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CONSULTANT'S UPDATE

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HVAC AND THE CLASSROOM

By Laura M. Totten, BS

The October 2006 issue of ASHRAE Journal (vol.48) contains an article, entitled: "Research Report on Effects of HVAC on Student Performance and Classroom Habitat". This study, by Pawel Wargocki, Ph.D. and David P. Wyon, Ph.D., shows that the ventilation and temperature of a classroom impacts performance.

Previous research has shown that an office work environment with poor indoor air quality and high indoor temperature negatively affects performance. Other studies have attempted to establish a similar relationship in school performance.

In the subject study, Wargocki and Wyon performed five separate experiments at an elementary school in Denmark. Two alternating classrooms and their students were used as control and experimental arms, changing each week. The students ranged between ten and twelve years old. The studies were done in late summer and again in winter. Various tasks in reading and mathematics were measured. The rooms were mechanically ventilated in a way that air flow rates and temperature could be altered. An interesting part of the study was that the windows were allowed to be opened at will, even though the ventilation was determined by continuous CO_2 measurements during class periods.

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CHANGES IN THE CONSTRUCTION SPECIFICATIONS INSTITUTE PROJECT MANUAL ORGANIZATION

By Lisa Strine Lassi, PE, CDT

In 1963 the Construction Specifications Institute (CSI) developed the first standard for organizing construction information. This standard, which later became known as *MasterFormat™*, provides the organizational format and standard location for arranging Project Manuals. The Project Manual, which contains the various documents involved in a construction project, is utilized to guide the construction process. Over the last forty years, *MasterFormat* has become the leading standard for organizing construction specifications and is frequently utilized by architects, engineers, contractors, and owners.

MasterFormat organizes information about construction work results, requirements, products, and activities into a standard sequence using a master list of numbers and subject titles. Because construction projects use many different delivery methods, products, and installation methods, successful completion of a project requires effective communication among all the involved parties. CSI developed *MasterFormat* in order to effectively communicate construction documentation utilizing the "four Cs": Clear, Concise, Correct, and Complete.

Over the years, many revisions and expansions to *MasterFormat* have occurred due to changes in the construction industry. The most recent revision to *MasterFormat*, issued in 2004, included a significant expansion and reorganization of the Project Manual Division numbers. *MasterFormat*

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UNITED WAY

Chastain-Skillman staff members supported the United Way campaign again this year. The 2006 campaign was our best ever, with voluntary pledge donations of nearly $8,500 for the upcoming year.

LIFE SAVING DONATIONS

Chastain-Skillman employees give back to their community in many ways. Over the course of the 2006 year, Lakeland office staff members made 46 employee blood donations!

Inside this issue:

PLEASE JOIN US AS WE WELCOME OUR NEW HIRES …

Chastain-Skillman, Inc. is pleased to welcome Survey Instrument Technicians William Kerber and Timothy Magee to the survey staff, and Senior Project Manager Yunxiang "Phil" Fan, PE to the Civil Engineering staff. Phil earned his Master's Degree in Civil Engineering at Louisiana State University, and brings to the firm a broad range of experience in transportation, civil, environmental, water resources engineering, project implementation, and business development in both private and public sectors. Phil enhances our ability to meet our clients growing needs.

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Their findings showed that increasing the air supply rate and eliminating high temperatures greatly improved a student's achievement in terms of speed and efficiency in the various tasks ($P<.05$). According to the article,"…doubling outdoor air supply rate would improve the performance of school work in terms of speed by 14%, while reducing classroom air temperature by 1.8°F would improve performance in terms of speed by 4%". Interestingly, there was no correlation between the air flow and temperature in the room and the percentage of errors made in the students' tasks. These results held between 2 to 10 liters per second air flow and between the temperatures of 68 to 77°F.

The results could be generalized when both indoor and outdoor environments are similar to Denmark, but environments with a warmer climate and higher humidity would require more study. The authors postulate lowering pollutants by different methods or improving architectural design might also yield positive classroom effects.

To fully understand the data and resulting conclusions, review of the original article is recommended. A copy of the original article can be obtained at www.ashrae.org or by contacting Chastain-Skillman's Tampa office.

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2004 was created because the previous version, *MasterFormat* 1995, was overcrowded in many Divisions and could not continue to meet the needs of building engineering and facility services. In addition, *MasterFormat* 1995 did not adequately address facility management and operations activities for the whole life cycle of construction projects. In some Divisions, *MasterFormat* 1995 had become more of a product listing system than a system for organizing Project Manuals, as was originally intended.

MasterFormat 2004 divides the Project Manual into two groups: the Procurement and Contracting Requirements Group, and the Specifications Group. The Procurement and Contracting Requirements Group, Division 00 in the Project Manual, contains introductory information, procurement requirements, and contracting requirements. The Specifications Group contains the following five Subgroups: General Requirements (Division 01), Facility Construction (Divisions 02-19), Facility Services (Divisions 20-29), Site and Infrastructure (Divisions 30-39), and Process Equipment (Divisions 40-49).

MasterFormat 2004 utilizes a six digit section number in each Division allowing for more section numbers than the five-digit section numbers utilized in *MasterFormat* 1995 Divisions. The section numbers consist of three pairs of numbers, each pair separated by a space, with the ability to add a fourth pair of digits at the end, after a decimal point, when needed for very specific or user defined topics. In addition, there are now 50 Divisions available, as opposed to 16 Divisions under the 1995 version. This new numbering system allows for more than 100 times the number of subjects at the same level when compared to the old numbering system.

Today *MasterFormat* is used by many people in the construction industry including design teams, owners, contractors, and suppliers. Chastain-Skillman, Inc. has been utilizing *MasterFormat* for many years as a means of effectively communicating the construction process to our clients and to their contractors. The conversion to the 2004 Standard requires a major effort to review, revise, and re-categorize specification sections. We are in the process of converting to the *MasterFormat* 2004 standard for all of our Project Manuals. This includes conversion of our specifications to an industry-recognized database program, BSD SpecLink. The conversion will allow Chastain-Skillman to provide a higher quality product, conforming to the *MasterFormat* 2004 standards, while automating and speeding specification production. Our licensed Construction Documents Technician (CDT) is available to assist our clients in understanding these major changes in specification format and to review conversion issues.

Lisa Lassi is a Senior Project Manager in the Environmental Engineering Department of Chastain-Skillman's Lakeland office. Ms. Lassi has been with the firm for twenty-seven years. She has a Bachelor's Degree in Civil Engineering and a Master's Degree in Environmental Engineering from the University of South Florida, and recently received certification from the Construction Specifications Institute as a Construction Documents Technologist. Ms. Lassi is responsible for the design, permitting, and construction of water and wastewater projects for various municipal and private clients. She can be reached at (863) 646-1402 or llassi@chastainskillman.com.

OSHA's TOP 10 FOR 2006

(Safety + Health/December 2006)

OSHA says they are 'getting to places they need to be' – the worksites and industries where injury, illness and fatality rates are highest.

OSHA's Top 10 lists can help employers and safety managers assess the readiness of their safety programs. The most cited violations for fiscal year 2006 fall into the same categories as 2005. The only major change was ladder violations moving from the 10th position in 2005 to the 9th position in 2006. In addition to the Top 10 "most cited" violations list below, the Top 10 "willful" and Top 10 "serious" are also provided. Upon review, if you have any questions regarding this information, the OSHA regulations or the compliance status of your company's Health & Safety plan, please contact our Tampa office.

TOP 10 MOST CITED VIOLATIONS

1.	Scaffolding	(Standard 1926.451)
2.	Hazard Communication	(Standard 1910.1200)
3.	Fall Protection	(Standard 1926.501)
4.	Respiratory Protection	(Standard 1910.134)
5.	Lockout/Tagout	(Standard 1910.147)
6.	Powered Industrial Trucks	(Standard 1910.178)
7.	Electrical – Wiring	(Standard 1910.305)
8.	Machine Guarding	(Standard 1910.212)
9.	Ladders	(Standard 1910.1053)
10.	Electrical – General	(Standard 1910.303)

TOP 10 WILLFUL[1] VIOLATIONS

1.	Excavations	(Standard 1926.652)
2.	Lead in Construction	(Standard 1926.62)
3.	Fall Protection	(Standard 1926.501)
4.	Respiratory Protection	(Standard 1910.134)
5.	Excavations – Specific Requirements	(Standard 1926.651)
6.	Scaffolding	(Standard 1926.451)
7.	Machine Guarding	(Standard 1910.212)
8.	Lockout/Tagout	(Standard 1910.147)
9.	Occupational Noise Exposure	(Standard 1910.95)
10.	Lead/PSM of Highly Hazardous Chemicals	(Standard 1910.1025 and 1910.119)

[1] Defined as one "committed with an intentional disregard of or plain indifference to the requirements of the OSHA regulations".

TOP 10 SERIOUS[2] VIOLATIONS

1.	Scaffolding	(Standard 1926.451)
2.	Fall Protection	(Standard 1926.501)
3.	Hazard Communication	(Standard 1910.1200)
4.	Lockout/Tagout	(Standard 1910.147)
5.	Respiratory Protection	(Standard 1910.134)
6.	Machine Guarding	(Standard 1910.212)
7.	Electrical – Wiring	(Standard 1910.305)
8.	Powered Industrial Trucks	(Standard 1910.178)
9.	Ladders	(Standard 1926.1053)
10.	Mech. Power Transmission	(Standard 1910.219)

[2] Defined as "one in which there is substantial probability that death or serious physical harm could result, and the employer knew or should have known of the hazard".

RECENT PROJECTS AND CONTRACTS OF INTEREST

- In **Sebring**, construction is complete on the Roadhouse Grill and is scheduled to open next month.

- In **Lakeland**, the Bartow Facility Plan was completed and accepted by the Commission, leading to the Bartow WWTP Expansion. Avon Park's Facility Plan will translate the previous Utility Plan into a funding request for plant construction. The Auburndale Regional WWTP is under design for expansion to 4.0 MGD. A Facility Plan for a Water System in Wauchula has also been recently authorized.

HOW CAN A CHEMICAL IN THE "PARTS PER BILLION" RANGE BE DANGEROUS?

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

Environmental engineering initially emerged as a design profession in order to address critical public health needs. As rural communities began to give way to more densely populated urban centers, the incidence of communicable diseases increased dramatically. In large part, this was due to poor sanitation practices. As a means to enhance living conditions and improve the population's health, engineers were tasked with developing better means of managing drinking water, wastewater and solid waste. Techniques for water and wastewater treatment, surface water management and solid waste disposal were developed, which dramatically reduced the acute disease and health risks that plagued the emerging urban environment.

As time went on, however, and the industrial revolution reshaped local and national economies, the impact that humans have on the environment began to be recognized. Humans are a part of a local, regional and global ecological balance and not independent of it. Therefore, damage that occurs as a part of anthropogenic impacts will ultimately return to affect people that are a part of that environment. The difference between this effect and the earlier communicable disease scourge is that these impacts tend to be more subdued and result in long-term health effects. Many of the state and federal environmental laws and regulations have been developed in response to such impacts.

While ecosystems can be altered or degraded in many ways, one of the most important, and yet in many cases the most difficult to quantify, is chemical pollution. Because chemistry is fundamental to much of the progress society has made, there are tens of thousands of chemicals that are discarded or excreted into the environment every day. Many of these are benign and have no measurable effect on the environment. Others, however, can have a profound effect on both the environment and, ultimately, public health. What makes these chemicals so dangerous, even when the discharge seems to be quite low ("parts per million" or "parts per billion" level)?

There are many factors involved as a chemical moves through the environment. One key question involves looking at whether the chemical **bioaccumulates** in the ecosystem. In other words, does the chemical remain in the environment and move through the food chain, or does it naturally degrade and decompose? Are the residual products harmful or benign?

Actually, there are three terms that many times are used synonymously to express this process, but which have slightly different meanings. The terms are bioconcentration, bioaccumulation, and biomagnification. Technically, **bioconcentration** refers to an organism's uptake of a contaminant from the external environment; **bioaccumulation** is the uptake of a contaminant from the external environment or food; and **biomagnification** refers to the increasing concentration of a contaminant as it moves through higher trophic levels. (A trophic level refers to an organism's position in the food chain, with humans being at the highest trophic level.) As you can see the terms are related. Most scientists classify bioaccumulation as the overall process term which is then divided into bioconcentration and biomagnification, with bioconcentration related to chemicals coming directly from the environment and biomagnification resulting from intake via the food chain.

We might find that interesting, but what does that have to do with harm to our personal health or damage to the environment? By looking at chemicals this way, we can begin to understand why certain chemicals, even when entering the environment in seemingly small amounts, can actually result in "poisoning" us.

Biologists and toxicologists have identified at least four factors which help provide clues as to which contaminants have the most potential for causing harm, especially through our food. Generally, they must have the following characteristics:

1. long-lived
2. mobile
3. soluble in fats
4. biologically active

If the chemical contaminant is short-lived, it will degrade before it can become dangerous because it won't be able to interact with a large portion of the population. If it's not mobile, unless there is just a massive amount of the material in the environment, it will be too dispersed for a population of organisms to efficiently consume it. If the contaminant is water soluble, it will tend to be routinely excreted by the organism's waste functions. However, if the chemical is soluble in fat, it will tend to be stored for long periods of time in the fatty tissue of the organism. This is one reason that environmental toxicants can show up in female milk and thus affect the very young who are often more susceptible to damage by toxins. Finally, a contaminant must be biologically active (cause changes) for it to be significant from a health perspective. With that background, all it takes is a cursory examination of where chemicals go (i.e. the fate of chemicals) and how they can enter the food chain to get a sense of the problem.

When human populations (or their activities) are concentrated, the waste products of that community tend to become concentrated at localized points rather than dispersed over large land areas as we might see in rural settings. This concept could also be extended to agriculture or other activities that significantly increase

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the "density" of production over normal levels. As a result, disposal of these wastes or byproducts are not uniformly distributed into the environment. When those wastes include chemicals that are persistent (don't easily breakdown or degrade), there is an opportunity for them to be consumed or otherwise absorbed by organisms at the lower levels of the food chain. Many times chemicals of concern mimic essential nutrients so the body tries to metabolize the contaminant. This is quite common so long as the concentration in the environment is not toxic to the organism. Persistent chemicals, then, will remain in the environment for long periods of time and, if the waste discharge continues, the concentration will continue to increase additively over time. This in turn gives the organisms feeding in the area an increased opportunity for uptake. If these chemicals enter the water (lake, river or groundwater), they can also be transported to other areas, increasing the range of their effect.

As organisms which are lower in the food chain metabolize the chemical, it is absorbed in the fat tissue and begins to concentrate. Thus, it is said that the body burden of the chemical increases. If they continue their intake of the chemical, it will begin to bioconcentrate because the body can eject it efficiently from the fatty tissue. Now the concentration of the chemical may not harm the organism at all because it is stable in the fatty tissue and doesn't interfere with the normal body functions, but it exists as a body burden.

At this point a very significant thing happens. As one moves up the trophic levels (food chain), the new organism will be consuming organisms (food) that has the chemical bioconcentrated in the fatty tissue. This means that, in addition to any intake that may occur directly from the environment, the new organism receives a more concentrated dose from the lower trophic level.

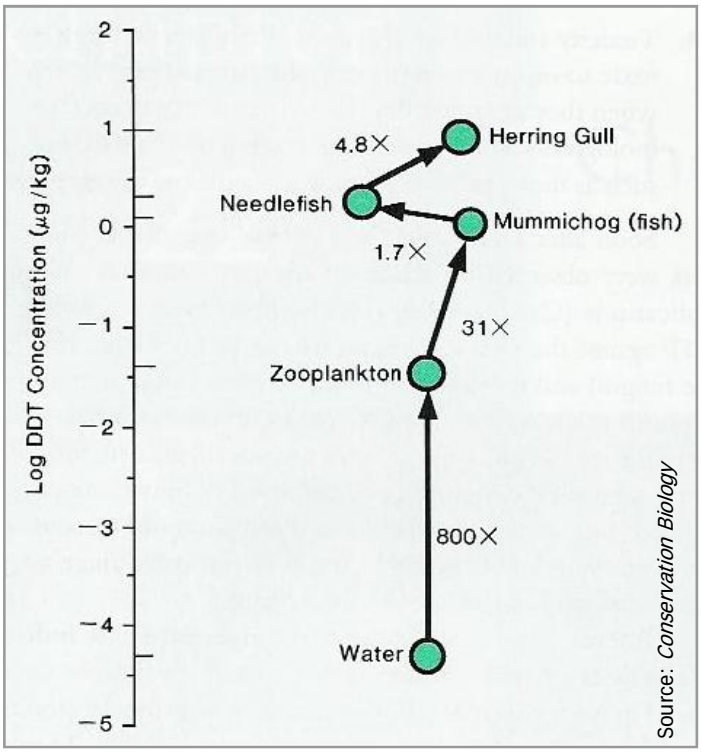

Figure 1: Example of Biomagnification with DDT

To illustrate this point, Figure 1 is provided. The graph shows the uptake of DDT from a low level in the water itself to a level in birds that is 200,000 times as great as the water itself. Thus, DDT has concentrated in the lipid tissue of birds more than five orders of magnitude. Continued concentration will occur as one proceeds to higher trophic levels (to include humans). Different chemicals have different concentration potentials, but the class of contaminants considered here (i.e. fat soluble) typically have bioconcentration ranges in the 10^3 to 10^6 (thousands to millions). Other chemicals, however, that are not fat soluble don't have this problem.

One final point might be noted. People that have been exposed to these contaminants over time can have high body burdens of the chemicals, but not be particularly aware of this fact. As explained above, this is concentrated in the fat deposits of the body. Therefore, if these people are overweight and elect to go on a crash diet, the chemicals can be released back into active circulation in the body and damage sensitive functional organs. In these rare cases, then, a person can actually damage their health significantly if they lose weight too quickly.

There is much that is not understood in these extremely complex interactions. However, the basic concepts have been recognized and on-going research may help untangle the fate of each chemical in its path through the environment. In the interim, regulatory agencies must attempt to develop regulations that balance the beneficial use of chemicals with their adverse and potentially long-term reactions. This is a difficult task in the face of the myriad of unknown factors in each case. In the face of this uncertainty, the so-called "precautionary principle" is invoked and a conservative ruling is passed based on expert assessments.

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