
# CCRA® Training Program

## Accumulation Management

September 5, 2019

# Accumulation Management

In the exposure data analysis course, accumulation management was briefly introduced as one of the more complex and utilized data analysis practices in catastrophe risk management. This course explores the topic of accumulation management in more detail. The agenda for the course starts by defining accumulation management and discussing it within the context of portfolio management and underwriting. Next, the current practices and challenges associated with managing multi-line exposures are discussed. Finally, the course covers the accumulation management tools that are available in RiskLink® on a world-wide basis. This functionality can be applied to a myriad of business purposes that will be considered in the context of case examples.

# Unit 1: What is Accumulation Management?

This unit will focus on the basic concepts and goals underlying accumulation management.

### Learning Objectives:

- Define accumulation management and explain how it has changed over time.
- Discuss reasons why aggregate data may be problematic for managing accumulations.
- Further define “high resolution geocoding” in the context of accumulation management.
- Identify when and where high resolution geocoding is most beneficial and explain why.

## Defining Accumulation Management

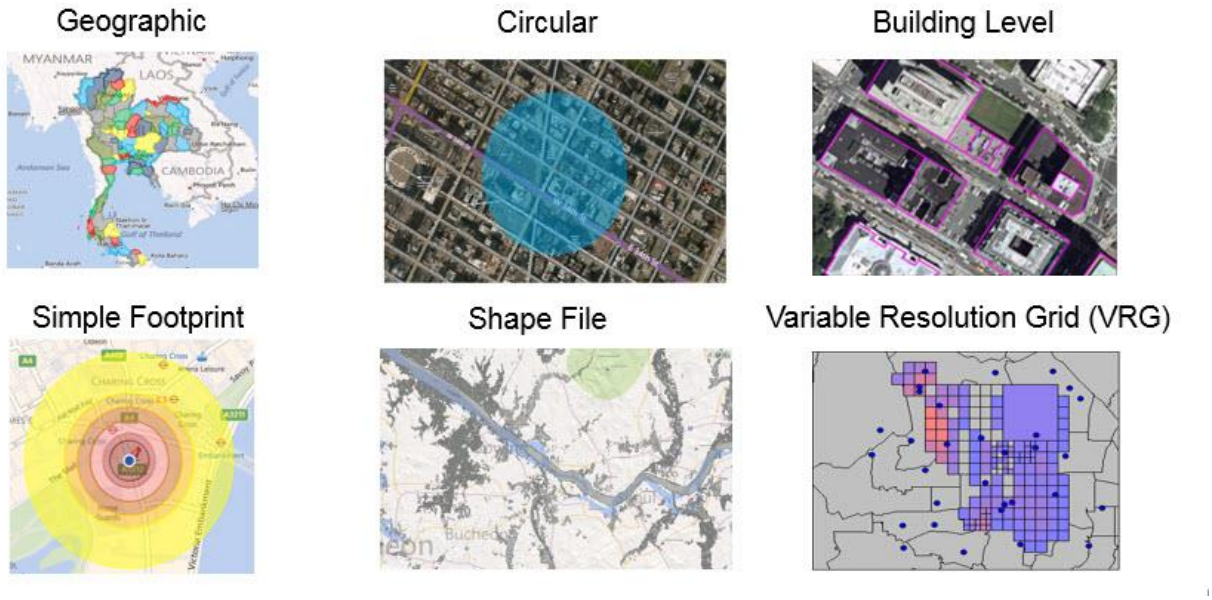
One of the key challenges in the catastrophe industry today is how to build business intelligence around catastrophe exposed data so as to more efficiently manage the “complete” risk. Probabilistic catastrophe models are an important ingredient in solutions to address this need, but they are well-complemented by other types of exposure data analysis that can help create an understanding of concentrations of risk. This is most commonly achieved through accumulation management. ***Accumulation management is the identifying, monitoring and managing of insured values (typically limits) in any one area to avoid an over-concentration of risk.***

The most common unit used in accumulation management is money. Companies want to know how much they might have to pay in the event something occurs. While the most common unit used to determine how much a company might have to pay is money, it is not the only unit as we will see in Unit 3. Not all risk is based on a monetary unit, which results in challenges when trying to analyze multi-line accumulations.

The foundation of accumulation management is the proximity of exposure. Information on the location of insured properties is the basis for understanding and managing concentrations of risk. The geocoding accuracy associated with a location is particularly important so that it is possible to determine whether a location is contributing to an accumulation area. Accurate geocoding information is a fundamental requirement for successful accumulation analyses.

Accumulation management identifies, monitors, and manages insured values (limits) in any one *area* to avoid an over-concentration of risk. But what is meant by an “area?” An area can be defined at several levels, as seen in Figure 1.

**FIGURE 1: Types of RMS Accumulation Areas**




A geographic accumulation area is typically defined in terms of some type of administrative unit, such as a CRESTA zone, a city, a postal code, etc. While geographic areas vary in size, they are familiar and are useful for traditional portfolio management such as monitoring aggregates. Geographic areas, such as postal codes, are not a consistent shape or size. They tend to be small in urban areas and much larger in rural areas. These area types are dependent upon the geo-political borders that define them.

A circular accumulation area is defined by a radius and latitude/longitude centroid, and is often described in terms of a distance from a location. The circular area is independent of geopolitical boundaries and has a consistent size and shape. Circular areas are useful for proximity analysis (e.g. how much exposure is within 500 meters of point x?). The placement of this type of area, however, is more difficult to visualize and may require associated maps or further explanation when discussing accumulation analysis results.

In some cases it may be preferable to represent a more complex event through a shape file, allowing one to accumulate based on an area defined by a shape. It is also possible to accumulate using a footprint with varying damage ratios. RiskLink provides two footprint options, the Simple Footprint and the Variable Resolution Grid (VRG). The simple footprint is a series of concentric circles that apply damage ratios that decrease from the center and is often used to approximate a bomb blast. The VRG, introduced in the Geocoding & Hazard Retrieval unit, is a grid that is superimposed over the exposure to represent an actual or theoretical event. The VRG area types are created by RMS and typically represent either actual or hypothetical events with more detailed boundaries. Footprints can also be created through GIS (Geographic Information Systems) tools and imported as shape files or similar formats. While not currently

supported in RiskLink, this accumulation option is available in RiskManager and equivalent bespoke products.

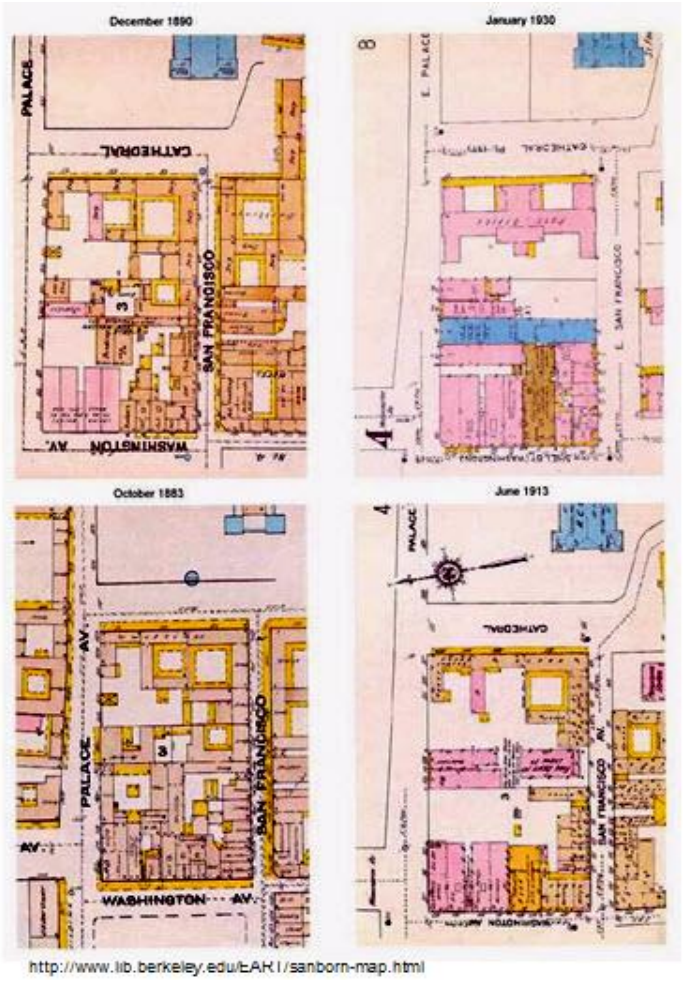
Finally, the building level area accumulates the exposure within a single structure. This is useful in urban areas, where a single building may have multiple addresses associated with it depending on which side of the building you enter. More on this and related types of accumulation analyses will be discussed in Unit 4.

The applicability of each of these areas types shown in Figure 1 is dependent on the problem or business goal you are trying to address. These can include capacity management, event response, or a simplified assessment of exposure to perils (especially for those perils not included in a probabilistic catastrophe model).

## Evolution of Accumulation Management

Accumulation management is not a new concept; it could be considered one of the first forms of catastrophe risk management. Map-based underwriting was originally used to determine fire hazard to individual buildings. Figure 2 on the following page is an example of map-based underwriting tools that have been used for many years. These four maps identify the changes in one city block of Santa Fe, New Mexico, over a 47-year time period. These maps reveal the transition from adobe construction in 1883 (olive-drab) to mostly brick construction by 1930 (pink), and would have been used to understand any one building's susceptibility to fire.

**FIGURE 2: Fire Hazard in Santa Fe, New Mexico 1883-1930**




http://www.lib.berkeley.edu/EART/sanborn-map.html

In addition, insurance companies used to hang large, regional maps on walls with colored “push pins” to identify the location of each insured risk. These maps provided a visual tool for monitoring the concentration of insured values in any given area, albeit on a manual basis.

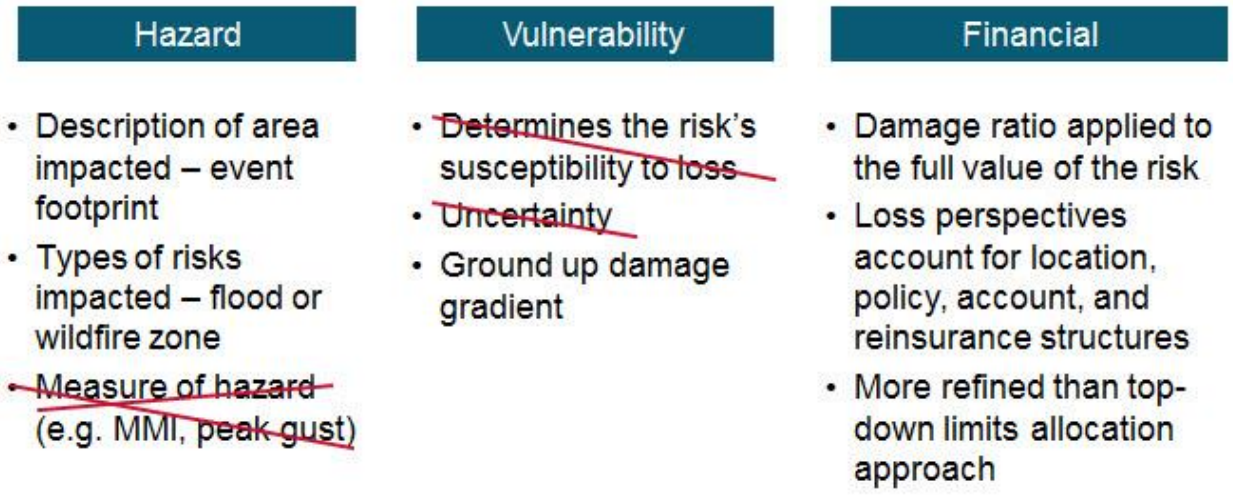
Today we have essentially created an electronic version of these early map techniques. The technology that exists today allows us to monitor the location of any insured risk (property, workers compensation, life, etc.); however, it relies heavily on the data that are input into the system. While these tools are a tremendous leap forward from paper maps and even postcode aggregates, if the underlying data do not exist (or are not accurate), the tools will not produce reliable results.

Current technology allows us to move away from political boundaries as a means of aggregating exposures. We can now use circles of any size as our accumulation area without needing tremendous GIS capabilities in-house. In addition, the technology allows us to identify insured risks that reside in the same building, even if their addresses are different. This is common in many urban areas where buildings take up entire blocks. Since high resolution geocoding assigns latitude and longitude coordinates based on interpolation of a street address, previous

methodologies could not link two properties in the same building together. The accumulation management tools also allow for monitoring exposure while taking into account the financial model (e.g. deductibles, limits, attachment points, etc.). Finally, accumulation management today is intended to assist the traditional accumulation management practices such as capacity management and monitoring aggregates.

These technological solutions and tools provide what is in essence a simplified catastrophe risk model, whose elements are charted in Figure 3. The accumulation management functionality provided in RMS products applies the same three basic catastrophe modeling modules that are used in the probabilistic catastrophe models – hazard, vulnerability, and financial – but with simplifications that limit some aspects of the analysis and facilitate others.

**FIGURE 3: Accumulation Management Today – The Modeling Context**




The hazard model in the accumulation management functionality describes the extent of the area impacted by an event (i.e. the event footprint). In the case of catastrophe modeling it is the swath of the area that is impacted by the peril hazard (e.g. ground motion intensity for earthquake or peak wind gust for windstorm). For accumulation, the impacted area can be defined as a circle, footprint, or geo-political boundary. In accumulation management, there is the flexibility of assessing location level hazard via location attributes. For example, it is common to specify locations relative to flood or wildfire zones.

The vulnerability module in accumulation management simply assesses the exposed value to a particular peril, or the mean "damage gradient" if peril footprints with varying levels of damage are applied, as in the case of terrorism footprints. In this case, different levels of damage are assessed for specific vulnerabilities and building height depending on the site location within bands of similar percent damage. Unlike probabilistic models, it does not assess how susceptible the risk is to getting damaged by applying building/site specific vulnerability curves. Nor does it incorporate damage uncertainty measures.

The financial model in RMS accumulation management applications applies footprint “damage” ratios (if available) to the coverage values and assumes 100% of the value is exposed and damaged based on the defined area. After the exposed limit or value is calculated, some accumulation management techniques report only the total policy limits or coverage values. As was demonstrated in the exposure data analysis course e-learning interaction, the allocation of values and limits for multi-location policies requires the use of assumptions that often do not include deductibles or attachment points. In that example, three options for the “top-down” allocation or pro ratio of policy limits across ten locations in Florida were discussed that could result in either conservative or not so conservative results.

Using accumulation management applications that apply the financial structures defined for each level (from the location, then site, then policy, then reinsurance level, etc.) alleviate the need to make difficult top-down limits allocation assumptions. This is the approach used in RMS applications.

## Accumulation vs. Probabilistic Modeling

There are some key differences between using accumulation management tools vs. probabilistic catastrophe modeling to manage catastrophe exposed risk. Probabilistic modeling accounts for uncertainty and provides a distribution of losses across a range of events. It incorporates multiple variables to provide a more accurate estimate of potential peril hazard at a site, including ground motion attenuation, surface roughness, and surge height. In addition, by incorporating vulnerability curves to calculate damage ratios, it is possible to vary damage by construction, occupancy, height, age, etc.

Accumulation management is a fundamentally deterministic form of analysis and provides a high level (less detailed) estimate of potential loss. Currently, it is most common to assume 100% of the limits or values within an area are damaged; however, for some scenarios such as terrorism footprints, it is possible to account for some variability in damage, and thus provide a less conservative assessment. Accumulation provides more flexibility in defining “areas” and the profiling of specific location attributes to assess risk to non-modeled perils or regions. It is essentially exposure data analysis using a set of deterministic scenarios that does not provide an assessment of uncertainty around the analysis results. In addition, it may lead to a more conservative approach to understanding potential exposure since the full value or limit is assumed to be damaged. The conservative estimate may also be the result of geocoding resolution or the size of the area relative to the peril hazard, which will be explored through the remainder of this unit.

Both accumulation and probabilistic modeling provide valuable insights and can be used as complementary components in a program of catastrophe risk management. The “return period” losses and uncertainties from an exceedance probability analysis can be more meaningful when compared to the total exposed limits for the same events; if they are just a small proportion of the total, a small variation in the EP results could be a large change in the absolute loss.

## Exposure Data for Accumulation Analyses

In the exposure data quality course, completeness was discussed as one of the data quality categories. Completeness is critical when looking at accumulations of exposure. If the exposure data are not complete, then the result of the accumulation analysis may not give a true indication of the exposure concentrations.

Traditionally, catastrophe models were used to capture information about accounts, policies, and locations exposed to natural catastrophes – earthquakes, hurricanes, and so on. In addition to natural catastrophe exposure, terrorism, fire, and casualty exposure data can also now be captured. It is important to evaluate the exposure data being analyzed in an accumulation. In order to fully access a company's concentrations of exposure, all of the exposure data must be captured. If the data in a RiskLink Exposure Data Module (EDM) only contain a company's earthquake exposures and an accumulation is performed on this EDM, then additional exposures for wind or fire would be missing from the accumulation. While there may be instances where you only want to analyze earthquake exposures, it is important to evaluate the exposure data prior to running an accumulation to be sure the data meet the goal of the analysis.

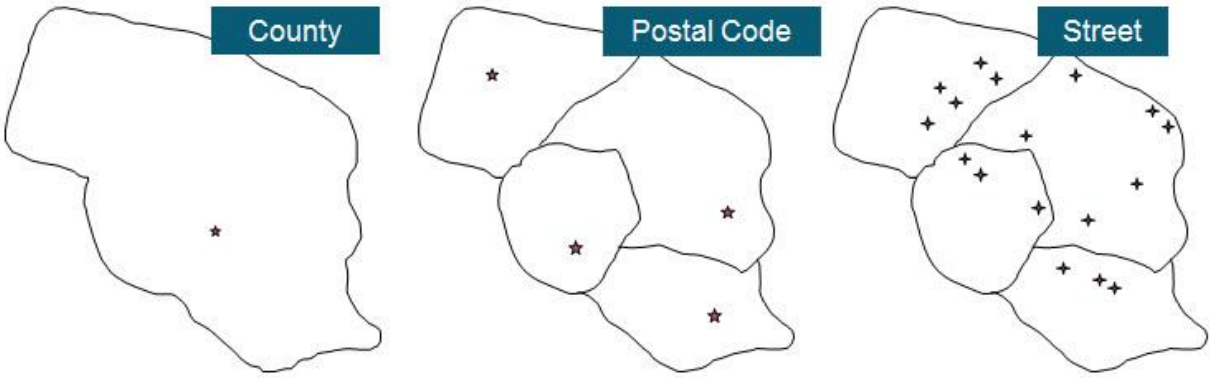
Finally, the geocoding resolution is important when running an accumulation analysis. While the level of geocoding needed to perform an accumulation analysis will depend on the purpose of the analysis, higher geocoding resolution will generally result in a higher quality analysis. ***The fundamental requirement for a successful accumulation analysis is accurate geographic information on the locations being analyzed so that it is possible to determine if a location is contributing to an accumulation area***.

Figure 4 on the following page shows the same exposure data geocoded to three different levels. In the first example, the data are geocoded to a county level; therefore, putting all the exposure in one centroid location in the county. This creates a false accumulation at the county centroid, and the system assumes that all locations are located in one place in the county.

In the second example, the same data are geocoded to a postal code level. Here, the locations in each postal code are geocoded to the postal code centroid. While this is an improvement over the county level example, it still created false accumulations in each postal code.

Finally, in the last example, all locations are geocoded to the street level and represent their true positions. This provides a more accurate representation of the distribution of exposure and the result will be a higher quality accumulation analysis.

**FIGURE 4: Exposure Data for Accumulation Analysis**




## Importance of Data Resolution

Recalling back to the geocoding and hazard retrieval course in this program, you learned that high resolution refers to data with street address or coordinate matches. To that list we will now also include building matches, which identify a property as being associated with a specific building in an urban area. When this type of a match occurs, the latitude/longitude coordinate pair returned by the system indicates the centroid of the building. This explains how two properties with different addresses that are actually in the same building can be aggregated together to identify the total exposure in the building. Currently, the data to perform this type of high resolution geocoding are only available in the central business districts of major urban areas of the United States.

High resolution data in any form have been available for most property data in the U.S. starting shortly after Hurricane Andrew in 1992. After the September 11, 2001 terrorist attacks in the U.S., there was a rapid improvement in the availability of detailed workers compensation data as well, although for many companies the detail available still falls behind that of the property exposure data.

The importance of high resolution data depends on the analysis objectives. For example, if you are monitoring your exposure to extra-tropical or tropical cyclones, a postcode resolution may be adequate given that these perils typically cover a large area and are less site-specific than other perils; however, if your goal is to manage your exposure against terrorism risk, high resolution data will be important as this is a very localized peril with a high degree of variability in a small area.

It is important to be aware that low resolution data may yield a conservative view of risk accumulation since all risks in your geographic area are considered to be essentially at the same location. Similarly, if you are working with aggregate data, this may yield a false accumulation given that all locations in the same aggregation level (say, postcode, for example) are given the same latitude/longitude coordinate pair. As a result, the technology has no choice

but to assume that the TIV from all risks in this area are stacked on top of each other at the same location.

While it is not necessarily wrong or “bad” to use lower resolution data for your analysis depending on your goals and objectives, it is generally better to have finer resolution data. The more detail you have regarding a portfolio of exposures, the better the overall analysis. Furthermore, as models become more refined in the future for various perils and regions, you will be able to take advantage of the latest technology as soon as it is available.

## Unit 1: Closing Key Concepts

Accumulation management is the identifying, monitoring and managing of insured values (typically limits) in any one area to avoid an over-concentration of risk. An area could mean a number of things, from a postal code, to a distance from a particular location, to a single building. Accurate geocoding information is a fundamental requirement for successful accumulation analyses.

Accumulation management has been around for many years, although in recent years it has evolved into an electronic process rather than a manual process. While accumulation management it based on the same three fundamental catastrophe modeling components considered in probabilistic models (hazard, vulnerability, and financial), they are simplified.

Completeness of the exposure data is critical when doing accumulation analyses. In addition, the geocoding resolution is highly important. Higher geocoding resolution equals a higher quality answer.

Finally, it is important to remember that the type of accumulation analysis you run and the level of data resolution needed ultimately depend on the end goal of the analysis.

# Unit 2: Portfolio Management and Underwriting

Now that we understand what we mean by accumulation management we will identify a few ways in which it can be used. This unit will discuss various business problems that can be addressed using accumulation management by walking through some scenarios. We will also review some special cautions that must be considered when running an accumulation analysis to ensure the accuracy of the results.

### Learning Objectives:

- Identify business problems that can be addressed using accumulation management.
- Identify exposure data issues that may degrade the accuracy of an accumulation analysis.

## Business Problems Addressed through Accumulation Management

Given the limitations of accumulation analysis discussed in Unit 1, why has it continued to be a mainstay of catastrophe risk management with the advent of probabilistic catastrophe risk analyses? The relatively short analysis time frames, the ability to assess exposure to non-modeled perils or regions, and the need to analyze multi-line exposures make accumulation management a key tool to provide answers to many business problems.

As one of the traditional ways of monitoring exposure, accumulation management continues to provide a quick first-pass estimate of total exposure to a peril. Understanding risk concentrations, which locations are driving your risk, and how your risk is changing over time in a hard or quick-response market makes these tools valuable. For example, as a specialty commercial underwriter, understanding your potential exposure to a 2-ton bomb can be quickly evaluated on a real-time basis, especially if you do not have a probabilistic model available for the region.

Capacity constraints can also be quickly assessed with accumulation management tools. Questions such as, “Given my exposure, where do I still have capacity, where do I need to control it, and where can I write more business?” can be assessed on a real-time basis prior to the running of extensive probabilistic analyses for other business purposes. The development of underwriting guidelines commonly utilizes information from both probabilistic analysis and accumulation management results to set regional aggregates by line of business and to set account limits.

Finally, the ultimate question – “What is my exposure to an event?” can be answered deterministically with accumulation management for non-modeled perils or regions. Using this method requires extensive experience by the analyst to arrive at realistic estimates of risk given the lack of uncertainty measures around the results. This may require evaluating a range of deterministic scenarios, or using a range of accumulation areas to best address the regional extent of the hazards.

Whatever your business application, accumulation management begins with the definition of an end goal. Accumulation management is often thought of as being synonymous with terrorism

risk management. This is a result of the September 11 terrorist attacks of 2001, which were a major catalyst for the advancement of this technology. However, there are a number of other business applications, all of which could be applied to both natural peril catastrophes as well as man-made catastrophes.

## Case Study: Using Accumulation Analysis for Portfolio and Underwriting Management

This unit will illustrate an example of how accumulation management can be used for portfolio management, underwriting, and event loss estimation.

Assume ABC Insurance Company wishes to limit its liability to $750 million in any 400 meter radius circle anywhere it writes business. A 400 meter radius circle is a common metric used to manage exposure accumulations since the majority of structural damage around a truck bomb is confined to the first 400 meters, and currently, conventional bombs are the most likely attack mode. In addition, management has provided the following guidelines:

- Limit exposure around any “trophy buildings,” i.e. high-profile buildings that are likely targets for terrorist attacks, to $500 million in total.
- Monitor new submissions to see how or if they add to previously identified “hot spots,” or accumulations.
- Monitor exposure to natural perils, such as flood and wildfire, in addition to terrorism (multi-peril exposure).

ABC Insurance Company writes both property and workers compensation business, and need to include both lines of business in the accumulation analysis in order to get a complete look at their concentrations of exposure.

### Portfolio Management – Identify the “Hot Spots”

From a terrorism standpoint, management’s strategy is to limit exposure concentration to $500 million around trophy buildings (400 meters). However, they also have a strategy to limit the maximum exposure concentrations within 400 meters globally to $750 million.

By selecting the spider analysis[1] in RiskLink and accumulating exposures with a 400 meter radius ring, management has identified four zones that exceed the $750 million threshold, as shown in Figure 5.

[1] The spider analysis will be discussed further in Unit 4. In brief, it seeks out the greatest concentrations of value anywhere in the portfolio falling within specified parameters, rather than in a static area.

**FIGURE 5: Top 400 Meter Exposure Accumulations**

Top 400 Meter Exposure Accumulations

| Rank | Accumulation Zone | Property Limit ($m) | Workers Comp ($m) | Total Exposure ($m) |
|---|---|---|---|---|
| 1 | CHICAGO, IL 60602 | 818.2 | 70.5 | 888.7 |
| 2 | NEW YORK, NY 10155 | 719.6 | 127.1 | 846.6 |
| 3 | NEW YORK, NY 10175 | 711.3 | 125.2 | 836.5 |
| 4 | DENVER, CO 80270 | 730.1 | 59.8 | 789.9 |
| 5 | ROCHESTER, NY 14603 | 625.2 | - | 625.2 |
| 6 | NEW YORK, NY 10174 | 534.5 | 77.2 | 611.7 |
| 7 | NEW YORK, NY 10114 | 561.2 | 42.5 | 603.8 |
| 8 | CHICAGO, IL 60610 | 592.8 | - | 592.8 |
| 9 | NEW YORK, NY 10090 | 500.3 | 60.1 | 560.4 |
| 10 | SAN FRANCISCO, CA 94111 | 415.9 | - | 415.9 |

Exceeds $750M Accumulation Guideline

Some of these zones may not be of concern from a terrorism standpoint, but these types of accumulation analyses can show concentrated exposure at risk from other perils like fire, industrial accident, or even flood.

Not only does this type of analysis enable a company to identify where it needs to limit its exposure, but also where it has the capacity to grow its business.

As we stated previously, management's strategy is to limit exposure to $500 million within 400 meters of any trophy building. When the company performed a 400 meter ring analysis around the RMS targets, 20 accumulation zones were identified as exceeding management's $500 million threshold. The top ten zones are listed in Figure 6 on the following page. Once these have been identified, the next step is to determine the potential losses that would be generated from an attack at any of these locations.

**FIGURE 6: Top Accumulation Zones Surrounding Terror Targets**

Top Accumulation Zones Around Terror Targets

| Rank | Property Name | City | Property Limit ($m) | Workers Comp ($m) | Total Exposure ($m) |
|---|---|---|---|---|---|
| 1 | New York Public Library | New York | 680.3 | 125.7 | 806.0 |
| 2 | 500 Fifth Ave | New York | 656.4 | 136.3 | 792.7 |
| 3 | Qwest Tower | Denver | 726.8 | 57.5 | 784.3 |
| 4 | Museum Tower | New York | 672.4 | 100.5 | 772.9 |
| 5 | Bank One Plaza | Chicago | 701.6 | 70.5 | 772.1 |
| 6 | Trump Tower | New York | 659.5 | 110.4 | 769.9 |
| 7 | 712 5th Avenue | New York | 650.8 | 112.6 | 763.3 |
| 8 | Lefcourt Colonial Building | New York | 646.0 | 114.0 | 760.1 |
| 9 | Bp Inc | New York | 637.8 | 118.3 | 756.1 |
| 10 | 10 Liberty Street Apartments | New York | 607.2 | 123.2 | 730.4 |

Exceeds $500M Accumulation Guideline

To better understand these areas, additional analyses can be done to identify which accounts and locations contribute to these zones. By running these types of analyses, management can decide where exposure should be limited to maintain an acceptable level of risk.

## Underwriting – Capacity for New Business

The top five 400 meter accumulations for this company's portfolio, regardless of proximity to targets, are show in Figure 7 on the following page. Part of managing these areas is being able to identify how any new accounts may contribute to or push them over their management guidelines. In this case, we are looking at an area of accumulation centered near ZIP code 10175 in New York. The portfolio accumulation is $836 million from both property and workers compensation policies. Looking at a new submission, we can see that there are three locations which could increase the concentration of exposure in the NY 10175 accumulation area. In fact, they could contribute $34.5 million to this area that is already over the company's target of $750 million.

**FIGURE 7: Monitor the Accumulation "Hot Spots"**

Monitor/Identify Existing Accumulation Areas

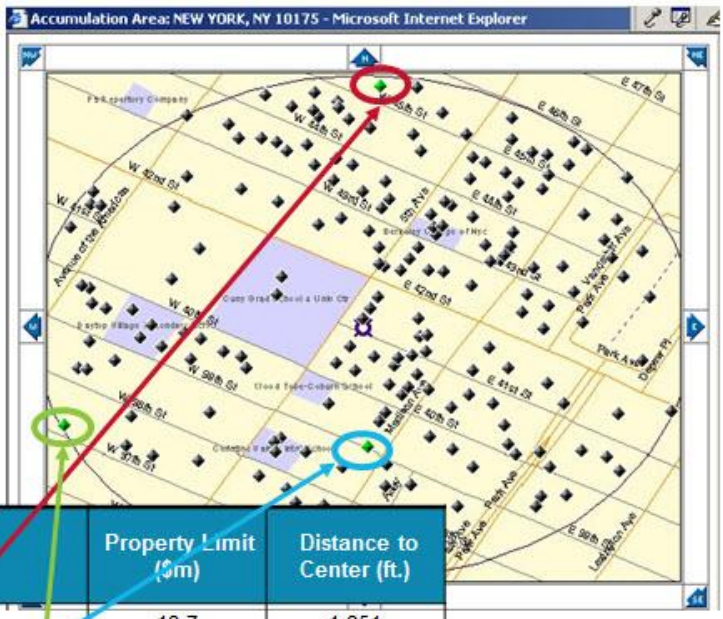
| Rank | Accumulation Zone | Property Limit ($m) | Workers Comp ($m) | Total Exposure ($m) |
|---|---|---|---|---|
| 1 | CHICAGO, IL 60602 | 818.2 | 70.5 | 888.7 |
| 2 | NEW YORK, NY 10155 | 719.6 | 127.1 | 846.6 |
| 3 | NEW YORK, NY 10175 | 711.3 | 125.2 | 836.5 |
| 4 | DENVER, CO 80270 | 730.1 | 59.8 | 789.9 |
| 5 | ROCHESTER, NY 14603 | 625.2 | - | 625.2 |

How Does a New Account Contribute to Existing Accumulations?

| Account | Account Name | Postal Code | State | Property Limit ($m) | Workers Comp ($m) | Total Exposure ($m) | # Locations |
|---|---|---|---|---|---|---|---|
| 1 | ACCT_1278 | 19127 | PA | 25.0 | 25.0 | 50.0 | 7 |
| 2 | ACCT_5909 | 10175 | NY | 34.5 | 0 | 34.5 | 3 |
| 3 | ACCT_4401 | 75208 | TX | 65.0 | 34.5 | 99.5 | 12 |

To further enhance the analysis, we can look at a map of the accumulation zone in Figure 8 to determine where the new locations (5, 24, and 17 in green) are in relation to one another as well as the existing locations, in black. This type of analysis helps to make decisions as to whether an account should be submitted for approval, denied, or referred for additional analysis.

**FIGURE 8: Analysis of New Submission**




| Location Name | Nearest Target | Property Limit (%m) | Distance to Center (ft.) |
|---|---|---|---|
| 5 | 264 ft W – Sofitel New York | 12.7 | 1,251 |
| 24 | 390 ft S – Jolly Madison Towers | 4.8 | 631 |
| 17 | 1,040 ft NE – New York Public Library | 17.0 | 1,288 |

One thing to consider is whether these new locations in themselves create new accumulations. For instance, the location 5 circled in red is at the margins of the accumulation circle, and may be highly correlated with other locations in your portfolio. It, and other locations, may create a new area that is of greater concern than the original one. To fully understand the impact of new locations on potentially new accumulation areas, we would have to add these locations to the portfolio and re-run the spider analysis at a 400 meter radius in RiskLink.

## Unit 2: Closing Key Concepts

We have focused on the definition and potential applications of accumulation management tools. Before moving on we would like to highlight areas of caution for you:

It is tremendously important that you understand your exposure and how it will impact your analysis. This includes geographic resolution, accuracy of the data values, and the location of limits (e.g. policy limits over multiple locations make these analyses very challenging).

Make sure that you understand how policy-level limits over multiple locations and/or policies with high attachment points are being handled, regardless whether your process is manual or automated using software.

- There is no 'right' way to allocate. It is an estimation. Allocated results for a particular area are likely to be inaccurate (could be high or low) when compared to what could be paid in an actual event. If using an allocation approach, understand the limitations.
- In a RiskLink accumulation analysis, it is assumed that all locations within the accumulation area are affected. The financial model is then applied in an expected mode basis to those locations without using allocation. The end result is the worst case scenario in that area. If you have software analyzing accumulations for you, be sure you understand how the software handles these accounts.

Lastly, no one has perfect data. When trying to figure out how to improve your information, prioritize your data cleansing process based on your analysis goals. If your primary goal is to manage against U.S. hurricane, you may not be as concerned about building-level resolution data as much as the accuracy of the limits and values.

# Unit 3: Multi-Line Exposures

Now that we understand what we mean by accumulation management and a few ways in which it can be used, we will turn our attention to modeling and managing a multi-line environment. This unit will define “clash” as it relates to accumulation management, it will identify the strengths and weaknesses of both single and multi-line accumulation efforts, and it will highlight for you some of the issues and challenges with analyzing human exposures.

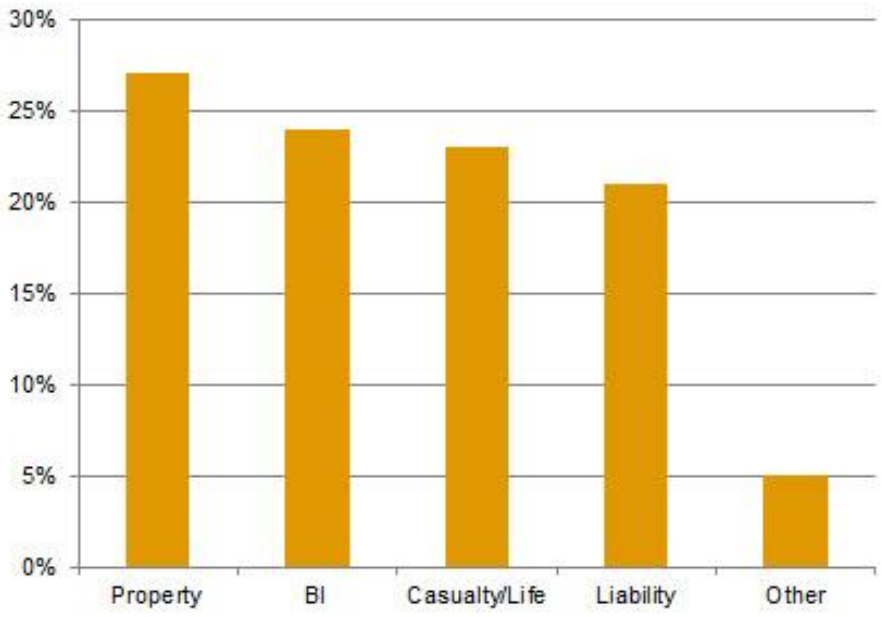
**Learning Objectives:**

- Define “clash” with respect to accumulation management.
- Identify the pros and cons of both single and multi-line accumulations.
- Identify the key challenges with analyzing human exposures.

## Multiple Lines of Business

Clash for accumulation management purposes is defined as any event that creates loss among multiple lines of business, such as property, workers compensation, liability, etc. The September 11, 2001 attacks on the World Trade Center in New York City represented the largest clash event ever at the time, and changed how insurers look at managing their entire portfolios (Figure 9). More recently, Hurricane Katrina in 2005, with over $100 billion in insured losses, represented the first recognized “Super Cat” event with large clash losses. The 2011 Tohoku earthquake and tsunami damaged structures, autos, and marine property, but also caused over 15,000 deaths in a market with a large take-up of life insurance. Liability and environmental claims losses, which in turn impact business interruption losses, in particular may be large in clash events.

**FIGURE 9: Estimated Breakdown of Losses by Line of Business - 2001 World Trade Center Attacks**




*Source: Managing Risk In The Aftermath of the WTC Catastrophe, RMS 2002*

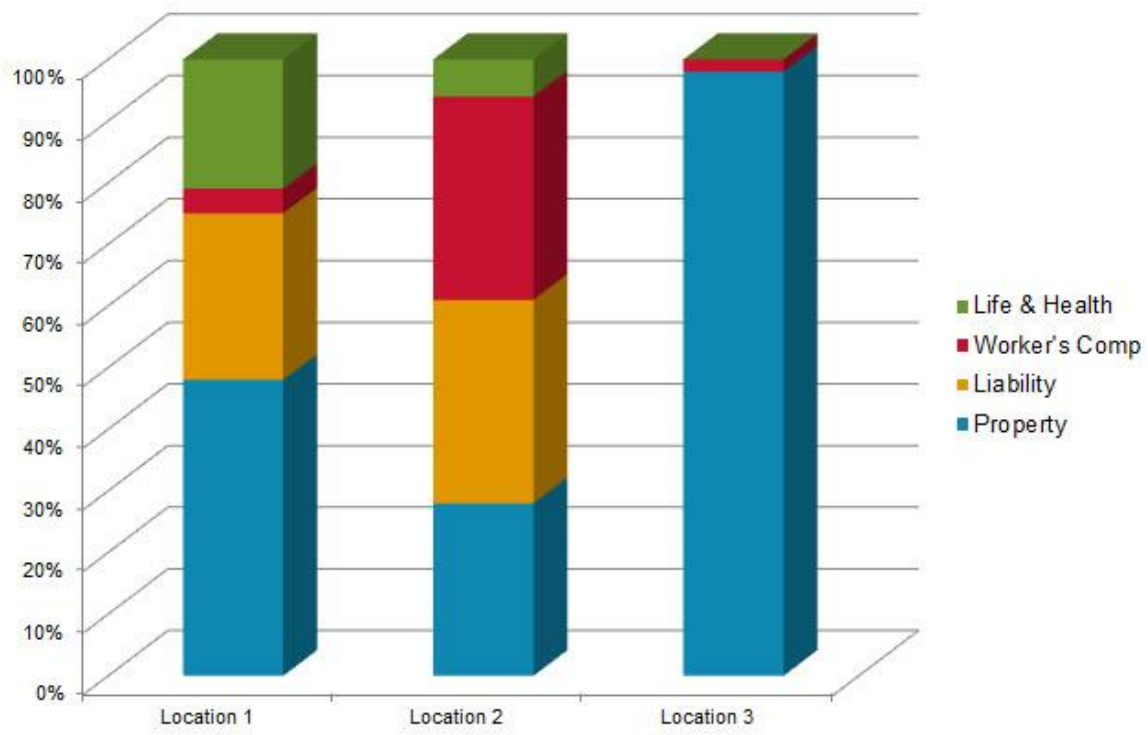
Prior to September 11, 2001, most companies managed each line of business separately and did not have processes in place to understand the overlap in potential losses. Part of the issue is the significant difference in the type and detail of data that are collected for each of the major lines.

For example, payroll is the main exposure unit for workers compensation and liability policies, and number of employees is the main exposure unit for life and health policies. Identifying the location of these risks is difficult and has traditionally been a low priority for insurers and reinsurers.

In large part prompted by these events, however, best practices in the market are increasingly focused on managing exposures on a more holistic basis in order to understand a company's potential to suffer loss in a clash event. While this is still a work in progress for many companies, there are those who have moved forward and are capturing very detailed data on the workers compensation, liability, and life and health side. Part of the impetus for this change in data capture is the fact that we now have automated tools available to manage clash potential, whether it results from man-made or natural perils.

Figure 10 shows an example of three locations, each with multiple lines of business present on site. It highlights the varying distributions of lines of business at locations, and the importance of including all those types of exposure when making business decisions.

**FIGURE 10: Multiple Lines of Business at a Location**




## Property Exposure vs. Human Exposure

As discussed in Unit 1, property accumulations have a long history back to the paper fire maps that underwriters would place on their walls. Values are typically captured in local currency, and location resolution is standard data collection (although there are still accuracy issues that should be monitored in all companies). Payouts for property are generally fast, which means there is no significant discounting necessary for long-tail claims. Finally, building values do not vary by time of day – a $10 million building costs the same at 8:00 in the morning as it does at 3:00 in the afternoon.

All of these things mean that creating accumulations for the property line of business is relatively straightforward, as reasonably good data are available and limited assumptions are required in order to conduct the analysis.

By contrast, human exposures (and all casualty lines) are more difficult to analyze. In terms of types of insurance covered under “human exposure,” we consider life, workers compensation, health, personal accident, and accidental death and dismemberment (AD&D) all to be in this same category.

First, the main data collection units for human exposures are payroll and number of people. However, unlike building values, people move around and as a result, the human exposure amount in any given building will always be dynamic (e.g. people are at lunch, on holiday, home sick, etc.). While we may be able to make some reasonable assumptions about the typical

distribution of people during a day given the type of business, this issue is further complicated by the fact that we do not know what time of day any given event will occur.

Secondly, once an event occurs, we still need to identify the vulnerability component, or the distribution of injured people based on the assumption of what happened during the event. Some people will escape injury, while others will have varying degrees of injury, from minor cuts to severe, life-threatening injuries. In addition, there may be fatalities associated with the event.

Lastly, we ultimately need to convert this to a common unit that can be combined with property losses, which means taking the number of people and translating their injury state to a currency value. This conversion is what allows a human exposure to be combined with property in order to fully understand the complete risk.

It is easy to see how human exposure is more complicated to model than property values simply by the dynamic nature of both the exposure and the peril.

## Measuring Multi-Line Accumulations

Given what we now know about human exposure modeling, how do we “convert” people to a common unit that can be combined with exposures representing your house or your car, which are represented as currency? Without this conversion, there is no option for combining these coverages with property exposure, which gets back to the very beginning of the discussion. If you are to continue the quest for a holistic view of risk at a location or geographic level, you would also need to convert all coverages, e.g. property, workers compensations, life, etc., to a common unit.

While there may be multiple methodologies for estimating losses from injuries, we will use RMS’ methodology as a discussion point. RMS has created a database by state in the U.S. for average workers compensation payouts by injury level. Once the injury level and the location of the individual are known, we can then multiply the average rate per person by the total number of people in each category. At this time, RMS only models casualty exposures for accumulation management purposes on a ground up basis. If workers compensation limits and deductibles are present, they are not applied. These and other financial perspectives would need to be calculated manually for workers compensation.

Determining the average cost severity by injury type and claim is a complex process. While RMS provides a database of payouts based on its own methodology, many insurance companies create their own company-specific databases reflecting their own workers compensation claims, filings, and submissions.

### E-LEARNING INTERACTION 1: Estimating Losses from Injuries

To see how the human exposure are converted to a monetary loss and then combined with property lines to create a complete view of risk, go to the Accumulation Management course in the CCRA portal of Owl and select Interaction 1: Estimating Losses from Injuries.

In Figure 11, accumulation management analysis results from RiskLink shows an example of a combined property and workers compensation loss. As you can see, we are able to obtain property losses at multiple financial perspectives. The lower half of the screen shows the workers compensation results including the distribution of injuries and the resulting payout, similar to the example in the e-learning interaction above.

**FIGURE 11: RiskLink Example of Multi-Line Exposure**

| Financial Perspective | Portfolio |
|---|---|
| **Financial Loss :** | |
| Total Value | 38,356,229,000.00 |
| Total Exposure | 669,408,000.00 |
| Ground Up Loss | 669,408,000.00 |
| Ground Up Specified Loss | NA |
| - Underlying Coverage Loss | NA |
| - Insured Loss | NA |
| - Other Insurer's Loss | NA |
| - Loss Above Limit | NA |
| Insurer Gross Loss | 46,249,350.00 |
| **Injuries :** | |
| Ground Up Loss | 65,580,400.98 |
| Total Number of People Analyzed | 118,279.28 |
| Number of People Exposed | 5,695.72 |
| Number of Total Casualties | 1,653.40 |
| Number of Medical Only Injuries | 1,435.15 |
| Number of Temporary Total Injuries | 102.51 |
| Number of Permanent Partial-minor Injuries | 18.19 |
| Number of Permanent Partial-major Injuries | 16.53 |
| Number of Permanent Total Injuries | 14.88 |
| Number of Fatalities | 66.14 |

Property

Exposed Limits

Workers Comp

Ground-Up WC Payout

Injury Distribution

Notice that the workers compensation losses reflect ground up loss only, as noted previously. The breakdown of the injury distribution is shown in terms of number of people. The ground up loss amount shown in the table is the final loss amount for this workers compensation portfolio after the number of people injured has been converted to a monetary unit.

Once the workers compensation injuries are converted to a currency, they can be combined with the property losses in the top portion of the table. Even though the property gross loss reflects the financial structures, it can still be combined with the workers compensation gross loss. While this approach is conservative, it is still better to include ground up workers compensation losses with the property losses than to ignore them and not include them in the complete view of risk.

## Challenges with Multi-Line Accumulations

There are many specific challenges associated with multi-line accumulations, some of which have already been discussed in this unit. The number one issue today for most companies is the accuracy and availability of good workers compensation data. This includes both resolution (where are the employees located) as well as accuracy (do the addresses represent the actual location). Casualty insurers are much less likely to capture the construction characteristics of buildings than if they were insuring those properties, increasing the uncertainty associated with the potential damage. Not only are the accuracy and availability of the data important, but the geocoding resolution received is very important in order to determine accurate accumulations of exposure.

Secondly, given the complexity of workers compensation as a dynamic exposure, estimating damage is difficult. Most people who model this exposure choose a conservative approach and assume that 80% of the work force is in the building (peak time of day) when an event occurs. This gives them a “worst case” type of scenario. Other assumptions have to be made, such as the injury distribution and the payouts for those injuries.

In addition, since financial perspectives other than ground-up are not available through RMS methodologies for accumulation management of all lines of business, we have to combine dissimilar financial perspectives when creating a multi-line analysis. For example, if we are analyzing a fire portfolio for exposure in a 400 meter radius circle, we may choose to look at “gross loss,” or the total limits net of deductibles, for that area. However, when we combine it with our workers compensation data, the best we can do is to combine the property gross loss with the workers compensation ground-up loss, unless we chose to do some manual analysis.

Even with all of these limitations and challenges, however, the current automated tools provide a better look at multi-line management of exposures than we had prior to September 11, 2001. Waiting until all of the data challenges are resolved would mean essentially ignoring the potential of clash losses.

## Unit 3: Closing Key Concepts

In this unit we focused on the importance of combining all lines of business in order to have a complete view of risk. Because not all lines of business are based on a monetary unit, it is necessary to convert exposures, such as human exposures, to a monetary unit so that it can be combined with other lines of business, such as property. In order to combine all lines of business accurately, they all must be reflected using the same metric. Any line of business can be included in a multi-line accumulation analysis as long as they can all be converted to a common, meaningful unit.

Many challenges exist when creating multi-line accumulations. Among these are the accuracy and availability of data, and limitations of calculating financial perspectives for workers compensation lines in RiskLink. The very nature of any human exposure leads to a complex set of assumptions regarding where the humans are located and when they are there, the time of day of event, the injury distribution after an event, and payouts associated with the various injuries.

In closing, despite the limitations of analyzing human exposures, it is still preferable to view them with other lines of business in order to see a complete view of risk than to not include them at all.

# Unit 4: Accumulation Management Analysis Types

For this unit of the Accumulation Management course, we will review the existing tools that are available in RiskLink. The purpose of this unit is to give you an overview of the different types of analyses that are available, provide you with an understanding of the differences between those options and their applicability in different situations, and to help you understand when each one may be appropriate.

**Learning Objectives:**

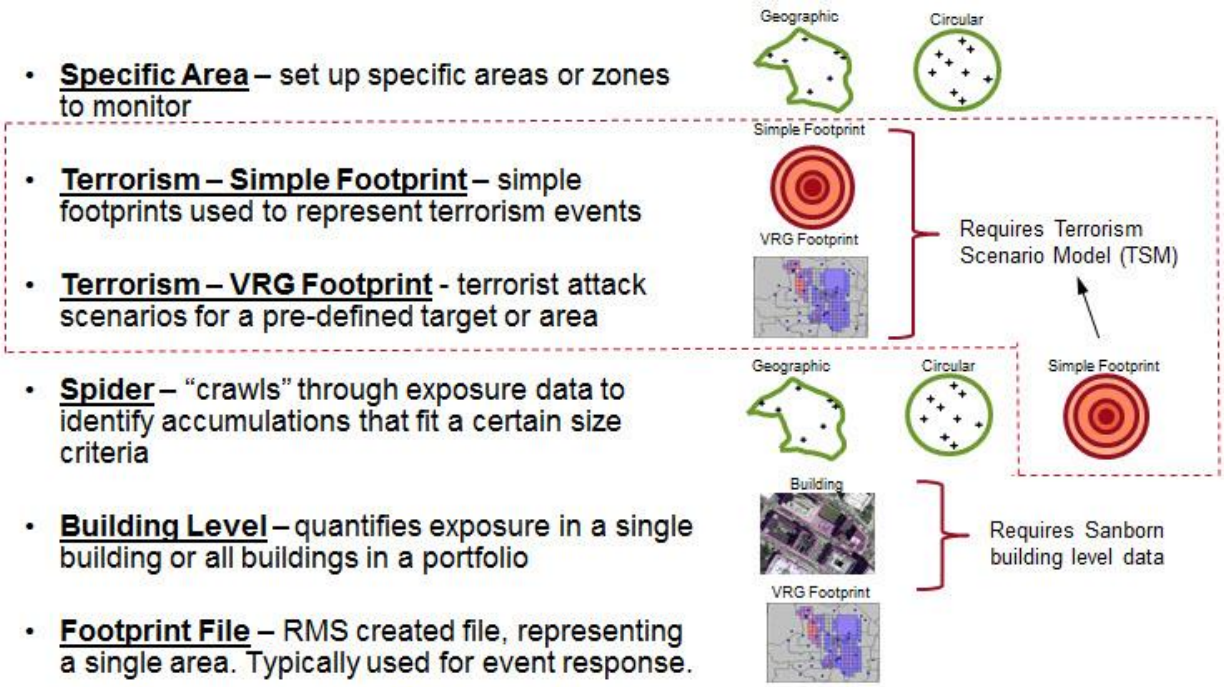
- Define RiskLink analysis options for accumulation.
- Identify some of the challenges with producing accumulation management analyses.

## RiskLink Accumulation Analysis Types Overview

This unit will cover each of the analysis types outlined in Figure 12 on the following page. The different types of accumulation analyses identified here are all available in RiskLink, and when combined with individual analysis settings, they provide flexibility which allows you to define your own accumulation management process. Additional capabilities are available through the RiskManager product, which has been specifically designed for accumulation management. This tool will only briefly be considered in this section, but should be noted as an option for additional capabilities in this field.

Throughout this unit, we will look at each type of RiskLink analysis in detail. The figure below offers a basic definition and visual description of the analysis type, and is useful to refer to throughout this unit.

**FIGURE 12: RiskLink Accumulation Analysis Types**




## Analysis Type - Specific Area

All licensees of the RiskLink DLM have access to the specific area accumulation analysis type. There are two types of specific area analysis types in RiskLink, the first of which is ***geographic***. In a geographic area analysis, the user defines the area of interest by identifying a geo-political area, such as postal code, city, county, or other administrative unit. A ***circular*** analysis is the second type of specific area analysis available in RiskLink. The circular area is defined by plotting a circle using a specified radius.

The specific area accumulation is calculated for an area that has been specified by the user. In other words, this type of analysis is used to monitor and manage an accumulation area that has already been identified as an area of concern. The specific area analysis does not seek out and identify accumulations for you.

Another important characteristic of the specific area analysis in RiskLink is that it always assumes 100% damage. In other words, the analysis assumes that all locations within the specified area are affected and all locations are completely damaged. It is, in effect, a worst case loss scenario and provides insight into the total exposed limit for an area[2]. Specific area options are available worldwide, as they do not require the development of region- and peril-specific modeling components.

[2] RiskManager and the footprint option do allow more flexibility in the assignment of specific damage ratios. Please see the RMS User Guides for commentary and direction on this capability.

Users can choose to include filters on these accumulation areas for characteristics of the exposure. For example, they may choose to calculate earthquake limits having high or very high liquefaction susceptibility, or Florida wind exposure built before 1992. These filters can further subdivide accumulation reporting to monitor specific exposure classes of concern to a company.

Next we will delve further into each of the specific area analysis types, geographic and circular.

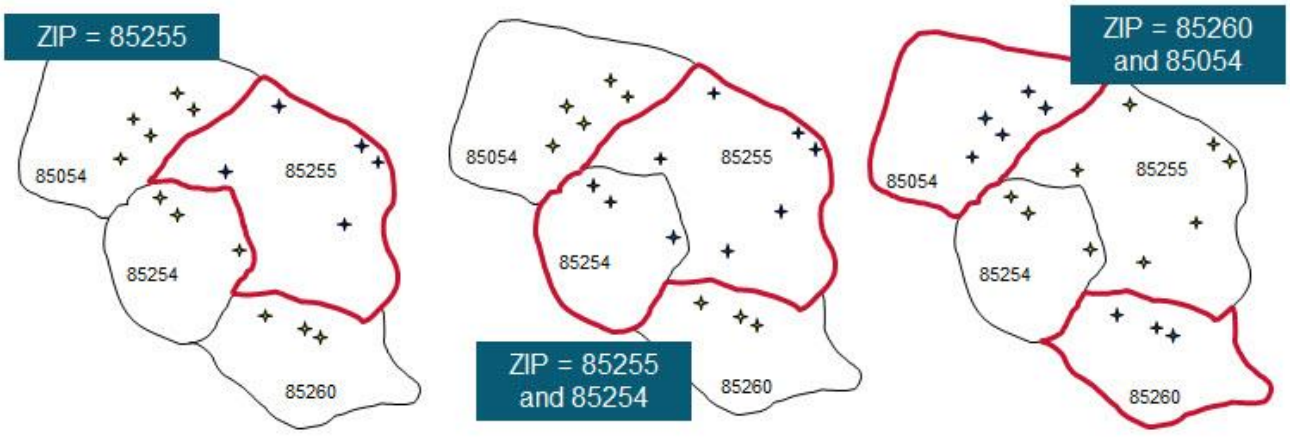
## Specific Area - Geographic

In a geographic area analysis, the user defines the area of interest by identifying a geo-political area, such as postal code, city, county, or other administrative unit, as the building blocks that define the area. Multiple geographies can be combined to form a single accumulation area. For example, the first map in Figure 13 shows ZIP Code 85255 outlined in red. A company may be interested in monitoring the accumulation of limits in this particular ZIP Code, so the area is defined as a single ZIP Code.

In the second map in Figure 13, there are two ZIP Codes outlined in red, indicating a specific area that has been defined with multiple geographic units. This type of area may be defined if a company is responding to an event. For example, a fire may be occurring in these ZIP Codes where the company insures a significant number of locations. Based on the location of the fire, the company could determine the exposure in those ZIP Codes exposed to the event by configuring an accumulation area.

The last map again shows multiple ZIP Codes highlighted in red. However, these ZIP Codes are not contiguous. In RiskLink, a specific area geographic accumulation does not have to be defined based on contiguous geographic units. A company may have identified various ZIP Codes to monitor corporate aggregation zones, and therefore a non-contiguous geographic area can be chosen when running an accumulation analysis.

**FIGURE 13: Specific Area Geographic Examples**



An example where multiple geographies are combined to form a single accumulation area is shown in Figure 14. The ZIP Codes outlined in pink experienced significant losses in the 1991 Oakland Hills Fire, prompting the company to continually monitor the concentrations of risk in this area. Each quarter, the company runs a specific area analysis based on the seven ZIP code area due to their high exposures in this area and the continued threat of wildfire.

One thing to remember with a specific area geographic analysis is that the size and shape of the area is dependent on the geopolitical boundaries of the area type. For example, postal codes are not a consistent size, and are often smaller in urban areas and larger in more rural areas. Postal codes also sometimes change to reflect the evolution of local demographics, splitting or being assigned new boundaries. If the boundary changes are not monitored, these could result in inconsistent results over time.

**FIGURE 14: Specific Area Geographic Analysis Area – 1991 Oakland Hills Fire**


## Specific Area - Circular

A circular analysis is the second type of specific area analysis available in RiskLink. The circular area is defined by plotting a circle using a specified radius. The user has the option to define one or more areas by which to aggregate exposures as follows:

1. User defined location – The user defines the centroid using latitude and longitude coordinates and the size of area within which to accumulate (e.g. a 400 meter circle with the centroid at the Vancouver International Airport in Vancouver, Canada: 49.19401, -123.17855).

2. RMS Terrorism Target location – If the risks are in major cities, the user may select one or more of the trophy buildings listed in the RMS database, and define a radius from the centroid within which to calculate a total exposure.

As another example, if you wish to know how much exposure you have within 400 meters of a location that is not an RMS Terror Target, you could define your area using the latitude and longitude coordinates for the centroid of that location or building. Any locations that have latitude and longitude coordinate pairs within this circle will be included in your analysis. But, for all locations within 400 meters of the Empire State Building, you could select the Empire State Building in New York City from the RMS Terrorism Target Database, without knowing the latitude and longitude, and choose 400 meters as the accumulation area. Any locations that have latitude and longitude coordinate pairs within this circle will be included in your analysis.

Figure 15 shows an example of a specific area circular analysis. As with the specific area geographic analysis, the area is defined by the user, and the user can profile an area containing one or more circles.

**FIGURE 15: Specific Area Circular Example**

One of the benefits of the specific area circular analysis is that the area type is a consistent shape and size. In addition, this area type is independent of geo-political boundaries, so that concentrations of exposure are not broken apart by geographic boundaries. This type of area can also be placed anywhere in the world.

## Analysis Type – Terrorism Simple Footprint

The terrorism simple footprint analysis defines the loss potential from a specific attack mode around a user-selected latitude and longitude coordinate. The footprint of the analysis is defined by concentric “rings” of damage and the centroid of the attack; the size of the rings and the associated damageability will vary by the method of attack.

The user selects the method of attack from a list of options, such as a 2-ton truck bomb, and the centroid of the event. The centroid of the event can either be at a user-defined location (e.g. the Vancouver International Airport in Canada) or one of the trophy buildings in the RMS Terror Target Database, available only in select cities around the world.

Once the footprint is defined, any locations that have latitude and longitude coordinate pairs that are within the definition will be included in the accumulation. With these locations identified, damage is applied to a bulls-eye of concentric rings around the centroid. Not only does damage vary from ring to ring, but it also varies based on where each location is within the ring. For example, if the outer edge of the light green circle in Figure 16 represents 80% damage and the outer edge of the medium green circle outward represents 50% damage, the software will interpolate between 80% and 50% for locations that are somewhere in-between these two boundaries.

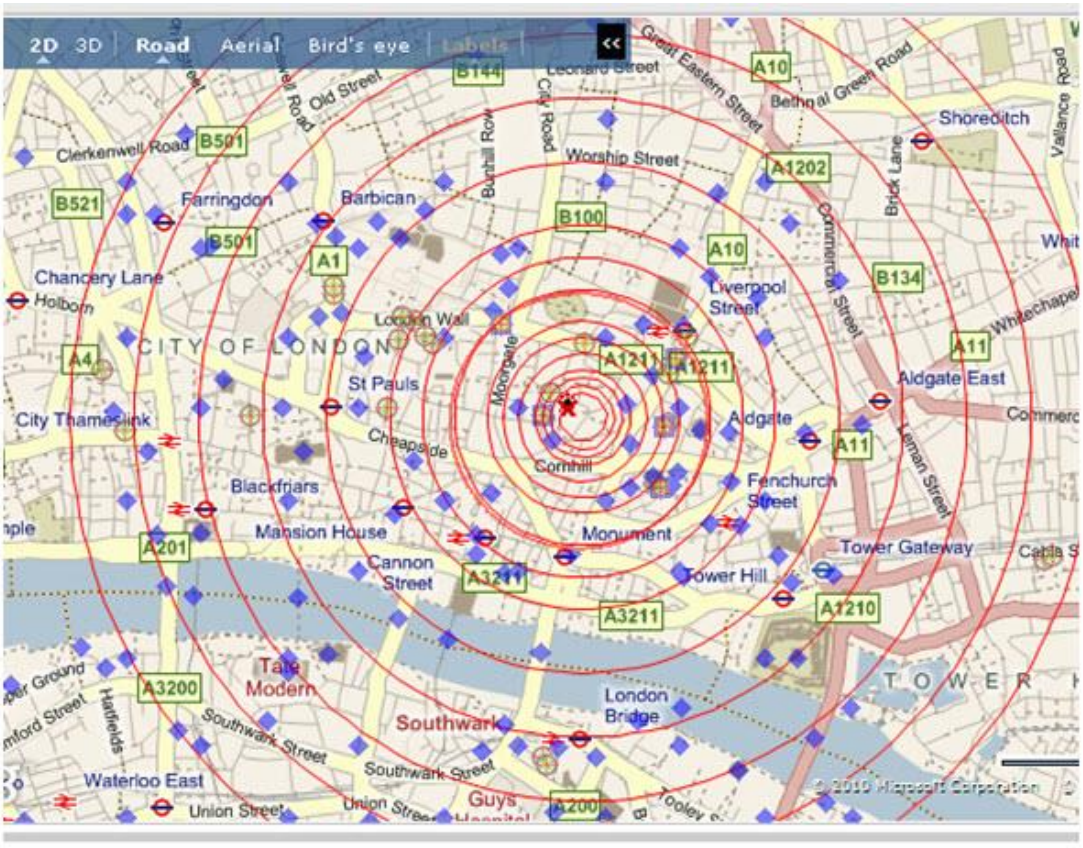
**FIGURE 16: Terrorism Simple Footprint Graphical Description**

Each method of attack will have a different set of concentric circles associated with it. Both the number of concentric circles and the size of those circles will vary based on the attack mode. Because the rings represent the variation of hazard within the circle, the amount of property damage and the injury distribution are partially determined based on the location's position within the circle.

This terrorism simple footprint functionality is available only if the RMS Terrorism Scenario Model (TSM) is licensed and installed. Once these data are installed, a simple footprint can be placed anywhere globally. When selecting the centroid of the attack, the user can either enter latitude and longitude coordinates or select a target from the RMS Target database. While the target database contains select cities only, other targets can be analyzed by entering the latitude and longitude of that target as the centroid of the attack. The ground-up losses are calculated not only based on the location's position within the circle, but also by both construction class and building height. These two primary construction characteristics affect the damage applied to a given location when running a terrorism simple damage footprint.

Figure 17 is a more realistic example of the terrorism simple footprint. In this example, the concentric rings represent a 10-ton bomb attack in central London. The concentric rings in this example show the variation on size which represents the hazard. The blue diamonds represent the insured locations.

**FIGURE 17: Terrorism Simple Footprint Example in London, U.K.**



## Analysis Type – Terrorism VRG Footprint

The VRG footprint analysis is a more refined version of the simple damage footprint analysis. It assumes the center of the attack is one of the buildings in the RMS Terror Target Database. Instead of assuming simple damage within a circle that interpolates between rings, this analysis provides detailed losses using pre-compiled data by VRG for each attack type. Similar to our discussion of the VRG in the natural catastrophe world, the grid sizes are smallest where the hazard is the greatest – towards the center of the attack – and they get progressively larger as you move away from the centroid. Figure 18 is a graphical representation of the terrorism VRG footprint.

**FIGURE 18: Terrorism VRG Footprint Graphical Description**

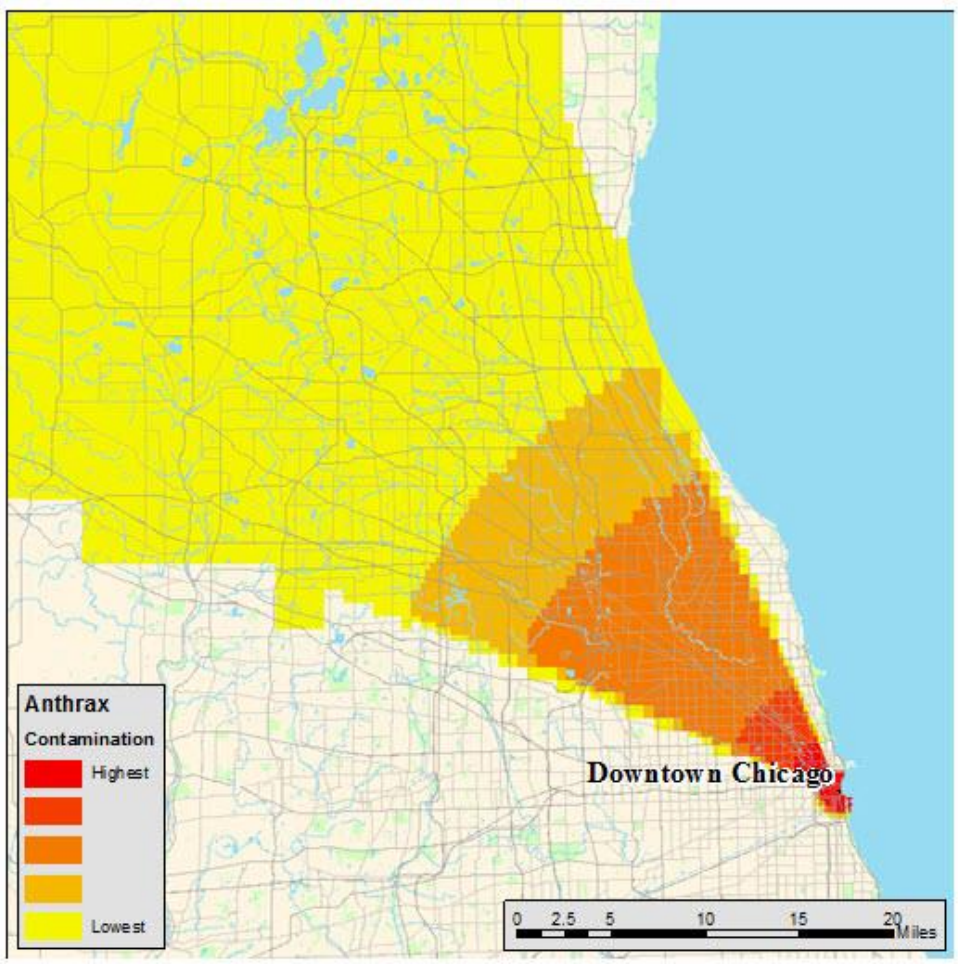

The terrorism VRG footprint functionality is available only if the RMS Terrorism Scenario Model (TSM) is licensed and installed. The VRG footprint functionality is only available for the cities that are included in the RMS Target data. When selecting the centroid of the attack, the user must select a target from the RMS Target database. Like the terrorism simple footprint, the terrorism VRG footprint considers how both construction class and building height affect the damage applied to a given location when running an analysis. Any location that falls within the VRG will be considered.

The position, orientation and hazard within each cell in the VRG are specific to each terror target. For example, a 2-ton truck bomb footprint placed at the Empire State Building will have a different cell structure to its VRG than a 2-ton truck bomb placed at London Bridge. The VRG is

designed to take into account the structural surroundings of the terror target, and how each method of attack will vary based on the surrounding.

Figure 19 is an example of an anthrax attack in downtown Chicago, Illinois, in the US. Because the spread of the anthrax is affected by the wind, this example shows the winds blowing in a northwesterly direction, away from the lake. A VRG footprint of an anthrax attack with winds blowing to the northeast would look very different.

**FIGURE 19: Terrorism VRG Footprint in Chicago, IL, U.S.**




The terrorism VRG footprint offers a more realistic representation of the attack mode, especially for events such as the anthrax example in Figure 19. However, because these footprints are precompiled in proximity to specific RMS terror targets, this analysis type has its limitations. The advantage of using the terrorism simple footprint is that is can be placed anywhere in the world, providing the TSM is licensed. This gives the user the ability to run an accumulation analysis at a location that is not part of the terror target database. Offering two types of footprints provides different, complementary perspectives for evaluating accumulations around terror targets.

## Analysis Type – Spider

The next analysis type is the Spider analysis. In general, the goal of the spider analysis is to identify the “worst” areas in terms of accumulations of exposure that occur within a set of analysis parameters defined by the user. Unlike the specific area and terrorism simple footprint and VRG analyses, where the user specifies the area to be analyzed, a Spider analysis “crawls” through the portfolio and identifies these areas for you. The area type can be a geographic area such as CRESTA zone, county or postal code. The area type could also be a simple damage circle with an assumption of 100% ground-up loss to all locations within the area defined, or a terrorism simple footprint where the user selects a method of attack.

The user can also specify a threshold when running a spider analysis. This threshold limits the number of accumulation areas identified. Assume you want to know where the top 50 areas of greatest exposure concentration within a 400 meter radius circle occur within your portfolio. This can be accomplished by performing a Spider analysis. The user could specify a variety of thresholds, including monetary thresholds such as $500 million in an area, or thresholds based on the number of employees or the number of injuries when analyzing casualty exposures.

We will look at the spider analysis and its underlying methodology in more detail through an e-learning interaction, providing a step-by-step approach for identifying the accumulation areas. In this example, we will use a 100% simple damage circle for the area type, which assumes 100% ground-up loss to all locations within a given circle. This interaction will also introduce the specific naming convention for the resulting accumulation areas, or “events”, used by RiskLink in this type of analysis.

**E-LEARNING INTERACTION 2: Spider Analysis (REQUIRED)**

To learn the methodology behind the spider accumulation analysis through a step-by-step example, go to the Accumulation Management course in the CCRA portal of Owl and select Interaction 2: Spider Analysis.

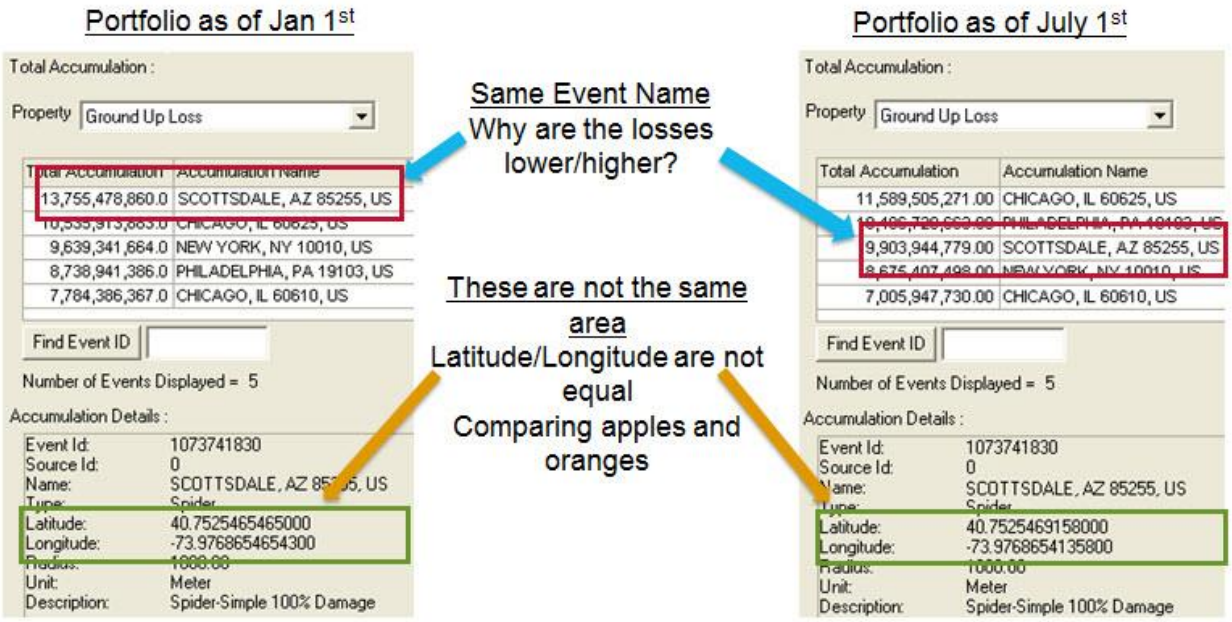
As you learned in the e-learning interaction, RiskLink gives each event in a simple 100% damage circle a descriptive name. All events are named based on the location closest to the center of the circle. It is important to understand how the event names are determined in a spider analysis, as it is a common mistake to misinterpret the meaning of these labels

A related pitfall involves the comparison of spider analyses from different portfolios. Comparing to an event in one portfolio to an event with the same name from a spider analysis on another portfolio will almost certainly not be on valid, consistent terms.

For example, Figure 20 shows a spider analysis run on a portfolio as of January 1. The top accumulation area is given the name “Scottsdale, AZ 85225, US.” Six months later, another spider analysis is run on the portfolio with exposures in force as of July 1. Again, “Scottsdale,

AZ 85225, US" is listed in the top accumulations. However, you will notice that the total accumulation amounts are different. While it is very likely that the exposure in the January 1 and July 1 portfolios has changed over the six month period, it is also important to note that these are not the same areas. If you review the latitude/longitude information highlighted by the green box, you will notice they are slightly different. It is important to remember that the accumulation name represents the postal code of the location nearest the center of the circular accumulation area. In this example, the center of the circle is not in the same location.

**FIGURE 20: Common Mistakes: Comparing Two Circular Spider Analyses**




In another example, assume that Company A is looking to acquire Company B. A spider analysis has been run for each company. When reviewing the results of the two spider analyses, can the results be combined? The answer is no.

When looking at the two portfolios, even though they may have the same accumulation name, the actual areas are in different locations. In order to truly compare the accumulation of one portfolio to the same accumulation of another portfolio, you must choose one of two options.

The first option is to combine the exposures of the two portfolios and run a spider analysis on the combined portfolio. The second option is to determine the accumulation area in one portfolio, and then run a specific area accumulation analysis on the second portfolio, specifying the latitude/longitude centroid and radius to be consistent with the first portfolio.

## Analysis Type – Building Level

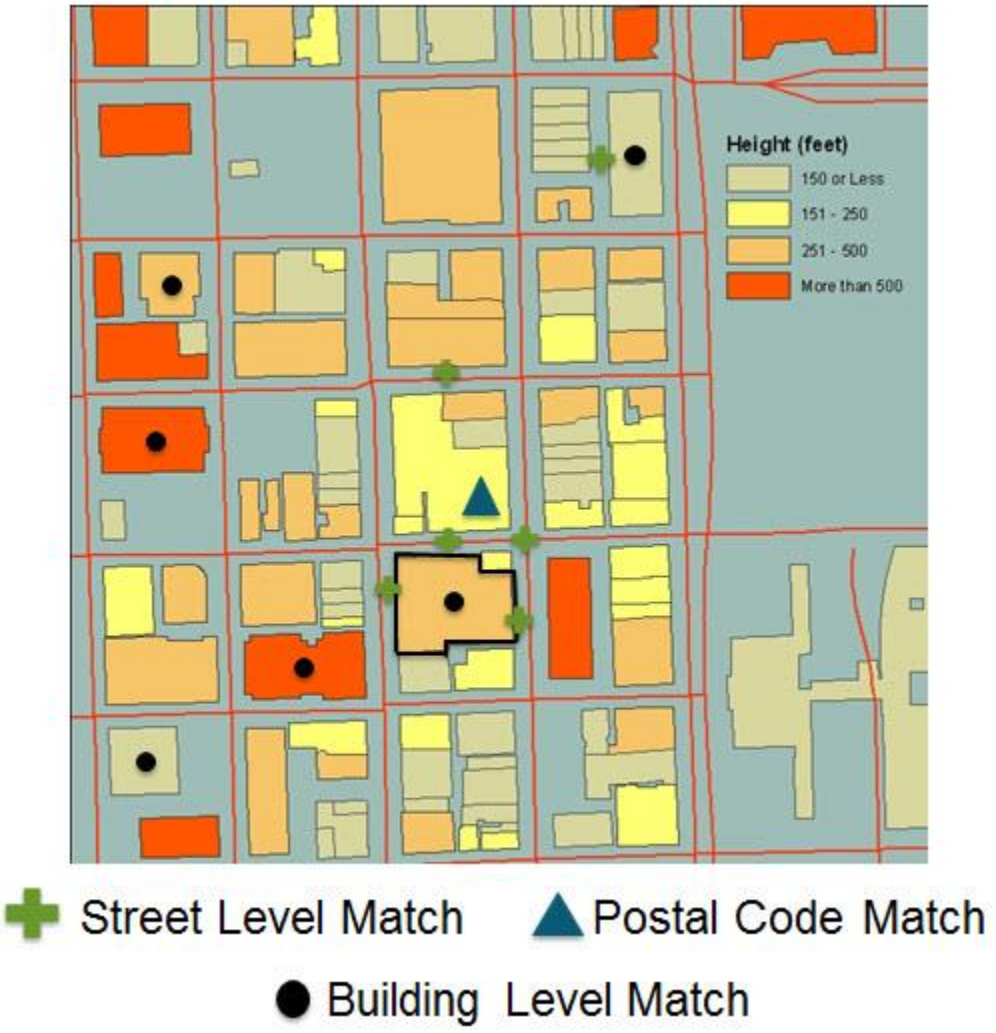
The next analysis type within the accumulation management functionality is the building level analysis. It is used to monitor exposure within a single building. This considers all risks within a

four-wall structure, regardless of the street address. It is dependent on data geocoded to the building level available through the RMS High Resolution Building (HRB) dataset, which must be installed in order to run the building level analysis. Currently the HRB building dataset is restricted to properties located in select city centers within the U.S.

As previously discussed in this course, this functionality will provide two properties with different addresses that are located in the same building the same latitude and longitude coordinate pair so that they can be grouped together for analysis purposes. Again, this is currently a U.S.-only feature within RMS products until better data become available worldwide.

When running a building level accumulation, the result provides totals by structure for either all buildings in the portfolio, or for specific locations that are specified by the user. Figure 21 shows a visual example of a building level accumulation analysis.

**FIGURE 21: Building Level Accumulation Analysis**

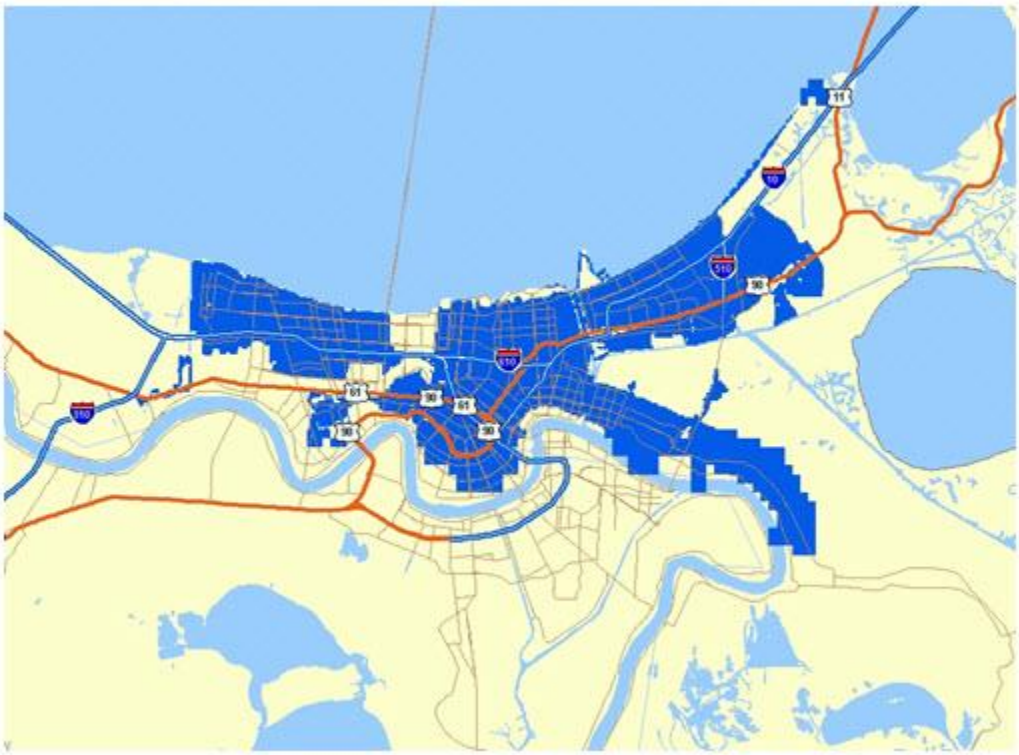


## Analysis Type – Footprint Files

The last accumulation analysis type is the footprint file. RMS has the ability to provide footprint files that allow users to accumulate exposures or estimate loss based on a specific event. The characteristics of these VRG footprints are similar to those described previously for the Terrorism VRG footprints, but the analysis capability is available to any licensee.

The footprints can be created for actual events or for theoretical events. These footprint files are provided at the VRG level; therefore, locations must have a latitude and longitude in order to be analyzed. RMS may develop footprint files for property loss, workers compensation loss, or both after an actual event. The files are not limited to RMS modeled countries or perils since they are created based on events. For example, following Hurricane Katrina in 2005 RMS created the footprint file shown in Figure 22 as a means for clients to identify locations exposed to flooding. Another peril for which RMS creates footprint files is wildfire.

**FIGURE 22: RMS Accumulation Footprint for Flooding - Hurricane Katrina 2005**



## Accumulation Management Challenges

There are some challenges when performing accumulation management analyses. There are often data quality issues, including both resolution and accuracy, as well as data availability.

Real-time management is also a challenge. The analysis that is run is only as current as the underlying portfolio. Depending on the size of the portfolio, updating the data can be a time

consuming process. Having said that, if the portfolio is relatively static, it may be sufficient to use quarterly or even semi-annual data.

In order to run an accumulation analysis in RiskLink, one specific requirement is that all of the exposures must be in a single EDM. This differs from other analysis types, such as exceedance probability, as these other analysis results can be combined outside the model using the unique event IDs provided. This limitation can be a particular challenge for reinsurers who manage hundreds (if not thousands) of cedant portfolios a year.

Lastly, standard practices are still evolving around this type of analysis. It can be difficult to know exactly the best analysis option for your specific business situation. Care must be taken to identify the end goal and end user for all accumulation management analyses, as well as the fitness for purpose.

## .Unit 4: Closing Key Concepts

Unit 4 focused specifically on the accumulation management analysis types that available in RiskLink. The type selected when running an analysis is dependent on the business problem that is being addressed.

The specific area, terrorism simple and VRG footprint files, building level, and footprint file, are all accumulation analysis types that are used to monitor and manage areas of accumulation that have already been identified by the user. If the accumulations have not been identified, it is the spider analysis that will identify those areas of highest accumulation for you.

There are two common mistakes when evaluating a spider accumulation analysis. The first is the misinterpretation of the event name. Each event in a spider circular analysis is named based on the location closest to the center of each circle. The second common mistake is comparing or combining results with an event of the same name from a spider analysis on another portfolio.

Finally, there are challenges with running accumulation analyses in RiskLink. These include data quality, “real time” management and the vintage of a portfolio, including exposures in one EDM, and identify management’s goals for the analysis.

Now that you have completed the reading for the accumulation management course, you must take the online assessment for this course, Accumulation Management Self-Assessment, which is found in the CCRA portal of Owl. The exercise for the course will be completed in class on the first day of the instructor led training, following a short review of accumulation management. This course will show a status of “complete” after you have viewed all the course materials and taken the self-assessment. You will not be able to move on to the Perils Module until all components of the Accumulation Management course have been completed.