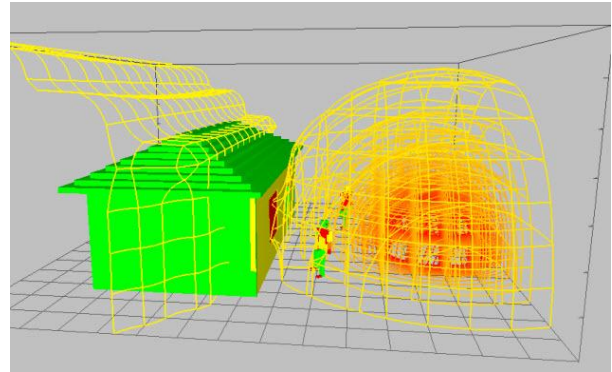


## BREEZE HEXDAM

The High Explosive Damage Assessment Model (HEXDAM) is designed to evaluate the damage caused to structures within a facility as a result of a primary explosion and any accompanying secondary explosions.

The application can also predict injury to an unlimited number of personnel in the facility. The principal use of HEXDAM software is for site analysis of explosive storage and manufacturing facilities; however, the software can also be used to evaluate terrorism and sabotage threats to an industrial or military facility.



### Overview

BREEZE HEXDAM can be used as a damage/injury assessment tool to determine the amount of blast damage/injury done to individual structures/persons in a certain geographical area due to the detonation of explosives at ground-level or at a specified height above the ground. This type of information would be helpful in determining the potential for destruction/ injury at an industrial facility where significant amounts of explosives are manufactured, handled, and/or stored. Such information should also be useful in evaluating the risk represented by acts of terrorism or sabotage to any commercial building or industrial complex.

Other information may be useful in determining whether structures subject to explosion (magazines, storage tanks, and fuel stockpiles, etc.) received enough damage to explode, and if so, how much additional damage/injury was done to other structures/ persons near the explosion. Because of the shielding algorithm in BREEZE HEXDAM, the effects of the presence of a shielding wall or a blast deflector can be taken into account.

HEXDAM has the capability to model an unlimited number of structures, each with different dimensions and structural properties, including elevated structures, and also an unlimited number of personnel.

HEXDAM utilizes widely accepted dynamic pressure and overpressure curves to predict the pressure level at each structure/person location. Structure shielding, based on the three-doublet advanced shielding algorithm, and secondary explosion effects are calculated, and damage/injury levels are determined for each structure/person. HEXDAM produces output in the form of damage/injury tables, before-blast and after-blast displays, pressure and damage/injury contour plots, and damage/injury-versus-distance graphs, all in color. Advanced graphical features include three-dimensional graphics in the form of oblique projections, as well as two-dimensional horizontal and vertical cross sections for both pressure contour and damage/injury contour plots.

BREEZE HEXDAM for Windows capabilities include:

- Predicts blast damage to 104 basic structure types and user defined structures
- Predicts blast injury to the human body via the "HEXDAM Man" human injury assessment mode
- Compatible with BREEZE Vulnerability Assessment of Structurally Damaging Impulses and Pressures (VASDIP) software
- Predicts blast damage/injury to both overpressure-sensitive and dynamic pressure-sensitive structures
- Predicts shielding effects by each structure on surrounding structures
- Predicts blast damage/injury resulting from secondary explosions triggered by a primary blast
- Models individual structures and/or persons within a structure or facility
- Models elevated structures Automatic or user-specified subdivision of structures Generates pressure and damage/injury contours

## Technical

In a BREEZE HEXDAM scenario analysis, a primary explosion is specified within or about a facility consisting of one or more structures and/or persons. Pressures received by each structure/person in the facility are calculated based on each structure's/person's location relative to the primary explosion, as well as, any secondary explosion. The effects of structures/persons shielding one another may also be taken into account.

The damage/injury occurring to each structure/person is then calculated based on the magnitude of the pressure it received and its ability to withstand the pressure. In addition to the calculations of pressures and damages/injuries occurring at the structures/persons within the facility, the user may overlay a grid (either 2-D or 3-D) over the facility to calculate pressures that occur at these locations. In a similar manner, the user may overlay a grid within specific structures/persons in order to analyze the distribution of damage/injury within the structures/persons.

## Input

- Primary explosion
  - location (including height)
  - yield
- Individual structures/persons
  - location
  - dimensions (length, width, height)
  - orientation
  - structure/person type
    - 104 basic (inanimate) structure types
    - 19 human body component types
    - user-defined types
  - explosion threshold for secondary explosions
  - yield for secondary explosions

## Output

The basic outputs of BREEZE HEXDAM are designed to provide descriptions (both tabular and graphical) of the structure(s)/person(s), which has been exposed to the primary explosion. Such outputs include the following:

- Before-Blast Display - Provides 3-D oblique projections and 2-D horizontal and vertical cross sections in color of all structures/persons being modeled.
- Damage/Injury Table - For each structure/person provides pressure level and damage/injury assessment.
- After-Blast Display - Provides same 3-D oblique projections and 2-D horizontal and vertical cross sections in color as Before-Blast Display but also indicates color-coded damage/injury level to each structure/person.
- Damage/Injury vs Distance Graph - Provides plot of damage/injury levels to all structures/persons versus distance from primary explosion.
- Pressure Contours - Provides 3-D oblique projections and 2-D horizontal and vertical cross sections of overpressure and dynamic pressure contours in color.
- Damage/Injury Contours - Provides 3-D oblique projections and 2-D horizontal and vertical cross-sections of contour plots of damage/injury levels to any specified structure/person in color.
- Data Tables - Provides tabulation of overpressure, dynamic pressure, and/or damage/injury at each grid point used in contour plots.

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