	General Characteristics	
1	**Abstract of Model Capabilities**	GXQ is a PC based program for calculating atmospheric dispersion using site specific joint frequency data. The Gaussian straight line model is invoked for both instantaneous and continuous releases. Several models are available to the user that modify parameters within the Gaussian plume model to account for phenomena such as plume depletion, building wake, plume meander, gravitational settling, and plume rise.
2	**Sponsor and/or Developing Organization**	B.E. Hey (Developer and Author) Westinghouse Hanford Company (WHC), Sponsored by DOE under WHC contract
3	**Last Custodian/ Point of Contact**	Brit E. Hey P.O. Box 1970 Westinghouse Hanford Company Richland, WA 99352 (509) 376-2921
4	**Life-Cycle**	This code was developed to supplement the downwind dispersion factor (c/Q) calculated by the GENII code used at Hanford for calculation of radiological doses.
5	**Model Description Summary**	GXQ Version 4.0 is an IBM compatible microcomputer-based program for calculating atmospheric dispersion using site-specific joint frequency and population data. It uses the Gaussian Straight-line model for both instantaneous and continuous releases. Several models are available to the user that modify parameters within the Gaussian plume model to account for phenomena such as plume depletion, building wake, plume meander, gravitational settling, plume rise and stack down wash. Additional controls alter the handling of joint frequency data, population data and output. The GXQ code calculates atmospheric dispersion coefficients for radiological and non-radiological release consequence evaluations. It is a combination of useful models taken from throughout the industry. The GXQ code was written by safety analysts, for safety analysts.
6	**Application Limitation**	The code only calculates the atmospheric dispersion coefficients and must be used in conjunction with other codes to provide sufficient information for either chemical or radiological assessments.
7	**Strengths/ Limitations**	Although the strengths of this code are the many source term modes, the code only calculates the atmosphere dispersion and must be used in conjunction with another code.
8	**Model References**	! Hey, B.E., “GXQ 4.0 Program Users’ Guide”, WHC-SD-GN-SWD-30002, Revision 1, Westinghouse Hanford Company, Richland, WA. ! Hey, B.E., 1994, “GXQ 4.0 Verification and Validation”, WHC-SD-GN-SWD-30003, Revision 1, Westinghouse Hanford Company, Richland, WA.
9	**Input Data/Parameter Requirements**	The user may specify either a joint frequency data file of constant meteorological conditions (windspeed/stability class). When using the joint frequency data file, the user may specify the frequency of exceedance and whether it should be based on a single sector or whole site. The release is characterized by a release height, release duration, initial plume width, and initial plume height.
10	**Output Summary**	The complete input file is echoed as part of the output file. Intermediate steps and files maybe output for hand verification. The c/Q value is output is either tabular form or an isopleth plot file suitable for input to a plotting package.
11	**Applications**	Chemical and radiological assessments for authoriation basis documentation.
12	**User-Friendliness**	Limited error diagnostics are performed by the code. The code will allow an user to select incompatible models when running the code without ending execution. The inform the user will incompatible models are being used or when other combinations of models should be used (e.g. if the Mills correction is not implemented and the release is ground-level with plume rise, the code will give a warning that the Mills correction should be considered).
13	**Hardware-Software Interface Constraints/ Requirements**	The code is written for and executed on a PC. Only the executable is available on disk. However, the source code is listed in the verification manual.
14	**Operational Parameters**	GXQ is written in the FORTRAN 77 computer language, with some Lahey Fortran enhancements. The source code was compiled and linked using Lahey Fortran, version 6.01. Approximately 200 kilobytes of free memory are required on an IBM or compatible personal computer with math co-processor and DOS version 3.0 or newer.

15	**Surety Considerations**	The user's manual is readable in respect to the models used. However, the manual is hard to understand how to implement those models during execution of the code. In addition, the manual lacks a discussion of the expected output. GXQ has been benchmarked against GENII and hand calculations. These are given in B.E. Hey, *GXQ 4.0 Verification and Validation*, WHC, Richland WA, WHC-SD-GN-SWD-30003, Rev. 1 (December 19, 1994).
16	**Runtime Characteristics**	Code takes very little time to execute.
		Specific Characteristics
Part A: Source Term Submodel Type		
A1	**Source Term Algorithm?**	__YES ✔ NO
Part B: Dispersion Submodel Type		
B1	**Gaussian**	**✔ Straight-line plume __Segmented plume __ Statistical plume ✔ Statistical puff**
Part C: Transport Submodel Type		
C2	**Deterministic**	Yes
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 (No Information Provided.)		
Part G: Effects and Countermeasures Submodel Type (No Information Provided.)		
Part H: Physical Features of Model		
H2	**Release Elevation**	**✔ ground ✔ roof**
H3	**Aerodynamic Effects from Buildings and Obstacles**	**✔ building wake __ cavity __ K-factors __ flow separation** **Virtual source distance application.**
H4	**Horizontal Plume Meander**	**Yes.**
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		

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		
J3	**Concentration Versus Time Plots**	Dispersion factor for maximum individual or population groups at user-specified isopleth.
J4	**Tabular at Fixed Downwind Locations**	Dispersion factor for maximum individual or population groups at user-specified quantile.
Part K: Model Usage Considerations (See Items 5 - 7.)		