

## CT-Analyst Integration in Chemical/Biological/Radiological (CBR) Analysis Applications

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**Introduction:** Modern information systems used in the fight to prevent or respond to chemical, biological, and radiological (CBR) attacks are greatly improved by incorporating complex plume modeling as a resource in their applications. This is one of the principal reasons that NRL's CT-Analyst (Contaminant Transport Analyst) has become such a valuable software tool in the field of CBR analysis. CT-Analyst accurately models the transport and dispersion of contaminants for instantaneous situation assessment. By taking advantage of compressed data structures pre-computed in a high performance computing (HPC) environment, it runs in real time, without having to re-compute each time a change is made to a given scenario. CT-Analyst is also designed for smaller scales than other similar tools — specifically cities, downtowns, and other complex urban environments. The computing speed and the focus on areas where attacks are likely to occur distinguish CT-Analyst as one of the top tools for use by first responders, crisis management teams, simulation designers, and others interested in fast and reliable plume predictions. CT-Analyst is also versatile in its connectivity with other applications; its application programming interface opens it to developers in a range of applications, and allows it to interface with many widely available public tools. Thus, CT-Analyst's integration with applications in the CBR arena makes it a powerful asset to the military, homeland security, local authorities, and software developers.

**Geographical Information Systems:** CT-Analyst's core functionality is to produce time-dependent plumes over a geographic area, and while the tool itself contains its own user-friendly graphical user interface (GUI), other products can also be used to display this kind of information. Some of the latest tools used to map, visualize, and process local and global geography are Geographical Information Systems (GIS), which range from publicly available programs, such as Google Earth, to more industry-specific tools. The advantage of a program such as Google Earth in particular is that it is well known by household users and by corporate and government institutions alike. The wide familiarity of this program makes it ideal for exporting CT-Analyst data and making it readily understood and usable by anyone. Google Earth's KML file format can show all the display states CT-Analyst offers, including plumes, total footprint, backtrack, consequence, and others (Fig. 7).

**Simulations:** CT-Analyst has been integrated alongside a number of simulation tools as well, with its plume predictions replacing the often simplified oval or standard Gaussian puff models that are part of many of these systems. One Semi-Automated Forces (OneSAF) is a military simulation used for demonstrating complex entity interaction, taking into account environmental factors and unit behaviors. OneSAF's existing model of representing plumes was replaced by CT-Analyst's, correctly modeling smoke and other airborne hazards so that line of sight and contamination could be computed, ultimately affecting the behaviors of units and the outcome of a given scenario. This greatly benefited the accuracy and effectiveness of the OneSAF model and emphasized the value of CT-Analyst capabilities.

CT-Analyst is also being incorporated into another simulation tool, Virtual Battlefield 2 (VBS2), a product of Bohemian Interactive. VBS2 is a gaming product that allows players to train in a variety of scenarios, including terrorist attacks, urban combat, or other types of missions. Like OneSAF, VBS2 natively features a very basic plume model, one that essentially operates on only a visual level, and involves no knowledge of terrain, buildings, or any other part of the geometry (Fig. 8). In this ongoing integration project, the objective is to have an interface between the VBS2 game engine and CT-Analyst, so that plumes are produced in CT-Analyst based on in-game events and then sent back into the game for display and for effects on the players.

**Preparedness Tools:** First responders and emergency planners have a variety of CBR analysis tools at their disposal. One of them, Chemical Biological Response Aide (CoBRA), features a highly detailed database of known contaminants and an incident reporting system that allows responders and officials at varying levels to both input and receive information from all the other users of the software. CT-Analyst was incorporated into CoBRA (Fig. 9) with several capability goals: 1) to have the CT-Analyst GUI embedded inside of CoBRA so that actual or practice events could be input, 2) to have such events saved out and inserted into the incident reporting system, 3) to allow other users to recall these reports and display the exact scenario within their own copy of the GUI, and 4) to locate important federal buildings in a scenario and determine if they are in the affected areas. All of these goals were satisfied in the integration project, with CT-Analyst able to quickly and easily distribute scenarios involving contaminant releases, and detect and report affected buildings.

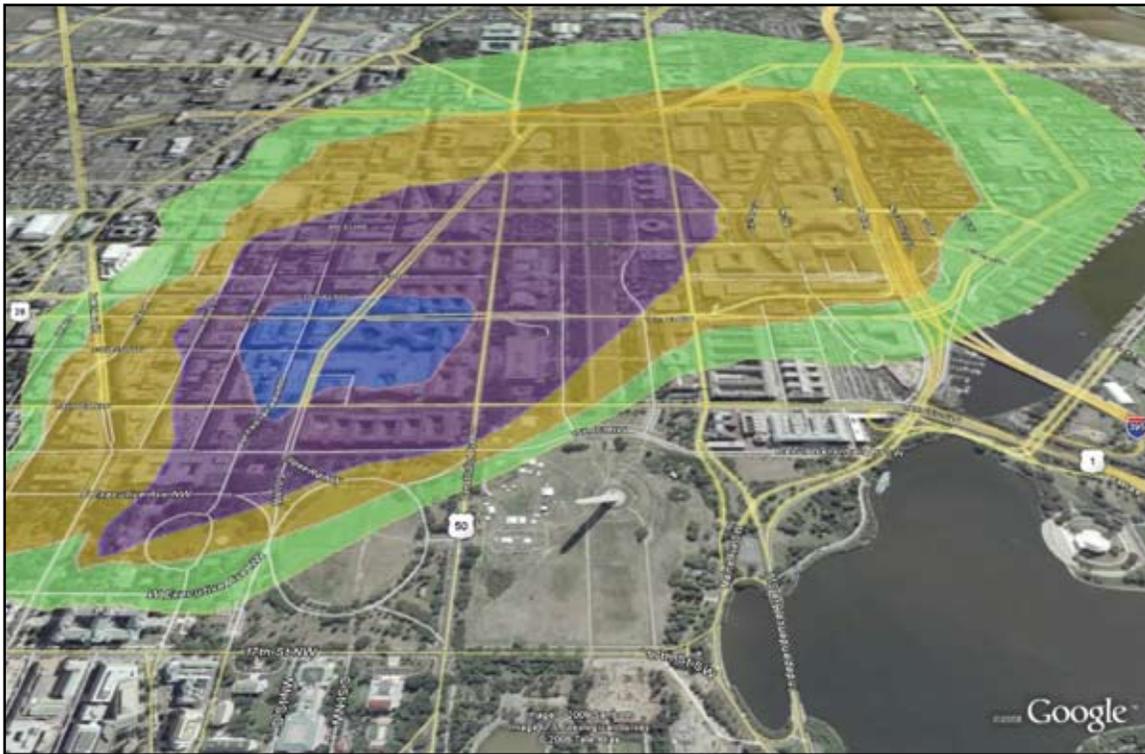
**Summary:** CT-Analyst's core ability to produce time-dependent plumes in complex urban environ-

# Report Documentation Page

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**FIGURE 7**  
CT-Analyst plumes displayed in Google Earth, showing the same colors and density information as in the CT-Analyst program.

ments is useful in a variety of applications in the CBR field. Among the common GIS systems, simulation tools, and emergency preparedness applications in use today, CT-Analyst has found a role in each. CT-Analyst is enhancing products that people are already using, and is certain to be important in other products undergoing development or yet in the planning stages.

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**FIGURE 8**  
Plumes as they appear in VBS2; work is ongoing to replace this format with time-dependent plumes from CT-Analyst.

The screenshot shows the CoBRA 4 - Sidewinder web application. The main content area displays 'CT-Analyst 3.2, LCPFD, Naval Research Lab' with a 'Switch to CT-Analyst View' button. Below this is a table titled 'Building Alerts' with the following data:

ID	Label	Type	Hot	UTM Easting	UTM Northing	UTM Zone	UTM Hemisp.
12	3632 W/INRE	3=Site	1=Hot	323022	4305935	18	N
13	CONNECTIC	3=Site	1=Hot	323022	4305935	18	N
14	mount alto sit	3=Site	1=Hot	323022	4305935	18	N
17	2121 VIRGIN	3=Site	1=Hot	323022	4305935	18	N
18	1709 NEW Y	3=Site	1=Hot	323075 3 99	4307257 969	18	N
19	901 SCHOOL	3=Site	1=Hot	323022	4305935	18	N
21	THE PORTA	3=Site	1=Hot	323022	4305935	18	N
22	EPA W/EST	3=Site	1=Hot	323792 5999	4306764 130	18	N
23	JOHNA. WIL	3=Site	1=Hot	323861 7 00	4307141 229	18	N
24	*525 SCHOO	3=Site	1=Hot	323022	4305935	18	N
25	1291 *AVLD	3=Site	1=Hot	323022	4305935	18	N
26	460 NEW YD	3=Site	1=Hot	323022	4305935	18	N

**FIGURE 9**  
CT-Analyst incident reporting information embedded in CoBRA.