# Professional Team Report to the
# Florida Commission on Hurricane Loss Projection Methodology

## Risk Management Solutions, Inc.
## Review of Issues/Errors
## September 20, 2011

On September 20, 2011, a subset of the Professional Team met with Risk Management Solutions, Inc. (RMS) in Tallahassee, Florida. The following individuals participated in the review:

***RMS***
Kay Cleary, FCAS, MAAA, FCA, Actuary & Director, Mitigation & Regulatory Affairs
Swaminathan Krishnamoorthy, Manager, Model Development
Joel Taylor, Senior Analyst, Mitigation & Regulatory Affairs
Michael Young, M.E.Sc., P.E., Senior Director Mitigation & Regulatory Affairs

***Professional Team***
Paul Fishwick, Ph.D., Computer Scientist
Mark Johnson, Ph.D., Statistician, Team Leader
Marty Simons, ACAS, Actuary
Masoud Zadeh, Ph.D., P.E., Structural Engineer
Donna Sirmons, Staff

On August 12, 2011, RMS informed the Chair of the Florida Commission on Hurricane Loss Projection Methodology (Commission) of "revisions to the RMS North Atlantic Hurricane Model, RiskLink 11.0.SP1 model" stating, "There are three incidents that affect the software that have been revised in version 11.0.SP2." The letter also stated, "None of these incidents change loss costs in Florida."

The three incidents reported were related to the exposure data import process for secondary modifier option codes and increased model run time where the software was modified to eliminate unnecessary calculations. RMS stated, "Three fixes were included in RiskLink 11.0.SP2 (Build 1411) and supersede version 11.0.SP1 (Build 1411)."

In the August 12 letter, RMS also requested the Commission consider RiskLink 11.0.SP2a (China Typhoon model) and RiskLink 11.0.SP2b (European Windstorm model in addition to the China Typhoon model) acceptable under the 2009 Standards.

On August 17, 2011, the Commission discussed the request from RMS and voted to defer action until the September 2011 meetings, and for the Chair to work with the Professional Team in order to make a recommendation on action to be taken.

On August 24, 2011, RMS was provided with the following memo to Chairman Scott Wallace from the Professional Team requesting RMS be prepared to present material and provide responses to the following questions during the upcoming review by the Professional Team.

# Memo

**To: Scott Wallace, Chair, Florida Commission on Hurricane Loss Projection Methodology**

**From: Paul Fishwick, Mark Johnson, and Masoud Zadeh, Professional Team**

**Date: August 24, 2011**

**Re: August 12, 2011 letter from Risk Management Solutions, Inc. (RMS) to the Florida Commission on Hurricane Loss Projection Methodology (Commission)**

The Commission received a letter from RMS dated August 12, 2011 regarding three new models: RiskLink 11.0.SP2, SP2a, and SP2b. These models are separate from RiskLink 11.0.SP1 that has been previously certified by the Commission for use in Florida.

In the letter, RMS noted three incidents in RiskLink 11.0.SP1 and created three patches present in a subsequent version, RiskLink 11.0.SP2. The first incident details an exposure data import process error, where "codes used in the previous releases to represent modifier options have been reorganized." The remaining two incidents derive from performance upgrades to the computation involved in model execution run times.

RMS will need to respond to the following items during the upcoming review.

**Questions about Incident 1:**

1. How was the incident discovered and by what group or organization?

2. What actions were taken by the modeler to address the problems defined as a result of this incident?

3. What communications were issued to clients regarding this problem? Copies of any communications should be available for review.

4. Are there organizations using RiskLink 11.0.SP1 for which the reported error may result in an incorrect use of the model by a client?

5. Why is RMS requesting consideration of acceptability for two new models (SP2a and SP2b) rather than for one model?

6. Why on page 2 (2nd to last paragraph) is the same build number (1411) used to describe two different versions of the model, RiskLink 11.0.SP2 and RiskLink 11.0.SP1?

7. On page 3, the first partial paragraph reads "...supporting documentation enclosed shows that the loss costs produced by SP2a and SP2b are identical to those produced by SP2." However, since SP1 is the model accepted by the Commission, the task of verifying identical results for SP2a and SP2b should be in comparison to SP1.

**Discussion Items for Incident 1:**

1. Be prepared to fully explain the secondary modifier mapping logic described on page 2 of the letter and under what circumstances this logic was "mistakenly applied." This explanation may involve questions regarding code and scripts where they may be used.

2. Be prepared to provide two or more distinct examples demonstrating imported exposures that cause the logic to be misapplied.

3. Be prepared to demonstrate under what possible exposures, and using which specific secondary modifiers of the eleven listed on page 2, RiskLink 11.0.SP1 could be used to mistakenly estimate loss costs for Florida.

**Questions on Incidents 2 and 3:**

1. What unnecessary calculations were eliminated?

2. What are "expected performance levels" compared to RiskLink 11.0.SP1?

**Discussion on Form A-6:**

In considering the RMS request and the comment at the Commission meeting (August 17, 2011) that there was no impact on Form A-6, (the Florida Hurricane Catastrophe Fund data not needing special pre-processing) the Professional Team re-examined Form A-6 provided by RMS. In reviewing Form A-6, we noted certain loss costs for Glades, Okeechobee, Taylor and Union counties were included or excluded without explanation. Be prepared to explain the inclusion/ exclusion of loss costs for condominium owners frame and condominium owners masonry for these counties with respect to the FHCF 2007 data. In particular, RMS includes Glades County for each of frame and masonry condo owners where there is no such exposure in the FHCF data; RMS includes condo owners frame for Union county (although there is no exposure in the FHCF data); RMS does not include Okeechobee condo owners frame yet there is exposure in the FHCF data. Be prepared to discuss if, and how, these observations relate to the reported incidents.

On September 2, 2011, RMS notified the Commission of "an issue whereby the relationship between 13 postal codes and associated counties used in preparing From A-6 were inconsistent with the shipped software (and also the associated postal code-county relationship found in the FHCF dataset)." RMS stated, "This issue does not affect the modeled losses at these individual postal codes, but only affects how results are aggregated up to county level summaries in Forms A-6, A-7, and A-8."

On September 9, 2011, RMS submitted revised Forms A-6, A-7, A-8, and Commercial Residential Output Ranges, differences in Forms A-6 and A-7, and a letter describing the details of the error and their plan for prevention of this type of error in the future.

RMS began the review on September 20, 2011 with an explanation of the known errors and their resolutions within the source code that resulted in the release of RiskLink 11.0.SP2. The Professional Team asked if any other errors had been discovered, and RMS stated there were no additional errors.

Review and Discussion of Error #1

Error #1 is related to the exposure data import process. RiskLink 11.0.SP1 includes updated secondary modifier option codes, and codes used in previous model versions that were reorganized. As part of the exposure upgrade process, the codes for certain modifiers were revised and mapped to new codes. During the exposure import process, the software was mistakenly applying the secondary modifier mapping logic used in exposure upgrade process causing some imported secondary modifiers to differ from the original secondary modifiers in the source data.

Discussed that the incident was discovered internally during the User acceptance testing by Client Development. Reviewed the "bug review" logs for testing of the re-mapped secondary modifiers.

Discussed the actions taken by RMS to address the problems defined as a result of the incident. Reviewed the incident log, actions taken by Software Development to fix the problem, actions taken by Quality Assurance to verify the fix, the root cause analysis conducted by Quality Assurance, and the known issue report created and shipped to clients with the software patch.

Reviewed the communications issued to clients regarding the problem. Clients were notified through RMS.com client resources as part of SP2 Known Issues Resolved in RiskLink 11.0.SP2 and through client communication by e-mail.

RMS stated there were no known clients using RiskLink 11.0.SP1 where the reported error could result in an incorrect use of the model in a rate filing, and that it is unlikely that any client analyses are affected by the secondary modifier incident. RMS stated the issue is rare, would be hard to repeat, and that clients who follow standard quality checks using the import summary

report would catch the error should it occur. RMS is not aware of any client organization that has used RiskLink 11.0.SP1 in a state of Florida rate filing that may be affected by this incident.

Reviewed the secondary modifier mapping logic. Discussed the circumstances that led to the logic being "mistakenly applied" where the data is assumed to already be in the 11.0 format and the secondary modifier re-mapping to RiskLink 11.0 format should not be done. Discussed the two ways to bring exposure data into the model and how the error occurred due to the relative ordering of scripts run during the import process.

Verified with the modeler that loss costs calculated using RiskLink 11.0.SP1 have the potential to be erroneous as a result of 1) error #1 identified by the modeler, and 2) a discussion of the primary cause of the error being due to two blocks of code that were executed in parallel, but which contained a cross-dependency.

Discussed the request for the Commission to consider the acceptability of SP2a and SP2b in addition to SP2. RMS confirmed that the North Atlantic Hurricane Model is identical in all three software service patches – SP2, SP2a, and SP2b. SP2a includes China Typhoon in addition to the North Atlantic Hurricane Model and SP2b includes China Typhoon and European Windstorm in addition to the North Atlantic Hurricane Model. The request to find SP2, SP2a, and SP2b acceptable is due to RMS submitting the model suite for acceptability rather than only the Florida specific model as in previous years.

Discussed why the same build number, 1411, was used to describe different versions of the model. Discussed the relationship between build numbers and software patches. RMS followed the re-versioning process documented in their model revision policy. Reviewed RMS model revision policy.

Discussed the regression testing provided to the Commission comparing results of SP2a and SP2b to SP2 to verify that the North Atlantic Hurricane Model is identical in all three software service patches.

Discussed actions taken to resolve the mapping error. Discussed the reasons for not catching the problem prior to releasing the model/software.

Reviewed conceptual flowchart of the import process. Discussed the importance of the order of execution in the import process. Discussed the error being unique to RiskLink 11.0 and not an issue with previous model versions.

Reviewed import code and the revised code created by removing the update script. The Professional Team noted the lack of adequate commenting in the SQL script and informed RMS more comments should be added to the code prior to the next on-site review.

Reviewed example of data prior to import and after import resulting in different values found for the same secondary modifiers at the same location demonstrating how the logic was misapplied.

Discussed the secondary modifier enhancements reviewed during the March 28-31, 2011 Professional Team on-site review. Reviewed example of secondary modifier mapping in SQL code.

Review and Discussion of Incident #2

In Incident #2, model users were experiencing increased run time when running North Atlantic Hurricane analyses at the same time as the Offshore Platform model. The software was modified to eliminate unnecessary calculations.

Discussed the "unnecessary calculations" eliminated. RMS removed a string array that was allocating and then de-allocating an unused variable for each location and event combination.

Reviewed code flowchart for computing location loss identifying the unused variable. Reviewed revised code with the string array for the unused variable commented out.

Discussed the "expected performance levels" compared to RiskLink 11.0.SP1. The Professional Team verified through the regression testing provided that there were no changes in the loss costs due to this software modification.

Reviewed regression test cases for incident #2.

Review and Discussion of Incident #3

In Incident #3, model users were experiencing increased run time when running North Atlantic Hurricane analyses for all regions (United States, Canada, and Caribbean) when Post Event Loss Amplification (demand surge) was included in the analyses. The software was modified to eliminate unnecessary calculations.

Discussed the "unnecessary calculations" eliminated. RMS discovered loading the loss amplification table was taking excessive time. The code has been optimized to load only the events that are affected by the portfolio where, previously, the full table was loaded irrespective of the events that are affected by a given portfolio.

Reviewed data flow diagram. Reviewed the old code and the revisions in the new code.

Discussed the "expected performance levels" compared to RiskLink 11.0.SP1. The Professional Team verified through the regression testing provided that there were no changes in the loss costs due to this software modification.

Review and Discussion of Error #4

Error #4 is the result of using the wrong software build for completing the forms in the submission. The relationship between 13 ZIP Codes and associated counties used in preparing Form A-6 and its associated forms were inconsistent with the software shipped to clients and with the ZIP Code-County relationship found in the FHCF exposure dataset provided for completing Form A-6.

Discussed the ZIP Codes in Okeechobee and Glade counties where the initial county assignment differed from the FHCF exposure data. Reviewed RMS procedure for processing exposure data. Discussed the error occurred due to using two different software builds for the county assignments. The submission work started during software build 1403 in order to meet the notification deadline, but the county assignments were updated and used under software build 1404.

Reviewed the impact of the county mapping. The reported county-level loss costs changed in 24 counties having a range of +/- $4.3 (loss cost/$1000). Reviewed specific examples of ZIP Codes assigned to Manatee County and Hardee County confirming the updated loss costs match with the total loss costs reported in Form A-6.

Reviewed specific examples where the United States Postal Service assigns a ZIP Code to one county while RMS analysis of the population distribution assigns the ZIP Code to another county.

Reviewed revised results in Forms A-6, A-7, and A-8. Reviewed the specific county changes in Form A-8 maps. Reviewed the revised results in the commercial residential output ranges.

Reviewed the revised Test Plan for FCHLPM Actuarial Forms to explicitly test for geocoding errors in an effort to prevent future errors of this type.

RMS stated that #1, #2, and #3 affect the model software, but #4 affects the submission only.

In the course of reviewing the RMS incidents/errors, RMS indicated that the minimum and maximum values in Form A-6 represent the extremes at the level of individual row entries in the FHCF exposure data file rather than across ZIP Codes within the county. In low population counties with only a single ZIP Code having a particular exposure, the information provided represents additional information. The Report of Activities states, “For each of these categories using ZIP Code centroids, the personal residential output range shall show the highest loss cost, the lowest lost cost, and the weighted average loss cost based on the 2007 Florida Hurricane Catastrophe Fund aggregate personal residential exposure data provided in the file named *“hlpm2007.exe*.”

Professional Team Conclusions

After a thorough and comprehensive review of the errors and corrective actions implemented, as well as relevant documents, the Professional Team verifies that RiskLink 11.0.SP2 meets the 2009 standards. With regards to SP2a and SP2b, the Professional Team recommends that, to avoid potential confusion and additional audit time, that the modeler submit only one model version to the Commission for acceptability.

After a comprehensive review of Error #1, and the genesis of the error found within an unexpected cross-dependency in concurrent code blocks, the Professional Team recommends that the acceptability of RiskLink 11.0.SP1 be rescinded.

The Professional Team reviewed the following revised pages from the March 31, 2011, final revised submission which will be provided electronically by September 21, 2011, with hard copies to follow no later than September 27, 2011.

1. Model Submission Checklist
2. Model Identification
3. Table of Contents
4. Standard G-1, Disclosure 1, Disclosure 5
5. Standard G-2, Disclosure 3b
6. Form G-1
7. Form G-4
8. Form G-6
9. Form G-7
10. Standard M-1
11. Standard M-4, Disclosure 2 & Figure 15
12. Standard A-1, Disclosure 2
13. Standard A-3, Disclosure 1
14. Standard A-4
15. Standard A-10, Disclosure 6
16. Form A-6
17. Form A-7
18. Form A-8
19. Standard C-6, Disclosure 2
20. Appendix C, Figure 103
21. Appendix D

Updated Form G-2, Form G-3, Form G-5, and Standard C-6, Disclosure 2 to be provided electronically.