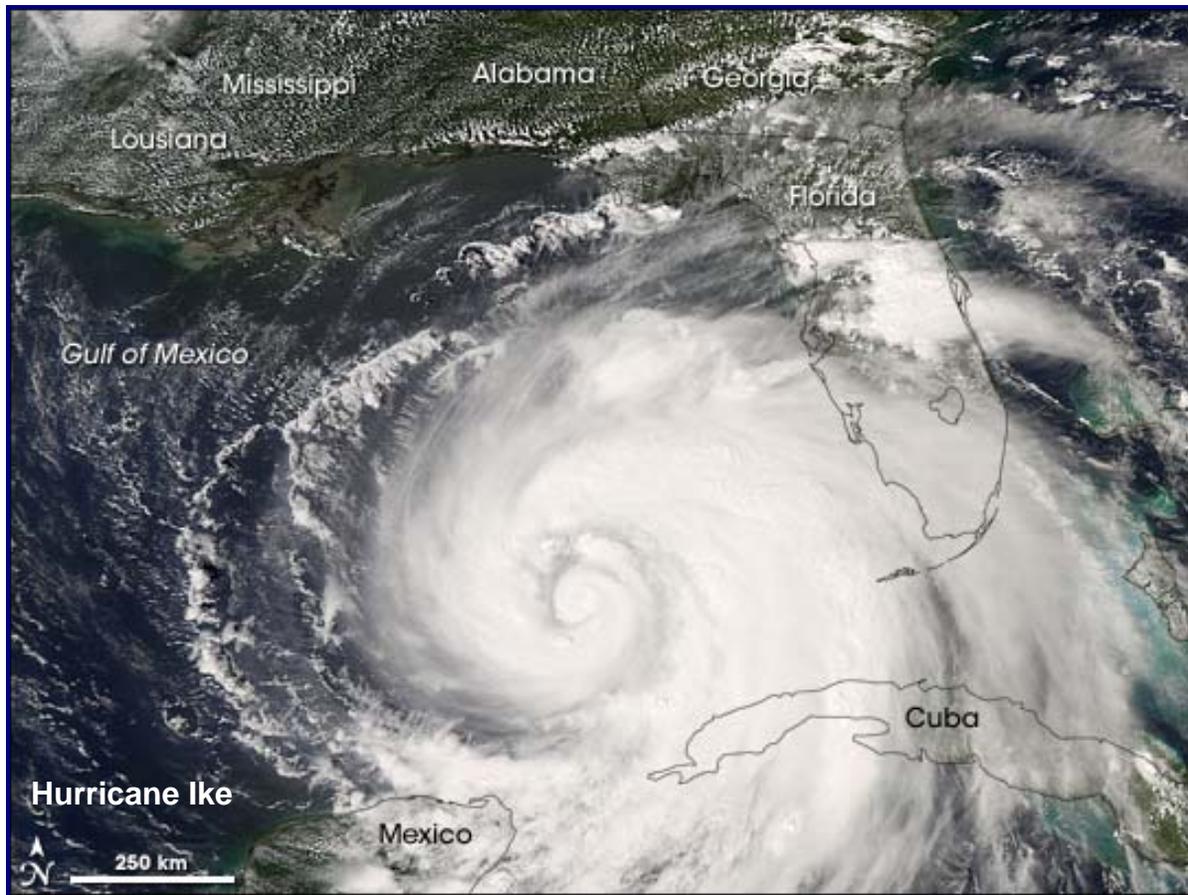


# Florida Commission on Hurricane Loss Projection Methodology



## Professional Team Report 2008 Standards

**Risk Management Solutions, Inc.**

**On-Site Review**

April 16 – 18, 2009

**Additional Verification Review**

June 1, 2009

On April 16-18, 2009, the Professional Team visited on-site at Risk Management Solutions, Inc. (RMS) in Newark, California to review RiskLink version 8.0.1a. The following individuals participated in the review:

**RMS**

Enrica Bellone, Ph.D., Lead Catastrophe Risk Modeler  
Kay Cleary, FCAS, MAAA, Actuary & Director, Mitigation & Regulatory Affairs  
Katie Coughlin, Ph.D., Senior Catastrophe Risk Modeler, Model Development  
Vincent Daniel, Ph.D., Project Lead Model Development  
Michael Drayton, Ph.D., Consultant  
Bikramjit Singh Goraya, Manager, Software Development Manager  
Nathalie Grima, Financial Modeler, Actuarial & Financial Modeling  
Nadja Leith, Senior Catastrophe Risk Modeler, Model Development  
Matthew Nielsen, Product Manager, Americas Models, Model Management  
Jonathan Meagher, Ph.D., Project Director  
Jonathan Moss, Manager, Financial Model Quality Assurance  
John Reiter, Vice President, Software Core Products Application Development  
Rajesh K. Singh, Ph.D., P.E., Senior Director, Model Development Operations  
Beth Stamann, Senior Documentation Specialist, Mitigation and Regulatory Affairs  
Shengjun (John) Su, Ph.D., Senior Software Engineer  
Joel Taylor, Risk Analyst, Mitigation & Regulatory Affairs  
Pantea Vaziri, Ph.D., Catastrophe Risk Modeler, Mitigation & Regulatory Affairs  
Michael Young, M.E.Sc., P.E., Senior Director Mitigation & Regulatory Affairs

**Professional Team**

Jenni Evans, Ph.D., Meteorologist  
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

The review began with introductions and an overview of the audit process. RMS followed with a presentation on the changes in the 2009 model (RiskLink version 8.0.1a) relevant to the personal residential lines of business and the impact of the changes on loss costs.

- Migration of the vulnerability database from a Microsoft Access-based file database to a Microsoft SQL-based platform and the truncation from 8 to 12 decimal places to 4 decimal places in the new version of the database.
- Update of the financial model resulting in changes to algorithms used to calculate the Exceedance Probability curves.

The Professional Team was unable to verify Standard A-10 (Output Ranges). Consequently, Standard A-6 could not be verified and Standards G-1, G-4, G-5, C-4, and C-5 could not be verified as they require the verification of the other two standards. At the exit interview, modeler options as given in the Report of Activities were reviewed.

The Professional Team reviewed the following corrections to be included in the revised submission to be provided to the Commission no later than 10 days prior to the May 19-21, 2009 meetings:

- Page 108, M-2.1, year range of H\*Wind data for shape parameter and wind related conversions and their references provided; clarified data used for the pressure profile parameter and the gradient to surface reduction factors
- Page 115, M-3.2, clarified data used for the pressure profile parameter and the gradient to surface reduction factors
- Page 119, M-4.1, Figure 7 revised to correct for standard units
- Page 306, S-1.7, *p*-values corrected for Figure 45
- Page 332, Form S-4, Table 36 revised to correct total difference percentage
- Page 339, C-3, Figure 58 revised to clarify the flow of vulnerability data through processing
- Page 369, last page of Appendix D revised to correct for new build number
- Pages 371-377, Appendix E revised to correct for new build number and additional analysis settings and exposure data detail statistics

### **Additional Verification Review – June 1, 2009**

RMS submitted revised Forms A-6, A-7, and A-8 on May 22, 2009 in accordance with the Form A-6 instructions contained in the Report of Activities. The Professional Team met with RMS on June 1, 2009 in Tallahassee to review the revisions in completing Form A-6, Output Ranges.

The following individuals participated in the additional verification review:

#### **RMS**

Kay Cleary, FCAS, MAAA, Actuary & Director, Mitigation & Regulatory Affairs  
John Reiter, Vice President, Software Core Products Application Development  
Joel Taylor, Risk 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  
Donna Sirmons, Staff

RMS provided an explanation of the changes made to incorporate year built and roof shape in the modeled exposure data as the basis for completion of Form A-6, Output Ranges. All Standards are now verified by the Professional Team.

## **Report on Deficiencies**

The Professional Team reviewed the following deficiency cited by the Commission at the March 19, 2009 meeting. The deficiency was corrected by the established time frame and the correction has been verified.

1. Form M-2 (page 133)  
Maximum windspeed locations not plotted on maps in Figure 15

## **Professional Team Pre-Visit Letter**

The Professional Team's pre-visit letter questions are provided in the report under the corresponding Standards.

### **Pre-Visit Letter**

The purpose of the pre-visit letter is to outline specific issues unique to the modeler's submission. The goal is to identify lines of inquiry to be followed during the on-site review so as to allow adequate advance preparation by the modeler. Aside from due diligence with respect to the full submission, various requests for information and questions that the Professional Team is certain to ask the modeler during the on-site review are provided in this letter. This letter does not preclude the Professional Team from asking for additional information during the on-site review that is not given below or discussed during the upcoming conference call that will be held, if requested by the modeler. One goal of the potential conference call is to clarify points in this letter. The comments are grouped by Standards sections. The overall intent is to expedite the on-site review and to avoid last minute preparations that could just as easily have been handled earlier.

The items provided below are to assist the modeler in preparing for the on-site review. Some of this material may have been shown or been available on a previous visit by the Professional Team. The Professional Team will also be considering material in response to the Commission's designation(s) of deficiencies and issues.

The goal of the Professional Team on-site review is to provide the Florida Commission on Hurricane Loss Projection Methodology (Commission) with a clear and thorough report of the model, subject to non-disclosure restrictions on proprietary information. All modifications, adjustments, assumptions, or other criteria that were included in producing the information requested by the Commission in the submission should be disclosed and will be reviewed.

It is important that all material prepared for presentation during the on-site review, be presented using a medium that is readable by all members of the Professional Team simultaneously. The Professional Team will review selected computer code in conjunction with the reviews performed for each section. Computer code should be available in a format that will allow simultaneous visualization by the entire Professional Team. Access to critical articles or materials referenced in the submission or during the on-site review should be available on-site for the Professional Team. The Professional Team should be provided access to an internet

connection through one of the Professional Team member computers for reference work that may be required while on-site.

The Professional Team will interview the individuals signing the Expert Certification Forms G-1 through G-7.

Provide for the Professional Team's review, all engineering data (post event surveys, tests, etc.) received since 2005. Describe any processes used to amend or validate the model that incorporates this engineering data. Describe any processes used to amend or validate the model that incorporates insurance company claims data covering the 2004 and 2005 hurricane seasons, especially processes used since the prior visit by the Professional Team.

Provide and describe all studies performed to determine whether the model meets the "probable maximum loss" requirements added to the standards in the 2008 Report of Activities (Standard A-11 and several other standards and forms).

Demonstrate that output reports produced by a user of the model reveal the values of all user inputs and selections used to run the model.

When the Professional Team arrives on-site, provide the electronic file used to complete Form V-3 on a removable drive medium. This material will be used during the on-site review and will be returned when the on-site review is complete.

For your information, the Professional Team will arrive in business casual attire.

### **ISSUES:**

Describe how the model incorporates number of stories in the vulnerability functions.

Discuss the development and application of mitigation credits for various parts of the state, by region (North, Central and South), and by proximity to water (Coastal and Inland) as defined in Form A-7. Expansion to structure types that resemble the actual Florida building stock is desired.

### **TRADE SECRET MATERIAL:**

Describe how the model determines the magnitude of demand surge to include in the calculation of loss costs and probable maximum loss levels.

Show the Professional Team "supportive design diagrams, equations, and pseudo-code" that you intend to show the Commission during the closed meeting portion of the modeler presentation.

## GENERAL STANDARDS – Mark Johnson, Leader

### G-1 Scope of the Computer Model and Its Implementation\*

(\*Significant Revision)

***The computer model shall project loss costs and probable maximum loss levels for personal lines residential property insured damage from hurricane events.***

#### Audit

1. The main intent of the audit is to determine the capabilities of the model and to assess its implementation for purposes of Florida projected insured loss costs and probable maximum loss levels. Copies of all representative or primary technical papers that describe the underlying model theory shall be made available.
2. All software located within the model, used to compile data used by the model, used to validate the model, and used to project model loss costs and probable maximum loss levels (1) fall within the scope of the Computer Standards, and (2) will be reviewed interactively (viewed simultaneously by all Professional Team members in conjunction with the review of each Standard).
3. Databases or data files relevant to the modeler's submission will be reviewed.

#### Pre-Visit Letter

1. G-1, Disclosure 5, page 43: Discuss the impact of the use of HURDAT valid February 2009 (page 105) on the modeled storm frequencies.
2. G-1, Disclosure 5, page 43: Describe the update to the financial model. The Financial Loss Module on page 31 is identical to the previous submission. The cover letter mentions an update of the financial model. It is not clear as to the financial model update.

**Verified: YES**

#### Professional Team Comments:

Reviewed in detail the update to the financial model and the platform conversion and the minimal impact on loss costs.

Reviewed RiskLink process diagram and the various steps to produce loss costs: event loss table, frequency Poisson distribution, severity beta distribution.

Reviewed plots of Poisson frequency, severity curve, aggregate exceedance probability curve and occurrence exceedance probability curve. Reviewed numerical examples of the frequency and severity distributions.

Reviewed the methodology for calculating the aggregate and occurrence exceedance probability curves.

Reviewed the fast Fourier transformation recalibration that increased the number of thresholds and extended the maximum limit.

Documentation reviewed:

RMS Exceedance Probability Methodology, October 31, 2003

Reviewed changes to the Analysis Summary Report provided in Appendix E of the submission. The revisions necessitated a change to the model build number, but not to the model version number.

## G-2 Qualifications of Modeler Personnel and Consultants\*

(\*Significant Revision)

- A. Model construction, testing, and evaluation shall be performed by modeler personnel or consultants who possess the necessary skills, formal education, and experience to develop the relevant components for hurricane loss projection methodologies.**
- B. The model or any modifications to an accepted model shall be reviewed by either modeler personnel or consultants in the following professional disciplines: structural/wind engineering (licensed Professional Engineer), statistics (advanced degree), actuarial science (Associate or Fellow of Casualty Actuarial Society), meteorology (advanced degree), and computer/information science (advanced degree). These individuals shall be signatories on Forms G-1 through G-6 as applicable and shall abide by the standards of professional conduct if adopted by their profession.**

### Audit

1. The professional vitae of modeler personnel and consultants responsible for the current model and information on their predecessors if different than current personnel will be reviewed. Background information on individuals providing testimonial letters in the submission shall be provided.
2. Forms G-1, G-2, G-3, G-4, G-5, G-6, and all independent peer reviews of the model under consideration will be reviewed. Signatories on the individual Forms will be required to provide a description of their review process.
3. Discuss any incidents where modeler personnel or consultants have been found to have failed to abide by the standards of professional conduct adopted by their profession.

### Pre-Visit Letter

The Professional Team will interview the individuals signing the Expert Certification Forms G-1 through G-7.

3. G-2, Disclosure 2.B, page 82: Provide the resumes of the new employees (Mr. Farhan Asad, Mrs. Victoria Babina, Mr. Suman Bhattacharya, Mr. John Paul Castillo, Mr. Deval Chauhan, Mrs. Karishma Dambe, Ms. Shailja Dube, Mr. Henry Jou, Ms. Pratiksha Kadam, Mrs. Vidya Karthigeyan, Mr. Swaminathan Krishnamoorthy, Ms. Cindy Kuan, Dr. Nadja Leith, Mr. Jason Ling, Ms. Siyuan (Terry) Liu, Ms. Lin Lu, Ms. Reenal Mahajan, Mr. Venkat Morampudi, Ms. Lekshmi Prakash, Ms. Prachi Prakash, Mr. Pranav Raval, Mr. Ricardo Ruiz, Ms. Shraddha Sahay, Mr. Kalaiselvan Shakrapani, Ms. Benu Shroff, Mr. Maulik Shukla, Mr. Puja Sinha, Ms. Yongling Song, Mr. Shengjun (John) Su, Ms. Simi Thilakan, Ms. Monika Tomar, and Dr. Pantea Vaziri).

**Verified:     ~~CONTINGENT UPON RECEIPT OF COMPLETED EXPERT  
CERTIFICATION FORMS~~  
YES**

**Professional Team Comments:**

Completed Expert Certification Forms are required for verification.

Discussed new personnel added in the submission due to their involvement with any aspect of the model, the update to the financial model, and its implementation.

Reviewed resumes of personnel new to this year's model:

- Farhan Asad, B.S., Computer Sciences, National University of Computer & Emerging Sciences, Lahore, Pakistan
- Victoria Babina, B.S., Psychology, Moscow State University; BSCS, Moscow State University
- Suman Bhattacharya
- John Paul Castillo, Honors Program Certificate in Program and Project Management, UCSC Extension, Cupertino, California; B.S., Business Administration, Concentration in Finance, San Jose State University, San Jose, California
- Deval Chauhan, M.S., Computer Science, Illinois Institute of Technology, Chicago, Illinois; B.S., Electronics & Communication, Government Engineering College, India
- Karishma P. Dambe, B.S., Computer Engineering, Pune University, India
- Shailja Dube, Masters of Computer Application, Oriental Institute of Science and Technology, Bhopal, India; Bachelor of Commerce, Barkatullah University, Bhopal, India
- Henry T. Jou, B.S., Computer Science, Washington University, St. Louis, Missouri
- Pratiksha Kadam, M.S., Modeling and Simulation, University of Central Florida, Orlando, Florida; B.E., Electronics Engineering, University of Mumbai, India
- Vidya Karthigeyan, M.S., Business Administration in Computer Information Systems/Quantitative Business Methods, California State University, East Bay, California; M.S., Software Systems, Birla Institute of Technology & Science, Pilani, India; B.E., Civil Engineering, University of Mumbai, India
- Swaminathan Krishnamoorthy, M.S., Computer Applications, University of Madras, India; B.S., Physics, Bharathidasan University, Trichy, India
- Cindy Kuan, M.S., Computer Science, California State University, East Bay, California; B.S., Electrical Engineering and Computer Science, University of California, Berkeley, California
- Nadja A. Leith, Ph.D., Statistics, University College, London, United Kingdom; M.S., Applied Stochastic Systems, University College, London, United Kingdom; B.S., Mathematics, University of Bristol, United Kingdom
- Jason Ling, B.S., Computer Science, State University of New York at Stony Brook, Stony Brook, New York
- Siyuan (Terry) Liu, M.S., Computer Science, University of Tennessee; M.E., Computer Science & Engineering, Beijing University of Aeronautics and

- Astronautics, China; B.E., Computer Science & Engineering, Beijing University of Aeronautics and Astronautics, China
- Lin Lu, Ph.D., Computer Science, Minor in Statistical Science, Southern Methodist University, Dallas, Texas; M.S., Computer Science, Georgia State University, Atlanta, Georgia; B.E., Mechanical Engineering, East China University of Science and Technology, China
  - Reenal Mahajan, M.S., Computer Science, Virginia Polytechnic Institute and State University, Blacksburg, Virginia; B.S., Computer Engineering, Mumbai University, Mumbai, India
  - Venkat Morampudi, M.S., Computer Science, University of Alabama, Huntsville, Alabama; B.S., Computer Science, Acharya Nagarjuna University, India
  - Lekshmi Prakash, M.S., Computer Engineering, San Jose State University, San Jose, California; B.S., Computer Engineering, Cochin University of Science and Technology, India
  - Prachi Prakash, M.S., Computer Science, San Diego State University, San Diego, California; M.S., Computer Applications, Guru Gobind Singh Indraprastha University, Delhi, India; B.S., Electronics, Delhi University, Delhi, India
  - Pranav Raval, M.S., Computer Science, Illinois Institute of Technology, Chicago, Illinois; B.E., Civil Engineering, L.D. College of Engineering, Gujarat, India
  - Ricardo Ruiz, B.S., Computer Science, De La Salle University, Philippines
  - Shraddha Sahay, B.S., Electrical Engineering, VTU, Karnataka, India
  - Kalaiselvan Shakrapani, M.S., Computer Science, Anna University, India
  - Benu Shroff, M.S., Computer Science, Poona University, Pune, India; B.S., Physics, Delhi University, Delhi, India
  - Maulik Shukla, B.S., Computer Engineering, Regional Engineering College, India; M.S., Computer Science, Illinois Institute of Technology, Chicago, Illinois
  - Puja Sinha, B.E., Electrical, Nagpur University, Nagpur, India
  - Yongling Song, Ph.D., Computer and Information Science and Engineering, University of Florida, Gainesville, Florida; M.S., Computer Science, Xi'an Jiaotong University, China; B.E., Computer Science, Xi'an Jiaotong University, China
  - Shengjun (John) Su, Ph.D., Computational Analysis and Modeling, Louisiana Tech University; M.S., Applied Math, Louisiana Tech University; B.S., Thermal Energy Engineering, Shanghai Jiao Tong University, China; B.S., Computer Science, Shanghai Jiao Tong University, China
  - Simi Thilakan, M.S., Computer Application, Madurai Kamaraj University, India
  - Monika Tomar, M.S., Computer Application, Bundelkhand University, Jhansi, India; B.S., Mathematics, Delhi University, Delhi, India
  - Pantea Vaziri, Ph.D., Civil and Environmental Engineering, Cornell University, Ithaca, New York; M.S.E., Systems Analysis and Economics for Public Decision Making, Johns Hopkins University, Baltimore, Maryland; B.S., Civil Engineering, Imam Khomeini International University, Qazvin, Iran

Discussed with Kay Cleary her review of the Actuarial Standards and forms.

Discussed with Enrica Bellone her review of the Statistical Standards and forms.

**\*\*\*Additional Verification Review Comments\*\*\***

Reviewed updated Expert Certification Forms.

**G-3 Risk Location**

- A. ZIP Codes used in the model shall be updated at least every 24 months using information originating from the United States Postal Service. The United States Postal Service issue date of the updated information shall be reasonable.***
- B. ZIP Code centroids, when used in the model, shall be based on population data.***
- C. ZIP Code information purchased by the modeler shall be verified by the modeler for accuracy and appropriateness.***

**Audit**

1. Provide geographic displays for all ZIP Codes. The location of specific centroids will be reviewed.
2. Provide the third party vendor, if applicable, and a complete description of the process used to validate ZIP Code information.
3. The treatment of ZIP Code centroids over water or other uninhabitable terrain will be reviewed.

**Verified: YES**

**Professional Team Comments:**

Verified no change in the ZIP Code centroid database from the previous submission.

Discussed the process for handling ZIP Code centroids over water.

## G-4 Independence of Model Components

***The meteorological, vulnerability, and actuarial components of the model shall each be theoretically sound without compensation for potential bias from the other two components.***

### Audit

1. Demonstrate that the model components adequately portray hurricane phenomena and effects (damage, loss costs, and probable maximum loss levels). Attention will be paid to an assessment of (1) the theoretical soundness of each component and (2) the basis of their integration. For example, a model would not meet this Standard if an artificial calibration adjustment had been made to improve the match of historical and model results for a specific hurricane.
2. Describe all changes in the model since the previous submission that might impact the independence of the model components.

Verified:    **NO    YES**  
                   **Unable to verify pending verification of Standard A 10**

### Professional Team Comments:

#### \*\*\*Additional Verification Review Comments\*\*\*

There was no evidence to suggest that one component of the model was artificially adjusted to compensate for another component.

## G-5 Editorial Compliance\*

(\*Significant Revision due to new Audit language)

***The submission and any revisions provided to the Commission throughout the review process shall be reviewed and edited by a person or persons with experience in reviewing technical documents who shall certify on Form G-7 that the submission has been personally reviewed.***

### Audit

1. Demonstrate that the person or persons who have reviewed the submission has had experience in reviewing technical documentation and such person or persons is familiar with the submission requirements as set forth in the Commission's *Report of Activities as of November 1, 2008*.

2. Describe all changes to the submission document since the prior year's submission that might impact the final document submission.
3. Demonstrate that the modeler submission has been reviewed for grammatical correctness, typographical accuracy, completeness, and inclusion of extraneous data or materials.
4. The modification history for submission documentation will be reviewed.
5. A flowchart defining the process for Form creation will be reviewed.
6. Form G-7 will be reviewed.

### Pre-Visit Letter

The Professional Team will interview the individuals signing the Expert Certification Forms G-1 through G-7.

4. G-5, Disclosure 1, page 89: Review the process of submission form generation and its implementation since the previous submission.
5. G-5, Audit item 5 from page 73 of Report of Activities: Provide the flowchart used for form creation.

Verified: **NO YES**  
~~Unable to verify pending verification of Standard A-10~~

### Professional Team Comments:

Reviewed flowcharts describing submission form creation.

Reviewed the changes made to the form generation process including automated form data retrieval and calculation from the model and more detailed documentation on form creation instructions.

Documentation reviewed:

Creation of the Actuarial Forms of the FCHLPM Submission, April 13, 2009

Standard Operating Procedure: Submission Editing and Tracking, April 14, 2009

Reviewed the process and SQL query for completing Form A-1.

Reviewed SQL script results used to verify the results provided in Form A-1.

Reviewed the process for completing Form A-6.

Discussed with Beth Stamann the process for preparing and editing the submission document.

Editorial items noted by the Professional Team were satisfactorily addressed during the audit. The Professional Team has reviewed the submission per Audit item 3, but cannot

guarantee that all editorial difficulties were identified. The modeler is responsible for eliminating such errors.

**\*\*\*Additional Verification Review Comments\*\*\***

Reviewed updated Editorial Certification Form G-7.

## Meteorological Standards – Jenni Evans, Leader

### M-1 Base Hurricane Storm Set\*

(\*Significant Revision)

- A. Annual frequencies used in the model and model validation shall be based upon the National Hurricane Center HURDAT starting at 1900 as of June 1, 2008 (or later). Complete additional season increments based on updates to HURDAT approved by the Tropical Prediction Center/National Hurricane Center are acceptable modifications to these storm sets. Peer reviewed atmospheric science literature can be used to justify modifications to the Base Hurricane Storm Set.**
- B. Any trends, weighting or partitioning shall be justified and consistent with currently accepted scientific literature and statistical techniques. Validation and comparison shall encompass the complete Base Hurricane Storm Set as well as any partitions.**

### Audit

1. The modeler's Base Hurricane Storm Set will be reviewed.
2. Reasoning and justification underlying any modification by the modeler to the Base Hurricane Storm Set will be reviewed.
3. Reasoning and justification underlying any short-term and long-term variations in annual storm frequencies incorporated in the model will be reviewed.
4. Modeled probabilities will be compared with observed hurricane frequency using methods documented in currently accepted scientific literature. The goodness-of-fit of modeled to historical hurricane frequencies for the four regions of Florida and overall as provided in Form M-1 will be reviewed.
5. Form M-1 will be reviewed for consistency with Form S-1.
6. Comparisons of modeled probabilities and characteristics from the complete historical record will be reviewed. Modeled probabilities from any subset, trend, or fitted function will be reviewed, compared, and justified against the complete historical record. In the case of partitioning, modeled probabilities from the partition and its complement will be reviewed and compared with the complete historical record.

### Pre-Visit Letter

6. M-1.A, page 105: Explain why HURDAT as of February 3, 2009 is cited, but there was no change indicated in Standard G-1, Disclosure 5 on page 43.

7. Form M-1, pages 129-130: Explain the change in modeled rates for the entire state and various regions from the previous submission when there was no change or regeneration of the stochastic storm set indicated in Standard G-1, Disclosure 5 on page 43.
8. Form M-1, pages 129-130: Discuss the changes in frequencies from the previous submission, in particular of Region F.

**Verified: YES**

**Professional Team Comments:**

Verified no change in the modeled frequency from the previous submission. Modeled storm frequency is based on the period 1900-2007 and validated against the HURDAT database as of February 3, 2009.

Discussed the model being built based on pressure and validated with the windspeeds in HURDAT.

Discussed the periodic reanalysis updates of early storm seasons in HURDAT. Discussed the modeler approach to analyzing these HURDAT updates. Reviewed a preliminary flowchart of the modeler process to review these updates.

Discussed the application of statistical tests by Florida region to trigger a decision to re-run the storm set. Discussed the process of adjusting the stochastic frequencies based on the prior season activity and the criteria precipitating such an update.

Discussed with the modeler the requirement for annual updates to modeled frequencies based on revisions to the Base Hurricane Storm Set.

Reviewed changes in HURDAT for storms 1915 NoName1, 1916 NoName14, 1916 NoName15, and 1919 NoName2.

Reviewed storm parameters in the modeler database for each of these storms. Discussed input of Charlie Neumann's review for storm 1919 NoName2.

Reviewed windspeed maps by ZIP Code for this set of storms. Discussed spatial distributions at time of landfall in each case.

Reviewed the changes in Form M-1 from the previous submission. Differences related to amending cutoff bounds for categories to match NOAA and the use of multiple landfalls to complete the form in the previous submission and the use of the most intense landfall in the current submission.

Confirmed that no differential weighting or partitions were used in developing the historical landfall frequency by category.

Reviewed storm totals from Form M-1 for consistency with Form S-1.

## M-2 Hurricane Parameters and Characteristics

*Methods for depicting all modeled hurricane parameters and characteristics, including but not limited to windspeed, radial distributions of wind and pressure, minimum central pressure, radius of maximum winds, strike probabilities, tracks, spatial and time variant windfields, and conversion factors, shall be based on information documented in currently accepted scientific literature.*

### Audit

1. All hurricane parameters used in the model will be reviewed.
2. Prepare graphical depictions of hurricane parameters as used in the model. Describe and justify:
  - the data set basis for the fitted distributions,
  - the modeled dependencies among correlated parameters in the windfield component and how they are represented,
  - the asymmetric nature of hurricanes,
  - the fitting methods used and any smoothing techniques employed.
3. The goodness-of-fit of distributions to historical data will be reviewed.
4. The treatment of uncertainties associated with the conversion of gradient winds to surface winds will be compared with currently accepted literature. Variation of the conversion factor with storm intensity will be reviewed.
5. All modeler cited scientific literature provided in Standard G-1 will be reviewed to determine applicability.
6. All external data sources that affect model generated windfields will be identified and their appropriateness will be reviewed.
7. Describe the value(s) of the far-field pressure used in the model and approximate its sensitivity on the average annual zero deductible statewide loss costs.

### Pre-Visit Letter

9. M-2, Disclosure 1, page 108: Discuss the representativeness of the pressure profile parameter distribution and its latitudinal dependence based only on 4 years of storms (1998-2001).
10. M-2, Disclosure 1, page 109: Elaborate on the validation using HURDAT through February 3, 2009.

11.M-2, Disclosure 5, page 110: Provide details of the H\*WIND analyses used (number of storms and analyses, seasons sampled, resolution of data, etc.).

**Verified: YES**

**Professional Team Comments:**

Discussed the development of the pressure profile parameter and the historical data used. Discussed data from more recent years being consistent with the distribution currently in the model. Discussed the latitudinal dependence coming through Rmax.

Reviewed plot of pressure profile parameter values fitted to H\*Wind analyses from 1998 to 2000. Discussed ongoing research on the pressure profile parameter looking at the entire windfield footprint using more data and grids from 1998 to 2006. Reviewed scatter plot comparing the present database and the research set for the pressure profile parameter.

Reviewed details of the H\*Wind analyses used including number of storms, seasons involved, and the resolution of data.

Reviewed Kolmogorov-Smirnov confidence intervals for central pressure and forward speed cumulative distribution functions (Figures 45 and 46 on pages 306 and 307).

Reviewed revised response to M-2.1 (page 108) to reflect the time period used in the current pressure profile parameter database.

Discussed the far field pressure value used in the model.

### **M-3 Hurricane Probabilities**

- A. Modeled probability distributions of hurricane parameters and characteristics shall be consistent with historical hurricanes in the Atlantic basin.***
- B. Modeled hurricane probabilities shall reflect the Base Hurricane Storm Set used for category 1 to 5 hurricanes and shall be consistent with those observed for each coastal segment of Florida and neighboring states (Alabama, Georgia, and Mississippi).***

#### **Audit**

1. Demonstrate that the quality of fit extends beyond the Florida border by showing results for appropriate coastal segments in Alabama, Georgia, and Mississippi.
2. Describe and support the method of selecting stochastic storm tracks.
3. Describe and support the method of selecting storm track strike intervals. If strike locations are on a discrete set, show the landfall points for major metropolitan areas in Florida.
4. Provide any modeler specific research performed to develop the functions used for simulating model variables or to develop databases.

**Verified: YES**

#### **Professional Team Comments:**

Verified no change in the method for selecting storm tracks. Verified that the method of selecting storm track strike intervals is unchanged and is based on NWS-23.

Discussed the use of the DeMaria Extended Best Track data from 1988-2000 for Rmax.

## **M-4 Hurricane Windfield Structure**

- A. Windfields generated by the model shall be consistent with observed historical storms affecting Florida.***
- B. The translation of land use and land cover or other source information to geographic surface roughness distribution shall be consistent with current state-of-the-science.***

### **Audit**

1. Provide any modeler-specific research performed to develop the windfield functions used in the model. Identify the databases used.
2. Provide any modeler-specific research performed to derive the roughness distributions for Florida and adjacent states.
3. The spatial distribution of surface roughness used in the model will be reviewed.
4. Identify other variables in the model that affect over-land surface windspeed estimation.
5. Provide detailed comparisons of the model windfield with Hurricane Charley (2004), Hurricane Katrina (2005), and Hurricane Wilma (2005).
6. For windfield and/or pressure distributions not previously reviewed, the modeler will present time-based contour animations (capable of being paused) to demonstrate scientifically reasonable windfield characteristics.
7. Form M-2 will be reviewed.

### **Pre-Visit Letter**

- 12.M-4, Disclosure 1, page 118: Metric units are used in Figure 7 and for associated storm parameters.
- 13.M-4, Disclosure 5, page 119: Provide details of topography used in the model.
- 14.M-4, Disclosure 8, page 120: Provide point comparisons of windfield values distributed across the state for sample storms.
- 15.Form M-2, pages 133-134: Discuss the relatively minor changes in spatial distribution of windfields with the application of the model terrain compared to open terrain.

**Verified: YES**

**Professional Team Comments:**

Reviewed revised Figure 7 (page 118) with standard units.

Verified that topography is not included in the model for Florida.

Discussed the vintage and appropriateness of the land use and land cover dataset. Discussed "spot" updates of land use and land cover dataset using more recent ASTER data.

Reviewed comparisons of windspeed distribution across the state for Hurricane Charley (2004), Hurricane Katrina (2005), and Hurricane Wilma (2005) with station data.

Reviewed map of roughness distributions for actual terrain and open terrain. Reviewed roughness length changes affecting windspeeds. Reviewed ZIP Codes with windspeed differences from actual terrain to open terrain from the historical storm set.

Reviewed the maximum windspeeds provided in Form M-2 and the greater smoothness of the stochastic storm set compared to the historical storm set.

Reviewed spatial distribution of windfields for historical storms with actual terrain and open terrain. Discussed the reasonableness of the results and their differences.

## M-5 Landfall and Over-Land Weakening Methodologies

- A. The magnitude of land friction coefficients shall incorporate current geographic surface roughness distributions and shall be implemented with appropriate geographic information system data.**
- B. The hurricane over-land weakening rate methodology used by the model shall be consistent with historical records.**
- C. Models shall use maximum one-minute sustained 10-meter windspeed when defining hurricane landfall intensity. This applies both to the Base Hurricane Storm Set used to develop landfall strike probabilities as a function of coastal location and to the modeled winds in each hurricane which causes damage. The associated maximum one-minute sustained 10-meter windspeed shall be within the range of windspeeds (in statute miles per hour) categorized by the Saffir-Simpson Scale.**

### Saffir-Simpson Hurricane Scale:

Category	Winds (mph)	Damage
1	74 – 95	Minimal
2	96 – 110	Moderate
3	111 – 130	Extensive
4	131 – 155	Extreme
5	Over 155	Catastrophic

### Audit

1. Describe the variation in over-land decay rates used in the model.
2. Comparisons of the model's weakening rates to weakening rates for historical Florida hurricanes will be reviewed.
3. Transition of winds from over-water to over-land (i.e., landfall) will be reviewed.

### Pre-Visit Letter

- 16.M-5, Disclosure 2, page 126: Discuss the representativeness of the filling rate methodology with reference to Hurricane Charley (2004) and Hurricane Wilma (2005) in Figure 13.

**Verified: YES**

**Professional Team Comments:**

Verified no change in the weakening rate methodology.

Verified no change in the transition of winds from over-water to over-land or from over-land to over-water.

Reviewed filling rates for historical Florida storms (Figure 13, page 126). Reviewed revised figure extending storm track further in time.

Reviewed storm tracks of Hurricane Charley (2004), Hurricane Katrina (2005), and Hurricane Wilma (2005). Reviewed plots of Hurricane Charley (2004), Hurricane Katrina (2005), and Hurricane Wilma (2005) normalized windspeeds as the storms made landfall and crossed Florida. Reviewed plots of windspeed sensitivity at  $\pm 5$  knots.

Discussed the range of filling in the model and the recent storms not captured within the model's filling bounds.

Reviewed Figure 11 (page 124) of the submission, variation in friction coefficients with distance to coast for Florida ZIP Codes, with the scale provided.

## M-6 Logical Relationships of Hurricane Characteristics

- A. The magnitude of asymmetry shall increase as the translation speed increases, all other factors held constant.*
- B. The mean windspeed shall decrease with increasing surface roughness (friction), all other factors held constant.*

### Audit

1. Form M-3 and the modeler's sensitivity analyses provide the information used in auditing this Standard.
2. Justify the relationship between central pressure and radius of maximum winds.

### Pre-Visit Letter

17. Form M-3, page 135: Discuss the source of the changes in the wind radii bounds since, based on response to Standard M-2, Disclosure 1 on page 108, no wind radii data for storms later than 2005 have been used.
18. Form M-3, page 135: Discuss the lack of minima for the wind radii.
19. Form M-3, page 136: Justify the upper bound for Rmax in Figure 18.
20. Form M-3, pages 135-136: Explain the value differences in the table and in Figure 18 compared to the previous submission.

**Verified: YES**

### Professional Team Comments:

Reviewed comparison of radii provided in Form M-3 between the previous and the current submissions.

Discussed the cause for no wind radii minima.

Verified no change to the modeled radii. Reviewed the change in deriving Rmax bounds from a graphical method last year by inference from the bounds for central pressure values provided in table.

Discussed that upper bounds on other radii are solved for iteratively using the range of Rmax and other storm parameters.

Discussed the differences in the box-plots of modeled radii between the previous and the current submissions.

## VULNERABILITY STANDARDS – Masoud Zadeh, Leader

### V-1 Derivation of Vulnerability Functions

- A. Development of the vulnerability functions is to be based on a combination of the following: (1) historical data, (2) tests, (3) structural calculations, (4) expert opinion, or (5) site inspections. Any development of the vulnerability functions based on structural calculations or expert opinion shall be supported by tests, site inspections, and historical data.***
- B. The method of derivation of the vulnerability functions shall be theoretically sound.***
- C. Any modification factors/functions to the vulnerability functions or structural characteristics and their corresponding effects shall be clearly defined and be theoretically sound.***
- D. Construction type and construction characteristics shall be used in the derivation and application of vulnerability functions.***
- E. In the derivation and application of vulnerability functions, assumptions concerning building code revisions and building code enforcement shall be justified.***
- F. Vulnerability functions shall be separately derived for building structures, mobile homes, appurtenant structures, contents, and additional living expense.***
- G. The minimum windspeed that generates damage shall be reasonable.***

### Audit

1. Historical data shall be available in the original form with explanations for any changes made and descriptions of how missing or incorrect data were handled. To the extent that historical data are used to develop vulnerability functions, demonstrate the goodness-of-fit of the data to fitted models. Complete reports detailing loading conditions and damage suffered are required for any test data used. Complete structural calculations shall be presented so that a variety of different structure types and construction characteristics may be selected for review. The basis for expert opinion and original site inspection reports shall be available for review.
2. Copies of any papers, reports, and studies used in the development of the vulnerability functions shall be available for review. Copies of all public record documents used may be requested for review.

3. Multiple samples of vulnerability functions for building structures, mobile homes, appurtenant structures, contents, and additional living expense shall be available. The magnitude of logical changes among these items for a given windspeed shall be explained and validation materials shall be available.
4. Justify the construction types and characteristics used, and provide validation of the range and direction of the variations in damage.
5. Document and justify all modifications to the vulnerability functions due to building codes and their enforcement. If age of building is used as a surrogate for building code and code enforcement, provide complete supporting information for the number of age groups used as well as the year(s) of construction that separates particular group(s).
6. Provide validation material for the disclosed minimum windspeed. Provide the computer code showing the inclusion of the minimum windspeed at which damage occurs.
7. The effects on building vulnerability from local construction characteristics and building codes will be reviewed.
8. Form V-1 will be reviewed.

### **Pre-Visit Letter**

21. V-1, Disclosure 2, page 143: Provide an equivalent to Figure 20 using data from the 2004 and 2005 storms.

From preamble: Provide for the Professional Team's review, all engineering data (post event surveys, tests, etc.) received since 2005. Describe any processes used to amend or validate the model that incorporates this engineering data. Describe any processes used to amend or validate the model that incorporates insurance company claims data covering the 2004 and 2005 hurricane seasons, especially processes used since the prior visit by the Professional Team.

22. V-1, Disclosure 5, page 145: Explain the process for developing primary building classification options.
23. V-1, Disclosure 6, page 146 (new this year): Describe the process of examining the building code revisions and enforcement and their impact on the vulnerability model, including Florida Building Code Revisions 2001, 2004, and their supplements/amendments.
24. Form V-1.A, page 154: Justify the closeness of damage ratios across different structure types.

### **ISSUE:**

Describe how the model incorporates number of stories in the vulnerability functions.

**Information to be presented to the Professional Team:**

- V-1.2, page 141 – Summaries of exposure and loss data sets and their use in the development of vulnerability functions will be available for on-site review by the Professional Team.

**Verified: YES****Professional Team Comments:**

Reviewed plot of mean damage ratio versus peak gust windspeed for masonry construction and 2004 and 2005 claims data.

Reviewed plot of mean damage ratio versus peak gust windspeed for wood frame construction and 2004 and 2005 claims data.

Verified no change in the vulnerability functions since 2006.

Reviewed the process for developing primary building classification parameters.

Reviewed the process for evaluating building code revisions and the potential impact on building wind resistance, the vulnerability functions, and secondary modifiers.

Discussed evaluation of recent changes to the Florida Building Code and their impact on modifications to the existing vulnerability functions or secondary modifiers.

Documentation reviewed:

RMS Secondary Modifiers for U.S. Hurricane Vulnerability, RiskLink 6.0, October, 2006

Reviewed vulnerability effects for different windspeed zones.

Reviewed damage ratios provided in Form V-1. Reviewed plot of individual vulnerability curves comparing the average wood, masonry, and mobile home curves to the reference wood and masonry curves.

Discussed the relativities of damage ratios across different structural types on Form V-1.

Verified no new claims data processed or evaluated for potential updates to the vulnerability functions or secondary modifiers in 2008.

Discussed the minimum one-minute average sustained windspeed of 42 mph before damage occurs in the model.

Discussed how the model incorporates number of stories in the vulnerability functions. This information will be presented to the Commission during the Trade Secret session in response to an issue identified by the Commission at the March 19, 2009 meeting.

Reviewed summary of exposure and claims data. Discussed their use in the development of the vulnerability functions.

Reviewed graph of mean damage ratio versus peak gust windspeed for the masonry and wood frame curves.

Reviewed the coefficient of variation of damage ratio as a function of windspeed based on different year built bands.

Reviewed plot of the content loss ratio relationship to the structural loss ratio distinguishing between one and two stories.

Reviewed plot of mean damage ratio versus one-minute sustained windspeed for reinforced and average masonry.

## V-2 Mitigation Measures

***A. Modeling of mitigation measures to improve a structure's wind resistance and the corresponding effects on vulnerability shall be theoretically sound. These measures shall include fixtures or construction techniques that enhance:***

- Roof strength***
- Roof covering performance***
- Roof-to-wall strength***
- Wall-to-floor-to-foundation strength***
- Opening protection***
- Window, door, and skylight strength.***

***B. Application of mitigation measures shall be empirically justified both individually and in combination.***

## Audit

1. Forms V-2 and V-3 provide the information used in auditing this Standard.
2. Individual mitigation measures as well as their effect on damage due to use of multiple mitigation measures will be reviewed. Any variation in the change over the range of windspeeds for individual and multiple mitigation measures will be reviewed.
3. Mitigation measures used by the model that are not listed as required in this Standard will be disclosed and shown to be theoretically sound and reasonable.

**Pre-Visit Letter**

When the Professional Team arrives on-site, provide the electronic file used to complete Form V-3 on a removable drive medium. This material will be used during the on-site review and will be returned when the on-site review is complete.

25. Form V-2, page 157: Explain the trend of impact of various mitigation measures with windspeed.

26. Form V-2, page 157: Justify the negative Metal mitigation values.

**ISSUE:**

Discuss the development and application of mitigation credits for various parts of the state, by region (North, Central and South), and by proximity to water (Coastal and Inland) as defined in Form A-7. Expansion to structure types that resemble the actual Florida building stock is desired.

**Verified: YES**

**Professional Team Comments:**

Reviewed Form V-3 and confirmed consistency with the submitted Form V-2.

Discussed the impact of various mitigation measures with different windspeeds.

Discussed metal roof covering and its performance during storms. Reviewed site inspections of metal roof covering failures. Discussed the effect of metal roof covering on frame and masonry damage.

Reviewed plot of secondary modifier values for metal roof covering versus other types. Metal roof covering considered inferior in the model due to poor performance of connection to roof sheathing.

Reviewed the spatial variation of mitigation credits, the differences in gross annual average losses, and the percent reduction in gross average annual losses. This information will be presented to the Commission during the Trade Secret session in response to the issue identified by the Commission at the March 19, 2009 meeting.

**ACTUARIAL STANDARDS – Marty Simons, Leader****A-1 Modeled Loss Costs and Probable Maximum Loss Levels\****(\*Significant Revision)*

***Modeled loss costs and probable maximum loss levels shall reflect all insured wind related damages from storms that reach hurricane strength and produce minimum damaging windspeeds or greater on land in Florida.***

**Audit**

1. The model will be reviewed to determine that the definition of an event in the model is consistent with Standard A-1.
2. The model will be reviewed to determine that by-passing storms and their effects are considered in a manner that is consistent with Standard A-1.

**Pre-Visit Letter**

27.A-1, Disclosures 2 & 3, page 159 (new this year): Provide all analyses performed relating to the effects of “preceding flood or storm surge” as well as the effects of hurricanes on structure that have been weakened or destroyed by flood or storm surge. Provide justification for the way these effects are incorporated in the model.

**Verified: YES**

**Professional Team Comments:**

Verified no change in the definition of an event including handling of by-passing storms.

Reviewed the process for calculating wind and storm surge losses independently. Reviewed and discussed how the model considers wind losses only and how flood or storm surge losses are excluded from the calculations of loss costs and probable maximum loss levels.

Reviewed plot of loss ratios for Hurricane Ivan (2004) compared to loss ratios derived from Hurricane Charley (2004), Hurricane Jeanne (2004), and Hurricane Frances (2004) for the wood frame vulnerability curve.

**A-2 Underwriting Assumptions\***

(\*Significant Revision)

- A. When used in the modeling process or for verification purposes, adjustments, edits, inclusions, or deletions to insurance company input data used by the modeler shall be based upon accepted actuarial, underwriting, and statistical procedures.**
- B. For loss cost and probable maximum loss level estimates derived from or validated with historical insured hurricane losses, the assumptions in the derivations concerning (1) construction characteristics, (2) policy provisions, (3) claim payment practices, and (4) relevant underwriting practices underlying those losses, as well as any actuarial modifications, shall be appropriate.**

**Audit**

1. Demonstrate how the claim practices of insurance companies are accounted for when claims data for those insurance companies are used to develop or to verify model calculations. For example, the level of damage the insurer considers a loss to be a “total loss” or claim practices of insurers with respect to concurrent causation.

**Verified: YES**

**Professional Team Comments:**

Verified no change in methodology for reviewing claims payment practices of insurance companies.

**A-3 Loss Cost Projections and Probable Maximum Loss Levels\****(\*Significant Revision)*

- A. Loss cost projections and probable maximum loss levels produced by hurricane loss projection models shall not include expenses, risk load, investment income, premium reserves, taxes, assessments, or profit margin.**
- B. Loss cost projections and probable maximum loss levels shall not make a prospective provision for economic inflation.**
- C. Loss cost projections and probable maximum loss levels shall not include any provision for direct hurricane storm surge losses.**

**Audit**

1. Describe how the model handles expenses, risk load, investment income, premium reserves, taxes, assessments, profit margin, and economic inflation.

**Verified: YES****Professional Team Comments:**

Verified modeled loss costs do not include expenses, risk load, investment income, premium reserves, taxes, assessments, or profit margin, and the model does not make a prospective provision for economic inflation.

**A-4 Demand Surge\****(\*Significant Revision)*

- A. Demand surge shall be included in the model's calculation of loss costs and probable maximum loss levels using relevant data.**
- B. The methods, data, and assumptions used in the estimation of demand surge shall be actuarially sound.**

**Audit**

1. Provide the data and methods used to incorporate individual aspects of demand surge on each coverage type, inclusive of the effects from building material costs, labor costs, contents costs, repair time, etc.
2. All referenced literature will be reviewed to determine applicability.

**Pre-Visit Letter**

28.A-4, Disclosure 1, page 164: Provide evidence that there is no overlap or double counting of the individual parts of the loss amplification calculations.

**TRADE SECRET MATERIAL:** Describe how the model determines the magnitude of demand surge to include in the calculation of loss costs and probable maximum loss levels.

**Verified: YES**

**Professional Team Comments:**

Reviewed the methodology for calculating loss amplification. Verified no change to the loss amplification calculations since the previous submission.

Reviewed the modeling of economic demand surge in Florida. Reviewed modeler presentation and discussion that there is no double counting.

Documentation reviewed:

*A Judicious End to the Parade of Horribles*, Maria Elena Abate, Colodny, Fass, Talenfeld, Karlinsky & Abate, 2007.

## A-5 User Inputs

*All modifications, adjustments, assumptions, and defaults necessary to use the inputs in the model shall be actuarially sound and included with the model output. Treatment of missing values for user inputs required to run the model shall be actuarially sound and described with the model output.*

### Audit

1. Quality assurance procedures shall include methods to assure accuracy of insurance data. Compliance with this Standard will be readily demonstrated through documented rules and procedures.
2. All insurer inputs and assumptions will be reviewed.

### Pre-Visit Letter

29.A-5, page 166: Describe in more detail how the value of appurtenant structures is determined and input into the model.

Demonstrate that output reports produced by a user of the model reveal the values of all user inputs and selections used to run the model.

**Verified: YES**

### Professional Team Comments:

Verified all user inputs and selections used to run the model are provided on the model output reports.

Discussed the process for determining appurtenant structure values input into the model by the user. Verified the model does not provide, alter, or adjust these values.

**A-6 Logical Relationship to Risk\***

(\*Significant Revision due to new Form)

- A. Loss costs shall not exhibit an illogical relation to risk, nor shall loss costs exhibit a significant change when the underlying risk does not change significantly.**
- B. Loss costs produced by the model shall be positive and non-zero for all valid Florida ZIP Codes.**
- C. Loss costs cannot increase as the quality of construction type, materials and workmanship increases, all other factors held constant.**
- D. Loss costs cannot increase as the presence of fixtures or construction techniques designed for hazard mitigation increases, all other factors held constant.**
- E. Loss costs cannot increase as the quality of building codes and enforcement increases, all other factors held constant.**
- F. Loss costs shall decrease as deductibles increase, all other factors held constant.**
- G. The relationship of loss costs for individual coverages, (e.g., structures and appurtenant structures, contents, and loss of use/additional living expense) shall be consistent with the coverages provided.**

**Audit**

1. Graphical representations of loss costs by ZIP Code and county will be reviewed.
2. Color-coded maps depicting the effects of land friction on loss costs by ZIP Code will be reviewed.
3. Individual loss cost relationships will be reviewed. Forms A-1, A-2, A-3, A-4, and A-5 will be used to assess coverage relationships.

**Pre-Visit Letter**

30. Form A-4, page 195: Explain the changes in Figure 28 from the previous submission.

Verified: **NO YES**  
~~Unable to verify pending verification of Standard A-10~~

**Professional Team Comments:**

Reviewed the changes in Form A-4, Figure 28 (page 195) from the previous submission. Discussed that the changes related to a change in the methodology for selecting historical parameters input into the windfield model so as to be consistent with the process used for completing Form A-3.

Discussed with Kay Cleary her review of the results in Form A-2.

Reviewed the changes in loss costs for Franklin and Monroe Counties reflected in Form A-2.

Discussed differences in the spatial distribution of hazard based on re-analyses incorporated into HURDAT (June 1, 2008). See Standard M-1.

## **A-7 Deductibles and Policy Limits**

- A. The methods used in the development of mathematical distributions to reflect the effects of deductibles and policy limits shall be actuarially sound.***
- B. The relationship among the modeled deductible loss costs shall be reasonable.***
- C. Deductible loss costs shall be calculated in accordance with s. 627.701(5)(a), F.S.***

## **Audit**

1. Describe the process used to determine the accuracy of the insurance-to-value criteria in data used to develop or validate the model results.
2. The actuary for the modeler may be asked to attest to the actuarial soundness of the procedure for handling deductibles and policy limits.
3. To the extent that historical data are used to develop mathematical depictions of deductibles and policy limit functions, demonstrate the goodness-of-fit of the data to fitted models.
4. Justify changes from the prior submission in the relativities among corresponding deductible amounts for the same coverage.

**Verified: YES**

**Professional Team Comments:**

Verified no change in the process for calculating and applying deductibles and policy limits. Deductible calculations are in compliance with s. 627.701(5)(a), F.S.

**A-8 Contents**

- A. The methods used in the development of contents loss costs shall be actuarially sound.***
- B. The relationship between the modeled structure and contents loss costs shall be reasonable, based on the relationship between historical structure and contents losses.***

**Audit**

1. The actuary for the modeler may be asked to attest to the actuarial soundness of the procedure for calculating loss costs for contents coverage.
2. To the extent that historical data are used to develop mathematical depictions of contents functions, demonstrate the goodness-of-fit of the data to fitted models.
3. Justify changes from the prior submission in the relativities between loss costs for structures and the corresponding loss costs for contents.

**Verified: YES**

**Professional Team Comments:**

Verified no change in the process and calculations used to develop contents loss costs.

**A-9 Additional Living Expense (ALE)**

- A. The methods used in the development of ALE loss costs shall be actuarially sound.***
- B. ALE loss cost derivations shall consider the estimated time required to repair or replace the property.***
- C. The relationship between the modeled structure and ALE loss costs shall be reasonable, based on the relationship between historical structure and ALE losses.***
- D. ALE loss costs produced by the model shall appropriately consider ALE claims arising from damage to the infrastructure.***

**Audit**

1. The actuary for the modeler may be asked to attest to the actuarial soundness of the procedure for calculating loss costs for ALE coverage. Documentation and justification of the following will be reviewed:
  - a. The method of derivation and data on which the ALE vulnerability function is based;
  - b. Validation data specifically applicable to ALE;
  - c. Assumptions regarding the coding of ALE losses by insurers;
  - d. The effects of demand surge on ALE for Hurricane Andrew (1992);
  - e. Assumptions regarding the variability of ALE by size of property;
  - f. Statewide application of ALE assumptions;
  - g. Assumptions regarding ALE for mobile homes, tenants, and condo unit owners exposure;
  - h. The methods used to incorporate the estimated time required to repair or replace the property;
  - i. The methodology and available validation for determining the extent of infrastructure damage and its effect on ALE costs.
2. To the extent that historical data are used to develop mathematical depictions of ALE functions, demonstrate the goodness-of-fit of the data to fitted models.
3. Justify the differences in the relationship of structure and ALE loss costs from those previously found acceptable.

**Verified: YES**

**Professional Team Comments:**

Verified no change in the process and calculations used to develop ALE loss costs.

## A-10 Output Ranges

- A. Output ranges shall be logical and any deviations supported.**
- B. All other factors held constant, output ranges produced by the model shall reflect lower loss costs for:**
- 1. masonry construction versus frame construction,**
  - 2. residential risk exposure versus mobile home risk exposure,**
  - 3. in general, inland counties versus coastal counties, and**
  - 4. in general, northern counties versus southern counties.**

### Audit

1. Forms A-6, A-7, and A-8 will be reviewed.
2. The modeler will be required to justify all changes from the prior submission using the 2007 Florida Hurricane Catastrophe Fund aggregate exposure data.
3. Output ranges will be reviewed to ensure appropriate differentials among deductibles, coverage, and construction types.
4. Anomalies in the output range data will be reviewed and shall be justified.

**Verified:    NO    YES**

### Professional Team Comments:

Discovered that Form A-6 was not properly completed using the FHCF exposure data provided. A re-run of the output ranges is necessitated.

Reviewed the appropriate process to produce Form A-6 using the FHCF exposure data taking into account the construction and policy attributes provided in the exposure dataset in accordance with Report of Activities instructions.

Discussed that questions regarding FHCF exposure data should be communicated through Donna Simons.

Documentation reviewed:

2007 FHCF EDM Development Plan, February 16, 2009

**\*\*\*Additional Verification Review Comments\*\*\***

Reviewed incorporation of year built and roof shape in the modeled exposure data for Forms A-6, A-7, and A-8. Discussed the changes made in form generation.

Reviewed percentage changes in Form A-6 from last year and from the initial 2009 submission.

Documentation reviewed:

2007 FHCF EDM Development Plan, May 21, 2009

Technical Specification Document, Form A6 Query

**A-11 Probable Maximum Loss\****(\*New Standard)*

***The methods, data, and assumptions used in the estimation of probable maximum loss levels shall be actuarially sound.***

**Audit**

1. Provide the data and methods used for probable maximum loss levels for Form A-9.
2. All referenced literature will be reviewed to determine applicability.
3. The actuary for the modeler may be asked to attest to the actuarial soundness of the procedures used for calculating probable maximum loss levels.

**Pre-Visit Letter**

31. Form A-9, page 298: Explain the uncertainty intervals used in completing Part B, Table 23.

Provide and describe all studies performed to determine whether the model meets the “probable maximum loss” requirements added to the standards in the 2008 Report of Activities (Standard A-11 and several other standards and forms).

**Verified: YES**

**Professional Team Comments:**

Reviewed the process and calculations used to produce the probable maximum loss levels and uncertainty intervals.

Reviewed the aggregate exceedance probability curve generation used for calculating the estimated loss for the given return periods in Part B of Form A-9.

Reviewed the implementation for probable maximum loss calculations as given in the Robertson reference.

Documentation reviewed:

RMS Exceedance Probability Methodology, October 31, 2003

*The Computation of Aggregate Loss Distributions*, John P. Robertson, Proceedings of the Casualty Actuarial Society, Vol., LXXIV, 1992.

## STATISTICAL STANDARDS – Mark Johnson, Leader

### S-1 Modeled Results and Goodness-of-Fit\*

(\*Significant Revision due to new Form and Audit language)

- A. The use of historical data in developing the model shall be supported by rigorous methods published in currently accepted scientific literature.**
- B. Modeled and historical results shall reflect agreement using currently accepted scientific and statistical methods in the appropriate disciplines.**

### Audit

1. Forms S-1, S-2, and S-3 will be reviewed. Provide justification for the distributions selected including, for example, citations to published literature or analyses of specific historical data.
2. The modeler's characterization of uncertainty for windspeed, damage estimates, annual loss, and loss costs will be reviewed.

### Pre-Visit Letter

32. S-1, Disclosure 7, pages 306-308: Explain the changes in  $p$ -values for Kolmogorov-Smirnov (0.678 from 0.864, 0.816 from 0.721, 0.794 no change) while the Chi-square changed much less (0.509 from 0.527, 0.700 no change, 0.300 no change).
33. Form S-2, page 325: Explain the very small changes in Estimated Loss Hypothetical Data Set from the previous submission. Explain the mean and standard deviation in Part B being identical, but not the quantiles.

**Verified: YES**

### Professional Team Comments:

Discussed that the Kolmogorov-Smirnov and Chi-square tests utilized the model data of the previous year.

Discussed the revised  $p$ -values provided for the Chi-square test for central pressure and landfall by region in Florida.

Discussed the impact of the model changes on the results provided in Form S-2. The migration change to SQL in the vulnerability model had negligible effects on the average annual loss, standard deviation, and quantiles. The changes in the aggregate exceedance probability curve calculations affected the quantiles only.

Discussed explanation of alternate loss costs depicted within the submission in Figures 42-44 (pages 303-305) as it relates to Figures 45-47 (pages 306-308).

## S-2 Sensitivity Analysis for Model Output

*The modeler shall have assessed the sensitivity of temporal and spatial outputs with respect to the simultaneous variation of input variables using currently accepted scientific and statistical methods in the appropriate disciplines and have taken appropriate action.*

### Audit

1. The modeler's sensitivity analysis will be reviewed in detail. Statistical techniques used to perform sensitivity analysis shall be explicitly stated. The results of the sensitivity analysis displayed in graphical format (e.g., contour plots with temporal animation) will be reviewed.
2. Form S-6 will be reviewed for models submitted by modeling organizations which have not previously provided the Commission with this analysis.

**Verified: YES**

### Professional Team Comments:

The model updates did not necessitate an update to Form S-6. Verified no new sensitivity tests were performed since the previous submission.

## S-3 Uncertainty Analysis for Model Output

*The modeler shall have performed an uncertainty analysis on the temporal and spatial outputs of the model using currently accepted scientific and statistical methods in the appropriate disciplines and have taken appropriate action. The analysis shall identify and quantify the extent that input variables impact the uncertainty in model output as the input variables are simultaneously varied.*

### Audit

1. The modeler's uncertainty analysis will be reviewed in detail. Statistical techniques used to perform uncertainty analysis shall be explicitly stated. The results of the uncertainty analysis displayed in graphical format (e.g., contour plots with temporal animation) will be reviewed.
2. Form S-6 will be reviewed for models submitted by modeling organizations which have not previously provided the Commission with this analysis.

**Verified: YES**

**Professional Team Comments:**

The model updates did not necessitate an update to Form S-6. Verified no new uncertainty tests were performed since the previous submission.

#### **S-4 County Level Aggregation**

*At the county level of aggregation, the contribution to the error in loss cost estimates attributable to the sampling process shall be negligible.*

#### **Audit**

1. Provide a graph assessing the accuracy associated with a low impact area such as Nassau County. We would expect that if the contribution error in an area such as Nassau County is small, the error in the other areas would be small as well. Assess where appropriate, the contribution of simulation uncertainty via confidence intervals.

**Verified: YES**

**Professional Team Comments:**

Verified no change in the process of sample size determination nor the need to adjust the simulation sample size.

#### **S-5 Replication of Known Hurricane Losses**

*The model shall estimate incurred losses in an unbiased manner on a sufficient body of past hurricane events from more than one company, including the most current data available to the modeler. This Standard applies separately to personal residential and, to the extent data are available, to mobile homes. Personal residential experience may be used to replicate structure-only and contents-only losses. The replications shall be produced on an objective body of loss data by county or an appropriate level of geographic detail.*

#### **Audit**

1. The following information for each insurer and hurricane will be reviewed:

- a. The validity of the model assessed by comparing expected losses produced by the model to actual observed losses incurred by insurers at both the state and county level,
  - b. The version of the model used to calculate modeled losses for each hurricane provided,
  - c. A general description of the data and its source,
  - d. A disclosure of any material mismatch of exposure and loss data problems, or other material consideration,
  - e. The date of the exposures used for modeling and the date of the hurricane,
  - f. An explanation of differences in the actual and modeled hurricane parameters,
  - g. A listing of the departures, if any, in the windfield applied to a particular hurricane for the purpose of validation and the windfield used in the model under consideration,
  - h. The type of property used in each hurricane to address:
    1. Personal versus commercial
    2. Residential structures
    3. Mobile homes
    4. Condominiums
    5. Structures only
    6. Contents only,
  - i. The inclusion of demand surge, storm surge, loss adjustment expenses, or law and ordinance coverage in the actual losses, or the modeled losses.
2. The following documentation will be reviewed:
    - a. Publicly available documentation referenced in the submission,
    - b. The data sources excluded from validation and the reasons for excluding the data from review by the Commission (if any),
    - c. An analysis that identifies and explains anomalies observed in the validation data,
    - d. User input sheets for each insurer and hurricane detailing specific assumptions made with regard to exposed property.
  3. The confidence intervals used to gauge the comparison between historical and modeled losses will be reviewed.
  4. Form S-4 will be reviewed.
  5. The results of one hurricane event for more than one insurance company and the results from one insurance company for more than one hurricane event will be reviewed to the extent data are available.

### **Pre-Visit Letter**

34. S-5, page 317: Provide an example of geographic distribution of losses for a recent storm.
35. Form S-4, page 328: Provide the nature of the small changes in the comparisons in Tables 32-36 from the previous submission.

**Verified: YES**

**Professional Team Comments:**

Reviewed validation comparisons provided in Form S-4.

Reviewed spatial distribution maps of actual and modeled residential masonry losses per ZIP Code from Hurricane Charley (2004).

Reviewed spatial distribution maps of actual and modeled residential masonry loss costs per \$1,000 of exposure for Hurricane Charley (2004).

Discussed the changes in Form S-4 from the previous year's submission related to a change in the methodology for selecting historical parameters input into the windfield model to be consistent with the process used for completing Form A-3.

## **S-6 Comparison of Projected Hurricane Loss Costs**

*The difference, due to uncertainty, between historical and modeled annual average statewide loss costs shall be reasonable, given the body of data, by established statistical expectations and norms.*

### **Audit**

1. Form S-5 will be reviewed.
2. Justify the following:
  - a. Meteorological parameters,
  - b. The effect of by-passing storms,
  - c. The effect of actual hurricanes that had two landfalls impacting Florida,
  - d. The departures, if any, from the windfield, vulnerability functions, or insurance functions applied to the actual hurricanes for the purposes of this test and those used in the model under consideration, and
  - e. Exposure assumptions.

**Verified: YES**

**Professional Team Comments:**

Reviewed comparison of loss costs provided in Form A-3 and Form S-5.

## COMPUTER STANDARDS – Paul Fishwick, Leader

### **C-1 Documentation\***

*(\*Significant Revision)*

- A. The modeler shall maintain a primary document binder, containing a complete set of documents specifying the model structure, detailed software description, and functionality. Development of each section shall be indicative of accepted software engineering practices.**
- B. All computer software (i.e., user interface, scientific, engineering, actuarial, data preparation, and validation) relevant to the modeler's submission shall be consistently documented and dated.**
- C. The modeler shall maintain (1) a table of all changes in the model from the prior year's submission to the initial submission this year and (2) a table of all substantive changes since this year's initial submission.**
- D. Documentation shall be created separately from the source code.**

### **Audit**

1. The primary document binder, in either electronic or physical form, and its maintenance process will be reviewed. The binder shall contain fully documented sections for each Computer Standard.
2. All documentation shall be easily accessible from a central location.
3. Complete user documentation, including all recent updates, will be reviewed.
4. Modeler personnel, or their designated proxies, responsible for each aspect of the software (i.e., user interface, quality assurance, engineering, actuarial, verification) shall be present when the Computer Standards are being audited. Internal users of the software will be interviewed.
5. Provide verification that documentation is created separately from the source code.
6. The tables specified in C-1.C that contain the items listed in Standard G-1, Disclosure 5 will be reviewed. The tables shall contain the item number in the first column. The remaining five columns shall contain specific document or file references for affected components or data relating to the following Computer Standards: C-2, C-3, C-4, C-5, and C-6.
7. Trace the model changes specified in Standard G-1, Disclosure 5 through all Computer Standards.

Information to be presented to the Professional Team:

- C-1.A, page 335 – A Computer Standards primary document binder in electronic form has been prepared by RMS and is available for on-site review by the Professional Team.
- C-1.B, page 335 – Appropriate personnel for software, data preparation and validation, as well as internal users of the software, will be available to the Professional Team when the Computer Standards are being audited.

### Pre-Visit Letter

36.C-1.C, page 335: Relate the table of contents with the response to Standard G-1, Disclosure 5 on page 43 by demonstrating individual table item compliance with the Computer Standards C-1 through C-7.

**Verified: YES**

### Professional Team Comments:

Reviewed the table of all changes in the model from the previous year's submission.

Reviewed the Primary Document Binder organized electronically using a file hierarchy.

Discussed upgrades in documentation for RiskLink version 8.0.1a:

- Vulnerability database migrated from Microsoft Access and Excel to Microsoft SQL
- Exceedance probability algorithm updates

## C-2 Requirements

*The modeler shall maintain a complete set of requirements for each software component as well as for each database or data file accessed by a component.*

### Audit

1. Provide confirmation that a complete set of requirements for each software component, as well as for each database or data file accessed by a component, has been maintained and documented.

Information to be presented to the Professional Team:

- C-2, page 336 – This documentation, which is described in the response to disclosure C-2, is available for on-site review by the Professional Team.
- C-2.1, page 336 – Requirements documentation available for on-site review by the Professional Team includes:
  - RiskLink System Administration Guide
  - RiskLink DLM User Guide
  - Coding Standards
  - Market Requirements Documents
  - Functional Specifications
  - Project Management Documents
  - Microsoft Team Foundation Server and Visual SourceSafe 6.0
  - Information Technology Security Documents
  - Quality Assurance Test Plans

**Verified: YES**

### Professional Team Comments:

Reviewed Model Management Market Requirement Document Summary – RiskLink version 8.0.1a.

Reviewed RiskLink version 8.0 Exceedance Probability Engine Prototype for testing the exceedance probability curves in the model.

Discussed the upgrade in the requirements documentation for RiskLink version 8.0.1a.

Reviewed the requirement feature incident report for the update to the aggregate exceedance probability maximum loss calculation.

Reviewed the requirement feature incident report for the database migration from Microsoft Access to Microsoft SQL.

### C-3 Model Architecture and Component Design

*The modeler shall maintain and document (1) detailed control and data flow diagrams and interface specifications for each software component, and (2) schema definitions for each database and data file. Documentation shall be to the level of components that make significant contributions to the model output.*

#### Audit

1. The following will be reviewed:
  - a. Detailed control and data flow diagrams, completely and sufficiently labeled for each component,
  - b. Interface specifications for all components in the model,
  - c. Documentation for schemas for all data files, along with field type definitions,
  - d. Each network diagram including components, sub-component diagrams, arcs, and labels.
2. A model component custodian, or designated proxy, shall be available for the review of each component.

Information to be presented to the Professional Team:

- C-3, page 338 – This internal model architecture and component design documentation, as well as the developers or modelers responsible for each component, are available for on-site review by the Professional Team.

**Verified: YES**

#### Professional Team Comments:

Reviewed the process and associated SQL query scripts for completing Form A-1 and Form A-6.

Reviewed design documentation and flowchart for the aggregate exceedance probability curve generation.

Reviewed flowchart for Regular EP Engine Control Flow.

Reviewed schematic flowchart of the data flow connecting SQL tables in the vulnerability database. Reviewed revised schematic flowchart of the vulnerability database data flow with arrows added for clarity.

#### \*\*\*Additional Verification Review Comments\*\*\*

Reviewed Form A-6 data flow diagram.

## **C-4 Implementation**

- A. The modeler shall maintain a complete procedure of coding guidelines consistent with accepted software engineering practices.**
- B. The modeler shall maintain a complete procedure used in creating, deriving, or procuring and verifying databases or data files accessed by components.**
- C. All components shall be traceable, through explicit component identification in the flow diagrams, down to the code level.**
- D. The modeler shall maintain a table of all software components affecting loss costs, with the following table columns: (1) Component name, (2) Number of lines of code, minus blank and comment lines; and (3) Number of explanatory comment lines.**
- E. Each component shall be sufficiently and consistently commented so that a software engineer unfamiliar with the code shall be able to comprehend the component logic at a reasonable level of abstraction.**
- F. The modeler shall maintain the following documentation for all components or data modified by items identified in Standard G-1, Disclosure 5:**
  - 1. A list of all equations and formulas used in documentation of the model with definitions of all terms and variables.**
  - 2. A cross-referenced list of implementation source code terms and variable names corresponding to items within F.1.**

## **Audit**

- 1. The interfaces and the coupling assumptions will be reviewed.
- 2. Provide the documented coding guidelines and confirm that these guidelines are uniformly implemented.
- 3. The procedure used in creating, deriving, or procuring and verifying databases or data files accessed by components will be reviewed.
- 4. The traceability among components at all levels of representation will be reviewed.

5. The following information shall be available and will be reviewed for each component, either in a header comment block, source control database, or the documentation:
  - a. component name,
  - b. date created,
  - c. dates modified and by whom,
  - d. purpose or function of the component, and
  - e. input and output parameter definitions.
6. The table of all software components as specified in C-4.D will be reviewed.
7. Model components and the method of mapping to elements in the computer program will be reviewed.
8. Comments within components will be examined for sufficiency, consistency, and explanatory quality.

Information to be presented to the Professional Team:

- C-4, page 340 – Detailed data flow diagrams of the model components will be available for review by the Professional Team.

**Verified:    NO    YES**  
**~~Unable to verify pending verification of Standard A-10~~**

#### **Professional Team Comments:**

Reviewed the code for calculating the uncertainty intervals for probable maximum loss levels in Form A-9.

Reviewed the application of year built in the computer code.

Reviewed the code for calculating the aggregate exceedance probability.

Reviewed the code matrix table for each Visual SourceSafe project providing the file path, file name, file extension, total lines, code only lines, comment only lines, code with comment lines, and blank line counts.

Reviewed the equations, formulas, and source code updates for Standard A-11 relating to Standard C-4.F.

Reviewed the flowchart of the methodology for implementing updates to HURDAT.

Documentation reviewed:

VI# 6512  
VI# 14643  
VI# 16209

#### **\*\*\*Additional Verification Review Comments\*\*\***

Reviewed the code for processing Form A-6.

## **C-5 Verification**

### **A. General**

***For each component, the modeler shall maintain procedures for verification, such as code inspections, reviews, calculation crosschecks, and walkthroughs, sufficient to demonstrate code correctness. Verification procedures shall include tests performed by modeler personnel other than the original component developers.***

### **B. Component Testing**

- 1. The modeler shall use testing software to assist in documenting and analyzing all components.***
- 2. Unit tests shall be performed and documented for each component.***
- 3. Regression tests shall be performed and documented on incremental builds.***
- 4. Aggregation tests shall be performed and documented to ensure the correctness of all model components. Sufficient testing shall be performed to ensure that all components have been executed at least once.***

### **C. Data Testing**

- 1. The modeler shall use testing software to assist in documenting and analyzing all databases and data files accessed by components.***
- 2. The modeler shall perform and document integrity, consistency, and correctness checks on all databases and data files accessed by the components.***

## **Audit**

- 1. The components will be reviewed for containment of sufficient logical assertions, exception-handling mechanisms, and flag-triggered output statements to test the correct values for key variables that might be subject to modification.***
- 2. The testing software used by the modeler will be reviewed.***
- 3. The component (unit, regression, aggregation) and data test processes and documentation will be reviewed including compliance with independence of the verification procedures.***

Verified: **NO YES**  
~~Unable to verify pending verification of Standard A 10~~

**Professional Team Comments:**

Reviewed procedures for data testing and the model verification updates for RiskLink version 8.0.1a.

Reviewed test results for a prototype comparison of ground-up aggregate exceedance probability return periods from RiskLink version 7.0 to 8.0.1. Verified that the same type of analyses were conducted from RiskLink version 6.0b to 7.0.

Reviewed the RMS vulnerability signoff process and signoff sheet for verification of the internal model version to the production version of RiskLink version 8.0.1a.

Reviewed the functional specifications for engineering development of the vulnerability model data migration.

Reviewed testing procedure for ground-up owners masonry loss costs by ZIP Code from RiskLink version 6.0b to version 8.0.1a.

**C-6 Model Maintenance and Revision\***

*(\*Significant Revision)*

- A. The modeler shall maintain a clearly written policy for model revision, including verification and validation of revised components, databases, and data files.**
- B. A revision to any portion of the model that results in a change in any Florida residential hurricane loss cost shall result in a new model version number.**
- C. The modeler shall use tracking software to identify all errors, as well as modifications to code, data, and documentation.**
- D. The modeler shall maintain a list of all model versions since the initial submission for this year. Each model description shall have a unique version identification, and a list of additions, deletions, and changes that define that version.**

**Audit**

1. All policies and procedures used to maintain the code, data, and documentation will be reviewed. For each component in the system decomposition, the modeler shall provide the

installation date under configuration control, the current version number, and the date of the most recent change(s).

2. The policy for model revision will be reviewed.
3. The tracking software will be reviewed.
4. The list of all model revisions as specified in C-6.D will be reviewed.

### Pre-Visit Letter

37.C-6.D, page 348: Provide the model version history leading up to the version identified in the submission.

**Verified: YES**

### Professional Team Comments:

Reviewed the model version history leading to the current RiskLink version 8.0.1a.

Reviewed a life cycle process overview chart for the modeler's Product Development Process. Reviewed the ownership process step and other process step guidelines.

Discussed refinements to the Product Development Process for all key product life cycle steps.

Discussed the high level process for deciding on the content of model revisions provided in Figure 59 (page 347) of the submission. Discussed the detailed description of model revision policy in Figure 60 (page 349) of the submission.

Discussed the policy and procedures for application of model build and version numbers.

Verified that any model updates producing a change in loss costs would result in a new model version number.

## C-7 Security

*The modeler shall have implemented and fully documented security procedures for: (1) secure access to individual computers where the software components or data can be created or modified, (2) secure operation of the model by clients, if relevant, to ensure that the correct software operation cannot be compromised, (3) anti-virus software installation for all machines where all components and data are being accessed, and (4) secure access to documentation, software, and data in the event of a catastrophe.*

### Audit

1. The written policy for all procedures and methods used to ensure the security of code, data, and documentation will be reviewed. Specify all security procedures.
2. Documented security procedures for access, client model use, anti-virus software installation, and off-site procedures in the event of a catastrophe will be reviewed.

**Verified: YES**

### Professional Team Comments:

Reviewed the documented updates to the security policies and procedures.

Discussed with new employee the information technology training on security received.

Discussed with the modeler the ongoing training of personnel regarding the Computer Standards.

Reviewed e-mail security.

Documentation reviewed:

RMS Information Security Policy User Guide Effective November 30, 2005