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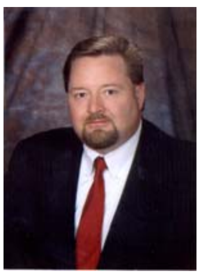
PROACTIVE PROPERTY MANAGEMENT: MINIMIZING THE RISKS OF MOLD, BEFORE OR AFTER STORM IMPACTS

By Paul L. Osley, PE, BCEE, CIH, CSP



Whether constructing/renovating or buying/renting property, or, more recently, responding to emergency storm damage, many factors must be considered in order to reduce the risk of mold contamination. These include:

- Preventive maintenance of HVAC, plumbing and other building systems can reduce the potential for mold growth. Owners that disregard maintenance of basic HVAC components – such as filter and condensate drains – face increased risk. HVAC systems that cycle off during non-occupancy hours to save energy can create fluctuations in temperature and humidity conditions, which may promote mold growth. Undersized and oversized HVAC systems are also associated with inadequate moisture control (ASHRAE 62-2001).
- Roof leaks, plumbing leaks, sewer back-ups or storm related damage that allow water into the structure often trigger a mold and bacteria problem. Water intrusion that occurs during construction and renovation is also associated with uncontrolled mold growth. The key to mold risk reduction is preventive maintenance of building systems, as well as regular inspections to identify leaks. Thorough planning prior to construction

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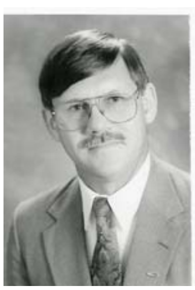
HOW HURRICANE SEASON AND WINDS AFFECT LAKES...AND AN OMINOUS PREDICTION

By W. R. "Ron" Cauthan, PE



This past summer, a representative of the South Florida Water Management District (SWFWMD) made a presentation at a meeting of the Highlands County Board of County Commissioners on the effects of the 2004 hurricane season on Lake Istokpoga in Highlands County.

As Hurricanes Francis and Jeanne entered the east coast of Florida at Fort Pierce, the winds were blowing from north to south across Highlands County and Lake Istokpoga. The normal water level for Lake Istokpoga is around elevation 39 feet. County Road 623 runs around the lake on the south side. The low point on C.R. 623 is approximately 42 feet. As the County was obviously aware, due to repairs that had to be made to the road, SWFWMD reported that the water from the lake had been blown one-quarter mile over the shoreline on the south side and overtopped C.R. 623.

Also at this meeting, a report was given on the storms' effects on Lake Okeechobee. In addition to the storms stirring up bottom sediments,

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EOH NEWS

- Jessica Lunsford Act - Florida Legislation (HB 1877 Chapter 2005-28. LOF, Section 21) effective as of September 1, 2005 require:
  - → *Level 2 Background Check of all contractor personnel who access Florida School Board sites when students are present*
  - → *Fingerprinting of all contractor personnel who access Florida School Board sites when students are present*
- Mold Remediation Worker Protection Guidelines Released by the National Institute of Environmental Health Sciences (NIEHS/Jun'05)
- ASSE Calls for Revisions of Haz-Comm Standard
- American Industrial Hygiene Association (AIHA) - Florida Section 2005 Fall Conference and Professional Development (PDC) Programs:
  - → *September 29th and 30th in St. Augustine, Florida*
- CDC: "Beginning October 24, 2005, all persons can get a flu shot." Check the CDC's website to see if you should get your shot earlier: www.cdc.gov/flu/about/qa/flushot.htm

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activities can prevent moisture from entering the structure. Consideration should also be given to protecting construction material from precipitation once the material arrives on site. Additionally, building openings should be protected when possible to reduce the amount of moisture that enters the interior of the structure during the construction process.

- Local weather conditions influence the degree of mold risk. Buildings located in areas with high precipitation or persistent high humidity must defend against outdoor conditions. To control indoor mold growth, the relative humidity should remain below 60 percent (ASHRAE 55-1992). Properties located within a flood plain may also need special design considerations such as sump pumps, moisture barriers and exterior grading to prevent rising surface and groundwater from entering the structure. Properties in a 100-year flood plain should be evaluated for suitability. (Remember, damage resulting from rising water due to storm surge is not normally covered under most insurance policies.) Basements and crawlspaces that are persistently high in humidity can be sources of mold which can damage stored contents as well as structural integrity.
- Interior moisture sources can also contribute to humidity levels within a structure. Indoor pools, spas, laundries or other wet processes add a significant moisture load. Therefore, HVAC systems should be designed to remove this extra moisture from the structure.
- Buildings with a history of water leaks present a high degree of mold risk as well as persistent small leaks that are not resolved – such as roof leaks or leaks around window frames – are commonly associated with uncontrolled mold growth. More extensive leaks (such as those caused by storm damage) that take more than two days to clean up and dehumidify are also high-risk indicators. If porous or semi-porous materials have been wetted and remain within the building, these materials are likely to harbor mold growth. Buildings constructed of biodegradable materials are also likely to harbor biological activity as the building envelope and structure members can absorb moisture.

To reduce the risk of indoor mold contamination, consider the following when purchasing and managing properties:

- Avoid buildings with basements.
- Do not locate properties within a flood plain.
- Any visible mold should be less than 10 sq. ft.
- Design HVAC systems to handle excess humidity sources.
- Maintain roofs and plumbing systems to prevent sudden or chronic leaks.
- Choose non-biodegradable building materials.
- Avoid properties that have a history of water leaks and/or significant storm damage.
- Ensure that recent renovations have not allowed water intrusion or used wetted construction materials.
- Ensure that recent storm related repairs and construction/renovations have been performed in accordance with approved remediation procedures (such as but not limited to the American Industrial Hygiene Association Assessment, Remediation, and Post-Remediation Verification and/or New York City Department of Health Guidelines on Assessment and Remediation of Fungi in Indoor Environments) and not allowed subsequent water intrusion or used wetted construction materials.
- Ensure that HVAC systems are maintained and run continuously to control temperature and humidity levels.
- Respond to a water intrusion event within 48 hours using documented procedures for containment dehumidification, and disposal of wet porous and non-porous materials.

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INNOVATION IN EXTENDING THE LIFE OF LANDFILLS

By R. Jerry Murphy, Ph.D., PE

Chastain-Skillman, Inc. has a U.S. patent pending application (No. 60/664,034) for integrating leachate recirculation and the collection of landfill gas while the landfill is under construction, rather than after it has been closed. The method was developed and applied at the Highlands County, Florida landfill. The purpose of recirculating leachate is to accelerate the degradation rate of the municipal solid waste (MSW) which enhances the rate at which the waste settles.

This provides an attendant increase in air space to accommodate additional MSW as the landfill is built. Concurrently, when not recirculating leachate, the same network used to distribute the leachate is used to collect landfill gas which evolves from the MSW degradation process. The design is based on the local hydrology, and the leachate distribution/gas collection system is configured to provide equalized flow of both phases of fluid. It has been estimated that the Highlands County landfill has saved in the order of $1 million annually based on the additional volume of landfill space recovered.

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(Wind Effects—Continued from page 1)

which is proving to be a serious water quality issue, it was reported that the lake's north shoreline receded one-quarter mile as the water was pooled against the Herbert Hoover Dike on the south side. This is the exact scenario which occurred in the 1920's when thousands were killed in Clewiston and Moore Haven and resulted in the construction of the dike around the lake by the Army Corps of Engineers.

While the effects of wind on Florida lakes might be surprising, it is hardly a surprise that New Orleans was recently decimated by flooding from Lake Pontchartrain. Only two years ago, in June 2003, Civil Engineering Magazine published an article with an ominous warning, entitled "The Creeping Storm." Excerpts from the article are presented below. For further information, or a copy of the article in its entirety, please contact Ron Cauthan or visit this website: http://www.pubs.asce.org/ceonline/ceonline03/0603feat.html.

In the late summer of 1965, a disorganized storm system formed over the warm, tropical waters of the mid Atlantic. Soon the storm grew into a high-powered cyclone—a twisting mass of wind and water that would torment the Gulf Coast in the coming days. The National Hurricane Center gave it a hauntingly innocuous name: Hurricane Betsy.

Storm prediction was still in its infancy then and researchers could not get a read on Betsy's erratic path. She zigzagged north from Puerto Rico and first seemed to be heading straight toward the Carolinas. At the last moment, however, Betsy swerved toward the Bahamas, then again toward Florida, finally veering west of the peninsula and straight toward Louisiana.

On September 9 Betsy hit the southern tip of the state. Almost every building in the small coastal town of Grand Isle was quickly destroyed. With 150 mph (240 km/h) winds, Betsy barreled up the Barataria Basin toward New Orleans. Lake Pontchartrain—which is just north of the city and is connected to the Gulf of Mexico—swelled with raging waters. Easterly winds pounded the high waters, in some areas easily topping the levees meant to protect the city. In streets in the eastern part of town water reached the eaves of houses.

Betsy finally calmed near Little Rock, Arkansas. She had dropped only 4 in. (100 mm) of rain on New Orleans and had claimed 81 lives and caused more than $1 billion in damage. Unlike any storm before it, Betsy made clear that the city was all too vulnerable to hurricanes. Cradled in a wide southern meander of the Mississippi River just north of the Gulf of Mexico, New Orleans is surrounded by Lake Pontchartrain to the north, Lake Borgne to the east, and lakes Cataouatche and Salvador to the south. This ring of freshwater is also surrounded by hundreds of square miles of wetlands and the Gulf of Mexico. To make matters worse, most of the city is below sea level.

Soon after the damage from Betsy was assessed, Congress made a historic decision to appropriate federal funds to build a system of levees to protect the city from a similar storm in the future. Its cultural significance aside, New Orleans was fast becoming the most important port in the nation—feeding commodities up the Mississippi to all of the Midwest and serving as an important base for the burgeoning oil and gas industry. Congress was not about to let it wash away.

Today New Orleans rests within a bowl formed by 16 ft (4.9 m) tall levees, locks, floodgates, and seawalls, the edge of the bowl extending for hundreds of miles. It is bisected from west to east by the Mississippi River, which is also contained within massive engineered embankments. Water flows through and all around the city while its residents go about their daily routines. A system of levees forming a ring around the northern half of the city to protect it from surging waters in Lake Pontchartrain is set to be completed within the next decade. Construction of a similar system around the southern half of the city will probably take several years longer than that.

But almost 40 years after beginning these projects, the U.S. Army Corps of Engineers is in the midst of reassessing them on the basis of an ominous question: Are the protective barriers high enough?

The design of the original levees, which dates to the 1960s, was based on rudimentary storm modeling that, it is now realized, might underestimate the threat of a potential hurricane. Even if the modeling was adequate, however, the levees were designed to withstand only forces associated with a fast-moving hurricane that, according to the National Weather Service's Saffir-Simpson scale, would be placed in category 3. If a lingering category 3 storm—or a stronger storm, say, category 4 or 5—were to hit the city, much of New Orleans could find itself under more than 20 ft (6 m) of water.

Some experts worry that even a less severe storm could flood the city. In the 40 years since the design criteria were established for New Orleans's hurricane protection levees, southeastern Louisiana's coastline has been subsiding—settling in on top of itself—even as the natural height of the sea rises. A century ago any hurricane heading toward New Orleans would have had to traverse a 50 mi (80 km) buffer of marshland. Today that marsh area is only half as broad and the hurricane would be striking a city that itself sinks lower every day.

Today, we know the protective barriers weren't high enough to stave off the storm surges caused by Hurricane Katrina—just one of the many issues facing New Orleans.

Source: 'The Creeping Storm', *Civil Engineering Magazine*, June 2003, Vol 73.

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ANNOUNCEMENTS

The opportunity for growth is always accompanied by the inherent challenge of staffing the firm to continue to provide a consistent level of service to our clients. Several recent hires have significantly boosted our ability to meet this challenge. Here is a brief spotlight on three recently hired individuals.

Mr. Thomas "Tom" Cowan has joined the firm as a construction representative. Tom brings with him over 30 years of experience in the construction industry, as well as an excellent reputation with the clients whom he has served through the years. He will focus on civil site work projects for the firm.

Our second highlighted new team member is Dr. Georgios Anipsitakis. George earned his Ph.D. in environmental engineering from the University of Cincinnati. His areas of expertise include: environmental/chemical engineering; studies of drinking water quality; industrial wastewater management; water resources management; industrial effluent record; and environmental impact assessments.

And last but certainly not least, Mr. Craig Little has joined the Occupational Health and Safety team in our Tampa office, and will assume the duties of Industrial Hygienist/Environmental Scientist. His degree in Environmental Geography adds unique diversity to the staff.

Welcome to the Chastain-Skillman family!

SUMMARIZING YOUR DATA...OR WHAT DOES A MEAN MEAN?

By James R. Chastain, Jr., PhD, PE, MPH

One of the consequences of our digital age is that data not only proliferates, it can absolutely overwhelm. For raw data to be useful it must be converted into useful information. Much of this data is numerical in nature and one of the ways it is interpreted is by the use of statistics or statistical inference. The mere mention of the word "statistics" causes many people to fall into a catatonic state, which is unfortunate. Certainly, statistical practice can be somewhat arcane and mathematically precise, but the fundamentals are quite accessible and are a part of most professionals' academic background. Two common queries that are typically made are to (1) summarize the data and (2) detect meaningful trends. This article will discuss a few important points to consider when summarizing data sets.

After thinking about it for a moment, the reason that difficulty exists in interpreting data is that the data changes. If every piece of data was the same, then interpretation wouldn't be a problem. However, the fact is that variability does exist…and variability in the numbers can lead to variability in interpretation which, in turn, can result in erroneous analysis or decisions. So how can summary statistics help with this task?

PRELIMINARY ISSUES

Before analyzing the data, the first thing that needs to be done is to characterize it. Normally this will only take a couple of minutes, but it helps to highlight the types of computations that are appropriate for the data. Thus, at the outset, the following should be identified: (1) the data type, (2) the data extent, and (3) the data distribution.

The data type refers to the nature of the data. Is it discrete (whole numbers) or continuous (includes fractional values)? When considering more sophisticated analyses, the data type can be an important distinction. Although we won't go into it in any detail in this article, it is helpful to also classify the data according to whether it is nominal, ordinal, interval or ratio. Many times this is a function of whether the data is coming from a specific "measurement" or whether it is the output of something like an opinion survey. For the purposes of this article, it is assumed that interval or ratio data (the typical numerical "measured" data) is being used.

The data extent refers to whether the data measures the whole source or just part of it. In other words, does the data describe the whole population or is it a sample of the population? This is an important distinction. For example, if the height of everyone in a room is measured and recorded…is that a population or a sample? To answer the question, another key question must be asked, 'how is the data going to be used?'. If one is just interested in understanding the height variation of people in that room, then it is a population measurement. Why? It is because everyone (in the population) has been measured and we have complete information about the group. On the other hand, if the analyst is using the people in the room to estimate the height variation for people in the state of Florida, then the group is a sample of the population and not the population itself. Thus, there is additional uncertainty in the statistics that must be accounted for. Misunderstanding this distinction is a common error and can lead to improper data summaries.

The data distribution simply refers to the shape of the data as it is plotted. Most everyone has used histograms to help visualize data. It is found, by experience, that different data sources can assume common shapes which can be approximated mathematically. These mathematical models can then be used to more efficiently summarize the data. But if the analysis is performed using the wrong data distribution, it is easy to see how errors in interpretation can be made.

CENTRAL TENDENCY

As a first step it is necessary to see where the "center of gravity" of the data lies. To characterize the data by a single number, this center of gravity value will represent the expected value of the system.

It seems almost instinctive, when faced with a ream of numbers, to compute the average. The average, or "**arithmetic mean**", is one of the first statistical parameters taught in school. It is merely the sum of all the data points in a data set, divided by the number of points in that data set. In most spreadsheets or calculators it can be automatically computed. Thus, it is commonly used because it's an easy value to obtain and the value is easy to interpret and explain.

VARIANCE

Unfortunately, the mean as a single point estimate may not adequately express the nature of the data. The next task, then, is to develop an estimate of the variation of the data from the mean (center of gravity). Ideally, what we would like to do is get an average of the variation so that we can represent the data variation by a single number too. Unfortunately, we can't do this directly because a simple average of the deviation from the mean will always equal zero. This is because values above the mean always equal the values below the mean (that's why it's the average!). So statisticians developed a clever way to get around the problem. Rather than average the difference between the mean and each value, they averaged the square of the difference between the mean and each data value. This will not equal zero (unless there is no variance) because the square of any deviation (above or below the mean) will be positive so nothing cancels out. This value is called the **variance**.

The only problem with the variance is that it's a squared term and is difficult to interpret when compared to the mean. However, if the square root of the variance is taken, the resulting value has the same dimensions as the mean. This value, the **standard deviation**, can be added to or subtracted from the mean to give a sense of the data's deviation from the mean.

With these simple operations, we have an estimate of the data's center of gravity (mean) and an idea of the variation of the data from that center of gravity (standard deviation).

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(Summarizing Your Data—Continued from page 4)

Up to this point there's probably not much that's been presented that you didn't know already. However, many times, there are subtle aspects of basic statistics that need to be understood so that misinterpretations don't bias the use of the information.

THE AMAZING CENTRAL LIMIT THEOREM

One of the truly amazing relationships to come from mathematical statistics is the Central Limit Theorem. In essence it states that, for a sample from any distribution, the true mean lies within ± 1.96 times the standard deviation of the data 95% of the time given a large set of samples. What makes this amazing is that it applies to any data distribution…not just the normal (Bell Curve) distribution. So it doesn't matter what the underlying distribution is (ex. normal, uniform, triangular, weibull, non-uniform, etc.); the mean will be located by the Central Limit Theorem with a stated probability. Of course the more elements in the data set, generally the smaller (tighter) the standard deviation becomes, so the estimate becomes more reliable.

HOW IS THIS MISUSED?

The most common reason for mistakes being made with this theorem is that it is assumed that 95% of the values lie between ± 1.96 times the standard deviation from the mean. This only applies to data sets that encompass the entire population (all possible values). Most data that is generated in practical settings are samples of the population. The central limit theorem says that, for repeated samples, the actual mean lies within ± 1.96 standard deviations of the computed mean (with 95% probability). Note the central limit theorem attempts to locate the mean (only) and not all of the data values.

Thus, when summarizing data, be clear about the nature of the data set and the assertions that you make. In other words, is it the mean that is being discussed or is it the data distribution? If this isn't clearly understood, significant errors can be made in the data analysis.

IS THE MEAN MEANINGFUL?

As valuable as the mean is, there are situations where it can mislead. The mean is most useful with data distributions that are symmetrical, that is the data is a mirror image on either side of the mean. However, many times the data that is encountered in practice is skewed or, in other words, there are more data points on one side of the mean than the other. It is common to find this situation when dealing with environmental or economic data. For example, consider an environmental system that is in compliance most of the time but has a one-time pollutant spill. The average of all those values might indicate that the system was routinely out of compliance because the average was higher than the permit value. This would be untrue though. The system only had one non-compliance event that skewed the average.

In cases where the distribution is highly skewed, many times it is better to use the **median** instead of the mean. The median represents the data point where 50% of the data points are above it and 50% are below it. Thus, the median is based on a sorted or ranked set of the data. As an example, if there are 99 data points in the ranked data set, then 49 points would be above the median and 49 points would be below it.

Using the same process, the variance can be described by recording the value at any desired percentile (ex. 10th percentile, 20th percentile, etc.). Thus, any percentile (also called quantile) can be located and recorded. When these values are plotted, they can provide a good sense of the data distribution.

The key point here is that the median limits the effect of extreme values on the magnitude of the measure of central tendency. Also, note that since the median is based on the ranking process, it is not dependent on the underlying distribution of the data (i.e. it is non-parametric or distribution-free).

SO WHAT DOES ONE DO?

Given a long list of numbers, what initial steps should one take to summarize the data? The following steps might be helpful.

1. Understand what the data represents.
   a. Does it encompass the whole population of the set of interest or is it actually just a sample of the population?
   b. Is the data independent (i.e., selected randomly)? This is critical if it is a sample.
2. Compute basic statistics.
   a. Compute Mean and Standard Deviation.
      i. If the data is population-based, compute the confidence limits for the data set.
      ii. If the data is a sample, compute the confidence limits for the mean.
   b. Compute the Median and desired Quantiles.
   c. Compare Mean and Median values.
      i. Look at magnitude of deviation. The greater the deviation, the larger the data is skewed or non-symmetrical.
      ii. Identify extreme values that drive the mean. What happens to the mean if those value(s) are eliminated? Does the existence of those values make sense and should additional study be done to understand them?
3. Plot the data.
   a. Plot a dot plot, histogram and/or probability plot of the data to form a concept of the data distribution. Look for patterns or clusters.
   b. Can the data be classified into a common distribution?
   c. Plot the Median and other percentile values. How does that compare to the parametric distribution?
   d. Identify extreme values. Can they be explained?

By using this simple approach, better insight into the data can be gained. Many times it will also identify questions that can be used to initiate other tests or queries to further clarify underlying causes or events. And, by understanding the limitations on the interpretation of the mean, it can help one avoid making faulty judgments based on incorrectly summarized data.

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