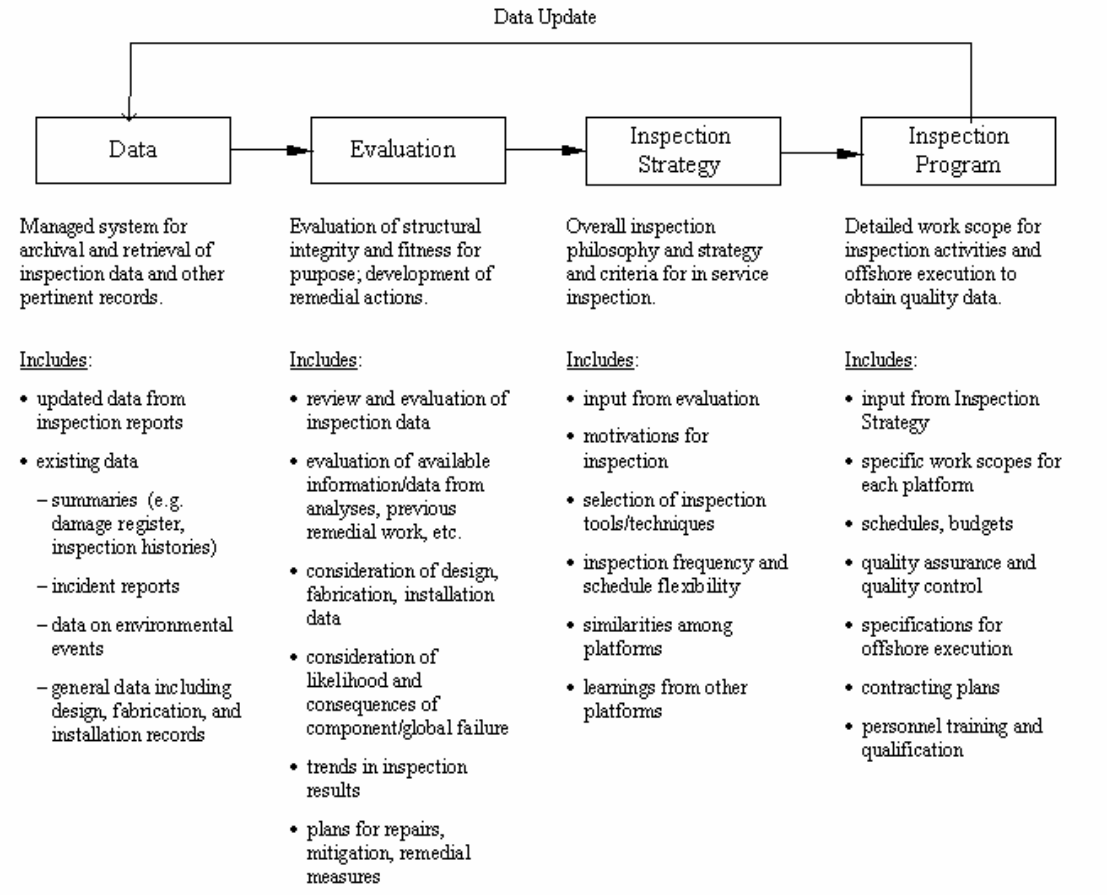


Figure 1 - Overall Structural Integrity Management (SIM) Process