Docket No. 50-220

JAN 8 1979

Distribution
Docket
ORB #3
Local PDR
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VStello
BGrimes
Attorney, OELD
OI&E (3)
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JRBuchanan
ACRS (16)

Mr. Donald P. Dise
Vice President - Engineering
Niagara Mohawk Power Corporation
300 Erie Boulevard West
Syracuse, New York 13202

Dear Mr. Dise:

By letter dated September 1, 1978, as amended by letters of November 30 and December 13, 1978, you requested approval of the installation of a radwaste reduction system as required by 10 CFR 20.305. The proposed system is to be installed at the Nine Mile Point Unit 1 Nuclear Station.

In order to continue our review of your proposal, you are requested to provide written responses for the items identified in Enclosure 1 by February 9, 1979. In addition, it is our present intention to discuss these items and other items with you during the forthcoming technical meeting in Oswego, New York. This meeting has been scheduled for January 30, 1979.

In consonance with NUREG-0292, the January meeting will be an open meeting to allow the public an opportunity to observe the NRC review process. It will begin at 1:00 P.M. at the Pontiac Hotel in Oswego, New York. Following an introduction and presentation of background information by the NRC staff and a facility description by Niagara Mohawk, we will discuss technical concerns which have been brought to your attention. After a break for dinner, the meeting will resume at 7:00 P.M. The meeting with you is expected to end about 8:00 P.M. after which time members of the public are invited to ask questions or offer comments to the NRC concerning the review of your proposal.

If we can be of further assistance, please advise.

Sincerely,

Original Signed by
T. A. Ippolito

Thomas A. Ippolito, Chief
Operating Reactors Branch #3
Division of Operating Reactors

APP-3

7901170054

Enclosure:
Request for Additional Information

*SEE PREVIOUS YELLOW FOR CONCURRENCES

cc w/enclosure: See next page

OFFICE➤			ORB #3	EEB	ORB #3	
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DATE➤			1/4/79	1/5/79	1/5/79	

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Thomas A. Ippolito, Chief
Operating Reactors Branch #3
Division of Operating Reactors

Enclosure:
Request for Additional Information

~~cc w/enclosure: See page 2~~

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DATE		1/4/79	1/ /79	1/5/79	

NRC FORM 318 (9-76) NRCM 0240 ☆ U.S. GOVERNMENT PRINTING OFFICE: 1978 - 265 - 769

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REQUEST FOR ADDITIONAL INFORMATION

TO

NIAGARA MOHAWK POWER CORPORATION
ON
PROPOSED RADWASTE VOLUME REDUCTION SYSTEM
AT
NINE MILE POINT UNIT 1 NUCLEAR POWER PLANT

RADIOLOGICAL ASSESSMENT BRANCH

1. Based on operating experience and on the specific design features of the Nine Mile Point 1 radwaste handling system, provide an estimate of the annual man-rem associated with each of the following functions; operation, maintenance, and inservice inspection. Include in your response 1) the radiation fields (R/hr) associated with all components and cubicles of the radwaste system where personnel may require access to perform the above mentioned functions, 2) the occupancy times (hrs/yr) required in each of these locations, and 3) the exposure (man-rems/yr) received for each function and/or location. Supply this information for all segments of the radwaste system, including the off-gas clean up system, from the inputs to the RWR-1 system to the shipment of solidified wastes offsite.

2. Describe how the solid waste ash is transferred from the dry cyclone to the product container. Describe the means of regulating the amount of waste ash inserted into each product container. What features are incorporated to ensure that personnel doses during this operation are maintained ALARA?

3. Provide the approximate locations of and give the criteria used for placement of radiation monitors in the radwaste drumming and incinerator areas.

ACCIDENT ANALYSIS BRANCH

1. Justify your statement that the maximum credible accident is the gross failure of the product container by discussing radiological consequences and likelihood of other postulated accidents such as gross incinerator failure, failure of piping between incinerator and dry cyclone, failure of piping between dry cyclone and quench tank, and the failure of tanks containing radioactive liquids, such as the scrub liquid tank.

2. For the maximum credible accident as you describe, i.e., gross failure of a product container, explain why a dilution factor (X/Q) for an elevated (100 meter) release is appropriate. What is the radiological impact if a ground-level release is assumed?

3. The operation of incinerators in the past has resulted in a significant number of explosions. Discuss the likelihood of an explosion in your incinerator, measures taken (by design or administrative procedures) to prevent explosion, and the radiological consequences of an explosion.

4. Provide layout drawings including expected radiation fields, shielding thicknesses and personnel access routes for the building proposed to house the radwaste reduction system.

5. Discuss what actions you've taken in the design of the facility and what action you expect to take during the operation of the facility to assure that occupational radiation exposures will be as low as is reasonably achievable. Regulatory Guide 8.8 may be used for guidance for activities which may be incorporated to meet this requirement.

HYDROLOGY-METEOROLOGY BRANCH - METEOROLOGY

Q372.2 In your evaluation of the maximum credible accident, you used the model described in Regulatory Guide 1.3 and assumed an elevated release. As stated in Regulatory Guide 1.3, the guide's model should be used only until adequate site meteorological data are obtained. It is our position that you should either (1) provide relative concentration (X/Q) values based on site data for both elevated and ground-level releases for the maximum credible accident, or (2) justify that your FSAR or latest assessment of short term diffusion estimates is conservative. If you undertake to justify your recent assessment, describe the atmospheric dispersion model which you have used to estimate X/Q values for the maximum credible accident. (Also see Q.372.3.) Provide (or reference) the meteorological data that you have used and justify that it is either representative of the air layers into which the effluents will be released or provides for a conservative assessment. Include a discussion on the marine-air/land-air transition zone as it relates to the meteorological tower data and the atmospheric diffusion model.

Q372.3 In your response to part 1 of 372.2 above, we suggest you consider DRAFT Regulatory Guide 1.XXX, "Atmospheric Dispersion Models for Potential Accident Consequence Assessments at Nuclear Power Plants" (9/23/77), which is attached. The Draft describes a procedure for calculating short-term relative concentration (X/Q) values. This method considers 1) lateral plume meander; 2) atmospheric dispersion conditions as a function of direction; 3) wind direction frequencies; and 4)

exclusion area boundary distances as a function of direction. Also enclosed is an interim branch technical position concerning the use of the Draft and the model described in Standard Review Plan 2.3.4.

Q372.4 For any effluent particulate matter with an effective deposition velocity greater than five centimeters/second, provide the effective deposition velocity.

HYDROLOGY-METEOROLOGY BRANCH

It is our position that either the draft Regulatory Guide 1.XXX, "Atmospheric Dispersion Models for Potential Accident Consequence Assessments at Nuclear Power Plants" (dated September 23, 1977), or the procedures described in Standard Review Plan Section 2.3.4 may be used to evaluate atmospheric transport conditions for analysis of accidents with the following amendments to the draft regulatory guide model: (a) a limiting sector X/Q value at the 0.5% probability level be used*, (b) the accumulated frequency of the limiting sector X/Q or higher value in all sectors may not exceed 5% for the site, and; (c) normalization of individual sector probability distributions is not used.

*Amendment based on Memorandum from H. R. Denton to D. R. Muller, Subject: Proposed New Meteorological Model, dated August 2, 1978.

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REGULATORY GUIDE 1.XXX

ATMOSPHERIC DISPERSION MODELS FOR POTENTIAL ACCIDENT CONSEQUENCE ASSESSMENTS AT NUCLEAR POWER PLANTS

A. INTRODUCTION

Section 50.34 of 10 CFR Part 50 requires that each applicant for a construction permit or operating license provide an analysis and evaluation of the design and performance of structures, systems and components of the facility with the objective of assessing the risk to public health and safety resulting from the operation of the facility. Section 50.34 of 10 CFR Part 50 further states that the site evaluation factors identified in 10 CFR Part 100 shall be included in the analysis and evaluation described above. Section 100.10 of 10 CFR Part 50 states that meteorological conditions at the site and surrounding area are to be included in the factors to be considered in assessing the consequences of potential reactor accidents.

This guide provides acceptable procedures and assumptions that may be used to determine appropriate atmospheric dispersion conditions for assessing the consequences of potential nuclear power plant reactor accidents which are made as required by Section 100.11 of 10 CFR Part 50.

The Regulatory Position presented in this guide represents a substantial change in procedures used to determine atmospheric dispersion conditions appropriate for use in assessing the potential offsite radiological

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consequences resulting from a range of postulated accidental releases of radiological material to the atmosphere.

This guide provides an acceptable methodology for determining site specific relative concentrations (χ/Q) and replaces portions of Regulatory Guide 1.3, Revision 2, "Assumptions Used for Evaluating the Potential Radiological Consequences of a Loss of Coolant Accident for Boiling Water Reactors," Regulatory Guide 1.4, Revision 2, "Assumptions Used for Evaluating the Potential Radiological Consequences of a Loss of Coolant Accident for Pressurized Water Reactors," Regulatory Guide 1.5, "Assumptions Used for Evaluating the Potential Radiological Consequences of a Steam Line Break Accident for Boiling Water Reactors," Regulatory Guide 1.24, "Assumptions Used for Evaluating the Potential Consequences of a Pressurized Water Reactor Radioactive Gas Storage Tank Failure," Regulatory Guide 1.25, "Assumptions Used for Evaluating the Potential Radiological Consequences of a Fuel Handling Accident in the Fuel Handling and Storage Facility for Boiling and Pressurized Water Reactors," Regulatory Guide 1.77, "Assumptions Used for Evaluating a Control Rod Ejection Accident for Pressurized Water Reactors," and Regulatory Guide 1.98, "Assumptions Used for Evaluating the Potential Radiological Consequences of a Radioactive Offgas System Failure in a Boiling Water Reactor."

B. DISCUSSION

The procedural changes contained in this guide are based on a review of recent experimental data on diffusion from ground-level releases without buildings present and from releases at various locations on reactor facility

buildings during stable atmospheric conditions with light wind speeds (Refs. 1-6), and a recognition that meteorological evaluation procedures should provide estimates of the variations in atmospheric dispersion that occur as a function of wind direction and distance from the source to receptor.

The procedures described in this guide incorporate the results of the atmospheric tests referred to above which verify the existence of effluent plume "meander" under stable (E, F and G) atmospheric conditions, as defined by the ΔT criteria in Regulatory Guide 1.23 (Ref. 7), when wind speeds are light. Effluent concentrations measured over a period of one hour under such conditions have been shown to be substantially lower than would be predicted using the traditional curves (Ref. 8) of lateral and vertical plume spread, based upon current atmospheric stability criteria. The procedures in this guide also recognize that atmospheric dispersion conditions are frequently directionally dependent; that is, certain air flow directions can exhibit substantially more or less favorable diffusion conditions than others, and the wind can transport effluents in certain directions more frequently than in others.

C. REGULATORY POSITION

This section identifies the atmospheric transport and diffusion models, methods of evaluating boundary distances for the exclusion area and the outer boundary of the low population zone for purposes of estimating dispersion values, and the methods of establishing χ/Q value distributions and selecting χ/Q values to be used in consequence assessments that are acceptable to the NRC staff.

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1. Calculation of Relative Atmospheric Concentration χ/Q Values

χ/Q values should be calculated at appropriate distances (see C.2 below) for each wind direction (16 compass points; 22-1/2 degree sectors centered on true north, etc.) based on wind speed and atmospheric stability class indicated by vertical temperature gradient (ΔT), as defined in Regulatory Guide 1.23 for distances to 80 km (50 mi) from the site. Either hourly averaged data or joint frequency distributions of hourly data may be used. When joint frequency distributions are used, the wind speed for χ/Q calculations should be the maximum value in the wind speed class interval so that the individual χ/Q values are calculated to represent the minimum value in the cumulative frequency class interval. The distribution is then enveloped by the maximal χ/Q values. Thus, when the cumulative probability distributions of χ/Q are assessed, each χ/Q value represents that which is equaled or exceeded within the class interval (Ref. 9). When hourly data are used, the wind speed for χ/Q calculation should be the "hourly averaged" wind speed as defined in Regulatory Guide 1.23. Calms should be defined as hourly average wind speeds below the starting speed of the anemometer, and should be assigned a wind speed equal to that of the anemometer or vane starting speed, whichever is higher. When joint frequency distributions are used, wind directions during calm conditions should be assigned in proportion to the directional distribution of the lowest non-calm wind speed class. When hourly data are used, wind directions during calm conditions should be assigned in proportion to the directional distribution of non-calm conditions with a wind speed less than 0.7 meters per second (m/s) (the wind speed class limit, i.e., 1.5 mph).

Formulae and parameters presented in this section should be used in the absence of site specific diffusion data unless unusual siting, meteorological or terrain conditions dictate the use of other models or considerations. For example, quality controlled, site-specific atmospheric diffusion tests may be used as a basis for modifying the formulae and parameters.

a. Short-term (≤ 2 hours) release period calculations

Acceptable mathematical models for calculating χ/Q values appropriate for short time period atmospheric dispersion calculations are presented below. Meteorological data and calculations for the one hour time period are assumed to apply over the entire two hour release period. This assumption has been confirmed as reasonably conservative, considering the variation with time of postulated accidental releases. If releases associated with a given postulated event are estimated to occur in a period substantially less than one hour (i.e., less than 20 minutes), the applicability of the models should be evaluated on a case-by-case basis.

(1) Releases through vents or other building penetrations

This class of release modes includes all release points or areas which are lower than two and one half times the height of adjacent solid structures (Ref. 10). The formulae and assumptions are:

(a) During conditions of neutral (D) and stable (E, F and G) stability when the speed at the 10 meter level is less than 6 m/s, credit for horizontal plume meander can be considered such that

$$\frac{\chi}{Q} = \frac{1}{\bar{u}_{10}\,\pi\,\Sigma_y\,\sigma_z} \qquad (1)$$

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whenever the χ/Q value, calculated using Equation 1, is less than the greater value calculated from either

$$\frac{\chi}{Q} = \frac{1}{\bar{u}_{10}\,(\pi\,\sigma_y\sigma_z + A/2)} \qquad (2)$$

or

$$\frac{\chi}{Q} = \frac{1}{\bar{u}_{10}\,(3\pi\,\sigma_y\,\sigma_z)} \qquad (3)$$

where

χ/Q is the relative concentration (sec/m^3) at ground level,

π is 3.14159,

$\bar{u}_{10}$ is the wind speed (m/s) at 10 meters above grade,

Σ_y is the lateral plume spread (m), a function of atmospheric stability, wind speed $\bar{u}_{10}$ and downwind distance from release. For distances to 800 meters, $\Sigma_y = M\sigma_y$; M being a function of atmospheric stability and wind speed (see Figure 3). For distances greater than 800 meters, $\Sigma_y = (M-1)\sigma_{y800m} + \sigma_y$,

σ_y is the lateral plume spread (m), a function of atmospheric stability and distance (Figure 1),

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σ_z is the vertical plume spread (m), a function of atmospheric stability and distance (Figure 2), and

A is the smallest vertical plane, cross-sectional area (m^2) of the building from which the effluent is released.

Otherwise χ/Q is the greater value calculated from either Equation 2 or 3.

In other words, calculate χ/Q values based on Equations 1, 2, and 3. Compare the values computed from Equations 2 and 3, and select the higher value. Compare this higher value with the value calculated through use of Equation 1, and select the lower of these two values to represent the χ/Q value for postulated release and atmospheric conditions. Examples and a detailed explanation of the rationale are given in Appendix A.

(b) During all other atmospheric stability and/or wind speed conditions, χ/Q is the greater value calculated from either Equation 2 or 3.

(2) Stack Releases

A stack release is assumed when the effluent is exhausted from a release point that is higher than two and one half times the height of adjacent solid structures (Ref. 10). The general formula and assumptions are:

$$\frac{\chi}{Q} = \frac{1}{\pi \bar{u}_h \sigma_y \sigma_z} \exp\left[\frac{-h_e^2}{2\sigma_z^2}\right] \quad (4)$$

where

$\bar{u}_h$ is the wind speed (m/s) which represents conditions at the release height,

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h_e is the effective height (m) determined from

$$h_e = h_s - h_t,$$

h_s is the height of the release point above plant grade, and

h_t is the maximum terrain height above plant grade between the release point and the point for which the calculation is made, but should not be allowed to exceed h_s.

The other parameters in Equation 4 have been defined previously.

Atmospheric stability for determination of σ_y and σ_z is obtained from the vertical temperature differences (ΔT) between the release height and the 10-meter level as described in Regulatory Guide 1.23.

For those cases where fumigation conditions are to be evaluated for elevated releases, the formula and assumptions are:

$$\frac{\chi}{Q} = \frac{1}{(2\pi)^{1/2}\, \bar{u}\, \sigma_y\, h_e} \qquad (5)$$

where

$\bar{u}$ is wind speed (m/s) representative of the layer, h_e, for which a value of 2 m/s is a reasonably conservative assumption in most cases,

σ_y is the lateral plume spread (m) at a given distance which is usually assumed for a moderately stable (F) atmospheric stability condition which normally precedes the onset of fumigation, and

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h_e is as defined above for elevated releases.

The χ/Q value calculated by Equation 5 should not exceed $\frac{1}{\pi \bar{u} \sigma_y \sigma_z}$

b. Release periods greater than 2 hours

The average χ/Q values should be calculated for appropriate time periods during the course of the postulated accident as described below. The time periods for averaging should represent intra-diurnal, diurnal and synoptic meteorological regimes (e.g., 8 and 16 hours and 3 and 26 days as presented in Section 2.3.4 of Regulatory Guide 1.70) (Ref. 11). The χ/Q value for each appropriate time period at the distance of interest in each direction sector should be obtained by a logarithmic interpolation between the calculated value that is selected using the procedure described in Section C.3.a below, assumed as a "2 hour" value, and the annual average (8760 hour) value at the distance of interest in that direction sector (Ref. 9).

The annual average χ/Q value should be calculated using the method described in Regulatory Guide 1.111, Section C.1.c. (Ref. 12), but with h_e determined as described in Section C.1.a.(2) above.

2. Determination of Distances for χ/Q Calculations

In order to take into consideration the possibility of airflow trajectory deviations, plume segmentation (particularly in light wind, stable conditions), and the potential for wind speed and direction frequency shifts from year to year, the following procedure should be used to determine the distance from which the calculations of relative concentrations (χ/Q) are made.

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For each wind direction sector, the minimum distance (exclusion area or LPZ) to be assumed for the sector of interest should be defined as the minimum distance within that sector and one-half of the width of the direction sector on either side of the sector of interest. Effectively, this distance is the minimum distance of either the exclusion area or LPZ within a 45 degree direction sector, centered on the direction sector of interest. However, should there not be a well defined exclusion boundary in a sector (e.g., a sector extending seaward at a coastal site) then the distance for that sector should be taken as that distance over which the applicant or licensee intends to have control.

3. <u>Determination of χ/Q Values by Sector</u>

a. <u>Assessment of χ/Q's at the exclusion distance</u>

Acceptable procedures for selecting the χ/Q values to be used in the consequence assessment analyses for both the "conservative" and "realistic" accident conditions (see Section 2.3.4 of Ref. 11) are described below. For the realistic assessment, fumigation conditions may be ignored.

(1) Non-fumigation conditions

Cumulative probability distributions of the χ/Q values, as determined from Section C.1.a above at the distances determined from Section C.2 above, excluding fumigation from elevated releases, should be constructed for each of the 16 cardinal compass point directions (22-1/2 degree direction sectors). Each directional probability distribution should be normalized to 100%. If joint frequency table data are used to calculate the χ/Q values, the cumulative probability distribution function should be computed such as to envelope the data points.

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The effective probability level (P_e) for the selection of the χ/Q value in each direction sector should be determined (Ref. 9) by first multiplying the probability level (P), selected as 5% for the conservative accident assessment, by the ratio of the total number of hours (N) having valid wind and stability data in the meteorological data record (1 year = 8760 hours) to the number of those hours (n) in which the wind flow was into the direction sector of interest, and then dividing this product by the total number of sectors (S) (16 for sectors of 22½ degrees). For the realistic accident assessment χ/Q determination as described in Section 2.3.4 of Regulatory Guide 1.70 (Ref. 11), P should be selected as 50%. This procedure, in equation form may be stated as:

$$P_e = \frac{P\ (N/n)}{S} \qquad (6)$$

where the individual terms in the equation are described as above. It should be noted that P_e can exceed 100% if n is sufficiently small. In those directions, the selection of a χ/Q value may be ignored unless the χ/Q values for that sector are very high when compared with χ/Q values at P_e in other direction sectors.

For each assessment, the χ/Q values that are selected, as described above, for the 16 directions are compared and the highest value is selected.

(2) Fumigation conditions - conservative assessment

In the absence of information which indicates that fumigation conditions occur substantially less than five percent of the time, χ/Q values should be calculated, assuming fumigation conditions, for each of the 16 directions sectors using Equation 5.

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(a) Inland sites

For elevated releases at sites located at distances equal to or greater than 3200 meters from large bodies of water (e.g., oceans or a Great Lake), a fumigation condition at the exclusion distance should be assumed to exist at the time of the accident and continue for one-half hour (Ref. 13). In this case, two χ/Q values, one for the 0 to 1/2-hour time period and the other for the 1/2 to 2-hour time period following the accident, should be selected for the accident consequence analysis using the following procedures.

For the 0 to 1/2-hour time period χ/Q values should be determined, using Equation 5 for sectors in which the effective height of release (h_e) is greater than 0, or using Equation 4 and the selection procedure described in Section C.3.a.(1) above for sectors in which $h_e = 0$, for each of the 16 direction sectors.

For the 1/2 to 2-hour time period, χ/Q values for each of the 16 direction sectors should be determined using Equation 4 and the selection procedure described in Section C.3.a.(1) above.

(b) Coastal sites

For elevated releases at sites located less than 3200 meters from large bodies of water, a fumigation condition at the exclusion distance should be assumed to exist at the time of the accident and continue for four hours (Ref. 13) in each of the onshore and along shore airflow directions. The χ/Q value to be used in the accident consequence analysis for the 0 to 2 hour period following an accident, in this case, is the maximum of the 16 individual direction sector χ/Q values, calculated and selected as described

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above for the 0 to 1/2-hour time period. Therefore, two-hour χ/Q values for exclusion distances should be based entirely on fumigation conditions.

This conservative assessment does not consider frequency and duration of fumigation conditions as a function of airflow direction. If information can be presented to substantiate the actual directional occurrence and duration of fumigation conditions at a site, the assumptions of fumigation in all appropriate directions and of duration of one-half hour and four hours may be modified. Then fumigation need only be considered for airflow directions in which fumigation has been determined will occur and of a duration determined from the study. For example, examination of site-specific information at a location in a pronounced river valley may indicate that fumigation conditions occur predominatly during the down-valley "drainage flow" regime and persist for durations of about one-half hour. Therefore, in this case airflow directions other than the down-valley directions can be excluded from consideration of fumigation conditions, and the duration of fumigation would still be considered as one half hour. On the other hand, sites in open terrain (non-coastal) may show no directional preference for fumigation conditions, but may show durations much less than one half hour. In this case, fumigation should be considered for all directions, but with durations much less than one-half hour.

b. Assessments of χ/Q's at the LPZ

Acceptable procedures for selecting the χ/Q values to be used in the consequence assessments are described below.

In most cases, the highest χ/Q values for the appropriate time periods will all occur within the same 22-1/2 degree direction sector.

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However, for those sites at which the highest χ/Q values for the various time periods do not all occur within the same direction sector, an evaluation of the consequences of the potential accident should be made for each sector using the χ/Q values in that sector for the course of the accident analysis. The χ/Q values, for that sector which produces the greatest potential risk to the health and safety of the public (i.e., the highest dose estimate), should be considered controlling.

(1) Non-fumigation conditions

The 16 sets of χ/Q values obtained by using the interpolation procedure described in Section C.1.b above should be compared, and the values for the sector, evaluated as described above, should be considered controlling. This procedure may be used for both the conservative and realistic accident assessments.

(2) Fumigation conditions - conservative assessment

For elevated releases at sites located at distances equal to or greater than 3200 meters from large bodies of water, the χ/Q value for each sector, at the LPZ, for the 0 to 1/2 hour and 1/2 to 2 hour time periods following the accident should be determined as described for this case in Section C.3.a.(2) above.

For elevated releases at sites located less than 3200 meters from large bodies of water, the χ/Q value for each sector, at the LPZ, for the 0 to 4 hour period following an accident should be evaluated as described for this case in Section C.3.a.(2) above.

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D. IMPLEMENTATION

The purpose of this section is to provide information to applicants regarding the NRC staff's plans for using this regulatory guide.

This guide reflects current practice accepted by the Commission. Except in those cases in which the applicant proposes an acceptable alternative method for complying with specified portions of the Commission's regulations, the method described herein will be used in the evaluation of submittals for operating license or construction permit applications docketed after *____________. The method described herein will be considered for licensing actions concerning operating reactors on an individual basis. If an applicant wishes to use this regulatory guide in developing submittals for operating license or construction permit applications docketed on or before *____________, the pertinent portions of the application will be evaluated on the basis of this guide.

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*Date 4 months after publication for public comment.

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REFERENCES

1. Van der Hoven, I., " A Survey of Field Measurements of Atmospheric Diffusion Under Low-Wind Speed Inversion Conditions," Nuclear Safety, March-April 1976, Vol. 17 No. 4.

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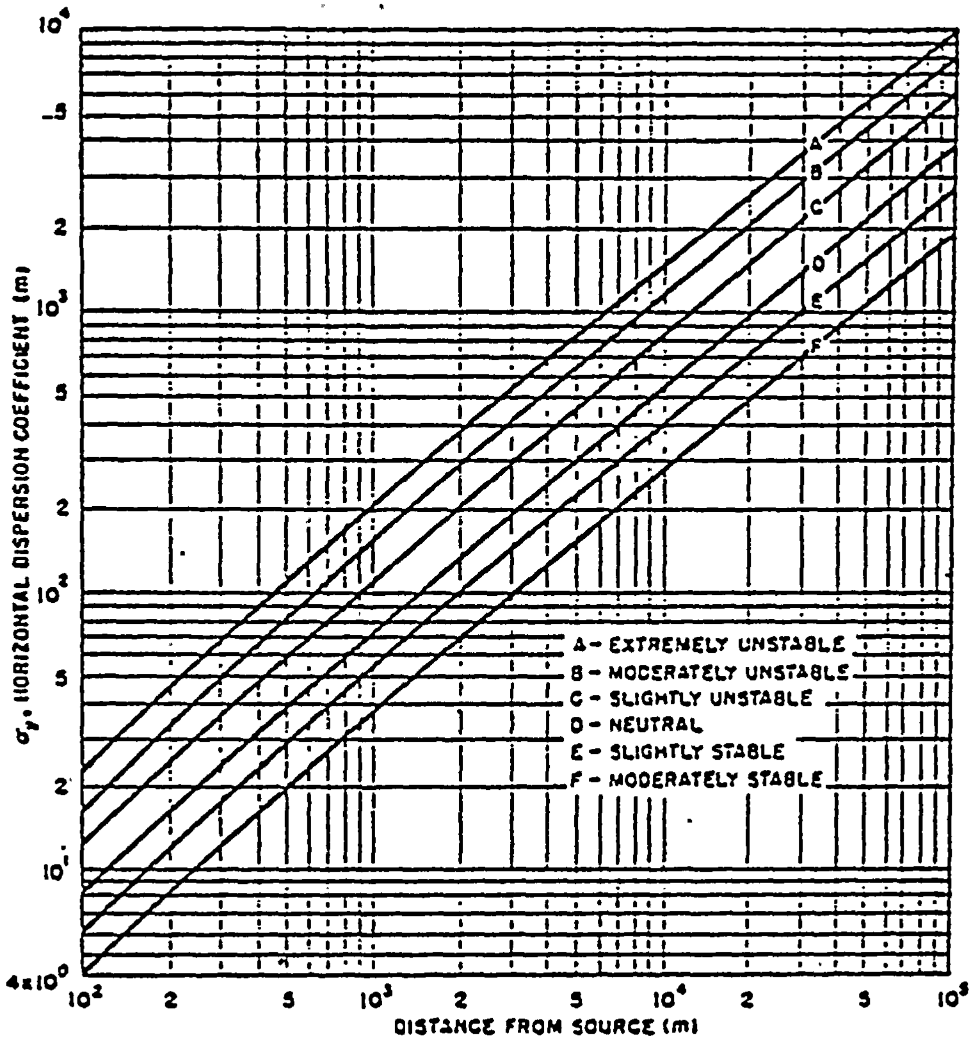

Figure 1. Lateral diffusion, σ_y, vs. downwind distance from source for Pasquill's turbulence types (Ref. 8).

For purposes of estimating σ_y during extremely stable (G) conditions, without plume meander or other lateral enhancement, the following approximation is appropriate:

$$\sigma_y\ (G) = \frac{2}{3}\sigma_y\ (F)$$

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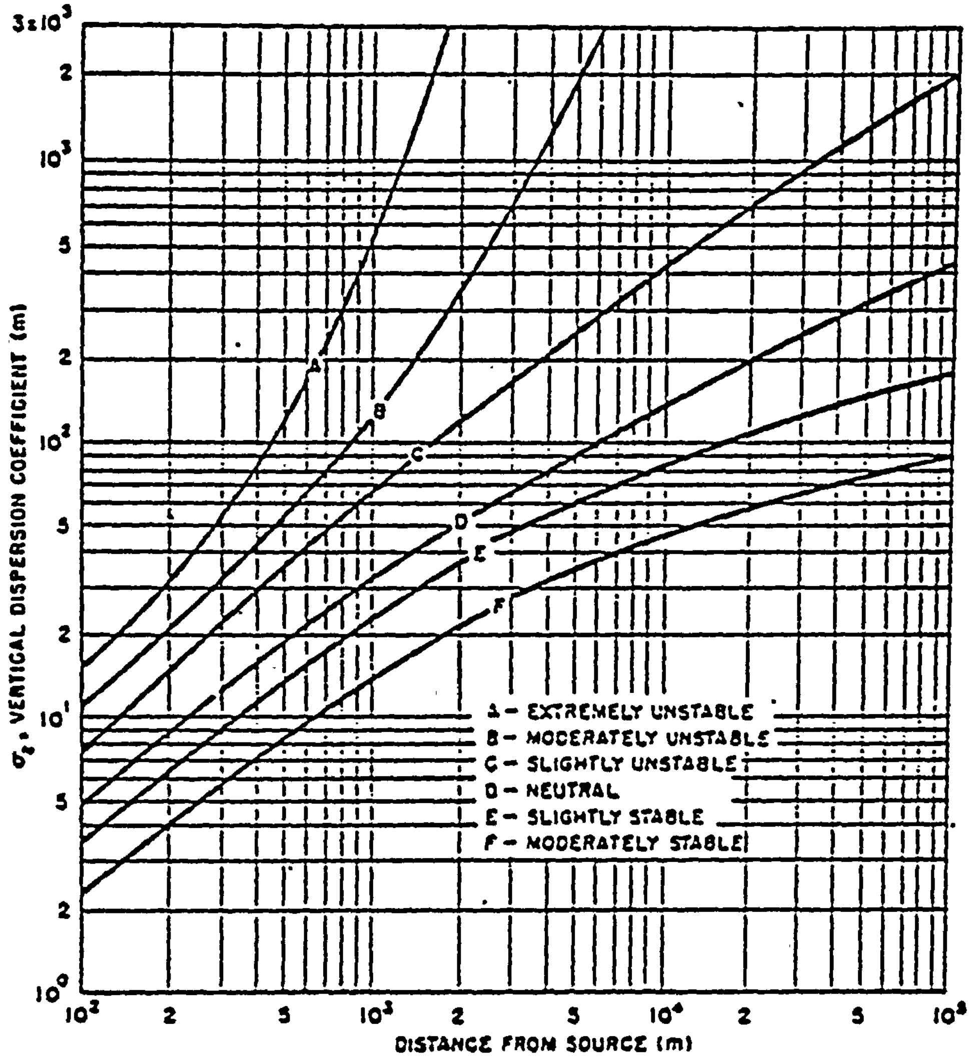

Figure 2. Vertical diffusion, σ_z, vs. downwind distance from source for Pasquill's turbulence types (Ref. 8).

For purposes of estimating σ_z during extremely stable (G) conditions, the following approximation is appropriate:

$$\sigma_z(G) = \frac{3}{5}\sigma_z\ (F)$$

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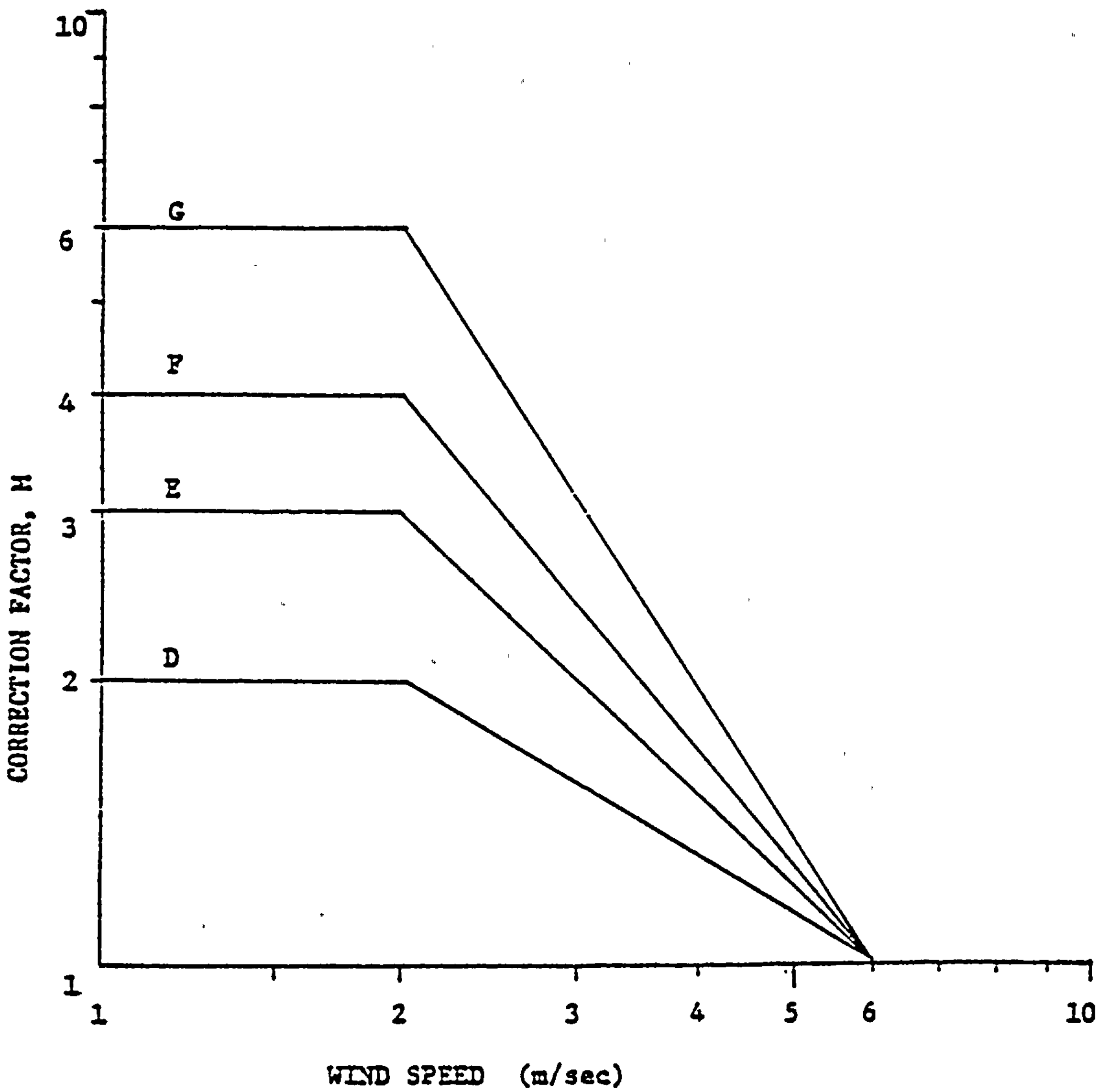

Figure 3. Correction factors for Pasquill-Gifford σ_y values.

(Based on analyses of Ref. 2)

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APPENDIX A

ATMOSPHERIC DIFFUSION MODEL FOR RELEASES THROUGH VENTS AND BUILDING PENETRATIONS

Rationale

The effects of building wake mixing and ambient plume meander on atmospheric dispersion is expressed in this guide in terms of conditional use of Equations 1, 2 and 3. Equation 1 is an empirical formulation based on atmospheric diffusion experiment results (Reference 2) and includes the combined effects of increased plume meander and of building wake in the horizontal crosswind direction over time periods of one hour when the wind speed is light. Although the results could not be quantified, these experiments also indicate that vertical building wake mixing is not as complete during light wind, stable atmospheric conditions as during moderate wind, unstable conditions. Equations 2 and 3 are formulations which have had widespread acceptance within the meteorological community over a period of many years (Ref. 8), but have been recently found to provide estimates which are too conservative at least for the light wind, stable atmospheric conditions (Ref. 1 and 2). Therefore, based on the principles that horizontal plume meander dominates dispersion during light wind, stable conditions and that meander diminishes as the wind speed increases and the atmospheric stability decreases while building wake mixing becomes more effective in dilution of effluents, the conditional use of Equations 1, 2 and 3 is appropriate for providing reasonable χ/Q estimates.

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Example

Figure A-1 shows plots of χ/Q times the wind speed $\bar{u}_{10}$ versus downwind distance for Equations 1, 2 and 3 for atmospheric stability class G. Equation 1 is plotted for M = 2, 3 and 6. Figure A-2 shows plots of χ/Q times $\bar{u}_{10}$ versus downwind distance based on the conditional use of Equations 1, 2 and 3 as described in the Regulatory Position for wind speed conditions appropriate for M = 2, 3 and 6. Comparison of Figure A-1 to Figure A-2 shows that for M = 6, Equation 1 is used for all distances since the $\chi\,\bar{u}_{10}/Q$ for Equation 1 is less than the values calculated for the greater value produced by either Equation 2 or Equation 3 at all distances. For M = 3, the values from Equation 1 are used for distances beyond 0.8 km since the greater value produced by either Equation 2 or Equation 3 is greater than the value produced by Equation 1. However, for distances less than 0.8 km, Equation 1 equals Equation 3. Therefore, the appropriate χ/Q value is determined from Equation 3 since Equation 1 is not less than Equation 3, and Equation 3 produces the higher value when compared with Equation 2. When M = 2, Equation 1 will not be used at all since it is never less than the greater value produced by either Equation 2 or Equation 3. Instead, Equation 3 will be used up to 0.8 km and Equation 2 will be used beyond 0.8 km.

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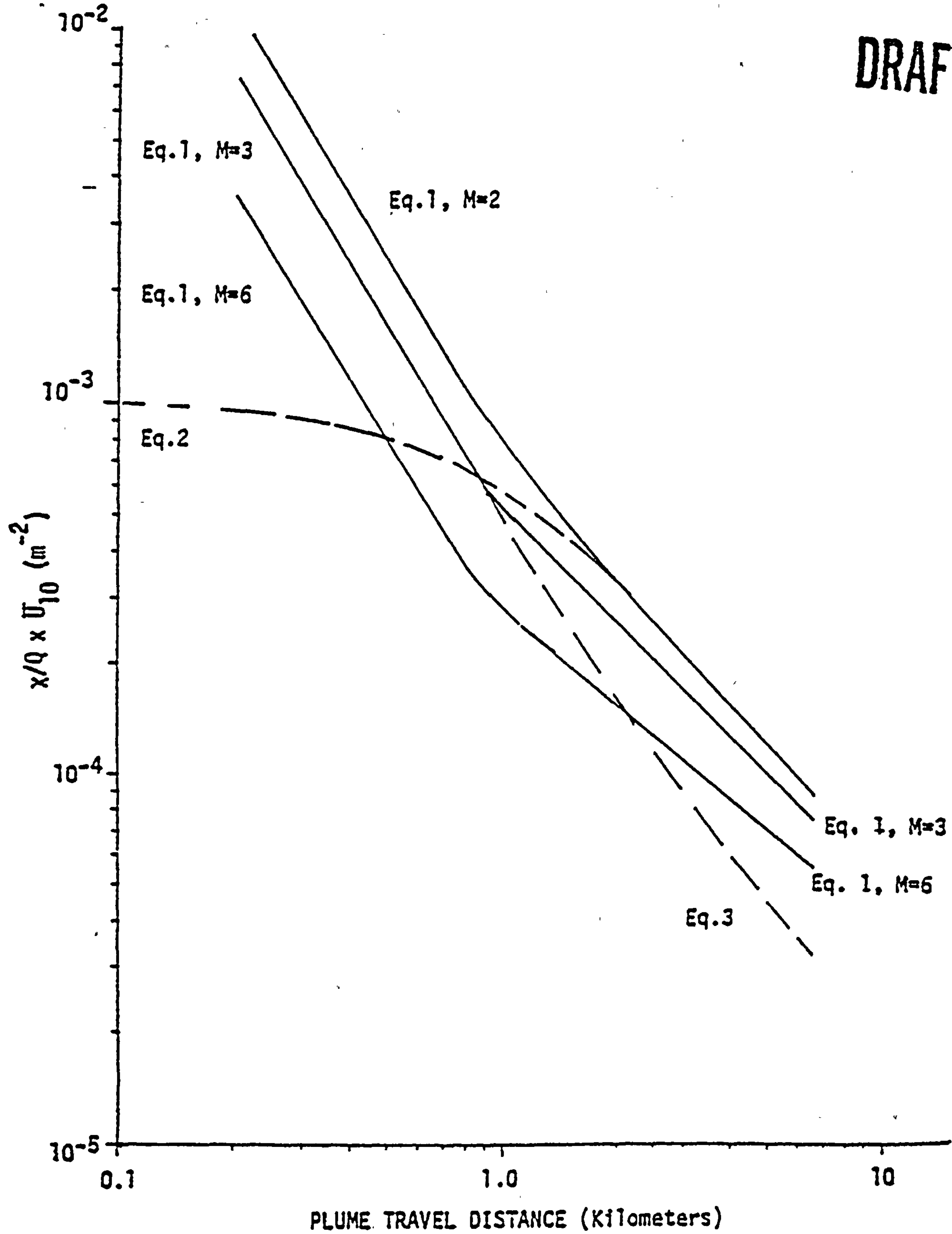

Figure A-1. $\chi\ \overline{U}_{10}/Q$ as a function of plume travel distance for G stability condition using Equations 1, 2 and 3.

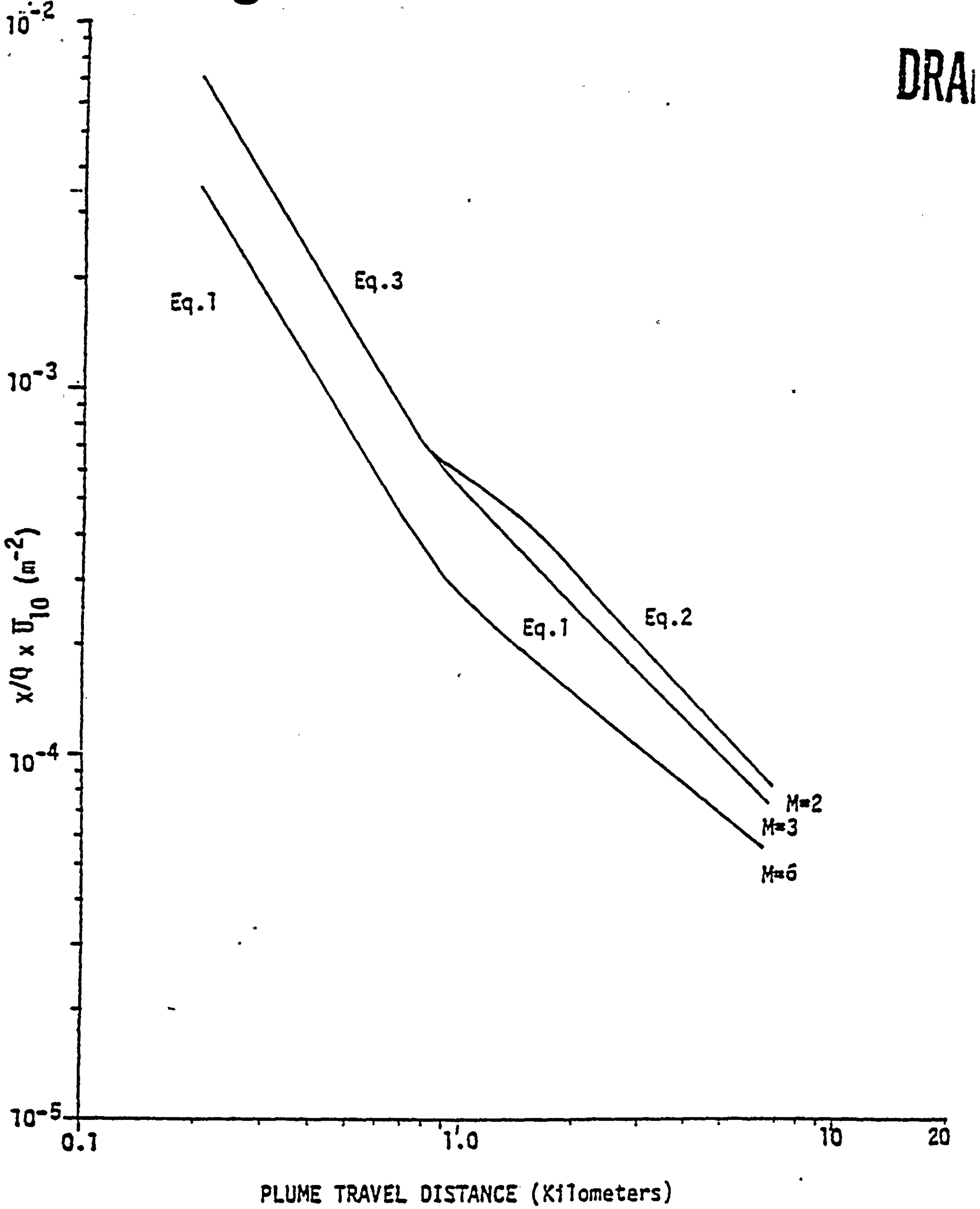

Figure A-2. Regulatory Position on $\chi \bar{U}_{10}/Q$ as a function of plume travel distance for G stability condition.