



Risk Based Capital Allocation In Fire Underwriting: *An Illustrative Case Study*

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June 4, 2009



Agenda

- Background
- Account Fire Model (AFM) overview
 - Key benefits of using the AFM
- Illustrative Case Study
 - Objectives
 - Results
 - Summary findings

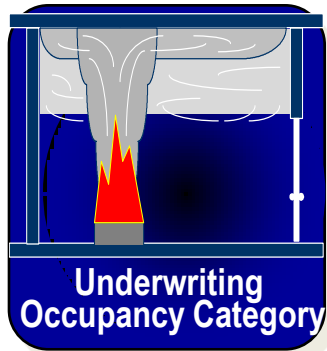
Background

Case Study Background

- Fireman's Fund® engaged RMS to undertake a comprehensive evaluation of the effectiveness of its property reinsurance structuring and purchasing strategies
 - Analysis was performed using the AFM and focused post processing of results
- Specific risk based metrics were requested for:
 - PML losses by account with the associated return period
 - Activation and exhaustion probabilities for fire reinsurance treaty layers
 - Allocation of fire reinsurance costs by layer, business unit, and account
- Treaty structure and analysis results are confidential to Fireman's Fund®
 - Exhibits shown are all fictional and are presented for illustrative purposes

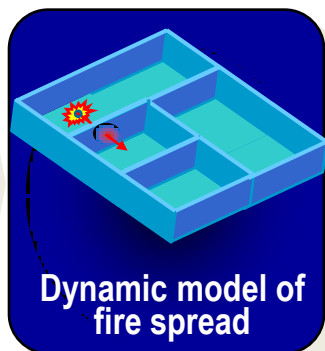
Account Fire Model Overview

Decision Support Methodology



Occupancy profiling establishes the hazard for the underwriter

Linked to building codes, design, size, height, etc.



Fire start and spread are function of profile

Sprinkler & FD performance by zip code

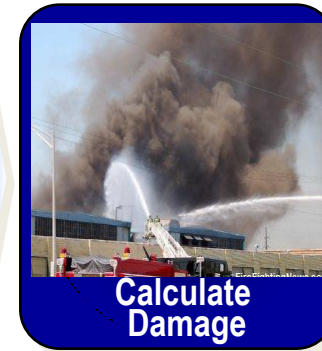
Impaired protection - PML event risk quantified



Where is the exposure – zip code?

What are the values

Occupancy, construction, sprinklers, alarms?



Fire spread drives building / contents damage

BI following damage?



Technical price?
Deductibles/limits?
Excess layer AAL?
Frequency of PML event & loss amount

Enhancing Underwriting Decisions



- The AFM informs the key pillars of the fire account underwriting process

Risk Selection	Efficiency	PML Analysis Capabilities	Technically Sound Methodology
<u>Consistent</u> technical base rate calculation	Large accounts take minutes to analyze; quote generation is fast, yielding higher production	Classic scenarios (PML, NLE, MFL) included in standard AFM output	AFM built on first principals of fire ignition and development
Granular risk segmentation (>1 million combinations) compared to 1,000 for standard industry methods	Simple to adjust policy terms and analyze impact in ground-up, gross and net loss positions	Return periods assigned to classic scenarios establish frequency of occurrence	Applies state of the art fire modeling and the best statistical data available
<u>Competitive</u> rates in the current market	Ability to transfer accounts from existing RMS exposure database (i.e. hurricane and earthquake EDMs)	Consistent calculation of classic scenarios	Utilized fire protection engineering firms and fire department chiefs as consultants during development for key issues
<u>Calibrated</u> to >\$1 billion in claims	Uses standard COPE data commonly captured by insurers. Where data are unknown, AFM databases populate with "Smart Unknowns"	Analytical views on cost-benefit of risk transfer layering strategies	Directly linked to building codes, building fire safety design and insurance risk engineering practices

Risk Segmentation

Fire Risk Driver	Typical Rating Approach	Account Fire Model Rating Granularity
Occupancy	Use ~9 hazard grades	Use 32 underwriting occupancy class profiles (UOCs), with sub-profiles by size
Construction	Use 6 unique types	Use 6 unique types
Sprinkler Protection	Yes or No	Yes, No or Unknown*
Fire Department Effectiveness	10 protection classes (most insurers apply on average 4 factors)	8 RMS derived ratings at zip code level based on national data pertaining to response time and effectiveness
Number of Stories	Not addressed	From 1 to 40 stories (3 bands typical by occupancy)
Year Built	Not addressed	4 ranges that address key building code issues related to fire growth
24/7 Alarm Monitoring	Not addressed	Yes, No or Unknown*
Square Footage	Not addressed	Calculated uniquely for any value input (6 bands typical by occupancy)
Base Combinations	~1,000	>1 million

* Unknowns for a variety of parameters are automatically populated by AFM zip code level databases known as "Smart Unknowns"

AFM Underwriting Occupancy Category (UOC)

- AFM occupancy type profiles take into account a wide variety of occupancy driven issues, which dictate fire risk such as fire growth, compartmentation, ignition frequency, etc.
 - Listed 32 AFM UOCs cover >80% of the standard commercial fire market (color coded by hazard group below)
1. Office
 2. Retail Trade - Average Challenge Hazard
 3. Retail Trade - High Challenge Hazard
 4. Retail - Warehouse
 5. Restaurant
 6. Houses of Worship
 7. Hotel/Motel
 8. Apartment/Condo
 9. Primary and Secondary Schools
 10. Universities & Schools - Admin Use
 11. Universities & Schools - Dorm Use
 12. Universities & Schools - Academic Use
 13. Libraries
 14. Medical - Hospital Building
 15. Medical - Clinic & Medical Offices
 16. Medical - Stand Alone - Nursing Home
 17. Medical - Lab, Diagnostics & Operation Rooms
 18. Medical - In Patient Rooms
 19. Light Ind. Manufacturing - General
 20. Light Ind. Manufacturing - Wood
 21. Light Ind. Manufacturing - Textiles
 22. Light Ind. Manufacturing - Paper
 23. Light Ind. Manufacturing - Pharmaceutical
 24. Light Ind. Manufacturing - Metal
 25. Light Ind. Manufacturing - Plastic
 26. Light Ind. Manufacturing - Printing
 27. Light Ind. Manufacturing - Electronics
 28. Light Ind. Manufacturing - Food
 29. Light Ind. Manufacturing - Beverage
 30. Warehouse - Low Challenge Hazard
 31. Warehouse - Medium Challenge Hazard
 32. Warehouse - High Challenge Hazard

Benefits Of Using The AFM For This Analysis

- PML return period quantification adds the risk perspective to the fire underwriting process
- PMLs can be easily generated for all locations instead of just the largest risks
- AFM brings a risk based approach into the fire treaty decision making process as opposed to an aggregate exposure approach
 - Quantification of activating and exhausting layers in a treaty structure provides decision makers with a clear measure of the risk of penetrating and exceeding a given layer
 - Evaluation of a variety of layer structures
 - Ability to drill down into the drivers of reinsurance costs

Illustrative Case Study

Objectives

- Analyze the Fireman's Fund® commercial fire book using the RMS Account Fire Model (AFM)
- Use analysis output to create decision making metrics with respect to the following:
 - AFM PMLs with Return Periods and comparisons to TIV
 - Selective comparisons of AFM PMLs to Fireman's Fund® field generated PMLs
 - Treaty options (existing treaty structure & an alternative structure provided by Fireman's Fund®)
 - Activation/exhaustion probability by layer
 - For whole portfolio and major business segments (Business Unit 1, Business Unit 2, Business Unit 3)
 - Reinsurance cost allocation (existing treaty structure & an alternative structure)
 - By layer, business segment, and account

Results: PML Analysis – Account Level

- The AFM PML scenario considered a selected impairment in synch with the Fireman’s Fund® definition
- Table below lists the top 20 location AFM PML estimates, the return period, and percentage of location TIV

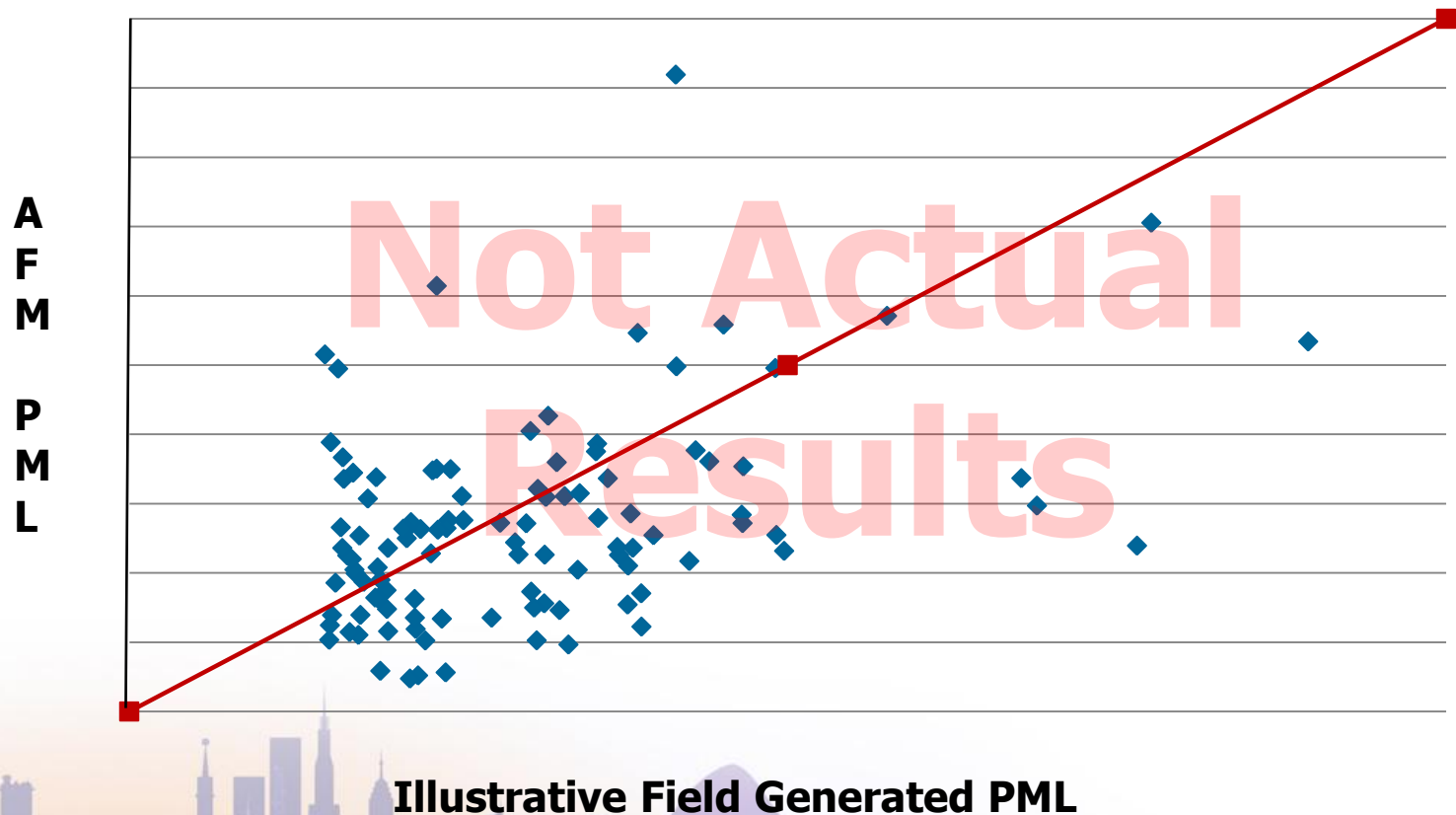
Account	Location TIV	PML Estimate	PML/TIV (%)	PML Return Period (years)	Business Segment
A	\$283,000,000	\$179,000,000	96%	1,208	Business Unit 1
B	\$297,000,000	\$155,000,000	76%	30,441	Business Unit 1
C	\$295,000,000	\$153,000,000	52%	5,783	Business Unit 1
D	\$141,000,000	\$137,000,000	98%	917	Business Unit 1
E	\$185,000,000	\$135,000,000	73%	100,000	Business Unit 1
F	\$118,000,000	\$115,000,000	98%	11,388	Business Unit 1
G	\$108,000,000	\$99,000,000	92%	42,251	Business Unit 1
H	\$122,000,000	\$93,000,000	76%	428	Business Unit 1
I	\$205,000,000	\$93,000,000	45%	14,487	Business Unit 1
J	\$100,000,000	\$93,000,000	92%	638	Business Unit 1
K	\$94,000,000	\$88,000,000	93%	1,518	Business Unit 1
L	\$93,000,000	\$86,000,000	92%	1,274	Business Unit 1
M	\$90,000,000	\$85,000,000	94%	771	Business Unit 1
N	\$252,000,000	\$82,000,000	32%	1,297	Business Unit 1
O	\$89,000,000	\$79,000,000	89%	7,622	Business Unit 1
P	\$99,000,000	\$77,000,000	78%	453	Business Unit 1
Q	\$97,000,000	\$76,000,000	79%	13,255	Business Unit 1
R	\$285,000,000	\$76,000,000	27%	6,133	Business Unit 1
S	\$77,000,000	\$75,000,000	97%	1,474	Business Unit 1

■ Note the generally high return periods assigned to these PML events, which highlights that though possible, these scenarios are unlikely to occur

The information contained in these slides is fictional and included for illustrative purposes.

Results: AFM PMLs Compared to Field Generated PMLs

- The top AFM generated PMLs were compared to the corresponding Fireman's Fund® field generated PMLs for large value locations
- General finding is AFM PMLs are lower than field generated PMLs, but show reasonable agreement



The information contained in these slides is fictional and included for illustrative purposes.

Results: Layer Activation/Exhaustion Probability

- Fireman's Fund® property treaty structure was analyzed using the AFM including the specific terms of the treaty (a fictional illustrative example)

Not Actual Results or Structure	Layer 1		Layer 2		Layer 3	
	Activate	Exhaust	Activate	Exhaust	Activate	Exhaust
Perspective						
Entire Book	40%	20%	20%	5%	5%	.5%
Business Unit 1	30%	18%	18%	2%	2%	.04%
Business Unit 2	15%	4%	4%	1%	1%	.02%
Business Unit 3	10%	2%	2%	.1%	.1%	.00%

- Entire Book and Business Unit 1 have similar results in this example so clearly this business unit drives the treaty risk for the entire book
- Business Units 2 and 3 all have probabilities that are far lower than Business Unit 1
- Business Unit 3 has little risk in Layers 2 and 3

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Results: Layer Activation/Exhaustion Probability

- Alternate treaty design statistics for entire book and by largest three business segments are shown in the table below (a fictional illustrative example)
 - Changed the stacked 3 layer structure

Not Actual Results or Structure	New Layer 1		New Layer 2		New Layer 3	
	Activate	Exhaust	Activate	Exhaust	Activate	Exhaust
Perspective						
Entire Book	20%	10%	10%	3%	3%	.3%
Business Unit 1	15%	9%	9%	1%	1%	.02%
Business Unit 2	8%	2%	2%	.5%	.5%	.01%
Business Unit 3	5%	1%	1%	.05%	.05%	.00%

- New structure can be contrasted against the original structure to quantify the differences with respect to risk with the intent of moving toward an *optimum* solution

Results: Layer Activation/Exhaustion Probability

- Key questions generated from the treaty analysis
 - Are the probabilities of activation and exhaustion high enough to retain all layers?
 - Can we carve out Business Units 2 & 3 from the treaty structure since the risk of hitting the layers from these business units is minimal?
 - How can we optimize the program structure (evaluation of risk versus reward)?

Results: Reinsurance Cost Allocation

- Reinsurance cost allocation by account for existing **Layer 3**
 - Top 20 accounts represent >80% of layer cost & top 5 represent 50%

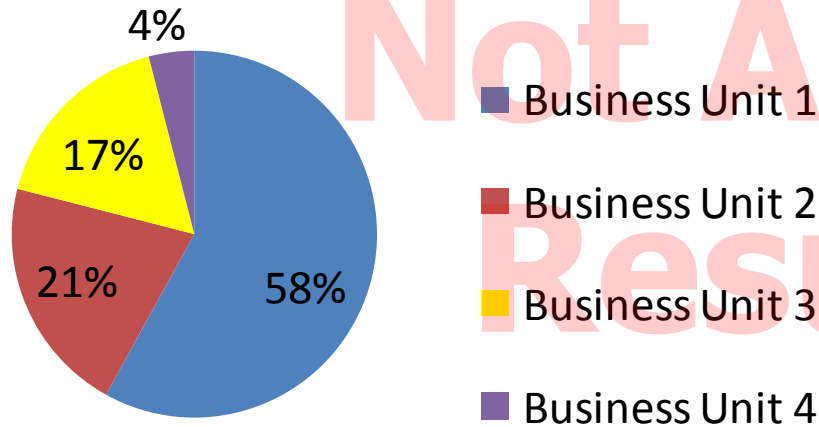
Rank	Account Number	Business Segment	Layer 3 Reinsurance Cost Percentage
1	A	Business Unit 1	13.4%
2	B	Business Unit 1	13.2%
3	C	Business Unit 1	8.9%
4	D	Business Unit 1	8.1%
5	E	Business Unit 1	6.9%
6	F	Business Unit 1	5.8%
7	G	Business Unit 1	5.9%
8	H	Business Unit 1	4.0%
9	I	Business Unit 1	3.8%
10	J	Business Unit 1	3.4%
11	K	Business Unit 1	3.2%
12	L	Business Unit 1	2.9%
13	M	Business Unit 1	1.8%
14	N	Business Unit 1	1.8%
15	O	Business Unit 1	1.6%
16	P	Business Unit 1	1.4%
17	Q	Business Unit 1	0.8%
18	R	Business Unit 1	0.7%
19	S	Business Unit 1	0.7%
20	T	Business Unit 1	0.7%

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Results: Reinsurance Cost Allocation

- Reinsurance cost allocation by business unit for Layer 1 for current treaty structure

Reinsurance Cost Allocation by Business Unit - Layer 1



Note: Additional business units make up negligible amount of cost allocation

Top 10 Accounts in Business Unit 1 Driving Layer 1 Reinsurance Costs

Account Number	Layer 1 Reinsurance Cost Percentage
A	7.0%
B	6.3%
C	3.9%
D	2.4%
E	2.4%
F	2.1%
G	2.0%
H	2.0%
I	1.9%
J	1.8%

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Results: Reinsurance Cost Allocation

- Accurately allocate cost internally based on risk to the business unit that the account represents
 - Standard approaches to allocation of reinsurance costs are not risk driven, but instead are focused on values exposed, business unit appetites, etc.
- Ability to calculate the allocation of reinsurance costs results and to identify accounts/locations that drive costs to specific layers
- For these accounts and locations alternatives can then be considered such as
 - Retention - Reevaluate the risk (adjust deductibles, attachment points, limits, etc.)
 - Risk Transfer – Add spot facultative coverage, other

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Additional Analysis Perspectives Not Included in Case Study

- This case study highlights many of the analysis perspectives possible with respect to reinsurance
- However, some additional related perspectives not specifically addressed in the scope of the case study are as follows
 - Quantification of XS AAL by layer of coverage
 - Ability to specifically account for reinstatements in place for a particular layer of coverage
 - Reinsurance allocation sensitivities based on fire risk drivers at the account level (occupancy, construction, etc.)

Summary

- PML loss estimation of the AFM enhances risk selection by considering loss according to the risk of occurrence
 - AFM PMLs can be easily derived over an entire portfolio as opposed to only for the largest risks
 - AFM derived PML shows reasonable agreement with field engineered scenario PMLs
- Reinsurance treaty analysis has provided:
 1. Ability to understand the effectiveness of one treaty structure versus the advantages of an alternative structure
 2. Transparent ability to allocate risk insurance costs based on underwriting attributes
- To learn more about the Account Fire Model and using RMS to perform this type of study for your organization please contact your RMS account representative