AROOSTOOK COUNTY HAZARDOUS MATERIALS EMERGENCY RESPONSE PLAN

Attachment 8

ALOHA® PROGRAM OVERVIEW

ALOHA® Program Overview

Excerpted from: US Department of Commerce
National Oceanic and Atmospheric Administration
Office of Response and Restoration
http://response.restoration.noaa.gov/oil-and-chemical-spills/chemical-spills/response-tools/aloha.html

OVERVIEW

ALOHA (Areal Locations of Hazardous Atmospheres) is a program designed to model chemical releases for emergency responders and planners. It can estimate how a toxic cloud might disperse after a chemical release and also features several fires and explosions scenarios.

ALOHA displays its estimate as a threat zone, which is an area where a hazard (such as toxicity, flammability, thermal radiation, or damaging overpressure) has exceeded a user-specified Level of Concern (LOC).

With the help of ALOHA, you can calculate how quickly chemicals are escaping from tanks, puddles (on both land and water), and gas pipelines and predict how that release rate changes over time.

The program generates a variety of scenario, including threat zone plots, threats at specific locations, and source strength graphs. You can then display threat zones on MARPLOT maps (and on ArcView and ArcMap with the Arc Tool extensions).

ALOHA allows you to model many release scenarios: toxic gas clouds, BLEVEs (Boiling Liquid Expanding Vapor Explosions), jet fires, vapor cloud explosions, and pool fires. Depending on the release scenario, ALOHA evaluates the corresponding type of hazard.

As part of the CAMEO software suite, ALOHA works seamlessly with the companion programs CAMEO Chemicals and MARPLOT. However, it can also be used as a standalone program.

WORKING WITH ALOHA

ALOHA is designed to produce results quickly enough to be of use to responders during a chemical emergency response. ALOHA can help responders rapidly assess the scale of a chemical incident—that is, whether the release will travel 10s, 100s, or 1,000s of yards.

To help you get the hazard information you need quickly, ALOHA:

- Minimizes data entry errors by checking the input values and warning you if the value is unlikely or not physically possible. ALOHA also offers default values when possible.
- Contains its own chemical library with physical properties for approximately 1,000 common hazardous chemicals so that you do not have to enter that data.
- Uses calculations that are a compromise between accuracy and speed.

In addition to emergency response, ALOHA's hazard modeling capabilities can also be used for planning, training, and academic purposes.

Using ALOHA to Model a Toxic Gas Cloud, Fire, or Explosion

To model hazards with ALOHA, you must enter the required scenario information (see below). ALOHA's easy-to-use interface guides you through the data entry process using a series of dialog boxes. Detailed help is provided with each dialog box.

Required Inputs:

- Enter basic scenario information (such as date, time, and location).
- Choose a chemical from ALOHA's chemical library.
- Enter atmospheric information (such as wind speed and direction, air temperature, and cloud cover) by hand or automatically using a portable station for atmospheric measurements (SAM).
- Choose a source: direct, puddle, gas pipeline, or tank.
- Enter source information (such as release amount, tank dimensions, and whether the chemical is burning).
- Specify the Levels of Concern (LOCs) you want ALOHA to use when estimating the threat zones or use the default LOCs ALOHA offers.
- Choose the type of hazard (such as toxicity or thermal radiation) you want ALOHA to use when estimating the threat zones.

As you enter information, ALOHA displays key information in a Text Summary screen. Once all of ALOHA's calculations are complete, you can display the results in a variety of graphical outputs (including a threat zone picture).

ALOHA displays your hazard modeling results in four windows: threat zone, text summary, threat at a point, and source strength. The contents of each window can be printed, pasted into other documents, or saved.

THREAT ZONES AND OTHER OUTPUT

Threat Zone Window

An ALOHA threat zone estimate displayed on a Google Earth map. The red, orange, and yellow zones indicate areas where specific Level of Concern thresholds were exceeded.

This window displays up to three threat zones overlaid on a single picture. A threat zone represents the area within which the hazard level (toxicity, flammability, thermal radiation, or overpressure) is predicted to exceed your Level of Concern (LOC) at some time after a release begins.

If you choose three LOCs, ALOHA will display the threat zones in red, orange, and yellow. By default, the red zone represents the worst hazard. For dispersion scenarios, you may also see dashed lines along both sides of the threat zone, which represent uncertainty in the wind direction.

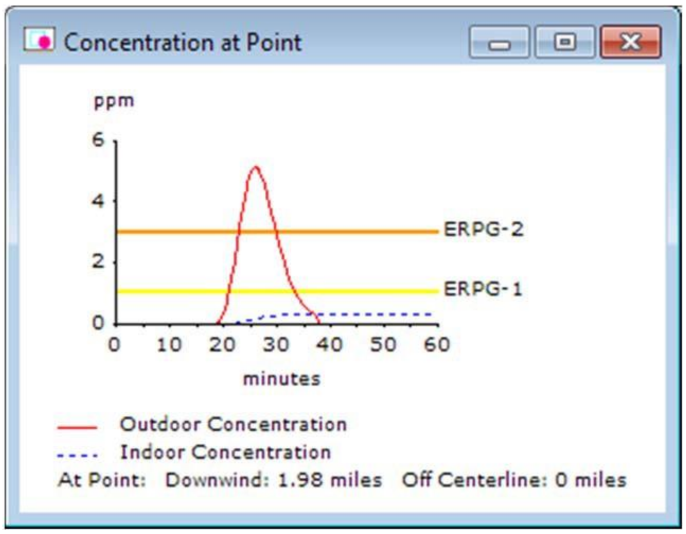
Threat zone estimates can also be displayed in a variety of mapping programs, including MARPLOT, ArcGIS (using the ALOHA Arc Tools), Google Maps, and Google Earth.

Text Summary Window

This displays the scenario information you entered; physical properties of the selected chemical; and ALOHA's source strength, threat zone, and threat at a point estimates as text.

Threat at a Point Window

This window displays specific information about the hazards at a selected point of interest (such as a school or hospital) that is in or around the threat zones. ALOHA will display the Threat at Point either as a graph or as text. For example, if you choose to see the Threat at Point for a toxic gas dispersion scenario, ALOHA will display a graph of concentration versus time like the one at right.



This Concentration at Point graph shows the ground-level chemical concentrations in outdoor and indoor air at a user-specified location. If applicable to the chosen location, up to three horizontal lines representing the LOCs may be shown (as in this picture).

Source Strength Window

This displays either the predicted rate at which the chemical enters the atmosphere or the burn rate, depending on the scenario. The graph shows the rate (source strength) for the first hour after a release begins or until the release is complete, whichever is shortest.

LIMITATIONS

ALOHA predicts source strength as a series of hundreds of brief time steps. These values must be averaged into fewer steps so that calculations can be completed quickly.

ALOHA's accuracy depends on the quality of the information you give it to work with. But even when you provide the best input values possible, ALOHA (like any model) can be unreliable in certain situations, and it cannot model some types of releases at all.

Conditions that Reduce Atmospheric Mixing

When making concentration estimates, ALOHA assumes that the chemical is released into the atmosphere and immediately becomes mixed so that the concentration looks like a bell-shaped curve throughout the cloud (the highest concentration is downwind along the centerline). Even though that is not exactly what happens in a chemical release, this "Gaussian" assumption is fairly typical and provides reasonable concentration estimates in most cases.

However, ALOHA's concentration estimates can be less accurate when any condition exists that reduces mixing in the atmosphere. For example:

- Very low wind speeds. At very low wind speeds (less than 3 miles per hour) the pollutant cloud does not mix quickly with the surrounding air. The concentration of the gas in the chemical cloud may remain higher than ALOHA predicts, especially near the source.
- Very stable atmospheric conditions. Very stable atmospheric conditions (stability classes E and F) generally occur at night or in the early morning, and may be indicated by conditions such as low-lying fog. Under these atmospheric conditions, gas concentrations within a pollutant cloud can remain high far from the source.

Concentration Patchiness, Particularly Near the Source

Concentration patchiness is the term used for situations where the gas concentration cannot be described as a bell-shaped curve (as mentioned above). Concentration patchiness occurs in every dispersing cloud, particularly very near the source.

Near the source, ALOHA's concentration estimates may overestimate or underestimate concentrations, because ALOHA uses concentration averages. For the average concentration to be valid, the cloud must travel downwind to the point where enough eddies have mixed the air and the gas. This distance varies depending on the stability, wind speed, and release details. If the maximum distance to the toxic Level of Concern (LOC) concentration is less than 50 meters, ALOHA will not show the threat zone, because concentration patchiness makes the estimate unreliable near the source of the release (where patchiness is most pronounced).

ALOHA Doesn't Account for Some Effects

When using ALOHA, keep in mind that the program doesn't account for the effects of:

- Byproducts from fires, explosions, or chemical reactions. ALOHA doesn't account for the byproducts of combustion (such as smoke) or chemical reactions. The smoke from a fire, because it is has been heated, rises before it moves downwind. ALOHA doesn't account for this initial rise. ALOHA assumes that a dispersing cloud does not react with the gases that make up the atmosphere, such as oxygen and water vapor. However, many chemicals react with dry or humid air, water, other chemicals, or even themselves. Because of these chemical reactions, the chemical that disperses downwind might be very different from the chemical that originally escaped from containment. In some cases, this difference may be enough to make ALOHA's dispersion predictions inaccurate.

- Particulates. ALOHA does not account for the processes that affect dispersion of particulates (including radioactive particles).
- Chemical mixtures. ALOHA is designed to model the release and dispersion of pure chemicals and a few select solutions; the property information in its chemical library is not valid for mixtures of chemicals.
- Wind shifts and terrain steering effects. ALOHA assumes that wind speed and direction are constant throughout the area downwind of a chemical release. ALOHA also expects the ground below a dispersing cloud to be flat. In reality, though, the wind typically shifts speed and direction as it flows up or down slopes, between hills or down into valleys, turning where terrain features turn. In urban areas, wind flowing around large buildings forms eddies and changes direction and speed, significantly altering a cloud's shape and movement. ALOHA ignores these effects when it produces a threat zone estimate.
- Terrain. ALOHA assumes the ground is flat, which has different implications depending on the release scenario. For liquid releases, ALOHA does not account for pooling within depressions or the flow of liquid across sloping ground. ALOHA assumes that the liquid spreads out evenly in all directions, which may cause the puddle size and release rate to be overestimated when the ground is not flat. For gas releases, ALOHA does not account for changes in wind flow that can occur as the cloud is diverted by tall buildings and mountains.
- Hazardous fragments. If a chemical release involves an explosion, there will be flying debris from the container and the surrounding area. ALOHA does not model the trajectories of the hazardous fragments.