General Characteristics		
1	**Abstract of Model Capabilities**	ALOHA is an emergency response model intended primarily for rapid deployment by responders, as well as for use in emergency preplanning. It incorporates source strength, as well as Gaussian and heavy gas dispersion models and an extensive chemical property library. Model output is in both text and graphic form, and includes a "footprint" plot of the area downwind of a release, where concentrations may exceed a user-set threshold level. ALOHA can accept weather data transmitted from portable monitoring stations, and can plot footprints on electronic maps displayed in a companion mapping application, MARPLOT.
2	**Sponsor and/or Developing Organization**	Joint sponsorship by the following organizations: (1) National Oceanic and Atmospheric Administration Hazardous Materials Response and Assessment Division 7600 Sand Point Way N.E. Seattle, WA 98115 (2) United States Environmental Protection Agency Chemical Emergency Preparedness and Prevention Office Washington, DC 20460
3	**Last Custodian/ Point of Contact**	Dr. Jerry Galt NOAA/HAZMAT 7600 Sand Point Way N.E. Seattle, WA 98115 Phone: (206) 526-6323 jerry_galt@hazmat.noaa.gov **primary individual** Phone: (206) 526-6945 mark_miller@hazmat.noaa.gov **secondary individual**
4	**Life-Cycle**	ALOHA was first written in BASIC for the Apple II + in the early 1980's as a passive gas plume model for in-house response use. It was rewritten in FORTRAN for the Apple Macintosh in the mid-1980's. A chemical property library, meteorological station serial port interface, and base mapping were added in the late 1980's. ALOHA was rewritten again in C, and time-dependent Gaussian and heavy gas dispersion and additional source strength algorithms were added in 1991. A version for Microsoft Windows was released in 1992. New upgrades of ALOHA are released approximately every two years. ALOHA 5.2 was released in early 1995.
5	**Model Description Summary**	ALOHA computes time-dependent source strength for evaporating puddles (boiling or nonboiling), pressurized or non-pressurized gas, or liquid release from a storage vessel, and pressurized gas from a pipeline. User can also enter a constant source strength and release duration. ALOHA can model pure non-reactive chemicals. More than 700 pure chemicals are included in ALOHA's chemical library. ALOHA models Gaussian puff and plume, and heavy gas dispersion. Wind speed and direction are assumed constant in all horizontal directions. However, ALOHA accounts for the effects of vertical wind shear on both Gaussian and heavy gas dispersion, and on pool evaporation. Modified time-dependent Gaussian equation based on "Handbook on Atmospheric Diffusion" and heavy gas dispersion based on "Development of an Atmospheric Dispersion Model for Heavier-Than-AirGas Mixtures".
6	**Application Limitation**	ALOHA models releases and disperses pure, nonreactive chemicals only. It does not account for terrain steering or changes in wind speed and horizontal direction, nor does it model particulate dispersion. It does not account for initial positive buoyancy of a gas escaping from a heated source. Due to its non-robust Gaussian nucleus, improvements in its ability to address comprehensive scenarios, is limited.
7	**Strengths/ Limitations**	**Strengths:** ALOHA has many strengths on the chemical source term side and many weaknesses on the dispersion model side. These are enumerated in the body of the evaluation. **Limitations:** ALOHA has many strengths on the chemical source term side and many weaknesses on the dispersion model side. These are enumerated in the body of the evaluation.
8	**Model References**	**!** National Oceanic and Atmospheric Administration, Hazardous Materials Response and Assessment Division (NOAA-HMRAD), 1992, ALOHA *(Areal Locations of Hazardous Atmospheres), 5.0 Theoretical Description*, Contribution No. HMRAD 92-5, draft report, Seattle. WA. **!** NOAA-HMRAD and United States Environmental Protection Agency, Chemical Emergency Preparedness and Prevention Office, 1992, *ALOHA User's Manual*, National Safety Council, Washington, D.C. **!** NOAA-HMRAD and United States Environmental Protection Agency, Chemical Emergency Preparedness and Prevention Office, 1992, *ALOHA User's Manual*, National Safety Council, Washington, D.C.

9	**Input Data/Parameter Requirements**	Mean wind speed, wind direction, and air temperature (this information can be transmitted from a portable monitoring station to ALOHA); ground roughness length, cloud cover in tenths; and relative humidity. Time, date, latitude, and longitude (geographic information for individual cities is stored in ALOHA's location library) are required to compute solar radiation and atmospheric pressure (computed from elevation information in the location library), which affects some source strength estimates.
10	**Output Summary**	Text summaries of user inputs and model results; graphs of predicted source strength and on- and off-centerline indoor and outdoor concentrations; dose over time at specified locations; and a "footprint" plot of the area downwind of a release where concentrations may exceed a user-set threshold level. Complete scenario sets can be saved as archive files.
11	**Applications**	ALOHA enjoys wide use in the public and private sector.
12	**User-Friendliness**	ALOHA is designed to be extremely user friendly. It contains pull down menus with prompts and warning and caution messages.
13	**Hardware-Software Interface Constraints/ Requirements**	ALOHA runs on Apple Macintosh computers in Microsoft Windows (Version 3.0 or later). It requires at least 1 megabyte of RAM and a hard drive. It enjoys extremely good portability and can be used by a first responder at the scene of an emergency. **Run execution time** (for a typical problem)**:** 1-2 minutes **Programming language:** FORTRAN 77
14	**Operational Parameters**	**Identify whether the code has any error diagnostic messages to assist the user in troubleshooting operational problems:** No information provided. **Set up time for:** No information provided. **Typical times are:** ***first-time user:*** NA ***experienced user:*** NA
15	**Surety Considerations**	**All quality assurance documentation:** No information provided. **Benchmark runs:** No information provided. **Validation calculations:** No information provided. **Verification with field experiments that has been performed with respect to this code:** See references above.
16	**Runtime Characteristics**	Several seconds (CRAY) to 1-2 minutes (workstation).

Specific Characteristics

Part A: Source Term Submodel Type		
A1	**Source Term Algorithm?**	_✔_YES __NO
A2	**For Chemical Consequence Assessment Models**	**Liquid spill: _✔_ pool evaporation __ particulate resuspension** **Pressurized releases:_✔_ two-phase jets_✔_ flashing__ entrainment_✔_ aerosol formation** **Solid spills: __ resuspension __ sublimation**
Part B: Dispersion Submodel Type		
B1	**Gaussian**	**_✔_Straight-line plume _✔_Segmented plume __ Statistical plume __ Statistical puff**
Part C: Transport Submodel Type		
C2	**Deterministic**	ALOHA is a deterministic model without any prognostic capability.
C4	**Frame of Reference**	**_✔_ Eulerian __ Lagrangian __ Hybrid __ Eulerian-Lagrangian**
Part D: Fire Submodel Type (Not Applicable).		
Part E: Energetic Events Submodel Type (Not Applicable).		

Part F: Health Consequence Submodel Type		
F1	**For Chemical Consequence Assessment Models**	**Health effects: __ fatalities __ cancers __ latent cancers __ symptom onset** **Health criteria** **_✔_ IDLH __ STEL __ TLV __ TWA** **__ ERPG __ TEEL __ AEGL __ WHO** **Zones with flammable limits: __ UFL __ LFL** **Blast overpressure regions:** **Fire radiant energy zones:** **Risk qualification:** **Concentration: __ single value __ time-history __ integrated dose** **Probits:**
F2	**For Radiological Consequence Assessment Models**	**Cloudshine: __ finite cloud __ semi-finite cloud __ other** **Groundshine: __ short-term __ long-term** **Inhalation: __ short-term _✔_ long-term** **__ Total effective dose equivalent** **__ Uptake of respirable fraction of particle spectra** **Resuspension: __ short-term __ long-term __ Anspaugh** **Food/Water Ingestion: __ dynamic __ static** **Dose assessment: __ ICRP-60 criteria __ organs __ pathways** **Health effects: __ early __ latent**
Part G: Effects and Countermeasures Submodel Type (No Information Provided.)		
Part H: Physical Features of Model		
H1	**Stability Classification Turbulence Typing**	**Pasquill-Gilfford-Turner:** ALOHA uses the six class (A-F) Pasquill-Gifford-Turner classification system. **STAR:** ALOHA can determine the stability class using cloud ceiling, cloud cover, solar insolation, day-night criterion, and wind speed, using the STAR technique that is commonly applied to first-order National Weather Service station hourly observations. **Irwin:** **Sigma theta:** ALOHA can directly calculate stability class from the sigma theta measurements obtained from its SAM hookup. **Richardson number:** **Monin-Obukhov length:** **TKE-driven:** **Split sigma:**
H2	**Release Elevation**	**_✔_ ground _✔_ roof**
H7	**Cloud Buoyancy**	**_✔_ neutral [passive] _✔_ dense [negative] __ plume rise [positive]**
H10	**Deposition**	**__ gravitational setting __ dry deposition __ precipitation scavenging** **__ resistance theory deposition __ simple deposition velocity __ liquid deposition** **__ plateout and re-evaporation**
Part I: Model Input Requirements		
I1	**Radio(chemical) and Weapon Release Parameters**	**Release rate: _✔_ Continuous _✔_ Time dependent _✔_ Instantaneous** **Release container characteristics: _✔_ vapor temperature** **_✔_ tank diameter** **_✔_ tank height _✔_ tank temperature _✔_ tank pressure _✔_ nozzle diameter** **_✔_ pipe length** **Jet release: __ initial size __ shape** **_✔_ concentration profile at end of jet affected zone** **Release dimensions: _✔_ point __ line _✔_ area** **Release elevation: _✔_ ground _✔_ roof __ stack**

I2	**Meteorological Parameters**	**Wind speed and wind direction: ✔ single point __ single tower/multiple point __ multiple towers** **Temperature: ✔ single point __ single tower/multiple point ✔ multiple towers** See above. **Dew point temperature: __ single point __ single tower/multiple point __ multiple towers**. **Precipitation: __ single point __ single tower/multiple point __ multiple towers** See above. **Turbulence typing parameters: __ temperature difference __ sigma theta __ sigma phi __ Monin-Obukhov length ✔ roughness length ✔ cloud cover ✔ incoming solar radiation ✔ user-specified** **Four dimensional meteorological fields from prognostic model:**
Part J: Model Output Capabilities		
J1	**Hazard Zone**	Yes, per input IDLH value. However, the user can input other health effects indicators such as ERPG's and LOC's.
J2	**Graphic Contours and Resolution**	Yes
J3	**Concentration Versus Time Plots**	Yes
J4	**Tabular at Fixed Downwind Locations**	Yes
J5	**Health Effects**	**✔ toxicity indices [e.g., ERPG's, PAG's] __ potential fatalities __ cancers __ other adverse effects**
J6	**Number of People Affected, Calculated at What Resolution?**	**✔ block ✔ block group ✔ country** ALOHA can provide this information if overlain on the MARPLOT demographic information.
J7	**Graphic Contours of Probability of Exceeding Concentration**	For a specified concentration value, ALOHA shows outdoor and indoor time concentration plots as they compare to that value.
J9	**Commerical Off-the-Shelf (COTS) Geographic Information System (GIS) Used**	MARPLOT
Part K: Model Usage Considerations		
K1	**Ease of Model Use**	Training required to run the model: 1 background (years of education) 1-3 months training time needed on the model to be able to exercise all model capabilities Training required to continue development of the model: 4 background (years of education) 6-12 months training time needed on the model to be able to exercise all model capabilities
K3	**Ease of Use of Output, Evaluated as the Time Needed to Train a College Graduate in the Use of the Output**	ALOHA's output is designed for easy use and interpretation.