General Characteristics		
1	**Abstract of Model Capabilities**	EMGRESP is a screening tool for assessing the downwind distance to a select chemical concentration. The source term models in the program include release of a pure vapor through an orifice, release of a subcooled liquid from a reservoir, and point source instantaneous and continuous plume gas releases. All source-term models are linked to neutral and heavy gas dispersion models.
2	**Sponsor and/or Developing Organization**	Ontario Ministry of the Environment Air Resources Branch 880 Bay St., 4th Floor Toronto, Ontario M5S 1Z8 Phone: (416) 325-4000
3	**Last Custodian/ Point of Contact**	Dr. Robert Bloxam Science & Technology Branch 2 St. Clair Ave. W. Floor 12A Toronto, Ontario M4V 1L5 (416) 323-5073 Sunny Wong Science & Technology Branch 2 St. Clair Ave. W. Floor 12A Toronto, Ontario M4V 1L5 (416) 323-5073
4	**Life-Cycle**	Development of the first version of EMGRESP began in 1980s as an adaptation of a more sophisticated simple (neutral) and heavy gas model implemented by the Ontario Ministry of the Environment on an IBM mainframe. The initial version was released in 1985. The 1988 release considered in this evaluation includes, in addition to the 1985 release, capabilities for modeling an evaporating liquid pool. The latest release of EMGRESP was in 1991 and provides for elevated and buoyant releases and buoyancy effects from fires. However, these latest upgrades are not documented in the user's guide and therefore were not reviewed in this evaluation.
5	**Model Description Summary**	EMGRESP is a PC-based source term and dispersion screening tool designed for obtaining downwind distances to select levels of concern with a minimum of user input and computational expense. Its use is primarily as an emergency response tool in the event of a release of a hazardous chemical. The program provides hazardous contaminant information, calculates toxic concentrations at various distances downwind of a release, and displays the information on the screen compared to threshold exposure levels such as the Threshold Limit Values (TLV), Short Term Exposure Limits (STEL), and Immediately Dangerous to Life and Health (IDLH). Finally, in the event the release possesses combustible properties, the code gives an estimate of the mass of vapor within the flammable limits. The source term models consist of a gas release from a reservoir, a liquid release from a vessel, and liquid pool evaporation. The dispersion capabilities consist of a neutrally buoyant Gaussian plume and instantaneous puff model and an instantaneous dense gas "box" model.
6	**Application Limitation**	EMGRESP is admittedly a simple model and highly conservative under most release conditions. It is recommended for use solely as a preliminary screening tool. Although it is intended as an emergency response program, navigating through all the intermediate menus can take somewhat more time than is ideal.
7	**Strengths/ Limitations**	**Strengths:** The code processe an extremely large database of physical/chemical properties commonly required for screening level of analysis. Give the simplicity of the modeling, the computed results for mass of vapor within the flammable concentration limits has compared well to a limited set of large scale experiments (see Criterion 19). **Limitations:** The dispersion results for neutrally buoyant plumes and puffs are generally significantly greater (ie, several times greater in magnitude) than results obtained from other neutrally buoyant Gaussian models. The reasaon for these differences, to a large degree, lies in the formulation for the crosswind and the vertical dispersion parameters, which differ significantly from the standard Pasquill/Gifford F values cast into a functional form by Turner and Busse. No time-varying releases may be modeled. Only instaneous dense gas releases may be modeled.

8	**Model References**	Model description and references are provided in the user's manual: **!** Diamond, G.L., et al., 1988, A Portable Computing System for Use in Toxic Gas Emergencies, Ontario Ministry of the Environment, ARB-150-87, ISBN 0-7729-3448-7 (Revised Edition), March. **!** Chong, J., Hazardous Gas Release Model, 1980, Air Resources Branch, Program Documentation, Ontario Ministry of the Environment. **!** Eidsvik, K.J., 1980, "A Model for heavy Gas Dispersion in the Atmosphere," Atmospheric Environment, 14, 769-777. **!** Fryer, L.S. and G.D. Kaiser, 1979, DENZ - A Computer Program for the Calculation of the Dispersion of Dense Toxic or Explosive Gases in the Atmosphere, United Kingdom Atomic Energy Authority, Report SRD R152. **!** Reid, J., 1980, "Dispersion of Denser-than-Air Gases," Atmospheric Environment Service, Boundary Layer Research Division, January. **!** Van Ulden, A.P., "On the Spreading of a Heavy Gas Released Near the Ground," First International Loss Prevention Symposium, The Hague/Delft. Elsevier, Amsterdam, 221-226.
9	**Input Data/Parameter Requirements**	The dispersion model itself only requires limited meteorological data (time of day, sunshine intensity, mixing height, cloud cover, wind speed), source term data (release rate or total quantity released), and (optionally) specification of the lateral and vertical spread factors.
10	**Output Summary**	Downwind concentration as a function of distance from the release location; downwind distance to the IDLH, STEL, and TLV; necessary emission rate or total quantity released to result in a given concentration at a specified distance downwind.
11	**Applications**	Among other applications, EMGRESP has been used in the Ontario Waste Management Corporation study for a siting application for a hazardous waste processing facility and the DOE/DP Safety Survey.
12	**User-Friendliness**	The program is somewhat dated in the sense that it requires loading BASIC and the source object module, and then executing the program. There is no means of "backing out" of a select sequence of menu items (by repeatedly using the Esc key, for instance) at specific junctures in the program without first fulfilling the entire input list requirements. There are default values available in the program for many of the input menus, and those values can be invoked by simple striking the "Enter" key.
13	**Hardware-Software Interface Constraints/ Requirements**	**Computer operating system:** Microsoft DOS Version 3.0 or higher with the GWBASIC compiler. **Computer platform:** **Disk space requirements:** Less than 1MB **Run execution time** (for a typical problem)**:** Several seconds maximum on an 80386 processor or higher. **Programming language:** GWBASIC **Other computer peripheral information:** The program should be easily portable to any platform supporting a standard BASIC compiler and simple video screen graphics. The program is written in standard MicroSoft BASIC and distributed in object format with the source code. The physical/chemical database may be modified by the user.
14	**Operational Parameters**	**Identify whether the code has any error diagnostic messages to assist the user in troubleshooting operational problems:** Limited error handling capabilities are included in the program. Non-physical values are rejected by the program and the user is prompted for an alternate value. All input is performed interactively, so no batch mode capacity is available.
15	**Surety Considerations**	**All quality assurance documentation:** The program is written in standard MicroSoft BASIC and distributed in object format with the source code. The physical/chemical database may be reviewed and modified by the user. **Benchmark runs:** Sample cases using a set of large-scale propane release field experiment data were anlayzed **Validation calculations:** See V&V reports above. **Verification with field experiments that has been performed with respect to this code:** See V&V reports above.
16	**Runtime Characteristics**	o

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**
B6	**Box**	A simple, slumping dense cloud model for “instaneous” releases is available.
Part C: Transport Submodel Type (No Information Provided.)		
Part D: Fire Submodel Type (Not Applicable)		
Part E: Energetic Events Submodel Type (Not Applicable)		
Part F: Health Consequence Submodel Type (No Information Provided.)		
Part G: Effects and Countermeasures Submodel Type (No Information Provided.)		
Part H: Physical Features of Model		
H1	**Stability Classification Turbulence Typing**	**Pasquill-Gilfford-Turner:** **STAR:** Turbulence selection based on intensity of the incoming sun during the day and the degree of cloud cover at night. **Irwin:** **Sigma theta:** **Richardson number:** **Monin-Obukhov length:** **TKE-driven:** **Split sigma:**
H2	**Release Elevation**	**✔ ground __ roof**
H6	**Mixing Layer**	**✔ trapping __ lofting ✔ reflection __ penetration** **__ inversion breakup fumigation __ temporal variability**
H7	**Cloud Buoyancy**	**✔ neutral [passive] ✔ dense [negative] __ plume rise [positive]**
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** **Dew point temperature: __ single point __ single tower/multiple point** **__ multiple towers** **Precipitation: __ single point __ single tower/multiple point __ multiple towers** **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**	The cloud concentration and associated radius and height is given as a function of time, providing an indirect means of estimating the volume of the vapor/air mixture within the flammable limit.
J3	**Concentration Versus Time Plots**	Yes
J4	**Tabular at Fixed Downwind Locations**	Yes

Part K: Model Usage Considerations (No Information Provided.)