History of AristaTek – Part II

This month we'll continue to describe the background of AristaTek from where we left off last month (January 2006) when we described a portion of the research background the founders experienced while employees of the University of Wyoming Research Corporation (UWRC). This month we'll provide some insight into how the original PEAC software application was developed and some of the events that have directed the product to its current capabilities.

The Original Concept

In early 1996, management at UWRC was seeking ideas the company could invest resources into that could be developed into commercial products or services. The Hazardous Chemicals Research Group, that David Sheesley headed, proposed developing a software application that was composed of a database of chemical information plus an integrated dispersion model that would be packaged on a handheld computer. Thayne Routh, who was responsible for software support and computer analysis in the group, was the primary driving force behind this idea.

At this point in time, handheld computers or personal digital assistants (PDAs) were just being introduced into the market place. Thayne felt that we could assemble a database with the required chemical information a responder would need plus an integrated vapor dispersion model (plume model) into one of these new PDAs being introduced.

The Hazardous Chemicals Research Group felt that this was a natural trend in light of the SARA language that originally got UWRC started in the this research area. Specifically, the SARA §118(n) language emphasized the establishment of a "technology transfer" program and what better way to do technology transfer than to create a product a responder could actually use to make decisions at the scene. This concept was reinforced by one of the identified observations made by John Nordin in his 1989 chemical release study that found very few of the responders in these accidents had access to plume modeling when deciding how to protect themselves or the public. The general consensus was that if an easy to use software application with a database and plume model could be packaged into a portable handheld device, it would be widely used by First Responders. This was the basis for the proposal to management that was to become the *Palmtop Emergency Action for Chemicals* or PEAC® software.

The initial goal was to develop a prototype of the software with a sufficient number of chemicals to demonstrate the concept of selecting a chemical by name or UN#. Once the chemical was selected, there needed to be an ability to display the various types of information from the integrated database. For those chemicals that produced a toxic vapor cloud, there was the need for additional user provided information so the different sub-modules could be executed to compute a protective action distance or toxic exclusion zone.

The first prototype of the software application and database was written in Microsoft Visual Basic and ran on Casio Z-7000 PDAs. The prototype's database included only about 20 chemicals and the PAD calculations were based solely on the IDLH of the selected chemical.

The interface was designed to follow the methodology used in the 1993 Emergency Response Guidebook (ERG) developed by the U.S. Department of Transportation. This allowed information to be searched by either chemical name, UN Number or Guide Number. The databases were limited to chemical properties and response procedures found in the "orange pages" of the US DOT ERG. The product was to deal only with toxic industrial chemicals (TICs) and toxic industrial materials (TIMs) that a responder would encounter in accidental releases associated with transportation accidents or at fixed facilities.

These prototypes, at that time called the Palmtop Emergency Response System (PERS), were submitted along with a beta version of a User's/Operator's Manual to a number of fire service and Hazmat professional experts across the country for their critical review. After several months, a body of comments had been gathered and reviewed. Based upon the feedback from these professionals, the hardware platform and software product design was finalized. This was all completed by the late summer of 1996. Two common comments from the reviewers were the lack of backlight for use at night, since the selected unit had no backlight, and the slowness of the computations, because this PDA had a very slow processor. The decision was to migrate the software application to the Apple Newton MessagePad 130 PDA which had ~1.5 MB of RAM, an integrated backlight and a faster processor to improve performance.

In August 1996, a patent application was filed with the US Patent and Trademark Office to protect the technical aspects of the technology and methodology of how it was implemented. At the same time, UWRC began market tests process by attending some HAZMAT conferences and demonstrating the prototype and discussing the COTS version that was coming soon. One of the first conferences was the Continuing Challenge in Sacramento in September 1996. This first marketing experience at Sacramento proved to be rewarding with a receptive audience. The organizers understand the objectives of the attendees and the exhibitors and treated both with equal respect. The hazardous materials focus of the Continuing Challenge conference continues and AristaTek still attends and participates as an exhibitor, with this year's to be our 11^{th} straight conference.

The TSWG Project (PEAC-CW) and AristaTek formation

In 1997 the University of Wyoming Milward Simpson Distinguished Lecture Series in UW's Department of Political Science had a presentation by Ambassador Philip C. Wilcox, Jr., then the U.S. State Department Coordinator for Counterterrorism, on the proliferation of weapons of mass destruction. After his lecture, David Sheesley approached Ambassador Wilcox to demonstrate the PEAC tool and discuss how it could be adapted to deal with chemical warfare agents in addition to the TICs/TIMs already included. Ambassador Wilcox suggested that UWRC make contact with another federal agency that was tasked with developing counterterrorism technologies for military and civilian responders; the agency is called the Technical Support Working Group (TSWG).

In 1997, UWRC submitted a proposal to TSWG to develop a version of the PEAC software that would provide information and plume modeling for chemical warfare agents. In the spring of 1999 TSWG signed a contract with UWRC to develop the PEAC-CW (chemical warfare agents) product. AristaTek, then a new spin out from UWRC, was the subcontractor to develop

the enhanced capability.

To satisfy all parties that the database information on the chemical warfare agents and their precursors was correct, the Edgewood Chemical Biological Center (ECBC) that is part of SBCCOM located at Aberdeen Proving Ground, MD provided the database information for the PEAC-CW project. Once the product was completed in June 2000, it was submitted to TSWG for review and evaluation before it could be released as a COTS product. This evaluation was performed by ECBC for TSWG. The evaluation focused on two primary areas:

1. The accuracy of the database information that was displayed to the user. This was the information provided in the Chemical Information, Chemical Protective Clothing selections, and recommended respirators.
2. The plume modeling results when compared to the EPA's ALOHA and the US Army's D2PC dispersion model results. The plume modeling comparison was a complicated task. It assessed the performance for all three models by comparing the results of selected multiple chemicals for different sized releases and under different conditions. The results showed that all three models gave almost the same results for neutral conditions, i.e., daytime conditions, but showed some differences for nighttime conditions, i.e., stable or "worst case" conditions as were described in last month's article. For the nighttime conditions the PEAC plume model typically predicted downwind exclusion distances that were between those predicted by the ALOHA and D2PC models. The results were acceptable to TSWG and its review panel and the product (the PEAC-CW system with the chemical warfare agents and precursors) was then available as a COTS product.

This COTS PEAC-CW product was then released in late 2000 and was immediately recognized as a unique product that met multiple requirements for both the military and the civilian responder community. One of the significant aspects of the software was the proprietary intuitive interface that provided quick and easy access to information, which made training and maintaining proficiency an easier process when compared to the EPA CAMEO product.

The PEAC-WMD Product

During early 2001, it became obvious that additional information related to explosives, bio-agents and radioactive isotopes would be useful for the PEAC customer base. Therefore, in the late spring of 2001 work began on developing additional databases that related to these areas. This process was accelerated when the tragic events of the September 11, 2001 heightened the push to incorporate the additional information into the PEAC application that related to weapons of mass destruction (WMD).

AristaTek also incorporated the use of non-volatile memory cards (Compact Flash and Secure Digital cards) with the ability to load the PEAC application into main memory from the memory card when necessary. The resulting release was referred to as PEAC-WMD 2002. When this product was released AristaTek started using a new logo, Figure 1. It helped to

convey the message to the reader that the application dealt with more than just chemicals; it now addressed all aspects of the WMD or CBRNE matrix.

Figure 1 – New PEAC-WMD logo

Even though the PEAC application had expanded beyond the TICs/TIMs chemicals, the founders have always felt that the primary mission is to provide the information and guidance the responder needs to protect themselves and the public. In addition, it was recognized the best way to ensure that responders are proficient in using a product is to design the product such that it will be used frequently, i.e., for a large assortment of events. This includes accidental or intentional releases, e.g., terrorist events. This is therefore a never-ending process to include not only data on new chemicals, but also the features to provide the user with additional capabilities when dealing with chemicals released from their containers.

The next release focused on several new features plus the continuing work to add new chemicals to the database. The new features included:
1. Providing access or ability to search independent reference sources besides the PEAC-WMD database integrated into the application. This involved incorporating the NIOSH Pocket Guide and the US Coast Guard CHRIS Manual as separately searchable database within the PEAC-WMD application.
2. Inclusion of the Glossary terms and the interactive Glossary built into the application display screens.
3. Logging of all activities performed by the application.
4. Implementing the Threat Matrix display to provide a quick thumbnail assessment of multiple chemicals and the relative threats they presented. This was integrated with the Working List feature to create and even save for later recall a specific list of chemicals.
5. Implementing the EPA's Chemical Reactivity Worksheet to provide assistance assessing the

results of multiple chemicals coming into contact.
6. Implementing an Explosion Calculator to compute standoff distances for improvised explosive devices (IEDs).
7. Including the ATF Vehicle Bomb Tables for appropriate standoff distances from different sized vehicle bombs.
8. Implementation of DOD's NBC Indicator Matrix to assist with identifying WMD class of agent that may have created mass casualties.
9. Use of html data display screens to increase the graphical and text display readability.
10. Implementation of a search feature to assist in finding database entries with certain terms.
11. Implementation of the user specified data files to allow the user to customize the additional information to meet their needs.
12. Modification of the plume modeling to allow the user to specify a continuous mass release rate or an instantaneous released mass.

These new features were accompanied with new database entries for military chemical exposure guidelines, ATSDR medical management guidelines, and the option of including the French and Spanish versions of the DOT Emergency Response Guidebook. To assist all of our customers and particularly our customers located outside the continental United States, the accessibility of new updates was made available through our web site so downloads could be accomplished at the customer's convenience and not just through receipt of a CD via snail mail.

The Current Market Place

One of the common questions we are asked is what is the difference between the PEAC-WMD application and other products on the market, or tell me why your product is better than product ABC or XYZ?

Obviously AristaTek's perspective is different than other vendors and therefore the application will reflect that difference. This description of the AristaTek experience and how the PEAC technology came to its current status was to emphasize how these factors have differentiated the creation of a slightly, or perhaps significantly, different product.

Vendor or manufacturers will have similar objectives but because of their different backgrounds and objectives there will be differences. AristaTek focused on some issues that cannot be ignored when developing an informational and decision support tool that is composed of a database integrated with computational tools. For instance, the creation of the database and expanding it to include a greater number of chemicals, primarily TICs/TIMs since most COTS products and their databases have all the CBRNE agents or those that are legitimate threats.

The founders take pride in the fact that a considerable amount of time and resources have been invested in qualifying the chemical entries that are added to the PEAC-WMD database. It takes time to qualify data and that's why the PEAC-WMD software may not compare head to head with some other vendors' claims for number of chemicals available. Competitors have identified the PEAC-WMD system as not including a greater number of chemicals with their synonyms and trade names. The truth is, adding new chemicals from a public domain database

is not a simple process because the key is to ensure that the new material is accurate. Dr. John Nordin, who writes the monthly technical article included in AristaTek ***First Responder*** newsletter is the individual that oversees the methodology used for addition of new entries into the database. To qualify an entry requires time and correlation with other databases or reference sources to ensure the information is correct. In many cases, what may appear as a reliable reference resource will have errors or invalid information. In those cases where there is doubt or conflicting information on a certain value, we will select the most conservative value, to error on the side of safety when entering values into the database.

AristaTek encourages readers to do some research and understand what technical basis decision support systems come from and the developer's experience before making their decision to purchase. Get a demo copy of the software and evaluate it objectively. Compare the PEAC-WMD application with other products in the marketplace. Ask questions, think about technical support, training materials, and future upgrades. Don't be sold a "bill of goods" by ***Sept 12thers***, which are those that have recently entered the market to capture what they think will be some very quick profits from the nation's First Responder community as they endeavor to protect themselves and the public.

Future Research

Because there are many fundamentals of hazardous materials behavior requiring investigations, the founders have continued to keep abreast of emergency response needs development. During 1999-2001, the AristaTek founders continued to support the Department of Energy (DOE) Hazmat Spill Center (HSC) research program as part-time employees for UWRC working under the contract between UWRC and DOE. Since UWRC no longer had full-time staff with a public safety research background, particularly with hazardous materials, UWRC decided it would relinquish its support contract for the DOE HSC to a new entity. Albany County Research Corporation (ACRC) was formed by the principals of AristaTek as a separate Wyoming not-for-profit corporation in November 2000 and entered into a 5-year contract to support the DOE HSC research program in April 2001. This entity continues to seek research funding to conduct new studies in hazardous materials behavior and transfer the new data and understanding into the public domain. We are constantly looking for new technology that could eventually appear in a future PEAC product.

To give the reader a brief history of some of the research conducted at the HSC, I've included a short description of some of the activities that have been conducted at the HSC. There have been a number of experiments conducted at the HSC. As discussed in detail in last month's (January 2006) newsletter article, the HSC (that was originally named the Liquefied Gaseous Fuels Spill Test Facility [LGFSTF] under the Fossil Energy program management of DOE) was the location of the Kit Fox Series of field experiments the former UWRC employees conducted. Some early experiments dealt with the behavior of liquefied natural gas (LNG) when it is released from its container. These experiments were conducted starting in the early 1980's at the Naval Weapons Center (NWC), China Lake, California. The major concern was the consequences of an accident during the off loading of a LNG tanker at one of the port terminals. LNG was viewed in the late 1970's and early 1980's as significant resource that would be used extensively to supply fuel to the Eastern portions of the United States during the

period when energy prices were escalating rapidly with oil embargos that occurred during the early and late 1970's. In fact, LNG and its presence in port facilities may become an issue again with the current escalation of energy in today's marketplace.

After the first two series of experiments conducted at the China Lake site, the nation decided to have DOE build a permanent facility and selected the Frenchman Flat dry lakebed at the Nevada Test Site for the LGFSTF. The facility has been the site of numerous testing:
· LNG release experiments (Falcon Series - June – Aug 1987)
· Anhydrous Ammonia releases (Desert Tortoise Series - Aug & Sept 1983)
· Nitrogen Tetroxide releases (Eagle Series – Sept & Oct 1983)
· Anhydrous Hydrofluoric Acid releases (Goldfish Series – Aug 1986)
· Chlorosulfonic Acid, 65% Oleum, and Sulfur Trioxide releases (Apr 1990)
· Trichlorosilane and Silicon Tetrachloride releases (May 1990)
· Liquid Chlorine releases (May 1990)
· Hydrogen Fluoride suit tests (May – July 1991) in the newly constructed wind tunnel

Additional information, description, and references to publications that used data collected from these experiments can be found in contributed chapter in *The Handbook of Hazardous Materials Spills Technology* the AristaTek founders authored in 2001[1].

The photo below was taken during the Anhydrous Hydrofluoric Acid releases (Goldfish Series) sponsored by Amoco Corporation and Allied Signal Corporation in August 1986. The cloud seen is the actual aerosol that was generated and which moved downwind a significant distance.

Figure 2 – Goldfish Series Anhydrous Hydrogen Fluoride release at HSC

Another photo of the some of the work done is in Figure 3, taken during the Trichlorosilane and Silicon Tetrachloride releases sponsored by the Silicones Health Council and conducted in May 1990. A series of experiments were conducted at the HSC to evaluate the effectiveness of

aqueous foams for suppressing vapors and mitigate chlorosilane fires

Figure 3 – May 1990 Trichlorosilane and Silicon Tetrachloride releases

As mentioned in last month's article, the HSC is now used mostly for classified experiments conducted by DTRA and other government agencies that require a remote, secure and open area to test technologies or systems that can't be tested any other place.

[1] King, S. Bruce, J. Nordin, D. Sheesley, and T. Routh, "U.S. DOE HAZMAT Spill Center Database," *The Handbook of Hazardous Materials Spills Technology,* McGraw-Hill Professional Publishing, Editor, Merv Fingas, August 2001.