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Vertical Plume Velocity Assessment

SVY Backup Generating Facility

San Jose, California

Submitted to California Energy Commission

Submitted by



Prepared by Atmospheric Dynamics, Inc.



September 2022

Introduction

This report presents the evaluation of the STACK Infrastructure Backup Generating Facility (SVYBGF) thermal source generated plumes from the 36 Caterpillar diesel engines and 72 rooftop chillers on the effects on airport/aircraft operations. The Normal Y. Mineta San Jose International Airport is located approximately 3.1 miles southwest of the SVYBGF. This report is based upon an analysis prepared by Atmospheric Dynamics, Inc. in accordance with the California Energy Commission (CEC) application requirements for a Small Power Plant Exemption (SPPE) pursuant to the power plant siting regulations. This analysis is but one part of a larger analysis, which seeks an SPPE Decision from the CEC.

Based on the stack parameter data, an analysis of the potential plume characteristics from the routine operation the diesel engines and rooftop chillers on vertical winds was prepared and compared to the California Energy Commission (CEC) significance criteria of 5.3 meters per second (m/s) for the average vertical plume velocities as described below.

Atmospheric Dynamics, Inc. (ADI) prepared a screening level plume vertical velocity assessment which are based on the calm wind Spillane methodology outlined in the "Aviation Safety and Buoyant Plumes" paper (Peter Best, et. al., presented at the Clean Air Conference, Newcastle, New South Wales, Australia, 2003). This methodology is also recognized as a screening tool for aviation safety set out by the Australian Civil Aviation Safety Authority (CASA) and presented in "AC 139-5(1) Plume Rise Assessments (CASA, 2012)".

The aim of this screening assessment is to conservatively determine the potential for turbulence generated by the diesel engines and rooftop chillers waste heat exhaust plumes. Part 139.370 of the Australian Civil Aviation Safety Regulations (1998, 2004) provides that CASA may determine that plume velocities in excess of 4.3 m/s is or will be a potential hazard to aircraft operations. The *Manual of Aviation Meteorology* (Australian Bureau of Meteorology 2003) defines severe turbulence as a vertical wind gust velocity in excess of 10.6 m/s. The assumed critical vertical velocity used as a CEC significance threshold is 5.3 meters per second* (m/s) but it should be noted that the basis of the original CASA derived threshold of 4.3 m/s has been lost in antiquity and that CASA no longer relies on the 1998 and 2004 regulations that established this critical threshold other than to note that a more rigorous analysis, which includes site specific meteorology, should be used if the 4.3 m/s and 10.6 m/s screening thresholds are exceeded. The screening method uses absolute worst-case assumptions of calm winds and neutral atmospheric conditions for the entire vertical extent of the plume to determine these worst-case impacts. It should be noted that these results are extremely conservative in that these worst-case conditions typically only occur during a few hours each year.

The Spillane methodology is generally applied to a limited number of plume source geometry's (turbines, power plant boilers, etc.) with the stacks arranged linearly (in a single straight-line) and separated by distances that typically exceed the individual stack diameters. For the diesel engines, this assumption was maintained. Only one engine stack was modeled consistent with the normal operational testing schedule of the emergency generator engines. For the chiller assessment, a conservative assumption was made in order to use the Spillane methodology on an atypical chiller plume configuration, which is made up of 72 chillers arranged on a two-dimensional surface. Here, the methodology, as described below, assumed that all 18 chiller cells for each chiller were merged into a single stack with an effective diameter based on the combined area of all 18 chiller cells, which was calculated to be 3.66 meters. In other words, a single stack

*For the Puente Power Project (Docket#15-AFC-01, TN#213674, 9/15/2016), "CEC staff ... concluded that an average velocity of 5.3 m/s is the appropriate velocity ... (for a plume velocity threshold)." The CEC staff "Plume Background Threshold" attached to the docketed document concludes with "...[CEC] staff will use 10.6 m/s peak vertical plume velocity as the new threshold. The altitude at which a plume would have a peak vertical velocity of 10.6 m/s would be the same altitude at which a plume would have an average vertical velocity of half that, 5.3 m/s."



was assumed to initially describe the release parameters of the combined chiller cells in each of the 72 individual chillers. The effective plume diameter is appropriate for each individual chiller based on the close proximity and arrangement of the 18 chiller cells.

Screening Methodology and Vertical Plume Velocity Calculations

The Spillane methodology is based on worst-case calm wind neutral stability conditions to assess the average plume vertical velocity as a function of height. The methodology is based on wellverified laboratory and theoretical treatments of the rise and spread of a buoyant jet, both into a still ambient environment and into a light crosswind. This treatment covers in detail the initial dynamics of the plume as it exits the stack and the entrainment of ambient air into the plume as it rises directly above the stack. In addition to providing clarifications and algebraic solutions to the Spillane methodology, the 2003 Peter Best paper provides additional methodologies that also consider the enhancement of vertical velocities that may occur if the plumes from multiple identical stacks merge and form a higher buoyancy combined plume (referred to here as the enhanced Spillane methodology).

The vertical plume assessment will involve several stages of development. For individual plumes, the stages are:

- (a) In the first stage very close to the stack exit, the high plume momentum will result in a short section in which the conditions at the center of the plume are relatively unaffected by ambient and plume buoyancy conditions. This jet phase extends from the stack exit to approximately a distance of 6.25 D above the stack (where D is the stack diameter) in calm conditions. At the end of this stage, the plume-averaged vertical velocity has decreased to half of the stack exit velocity, with a corresponding increase, or doubling, in effective plume diameter.
- (b) In the second stage, the plume responds to differences between ambient and plume buoyancy conditions, with much cooler and less turbulent ambient air being entrained into the plume from the outside regions of the plume towards the plume centerline. The momentum and buoyancy of the plume significantly influences plume rise and subsequently the dilution of the stack exhaust to decrease plume vertical velocities. This dilution is very sensitive to ambient wind speed, so the calm wind conditions considered here are extremely conservative.
- (c) In the third stage of plume development, plume rise is due entirely to the buoyancy of the plume and continues from some distance until there is an equalization of turbulence conditions within and outside the plume. This final rise is often only achieved at considerable heights/distances from the stack where the effective average vertical velocity is then close to zero. Since there is very little turbulence and near-zero vertical velocities, this stage of plume development is usually not considered for this type of analysis.

In the second stage of development, the analytical solution of the governing equations under these conditions is given by:



Where the subscript 'o' refers to values of the parameters at the stack outlet and the variables are:

- a plume radius (m)
- V average vertical velocity (m/s)
- z height above stack top (m)
- z_v virtual source height (m)
- D stack diameter (m)
- F_o buoyancy flux evaluated at the stack outlet (m⁴s⁻³)

These are the two primary equations governing the growth of a single plume in the second stage of development under neutral calm wind conditions. Additional equations governing the first stage of single plume development as well as the interaction of multiple plumes in the second stage of development are discussed in detail in the Best paper.

For multiple stacks in the enhanced Spillane methodology, the equations governing the second stage are calculated from the point when the plumes begin to merge until they are fully merged. The plume merging begins at the height where the plume diameters equal the stack separations and the plumes are fully merged at the height where the plume diameters are equal to 2d(N-1)/2 for three or more stacks or 2d for two stacks. At the fully merged height, the merged plume diameter and velocity is enhanced by the fourth root of the number of stacks. Above the fully merged plume height, the enhanced plume diameter and plume velocities follow the regular equations given for the second stage. Below the fully merged plume height for the merging phase, plume velocities are linearly interpolated by height from the single plume velocity at the height where the plumes begin to merge to the enhanced plume velocity at the fully merged plume height.

Vertical Plume Velocity Calculations for the Diesel Engines

The SVYBGF is comprised of 36 individual large and three (3) small diesel emergency generator stacks. The small diesel emergency generators were not assessed as it would have smaller plume vertical velocities. Generator stack parameter data (plume exit velocity, plume exit temperature and stack exit diameter) were provided by Caterpillar. Only one (1) engine will be tested during any one hour. While the engines will be tested at minimum loads, the 100 percent load case was utilized for the worst-case plume analysis. For the engine analysis, two ambient conditions were considered: 41.0°F, the minimum monthly mean of daily minimum temperatures, and 84.3°F, the maximum monthly mean of daily maximum temperatures for the San Jose Airport (*"Climatology of the United States No. 81 – Monthly Station Normals of Temperature, Precipitation, and Heating and Cooling Degree Days 1971-2000 – California"*, February 2002, and *"Climatology of the United States No 20 – Monthly Station Climate Summaries, 1971-2000 – California"*, February 2004. These data are summarized in Table 1.



Table 1 Cummins Diesel Stack Characteristics for Vertical Plume Velocity Analysis							
	Case #	1	2				
Ambient Temperature (°F)*		41.0	84.3				
Stack Diameter (m)		0.5080	0.5080				
Exhaust Velocity (m/s)*		53.10	53.10				
Exhaust Temperature (K)*		766.48	766.48				
Stack Release Height (m)		18.59	18.59				
Stack Buoyancy Flux (m ⁴ /s ³)		20.18	20.18				
*Stack data provided by Caterpillar at 100% load	d with SCR/CO Catalyst						

Screening level vertical plume velocity assessments were made for two ambient temperatures with calm winds and neutral atmospheric conditions for the cases presented in Table 1 which are based on 100 percent load. The results based on the two ambient conditions are presented in Table 2 and the output from the calculation spreadsheet provided in Attachment A.

The initial jet phase extends to a height of about 71.4 feet above grade level (ft-agl) for both cases. After the jet phase, plume temperature buoyancy characteristics modeled in the Spillane methodology cause a uniform decrease in plume-averaged vertical velocities, with the critical plume-averaged vertical velocity of 5.3 m/s occurring at about 103 ft-agl for both cases

Table 2 Diesel Engine Vertical Plume Velocity Analysis Results for Reference Height							
Case #	1	2					
Ambient Temperature (°F)	41.0	84.3					
Single Plume Results:							
Plume-Averaged Vertical Velocity at 200 feet-agl (m/s)	2.58	2.54					
Height of 5.3 m/s Plume-Averaged Vertical Velocity (feet-agl)	102.0	102.6					

These screening results indicate that mechanical and thermal turbulence levels due to the flow from the diesel engine always remain in the light turbulence category and below the significance level of 5.3 m/s at all heights above about 103 ft-agl. Even light wind speeds can dramatically decrease the predicted plume-averaged vertical velocities, so the above results are very conservative indications of adverse conditions. The important factor for a given location is the appropriateness of available information for estimating true wind and temperature profiles throughout a typical year. Theoretical calculations, as shown in the tables above, are likely to overestimate the expected vertical velocities, for the following reasons:

- The wind profile is assumed constant with height with no occurrence of wind-shear when realistically, there is a considerable variation with height, especially in light winds;
- Worst-case scenarios are based on very light-wind, near-neutral atmospheric conditions with maximum loading.

Vertical Plume Velocity Calculations for the Rooftop Chillers

The 72 rooftop chillers are each comprised of 18 individual cells, each with a cell fan diameter of 34 inches. The two data center buildings have different chiller arrangements as is presented in Figure 1. SVY05 is comprised of 30 chillers with SVY06 comprised of 42 individual chillers. The 42 chillers on SVY06 have a larger capacity (295.7 tons) and fan airflow (257,143 ACFM) than the 30 chillers on SVY05 (276 tons and 240,000 ACFM). As the potential for combining the two data



center plumes is not possible, SVY06 with the larger air flow and larger number of chillers was used to assess the chiller plume velocities. The 42 chillers on SVY06 are generally arranged in rows of six (6) along the longer building length (averaging 24.5 feet between adjacent chillers) by eight (8) along the shorter building width (averaging 15 feet between adjacent chillers). Based on the groupings of chillers, the single and merged plumes were based on the 42 (6x8) chiller arrangement by merging plumes along the length (6 merged stacks) and width (8 merged stacks). Chiller stack parameter data (exit velocity and temperature) were provided by the applicant. An effective stack diameter for all 18 cells of 3.66 meters was utilized for each chiller. The chillers will utilize variable speed fans and the number of fans that are operational are dependent upon ambient temperature and plant load. However, to be conservative, all chillers/cells were assumed to be operating at full load. These data are summarized in Table 3 for the same ambient temperatures used for the engine analysis.

Table 3 Chiller Stack Characteristics for Vertical Plume Velocity Analysis							
	Case # 1	2					
Ambient Temperature (°F)*	41.0	84.3					
Effective Stack Diameter (m)**	3.66	3.86					
Exhaust Velocity (m/s)*	11.51	8.06					
Exhaust Temperature (K)*	289.26	313.32					
Stack Release Height (m)	24.38	24.38					
Stack Buoyancy Flux (m ⁴ /s ³)	14.56	13.43					
*Chiller stack data provided by the applicant							

** Calculated value based on the cell diameter of 34 inches multiplied by the square of the number of operating cells, or $D_{eff} = 34"*\sqrt{18}$

The Spillane methodology was originally developed to treat multiple individual stacks that are arranged along a linear x or y direction, but not both directions at once, with stack separations much greater than the stack diameters, typical of boilers/turbines at large power plants. As noted above, the 42 chillers on SVY06 are generally arranged in a 6 x 8 pattern. Therefore, the enhanced Spillane methodology was based on calculating the total merging height for the largest linear direction of chiller placements (which is eight chillers spaced 27.1 feet apart along the shorter length (width) of the building). The largest grouping of 42 (6x8) chillers were considered in the calculation of vertical velocity plume enhancement (both at and above the totally merged height, and for the interpolation down to the plume touching height. Again, the effective single stack diameter of each chiller was based on the combined 18 chiller cells.

Screening level vertical plume velocity assessments were made for the same ambient temperatures with calm winds and neutral atmospheric conditions as was done for the emergency generator engines. The results are presented in Table 4 and the output from the calculation spreadsheets are provided in Attachment A.

The initial jet phase extends to a height of about 155.1 ft-agl for both winter and summer cases (the larger of the merged length or merged width are presented). The critical plume-averaged vertical velocity of 5.3 m/s occurs in the jet phase at about 155.1 ft-agl for both cases. The plumes touch (begin to merge) at about 166 ft-agl and are fully merged at about 674 ft-agl for both cases. Under the enhanced Spillane methodology, the merged plume-averaged vertical velocities never approach 5.3 m/s (either above the totally merged height or when interpolated down to the touching height).



Table 4 Chiller Vertical Plume Velocity Analysis Results for Reference Height							
Case #	1	2					
Ambient Temperature (°F)	41.0	84.3					
Single Plume Results:							
Height of 5.3 m/s Plume-Averaged Vertical Velocity (Within the Jet Phase, feet-agl)	162.0	161.9					
Merged Plume Results:							
Plume-Averaged Vertical Velocity at 1,000 feet-agl (m/s)	3.20	3.12					

From these results and for each ambient condition, the vertical plume velocities are less than the threshold value of 5.3 m/s for all heights above about 162 ft-agl and above for the chillers. The heights at which plume-averaged vertical velocities exceed 5.3 m/s only occur during the jet phase for both cases. These cases also represent worst-case conditions of calm winds at all levels of a neutral atmosphere.

These screening results indicate that mechanical and thermal turbulence levels due to the flow from the chillers always remain in the light turbulence category and below the significance level of 5.3 m/s at all heights above about 162 ft-agl. Even light wind speeds can dramatically decrease the predicted plume-averaged vertical velocities, so the above results are very conservative indications of adverse conditions. The important factor for a given location is the appropriateness of available information for estimating true wind and temperature profiles throughout a typical year. Theoretical calculations, as shown in the tables above, are likely to overestimate the expected vertical velocities, for the following reasons:

- The wind profile is assumed constant with height with no occurrence of wind-shear when realistically, there is a considerable variation with height, especially in light winds;
- Worst-case scenarios are based on very light-wind, near-neutral atmospheric conditions with maximum loading.



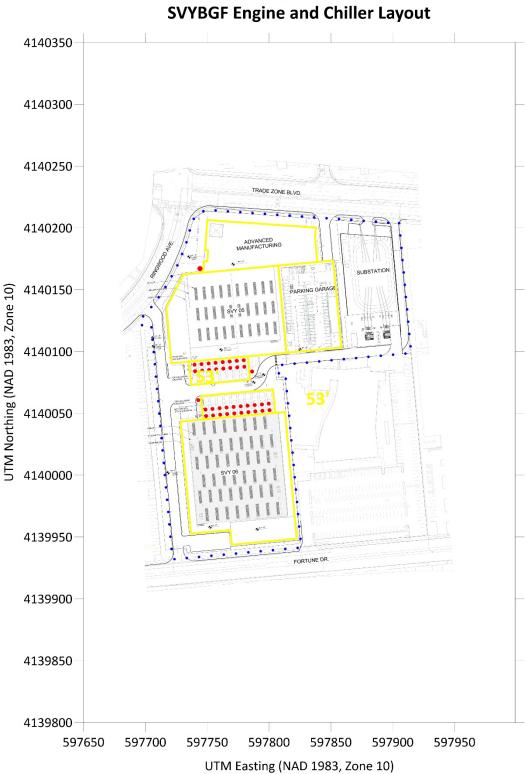


Figure 1



Attachment A Spillane Method Plume Velocity Calculations



	Aviation ou		yant Plumes	," Peter Be	est, et. al.			
	"The Evaluat	ion of Maxin	num Updraft	Speeds for	Calm Cond	litions at V	arious Heights in the Plum	e
		from a Gas-	Turbine Pow	er Station	at Oakey, Q	ueensland,	Australia," Dr. K.T. Spilla	ne
bient Conditions:					Constants:	Assume ne	eutral conditions (d0/dz=0 or	θ _a =θ _e)
Ambient Potential Temp θ _a	278.15	Kelvins	41.0	°F		0.3048	meters/feet	
ume Exit Conditions:					Gravity g	9.81	m/s ²	
Maximum Stack Height hs	18.59	meters	61	feet-inches	λ	1.11		
Stack Diameter D	-	meters	20	inches	λο	~1.0		
Stack Velocity V _{exit}	53.10		174.21	ft/sec				
Volumetric Flow		cu.m/sec	22,987	ACFM	$\pi V_{exit} D^2/4$			Sect.2/¶1
		Kelvins		°F	n v exito / 4			0000.2/ [[1
Stack Potential Temp θ _s			902	F	-> -> -> -> -> -> -> -> -> -> -> -> -> -	10 14 - 14	-1 Elaw(a/a)(4.0, (0,)	0
Initial Stack Buoyancy Flux Fo	21.4178						ol.Flow(g/π)(1-θ _a /θ _s)	Sect.2/¶1
Plume Buoyancy Flux F		m ⁴ /s ³					,θ _p at plume height (see belo	w)
No.of Stacks N	1			1.000	Multiple Sta	ack Multipli	cation Factor (N ^{0.25})	
nditions at End (Top) of Jet Phase:								
Height above Stack z _{jet}	3.188	meters*	10.5	feet*	$z_{jet} = 6.250$), meters*=	meters above stack top	Sect.3/¶1
Height above Ground z _{jet} +h _s	21.778	meters	71.4	feet				
Vertical Velocity V _{jet}	26.550	m/s	87.11	ft/sec	V _{jet} = 0.5V _e	$e_{xit} = V_{exit}/2$		
Plume Top-Hat Diameter 2a _{jet}	1.020	meters	3.3	feet	2a _{jet} = 2D		Conservation of momentum	•
illane Methodology - Analytical Solutions	for Calm Con	ditions for P	lume Height	s above Je	t Phase			
Single Plume-averaged Vertical Velocity			-			aiven bv e	quations below:	
Plume Top-Hat Radius a		olutions in T					rease with height	Sect.2/Eq.6
				foot*			•	
Virtual Source Height z _v		meters*		feet*	υ.∠ο⊔[1-(θ _e	/ʊs) ⁼], mete	ers*=meters above stack top	Sect.2/Eq.6
Height above Ground zv+hs		meters	65.1	teet			where $(\theta_a/\theta_s)^{1/2} = (\theta_e/\theta_s)^{1/2} =$	
Vertical Velocity V		olutions in T	able Below) ² - (6.25D-z _v) ²]} ^(1/3) / a	Sect.2.1(6)
Product (Va) _o	8.211	m²/s			$V_{exit}D/2(\theta_e/$	θ _s) ^{1/2}		
Solve for plume-averaged vertical velo	city at height	200.0	feet	60.96	meters abo	ve ground (z'+hs)	
Gives the following Height above Stack z'		meters*	139.0			J 2010 (1	-,	
Plume Top-Hat Diameter 2a'		meters	43.2		2a'=2*0.16(7'-7)		Sect.2/Eq.6
							/) ² -(6.25D-z _v) ²]} ^(1/3) /(2a'/2)	
Vertical Velocity V	2.580	m/s	8.46	ft/sec	V={(Va) _o -+	J.12⊢₀[(Z-Z∖	/)"-(6.25D-Z _v)"]} /(2a/2)	Sect.2/Eq.6
Solve for Height of CASC critical vertical	velocity V _{crit}	5.30	m/s plume⊣	veraged v	ertical velo	city	Critical VV	> Top of Jet (Spilla
Find Height above Stack z _{crit}	12.511	meters	41.0	feet	Solve for x=	(z-z _v) simu	Itaneously in both eqs. (i.e.,	Va and a)
Height above Ground zcrit+hs	31.101	meters	102.0	feet	for V=4.3 m	n/s usina th	e cubic equation ax3+bx2+cx	+d=0, where
0						•	and b=-(0.12Fo)/(4.330.163)=	-4.2
Interpolated Height of critical vertical ve	elocity in .let	Phase ·			and d		25D-z _v) ² -(Va) _o ³]/(4.3 ³ 0.16 ³)=	-89
Find Height above Stack z _{crit}		meters	#N/A	faat	and o	[0.1210(0.		/www.1728.org/cubic.
•								
Height above Ground z _{crit} +h _s	#IN/A	meters	#N/A	ieet		give	s the real solution x = z-zv =	11.2
							or z(m/above stack) =	12.
							z(ft/above ground) =	10
ble of Plume Top-Hat Diameters (2a) and F	lume-Averag	ed Vertical	Velocities st	arting at er	nd of jet ph	ase:		
Height (feet)	(meters)	Plume	SingleStk	Plume				
Height (feet) above ground			SingleStk VertVel(m/s)					
		Radius(m)	-					
above ground Stack.Rel.Ht = 61.0	above stack 0.00	Radius(m) 0.255	VertVel(m/s) 53.10	Temp(K)			Jet Phase Eos:	5 foot Inter
above ground Stack.Rel.Ht = 61.0 65.0	above stack 0.00 1.22	Radius(m) 0.255 0.353	VertVel(m/s) 53.10 42.89	Temp(K)			Jet Phase Eqs:	
above ground <u> Stack.Rel.Ht</u> = 61.0 65.0 70.0	above stack 0.00 1.22 2.75	Radius(m) 0.255 0.353 0.476	VertVel(m/s) 53.10 42.89 30.12	Temp(K)			Linearly interpolated from Stack R	
above ground Stack.Rel.Ht = 61.0 65.0 70.0 Top of jet = 71.4	above stack 0.00 1.22 2.75 3.17	Radius(m) 0.255 0.353 0.476 0.510	VertVel(m/s) 53.10 42.89 30.12 26.55	Temp(K)			Linearly interpolated from Stack R Spillane Equations:	el.Ht to Top of Jet
above ground Stack.Rel.Ht = 61.0 65.0 70.0 Top of jet = 71.4 80.0	above stack 0.00 1.22 2.75 3.17 5.79	Radius(m) 0.255 0.353 0.476 0.510 0.726	VertVel(m/s) 53.10 42.89 30.12 26.55 11.59	Temp(K) 358.75			Linearly interpolated from Stack R Spillane Equations: V _{plume} ={(Va) _o ³ +0.12F _o [(z-z _v) ² -(6.2	el.Ht to Top of Jet 5D-z _v) ²]} ^{1/3} / a
above ground Stack. Rel.Ht = 61.0 65.0 70.0 Top of jet = 71.4 80.0 90.0	above stack 0.00 1.22 2.75 3.17 5.79 8.84	Radius(m) 0.255 0.353 0.476 0.510 0.726 1.214	VertVel(m/s) 53.10 42.89 30.12 26.55 11.59 7.29	Temp(K) 358.75 324.05			Linearly interpolated from Stack R Spillane Equations: $V_{plume}=\{(Va)_o^3+0.12F_o[(z-z_v)^2-(6.2a))^2-(6.2a))^2$ $a = 0.16(z-z_v)$	el.Ht to Top of Jet (5D-z _v) ²]} ^{1/3} / a 10 foot Inter
above ground Stack.Rel.Ht = 61.0 65.0 70.0 Top of jet = 71.4 80.0	above stack 0.00 1.22 2.75 3.17 5.79	Radius(m) 0.255 0.353 0.476 0.510 0.726 1.214	VertVel(m/s) 53.10 42.89 30.12 26.55 11.59 7.29	Temp(K) 358.75 324.05			Linearly interpolated from Stack R Spillane Equations: V _{plume} ={(Va) _o ³ +0.12F _o [(z-z _v) ² -(6.2	el.Ht to Top of Jet (5D-z _v) ²]} ^{1/3} / a 10 foot Inte r
above ground Stack.Rel.Ht = 61.0 65.0 70.0 Top of jet = 71.4 80.0 90.0	above stack 0.00 1.22 2.75 3.17 5.79 8.84	Radius(m) 0.255 0.353 0.476 0.510 0.726 1.214	VertVel(m/s) 53.10 42.89 30.12 26.55 11.59 7.29	Temp(K) 358.75 324.05			Linearly interpolated from Stack R Spillane Equations: $V_{plume}=\{(Va)_o^3+0.12F_o[(z-z_v)^2-(6.2a))^2-(6.2a))^2$ $a = 0.16(z-z_v)$	el.Ht to Top of Jet (5D-z _v) ²]} ^{1/3} / a 10 foot Inte r
above ground Stack.Rel.Ht = 61.0 65.0 70.0 Top of jet = 71.4 80.0 90.0 100.0	above stack 0.00 1.22 2.75 3.17 5.79 8.84 11.89	Radius(m) 0.255 0.353 0.476 0.510 0.726 1.214 1.702 1.801	VertVel(m/s) 53.10 42.89 30.12 26.55 11.59 7.29 5.53 5.30	Temp(K) 358.75 324.05 308.91			Linearly interpolated from Stack R Spillane Equations: $V_{plume}=\{(Va)_o^3+0.12F_o[(z-z_v)^2-(6.2a))^2-(6.2a))^2$ $a = 0.16(z-z_v)$	el.Ht to Top of Jet (5D-z _v) ²]} ^{1/3} / a 10 foot Inte r
above ground Stack.Rel.Ht = 61.0 65.0 70.0 Top of jet = 71.4 80.0 90.0 100.0 Spillane 5.3 m/s Height = 102.0 110.0	above stack 0.00 1.22 2.75 3.17 5.79 8.84 11.89 12.51 14.94	Radius(m) 0.255 0.353 0.476 0.510 0.726 1.214 1.702 1.801 2.189	VertVel(m/s) 53.10 42.89 30.12 26.55 11.59 7.29 5.53 5.30 4.61	Temp(K) 358.75 324.05 308.91 306.82 300.48			Linearly interpolated from Stack R Spillane Equations: $V_{plume}=\{(Va)_o^3+0.12F_o[(z-z_v)^2-(6.2a))^2-(6.2a))^2$ $a = 0.16(z-z_v)$	el.Ht to Top of Jet (5D-z _v) ²]} ^{1/3} / a 10 foot Inte r
above ground Stack.Rel.Ht = 61.0 65.0 70.0 Top of jet = 71.4 80.0 90.0 100.0 Spillane 5.3 m/s Height = 102.0 110.0 120.0	above stack 0.00 1.22 2.75 3.17 5.79 8.84 11.89 12.51 14.94 17.99	Radius(m) 0.255 0.353 0.476 0.510 0.726 1.214 1.702 1.801 2.189 2.677	VertVel(m/s) 53.10 42.89 30.12 26.55 11.59 7.29 5.53 5.30 4.61 4.04	Temp(K) 358.75 324.05 308.91 306.82 300.48 295.18			Linearly interpolated from Stack R Spillane Equations: $V_{plume}=\{(Va)_o^3+0.12F_o[(z-z_v)^2-(6.2a))^2-(6.2a))^2$ $a = 0.16(z-z_v)$	el.Ht to Top of Jet 5D-z.,) ²]) ^{1/3} / a 10 foot Inte m [*] (a ^{2*} λ ²)))
above ground Stack.Rel.Ht = 61.0 65.0 70.0 Top of jet = 71.4 80.0 90.0 100.0 Spillane 5.3 m/s Height = 102.0 110.0 120.0 130.0	above stack 0.00 1.22 2.75 3.17 5.79 8.84 11.89 12.51 14.94 17.99 21.03	Radius(m) 0.255 0.353 0.476 0.510 0.726 1.214 1.702 1.801 2.189 2.677 3.165	VertVel(m/s) 53.10 42.89 30.12 26.55 11.59 7.29 5.53 5.30 4.61 4.04 3.66	Temp(K) 358.75 324.05 308.91 306.82 300.48 295.18 291.61			Linearly interpolated from Stack R Spillane Equations: $V_{plume}=\{(Va)_o^3+0.12F_o[(z-z_v)^2-(6.2a))^2-(6.2a))^2$ $a = 0.16(z-z_v)$	el.Ht to Top of Jet 5D-z.,) ²]) ^{1/3} / a 10 foot inte r m [*] (a ^{2*} λ ²)))
above ground Stack.Rel.Ht = 61.0 65.0 70.0 Top of jet = 71.4 80.0 90.0 100.0 Spillane 5.3 m/s Height = 102.0 110.0 120.0 130.0 140.0	above stack 0.00 1.22 2.75 3.17 5.79 8.84 11.89 12.51 14.94 17.99 21.03 24.08	Radius(m) 0.255 0.353 0.476 0.510 0.726 1.214 1.702 1.801 2.189 2.677 3.165 3.652	VertVel(m/s) 53.10 42.89 30.12 26.55 11.59 7.29 5.53 5.30 4.61 4.04 3.66 3.38	Temp(K) 358.75 324.05 308.91 306.82 300.48 295.18 291.61 289.08			Linearly interpolated from Stack R Spillane Equations: $V_{plume}=\{(Va)_o^3+0.12F_o[(z-z_v)^2-(6.2a))^2-(6.2a))^2$ $a = 0.16(z-z_v)$	el.Ht to Top of Jet 5D-z.,) ²]) ^{1/3} / a 10 foot Inte m [*] (a ^{2*} λ ²)))
above ground Stack.Rel.Ht = 61.0 65.0 70.0 Top of jet = 71.4 80.0 90.0 100.0 Spillane 5.3 m/s Height = 102.0 110.0 130.0 130.0 130.0	above stack 0.00 1.22 2.75 3.17 5.79 8.84 11.89 12.51 14.94 17.99 21.03 24.08 27.13	Radius(m) 0.255 0.353 0.476 0.510 0.726 1.214 1.702 1.801 2.189 2.677 3.165 3.652 4.140	VertVeI(m/s) 53.10 42.89 30.12 26.55 11.59 7.29 5.53 5.30 4.61 4.04 3.66 3.38 3.17	Temp(K) 358.75 324.05 308.91 306.82 300.48 295.18 291.61 289.08 287.22			Linearly interpolated from Stack R Spillane Equations: $V_{plume}=\{(Va)_o^3+0.12F_o[(z-z_v)^2-(6.2a))^2-(6.2a))^2$ $a = 0.16(z-z_v)$	el.Ht to Top of Jet 5D-z.,) ²]) ^{1/3} / a 10 foot inte r m [*] (a ^{2*} λ ²)))
above ground Stack.Rel.Ht = 61.0 65.0 70.0 Top of jet = 71.4 80.0 90.0 100.0 Spillane 5.3 m/s Height = 102.0 110.0 120.0 130.0 140.0	above stack 0.00 1.22 2.75 3.17 5.79 8.84 11.89 12.51 14.94 17.99 21.03 24.08	Radius(m) 0.255 0.353 0.476 0.510 0.726 1.214 1.702 1.801 2.189 2.677 3.165 3.652 4.140	VertVeI(m/s) 53.10 42.89 30.12 26.55 11.59 7.29 5.53 5.30 4.61 4.04 3.66 3.38 3.17	Temp(K) 358.75 324.05 308.91 306.82 300.44 295.18 291.61 289.08 287.22			Linearly interpolated from Stack R Spillane Equations: $V_{plume}=\{(Va)_o^3+0.12F_o[(z-z_v)^2-(6.2a))^2-(6.2a))^2$ $a = 0.16(z-z_v)$	el.Ht to Top of Jet 5D-z.,) ²]) ^{1/3} / a 10 foot inte r m [*] (a ^{2*} λ ²)))
above ground Stack.Rel.Ht = 61.0 65.0 70.0 Top of jet = 71.4 80.0 90.0 100.0 Spillane 5.3 m/s Height = 102.0 110.0 130.0 130.0 130.0	above stack 0.00 1.22 2.75 3.17 5.79 8.84 11.89 12.51 14.94 17.99 21.03 24.08 27.13	Radius(m) 0.255 0.353 0.476 0.510 0.726 1.214 1.702 1.801 2.189 2.677 3.1655 3.652 4.140 4.628	VertVel(m/s) 53.10 42.89 30.12 26.55 11.55 5.53 5.53 4.61 4.04 3.866 3.38 3.17 3.01	Temp(K) 358.75 324.05 308.91 306.82 300.48 295.18 291.61 289.08 287.22 285.80			Linearly interpolated from Stack R Spillane Equations: $V_{plume}=\{(Va)_o^3+0.12F_o[(z-z_v)^2-(6.2a))^2-(6.2a))^2$ $a = 0.16(z-z_v)$	eLH to Top of Jet (5D-z,) ²]) ¹³⁷ / a 10 foot Inter m ² ^{12*} ² ³))) Max<5.30
above ground Stack.Rel.Ht = 61.0 65.0 70.0 Top of jet = 71.4 80.0 90.0 100.0 Spillane 5.3 m/s Height = 102.0 110.0 120.0 130.0 140.0 150.0 160.0	above stack 0.00 1.22 2.75 3.17 5.77 8.84 11.89 12.51 14.94 17.99 21.03 24.00 27.13 30.18	Radius(m) 0.255 0.353 0.476 0.510 0.726 1.214 1.702 1.801 2.189 2.677 3.165 3.652 4.140 4.628 7.066	VertVel(m/s) 53.10 42.89 26.555 11.59 7.29 5.53 6.30 4.61 4.04 3.66 3.38 3.17 3.01 2.51	Temp(K) 358.75 324.05 308.91 306.82 300.48 295.18 291.61 289.08 287.22 285.80 282.29			Linearly interpolated from Stack R Spillane Equations: $V_{plume}=\{(Va)_o^3+0.12F_o[(z-z_v)^2-(6.2a))^2-(6.2a))^2$ $a = 0.16(z-z_v)$	eLH to Top of Jet (5D-z,) ²]) ^{1/2} / a 10 foot inter m ² ^{(2²*λ²))) Max<5.30}
above ground Stack.Rel.Ht = 61.0 65.0 70.0 Top of jet = 71.4 80.0 90.0 100.0 Spillane 5.3 m/s Height = 102.0 110.0 120.0 130.0 140.0 150.0 160.0 210.0 260.0	above stack 0.00 1.22 2.75 3.17 5.79 8.84 11.88 12.51 14.94 17.99 21.03 24.08 27.13 30.18 45.42 60.66	Radius(m) 0.255 0.353 0.476 0.510 0.726 1.214 1.702 1.801 2.189 2.677 3.165 3.652 4.140 4.628 7.066 9.505	VertVel(m/s) 53.10 42.89 30.12 26.555 5.30 4.61 4.04 3.66 3.38 3.17 3.01 2.515	Temp(K) 358.75 324.05 308.91 306.82 300.48 295.18 291.61 289.08 287.22 285.80 282.09 280.59			Linearly interpolated from Stack R Spillane Equations: $V_{plume}=\{(Va)_o^3+0.12F_o[(z-z_v)^2-(6.2a))^2-(6.2a))^2$ $a = 0.16(z-z_v)$	eLH to Top of Jet (5D-z,) ²]) ^{1/2} / a 10 foot inter m ² ^{(2²*λ²))) Max<5.30}
above ground Stack.Rel.Ht = 61.0 65.0 70.0 Top of jet = 71.4 80.0 90.0 100.0 Spillane 5.3 m/s Height = 102.0 110.0 120.0 130.0 140.0 150.0 160.0 210	above stack 0.00 1.22 2.75 3.17 5.79 8.84 11.88 12.51 14.94 17.99 21.03 24.06 27.13 3.0.18 45.42 60.66 75.90	Radius(m) 0.255 0.353 0.476 0.510 0.726 1.214 1.702 1.801 2.189 2.677 3.165 3.652 4.140 4.628 7.066 9.505 11.943	VertVe1(m/s) 53.10 42.89 30.12 26.55 11.59 7.29 5.535 6.30 4.61 4.04 3.66 3.38 3.17 3.01 2.51 2.24 2.06	Temp(K) 358.75 324.05 308.91 306.82 300.48 295.18 291.61 289.08 287.22 285.80 282.05 280.59 280.59 279.83			Linearly interpolated from Stack R Spillane Equations: $V_{plume}=\{(Va)_o^3+0.12F_o[(z-z_v)^2-(6.2a))^2-(6.2a))^2$ $a = 0.16(z-z_v)$	eLH to Top of Jet (5D-z,) ²]) ^{1/2} / a 10 foot inter m ² ^{(2²*λ²))) Max<5.30}
above ground Stack.Rel.Ht = 61.0 65.0 70.0 Top of jet = 71.4 80.0 100.0 Spillane 5.3 m/s Height = 102.0 110.0 130.0 130.0 140.0 150.0 160.0 210.0 310.0	above stack 0.00 1.22 2.75 3.17 5.79 8.84 11.89 12.51 14.94 17.99 21.03 24.08 27.13 30.18 45.42 60.66 67.590 91.14	Radius(m) 0.255 0.353 0.476 0.510 0.726 1.214 1.702 1.801 2.677 3.165 3.652 4.140 4.628 7.066 9.505 11.943 14.381	VertVe1(m/s) 53.10 42.89 30.12 26.55 5.53 5.53 4.61 4.64 3.66 3.38 3.17 3.01 2.55 2.24 2.00 0.193	Temp(K) 358.75 324.05 308.91 306.82 300.48 295.18 291.61 289.06 287.22 285.80 282.09 280.59 279.39 279.39			Linearly interpolated from Stack R Spillane Equations: $V_{plume}=\{(Va)_o^3+0.12F_o[(z-z_v)^2-(6.2a))^2-(6.2a))^2$ $a = 0.16(z-z_v)$	eLH to Top of Jet (5D-z,) ²]) ^{1/2} / a 10 foot inter m ² ^{(2²*λ²))) Max<5.30}
above ground Stack.Rel.Ht = 61.0 65.0 70.0 Top of jet = 71.4 80.0 90.0 1000 Spillane 5.3 m/s Height = 102.0 110.0 120.0 140.0 150.0 160.0 210.0 260.0 310.0 360.0 410.0	above stack 0.00 1.22 2.75 3.17 5.79 8.84 11.88 12.51 14.94 17.99 21.03 24.08 27.13 30.18 45.42 60.66 75.90 91.141 106.38	Radius(m) 0.255 0.353 0.476 0.510 0.726 1.214 1.702 1.801 2.189 2.677 3.165 3.652 3.652 4.140 4.628 7.066 9.505 11.943 14.381 16.820	VertVe1(m/s) 53.10 42.89 30.12 26.55 11.59 7.29 5.53 5.30 4.61 4.04 4.61 3.66 3.38 3.17 3.01 2.51 2.24 2.06 1.93 1.83	Temp(K) 358.75 324.05 308.91 306.82 300.48 291.61 289.08 287.22 285.80 282.09 280.59 279.83 279.33 279.10			Linearly interpolated from Stack R Spillane Equations: $V_{plume}=\{(Va)_o^3+0.12F_o[(z-z_v)^2-(6.2a))^2-(6.2a))^2$ $a = 0.16(z-z_v)$	eLH to Top of Jet (5D-z,) ²]) ^{1/2} / a 10 foot inter m ² ^{(2²*λ²))) Max<5.30}
above ground Stack.Rel.Ht = 61.0 65.0 70.0 Top of jet = 71.4 80.0 90.0 5pillane 5.3 m/s Height = 102.0 110.0 120.0 130.0 140.0 150.0 260.0 310.0 360.0 410.0 410.0 460.0	above stack 0.00 1.22 2.75 3.17 5.79 8.84 11.88 12.51 14.94 17.99 21.03 24.08 27.13 30.18 45.42 60.66 75.90 91.14 10.68 12.162	Radius(m) 0.255 0.353 0.476 0.510 0.726 1.214 1.702 1.801 2.189 2.677 3.165 3.652 4.140 4.628 7.066 9.505 11.943 14.381 16.820 19.258	VertVe1(m/s) 53.10 42.89 30.12 26.55 11.59 5.53 5.30 4.61 4.04 3.66 3.38 3.37 3.01 2.51 2.24 2.06 1.93 1.83 1.74	Temp(K) 358.75 324.05 308.91 306.82 300.48 291.61 289.08 287.22 285.80 288.09 280.59 279.83 279.93 279.10 278.91			Linearly interpolated from Stack R Spillane Equations: $V_{plume}=\{(Va)_o^3+0.12F_o[(z-z_v)^2-(6.2a))^2-(6.2a))^2$ $a = 0.16(z-z_v)$	eLH to Top of Jet (5D-z,) ²]) ^{1/2} / a 10 foot inter m ² ^{(2²*λ²))) Max<5.30}
above ground Stack.Rel.Ht = 61.0 66.0 70.0 Top of jet = 71.4 80.0 90.0 100.0 Spillane 5.3 m/s Height = 102.0 120.0 130.0 140.0 120.0 200.0 310.0 210.0 260.0 310.0	above stack 0.00 1.22 2.75 3.17 5.79 8.84 11.88 12.51 14.94 17.99 21.03 24.08 27.13 30.18 45.42 60.66 75.90 91.141 106.38	Radius(m) 0.255 0.353 0.476 0.510 0.726 1.214 1.702 1.801 2.189 2.677 3.165 3.652 4.140 4.628 7.066 9.505 11.943 14.381 16.820 19.258	VertVe1(m/s) 53.10 42.89 30.12 26.55 11.59 5.53 5.30 4.61 4.04 3.66 3.38 3.37 3.01 2.51 2.24 2.06 1.93 1.83 1.74	Temp(K) 358.75 324.05 308.91 306.82 300.48 291.61 289.08 287.22 285.80 288.09 280.59 279.83 279.93 279.10 278.91			Linearly interpolated from Stack R Spillane Equations: $V_{plume}=\{(Va)_o^3+0.12F_o[(z-z_v)^2-(6.2a))^2-(6.2a))^2$ $a = 0.16(z-z_v)$	eLH to Top of Jet (5D-z,) ²]) ^{1/2} / a 10 foot inter m ² ^{(2²*λ²))) Max<5.30}
above ground Stack.Rel.Ht = 61.0 65.0 770.0 Top of jet = 71.4 80.0 90.0 100.0 Spillane 5.3 m/s Height = 102.0 110.0 120.0 130.0 140.0 150.0 160.0 21	above stack 0.00 1.22 2.75 3.17 5.79 8.84 11.88 12.51 14.94 17.99 21.03 24.08 27.13 30.18 45.42 60.66 75.90 91.14 10.68 12.162	Radius(m) 0.255 0.353 0.476 0.510 0.726 1.214 1.702 1.801 2.189 2.677 3.1652 4.140 4.628 7.066 9.505 11.943 14.381 16.820 11.943 21.697	VertVe1(m/s) 53.10 42.89 30.12 26.55 11.59 5.53 5.30 4.61 4.61 4.04 3.66 3.38 3.17 3.01 2.51 2.24 2.06 1.93 1.83 1.74 1.67	Temp(K) 358.75 324.05 308.91 306.82 300.48 291.61 289.06 287.22 285.80 287.93 279.83 279.83 279.93 279.10 278.91 278.78			Linearly interpolated from Stack R Spillane Equations: $V_{plume}=\{(Va)_o^3+0.12F_o[(z-z_v)^2-(6.2a))^2-(6.2a))^2$ $a = 0.16(z-z_v)$	eilH to Top of Jet 5D.z.,7)1 ¹⁰⁷ / a 10 foot Inte *2 ^a ² /A ²))) Max<5.30 50 foot Inte
above ground Stack.Rel.Ht = 61.0 65.0 70.0 Top of jet = 71.4 80.0 90.0 100.0 Spillane 5.3 m/s Height = 102.0 110.0 120.0 130.0 140.0 160.0 210.0 310.0 310.0 340.0 310.0 360.0 310.0 360.0 310.0 360.0 310.0 360.0 310.0 360.0 310.0 360.0 310.0 360.0 310.0 360.0 310.0 360.0 310.0 360.0 310.0 360.0 310.0 360.0 310.0 360.0 310.0 360.0 310.0 360.0 310.0 360.0 310.0 360.0 310.0 360.0 310.0 360.0 360.0 310.0 360	above stack 0.00 1.22 2.75 3.17 5.79 8.84 11.88 12.51 14.94 17.99 21.03 24.06 27.13 30.18 45.42 60.66 75.90 91.14 106.38 121.62 136.86	Radius(m) 0.255 0.363 0.476 0.510 0.726 1.214 1.702 1.801 2.677 3.165 3.652 3.652 4.140 4.628 7.066 9.505 11.943 14.381 16.820 19.258 21.697 26.573	VertVe1(m/s) 53.10 42.89 30.12 26.55 5.53 5.53 4.61 4.04 3.66 3.38 3.17 3.01 2.51 2.24 2.00 1.93 1.83 1.74 1.67 5.53	Temp(K) 358.75 324.05 308.91 306.62 95.18 291.61 289.08 287.22 285.80 280.59 280.59 279.39 279.39 279.10 278.78.91 278.78.60			Linearly interpolated from Stack R Spillane Equations: $V_{plume}=\{(Va)_o^3+0.12F_o[(z-z_v)^2-(6.2a))^2-(6.2a))^2$ $a = 0.16(z-z_v)$	یدا.H to Top of Jet (50-z,) ²)) ^{1/2} /a 10 foot inter m ² ^{2²*²))) Max<5.30 50 foot inter}
above ground Stack.Rel.Ht = 61.0 66.0 70.0 Top of jet = 71.4 80.0 90.0 Spillane 5.3 m/s Height = 102.0 110.0 130.0 140.0 140.0 150.0 140.0 160.0 210.0 260.0 310.0 210.0 260.0 310.0 260.0 310.0 210.0 260.0 310.0 210.0	above stack 0.00 1.22 2.75 3.17 5.79 8.84 11.88 12.51 14.94 17.99 21.03 24.08 27.13 30.18 45.42 60.66 75.90 91.14 106.38 121.62 136.86 167.34 197.82	Radius(m) 0.255 0.353 0.476 0.510 0.726 1.214 1.702 1.801 2.189 2.677 3.165 3.652 4.140 4.622 4.140 4.622 4.505 11.943 14.381 16.820 19.258 21.697 26.573 31.450	VertVe1(m/s) 53.10 42.89 30.12 26.55 11.59 7.29 5.53 5.30 4.61 4.04 3.66 3.38 3.17 3.01 2.51 2.24 2.06 1.93 1.83 1.74 1.67 1.56 5.148	Temp(K) 358.75 324.05 308.91 306.82 300.48 295.18 291.61 289.08 289.08 288.09 288.59 279.83 279.30 279.30 279.49 278.78 279.60 278.49			Linearly interpolated from Stack R Spillane Equations: $V_{plume}=\{(Va)_o^3+0.12F_o[(z-z_v)^2-(6.2a))^2-(6.2a))^2$ $a = 0.16(z-z_v)$	یدا.H to Top of Jet (50-z,) ²)) ^{1/2} /a 10 foot inter m ² ^{2²*²))) Max<5.30 50 foot inter}
above ground Stack.Rel.Ht = 61.0 65.0 70.0 Top of jet = 71.4 80.0 90.0 Spillane 5.3 m/s Height = 102.0 110.0 120.0 140.0 130.0 140.0 160.0 260.0 310.0 260.0 310.0 260.0 310.0 260.0 310.0 260.0 310.0 260.0 310.0 260.0 310.0 260.0 310.0 260.0 310.0 260.0 310.0 260.0 310.0 260.0 310.0 260.0 310.0 260.0 310.0 260.0 310.0 310.0 360.0 310.0 360.0 310.0 310.0 360.0 310.0 360.0 310.0 360.0 310.0 360.0 310.0 310.0 360.0 310.0 360.0 310.0 360.0 310.0 360.0 310.0 360.0 360.0 310.0 360.0 310.0 360.0 360.0 310.0 360.0 310.0 360.0 360.0 310.0 360.0 370	above stack 0.00 1.22 2.75 3.17 5.79 8.84 11.88 12.51 14.94 17.99 21.03 24.08 27.13 30.18 45.42 60.66 75.90 91.14 10.688 121.62 136.686 167.34 197.82 228.30	Radius(m) 0.255 0.353 0.476 0.510 0.726 1.214 1.702 1.801 2.189 2.677 3.165 3.652 4.140 4.628 7.066 9.505 11.943 14.481 16.820 19.258 21.697 26.573 31.450 26.573	VertVe1(m/s) 53.10 42.89 30.12 26.55 11.59 7.29 5.53 5.30 4.61 4.04 3.666 3.38 3.37 3.01 2.515 2.24 2.06 1.93 1.83 1.74 1.67 1.56 1.48 4.61	Temp(K) 358.75 324.05 308.91 306.82 300.48 291.61 289.08 287.22 285.80 280.59 279.63 279.63 279.63 279.78.91 278.78 278.60 278.42			Linearly interpolated from Stack R Spillane Equations: $V_{plume}=\{(Va)_o^3+0.12F_o[(z-z_v)^2-(6.2a))^2-(6.2a))^2$ $a = 0.16(z-z_v)$	eLH to Top of Jet (5D-z.) ²]) ¹² / a 10 foot Inter m ² ^{2²'A²}))) Max<5.30 50 foot Inter
above ground Stack.Rel.Ht = 61.0 65.0 70.0 Top of jet = 71.4 80.0 100.0 Spillane 5.3 m/s Height = 102.0 110.0 130.0 140.0 160.0 210.0 300.0 310.0	above stack 0.00 1.22 2.75 3.17 5.79 8.84 11.89 12.51 14.94 17.99 21.03 24.08 27.13 3.0.18 45.42 60.66 75.90 91.14 106.38 121.62 136.68 121.62 136.68 121.62 136.68 121.62 136.68 121.62 136.68 121.62 136.68 121.62 136.68 121.62 136.68 121.62 136.68 121.62 136.68 121.62 136.68 121.62 136.68 121.62 136.68 121.62 121.62 121.62 126.68 127.67	Radius(m) 0.255 0.353 0.476 0.510 0.726 1.214 1.702 1.801 2.677 3.165 3.652 3.652 3.652 3.652 3.652 3.652 3.165 3.652 3.165 3.652 3.165 3.652 3.165 3.652 3.165 3.652 3.165 3.165 3.652 3.165 3.165 3.652 3.165 3.652 3.165 3.652 3.165 3.652 3.165 3.652 3.165 3.652 3.165 3.652 3.165 3.652 3.165 3.652 3.165 3.652 3.165 3.652 3.165 3.652 3.165 3.652 3.165 3.652 3.165 3.652 3.165 3.652 3.165 3.652 3.165 3.652 3.165 3.104 3.165 3.	VertVe1(m/s) 53.10 42.89 30.12 26.55 533 5.53 4.61 4.64 3.66 3.38 3.17 3.01 2.51 2.24 2.06 1.93 1.83 1.74 1.65 1.48 1.44 1.45	Temp(K) 358.75 324.05 308.91 306.82 95.18 291.61 289.06 287.22 285.80 282.09 286.59 279.93 279.10 278.78 91 278.78 92 778.91 278.78 278.60 278.49 279.59 279			Linearly interpolated from Stack R Spillane Equations: $V_{plume}=\{(Va)_o^3+0.12F_o[(z-z_v)^2-(6.2a))^2-(6.2a))^2$ $a = 0.16(z-z_v)$	یدا.H to Top of Jet (50-z,) ²)) ^{1/2} /a 10 foot inter m ² ^{2²*²))) Max<5.30 50 foot inter}
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above ground Stack.Rel.Ht = 61.0 65.0 70.0 Top of jet = 71.4 80.0 90.0 100.0 Spillane 5.3 m/s Height = 102.0 110.0 130.0 140.0 150.0 210.0 220.0 310.0 30.0	above stack 0.00 1.22 2.75 3.17 5.79 8.84 11.88 12.51 14.94 17.99 21.03 24.08 27.13 30.18 45.42 60.66 75.90 91.14 106.38 121.62 136.86 167.34 197.82 228.30 258.76 269.26 319.74 350.22 380.70 411.18	Radius(m) 0.255 0.363 0.476 0.510 0.726 1.214 1.702 1.801 2.677 3.165 3.662 4.140 4.628 7.066 9.505 11.943 14.381 16.820 19.258 21.697 26.573 31.450 36.327 41.204 46.081 50.957 55.834 60.711 16.5588	VertVe1(m/s) 53.10 42.89 30.12 26.55 11.59 7.29 5.33 5.33 4.61 4.04 3.66 3.38 3.17 3.01 2.51 2.24 2.06 1.93 1.83 1.74 1.67 1.65 1.48 1.44 1.41 1.55 1.48 1.41 1.55 1.48 1.41 1.55 1.48 1.41 1.55 1.48 1.41 1.55 1.48 1.41 1.55 1.48 1.45 1.45 1.45 1.45 1.45 1.45 1.45 1.45 1.55 1.45 1.55 1.45 1.55 1.45 1.55 1.45 1.55 1.45 1.55 1.45	Temp(K) 358.75 324.05 308.91 306.82 300.48 291.61 289.08 287.22 285.80 282.09 280.59 279.83 279.10 278.91 278.78 278.42 278.43 278.42 278.43 278.43 278.43 278.43 278.43 278.26 278.25			Linearly interpolated from Stack R Spillane Equations: $V_{plume}=\{(Va)_o^3+0.12F_o[(z-z_v)^2-(6.2a))^2-(6.2a))^2$ $a = 0.16(z-z_v)$	eLH to Top of Jet (5D-z.) ²]) ¹² / a 10 foot Inter m ² ^{2²'A²}))) Max<5.30 50 foot Inter
above ground Stack. Rel.Ht = 61.0 65.0 70.0 Top of jet = 71.4 80.0 90.0 1000 Spillane 5.3 m/s Height = 102.0 110.0 120.0 140.0 150.0 260.0 310.0 31.	above stack 0.00 1.22 2.75 3.17 5.79 8.84 11.88 12.51 14.94 17.99 21.03 24.08 27.13 30.18 45.42 60.66 75.90 91.14 106.38 121.62 136.86 167.34 197.82 228.30 258.78 259.25 319.74 350.22 380.70 411.88 441.68	Radius(m) 0.255 0.353 0.476 0.510 0.726 1.214 1.702 1.801 2.189 2.677 3.165 3.652 4.140 4.628 7.066 9.505 11.943 14.381 16.820 19.258 21.697 26.573 31.450 36.327 41.204 46.081 50.957 55.834 60.711 65.588 70.465	VertVe1(m/s) 53.10 42.89 30.12 26.55 11.59 7.29 5.53 5.30 4.61 4.04 3.66 3.38 3.17 3.01 2.25 1.224 2.06 1.93 1.83 1.74 1.67 1.65 1.48 1.44 1.41 1.55 1.225 1.255 1.225 1.255 1	Temp(K) 358.75 324.05 308.91 306.82 300.48 291.61 289.06 287.22 285.06 288.09 280.59 279.30 279.30 279.30 279.40 278.49 278.49 278.49 278.49 278.49 278.49 278.49 278.49 278.26 278.26 278.26 278.26 278.26 278.26			Linearly interpolated from Stack R Spillane Equations: $V_{plume}=\{(Va)_o^3+0.12F_o[(z-z_v)^2-(6.2a))^2-(6.2a))^2$ $a = 0.16(z-z_v)$	eLH to Top of Jet (5D-z.) ²]) ¹² / a 10 foot Inter m ² ^{2²'A²}))) Max<5.30 50 foot Inter
above ground Stack. Rel. Ht = 61.0 65.0 70.0 Top of jet = 71.4 80.0 90.0 100.0 Spillane 5.3 m/s Height = 102.0 110.0 120.0 140.0 130.0 140.0 260.0 310.0 260.0 310.0 260.0 310.0 260.0 310.0 260.0 310.0 260.0 310.0 210.0 260.0 310.0 2	above stack 0.00 1.22 2.75 3.17 5.79 8.84 11.88 12.51 14.94 17.99 21.03 24.08 27.13 30.18 45.42 60.66 75.90 91.14 10.68 121.62 136.66 167.34 121.62 136.86 167.34 197.82 228.30 258.78 299.26 319.74 350.22 380.70 411.18 441.66 472.14	Radius(m) 0.255 0.353 0.476 0.510 0.726 1.214 1.702 1.801 2.189 2.677 3.165 3.652 4.140 4.628 7.066 9.505 11.943 14.381 16.820 19.258 21.697 26.573 31.450 36.327 41.204 46.081 50.957 55.834 60.711 65.588 70.465 75.341	VertVe1(m/s) 53.10 42.89 30.12 26.55 11.59 7.29 5.53 5.30 4.61 4.04 3.666 3.38 3.17 3.01 2.51 2.24 2.06 1.93 1.83 1.74 1.67 1.56 1.48 1.41 1.55 1.30 1.25 1.33 1.33 1.25 1.33 1.33 1.25 1.33 1.33 1.25 1.33 1.33 1.25 1.33 1.33 1.25 1.33 1.34 1.35 1.33 1.34 1.35 1.35 1.32 1.35 1.33 1.35	Temp(K) 358.75 324.05 308.91 306.82 300.48 291.61 289.08 287.22 285.80 289.08 287.22 285.80 280.59 279.63 279.63 279.63 279.42 278.77 278.84 278.60 278.44 278.43 278.33 278.30 278.26 2			Linearly interpolated from Stack R Spillane Equations: $V_{plume}=\{(Va)_o^3+0.12F_o[(z-z_v)^2-(6.2a))^2-(6.2a))^2$ $a = 0.16(z-z_v)$	eLH to Top of Jet (5D-z.) ²]) ¹² / a 10 foot Inter m ² ^{2²'A²}))) Max<5.30 50 foot Inter
above ground Stack. Rel.Ht = 61.0 65.0 70.0 Top of jet = 71.4 80.0 90.0 1000 Spillane 5.3 m/s Height = 102.0 110.0 120.0 140.0 150.0 260.0 310.0 310	above stack 0.00 1.22 2.75 3.17 5.79 8.84 11.88 12.51 14.94 17.99 21.03 24.08 27.13 30.18 45.42 60.66 75.90 91.14 106.38 121.62 136.86 167.34 197.82 228.30 258.78 259.25 319.74 350.22 380.70 411.88 441.68	Radius(m) 0.255 0.353 0.476 0.510 0.726 1.214 1.702 1.801 2.189 2.677 3.165 3.652 4.140 4.628 7.066 9.505 11.943 14.381 16.820 19.258 21.697 26.573 31.450 36.327 41.204 46.081 50.957 55.834 60.711 65.588 70.465 75.341	VertVe1(m/s) 53.10 42.89 30.12 26.55 11.59 7.29 5.53 5.30 4.61 4.04 3.666 3.38 3.17 3.01 2.51 2.24 2.06 1.93 1.83 1.74 1.67 1.56 1.48 1.41 1.55 1.30 1.25 1.33 1.33 1.25 1.33 1.33 1.25 1.33 1.33 1.25 1.33 1.33 1.25 1.33 1.33 1.25 1.33 1.34 1.35 1.33 1.34 1.35 1.35 1.32 1.35 1.33 1.35	Temp(K) 358.75 324.05 308.91 306.82 300.48 291.61 289.08 287.22 285.80 289.08 287.22 285.80 280.59 279.63 279.63 279.63 279.42 278.77 278.84 278.60 278.44 278.43 278.33 278.30 278.26 2			Linearly interpolated from Stack R Spillane Equations: $V_{plume}=\{(Va)_o^3+0.12F_o[(z-z_v)^2-(6.2a))^2-(6.2a))^2$ $a = 0.16(z-z_v)$	eLH to Top of Jet (5D-z.) ²]) ¹⁰ / a 10 foot Inter m ² ^{2²'λ²}))) Max<5.30 50 foot Inter
above ground Stack. Rel. Ht = 61.0 65.0 70.0 Top of jet = 71.4 80.0 90.0 100.0 Spillane 5.3 m/s Height = 102.0 110.0 120.0 140.0 130.0 140.0 260.0 310.0 260.0 310.0 260.0 310.0 260.0 310.0 260.0 310.0 210.0 260.0 310.0 2	above stack 0.00 1.22 2.75 3.17 5.79 8.84 11.88 12.51 14.94 17.99 21.03 24.08 27.13 30.18 45.42 60.66 75.90 91.14 10.68 121.62 136.66 167.34 121.62 136.86 167.34 197.82 228.30 258.78 299.26 319.74 350.22 380.70 411.18 441.66 472.14	Radius(m) 0.255 0.353 0.476 0.510 0.726 1.214 1.702 1.801 2.677 3.165 3.652 4.140 4.628 7.066 9.505 11.943 14.381 16.820 19.258 31.450 36.327 41.204 46.081 50.957 55.834 60.711 65.588 70.465	VertVe1(m/s) 53.10 42.89 30.12 26.55 11.59 7.22 5.53 5.33 4.61 4.04 3.66 3.38 3.17 3.01 2.51 2.24 2.06 1.93 1.83 1.74 1.65 1.48 1.48 1.41 1.55 1.30 1.25 1.22 1.83 1.30 1.25 1.22 1.83 1.30 1.55 1.30 1.55 1.30 1.55 1.30 1.55 1.30 1.55 1.30 1.55 1.30 1.55 1.30 1.55 1.30 1.55 1.30 1.55 1.30 1.55 1.30 1.55 1.30 1.55 1.30 1.55 1.30 1.55 1.30 1.55 1.30 1.55 1.30 1.55 1.30 1.55	Temp(K) 358.75 324.05 308.91 306.82 95.18 291.61 289.06 287.22 285.80 280.52 279.39 279.10 278.91 278.78.91 278.78.91 278.78.42 278.43 278.43 278.43 278.33 278.26			Linearly interpolated from Stack R Spillane Equations: $V_{plume}=\{(Va)_o^3+0.12F_o[(z-z_v)^2-(6.2a))^2-(6.2a))^2$ $a = 0.16(z-z_v)$	5D-z _v) ²]} ^{1/3} / a 10 foot Inter
above ground Stack.Rel.Ht = 61.0 65.0 70.0 Top of jet = 71.4 80.0 100.0 Spillane 5.3 m/s Height = 102.0 110.0 130.0 140.0 150.0 300.0 310.0 300.0 310.0 300.0 310.0 300.0 310.0	above stack 0.00 1.22 2.75 3.17 5.79 8.84 11.89 12.51 14.94 17.99 21.03 24.08 27.13 30.18 45.42 60.66 75.90 91.14 106.38 121.62 136.66 167.54 288.30 288.78 289.26 319.74 350.22 380.70 411.18 441.66 380.70 411.18 442.54 289.26 299.26 299.26 299.26 299.26 299.26 299.26 299.26 2	Radius(m) 0.255 0.353 0.476 0.510 0.726 1.214 1.702 1.801 2.189 2.677 3.165 3.652 4.140 4.628 7.066 9.505 11.943 14.381 16.820 19.258 21.697 26.573 31.450 36.327 41.204 46.021 11.65,588 70.465 75.341 80.278 85.095	VertVe1(m/s) 53.10 42.89 30.12 26.55 11.59 7.29 5.33 5.30 4.61 4.04 4.04 3.66 3.38 3.17 3.01 2.51 2.24 2.06 1.93 1.83 1.74 1.67 1.65 1.48 1.41 1.55 1.48 1.41 1.55 1.30 1.22 1.22 1.83 1.74 1.55 1.30 1.25 1.30 1.55 1.30 1.55 1.30 1.55 1.30 1.55 1.30 1.55 1.30 1.55 1.30 1.55 1.30 1.55 1.30 1.55 1.30 1.55 1.30 1.55 1.30 1.55 1.30 1.55 1.30 1.55 1.30 1.55 1.30 1.55 1.30 1.55 1.30 1.55 1.30 1.55 1.48 1.48 1.41 1.55 1.30 1.25 1.30 1.55 1.30 1.55 1.48 1.35 1.30 1.55 1.30 1.55 1.48 1.35 1.30 1.55 1.30 1.55 1.48 1.35 1.30 1.55 1.30 1.55 1.48 1.35 1.55 1.30 1.55 1.30 1.55 1.30 1.55 1.48 1.35 1.55 1.30 1.55	Temp(K) 358.75 324.05 308.91 306.82 300.48 291.61 289.06 287.22 285.80 282.09 280.59 279.83 279.10 278.91 278.78 278.84 278.42 278.42 278.43 278.33 278.33 278.33 278.33 278.28 278.24 278.25 278.24 278.24 278.25 278.24 278.24 278.25 278.25 278.24 278.25 2			Linearly interpolated from Stack R Spillane Equations: $V_{plume}=\{(Va)_o^3+0.12F_o[(z-z_v)^2-(6.2a))^2-(6.2a))^2$ $a = 0.16(z-z_v)$	eLH to Top of Jet (5D-z.) ²]) ¹² / a 10 foot Inter m ² ^{2²'A²}))) Max<5.30 50 foot Inter

NOAA Sources: Climatography of the United States No.81 "Monthly Station Normals of Temperatures, Precipitation, and Heating and Cooling Degree Days, 1971-2000 California" and Climatography of the United States No. 20 "Monthly Station Climate Summaries, 1971-2000 California"



	"Aviation Sa							
	"The Evaluat						arious Heights in the Plum	
		from a Gas-	Turbine Pow		-		Australia," Dr. K.T. Spilla	
nbient Conditions:		14.1.1			Constants:		eutral conditions (dθ/dz=0 or	θ _a =θ _e)
Ambient Potential Temp θ _a ume Exit Conditions:	302.21	Kelvins	84.3	F	Orreitere		meters/feet m/s ²	
	40.50			fa a t in also a	Gravity g		m/s*	
Maximum Stack Height hs Stack Diameter D	-	meters	61	feet-inches	λ	1.11		
Stack Velocity Vexit	53.10	meters	174.21	inches	λο	~1.0		
Volumetric Flow		cu.m/sec	22,804		πV _{exit} D ² /4			Cost 2/61
					IIV _{exit} D /4			Sect.2/¶1
Stack Potential Temp θ _s Initial Stack Buoyancy Flux F _o		Kelvins	902	F	-> -> -> -> -> -> -> -> -> -> -> -> -> -	10 XA - X	ol.Flow(g/π)(1-θ _a /θ _a)	0
, ,	20.1812				0 (,	οι.Flow(g/π)(1-θ _a /θ _s) ,θ _o at plume height (see belo	Sect.2/¶1
Plume Buoyancy Flux F No.of Stacks N	1	m ⁴ /s ³		1 000			cation Factor (N ^{0.25})	w)
NO.01 STACKS IN				1.000	Multiple Sta	аск іліціцрії	cation Factor (N)	
nditions at End (Top) of Jet Phase:								
Height above Stack z _{iet}	3 175	meters*	10.4	feet*	7 - 6 250	motors*-	meters above stack top	Sect.3/¶1
Height above Ground z _{iet} +h _s		meters	71.4		zjet = 0.23L	, meters =	ineters above stack top	360L3/ 1
Vertical Velocity V _{iet}	26.550			ft/sec	V _{jet} = 0.5V _e	1/ /2		
						exit − V _{exit} /∠	Conconntion of momentum	
Plume Top-Hat Diameter 2a _{jet}	1.010	meters	3.3	feet	2a _{jet} = 2D		Conservation of momentum	
Illene Methodolomy Analytical Colutions	(0-l 0	diti a na fan D			6 Dh			
illane Methodology - Analytical Solutions			-			alven hv e	quations halows	
Single Plume-averaged Vertical Velocity				er wilere F				Sect.2/Eq.6
Plume Top-Hat Radius a		olutions in T		faat*			crease with height	
Virtual Source Height z _v		meters*		feet*	0.25D[1-(θ _e	/⊎ _s)‴^], mete	ers*=meters above stack top	Sect2/Eq.6
Height above Ground zv+hs		meters	64.8	feet			where $(\theta_a/\theta_s)^{1/2} = (\theta_e/\theta_s)^{1/2} =$	
Vertical Velocity V		olutions in T	able Below) ² - (6.25D-z _v) ²]} ^(1/3) / a	Sect.2.1(6)
Product (Va) _o	8.525	m²/s			$V_{exit}D/2(\theta_e/$	θ _s) ^{1/2}		
Solve for plume-averaged vertical velo	city at height	200.0	feet	60.96	meters abo	ve ground (z'+h _s)	
Gives the following Height above Stack z'	42.370	meters*	139.0					
Plume Top-Hat Diameter 2a'	13.185	meters	43.3	feet	2a'=2*0.16(Sect.2/Eq.6
Vertical Velocity V	2.545	m/s	8.35	ft/sec	V={(Va) _o ³ +	0.12F _o [(z-z	/) ² -(6.25D-z _v) ²]} ^(1/3) /(2a'/2)	Sect.2/Eq.6
Solve for Height of CASC critical vertical	velocity V _{crif}	5.30	m/s plume-a	averaged v	ertical velo	city	Critical VV	> Top of Jet (Spilla
Find Height above Stack z _{crit}	12.683	meters	41.6	feet	Solve for x=	(z-z _v) simu	Itaneously in both eqs. (i.e.,	Va and a)
Height above Ground z _{crit} +h _s	31.273	meters	102.6	feet	for V=4.3 m	n/s usina th	e cubic equation ax3+bx2+cx	+d=0, where
						•	and b=-(0.12Fo)/(4.330.163)=	-3.9
Interpolated Height of critical vertical ve	elocity in Jet	Phase:			and d		25D-zy) ² -(Va) _o ³]/(4.3 ³ 0.16 ³)=	-1000
Find Height above Stack z _{crit}	-	meters	#N/A	feet		L. 0()		/www.1728.org/cubic.
Height above Ground z _{crit} +h _s		meters	#N/A			aive	s the real solution x = z-zv =	11.5
						3	or z(m/above stack) =	12.
							z(ft/above ground) =	10
ble of Plume Top-Hat Diameters (2a) and F	lume-Avers:	ed Vertical	Velocities et:	arting at e	nd of iet nh	ase:	= = = = = = = = = = = = = = = = = = =	
Height (feet)	(meters)	Plume						
above ground			VertVel(m/s)					
above ground Stack. Rel. Ht = 61.0	above stack	0.254	53.10					
Stack.Rel.Ht = 61.0 65.0	1.22						Jet Phase Eqs:	5 foot Inter
70.0	2.75	0.474					Linearly interpolated from Stack R	el.Ht to Top of Jet
Top of jet = 71.4	3.17	0.508	26.55				Spillane Equations:	
80.0	5.79						$V_{plume} = {(Va)_o^3 + 0.12F_o[(z-z_v)^2 - (6.2)^2 - $	
90.0	8.84						a = 0.16(z-z _v)	10 foot Inter
100.0	11.89	1.715	5.60	332.81			$\theta_p = \theta_s (1 + (1 - (\theta_e/\theta_s))^* (V_{exit}D^2/(4V_{plu}))^*)$	_{me} *a-́*λ-́)))
Spillane 5.3 m/s Height = 102.6	12.68	1.842	5.30	330.26				
Spillane 5.3 m/s Height = 102.6 110.0								
	12.68	2.203		324.61				
110.0	12.68 14.94	2.203 2.691	4.64 4.05	324.61 319.42				Max<5.30
110.0 120.0	12.68 14.94 17.99	2.203 2.691 3.179	4.64 4.05 3.65	324.61 319.42 315.88				Max<5.30
110.0 120.0 130.0	12.68 14.94 17.99 21.03	2.203 2.691 3.179 3.666	4.64 4.05 3.65 3.37	324.61 319.42 315.88 313.36				Max<5.30
110.0 120.0 130.0 140.0	12.68 14.94 17.99 21.03 24.08	2.203 2.691 3.179 3.666 4.154	4.64 4.05 3.65 3.37 3.15	324.61 319.42 315.88 313.36 311.49				Max<5.30
110.0 120.0 130.0 140.0 140.0 150.0 160.0	12.68 14.94 17.99 21.03 24.08 27.13 30.18	2.203 2.691 3.179 3.666 4.154 4.642	4.64 4.05 3.65 3.37 3.15 2.98	324.61 319.42 315.88 313.36 311.49 310.07				
110.0 120.0 130.0 140.0 160.0 160.0 210.0	12.68 14.94 17.99 21.03 24.08 27.13 30.18 45.42	2.203 2.691 3.179 3.666 4.154 4.642 7.080	4.64 4.05 3.65 3.37 3.15 2.98 2.47	324.61 319.42 315.88 313.36 311.49 310.07 306.28				
110.0 120.0 130.0 140.0 150.0 160.0 210.0 260.0	12.68 14.94 17.99 21.03 24.08 27.13 30.18 45.42 60.66	2.203 2.691 3.179 3.666 4.154 4.642 7.080 9.518	4.64 4.05 3.65 3.37 3.15 2.98 2.47 2.20	324.61 319.42 315.88 313.36 311.49 310.07 306.28 304.74				
110.0 120.0 130.0 140.0 150.0 160.0 210.0 280.0 310.0	12.68 14.94 17.99 21.03 24.08 27.13 30.18 45.42 60.66 75.90	2.203 2.691 3.179 3.666 4.154 4.642 7.080 9.518 11.957	4.64 4.05 3.65 3.37 3.15 2.98 2.47 2.20 2.02	324.61 319.42 315.88 313.36 311.49 310.07 306.28 304.74 303.96				
110.0 120.0 130.0 140.0 150.0 160.0 210.0 260.0 310.0 360.0	12.68 14.94 17.99 21.03 24.08 27.13 30.18 45.42 60.66 75.90 91.14	2.203 2.691 3.179 3.666 4.154 4.642 7.080 9.518 11.957 14.395	4.64 4.05 3.65 3.37 3.15 2.98 2.47 2.20 2.02 1.89	324.61 319.42 315.88 313.36 311.49 310.07 306.28 304.74 303.96 303.50				
110.0 120.0 130.0 140.0 160.0 210.0 260.0 310.0 360.0 410.0	12.68 14.94 17.99 21.03 24.08 27.13 30.18 45.42 60.66 75.90 91.14 106.38	2.203 2.691 3.179 3.666 4.154 4.642 7.080 9.518 11.957 14.395 16.834	4.64 4.05 3.65 3.37 3.15 2.98 2.47 2.20 2.02 1.89 1.79	324.61 319.42 315.88 313.36 311.49 310.07 306.28 304.74 303.96 303.50 303.20				
110.0 120.0 130.0 140.0 150.0 160.0 260.0 310.0 360.0 310.0 360.0 410.0 460.0	12.68 14.94 17.99 21.03 24.08 27.13 30.18 45.42 60.66 75.90 91.14 106.38 121.62	2.203 2.691 3.179 3.666 4.154 4.642 7.080 9.518 11.957 14.395 16.834 19.272	4.64 4.05 3.65 3.37 3.15 2.98 2.47 2.20 2.02 2.02 2.02 1.89 1.79 1.71	324.61 319.42 315.88 313.36 311.49 310.07 306.28 304.74 303.96 303.50 303.20 303.20				
110.0 120.0 130.0 140.0 210.0 220.0 310.0 3310.0 360.0 410.0 460.0 510.0	12.68 14.94 17.99 21.03 24.08 27.13 30.18 45.42 60.66 75.90 91.14 106.38 121.62 136.86	2.203 2.691 3.179 3.666 4.154 4.642 7.080 9.518 11.957 14.395 16.834 19.272 21.710	4.64 4.05 3.65 3.37 3.15 2.98 2.47 2.20 2.02 1.89 1.79 1.71 1.64	324.61 319.42 315.88 313.36 311.49 310.07 306.28 304.74 303.96 303.50 303.20 303.20 303.20				50 foot Inter
110.0 120.0 130.0 140.0 210.0 260.0 310.0 360.0 410.0 460.0 510.0 610.0	12.68 14.94 17.99 21.03 24.08 27.13 30.18 45.42 60.66 75.90 91.14 106.38 121.62 138.86 167.34	2.203 2.691 3.179 3.666 4.154 4.642 7.080 9.518 11.957 14.395 16.834 19.272 21.710 26.587	4.64 4.05 3.65 3.37 2.98 2.47 2.20 2.02 1.89 1.79 1.71 1.64	324.61 319.42 315.88 313.36 311.49 310.07 306.28 304.74 303.96 303.50 303.20 303.00 303.20 303.00 302.86				50 foot Inter
110.0 120.0 130.0 140.0 150.0 210.0 280.0 310.0 360.0 410.0 450.0 510.0	12.68 14.94 17.99 21.03 24.08 27.13 30.18 45.42 60.66 75.90 91.14 106.38 121.62 136.86	2.203 2.691 3.179 3.666 4.154 4.642 7.080 9.518 11.957 14.395 16.834 19.272 21.710 26.587	4.64 4.05 3.65 3.37 2.98 2.47 2.20 2.02 1.89 1.79 1.71 1.64	324.61 319.42 315.88 313.36 311.49 310.07 306.28 304.74 303.96 303.50 303.20 303.00 303.20 303.00 302.86				50 foot Inter
110.0 120.0 130.0 140.0 150.0 160.0 210.0 260.0 310.0 360.0 410.0 460.0 510.0 510.0	12.68 14.94 17.99 21.03 24.08 27.13 30.18 45.42 60.66 75.90 91.14 106.38 121.62 138.86 167.34	2.203 2.691 3.179 3.666 4.154 4.642 7.080 9.518 11.957 14.395 16.834 19.272 21.710 26.587 31.464	4.64 4.05 3.65 3.37 2.98 2.47 2.20 2.02 1.89 1.79 1.71 1.64 1.53 1.45	324.61 319.42 315.88 313.36 311.49 310.07 306.28 304.74 303.50 303.50 303.20 303.00 302.86 302.68				50 foot Inter
110.0 120.0 130.0 140.0 150.0 210.0 260.0 310.0 360.0 410.0 400.0 510.0 610.0 710.0	12.68 14.94 17.99 21.03 24.06 27.13 30.18 45.42 60.66 60.66 60.66 91.14 106.38 121.62 136.86 167.34 136.86	2.203 2.691 3.179 3.666 4.154 4.642 7.080 9.518 11.957 14.395 16.834 19.272 21.710 26.587 31.464 36.341	4.64 4.05 3.65 3.37 2.98 2.47 2.20 2.02 1.89 1.79 1.71 1.64 1.53 1.45 1.38	324.61 319.42 315.88 313.36 311.49 310.07 306.22 304.74 303.96 303.50 303.20 303.20 303.20 302.86 302.86 302.26 302.26				50 foot Inter
110.0 120.0 130.0 140.0 150.0 210.0 210.0 280.0 310.0 360.0 410.0 460.0 510.0 610.0 710.0 810.0	12.68 14.94 17.99 21.03 24.08 27.13 30.18 45.42 60.66 75.90 91.14 106.88 121.62 136.66 167.34 197.82 228.30	2.203 2.691 3.179 3.666 4.154 4.642 7.080 9.518 11.957 14.395 16.834 19.272 21.710 26.587 31.464 36.341 41.218	4.64 4.05 3.65 3.37 2.98 2.47 2.20 2.02 1.89 1.79 1.71 1.64 1.53 1.45 1.38 1.45 1.38	324.61 319.42 315.88 313.36 311.49 310.07 306.28 303.50 303.20 303.00 302.86 302.66 302.65 302.49				50 foot Inter
110.0 120.0 130.0 140.0 150.0 210.0 280.0 310.0 360.0 410.0 510.0 610.0 710.0 810.0 810.0 910.0	12.68 14,94 17.99 21.03 24.08 27.13 30.18 45.42 60.66 75.90 91.14 106.38 121.62 136.66 167.34 197.82 228.30 258.78	2.203 2.691 3.666 4.154 4.642 7.080 9.518 11.957 14.395 16.834 19.272 21.710 26.587 31.464 36.341 41.218 46.094	4.64 4.05 3.65 2.98 2.47 2.20 2.02 2.02 1.89 1.79 1.71 1.64 1.53 1.45 1.45 1.38 1.32 2.1.27	324.61 319.42 315.88 313.36 311.49 300.628 304.74 300.96 303.50 303.20 303.00 302.86 302.68 302.68 302.68 302.49 302.43 302.40				50 foot Inter
110.0 120.0 130.0 140.0 160.0 210.0 260.0 310.0 310.0 360.0 410.0 460.0 610.0 710.0 810.0 910.0 1010.0 1110.0	12.68 14.94 17.99 21.03 24.08 27.13 30.18 45.42 60.66 75.90 91.14 166.83 121.62 136.86 1167.34 197.82 228.30 258.78 258.78 319.74	2,203 2,691 3,179 3,666 4,154 4,642 7,080 9,518 11,957 14,395 16,834 19,272 21,710 26,577 31,464 36,341 41,218 46,004 50,971	4.64 4.05 3.37 3.15 2.98 2.47 2.20 2.02 1.89 1.71 1.64 1.53 1.45 1.38 1.32 1.32 1.27 1.27	324.61 319.42 315.88 311.36 311.44 310.07 306.28 303.50 303.20 303.20 303.20 303.20 302.66 302.48 302.49 302.43 302.40 302.43 302.40				50 foot Inter
110.0 120.0 130.0 140.0 150.0 210.0 280.0 310.0 360.0 410.0 410.0 460.0 510.0 610.0 710.0 810.0 910.0 1011.0 1110.0	12.68 14,94 17,99 21,03 24,08 27,13 30,18 45,42 60,66 75,90 91,14 166,38 121,62 136,66 167,34 197,82 228,30 258,78 289,26 319,74 350,22	2,203 2,661 3,179 3,666 4,154 4,642 7,080 9,518 11,957 14,395 16,834 19,272 21,710 26,587 31,464 36,341 41,218 46,094 55,848	4.64 4.05 3.65 3.37 2.98 2.47 2.20 1.99 1.77 1.179 1.14 1.64 1.53 1.45 1.38 1.45 1.38 1.22 1.27 1.23 1.19	324.61 319.42 315.88 313.36 311.44 310.07 306.28 304.74 303.96 303.20 303.00 303.00 302.86 302.86 302.66 302.49 302.43 302.43 302.43				50 foot Inter
110.0 120.0 130.0 140.0 150.0 210.0 280.0 310.0 360.0 410.0 510.0 610.0 710.0 810.0 910.0 1010.0 1110.0 1210.0 1310.0	12.68 14,94 17,99 21,03 24,08 27,13 30,18 45,42 60,66 75,90 91,14 106,38 121,62 136,66 167,34 197,82 228,30 258,78 289,26 319,74 350,22 380,70	2.203 2.691 3.666 4.154 4.642 7.080 9.518 11.957 14.395 16.834 19.272 21.710 26.587 31.464 36.341 41.218 46.094 50.971 55.848 60.725	4.64 4.05 3.65 2.98 2.47 2.20 2.02 1.89 1.79 1.71 1.64 1.53 1.45 1.38 1.32 1.27 1.23 1.23 1.19	324.61 319.42 315.88 313.36 311.49 300.74 300.28 303.50 303.50 303.00 302.86 302.68 302.68 302.68 302.43 302.43 302.43 302.43 302.43				50 foot Inter
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110.0 120.0 130.0 140.0 150.0 210.0 280.0 310.0 380.0 410.0 510.0 610.0 710.0 810.0 910.0 1110.0 1210.0 1310.0 1310.0 1510.0 1510.0 1510.0 1510.0 1510.0 1510.0 1510.0 1510.0 1510.0 1510.0 1510.0 1510.0 1510.0 1510.0 1510.0 1510.0 1710.0 1710.0	12.68 14,94 17,99 21,03 24,08 27,13 30,18 45,42 60,66 75,90 91,14 106,38 121,62 136,66 167,34 197,82 288,78 289,26 319,74 350,22 380,70 411,18 441,66 442,144,66	2,203 2,661 3,179 3,666 4,154 4,642 7,080 9,518 11,957 14,395 16,834 19,272 21,710 26,587 31,464 99,271 36,341 41,218 46,094 50,971 55,848 60,725 56,602 70,478 75,355 80,232	4.64 4.65 3.65 3.37 2.29 2.27 2.02 2.02 1.89 1.77 1.79 1.71 1.64 1.53 1.45 1.38 1.32 1.27 1.23 1.19 1.23 1.19 1.23 1.19 1.23 1.19 1.16 1.13 1.10 1.106	324.61 319.42 315.88 313.36 311.49 300.74 300.28 303.50 303.00 302.86 302.68 302.68 302.68 302.43 302.23 30				50 foot Inter
110.0 120.0 130.0 140.0 160.0 260.0 310.0 360.0 410.0 460.0 510.0 610.0 710.0 810.0 910.0 1110.0 1310.0 1310.0 1410.0 1510.0 1510.0 1510.0 1611.0 1710.0	12.68 14.94 17.99 21.03 24.08 27.13 30.18 45.42 60.66 75.90 91.14 106.38 121.62 136.86 167.34 197.82 228.30 258.78 259.25 319.74 350.22 350.77 411.18 441.66 472.14 533.10	2,203 2,661 3,179 3,666 4,154 4,642 7,080 9,518 11,957 14,395 16,834 19,272 21,710 26,587 31,464 36,341 41,218 46,094 50,971 55,848 60,725 55,848 60,725 55,848 60,725 55,848 61,725 55,848 61,725 55,848 61,725 55,848 61,725 55,848 61,725 55,848 61,725 55,848 61,725 55,848 61,725 55,848 61,725 55,848 61,725 70,478 55,848 56,848 56,848 56,848 56,949 56,948 56,949 56,948 56,949 56,949 56,948 56,94956 56,94956,949 56,949 56,949 56,94956 56,949 56,949 56,94956,949 56,949 56,94956,949 56,949 56,94956,949 56,949 56,94956,949 56,949 56,94956,949 56,949 56,94956,949 56,949 56,94956,949 56,949 56,94956,949 56,949 56,94956,949 56,94956,949 56,949 56,94956,949 56,949 56,94956,949 56,94956,949 56,94956,9	4.64 4.65 3.65 3.37 2.89 2.249 2.20 2.02 1.89 1.71 1.64 1.55 1.45 1.38 1.32 1.27 1.23 1.23 1.19 1.16 1.13 1.16 1.13 1.10 1.100 1.000 1.000 1.000 1.000	324.61 319.42 315.88 311.36 311.49 300.628 300.628 300.20 303.50 303.00 302.68 302.68 302.68 302.49 302.49 302.43 302.40 302.37 302.33 302.31 302.31 302.32 302.28				50 foot Inter
110.0 120.0 130.0 140.0 150.0 210.0 280.0 310.0 360.0 410.0 510.0 610.0 710.0 810.0 910.0 1010.0 1110.0 1210.0 1310.0 1310.0 1510.0 1510.0 1510.0 1510.0 1510.0 1510.0 1510.0 1510.0 1510.0 1510.0 1510.0 1510.0 1710.0	12.68 14,94 17,99 21,03 24,08 27,13 30,18 45,42 60,66 75,90 91,14 106,38 121,62 136,66 167,34 197,82 288,78 289,26 319,74 350,22 380,70 411,18 441,66 442,144,66	2.203 2.691 3.606 4.154 4.642 7.080 9.518 11.957 14.395 16.834 19.272 21.710 26.587 31.464 36.341 41.218 46.094 50.971 55.848 60.725 65.602 70.478 75.355 80.232 85.109	4.64 4.65 3.65 3.37 2.89 2.249 2.20 2.02 1.89 1.71 1.64 1.55 1.45 1.38 1.32 1.27 1.23 1.23 1.19 1.16 1.13 1.16 1.13 1.10 1.100 1.000 1.000 1.000 1.000	324.61 319.42 315.88 311.36 311.49 300.628 300.628 300.20 303.50 303.00 302.68 302.68 302.68 302.49 302.49 302.43 302.40 302.37 302.33 302.31 302.31 302.32 302.28				50 foot Inter

NOAA Sources: Climatography of the United States No.81 "Monthly Station Normals of Temperatures, Precipitation, and Heating and Cooling Degree Days, 1971-2000 California" and Climatography of the United States No. 20 "Monthly Station Climate Summaries, 1971-2000 California"



ased on 42 chillers w/ 18 cells/chiller. Calc'	"Aviation Sat	-	-			ditio ···	arious Hoi-the in 11 - Di	
f.diam for each chiller wiith each cell at 34" ID 57,143 ACFM total for each chiller).	i ne Evaluat		-				arious Heights in the Plume	
		from a Gas-	Turbine Pow				, Australia," Dr. K.T. Spilla	
mbient Conditions:					Constants:		eutral conditions (dθ/dz=0 or	θ _a =θ _e)
Ambient Potential Temp θ _a	278.15	Kelvins	41.0	۳F			meters/feet	
ume Exit Conditions:					Gravity g		m/s ²	
Stack Height hs	-	meters	80	feet-inches	λ			
Individual Chiller Stack Diameter D	3.6639	meters		inches	λο	~1.0		
Stack Velocity V _{exit}	11.51	m/s	37.76	ft/sec	4Vol/(60πE	0 ²)		
Individual Chiller Volumetric Flow	121.36	cu.m/sec	257,143	ACFM	πV _{exit} D ² /4			Sect.2/¶1
Stack Potential Temp θ _s	289.26	Kelvins	61.0	°F				
Initial Stack Buoyancy Flux Fo	14.5564	m ⁴ /s ³	20.0	ΔT(°F)	gV _{exit} D ² (1-6	$\theta_a/\theta_s)/4 = V$	ol.Flow(g/π)(1-θ _a /θ _s)	Sect.2/¶1
Plume Buoyancy Flux F	N/A	m ⁴ /s ³			λ ² gVa ² (1-θ	_a /θ _p) for a,V	θ_p at plume height (see below	w)
Number of Chillers n	42			2.546	Multiple St	ack Multipli	cation Factor (n ^{0.25})	
onditions at End (Top) of Jet Phase:								
Height above Stack z _{iet}	22.900	meters*	75.1	feet*	z _{iet} = 6.250), meters*=	meters above stack top	Sect.3/¶1
Height above Ground z _{jet} +h _s	47.284	meters	155.1	feet				
Vertical Velocity Viet	5.755	m/s	18.88	ft/sec	V _{jet} = 0.5V	_{ovit} = V _{ovit} /2		
Plume Top-Hat Diameter 2a _{let}		meters	24.0		2a _{iet} = 2D		Conservation of momentum	
Tranie Top Hat Blanietor Edge	7.020	motoro	21.0	1001	Edjat 20			
aillano Mothodology - Analytical Solutions	for Calm Con	ditions for P	lumo Hoight	sahovo lo	t Phace			
pillane Methodology - Analytical Solutions Single Plume-averaged Vertical Velocity						aiven hu -	quations below:	
Single Plume-averaged Vertical Velocity		olutions in T		er willere P				Sout 2/Fre 6
Plume Top-Hat Radius a				6			crease with height	Sect2/Eq.6
Virtual Source Height zv		meters*		feet*	o.25D[1-(θ _e	₂/⊎ _s)‴^], met	ers*=meters above stack top	Sect.2/Eq.6
Height above Ground zv+hs		meters	81.5	reet	10.1 - 2		where $(\theta_{a}/\theta_{s})^{1/2} = (\theta_{e}/\theta_{s})^{1/2} =$	
Vertical Velocity V		olutions in T	able Below				/) ² - (6.25D-z _v) ²]} ^(1/3) / a	Sect.2.1(6)
Product (Va) _o	20.677	m²/s			$V_{exit}D/2(\theta_e/$	(θ _s) ^{1/2}		
ngle Chiller Results:								
Solve for plume-averaged vertical velo	city at height	540.0	feet	164.592	meters abo	ove ground (z'+h _s)	
Gives the following Height above Stack z'	140.208	meters*	460.0	feet*				
Plume Top-Hat Diameter 2a	44.724	meters	146.7	feet	2a'=2*0.16			Sect.2/Eq.6
Vertical Velocity V	1.555	m/s	5.10	ft/sec	V={(Va) _o 3+	0.12F _o [(z-z	() ² -(6.25D-z _v) ²]} ^(1/3) /(2a'/2)	Sect.2/Eq.6
Solve for Height of CASC critical vertical	velocity Varia	5 30	m/s plume-a	veraged v	ertical velo	ncity	Critical VV > Top	of let (Spillan
Find Height above Stack z _{crit}		meters	82.0	_		-	Itaneously in both eqs. (i.e.,	
Height above Ground z _{crit} +h _s			162.0				ubic equation ax ³ +bx ² +cx+d=	
Height above Ground Z _{crit} +n _s	49.300	meters	102.0	IEEL	IOI V - V _{crit}	-		
		Dh					and b=-(0.12F _o)/($V_{crit}^{3}0.16^{3}$)=	-2.864
Interpolated Height of critical vertical v	-				and d	=[0.12F _o (6.)	25D-z _v) ² -(Va) _o ³]/(V _{crit} ³ 0.16 ³)=	-13052.
Find Height above Stack z _{crit}		meters	#N/A					28.org/cubic.ht
Height above Ground z _{crit} +h _s	#N/A	meters	#N/A	feet		give	s the real solution x = z-zv =	24.53
							or z(m/above stack) =	24.9
							or z(m/above stack) = z(ft/above ground) =	24.9 162
able of Plume Top-Hat Diameters (2a) and F	Plume-Averag	ed Vertical		arting at er	nd of jet ph	ase:		
able of Plume Top-Hat Diameters (2a) and F Height (feet)	Plume-Averag (meters)	ed Vertical Plume	Velocities st		nd of jet ph	ase:		
	(meters)	Plume	Velocities st	Plume		ase:		
Height (feet)	(meters)	Plume	Velocities sta SingleStk	Plume		ase:		
Height (feet) above ground	(meters) above stack	Plume Radius(m)	Velocities sta SingleStk VertVel(m/s)	Plume Temp(K)		a se :		
Height (feet) above ground <u>Stack.Rel.Ht = 80.0</u> 100.0	(meters) above stack 0.00 6.10	Plume Radius(m) 1.832 2.198	Velocities sta SingleStk VertVel(m/s) 11.51 10.36	Plume Temp(K)		ase:	z(ft/above ground) = Jet Phase Eqs:	163 20 ft Interval
Height (feet) above ground <i>Stack.Rel.Ht</i> = 80.0 100.0 120.0	(meters) above stack 0.00 6.10 12.19	Plume Radius(m) 1.832 2.198 2.565	Velocities sta SingleStk VertVel(m/s) 10.36 9.21	Plume Temp(K)		ase:	z(ft/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R	16 20 ft Interval
Height (feet) above ground Stack.Rel.Ht = 80.0 100.0 120.0 140.0	(meters) above stack 0.00 6.10 12.19 18.29	Plume Radius(m) 1.832 2.198 2.565 2.931	Velocities sta SingleSta VertVel(m/s) 11.51 10.36 9.21 8.06	Plume Temp(K)		ase:	z(ft/above ground) = Jet Phase Eqs:	16 20 ft Interval
Height (feet) above ground Stack.Rel.Ht = 80.0 100.0 120.0 140.0 160.0	(meters) above stack 0.00 6.10 12.19 18.29 24.38	Plume Radius(m) 2.198 2.565 2.931 3.298	Velocities sta SingleSta VertVel(m/s) 11.51 10.36 9.21 8.06 6.91	Plume Temp(K)		ase:	z(ft/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations:	16 20 ft Interval
Height (feet) above ground Stack.Rel.Ht = 80.0 100.0 120.0 140.0 160.0 Top of Single jet = 155.1	(meters) above stack 0.00 6.10 12.19 18.29 24.38 22.90	Plume Radius(m) 1.832 2.198 2.565 2.931 3.298 3.208	Velocities st SingleStk VertVel(m/s) 11.51 10.36 9.21 8.06 6.91 7.19	Plume Temp(K)		ase:	z(ft/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: V _{ptom=} =((Va), ^a +0.12F _a](z-z.) ² -(6.2	16 20 ft Interval
Height (feet) above ground <i>Stack.Rel.Ht = 80.0</i> 100.0 120.0 140.0 160.0 Top of Single jet = 155.1 180.0	(meters) above stack 0.00 6.10 12.19 18.29 24.38 22.90 30.48	Plume Radius(m) 1.832 2.198 2.565 2.931 3.298 3.208 3.664	Velocities sta SingleStk VertVel(m/s) 11.51 10.36 9.21 8.06 6.91 7.19 5.76	Plume Temp(K) 282.68		ase:	z(ft/above ground) = Jet Phase Eqs: Linearly interpolated from Stack Ri Spillane Equations: V _{pluma} =((va) ₀ ³ +0.12F ₀ ((z-z _v) ² -(6.2 a = 0.16(z-z _v)	20 ft interval el.Ht to Top of Jet 5D-z _v) ²]) ^{1/3} / a
Height (feet) above ground <i>Stack.Rel.Ht =</i> 80.0 120.0 140.0 160.0 Top of Single jet = 155.1 180.0 160.0	(meters) above stack 0.00 6.10 12.19 18.29 24.38 22.90 30.48 24.38	Plume Radius(m) 1.832 2.198 2.565 2.931 3.298 3.208 3.664 3.830	Velocities sta SingleStk VertVel(m/s) 11.51 10.36 9.21 8.06 6.91 7.19 5.76 5.42	Plume Temp(K) 282.68 282.49		ase:	$z(ft/above ground) =$ $Jet Phase Eqs:$ Linearly interpolated from Stack R Spillane Equations: $V_{ploma} = (Va)_{a}^{a+0}.12F_{a}[(z-z_{a})^{2}.(6.2 a) = 0.16(z-z_{v})$ $\theta_{p} = \theta_{a}(1+(1-(\theta_{v}\theta_{a}))^{v}V_{osc}D^{2}/t(z)$	16 20 ft Interval el.Ht to Top of Je 5D-z_v) ²]) ^{1/3} / a
Height (feet) above ground <i>Stack.Rel.Ht = 80.0</i> 100.0 120.0 140.0 160.0 Top of Single jet = 155.1 180.0	(meters) above stack 0.00 6.10 12.19 18.29 24.38 22.90 30.48 24.38	Plume Radius(m) 1.832 2.198 2.565 2.931 3.298 3.208 3.664	Velocities sta SingleStk VertVel(m/s) 11.51 10.36 9.21 8.06 6.91 7.19 5.76	Plume Temp(K) 282.68		ase:	z(ft/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: $V_{atom} = (0, 16)(z-z_v)$ $\theta_p = \theta_n (1+(1-\theta_j/\theta_n))^* (V_{ext}D^2/t)$ CEC Staff Equation:	16 20 ft Interval el.Ht to Top of Je 5D-z_v) ²]) ^{1/3} / a
Height (feet) above ground <i>Stack.Rel.Ht =</i> 80.0 120.0 140.0 160.0 Top of Single jet = 155.1 180.0 160.0	(meters) above stack 0.00 6.10 12.19 18.29 24.38 22.90 30.48 24.38 30.48	Plume Radius(m) 1.832 2.198 2.565 2.931 3.298 3.208 3.664 3.830	Velocities sta SingleStk VertVel(m/s) 11.51 10.36 9.21 8.06 6.91 7.19 5.76 5.42	Plume Temp(K) 282.68 282.49 282.36		ase:	$z(ft/above ground) =$ $Jet Phase Eqs:$ Linearly interpolated from Stack R Spillane Equations: $V_{ploma} = (Va)_{a}^{a+0}.12F_{a}[(z-z_{a})^{2}.(6.2 a) = 0.16(z-z_{v})$ $\theta_{p} = \theta_{a}(1+(1-(\theta_{v}\theta_{a}))^{v}V_{osc}D^{2}/t(z)$	16 20 ft Interval el.Ht to Top of Je 5D-z_v) ²]) ^{1/3} / a
Height (feet) above ground Stack.Rel.Ht = 80.0 100.0 140.0 160.0 Top of Single jet = 155.1 180.0 160.0 180.0	(meters) above stack 0.00 6.10 12.19 18.29 24.38 22.90 30.48 24.38 30.48 36.58	Plume Radius(m) 1.832 2.198 2.565 2.931 3.298 3.208 3.664 3.830 4.806	Velocities st. SingleStk VertVel(m/s) 11.51 10.03 9.21 8.06 6.91 7.19 5.76 5.42 4.41 3.76	Plume Temp(K) 282.68 282.49 282.36 281.44		a se:	$z(ft/above ground) =$ $Jet Phase Eqs:$ Linearly interpolated from Stack R Splilane Equations: $V_{pumm} = (Va)_{a}^{-k} 0.12F_{a}[(z-z_{v})^{2}(6.2 a) = 0.16(z-z_{v})$ $\theta_{p} = \theta_{a}(1+(1+(\theta_{a}\theta_{a}))^{*}(V_{exst})D^{2}/(CEC Staff Equation:)$ $V_{pum} = 0.25 + 0.25$	16 20 ft Interval el-H to Top of Jer 5D-z _v) ²]) ^{1/2} / a 4V _{plume} *a ²⁺ λ ²))
Height (feet) above ground Stack.Rel.Ht = 80.0 100.0 120.0 140.0 160.0 Top of Single jet = 155.1 180.0 160.0 180.0 180.0	(meters) above stack 0.00 6.10 12.19 18.29 24.38 22.90 30.48 30.48 30.48 30.48 30.48	Plume Radius(m) 1.832 2.198 2.565 2.931 3.298 3.208 3.664 3.830 4.806 5.781	Velocities str Single Stk VertVel(m): 9.21 8.06 6.91 7.19 5.76 5.42 4.41 3.76 3.30	Plume Temp(K) 282.68 282.49 282.36 281.44 280.82		ase:	$z(ft/above ground) =$ $Jet Phase Eqs:$ Linearly interpolated from Stack R Spillane Equations: $V_{piana} = (Va)_a^{-1} + 0.12F_a[(z-z_a)^2 - (6.2 a = 0.16(z-z_a))$ $\theta_p = \theta_a(1 + (1-(4)/6.a))^n (V_{ext}D^2/t) (CEC Staff Equation: V_{exp} = m^{-0.25}v_{xp}$	16 20 ft Interval el-H to Top of Jer 5D-z _v) ²]) ^{1/2} / a 4V _{plume} *a ²⁺ λ ²))
Height (feet) above ground Stack.Rel.Ht = 80.0 100.0 120.0 140.0 160.0 Top of Single jet = 155.1 180.0 160.0 180.0 200.0	(meters) above stack 0.00 6.10 12.19 18.29 24.38 22.90 30.48 24.38 30.48 36.58 42.67 48.77	Plume Radius(m) 1.832 2.198 2.565 2.931 3.298 3.208 3.864 3.830 4.806 5.781 6.756	Velocities str. Single Stk VertVel(m(s)) 9.21 8.06 6.91 7.19 5.76 5.42 4.41 3.76 3.30	Plume Temp(K) 282.68 282.49 282.36 281.44 280.82		ase:	$z(ft/above ground) =$ $Jet Phase Eqs:$ Linearly interpolated from Stack R Splilane Equations: $V_{pumm} = (Va)_{a}^{-k} 0.12F_{a}[(z-z_{v})^{2}(6.2 a) = 0.16(z-z_{v})$ $\theta_{p} = \theta_{a}(1+(1+(\theta_{a}\theta_{a}))^{*}(V_{exst})D^{2}/(CEC Staff Equation:)$ $V_{pum} = 0.25 + 0.25$	16 20 ft Interval el-H to Top of Jer 5D-z _v) ²]) ^{1/2} / a 4V _{plume} *a ²⁺ λ ²))
Height (feet) above ground Stack.Rel.Ht = 80.0 100.0 120.0 140.0 160.0 Top of Single jet = 155.1 180.0 180.0 220.0 220.0 240.0	(meters) above stack 0.00 6.10 12.19 18.29 24.38 22.90 30.48 24.38 30.48 36.58 42.67 48.77 54.86	Plume Radius(m) 1.832 2.198 2.2565 2.931 3.298 3.208 3.664 3.830 4.806 5.781 6.765 7.732 8.707	Velocities sta SingleStk VertVel(m/s) 11.51 10.36 6.91 7.19 5.76 5.42 4.41 3.76 3.30 2.96 2.71	Plume Temp(K) 282.68 282.49 282.36 281.44 280.82 280.82 280.37 280.04		a se:	$z(ft/above ground) = \\ \\ Jet Phase Eqs: \\ \\ Linearly interpolated from Stack RiSpillane Equations: \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\$	16 20 ft Interval el-H to Top of Jer 5D-z _v) ²]) ^{1/2} / a 4V _{plume} *a ²⁺ λ ²))
Height (feet) above ground Stack.Rel.Ht = 80.0 100.0 120.0 140.0 160.0 Top of Single jet = 155.1 180.0 180.0 2200.0 240.0 220.0 240.0 280.0	(meters) above stack 0.00 6.10 12.19 22.90 30.48 24.33 30.48 36.58 24.33 30.48 36.58 42.67 42.67 45.66 60.96	Plume Radius(m) 1.832 2.198 2.565 2.931 3.298 3.664 3.830 4.806 5.781 6.756 7.732 8.707 9.683	Velocities str SingleStk VertVel(m/s) 11.51 10.36 9.21 8.06 6.91 7.19 5.76 5.42 4.41 3.76 3.30 2.96 2.71 2.51	Plume Temp(K) 282.68 282.49 282.36 281.44 280.82 280.37 280.04 279.78		ase:	$z(ft/above ground) = \\ \\ Jet Phase Eqs: \\ \\ Linearly interpolated from Stack RiSpillane Equations: \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\$	16 20 ft Interval el-H to Top of Jer 5D-z _v) ²]) ^{1/2} / a 4V _{plume} *a ²⁺ λ ²))
Height (feet) above ground Stack. Rel. Ht = 80.0 100.0 120.0 140.0 160.0 Top of Single jet = 155.1 180.0 160.0 200.0 220.0 240.0 260.0 280.0 300.0	(meters) above stack 0.00 6.101 12.19 18.29 22.90 30.48 22.90 30.48 36.56 42.67 48.77 54.86 60.96 60.96 60.96 60.706	Plume Radius(m) 1.832 2.198 2.565 2.931 3.298 3.208 3.664 3.830 4.806 5.781 6.756 7.732 8.707 9.683 10.658	Velocities str SingleStk VertVel(m/s) 9.21 10.36 6.91 7.19 5.76 5.42 4.41 3.76 3.30 2.96 2.71 2.51 2.35	Plume Temp(K) 282.68 282.49 282.36 281.44 280.82 280.37 280.04 279.78		ase:	$z(ft/above ground) = \\ \\ Jet Phase Eqs: \\ \\ Linearly interpolated from Stack RiSpillane Equations: \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\$	$\frac{20 \text{ ft interval}}{50 \text{ z}_{4}^{2} \gamma_{1}^{2} \gamma_{2}^{1}} / \frac{1}{a}$
Height (feet) above ground Stack. Rel. Ht = 80.0 120.0 140.0 160.0 Top of Single jet = 155.1 180.0 200.0 220.0 240.0 220.0 240.0 280.0 300.0	(meters) above stack 0.00 6.010 12.19 18.29 22.390 30.48 22.30 30.48 36.58 42.67 48.77 54.86 6.96 67.06 82.30	Plume Radius(m) 1.832 2.198 2.2565 2.931 3.208 3.208 3.208 3.208 5.781 6.756 6.7.732 8.707 9.683 10.688 13.096	Velocities sta SingleStk VertVel(m/s) 9.21 8.06 6.91 7.19 5.76 5.42 4.41 3.76 3.30 2.96 2.71 2.51 2.53 2.26	Plume Temp(K) 282.68 282.49 282.36 281.44 280.82 280.37 280.04 279.78 279.57 279.40		350:	$z(ft/above ground) =$ $Jet Phase Eqs:$ Linearly interpolated from Stack R Spillane Equations: $V_{param} = ((va)_{n}^{-3} d \cdot 12F_{n} (z-z_{r})^{2} (d.2z)$ $a = 0.16 (z-z_{r})$ $\theta_{p} = \theta_{n} (1 + (1 + (\theta_{p} \theta_{n}))^{n} (V_{exc} D^{2}) (c$ CEC Staff Equation: $V_{allogib} = (23) \times 16^{3/23} \times F_{sp}^{10/23} \times t$ where $F_{sp} = nF_{sp}$	16 20 ft Interval el.H to Top of Je 5D.z.,7) ²) ¹⁰ / a 4V _{plume} *a ² Å ²)) ⁽⁴²⁾ x z ⁽⁴²⁾ 50 ft Interval
Height (feet) above ground Stack.Rel.Ht = 80.0 100.0 120.0 140.0 160.0 Top of Single jet = 155.1 180.0 180.0 220.0 220.0 240.0 280.0 280.0 300.0	(meters) above stack 0.00 6.101 12.19 18.29 22.90 30.48 24.38 30.48 30.48 30.48 30.48 30.48 30.48 30.48 50.58 42.67 48.77 54.86 60.96 67.06 82.30 97.54	Plume Radius(m) 1.832 2.198 2.565 2.931 3.298 3.208 3.664 3.830 4.806 5.781 6.7565 7.732 8.707 9.683 10.658 13.006 15.535	Velocities stat SingleStk VertVel(m/s) 11.51 10.36 0.21 18.66 6.91 7.19 5.76 5.42 4.41 3.76 3.30 2.96 2.71 2.51 2.35 2.060 1.87	Plume Temp(K) 282.68 282.49 282.36 281.44 280.82 280.37 280.04 279.78 279.40 279.70		ase:	$z(ft/above ground) = \\ \\ Jet Phase Eqs: \\ \\ Linearly interpolated from Stack RiSpillane Equations: \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\$	16 20 ft Interval el.H to Top of Je 5D-z,) ²)) ^{1/3} / a 4V _{plume} *a ² *A ²); ⁽⁴²⁾ x z ^(1/2) 50 ft Interval
Height (feet) above ground Stack.Rel.Ht = 80.0 100.0 120.0 140.0 160.0 Top of Single jet = 155.1 180.0 180.0 220.0 240.0 240.0 280.0 300.0 350.0	(meters) above stack 0.00 12.19 24.38 22.90 30.48 24.38 30.48 36.58 42.67 48.77 54.86 60.96 67.06 82.30 97.54 112.78	Plume Radjus(m) 1.832 2.198 2.565 2.931 3.298 3.664 3.830 4.806 5.781 6.756 7.732 8.707 9.683 10.658 13.096 15.555 17.973	Velocities str SingleStk VertVel(m/s) 11.51 10.36 9.21 8.66 6.91 7.19 5.76 5.42 4.41 3.76 3.30 2.96 2.71 2.51 2.25 2.06 1.87 1.73	Plume Temp(K) 282.68 282.49 282.36 281.44 280.37 280.04 279.78 279.40 279.10 279.40 279.10 278.89		ase:	$z(ft/above ground) =$ $Jet Phase Eqs:$ Linearly interpolated from Stack R Spillane Equations: $V_{param} = ((va)_{a}^{-a} 0.12F_{a}(z.z.)^{2}(6.2 a) = 0.16(z.z{v})$ $\theta_{p} = \theta_{a}(1+(1+(\theta_{p}\theta_{a}))^{*}(V_{exc}D^{2})(c$ CEC Staff Equation: $V_{allogib} = (23) \times 16^{3/2} \times F_{sp}^{1/2} \times t$ where $F_{sp} = nF_{sp}$	16 20 ft Interval el.H to Top of Je 5D-z,) ²)) ^{1/3} / a 4V _{plume} *a ² *A ²); ⁽⁴²⁾ x z ^(1/2) 50 ft Interval
Height (feet) above ground Stack.Rel.Ht = 80.0 100.0 120.0 140.0 160.0 Top of Single jet = 155.1 180.0 160.0 220.0 240.0 220.0 240.0 280.0 300.0 350.0 400.0 400.0 400.0	(meters) above stack 0.00 6.010 12.19 18.29 22.90 30.48 22.90 30.48 36.56 42.67 48.77 54.86 60.95 60.95 60.95 60.95 60.95 60.97.54 82.30 97.54 112.78 21.28.02	Plume Radius(m) 1.832 2.186 2.565 2.331 3.208 3.208 3.208 5.781 6.756 7.732 8.707 9.683 10.658 13.096 15.535 17.973 20.412	Velocities str SingleStk VertVel(m/s) 9.21 8.000 6.91 7.19 5.76 5.42 4.41 3.76 3.30 2.96 2.71 2.51 2.35 2.06 1.87 1.73 1.62	Plume Temp(K) 282.68 282.49 282.36 281.44 280.82 280.37 280.04 279.78 279.40 279.79 279.40 279.10 278.89 278.75		ase:	$z(ft/above ground) =$ $Jet Phase Eqs:$ Linearly interpolated from Stack R Spillane Equations: $V_{param} = ((va)_{a}^{-a} 0.12F_{a}(z.z.)^{2}(6.2 a) = 0.16(z.z{v})$ $\theta_{p} = \theta_{a}(1+(1+(\theta_{p}\theta_{a}))^{*}(V_{exc}D^{2})(c$ CEC Staff Equation: $V_{allogib} = (23) \times 16^{3/2} \times F_{sp}^{1/2} \times t$ where $F_{sp} = nF_{sp}$	16 20 ft Interval el.H to Top of Je 5D.z.,7) ²) ¹⁰ / a 4V _{plume} *a ² Å ²)) ⁽⁴²⁾ x z ⁽⁴²⁾ 50 ft Interval
Height (feet) above ground Stack. Rel. Ht = 80.0 120.0 140.0 Top of Single jet = 155.1 180.0 160.0 200.0 220.0 240.0 280.0 300.0 350.0 400.0 350.0	(meters) above stack 0.00 6.101 12.19 18.29 24.38 22.90 30.48 24.38 30.48 36.68 42.67 48.77 54.66 60.96 67.06 82.30 97.54 81.28 12.87 41.278 112.78 1	Plume Radius(m) 1.832 2.198 2.2565 2.931 3.208 3.208 3.208 3.664 3.830 4.806 5.765 7.732 8.707 9.683 10.658 13.096 15.535 17.973 20.412 22.850	Velocities sta SingleStk VertVel(m/s) 9.21 8.06 6.91 7.19 5.767 5.42 4.41 3.76 3.300 2.96 2.71 2.55 2.06 1.87 1.73 1.62 1.54	Plume Temp(K) 282.68 282.49 282.36 281.44 280.62 280.37 280.04 279.78 279.40 279.79.40 279.9.10 278.75 278.89 278.75 278.65			$z(ft/above ground) =$ $Jet Phase Eqs:$ Linearly interpolated from Stack R Spillane Equations: $V_{param} = ((va)_{a}^{-a} 0.12F_{a}(z.z.)^{2}(6.2 a) = 0.16(z.z{v})$ $\theta_{p} = \theta_{a}(1+(1+(\theta_{p}\theta_{a}))^{*}(V_{exc}D^{2})(c$ CEC Staff Equation: $V_{allogib} = (23) \times 16^{3/2} \times F_{sp}^{1/2} \times t$ where $F_{sp} = nF_{sp}$	16 20 ft Interval el.H to Top of Je 5D.z.,7) ²) ¹⁰ / a 4V _{plume} *a ² A ²)) ⁽⁴²⁾ x z ⁽⁴²⁾ 50 ft Interval
Height (feet) above ground Stack.Rel.Ht = 80.0 100.0 120.0 140.0 160.0 Top of Single jet = 155.1 180.0 180.0 220.0 240.0 220.0 240.0 220.0 240.0 220.0 240.0 280.0 280.0 300	(meters) above stack 0.00 6.010 12.19 18.29 24.38 22.90 0.048 24.38 30.49 30.48 30.49 30.48 30.48 30.48 30.48 30.48 30.48 30.48 30.4	Plume Radjus(m) 1.832 2.198 2.565 2.931 3.208 3.208 3.208 3.208 1.6756 7.732 8.707 9.683 10.658 13.096 15.535 17.973 20.412 22.850 25.288	Velocities sta SingleStk VertVel(m/s) 9.21 10.36 9.21 8.66 6.91 7.19 5.76 5.42 4.41 3.76 3.30 2.966 2.71 2.55 2.066 1.87 1.73 1.62 1.64 1.47	Plume Temp(K) 282.68 282.49 282.36 281.44 280.82 280.37 280.04 279.76 279.40 279.70 279.40 279.10 278.89 278.75 278.65 278.57			$z(ft/above ground) =$ $Jet Phase Eqs:$ Linearly interpolated from Stack R Spillane Equations: $V_{param} = ((va)_{a}^{-a} 0.12F_{a}(z.z.)^{2}(6.2 a) = 0.16(z.z{v})$ $\theta_{p} = \theta_{a}(1+(1+(\theta_{p}\theta_{a}))^{*}(V_{exc}D^{2})(c$ CEC Staff Equation: $V_{allogib} = (23) \times 16^{3/2} \times F_{sp}^{1/2} \times t$ where $F_{sp} = nF_{sp}$	16 20 ft Interval el.H to Top of Je 5D.z.,7) ²) ¹⁰ / a 4V _{plume} *a ² A ²)) ⁽⁴²⁾ x z ⁽⁴²⁾ 50 ft Interval
Height (feet) above ground Stack. Rel. Ht = 80.0 120.0 140.0 Top of Single jet = 155.1 180.0 160.0 200.0 220.0 240.0 280.0 300.0 350.0 400.0 350.0	(meters) above stack 0.00 6.101 12.19 18.29 24.38 22.90 30.48 24.38 30.48 30.58 30.48 30.58 30.48 30.59 30.48 30.58 30.59 30	Plume Radius(m) 1.832 2.198 2.2565 2.931 3.208 3.208 3.208 3.664 3.830 4.806 5.765 7.732 8.707 9.683 10.658 13.096 15.535 17.973 20.412 22.850	Velocities sta SingleStk VertVel(m/s) 9.21 8.06 6.91 7.19 5.767 5.42 4.41 3.76 3.300 2.96 2.71 2.55 2.06 1.87 1.73 1.62 1.54	Plume Temp(K) 282.68 282.49 282.36 281.44 280.82 280.37 280.04 279.76 279.40 279.70 279.40 279.10 278.89 278.75 278.65 278.57			$z(ft/above ground) =$ $Jet Phase Eqs:$ Linearly interpolated from Stack R Spillane Equations: $V_{param} = ((va)_{a}^{-a} 0.12F_{a}(z.z.)^{2}(6.2 a) = 0.16(z.z{v})$ $\theta_{p} = \theta_{a}(1+(1+(\theta_{p}\theta_{a}))^{*}(V_{exc}D^{2})(c$ CEC Staff Equation: $V_{allogib} = (23) \times 16^{3/2} \times F_{sp}^{1/2} \times t$ where $F_{sp} = nF_{sp}$	16 20 ft Interval el.H to Top of Je 5D.z.,7) ²) ¹⁰ / a 4V _{plume} *a ² A ²)) ⁽⁴²⁾ x z ⁽⁴²⁾ 50 ft Interval
Height (feet) above ground Stack.Rel.Ht = 80.0 100.0 120.0 140.0 160.0 Top of Single jet = 155.1 180.0 180.0 220.0 240.0 220.0 240.0 220.0 240.0 220.0 240.0 280.0 280.0 300	(meters) above stack 0.00 6.10 12.19 24.38 22.90 30.48 24.38 30.48 30.59 30.48 30.59 30.59 30.59 30.59 30.59 30.50 30.	Plume Radjus(m) 1.832 2.198 2.565 2.931 3.208 3.208 3.208 3.208 1.6756 7.732 8.707 9.683 10.658 13.096 15.535 17.973 20.412 22.850 25.288	Velocities sta SingleStk VertVel(m/s) 9.21 10.36 9.21 8.66 6.91 7.19 5.76 5.42 4.41 3.76 3.30 2.966 2.71 2.55 2.066 1.87 1.73 1.62 1.64 1.47	Plume Temp(K) 282.68 282.49 282.36 281.44 280.37 280.04 279.78 279.40 279.10 279.80 279.57 278.40 279.57 278.65 278.65 278.51			$z(ft/above ground) =$ $Jet Phase Eqs:$ Linearly interpolated from Stack R Spillane Equations: $V_{param} = ((va)_{a}^{-a} 0.12F_{a}(z.z.)^{2}(6.2 a) = 0.16(z.z{v})$ $\theta_{p} = \theta_{a}(1+(1+(\theta_{p}\theta_{a}))^{*}(V_{exc}D^{2})(c$ CEC Staff Equation: $V_{allogib} = (23) \times 16^{3/2} \times F_{sp}^{1/2} \times t$ where $F_{sp} = nF_{sp}$	16 20 ft Interval el.H to Top of Je 5D.z.,7) ²) ¹⁰ / a 4V _{plume} *a ² A ²)) ⁽⁴²⁾ x z ⁽⁴²⁾ 50 ft Interval
Height (feet) above ground Stack.Rel.Ht = 80.0 100.0 120.0 140.0 160.0 Top of Single jet = 155.1 180.0 180.0 220.0 20.	(meters) above stack 0.00 6.101 12.19 18.29 24.38 22.90 30.48 36.56 42.67 48.77 54.86 60.95 60.95 60.95 67.06 82.30 97.54 112.78 128.02 113.26 113.26 113.26 113.27 41.85 90 113.74 41.85 80	Plume Radjus(m) 1.832 2.198 2.565 2.931 3.298 3.664 3.830 4.806 5.781 6.758 7.732 8.707 9.683 10.658 13.096 15.535 17.973 20.412 22.850 22.2850 22.2850 22.2850 22.727	Velocities str SingleStk VertVel(m/s) 9.21 8.060 6.91 7.19 5.76 5.42 4.41 3.76 3.30 2.96 2.71 2.51 2.35 2.06 1.87 1.73 1.62 1.147 1.42 1.44 1.47	Plume Temp(K) 282.68 282.49 282.36 281.44 280.82 280.37 280.04 279.78 279.40 279.78 279.40 279.75 278.45 278.65 278.57 278.65 278.57 278.46			$z(ft/above ground) =$ $Jet Phase Eqs:$ Linearly interpolated from Stack R Spillane Equations: $V_{param} = ((va)_{a}^{-a} 0.12F_{a}(z.z.)^{2}(6.2 a) = 0.16(z.z{v})$ $\theta_{p} = \theta_{a}(1+(1+(\theta_{p}\theta_{a}))^{*}(V_{exc}D^{2})(c$ CEC Staff Equation: $V_{allogib} = (23) \times 16^{3/2} \times F_{sp}^{1/2} \times t$ where $F_{sp} = nF_{sp}$	16 20 ft Interval el-H to Top of Ja 5D.z.,) ²]) ^{1/2} / a 4V _{plume} *a ² *λ ²)) 50 ft Interval
Height (feet) above ground Stack. Rel. Ht = 80.0 120.0 140.0 160.0 Top of Single jet = 155.1 180.0 160.0 220.0 240.0 220.0 240.0 280.0 300.0 250.0 400.0 350.0 400.0 4	(meters) above stack 0.00 6.101 12.19 18.29 24.38 22.90 30.48 36.56 42.67 48.77 54.86 60.95 60.95 60.95 67.06 82.30 97.54 112.78 128.02 113.26 113.26 113.26 113.27 41.85 90 113.74 41.85 80	Plume Radius(m) 1.832 2.198 3.208 3.208 3.208 5.781 6.756 7.732 8.707 9.683 10.658 13.096 15.535 10.658 13.096 15.535 17.973 20.412 22.850 25.288 27.727 30.165	Velocities str SingleStk VertVel(m/s) 9.21 8.060 6.91 7.19 5.76 5.42 4.41 3.76 3.30 2.96 2.71 2.51 2.35 2.06 1.87 1.73 1.62 1.147 1.42 1.44 1.47	Plume Temp(K) 282.68 282.49 282.36 281.44 280.82 280.37 280.04 279.78 279.40 279.79 279.40 279.75 278.65 278.65 278.57 278.51 278.64 278.42			$z(ft/above ground) =$ $Jet Phase Eqs:$ Linearly interpolated from Stack R Spillane Equations: $V_{param} = ((va)_{a}^{-a} 0.12F_{a}(z.z.)^{2}(6.2 a) = 0.16(z.z{v})$ $\theta_{p} = \theta_{a}(1+(1+(\theta_{p}\theta_{a}))^{*}(V_{exc}D^{2})(c$ CEC Staff Equation: $V_{allogib} = (23) \times 16^{3/2} \times F_{sp}^{1/2} \times t$ where $F_{sp} = nF_{sp}$	16 20 ft Interval el-H to Top of Ja 5D.z.,) ²]) ^{1/2} / a 4V _{plume} *a ² *λ ²)) 50 ft Interval
Height (feet) above ground Stack. Rel. Ht = 80.0 120.0 140.0 160.0 Top of Single jet = 155.1 180.0 160.0 200.0 220.0 240.0 220.0 240.0 280.0 350.0 400.0 350.0 400.0 550.0 600.0 550.0 5	(meters) above stack 0.00 6.010 12.19 18.29 24.38 22.90 30.48 24.38 30.48 30.68 42.67 48.77 54.86 67.06 82.30 97.54 112.78 112.78 112.78 112.78 112.78 112.78 113.802 1143.26 1158.50 1173.74 188.98 219.46 249.94	Plume Radius(m) 1.832 2.198 2.2565 2.931 3.208 3.208 3.208 4.806 5.766 7.732 8.707 9.683 10.668 13.096 15.535 17.973 20.412 22.850 25.288 27.727 30.165 5.35.042	Velocities sta SingleStk VertVel(m/s) 11.51 10.36 10.36 10.36 10.37 10.36 10.37 10.37 10.37 10.37 10.47 10.37 10.4	Plume Temp(K) 282.68 282.49 282.36 281.44 280.82 280.37 280.04 279.76 279.40 279.70 279.40 279.70 279.40 279.51 278.65 278.57 278.51 278.46 278.45 278.56 27			$z(ft/above ground) =$ $Jet Phase Eqs:$ Linearly interpolated from Stack R Spillane Equations: $V_{param} = ((va)_{a}^{-a} 0.12F_{a}(z.z.)^{2}(6.2 a) = 0.16(z.z{v})$ $\theta_{p} = \theta_{a}(1+(1+(\theta_{p}\theta_{a}))^{*}(V_{exc}D^{2})(c$ CEC Staff Equation: $V_{allogib} = (23) \times 16^{3/2} \times F_{sp}^{1/2} \times t$ where $F_{sp} = nF_{sp}$	16 20 ft Interval el-H to Top of Ja 5D.z.,) ²]) ^{1/2} / a 4V _{plume} *a ² *λ ²)) 50 ft Interval
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Height (feet) above ground Stack.Rel.Ht = 80.0 100.0 120.0 140.0 160.0 Top of Single jet = 155.1 180.0 180.0 220.0 240.0 220.0 240.0 220.0 240.0 220.0 240.0 280.0 200.0 280.0 290.0 290.0 290.0 200	(meters) above stack 0.00 6.101 12.19 18.29 24.38 22.90 30.48 24.38 30.48 30.48 30.48 42.67 48.77 54.66 67.06 82.30 97.54 112.78 128.02 143.26 158.50 173.74 188.98 219.46 249.54 249.54 249.54 249.54 249.54 249.54 249.54 249.54 249.55 219.64 249.55 219.64 249.55 219.64 249.55 219.65 219.55 219.	Plume Radjus(m) 1.832 2.198 2.565 2.931 3.208 3.208 3.208 3.208 3.208 1.6766 7.732 8.707 9.683 10.658 13.006 15.535 17.973 20.412 22.850 25.288 27.727 30.165 35.042 22.850 25.288 27.727 30.165 35.042 22.850 25.288 27.727 30.165 35.042 22.850 25.555	Velocities str SingleStk VertVel(m/s) 9.21 10.36 9.21 8.66 6.91 7.19 5.76 5.42 4.41 3.76 3.30 2.96 2.71 2.51 2.265 2.060 1.87 1.73 1.62 1.54 1.47 1.42 1.54 1.47 1.42 1.54 1.47 1.42 1.54 1.47 1.42 1.54 1.47 1.42 1.54 1.47 1.42 1.54 1.47 1.42 1.54 1.47 1.42 1.54 1.47 1.42 1.54 1.42 1.54 1.44 1.44 1.44 1.44 1.44 1.44 1.44	Plume Temp(K) 282.68 282.49 282.36 281.44 280.82 280.37 280.04 279.78 279.40 279.10 279.40 279.10 278.89 278.57 278.51 278.64 278.56 278.57 278.54 278.65 278.52 278.29 278 278.29 278 278 278 278 278 278 278 278 278 278			$z(ft/above ground) =$ $Jet Phase Eqs:$ Linearly interpolated from Stack R Spillane Equations: $V_{param} = ((va)_{a}^{-a} 0.12F_{a}(z.z.)^{2}(6.2 a) = 0.16(z.z{v})$ $\theta_{p} = \theta_{a}(1+(1+(\theta_{p}\theta_{a}))^{*}(V_{exc}D^{2})(c$ CEC Staff Equation: $V_{allogib} = (23) \times 16^{3/2} \times F_{sp}^{1/2} \times t$ where $F_{sp} = nF_{sp}$	16 20 ft Interval el-H to Top of Ja 5D.z.,) ²]) ^{1/2} / a 4V _{plume} *a ² *λ ²)) 50 ft Interval
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Height (feet) above ground Stack.Rel.Ht = 80.0 100.0 120.0 140.0 160.0 Top of Single jet = 155.1 180.0 180.0 220.0 240.0 220.0 240.0 220.0 240.0 220.0 240.0 280.0 200.0 280.0 290.0 290.0 290.0 200	(meters) above stack 0.00 6.101 12.19 18.29 24.38 22.90 30.48 24.38 30.48 30.48 30.48 42.67 48.77 54.66 67.06 82.30 97.54 112.78 128.02 143.26 158.50 173.74 188.98 219.46 249.54 249.54 249.54 249.54 249.54 249.54 249.54 249.54 249.55 219.64 249.55 219.64 249.55 219.64 249.55 219.65 219.55 219.	Plume Radjus(m) 1.832 2.198 2.565 2.931 3.208 3.208 3.208 3.208 3.208 1.6766 7.732 8.707 9.683 10.658 13.006 15.535 17.973 20.412 22.850 25.288 27.727 30.165 35.042 22.850 25.288 27.727 30.165 35.042 22.850 25.288 27.727 30.165 35.042 22.850 25.555	Velocities str SingleStk VertVel(m/s) 9.21 10.36 9.21 8.66 6.91 7.19 5.76 5.42 4.41 3.76 3.30 2.96 2.71 2.51 2.265 2.060 1.87 1.73 1.62 1.54 1.47 1.42 1.54 1.47 1.42 1.54 1.47 1.42 1.54 1.47 1.42 1.54 1.47 1.42 1.54 1.47 1.42 1.54 1.47 1.42 1.54 1.47 1.42 1.54 1.47 1.42 1.54 1.42 1.54 1.44 1.44 1.44 1.44 1.44 1.44 1.44	Plume Temp(K) 282.68 282.49 282.36 281.44 280.82 280.37 280.04 279.78 279.40 279.10 278.89 278.75 278.46 278.45 278.46 278.42 278.46 278.42 278.36 278.42 278.32 278.27 278.25 278.24 278.25 278.24 278.25			$z(ft/above ground) =$ $Jet Phase Eqs:$ Linearly interpolated from Stack R Spillane Equations: $V_{param} = ((va)_{a}^{-a} 0.12F_{a}(z.z.)^{2}(6.2 a) = 0.16(z.z{v})$ $\theta_{p} = \theta_{a}(1+(1+(\theta_{p}\theta_{a}))^{*}(V_{exc}D^{2})(c$ CEC Staff Equation: $V_{allogib} = (23) \times 16^{3/2} \times F_{sp}^{1/2} \times t$ where $F_{sp} = nF_{sp}$	16 20 ft Interval EI-z,1 ²) ^{1/2} / a 4V _{plume} *a ²⁺ λ ²)) 50 ft Interval 100 ft Interval
Height (feet) above ground Stack.Rel.Ht = 80.0 120.0 140.0 160.0 Top of Single jet = 155.1 180.0 160.0 220.0 240.0 220.0 240.0 220.0 240.0 280.0 300.0 250.0 300.0 350.0 400.0 550.0 650.0 550.0 650.0 550.0 100	(meters) above stack 0.00 6.101 12.19 18.29 24.38 22.90 30.48 36.56 42.67 48.77 54.86 60.95 67.06 82.30 97.54 112.78 1188.02 113.26 113.274 1188.98 2219.46 249.94 249.94 280.42 310.90 341.38 371.86	Plume Radius(m) 1.832 2.198 3.208 3.208 3.208 5.781 6.756 7.732 8.707 9.683 10.658 13.096 15.535 10.658 13.096 15.535 17.973 20.412 22.850 25.288 27.727 30.165 35.042 39.919 44.796 44.9672 54.549 55.555 55.5555 55.5555555555	Velocities str SingleStk VertVel(m/s) 9.21 8.060 6.91 7.19 5.76 5.42 4.41 3.76 3.30 2.96 2.21 2.51 2.25 2.06 1.87 1.73 1.62 1.54 1.47 1.42 1.37 1.29 1.22 1.17 1.13 1.09 1.02 1.09 1.00 1.00 1.00 1.00 1.00 1.00 1.00	Plume Temp(K) 282.68 282.49 282.36 281.44 280.82 280.37 280.04 279.79.40 279.79.40 279.79.40 279.75 278.65 278.65 278.65 278.65 278.65 278.65 278.65 278.65 278.65 278.65 278.65 278.65 278.65 278.65 278.65 278.27 278.22 278.22 278.22 278.22 278.22 278.22 278.22 278.22 278.22 278.22 278.22 278.22			$z(ft/above ground) =$ $Jet Phase Eqs:$ Linearly interpolated from Stack R Spillane Equations: $V_{param} = ((va)_{a}^{-a} 0.12F_{a}(z.z.)^{2}(6.2 a) = 0.16(z.z{v})$ $\theta_{p} = \theta_{a}(1+(1+(\theta_{p}\theta_{a}))^{*}(V_{exc}D^{2})(c$ CEC Staff Equation: $V_{allogib} = (23) \times 16^{3/2} \times F_{sp}^{1/2} \times t$ where $F_{sp} = nF_{sp}$	16 20 ft Interval EI-z,1 ²) ^{1/2} / a 4V _{plume} *a ²⁺ λ ²)) 50 ft Interval 100 ft Interval
Height (feet) above ground Stack. Rel. Ht = 80.0 120.0 140.0 160.0 Top of Single jet = 155.1 180.0 160.0 220.0 240.0 220.0 240.0 280.0 350.0 280.0 350.0 400.0 550.0 600.0 550.0 600.0 550.0 600.0 550.0 600.0 1	(meters) above stack 0.00 6.010 12.19 18.29 24.38 22.90 30.48 36.58 42.67 48.77 54.66 60.96 67.06 82.30 97.54 54.66 128.02 1143.26 158.50 1173.74 128.02 143.26 158.50 173.74 188.59 219.46 249.94 220.42 310.90 34.13 371.86 402.34 34.13 371.86 402.34 34.13 371.86 402.34 34.13 371.86 402.34 34.13 371.86 402.34 34.13 371.86 402.34 34.13 371.86 402.34 34.13 371.86 402.34 34.13 371.86 402.34 34.13 371.86 402.34 34.13 371.86 402.34 34.13 371.86 402.34 34.13 371.86 402.34 34.13 371.86 402.34 34.13 371.86 402.34 34.13 371.86 402.34 371.86 40.25	Plume Radjus(m) 1.832 2.198 3.208 3.208 3.208 3.208 3.208 5.781 3.208 5.781 3.208 5.781 3.208 5.781 3.208 5.781 3.208 5.781 3.208 5.781 3.208 5.781 3.208 5.781 3.208 5.781 3.208 5.781 3.208 5.781 3.208 5.781 5.752	Velocities st: SingleStk VertVel(m/s) 11.51 0.36 0.21 8.06 6.91 7.19 5.76 5.42 4.41 3.76 3.30 2.66 2.71 2.61 2.35 2.06 1.87 1.73 1.62 1.64 1.47 1.42 1.54 1.47 1.29 1.22 1.54 1.47 1.29 1.22 1.54 1.47 1.29 1.22 1.54 1.47 1.29 1.22 1.54 1.57 1.29 1.22 1.54 1.57 1.29 1.22 1.54 1.57 1.29 1.22 1.54 1.57 1.29 1.22 1.54 1.57 1.29 1.22 1.54 1.57 1.29 1.22 1.54 1.57 1.29 1.22 1.54 1.57 1.29 1.57 1.29 1.57 1.29 1.57 1.57 1.57 1.57 1.57 1.57 1.57 1.57	Plume Temp(K) 282.68 282.49 282.36 281.44 280.82 280.37 280.04 279.78 279.40 279.78 279.40 279.78 278.65 278.65 278.57 278.65 278.54 278.42 278.36 278.32 278.29 278.29 278.27 278.24 278.23 278.24 278.23 278.24 278.23 278.24 278.23 278.24 278.25 278.25 278.24 278.25 27			$z(ft/above ground) =$ $Jet Phase Eqs:$ Linearly interpolated from Stack R Spillane Equations: $V_{param} = ((va)_{a}^{-a} 0.12F_{a}(z.z.)^{2}(6.2 a) = 0.16(z.z{v})$ $\theta_{p} = \theta_{a}(1+(1+(\theta_{p}\theta_{a}))^{*}(V_{exc}D^{2})(c$ CEC Staff Equation: $V_{allogib} = (23) \times 16^{3/2} \times F_{sp}^{1/2} \times t$ where $F_{sp} = nF_{sp}$	16 20 ft Interval EI-z,1 ²) ^{1/2} / a 4V _{plume} *a ²⁺ λ ²)) 50 ft Interval 100 ft Interval
Height (feet) above ground Stack. Rel. Ht = 80.0 100.0 120.0 140.0 160.0 Top of Single jet = 155.1 180.0 200.0 220.0 240.0 220.0 240.0 220.0 240.0 220.0 240.0 220.0 240.0 280.0 280.0 280.0 350.0 400.0 3550.0 400.0 550.0 600.0 550.0 550.0 600.0 550.0	(meters) above stack 0.00 6.010 12.19 18.29 24.38 22.90 30.48 36.58 42.67 48.77 54.66 60.96 67.06 82.30 97.54 54.66 128.02 1143.26 158.50 1173.74 128.02 143.26 158.50 173.74 188.59 219.46 249.94 220.42 310.90 34.13 371.86 402.34 34.13 371.86 402.34 34.13 371.86 402.34 34.13 371.86 402.34 34.13 371.86 402.34 34.13 371.86 402.34 34.13 371.86 402.34 34.13 371.86 402.34 34.13 371.86 402.34 34.13 371.86 402.34 34.13 371.86 402.34 34.13 371.86 402.34 34.13 371.86 402.34 34.13 371.86 402.34 34.13 371.86 402.34 34.13 371.86 402.34 371.86 40.25	Plume Radjus(m) 1.832 2.198 3.208 3.5042 3.5	Velocities st: SingleStk VertVel(m/s) 11.51 0.36 0.21 8.06 6.91 7.19 5.76 5.42 4.41 3.76 3.30 2.66 2.71 2.61 2.35 2.06 1.87 1.73 1.62 1.64 1.47 1.42 1.54 1.47 1.29 1.22 1.54 1.47 1.29 1.22 1.54 1.47 1.29 1.22 1.54 1.47 1.29 1.22 1.54 1.57 1.29 1.22 1.54 1.57 1.29 1.22 1.54 1.57 1.29 1.22 1.54 1.57 1.29 1.22 1.54 1.57 1.29 1.22 1.54 1.57 1.29 1.22 1.54 1.57 1.29 1.22 1.54 1.57 1.29 1.57 1.29 1.57 1.29 1.57 1.57 1.57 1.57 1.57 1.57 1.57 1.57	Plume Temp(K) 282.68 282.49 282.36 281.44 280.82 280.37 280.04 279.76 279.40 279.10 278.65 278.46 278.57 278.46 278.52 278.65 278.42 278.65 278.42 278.62 278.29 278.27 278.22 278.24 278.24 278.23 278.22 278.24 278.24 278.24 278.25 278.24 278.24 278.25 278.25 278.24 278.25 27			$z(ft/above ground) =$ $Jet Phase Eqs:$ Linearly interpolated from Stack R Spillane Equations: $V_{param} = ((va)_{a}^{-a} 0.12F_{a}(z.z.)^{2}(6.2 a) = 0.16(z.z{v})$ $\theta_{p} = \theta_{a}(1+(1+(\theta_{p}\theta_{a}))^{*}(V_{exc}D^{2})(c$ CEC Staff Equation: $V_{allogib} = (23) \times 16^{3/2} \times F_{sp}^{1/2} \times t$ where $F_{sp} = nF_{sp}$	16 20 ft Interval el.H to Top of Jet 5D.z., ²) ¹ , ¹³ / a 4V _{plume} *a ² A ²)) ^(1/2) x z ^(1/2) 50 ft Interval
Height (feet) above ground Stack.Rel.Ht = 80.0 100.0 120.0 140.0 160.0 Top of Single jet = 155.1 180.0 180.0 220.0 240.0 220.0 240.0 220.0 240.0 220.0 240.0 220.0 240.0 260.0 280.0 200.0 280.0 200	(meters) above stack 0.00 6.010 12.19 18.29 24.38 22.90 30.48 30.4	Plume Radjus(m) 1.832 2.198 2.565 2.931 3.208 3.208 3.208 3.208 1.6756 7.732 8.707 9.683 10.658 13.096	Velocities str SingleStk VertVel(m/s) 11.51 10.36 9.21 18.66 6.91 7.19 5.76 5.42 4.41 3.76 3.30 2.96 2.71 2.51 2.265 1.87 1.73 1.62 1.54 1.47 1.42 1.54 1.47 1.13 1.09 1.02 1.03 1.00 0.90 0.04 4.078	Plume Temp(K) 282.68 282.49 282.36 281.44 280.82 280.37 280.04 279.76 279.40 279.10 278.65 278.46 278.57 278.46 278.52 278.65 278.42 278.65 278.42 278.62 278.29 278.27 278.22 278.24 278.24 278.23 278.22 278.24 278.24 278.24 278.25 278.24 278.24 278.25 278.25 278.24 278.25 27			$z(ft/above ground) =$ $Jet Phase Eqs:$ Linearly interpolated from Stack R Spillane Equations: $V_{param} = ((va)_{a}^{-a} 0.12F_{a}(z.z.)^{2}(6.2 a) = 0.16(z.z{v})$ $\theta_{p} = \theta_{a}(1+(1+(\theta_{p}\theta_{a}))^{*}(V_{exc}D^{2})(c$ CEC Staff Equation: $V_{allogib} = (23) \times 16^{3/2} \times F_{sp}^{1/2} \times t$ where $F_{sp} = nF_{sp}$	16 20 ft Interval EI-z,1 ²) ^{1/2} / a 4V _{plume} *a ²⁺ λ ²)) 50 ft Interval 100 ft Interval



	ical Velocitie "Aviation Sa		oyant Plumes	-				
		-				ditions at \	arious Heights in the Merg	ed
	rne Evalua						, Queensland, Australia," D	
mbient Conditions:		Fluine	nom nwo Gas				eutral conditions (dθ/dz=0 or 6	
	070.45	14-1-2			Constants:			$\theta_a = \theta_e)$
Ambient Potential Temp θ _a	278.15	Kelvins	41.0	۴F	0 11		meters/feet	
lume Exit Conditions:					Gravity g		m/s ²	
Stack Height h		meters	80	feet-inches	λ	1.11		
Individual Stack Diameter D				inches	λο	~1.0		
Stack Velocity V _{exit}				ft/sec	4Vol/(60πD	r ⁺)		
Individual Volumetric Flow		cu.m/sec	257,143		$\pi V_{exit} D^2/4$			Sect.2/¶1
Stack Potential Temp θ _s		Kelvins	61.0					
Initial Stack Buoyancy Flux F		m ⁴ /s ³	20.0				(0)(= =)	Sect.2/¶1
Plume Buoyancy Flux F	N/A	m ⁴ /s ³			$\lambda^2 g V a^2 (1-\theta)$	_a /θ _p) for a,V	θ_p at plume height (see below	w)
Total Number of Stacks n	42							
Average Adjacent Stack Separation d	13.44	meters	44.1	feet	Calcs base	d on multipl	e plume treatment in Peter Be	st Paper:
Number of Stacks along Orientation N	6				plume velor	cities increa	sed by N ^{0.25} at the height wher	re plumes
					fully merge	d (interp. be	low ht, single merged stack a	bove ht)
Conditions at End (Top) of Jet Phase:								
Height above Stack ziel	22,900	meters*	75.1	feet*	z _{int} = 6.250). meters*=	meters above stack top	Sect.3/¶1
Height above Ground ziet+hs		meters	155.1					
Vertical Velocity V _{jel}					V _{jet} = 0.5V,	$= V_{-2}/2$		
Plume Top-Hat Diameter 2a _{iel}		meters	24.0		2a _{jet} = 2D	sxit • exit =	Conservation of momentum	
Fiume Top-fiat Diameter Zaja	1.020	motora	24.0	1001	zajet - zD		Conscivation of momentum	
	fan Calm Can	ditions for	Diverse Height	la abaua la	t and Man	ine Dhase	-	
pillane Methodology - Analytical Solutions								
Single Plume-averaged Vertical Velocit		-						
ingle Plume Values: Plume Top-Hat Radius a			e Merging Onl				r increase with height	Sect.2/Eq.6
Virtual Source Height z _v	0.444	meters*	1.5	feet*	z _v = 6.25D	$[1-(\theta_e/\theta_s)^{1/2}]$, meters*=meters above stack top	
Height above Ground zv+hs	24.828	meters	81.5				where $(\theta_a/\theta_s)^{1/2}$ = $(\theta_e/\theta_s)^{1/2}$ =	0.9806
Single Plume Values: Vertical Velocity V	Use	d in Plume	e Merging Onl	y	{(Va) _o ³ + 0.	12F _o [(z-z,) ² - (6.25D-z _v) ²]} ^(1/3) / a	Sect.2.1(6)
Product (Va)			_		V _{exit} (D/2)(0			. /
lume Merging - Based on Single Plume Ca	culations wh	ere:						Sect.3/¶3
Begin Merging Plume Top-Hat Diameter 2atouch		meters	44.1	feet	2a _{touch} =d, (or a=d/	2)	2 001.0/ [[0
								ton
Height above Stack ztouch		meters*	139.3		∠ _{touch} = Z _v +	·u/(∠ ⁻ U.16),	meters*=meters above stack	ιop
Height above Ground ztouch+hs		meters	219.3		. ·			
Vertical Velocity V _{touch}							$=_{o} [(z-z_v)^2 - (6.25D-z_v)^2]^{(1/3)}$	
Total Merging Plume Top-Hat Diameter 2a _{ful}		meters	220.5				=d(N-1)/2) FOR 2 STACKS,	
Height above Stack z _{ful}	210.444	meters*	690.4	feet*	$z_{full} = z_v + 2$	d/(2*0.16),	meters*=meters above stack	top
Height above Ground z _{full} +h _s	234.828	meters	770.4	feet				
Vertical Velocity V _{ful}	1.309	m/s	4.3	ft/sec	V _{full} = {(Va) ₆ ³ + 0.12F _c	$[(z_{full}-z_v)^2 - (6.25D-z_v)^2]$	/a _{full}
Product (V ³ a) _{ful}	75	m ⁴ /s ³						
Conditions at End (Top) of Merging Phase - D			and are in Merr	ed Plume c	alculations	(based on T	OTAL number of stacks):	
Merged Plume Values: Plume Diameter 2a			Table Below				z _{full})), or linear increase with h	eight
-		meters	280.6				here Total Merging Occurs	leigin
Revised Merged Plume Radius am								
Revised Merged Plume Velocity Vm				ft/sec			here Total Merging Occurs	
Revised Virtual Source Height z _{ful}			690.4				ere Total Merging Occurs (sh	
Revised Vertical Velocity V	S	olutions in	Tables Below				eights above total merging ele	evation
					V=V _{touch} +(V	√m-Vtouch)*(2	z-z _{touch})/(z _{full} -z _{touch})	
Multiple Plume Calculations							for heights below total mergin	ng elevation
Solve for plume-averaged vertical velo	city at height	540.0	feet	164.592	meters abo	ve ground (z+h _s)	
Gives the following Height above Stack z	140.208	meters*	460.0	feet*	LESS THA	N TOP OF	MERGING PHASE-INTERPO	LATE
Plume Top-Hat Radius a	#N/A	meters	#N/A	feet	a=a _m +0.16	(z-z _{full}) if z>	Z _{full}	
Vertical Velocity V	3.324	m/s	10.90	ft/sec	V={n(V ³ a) _{fu}	/a} ^{1/3} if z>	Z _{6.11}	
							z'-z _{touch})/(z _{full} -z _{touch}) if z _{touch} <	Z <z6.11< td=""></z6.11<>
					V'=single p			
Solve for Height of CASC critical vertical	velocity V	5.30	m/e		BEFORE T			VV < Top of
Find Height above Stack z _{crit}		meters					/(V _{crit}) ³]-a _m }/0.16 if V _{crit} <v<sub>m</v<sub>	
United at the Operation of the	JEI	meters	JEI	feet	Z _{crit} =Z _{touch} +	(Zfull=Ztouch)	*(V _{crit} -V _{touch})/(V _m -V _{touch}) if V _{cr}	rit>Vm
Height above Ground z _{crit} +h _s								
•								
able of MERGED Plume-Averaged Vertical							ee Single Plume spreadsheet,)
Table of MERGED Plume-Averaged Vertical Height (feet)	(meters)	Plume	Vert.		V _{plume} ={(Va) _o	³ +0.12F _o [(z-z	ee Single Plume spreadsheet, ,)²-(6.25D-z _v)²]} ^{1/3} / a)
able of MERGED Plume-Averaged Vertical	(meters)	Plume	Vert.			³ +0.12F _o [(z-z)
Table of MERGED Plume-Averaged Vertical Height (feet)	(meters) above stack	Plume	Vert. Vel(m/s)		$V_{plume} = {(Va)_{o}}$ a = 0.16(z=	³ +0.12F _o [(z-z z _v))
Table of MERGED Plume-Averaged Vertical Height (feet) above ground	(meters) above stack 42.46	Plume Radius(m) 6.720	Vert. Vel(m/s) 3.31		$V_{plume} = {(Va)_{o}}$ a = 0.16(z=	³ +0.12F _o [(z-z, z _v) -(θ _e /θ _s))*(V _e	,)²-(6.25D-z,,)²]} ^{1/3} / a _{xit} D²/(4V _{plume} *a²*λ²)))	
Table of MERGED Plume-Averaged Vertical Height (fect) above ground Begin Merging (touch) = 219.3	(meters) above stack 42.46 42.67	Plume Radius(m) 6.720 #N/A	Vert. Vel(m/s) 3.31 3.31		$V_{plume} = {(Va)_o}$ a = 0.16(z - t) $\theta_p = \theta_s (1 + (1 - t))$ Interpolated	³ +0.12F _o [(z-z, z _v) -(θ _e /θ _s))*(V _e d Layer Eqn	,)²-(6.25D-z,,)²]} ^{1/3} / a _{xit} D²/(4V _{plume} *a²*λ²)))	
Table of MERGED Plume-Averaged Vertical Height (feet) above ground Begin Merging (touch) = 210.2 220.0	(meters) above stack 42.46 42.67 48.77	Plume Radius(m) 6.720 #N/A #N/A	Vert. Vel(m/s) 3.31 3.31 3.31		$V_{plume} = {(Va)_o}$ a = 0.16(z - t) $\theta_p = \theta_s (1 + (1 - t))$ Interpolated	³ +0.12F _o [(z-z, z _v) -(θ _e /θ _s))*(V _e d Layer Eqn) ² -(6.25D-z _v) ²]} ^{1/3} / a _{xit} D ² /(4V _{plume} *a ^{2*} λ ²))) s	
Fable of MERGED Plume-Averaged Vertical Height (feet above ground Begin Merging (touch) = 219.3 240.0 240.0	(meters) above stack 42.46 42.67 48.77 54.86	Plume Radius(m) 6.720 #N/A #N/A #N/A	Vert. Vel(m/s) 3.31 3.31 3.31 3.31		$V_{plume} = {(Va)_o}$ a = 0.16(z - t) $\theta_p = \theta_s (1 + (1 - t))$ Interpolated	³ +0.12F _o [(z-z, z _v) -(θ _e /θ _s))*(V _e d Layer Eqn) ² -(6.25D-z _v) ²]} ^{1/3} / a _{xit} D ² /(4V _{plume} *a ^{2*} λ ²))) s	
fable of MERGED Plume-Averaged Vertical Height (feet) above ground Begin Merging (touch) = 219.3 220.0 240.0 280.0 280.0	(meters) above stack 42.46 42.67 48.77 54.86 60.96	Plume Radius(m) 6.720 #N/A #N/A #N/A	Vert. Vel(m/s) 3.31 3.31 3.31 3.31 3.32		$V_{plume} = {(Va)_o}$ a = 0.16(z - t) $\theta_p = \theta_s (1 + (1 - t))$ Interpolated	³ +0.12F _o [(z-z, z _v) -(θ _e /θ _s))*(V _e d Layer Eqn) ² -(6.25D-z _v) ²]} ^{1/3} / a _{xit} D ² /(4V _{plume} *a ^{2*} λ ²))) s	
Table of MERGED Plume-Averaged Vertical Height (feet) above ground Begin Merging (touch) = 219.3 240.0 240.0 280.0 280.0 300.0	(meters) above stack 42.46 42.67 48.77 54.86 60.96 67.06	Plume Radius(m) 6.720 #N/A #N/A #N/A #N/A	Vert. Vel(m/s) 3.31 3.31 3.31 3.32 3.32 3.32		$V_{plume} = {(Va)_o}$ a = 0.16(z - t) $\theta_p = \theta_s (1 + (1 - t))$ Interpolated	³ +0.12F _o [(z-z, z _v) -(θ _e /θ _s))*(V _e d Layer Eqn) ² -(6.25D-z _v) ²]} ^{1/3} / a _{xit} D ² /(4V _{plume} *a ^{2*} λ ²))) s	
Table of MERGED Plume-Averaged Vertical Height (feet) above ground Begin Merging (touch) = 219.3 220.0 2240.0 2260.0 2280.0 3300.0 3300.0 320.0	(meters) above stack 42.46 42.67 48.77 54.86 60.96 67.06 73.15	Plume Radius(m) 6.720 #N/A #N/A #N/A #N/A #N/A	Vert. Vel(m/s) 3.31 3.31 3.31 3.31 3.32 3.32 3.32 3.32		$V_{plume} = {(Va)_o}$ a = 0.16(z - t) $\theta_p = \theta_s (1 + (1 - t))$ Interpolated	³ +0.12F _o [(z-z, z _v) -(θ _e /θ _s))*(V _e d Layer Eqn) ² -(6.25D-z _v) ²]} ^{1/3} / a _{xit} D ² /(4V _{plume} *a ^{2*} λ ²))) s	
fable of MERGED Plume-Averaged Vertical Height (feet) above ground Begin Merging (touch) = 219.3 220.0 240.0 260.0 260.0 300.0 320.0 330.0 340.0	(meters) above stack 42.46 42.67 48.77 54.86 60.96 67.06 73.15 79.25	Plume Radius(m) 6.720 #N/A #N/A #N/A #N/A #N/A	Vert. Vel(m/s) 3.31 3.31 3.31 3.32 3.32 3.32 3.32 3.32		$V_{plume} = {(Va)_o}$ a = 0.16(z - t) $\theta_p = \theta_s (1 + (1 - t))$ Interpolated	³ +0.12F _o [(z-z, z _v) -(θ _e /θ _s))*(V _e d Layer Eqn) ² -(6.25D-z _v) ²]} ^{1/3} / a _{xit} D ² /(4V _{plume} *a ^{2*} λ ²))) s	
Table of MERGED Plume-Averaged Vertical Height (feet) above ground Begin Merging (touch) = 219.3 220.0 220.0 220.0 220.0 220.0 300.0 3300.0 340.0 340.0 340.0 340.0 340.0	(meters) above stack 42.46 42.67 48.77 54.86 60.96 67.06 73.15 79.25 85.34	Plume Radius(m) 6.720 #N/A #N/A #N/A #N/A #N/A #N/A	Vert. Vel(m/s) 3.31 3.31 3.31 3.32 3.32 3.32 3.32 3.32		$\begin{split} & V_{plarma} = \{(Va)_o \\ a = 0.16(z-t) \\ \theta_p = \theta_s(1+(1-t)) \\ Interpolated \\ V' = V_{touch} + (t) \\ \end{split}$	⁸ +0.12F _e [(z-z, z _v) (θ _e /θ _s))*(V _e d Layer Eqn V _m -V _{touch})*() ² -(6.25D-z _v) ²]} ^{1/3} / a _{xit} D ² /(4V _{plume} *a ^{2*} λ ²))) s	
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fable of MERGED Plume-Averaged Vertical Height (feet) above ground Begin Merging (touch) = 219.3 220.0 220.0 220.0 240.0 280.0 320.0 320.0 320.0 320.0 320.0 40.0 End Merging (full/mp) = 770.4	(meters) above stack 42.46 42.67 48.77 54.86 60.96 67.06 67.06 73.15 79.25 85.34 210.43 97.54	Plume Radius(m) 6.720 #N/A #N/A #N/A #N/A #N/A #N/A 85.537 67.471	Vert. Vel(m/s) 3.31 3.31 3.32 3.32 3.32 3.32 3.32 3.32		$\label{eq:product} \begin{split} v_{\text{plana}} = & (Va)_o \\ a = 0.16(z\cdot dp_p = \theta_o (1+(1\cdot lnterpolate V + V_{touch} + (V = V_{touch} + ($	³ +0.12F ₀ [(z-z, z _v) (·(θ _d /θ _s))*(V _e d Layer Eqn V _m -V _{touch})*(ime Eqns _{al} /a) ^{1/3}) ² -(6.25D-z _v) ²]} ^{1/3} / a _{xit} D ² /(4V _{plume} *a ^{2*} λ ²))) s	20 ft Interva
Table of MERGED Plume-Averaged Vertical Height (feet) above ground Begin Merging (touch) = 219.3 220.0 220.0 220.0 220.0 220.0 220.0 220.0 220.0 220.0 220.0 280.0 3300.0 340.0 3800.0 2800 3800.0 2800.0 3800.0 2800.0	(meters) above stack 42.46 42.67 48.77 54.86 60.96 67.06 67.06 73.15 79.25 85.34 210.43 97.54	Plume Radius(m) 6.720 #N/A #N/A #N/A #N/A #N/A #N/A 85.537 67.471	Vert. Vel(m/s) 3.31 3.31 3.32 3.32 3.32 3.32 3.32 3.32		$V_{plume} = {(Va)_o}$ $a = 0.16(z-b_{e})$ $\theta_p = \theta_s (1+(1-z))$ <i>Interpolated</i> $V' = V_{touch} + (1-z)$ <i>Merged Plue</i>	³ +0.12F ₀ [(z-z, z _v) (·(θ _d /θ _s))*(V _e d Layer Eqn V _m -V _{touch})*(ime Eqns _{al} /a) ^{1/3}) ² -(6.25D-z _v) ²]} ^{1/3} / a _{xit} D ² /(4V _{plume} *a ^{2*} λ ²))) s	20 ft Interva
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able of MERGED Plume-Averaged Vortical Height (feut) Begin Merging (touch) = 219.3 2200. 2240.0 2260.0 2280.0 2280.0 2280.0 300.0 300.0 330.0 34	(meters) above stack 42.46 42.67 48.77 54.86 60.96 67.06 73.15 79.25 85.34 210.43 97.54 112.78	Plume Radius(m) 6.720 #N/A #N/A #N/A #N/A #N/A #N/A #N/A 85.537 67.471 69.910 72.348	Vert. Vel(m/s) 3.31 3.31 3.32 3.32 3.32 3.32 3.32 3.33 3.61 3.56 3.52		$\label{eq:product} \begin{split} v_{\text{plana}} = & (Va)_o \\ a = 0.16(z\cdot dp_p = \theta_o (1+(1\cdot lnterpolate V + V_{touch} + (V = V_{touch} + ($	³ +0.12F ₀ [(z-z, z _v) (·(θ _d /θ _s))*(V _e d Layer Eqn V _m -V _{touch})*(ime Eqns _{al} /a) ^{1/3}) ² -(6.25D-z _v) ²]} ^{1/3} / a _{xit} D ² /(4V _{plume} *a ^{2*} λ ²))) s	20 ft Interva
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"able of MERGED Plume-Averaged Vortical Height (feet) above ground Begin Merging (touch) = 219.3 220.0 2240.0 2200.0 340.0 400.0 450.0 550.0 550.0 600.0	(meters) above stack 42.46 42.67 48.77 54.88 67.06 73.15 79.25 85.34 210.43 97.54 112.78 128.02 143.26 158.50	Plume Radius(m) 6.720 #N/A #N/A #N/A #N/A #N/A #N/A 85.537 67.471 69.910 72.348 74.786 74.786	Vert. Vel(m/s) 3.31 3.31 3.32 3.32 3.32 3.32 3.32 3.32		$\label{eq:product} \begin{split} v_{\text{plana}} = & (Va)_o \\ a = 0.16(z\cdot dp_p = \theta_o (1+(1\cdot lnterpolate V + V_{touch} + (V = V_{touch} + ($	³ +0.12F ₀ [(z-z, z _v) (·(θ _d /θ _s))*(V _e d Layer Eqn V _m -V _{touch})*(ime Eqns _{al} /a) ^{1/3}) ² -(6.25D-z _v) ²]} ^{1/3} / a _{xit} D ² /(4V _{plume} *a ^{2*} λ ²))) s	20 ft Interva 50 ft Interva
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'able of MERGED Plume-Averaged Vortical Height (feet) above ground Begin Merging (touch) = 219.3 220.0 20.0 </td <td>(meters) above stack 42.46 42.67 48.77 54.86 60.96 60.96 60.96 67.06 73.15 77.25 85.34 210.43 97.54 9112.78 112.78 112.85 915.550 118.859 219.46</td> <td>Plume Radius(m) 6.720 #NVA #NVA #NVA #NVA #NVA #NVA #NVA #NVA</td> <td>Vert. Vel(m/s) 3.31 3.31 3.32 3.32 3.32 3.32 3.32 3.32</td> <td></td> <td>$\label{eq:product} \begin{split} v_{\text{plana}} = & (Va)_o \\ a = 0.16(z\cdot dp_p = \theta_o (1+(1\cdot lnterpolate V + V_{touch} + (V = V_{touch} + ($</td> <td>³+0.12F₀[(z-z, z_v) (+θ_d/θ_s))*(V_e d Layer Eqn V_m-V_{touch})*(ime Eqns _{al}/a)^{1/3}</td> <td>)²-(6.25D-z_v)²]}^{1/3} / a _{xit}D²/(4V_{plume}*a^{2*}λ²))) s</td> <td>20 ft Interva 50 ft Interva</td>	(meters) above stack 42.46 42.67 48.77 54.86 60.96 60.96 60.96 67.06 73.15 77.25 85.34 210.43 97.54 9112.78 112.78 112.85 915.550 118.859 219.46	Plume Radius(m) 6.720 #NVA #NVA #NVA #NVA #NVA #NVA #NVA #NVA	Vert. Vel(m/s) 3.31 3.31 3.32 3.32 3.32 3.32 3.32 3.32		$\label{eq:product} \begin{split} v_{\text{plana}} = & (Va)_o \\ a = 0.16(z\cdot dp_p = \theta_o (1+(1\cdot lnterpolate V + V_{touch} + (V = V_{touch} + ($	³ +0.12F ₀ [(z-z, z _v) (+θ _d /θ _s))*(V _e d Layer Eqn V _m -V _{touch})*(ime Eqns _{al} /a) ^{1/3}) ² -(6.25D-z _v) ²]} ^{1/3} / a _{xit} D ² /(4V _{plume} *a ^{2*} λ ²))) s	20 ft Interva 50 ft Interva
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able of MERGED Plume-Averaged Vertical Height (feet) above ground Begin Merging (touch) = 219.3 220.0 200.0	(metors) above stack 42.67 42.67 48.77 54.86 60.96 67.06 79.25 85.34 270.43 97.54 112.78 128.02 143.26 158.50 188.98 219.46 249.94 228.042	Plume Radius(m) 6.720 #N/A #N/A #N/A #N/A #N/A #N/A #N/A #N/A	Vert. Vel(m/s) 3.331 3.31 3.32 3.32 3.32 3.32 3.32 3.3		$\label{eq:product} \begin{split} v_{\text{plana}} = & (Va)_o \\ a = 0.16(z\cdot dp_p = \theta_o (1+(1\cdot lnterpolate V + V_{touch} + (V = V_{touch} + ($	³ +0.12F ₀ [(z-z, z _v) (+θ _d /θ _s))*(V _e d Layer Eqn V _m -V _{touch})*(ime Eqns _{al} /a) ^{1/3}) ² -(6.25D-z _v) ²]} ^{1/3} / a _{xit} D ² /(4V _{plume} *a ^{2*} λ ²))) s	20 ft Interva 50 ft Interva
'able of MERGED Plume-Averaged Vortical Height (feet) above ground Begin Merging (touch) = 219.3 220.0 220.0 220.0 280.0 280.0 280.0 280.0 280.0 280.0 280.0 380.0 380.0 580.0 6 6 6 6 6 6 6 700.0 800.0 9 6 6 6 700.0 800.0 9 1000.0 1000.0	(meters) above stack 42.64 42.67 48.77 54.868 60.96 67.06 79.25 85.34 97.54 112.78 128.02 143.26 158.50 128.02 143.26 158.50 128.02 143.26 158.50 128.02 129.46 249.44 229.42 230.42 230.42 240.45	Plume Radius(m) 6.720 #N/A #N/A #N/A #N/A #N/A #N/A 85.537 67.471 69.910 72.348 74.786 77.225 82.102 86.978 91.855 96.732 101.609	Vert. Vel(m/s) 3.31 3.31 3.32 3.32 3.32 3.32 3.32 3.32		$\label{eq:product} \begin{split} v_{\text{plana}} = & (Va)_o \\ a = 0.16(z\cdot dp_p = \theta_o (1+(1\cdot lnterpolate V + V_{touch} + (V = V_{touch} + ($	³ +0.12F ₀ [(z-z, z _v) (+θ _d /θ _s))*(V _e d Layer Eqn V _m -V _{touch})*(ime Eqns _{al} /a) ^{1/3}) ² -(6.25D-z _v) ²]} ^{1/3} / a _{xit} D ² /(4V _{plume} *a ^{2*} λ ²))) \$	20 ft Interva 50 ft Interva
able of MERGED Plume-Averaged Vertical Height (feet) above ground Begin Merging (touch) = 219.3 220.0 200.0	(meters) above stack 42.64 42.67 48.77 54.868 60.96 67.06 79.25 85.34 97.54 112.78 128.02 143.26 158.50 128.02 143.26 158.50 128.02 143.26 158.50 128.02 129.46 249.44 229.42 230.42 230.42 240.45	Plume Radius(m) 6.720 #N/A #N/A #N/A #N/A #N/A #N/A 85.537 67.471 69.910 72.348 74.786 77.225 82.102 86.978 91.855 96.732 101.609	Vert. Vel(m/s) 3.31 3.31 3.32 3.32 3.32 3.32 3.32 3.32		$\label{eq:product} \begin{split} v_{\text{plana}} = & (Va)_o \\ a = 0.16(z\cdot dp_p = \theta_o (1+(1\cdot lnterpolate V + V_{touch} + (V = V_{touch} + ($	³ +0.12F ₀ [(z-z, z _v) (+θ _d /θ _s))*(V _e d Layer Eqn V _m -V _{touch})*(ime Eqns _{al} /a) ^{1/3}) ² -(6.25D-z _v) ²]} ^{1/3} / a _{xit} D ² /(4V _{plume} *a ^{2*} λ ²))) \$	20 ft Interva 50 ft Interva
able of MERGED Plume-Averaged Vortical Height (feet) above ground Begin Merging (touch) = 219.3 220.0 220.0 220.0 220.0 220.0 220.0 220.0 220.0 220.0 220.0 220.0 220.0 220.0 200.0 200.0 200.0 3300.0	(meters) above stack 42.64 42.67 44.77 54.868 60.96 67.06 73.15 73.25 85.34 210.43 97.54 112.78 128.02 143.25 158.50 188.88 229.94 229.44 229.94 229.42 310.99 341.38	Plume Radius(m) 6.720 #N/A #N/A #N/A #N/A #N/A #N/A #N/A 85.537 67.471 69.910 72.348 74.786 67.7225 82.102 86.978 91.855 96.732 91.855 96.732 91.855	Vert. Vel(m/s) 3.331 3.31 3.32 3.32 3.32 3.32 3.32 3.3		$\label{eq:product} \begin{split} v_{\text{plana}} = & (Va)_o \\ a = 0.16(z\cdot dp_p = \theta_o (1+(1\cdot lnterpolate V + V_{touch} + (V = V_{touch} + ($	³ +0.12F ₀ [(z-z, z _v) (+θ _d /θ _s))*(V _e d Layer Eqn V _m -V _{touch})*(ime Eqns _{al} /a) ^{1/3}) ² -(6.25D-z _v) ²]} ^{1/3} / a _{xit} D ² /(4V _{plume} *a ^{2*} λ ²))) \$	20 ft Interva 50 ft Interva
'able of MERGED Plume-Averaged Vertical Height (feet) above ground Begin Merging (touch) = 219.3 220.0 2300.0 550.0 550.0 550.0 560.0 600.0 600.0 600.0 600.0 600.0 600.0 600.0 600.0 600.0	(metors) above stack 42.67 48.77 54.86 60.95 67.06 73.15 79.25 85.34 270.43 97.54 112.78 128.02 143.26 158.50 159.50 158.50 159.	Plume Radius(m) 6,720 #N/A #N/A #N/A #N/A #N/A #N/A 85.537 67.471 69.910 72.348 74.786 74.786 74.786 74.786 74.786 96.955 96.732 101.609 90.6486 910.6496 910.6496	Vert. Vel(m/s) 3.331 3.31 3.32 3.32 3.32 3.32 3.32 3.3		$\label{eq:product} \begin{split} v_{\text{plana}} = & (Va)_o \\ a = 0.16(z\cdot dp_p = \theta_o (1+(1\cdot lnterpolate V + V_{touch} + (V = V_{touch} + ($	³ +0.12F ₀ [(z-z, z _v) (+θ _d /θ _s))*(V _e d Layer Eqn V _m -V _{touch})*(ime Eqns _{al} /a) ^{1/3}) ² -(6.25D-z _v) ²]} ^{1/3} / a _{xit} D ² /(4V _{plume} *a ^{2*} λ ²))) \$	20 ft Interva 50 ft Interva
able of MERGED Plume-Averaged Vertical Height (feet) above ground Begin Merging (touch) = 219.3 220.0 320.0 380.0 580.0 580.0 580.0 580.0 580.0 580.0 680.0 680.0 680.0 680.0 680.0 680.0 </td <td>(meters) above stack 42.64 42.67 48.77 54.866 60.96 67.06 79.25 85.34 97.54 112.78 128.02 143.26 158.50 128.02 143.26 158.50 249.44 219.46 249.44 220.42 310.90 341.38 371186 402.34 402.34 10.90 10.9</td> <td>Plume Radius(m) 6.720 #N/A #N/A #N/A #N/A #N/A #N/A #N/A #N/A</td> <td>Vert. Vel(m/s) 3.31 3.31 3.32 3.32 3.32 3.32 3.32 3.32</td> <td></td> <td>$\label{eq:product} \begin{split} v_{\text{plana}} = & (Va)_o \\ a = 0.16(z\cdot dp_p = \theta_o (1+(1\cdot lnterpolate V + V_{touch} + (V = V_{touch} + ($</td> <td>³+0.12F₀[(z-z, z_v) (+θ_d/θ_s))*(V_e d Layer Eqn V_m-V_{touch})*(ime Eqns _{al}/a)^{1/3}</td> <td>)²-(6.25D-z_v)²]}^{1/3} / a _{xit}D²/(4V_{plume}*a^{2*}λ²))) \$</td> <td>20 ft Interva 50 ft Interva 100 ft Interv</td>	(meters) above stack 42.64 42.67 48.77 54.866 60.96 67.06 79.25 85.34 97.54 112.78 128.02 143.26 158.50 128.02 143.26 158.50 249.44 219.46 249.44 220.42 310.90 341.38 371186 402.34 402.34 10.90 10.9	Plume Radius(m) 6.720 #N/A #N/A #N/A #N/A #N/A #N/A #N/A #N/A	Vert. Vel(m/s) 3.31 3.31 3.32 3.32 3.32 3.32 3.32 3.32		$\label{eq:product} \begin{split} v_{\text{plana}} = & (Va)_o \\ a = 0.16(z\cdot dp_p = \theta_o (1+(1\cdot lnterpolate V + V_{touch} + (V = V_{touch} + ($	³ +0.12F ₀ [(z-z, z _v) (+θ _d /θ _s))*(V _e d Layer Eqn V _m -V _{touch})*(ime Eqns _{al} /a) ^{1/3}) ² -(6.25D-z _v) ²]} ^{1/3} / a _{xit} D ² /(4V _{plume} *a ^{2*} λ ²))) \$	20 ft Interva 50 ft Interva 100 ft Interv
'able of MERGED Plume-Averaged Vertical Height (feet) above ground Begin Merging (touch) = 219.3 Carbon Merging (touch) = 219.3 220.0 220.0 220.0 220.0 220.0 220.0 220.0 220.0 220.0 300.0 340.0 340.0 400.0 400.0 450.0 550.0 600.0 600.0 700.0 600.0 1000.0 11000.0 1200.0 1400.0 11000.0 11000.0 11000.0 11000.0 11000.0 11000.0 11000.0 11000.0 11000.0 11000.0 11000.0 11000.0 11000.0 11000.0 11000.0 11000.0 11000.0 11000.0	(meters) above stack 42.64 42.67 44.77 48.77 54.868 60.96 67.06 73.151 79.25 85.34 210.43 210.43 214.32 219.46 229.94 229.94 229.94 229.94 229.94 230.92 310.99 341.38 371.86 371.86 249.94	Plume Radius(m) 6.720 #N/A #N/A #N/A #N/A #N/A #N/A #N/A #N/A	Vert. Vel(m/s) 3.371 3.31 3.32 3.322 3.322 3.322 3.322 3.322 3.323 3.361 3.552 3.348 3.345 3.345 3.345 3.345 3.325 3.200 3.3151 3.310 3.322 3.320 3.310 3.315 3.3100 3.31000 3.31000 3.310000000000		$\label{eq:product} \begin{split} v_{\text{plana}} = & (Va)_o \\ a = 0.16(z\cdot dp_p = \theta_o (1+(1\cdot lnterpolate V + V_{touch} + (V = V_{touch} + ($	³ +0.12F ₀ [(z-z, z _v) (+θ _d /θ _s))*(V _e d Layer Eqn V _m -V _{touch})*(ime Eqns _{al} /a) ^{1/3}) ² -(6.25D-z _v) ²]} ^{1/3} / a _{xit} D ² /(4V _{plume} *a ^{2*} λ ²))) \$	20 ft Interva 50 ft Interva 100 ft Interv
Table of MERGED Plume-Averaged Vertical Height (feet) above ground Begin Merging (touch) = 219.3 220.0 300.0 300.0 300.0 500.0 550.0 550.0 550.0 550.0 6600.0 6000.0 1000.0 1000.0 1000.0 1100.0 1200.0 1300.0 1400.0 1200.0 2000.0	(metors) above stack 42.64 42.67 48.77 54.86 60.05 67.06 77.15 79.25 85.34 270.43 97.54 112.78 128.02 143.26 143.26 148.98 219.46 229.42 310.90 341.33 371.86 40.234 371.86 40.234 40.224 585.22	Plume Radius(m) 6,720 #N/A #N/A #N/A #N/A #N/A #N/A #N/A 85.537 67.471 69.910 72.348 74.786 74.77777777777777777777777777777777777	Vert. Vel(m/s) 3.331 3.31 3.32 3.32 3.32 3.32 3.32 3.3		$\label{eq:product} \begin{split} v_{\text{plana}} = & (Va)_o \\ a = 0.16(z\cdot dp_p = \theta_o (1+(1\cdot lnterpolate V + V_{touch} + (V = V_{touch} + ($	³ +0.12F ₀ [(z-z, z _v) (+θ _d /θ _s))*(V _e d Layer Eqn V _m -V _{touch})*(ime Eqns _{al} /a) ^{1/3}) ² -(6.25D-z _v) ²]} ^{1/3} / a _{xit} D ² /(4V _{plume} *a ^{2*} λ ²))) \$	20 ft Interva 50 ft Interva 100 ft Interv
Table of MERGED Plume-Averaged Vertical Height (feet) above ground Begin Merging (touch) = 219.3 220.0 320.0 320.0 320.0 320.0 320.0 320.0 320.0 320.0 320.0 320.0 450.0 550.0 550.0 600.0 700.0 1000.0 1000.0 1100.0 1200.0 1400.0 1200.0 1200.0 1200.0 <t< td=""><td>(meters) above stack 42.64 42.67 48.77 54.866 60.96 67.06 79.25 85.34 97.54 112.78 128.02 143.26 158.50 148.29 249.44 229.46 249.44 249.44 220.42 310.90 341.38 3711.86 402.34 402.34 371.85 229.737.62 73.762</td><td>Plume Radius(m) 6.720 #N/A #N/A #N/A #N/A #N/A #N/A #N/A #N/A</td><td>Vert. Velt(m/s) 3.31 3.31 3.32 3.32 3.32 3.32 3.32 3.32</td><td></td><td>$\label{eq:product} \begin{split} v_{\text{plana}} = & (Va)_o \\ a = 0.16(z\cdot dp_p = \theta_o (1+(1\cdot lnterpolate V + V_{touch} + (V = V_{touch} + ($</td><td>³+0.12F₀[(z-z, z_v) (+θ_d/θ_s))*(V_e d Layer Eqn V_m-V_{touch})*(ime Eqns _{al}/a)^{1/3}</td><td>)²-(6.25D-z_v)²]}^{1/3} / a _{xit}D²/(4V_{plume}*a^{2*}λ²))) \$</td><td>20 ft Interva 50 ft Interva 100 ft Interv</td></t<>	(meters) above stack 42.64 42.67 48.77 54.866 60.96 67.06 79.25 85.34 97.54 112.78 128.02 143.26 158.50 148.29 249.44 229.46 249.44 249.44 220.42 310.90 341.38 3711.86 402.34 402.34 371.85 229.737.62 73.762	Plume Radius(m) 6.720 #N/A #N/A #N/A #N/A #N/A #N/A #N/A #N/A	Vert. Velt(m/s) 3.31 3.31 3.32 3.32 3.32 3.32 3.32 3.32		$\label{eq:product} \begin{split} v_{\text{plana}} = & (Va)_o \\ a = 0.16(z\cdot dp_p = \theta_o (1+(1\cdot lnterpolate V + V_{touch} + (V = V_{touch} + ($	³ +0.12F ₀ [(z-z, z _v) (+θ _d /θ _s))*(V _e d Layer Eqn V _m -V _{touch})*(ime Eqns _{al} /a) ^{1/3}) ² -(6.25D-z _v) ²]} ^{1/3} / a _{xit} D ² /(4V _{plume} *a ^{2*} λ ²))) \$	20 ft Interva 50 ft Interva 100 ft Interv
Fable of MERGED Plume-Averaged Vertical Height (feet) above ground Begin Merging (touch) = 219.3 Call Begin Merging (touch) = 219.3 Call Call <	(meters) above stack 42.64 42.67 44.77 48.77 54.868 60.96 67.06 73.151 79.25 85.34 210.43 210.43 214.32 215.32 214.32 214.32 215.32 214.32 214.32 214.32 214.32 215.32 214.32 214.32 215.32 214.32 214.32 215.32 214.32 214.32 215.32 214.32 214.32 214.32 214.32 215.32 214.32	Plume Radius(m) 6.720 #N/A #N/A #N/A #N/A #N/A #N/A #N/A #N/A	Vert. Vel(m/s) 3.331 3.31 3.32 3.32 3.32 3.32 3.32 3.3		$\label{eq:product} \begin{split} v_{\text{plana}} = & (Va)_o \\ a = 0.16(z\cdot dp_p = \theta_o (1+(1\cdot lnterpolate V + V_{touch} + (V = V_{touch} + ($	³ +0.12F ₀ [(z-z, z _v) (+θ _d /θ _s))*(V _e d Layer Eqn V _m -V _{touch})*(ime Eqns _{al} /a) ^{1/3}) ² -(6.25D-z _v) ²]} ^{1/3} / a _{xit} D ² /(4V _{plume} *a ^{2*} λ ²))) \$	20 ft Interva 50 ft Interva 100 ft Interv
Table of MERGED Plume-Averaged Vertical Height (feet) above ground Begin Merging (touch) = 219.3 220.0 300.0 300.0 300.0 360.0 550.0 550.0 550.0 550.0 600.0 700.0 800.0 1000.0 1000.0 1100.0 1100.0 1100.0 1100.0 1100.0 1100.0 1100.0 1100.0 1100.0 1100.0 1100.0	(metors) above stack 42.66 42.67 48.77 54.88 60.96 67.06 77.15 79.25 85.34 210.43 97.54 112.78 128.02 143.26 158.50 188.98 219.46 229.42 310.90 341.13 371.86 402.54 229.42 310.90 341.33 371.86 402.54 85.92 273.76 88.90 20.42 20.	Plume Radius(m) 6,720 #N/A #N/A #N/A #N/A #N/A #N/A #N/A #N/A	Vert. Vel(m/s) 3.331 3.31 3.32 3.32 3.32 3.32 3.32 3.3		$\label{eq:product} \begin{split} v_{\text{plana}} = & (Va)_o \\ a = 0.16(z\cdot dp_p = \theta_o (1+(1\cdot lnterpolate V + V_{touch} + (V = V_{touch} + ($	³ +0.12F ₀ [(z-z, z _v) (+θ _d /θ _s))*(V _e d Layer Eqn V _m -V _{touch})*(ime Eqns _{al} /a) ^{1/3}) ² -(6.25D-z _v) ²]} ^{1/3} / a _{xit} D ² /(4V _{plume} *a ^{2*} λ ²))) \$	20 ft Interva 50 ft Interva 100 ft Interv
Table of MERGED Plume-Averaged Vertical Height (feet) above ground Begin Merging (touch) = 219.3 Begin Merging (touch) = 219.0 2200.0 2200.0 2200.0 2200.0 2200.0 2200.0 2200.0 2200.0 2200.0 2200.0 3300.0 340.0 360.0 End Merging (full/mp) = 270.4 400.0 450.0 5500.0 600.0 600.0 7070.0 600.0 1000.0 11000.0 1200.0 1200.0 1200.0 1200.0 1200.0 2500.0 2500.0 2500.0 2500.0 3000.0	(metors) above stack 42.66 42.67 48.77 54.88 60.96 67.06 77.15 79.25 85.34 210.43 97.54 112.78 128.02 143.26 158.50 188.98 219.46 229.42 310.90 341.13 371.86 402.54 229.42 310.90 341.33 371.86 402.54 85.92 273.76 88.90 20.42 20.	Plume Radius(m) 6,720 #N/A #N/A #N/A #N/A #N/A #N/A #N/A #N/A	Vert. Vel(m/s) 3.33 3.31 3.32 3.32 3.32 3.32 3.32 3.32		$\label{eq:product} \begin{split} v_{\text{plana}} = & (Va)_o \\ a = 0.16(z\cdot dp_p = \theta_o (1+(1\cdot lnterpolate V + V_{touch} + (V = V_{touch} + ($	³ +0.12F ₀ [(z-z, z _v) (+θ _d /θ _s))*(V _e d Layer Eqn V _m -V _{touch})*(ime Eqns _{al} /a) ^{1/3}) ² -(6.25D-z _v) ²]} ^{1/3} / a _{xit} D ² /(4V _{plume} *a ^{2*} λ ²))) \$	20 ft Interva 50 ft Interva 100 ft Interv
Fable of MERGED Plume-Averaged Vertical Height (feet) above ground Begin Merging (touch) = 219.3 220.0 300.0 300.0 300.0 360.0 550.0<	(meters) above stack 42.64 42.67 48.77 54.866 60.96 67.06 79.25 85.34 97.54 112.78 128.02 143.26 158.50 249.94 229.46 249.94 220.42 310.90 341.38 97.54 188.99 249.44 220.42 194.62 220.42 200.42	Plume Radius(m) 6.720 #N/A #N/A #N/A #N/A #N/A #N/A #N/A #N/A	Vert. Vel(m/s) 3.31 3.31 3.32 3.32 3.32 3.32 3.32 3.32		$\label{eq:product} \begin{split} v_{\text{plana}} = & (Va)_o \\ a = 0.16(z\cdot dp_p = \theta_o (1+(1\cdot lnterpolate V + V_{touch} + (V = V_{touch} + ($	³ +0.12F ₀ [(z-z, z _v) (+θ _d /θ _s))*(V _e d Layer Eqn V _m -V _{touch})*(ime Eqns _{al} /a) ^{1/3}) ² -(6.25D-z _v) ²]} ^{1/3} / a _{xit} D ² /(4V _{plume} *a ^{2*} λ ²))) \$	20 ft Interval 50 ft Interval 100 ft Interva 500 ft Interva



				oyant Plumes					
		"The Evalua						/arious Heights in the Merg	
which the state of the state			Plume	from Two Gas				, Queensland, Australia," I	
mbient Conditions:	at Datastial Tama 0	070.45	Kelvins	41.0		Constants:		eutral conditions (dθ/dz=0 or	$\theta_a = \theta_e$)
lume Exit Conditions:	ent Potential Temp θ_a	2/0.15	Keinns	41.0	F	Gravity g		meters/feet m/s ²	
Tume Exit Conditions.	Stack Height hs	24.38	meters	80	feet-inches	διανιτγιά λ	1.11		
Individu	al Stack Diameter D	3.6639445			inches	λο	~1.0		
	Stack Velocity Vexit	11.51	m/s		ft/sec	4Vol/(60πE) ²)		
Individ	dual Volumetric Flow	121.36	cu.m/sec	257,143	ACFM	$\pi V_{exit} D^2/4$			Sect.2/¶1
Sta	ck Potential Temp θ_s	289.26	Kelvins	61.0	°F				
	ck Buoyancy Flux F _o		m ⁴ /s ³	20.0	ΔT(°F)			ol.Flow(g/ π)(1- θ_a/θ_s)	Sect.2/¶1
	me Buoyancy Flux F		m ⁴ /s ³			λ ² gVa ² (1-θ	_a /θ _p) for a,V	,θ _p at plume height (see belo	w)
	I Number of Stacks n	42		07.4	4	Online house		e plume treatment in Peter Be	- Down
• •	t Stack Separation d	8.25	meters	27.1	teet			e plume treatment in Peter Be ised by N ^{0.25} at the height whe	•
Number of Stack	s along Orientation N	8						low ht, single merged stack a	
conditions at End (Top) o	f.let Phase					rully merge	u (interp. be	iow ni, single merged stack i	bove nit)
	eight above Stack z _{jet}	22.900	meters*	75.1	feet*	Zint = 6.25). meters*=	meters above stack top	Sect.3/¶1
	above Ground zjet+hs		meters	155.1		jet			
	Vertical Velocity V _{jet}	5.755	m/s	18.88	ft/sec	V _{jet} = 0.5V	_{exit} = V _{exit} /2		
Plume T	op-Hat Diameter 2ajet	7.328	meters	24.0	feet	2a _{jet} = 2D		Conservation of momentum	
pillane Methodology - A	nalytical Solutions	for Calm Cor	ditions for	Plume Height	ts above Je	t and Merg	ing Phase	s	
Single Plume-average									
Single Plume Values: Plu				e Merging On				r increase with height	Sect.2/Eq.6
	tual Source Height zv		meters*		feet*	z _v = 6.25D	[1-(θ _e /θ _s) ^{1/2}	, meters*=meters above stack top	
	above Ground zv+hs		meters	81.5 e Merging Onl		(0/=) 3	125 7 /-	where $(\theta_a/\theta_s)^{1/2} = (\theta_e/\theta_s)^{1/2} =$	
Single Plume Values:	Vertical Velocity V Product (Va)	20.677		e merging Un	7	{(Va) _o ³ + 0. V _{exit} (D/2)(θ		/) ² - (6.25D-z _v) ²]} ^(1/3) / a	Sect.2.1(6)
	Product (Va) _o	20.077	111 /S			×exit(U/∠)(U	e ^{, U} s)		
Plume Merging - Based o	n Single Plume Cal	culations wh	ere:						Sect.3/¶3
Begin Merging Plume Top			meters	27.1	feet	2a _{touch} =d, (or atouch=d/	2)	
	ht above Stack ztouch		meters*		feet*			meters*=meters above stack	top
	oove Ground z _{touch} +hs		meters	166.0			,		
	ertical Velocity V _{touch}	5.065		16.6	ft/sec	V _{touch} = {(V	'a) _o ³ + 0.12	F _o [(z-z _v) ² - (6.25D-z _v) ²]} ^(1/3)	/ a
otal Merging Plume Top	p-Hat Diameter 2a _{full}	57.750	meters	189.5	feet	2a _{full} =2d(N	-1)/2, (or a _f	al=d(N-1)/2) FOR 2 STACKS	2a _{full} =2d
He	eight above Stack z _{full}	180.913	meters*	593.5	feet*	$z_{full} = z_v + 2$	d/(2*0.16),	meters*=meters above stack	top
Height :	above Ground z _{full} +hs	205.297	meters	673.5	feet				
	Vertical Velocity V _{full}	1.391		4.6	ft/sec	V _{full} = {(Va) _o ³ + 0.12F,	$[(z_{full}-z_v)^2 - (6.25D-z_v)^2])^{(1/3)}$	/ a _{full}
	Product (V ³ a) _{full}		m ⁴ /s ³						
Conditions at End (Top) o					ed Plume c				
Merged Plume Values:				Table Below				z _{full})), or linear increase with	height
	ed Plume Radius am	73.508 3.542	meters	241.2				here Total Merging Occurs	
	d Plume Velocity Vm	180.913		593.5	ft/sec			here Total Merging Occurs ere Total Merging Occurs (sl	our abour)
	al Source Height z _{full} d Vertical Velocity V			Tables Below	leel			eights above total merging el	
1 Covide	a ventear velocity v			Labico Bolon				z-z _{touch})/(z _{full} -z _{touch})	Svelion
Aultiple Plume Calculation	ons					v - v touch ' (• m ⁻ • touch) (for heights below total merg	ng elevation
Solve for plume-ave		ity at height	540.0	feet	164.592	meters abo	ve around (
	Height above Stack z	140.208		460.0				MERGING PHASE-INTERPO	DLATE
Plu	me Top-Hat Radius a	#N/A	meters	#N/A	feet	a=a _m +0.16			
	Vertical Velocity V	3.943	m/s	12.94	ft/sec	V={n(V3a)ft			
								z'-ztouch)/(zfull-ztouch) if ztouch	<z<z<sub>full</z<z<sub>
						• •		s if z <z<sub>touch</z<sub>	
Solve for Height of CA				m/s		BEFORE T			VV < Top of
	ight above Stack z _{crit}		meters		feet			/(V _{crit}) ³]-a _m }/0.16 if V _{crit} <v<sub>m</v<sub>	
Height	above Ground z _{crit} +hs	JEI	meters	JET	feet	∠crit=∠touch*	tull=∠touch)	*(Vcrit=Vtouch)/(Vm=Vtouch) if Vc	rit V m
able of MERGED Plume	Averaged Vertice	/elocities etc	rting at To-	uchina Heiaht		Single Plu	ne Eans (s	ee Single Plume spreadshee	+)
	Height (feet)	(meters)				-		v)2-(6.25D-zv)2]}1/3 / a	.)
	above ground					a = 0.16(z-			
Begin Merg	ging (touch) = 166.0	26.21	4.125			,	.,	_{xit} D ² /(4V _{plume} *a ² *λ ²)))	
	180.0	30.48				Interpolate			20 ft Interval
	200.0	36.58						z'-z _{touch})/(z _{full} -z _{touch})	
	220.0	42.67							
	240.0	48.77							
	260.0	54.86							
	280.0	60.96							-
	300.0	67.06							50 ft Interva
	350.0	82.30							
	400.0 450.0	97.54 112.78							
	450.0	112.78							
	550.0	128.02							
	600.0	143.20							
	650.0	173.74							
End Mergi	ng (full/mp) = 673.5	180.90							
	700.0	188.98							100 ft Interv
	800.0	219.46	79.675	3.16					
	900.0	249.94							
	1000.0	280.42							
	1100.0	310.90							
	1200.0	341.38				Merged Plu			
	1200.0	341.38				V={n(V ³ a) _{ft}			
	1300.0	371.86				a=a _m +0.16	(z-z _{full})		
	1500.0	432.82							
	2000.0	585.22							500 0 1-4-
	2500.0	737.62							500 ft Interv
	3000.0	890.02							
	3500.0	10/12 /12							
	3500.0 4000.0	1042.42							
	3500.0 4000.0 4500.0	1042.42 1194.82 1347.22	235.732	2.40					



Based on 42 chillers w/ 18 cells/chiller. Calc'	al Velocities							
ased on 42 chillers w/ 18 cells/chiller. Calc		-	-			litions at V	arious Heights in the Plume	9
257,143 ACFM total for each chiller).			-	-			Australia," Dr. K.T. Spilla	
Ambient Conditions:					-		eutral conditions (dθ/dz=0 or	
Ambient Potential Temp θ _a	302.21	Kelvins	84.3				meters/feet	u 0,
Plume Exit Conditions:					Gravity g		m/s ²	
Stack Height h	24.38	meters	80	feet-inches	λ	1.11	11/3	
Individual Chiller Stack Diameter D	-	meters		inches		~1.0		
					λ.			
Stack Velocity V _{exit}	11.51			ft/sec	4Vol/(60πD	~)		
Individual Chiller Volumetric Flow		cu.m/sec	257,143		πV _{exit} D ² /4			Sect.2/¶1
Stack Potential Temp θ _s		Kelvins	104.3	°F				
Initial Stack Buoyancy Flux Fo	13.4335		20.0	ΔT(°F)			ol.Flow(g/π)(1-θ _a /θ _s)	Sect.2/¶1
Plume Buoyancy Flux F	N/A	m ⁴ /s ³			λ²gVa²(1-θ _a	/θ _p) for a,V	θ_p at plume height (see belo	w)
Number of Chillers n	42			2.546	Multiple Sta	ack Multiplie	cation Factor (n ^{0.25})	
conditions at End (Top) of Jet Phase:								
Height above Stack z _{jet}	22.900	meters*	75.1	feet*	z _{iet} = 6.25D	, meters*=	meters above stack top	Sect.3/¶1
Height above Ground ziet+hs	47.284	meters	155.1					
Vertical Velocity Viet	5.755			ft/sec	V _{jet} = 0.5V _e	wit = Vowit/2		
Plume Top-Hat Diameter 2a _{let}		meters	24.0		2a _{iet} = 2D	xii • exil/ =	Conservation of momentum	
	7.520	meters	24.0	ICCL	zajet = 20		Conservation of momentum	
pillane Methodology - Analytical Solutions								
Single Plume-averaged Vertical Velocity				er where P				a
Plume Top-Hat Radius a		olutions in T					rease with height	Sect.2/Eq.6
Virtual Source Height z _v		meters*		feet*	6.25D[1-(θ _e	/θ _s) ^{1/2}], mete	ers*=meters above stack top	Sect.2/Eq.6
Height above Ground zv+hs		meters	81.3	feet			where $\left(\theta_{a}/\theta_{s}\right)^{1/2}$ = $\left(\theta_{e}/\theta_{s}\right)^{1/2}$ =	0.9821
Vertical Velocity V	S	olutions in 1	able Below		{(Va) _o ³ + 0.	12F _o [(z-z _v) ² - (6.25D-z _v) ²]} ^(1/3) / a	Sect.2.1(6)
Product (Va)₀	20.709	m²/s			V _{exit} D/2(0 _e /6			. ,
Single Chiller Results:					un .=(-8/	-/		
Solve for plume-averaged vertical velo	city at height	540.0	feet	164 500	meters abo	ue around /-	z'+h)	
			460.0		meters abo	vo ground (a	- · ··s/	
Gives the following Height above Stack z	140.208				0-1-0+0 4-1	-1 - 1		Cast O/F - O
Plume Top-Hat Diameter 2a		meters	146.8		2a'=2*0.16(2 (0 055 22)(1/3)	Sect.2/Eq.6
Vertical Velocity V	1.523	m/s	5.00	ft/sec	v={(Va) _o 3+0	J. 12F _o [(z-z _v	/) ² -(6.25D-z _v) ²]} ^(1/3) /(2a'/2)	Sect.2/Eq.6
Solve for Height of CASC critical vertical	velocity V _{crit}	5.30	m/s plume-a	veraged v	ertical velo	city	Critical VV > Top	of Jet (Spillan
Find Height above Stack z _{crit}	24.974	meters	81.9	feet	Solve for x=	(z-z _v) simu	Itaneously in both eqs. (i.e.,	Va and a)
Height above Ground zcrit+hs	49.358	meters	161.9	feet	for V=V _{crit} u	ising the cu	ibic equation ax ³ +bx ² +cx+d=	0, where
						a=1. c=0. a	and b=-(0.12F _o)/(V _{crit} ³ 0.16 ³)=	-2.643
Interpolated Height of critical vertical v	elocity in Jet	Phase:					25D-z _v) ² -(Va) _o ³]/(V _{crit} ³ 0.16 ³)=	-13227.
Find Height above Stack z _{crit}	-	meters	#N/A	faat	and a	[0.1210(0.1		28.org/cubic.ht
-			#19/7	leel				20.019/00010.11
			#NI/ A	fact		aine		24 56
Height above Ground z _{crit} +h _s	#N/A	meters	#N/A	feet		give	s the real solution x = z-zv =	
Height above Ground z _{crit} +hs	#N/A	meters	#N/A	feet		give	or z(m/above stack) =	24.9
								24.56 24.9 161
Height above Ground z _{ort} +h _s Table of Plume Top-Hat Diameters (2a) and F					nd of jet pha		or z(m/above stack) =	24.9
			Velocities st		nd of jet pha		or z(m/above stack) =	24.9
able of Plume Top-Hat Diameters (2a) and f Height (feet)	Plume-Averag (meters)	ed Vertical Plume	Velocities sta SingleStk	arting at en Plume	nd of jet pha		or z(m/above stack) =	24.9
able of Plume Top-Hat Diameters (2a) and f	Plume-Averag (meters)	ed Vertical Plume	Velocities st	arting at en Plume	nd of jet pha		or z(m/above stack) =	24.9
able of Plume Top-Hat Diameters (2a) and F Height (feet) above ground Stack.Rel.Ht = 80.0	Plume-Averag (meters) above stack 0.00	ed Vertical Plume Radius(m) 1.832	Velocities sta SingleStk VertVel(m/s) 11.51	arting at er Plume Temp(K)	nd of jet pha	ase:	or z(m/above stack) = z(ft/above ground) =	24.9 161
able of Plume Top-Hat Diameters (2a) and I Height (feet) above ground <i>Stack.Rel.Ht</i> = 80.0 100.0	Plume-Averag (meters) above stack <mark>0.00</mark> 6.10	ed Vertical Plume Radius(m) 1.832 2.198	Velocities sta SingleStk VertVel(m/s) 11.51 10.36	arting at er Plume Temp(K)	nd of jet pha	150:	or z(m/above stack) = z(ft/above ground) = Jet Phase Eqs:	24.9 16 20 ft Interval
able of Plume Top-Hat Diameters (2a) and I Height (feet) above ground <i>Stack.Rel.Ht = 80.0</i> 100.0 120.0	Plume-Averag (meters) above stack 0.00 6.10 12.19	ed Vertical Plume Radius(m) 1.832 2.198 2.565	Velocities sta SingleStk VertVel(m/s) 11.51 10.36 9.21	arting at er Plume Temp(K)	nd of jet pha	150:	or z(m/above stack) = z(ft/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R	24.9 16 [.] 20 ft Interval
able of Plume Top-Hat Diameters (2a) and I Height (feet) above ground Stack.Rel.Ht = 80.0 100.0 120.0 140.0	Plume-Averag (meters) above stack 0.00 6.10 12.19 18.29	ed Vertical Plume Radius(m) 1.832 2.198 2.565 2.931	Velocities sta SingleStk VertVel(m/s) 11.51 10.36 9.21 8.06	arting at er Plume Temp(K)	nd of jet pha	150:	or z(m/above stack) = z(ft/above ground) = Jet Phase Eqs:	24.9 16 [.] 20 ft Interval
able of Plume Top-Hat Diameters (2a) and F Height (feet) above ground Stack.Rel.Ht = 80.0 100.0 120.0 Top of Single jet = 155.1	Plume-Averag (meters) above stack 0.00 6.10 12.19 18.29 22.90	ed Vertical Plume Radius(m) 1.832 2.198 2.565 2.931 3.208	Velocities sta SingleSta VertVel(m/s) 11.51 10.36 9.21 8.06 7.19	arting at er Plume Temp(K)	nd of jet pha	150:	or z(m/above stack) = z(t/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations:	24.9 16 ⁻ 20 ft Interval el.Ht to Top of Jet
able of Plume Top-Hat Diameters (2a) and H Height (feet) above ground <i>Stack.Rel.Ht = 80.0</i> 100.0 120.0 140.0 Top of Single jet = 155.1 160.0	Plume-Averag (meters) above stack 0.00 6.10 12.19 18.29 22.90 24.38	ed Vertical Plume Radius(m) 1.832 2.198 2.565 2.931 3.208 3.298	Velocities st SingleStk VertVel(m/s) 11.51 10.36 9.21 8.06 7.19 6.91	arting at en Plume Temp(K) 306.75		150:	or z(m/above stack) = z(ft/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: V _{pluma} ={(Va), ³ +0.12F _a](z-z,) ² -(6.2	24.5 16 20 ft Interval el.Ht to Top of Jel
able of Plume Top-Hat Diameters (2a) and F Height (feet) above ground Stack.Rel.Ht = 80.0 100.0 120.0 Top of Single jet = 155.1	Plume-Averag (meters) above stack 0.00 6.10 12.19 18.29 22.90	ed Vertical Plume Radius(m) 1.832 2.198 2.565 2.931 3.208	Velocities sta SingleSta VertVel(m/s) 11.51 10.36 9.21 8.06 7.19	arting at er Plume Temp(K)		350:	or z(m/above stack) = z(ft/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: V_num={(Va), ³ +0.12F_0[(z-z.,) ² -(6.2 a = 0.16[z-z.v)	24.9 16 20 ft Interval eLHt to Top of Jet 5D-z _v) ²]) ¹³ / a
able of Plume Top-Hat Diameters (2a) and H Height (feet) above ground <i>Stack.Rel.Ht = 80.0</i> 100.0 120.0 140.0 Top of Single jet = 155.1 160.0	Plume-Averag (meters) above stack 0.00 6.10 12.19 18.29 22.90 24.38	ed Vertical Plume Radius(m) 1.832 2.198 2.565 2.931 3.208 3.298	Velocities st SingleStk VertVel(m/s) 11.51 10.36 9.21 8.06 7.19 6.91	arting at en Plume Temp(K) 306.75		350:	or z(m/above stack) = z(ft/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: V _{pluma} ={(Va), ³ +0.12F _a](z-z,) ² -(6.2	24.5 16 20 ft interval el.Ht to Top of Jet 5D-z _v) ²]) ¹⁰ / a
able of Plume Top-Hat Diameters (2a) and I Height (feet) above ground <i>Stack.Rel.Ht</i> = 80.0 100.0 120.0 140.0 Top of Single jet = 155.1 160.0 180.0	Plume-Averag (meters) above stack 0.00 6.10 12.19 18.29 22.90 24.38 30.48	ed Vertical Plume Radius(m) 2.198 2.565 2.931 3.208 3.298 3.664	Velocities st SingleStk VertVel(m/s) 11.51 10.36 9.21 8.06 7.19 6.91 5.76	arting at er Plume Temp(K) 306.75 306.68 306.56		15e :	or z(m/above stack) = z(ft/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: V_num={(Va), ³ +0.12F_0[(z-z.,) ² -(6.2 a = 0.16[z-z.v)	24.5 16 20 ft interval el.Ht to Top of Jet 5D-z _v) ²]) ¹⁰ / a
able of Plume Top-Hat Diameters (2a) and H Height (feet) above ground Stack.Rel.Ht = 80.0 100.0 120.0 Top of Single jet = 155.1 160.0 180.0 200.0 220.0	Plume-Averag (meters) above stack 0.00 6.10 12.19 18.29 22.90 24.38 30.48 36.58 42.67	ed Vertical Plume Radius(m) 2.198 2.565 2.931 3.208 3.664 5.787 6.762	Velocities st. SingleStk VertVel(m/s) 11.51 10.36 9.21 8.06 7.19 6.91 5.76 3.74 3.28	arting at en Plume Temp(K) 306.75 306.68 306.56 304.89		356:	or z(m/above stack) = z(t/above ground) = Z(t	24.5 16 20 ft interval el.Ht to Top of Jet 5D-z _v) ²]) ¹⁰ / a
able of Plume Top-Hat Diameters (2a) and I Height (feet) above ground Stack. Rel. Ht = 80.0 100.0 120.0 Top of Single jet = 155.1 160.0 180.0 200.0 220.0 240.0	Plume-Averag (meters) above stack 0.00 6.10 12.19 18.29 22.90 24.38 36.58 42.67 48.77	ed Vertical Plume Radius(m) 1.832 2.198 2.2565 2.931 3.208 3.664 5.787 6.762 7.737	Velocities st. Single Stk VertVel(m/s) 11.51 10.33 9.21 8.06 7.19 6.91 6.91 6.91 6.93 7.49 6.374 3.28 2.95	arting at en Plume Temp(K) 306.75 306.68 306.66 304.89 304.45		356:	or z(m/above stack) = z(ft/above ground) = Z(ft/ab	24.5 16 20 ft interval el.Ht to Top of Jet 5D-z _v) ²]) ¹⁰ / a
able of Plume Top-Hat Diameters (2a) and H Height (feet) above ground Stack. Rel. Ht = 80.0 100.0 120.0 140.0 Top of Single jet = 155.1 160.0 200.0 220.0 220.0 220.0 220.0	Plume-Averag (meters) above stack 0.00 6.10 12.19 12.29 22.90 22.90 30.48 30.48 30.48 42.67 48.77 54.86	ed Vertical Plume Radius(m) 2.565 2.931 3.208 3.664 5.787 6.762 7.737 8.713	Velocities st SingleStk VertVel(m(s)) 9.21 8.06 7.19 6.91 5.76 3.74 3.28 2.259 2.69	arting at en Plume Temp(K) 306.75 306.68 306.68 306.89 304.45 304.45		350:	or z(m/above stack) = z(ft/above ground) = Z(ft/above ground) = Linearly interpolated from Stack R Spillane Equations: V_{plorm} =((Va), ² 40.12F ₂ (z-z,) ² (6.2 a = 0.16(z-z,v) θ_{p} = θ_{x} (1+(1-(θ_{x}) θ_{x}))*(V_{exc} D ² /c CEC Staff Equation: V_{exp} -m ^{2,2} V_{exp}	24.5 16 20 ft interval el.+t to Top of Jet 5D.z., ²)) ¹³ / a 4V _{plume} *a ² Å ²))
able of Plume Top-Hat Diameters (2a) and H Height (feet) above ground Stack. Rei. Ht = 80.0 100.0 140.0 Top of Single jet = 155.1 160.0 200.0 220.0 240.0 240.0 240.0 240.0 240.0 240.0	Plume-Averag (meters) above stack 0.00 6.10 12.19 18.29 22.90 22.90 24.38 30.44 36.58 42.67 48.77 54.86 60.96	ed Vertical Plume Radius(m) 1.832 2.198 2.565 2.931 3.208 3.664 5.787 6.762 7.737 8.713 9.688	Velocities st. SingleStk VertVel(m/s) 11.61 10.36 9.21 8.06 7.19 6.61 5.76 3.74 3.28 2.95 2.69 2.49	arting at er Plume Temp(K) 306.75 306.68 306.68 306.66 304.89 304.45 304.41 303.86		350:	or z(m/above stack) = z(t/above ground) = z(t/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: $V_{pharm} = (Va)_n^{-1} 0.12F_a (J2-z_a)^2 (-6.2a = 0.16(2-z_a))$ $\theta_p = \theta_n (1+(1-(\theta_0/\theta_0))^* (VacaD^2)(CCC Staff Equation:Vargen0.27VapBrigg's Equation:Vargen0.27Vap$	24.5 16 20 ft interval el.+t to Top of Jet 5D.z., ²)) ¹³ / a 4V _{plume} *a ² Å ²))
able of Plume Top-Hat Diameters (2a) and H Height (feet) above ground Stack.Rel.Ht = 80.0 100.0 120.0 Top of Single jet = 155.1 160.0 280.0 240.0 240.0 260.0 280.0 300.0	Plume-Averag (meters) above stack 0.00 6.10 12.19 22.90 24.38 36.65 42.67 48.77 54.86 60.96 67.06	ed Vertical Plume Radiuş(m) 1.832 2.565 2.931 3.208 3.664 5.787 6.762 7.737 8.713 9.688 10.663	Velocities st SingleStk VertVel(m/s) 11.51 10.36 7.19 6.91 5.76 3.74 3.28 2.95 2.69 2.49 2.32	arting at er Plume Temp(K) 306.75 306.68 306.68 306.68 304.45 304.45 304.41 303.86 303.65		350:	or z(m/above stack) = z(ft/above ground) = Z(ft/above ground) = Linearly interpolated from Stack R Spillane Equations: V_{plorm} =((Va), ² 40.12F ₂ (z-z,) ² (6.2 a = 0.16(z-z,v) θ_{p} = θ_{x} (1+(1-(θ_{x}) θ_{x}))*(V_{exc} D ² /(c CEC Staff Equation: V_{exp} -m ^{2,2} V_{exp} Brigg's Equation:	24.5 16 20 ft interval el.+t to Top of Jet 5D.z., ²)) ¹³ / a 4V _{plume} *a ² Å ²))
able of Plume Top-Hat Diameters (2a) and H Height (feet) above ground Stack. Rel. Ht = 80.0 100.0 140.0 Top of Single jet = 155.1 160.0 280.0 240.0 280.0 280.0 300.0 300.0 320.0	Plume-Averag (meters) above stack 0.00 6.10 12.19 18.22 22.90 22.30 24.38 36.48 36.58 42.67 48.77 54.66 6.0.96 67.06 73.15	ed Vertical Plume Radius(m) 1.832 2.198 2.2565 2.931 3.208 3.208 3.208 3.664 5.762 7.737 8.713 9.688 10.663 11.639	Velocities str SingleStk VertVel(m/s) 11.51 10.36 9.21 8.60 7.19 6.91 5.76 3.74 3.28 2.95 2.69 2.49 2.49 2.23 2.49 2.23 2.49	arting at er Plume Temp(K) 306.75 306.68 306.68 304.65 304.45 304.45 304.41 303.86 303.86 303.86		350:	or z(m/above stack) = z(t/above ground) = z(t/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: $V_{pharm} = (Va)_n^{-1} 0.12F_a (J2-z_a)^2 (-6.2a = 0.16(2-z_a))$ $\theta_p = \theta_n (1+(1-(\theta_0/\theta_0))^* (VacaD^2)(CCC Staff Equation:Vargen0.27VapBrigg's Equation:Vargen0.27Vap$	24.5 16 20 ft interval el.+t to Top of Jet 5D.z., ²)) ¹³ / a 4V _{plume} *a ² Å ²))
able of Plume Top-Hat Diameters (2a) and I Height (feet) above ground Stack. Rel. Ht = 80.0 100.0 120.0 Top of Single jet = 155.1 160.0 220.0 20	Plume-Averag (meters) above stack 0.00 6.10 12.19 18.29 22.90 24.38 30.48 30.53 30.48 30.53 30.5	ed Vertical Plume Radius(m) 1.832 2.198 2.565 2.931 3.208 3.664 5.787 6.762 7.737 8.713 9.668 10.663 11.663 11.639 13.102	Velocities st SingleStk VertVel(m/s) 9.21 8.066 7.19 6.91 5.76 3.74 3.22 2.95 2.69 2.49 2.32 2.49 2.32 2.19 2.03	arting at er Plume Temp(K) 306.75 306.68 304.89 304.45 304.41 303.86 303.86 303.65 303.48		350:	or z(m/above stack) = z(t/above ground) = z(t/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: $V_{pharm} = (Va)_n^{-1} 0.12F_a (J2-z_a)^2 (-6.2a = 0.16(2-z_a))$ $\theta_p = \theta_n (1+(1-(\theta_0/\theta_0))^* (VacaD^2)(CCC Staff Equation:Vargen0.27VapBrigg's Equation:Vargen0.27Vap$	24.5 16 20 ft Interval ei.ht to Top of Jet 5D-z _e) ²) ^{1/2} / a 4V _{plume} *a ²⁺ λ ²))
able of Plume Top-Hat Diameters (2a) and H Height (feet) above ground Stack. Rel. Ht = 80.0 100.0 140.0 Top of Single jet = 155.1 160.0 280.0 240.0 280.0 280.0 300.0 300.0 320.0	Plume-Averag (meters) above stack 0.00 6.10 12.19 18.22 22.90 22.30 24.38 36.58 42.67 48.77 54.86 60.96 67.06 73.15	ed Vertical Plume Radius(m) 1.832 2.198 2.565 2.931 3.208 3.664 5.787 6.762 7.737 8.713 9.668 10.663 11.663 11.639 13.102	Velocities str SingleStk VertVel(m/s) 11.51 10.36 9.21 8.60 7.19 6.91 5.76 3.74 3.28 2.95 2.69 2.49 2.49 2.23 2.49 2.23 2.49	arting at er Plume Temp(K) 306.75 306.68 304.89 304.45 304.41 303.86 303.86 303.65 303.48		350:	or z(m/above stack) = z(t/above ground) = z(t/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: $V_{pharm} = (Va)_n^{-1} 0.12F_a (J2-z_a)^2 (-6.2a = 0.16(2-z_a))$ $\theta_p = \theta_n (1+(1-(\theta_0/\theta_0))^* (VacaD^2)(CCC Staff Equation:Vargen0.27VapBrigg's Equation:Vargen0.27Vap$	24.5 16 20 ft Interval ei.ht to Top of Jet 5D-z _e) ²) ^{1/2} / a 4V _{plume} *a ²⁺ λ ²))
able of Plume Top-Hat Diameters (2a) and I Height (feet) above ground Stack. Rel. Ht = 80.0 100.0 120.0 Top of Single jet = 155.1 160.0 220.0 20	Plume-Averag (meters) above stack 0.00 6.10 12.19 18.29 22.90 24.38 30.48 30.53 30.48 30.53 30.5	ed Vertical Plume Radius(m) 1.832 2.565 2.931 3.208 3.664 5.787 6.762 7.737 8.713 9.688 10.663 11.639 13.102 15.540	Velocities st SingleStk VertVel(m/s) 9.21 8.066 7.19 6.91 5.76 3.74 3.22 2.95 2.69 2.49 2.32 2.49 2.32 2.19 2.03	arting at er Plume Temp(K) 306.75 306.68 304.89 304.45 304.41 303.86 303.86 303.65 303.48		350:	or z(m/above stack) = z(t/above ground) = z(t/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: $V_{pharm} = (Va)_n^{-1} 0.12F_a (J2-z_a)^2 (-6.2a = 0.16(2-z_a))$ $\theta_p = \theta_n (1+(1-(\theta_0/\theta_0))^* (VacaD^2)(CCC Staff Equation:Vargen0.27VapBrigg's Equation:Vargen0.27Vap$	24.5 16 20 ft interval al-R to Top of Jet 5D.z., ²) ^{1/2} / a 4V _{plume} *a ²⁺ λ ²)) ^(A2) χ.z ^(A2) 50 ft interval
Table of Plume Top-Hat Diameters (2a) and Height (feet) above ground Stack. Rel. Ht = 80.0 100.0 120.0 140.0 Top of Single jet = 155.1 160.0 220.0 220.0 220.0 240.0 280.0 300.0 300.0 300.0 300.0 320.0 320.0 350.0 400.0	Plume-Averag (meters) above stack 0.00 6.10 12.19 18.29 22.90 22.90 22.90 22.90 22.90 22.90 22.90 22.90 22.90 22.90 22.90 20.95 4.87 54.86 60.96 67.06 73.15 82.30 97.54	ed Vertical Plume Radiuş(m) 1.832 2.566 2.931 3.208 3.664 5.787 6.762 7.737 8.713 9.688 10.663 11.639 13.102 15.540 17.979	Velocities st SingleStk VertVel(m/s) 11.51 0.36 0.221 8.06 7.19 6.91 5.767 2.60 2.49 2.49 2.49 2.49 2.49 2.49 2.49 2.49	arting at err Plume Temp(K) 306.75 306.68 306.56 304.89 304.45 304.41 303.86 303.65 303.48 303.48 303.44 303.17		350:	or z(m/above stack) = z(t/above ground) = z(t/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: $V_{plant} = [(Va)_a^{-1} 0.12F_a](z-z_i)^2 (-6.2 a)$ $a = 0.16(z-z_i)$ $\theta_p = \theta_n(1+(1-(\theta_i)\theta_n))^* (Vacid)^2 (-CEC Staff Equation:V_{ab}qn^{-25}V_{ab}Brigg's Equation:V_{ab}qn^{-25}V_{ab}Brigg's Equation:V_{ab}qn^{-25} \times F_{ab}$	24.5 16 20 ft interval al-R to Top of Jet 5D.z., ²) ^{1/2} / a 4V _{plume} *a ²⁺ λ ²)) ^(A2) χ.z ^(A2) 50 ft interval
able of Plume Top-Hat Diameters (2a) and H Height (feet) above ground Stack. Rel. Ht = 80.0 100.0 120.0 Top of Single jet = 155.1 160.0 280.0 220.0 240.0 280.0 300.0 300.0 300.0 350.0 400.0 400.0 350.0 450.0 450.0	Plume-Averag (meters) above stack 0.00 6.10 12.19 18.29 22.90 22.30 4.38 36.68 42.67 48.77 54.86 60.96 67.06 73.15 82.30 97.54 112.78 21.20 21.2	ed Vertical Plume Radius(m) 1.832 2.198 2.565 2.931 3.208 3.208 3.208 3.664 5.787 6.762 7.737 8.713 9.688 10.663 11.639 13.102 13.102 15.540 17.979 20.417	Velocities str SingleStk VertVel(m/s) 11.51 10.36 9.21 8.60 7.19 6.91 5.76 3.747 3.28 2.49 2.49 2.49 2.49 2.49 2.49 2.49 2.49	306.75 306.68 306.68 304.89 304.45 303.65 303.86 303.86 303.48 303.43 303.43 303.43 303.24 303.24 303.24 302.82		350:	or z(m/above stack) = z(t/above ground) = z(t/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: $V_{plant} = [(Va)_a^{-1} 0.12F_a](z-z_i)^2 (-6.2 a)$ $a = 0.16(z-z_i)$ $\theta_p = \theta_n(1+(1-(\theta_i)\theta_n))^* (Vacid)^2 (-CEC Staff Equation:V_{ab}qn^{-25}V_{ab}Brigg's Equation:V_{ab}qn^{-25}V_{ab}Brigg's Equation:V_{ab}qn^{-25} \times F_{ab}$	24.5 16 20 ft Interval el.Ht to Top of Je 5D.z., ²] ^{1/3} / a 4V _{plume} *a ² *λ ²)) ^(A2) χ.z ^(1/2) 50 ft Interval
able of Plume Top-Hat Diameters (2a) and I Height (feet) above ground Stack. Rel. Ht = 80.0 100.0 120.0 Top of Single jet = 155.1 160.0 180.0 220.0 240.0 220.0 240.0 280.0 300.0 300.0 300.0 300.0 350.0 400.0 450.0 550.0	Plume-Averag (meters) above stack 0.00 6.10 12.19 18.29 22.90 22.30 42.67 48.77 54.86 67.06 67.06 67.03 73.15 82.30 97.54 112.78 112.78 112.78 112.78 112.78 112.78 112.80 112.78 112.80 112.80 112.80 112.80 112.90 12.90 12.90 1	ed Vertical Plume Radius(m) 1.832 2.198 2.255 2.931 3.208 3.298 3.664 5.787 6.762 7.737 8.713 9.688 10.663 11.639 13.102 15.540 11.540 11.540 2.4.77.979 2.0.417 2.2.855	Velocities str SingleStk VertVel(m/s) 9.21 8.000 7.19 6.91 5.76 3.74 3.22 2.95 2.60 2.49 2.23 2.19 2.03 1.84 1.70 1.55	arting at er Plume Temp(K) 306.75 306.68 306.68 306.68 304.85 304.45 304.45 304.41 303.86 303.86 303.48 303.34 303.31 7 302.82 302.72		350:	or z(m/above stack) = z(t/above ground) = z(t/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: $V_{plant} = [(Va)_a^{-1} 0.12F_a](z-z_i)^2 (-6.2 a)$ $a = 0.16(z-z_i)$ $\theta_p = \theta_n(1+(1-(\theta_i)\theta_n))^* (Vacid)^2 (-CEC Staff Equation:V_{ab}qn^{-25}V_{ab}Brigg's Equation:V_{ab}qn^{-25}V_{ab}Brigg's Equation:V_{ab}qn^{-25} \times F_{ab}$	24.5 16 20 ft Interval el.Ht to Top of Je 5D.z., ²] ^{1/3} / a 4V _{plume} *a ² *λ ²)) ^(A2) χ.z ^(1/2) 50 ft Interval
Table of Plume Top-Hat Diameters (2a) and Height (feet) above ground Stack. Rei. Ht = 80.0 100.0 140.0 Top of Single jet = 155.1 160.0 200.0 Top of Single jet = 200.0 220.0 200.0	Plume-Averag (meters) above stack 0.00 6.10 12.19 18.29 22.90 20.90 20.9	ed Vertical Plume Radius(m) 1.832 2.565 2.931 3.206 3.664 5.787 6.762 7.737 8.713 9.688 10.663 11.639 13.102 15.540 17.979 22.855 25.294	Velocities st SingleStk VertVel(m/s) 9.21 8.06 7.19 6.91 5.767 2.60 2.49 2.49 2.49 2.49 2.49 2.49 2.49 2.49	306.75 306.68 306.68 306.68 304.45 304.41 303.86 303.48 303.48 303.44 303.17 302.97 302.82 302.72 302.64		350:	or z(m/above stack) = z(t/above ground) = z(t/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: $V_{plant} = [(Va)_a^{-1} 0.12F_a](z-z_i)^2 (-6.2 a)$ $a = 0.16(z-z_i)$ $\theta_p = \theta_n(1+(1-(\theta_i)\theta_n))^* (Vacid)^2 (-CEC Staff Equation:V_{ab}qn^{-25}V_{ab}Brigg's Equation:V_{ab}qn^{-25}V_{ab}Brigg's Equation:V_{ab}qn^{-25} \times F_{ab}$	24.5 16 20 ft Interval el.Ht to Top of Je 5D.z., ²] ^{1/3} / a 4V _{plume} *a ² *λ ²)) ^(A2) χ.z ^(1/2) 50 ft Interval
able of Plume Top-Hat Diameters (2a) and H Height (feet) above ground Stack.Rel.Ht = 80.0 100.0 120.0 140.0 Top of Single jet = 155.1 160.0 220.0 240.0 220.0 240.0 280.0 300.0 320.0 350.0 450.0 550.0	Plume-Averag (meters) above stack 0.00 6.10 12.19 18.29 22.90 22.90 24.38 36.55 42.67 48.77 54.86 60.96 67.06 73.15 82.30 97.54 81.28.02 112.78 128.02 113.27 15.85 15.95 15.85 15.85 15.85 15.85 15.85 15.85 15.85 15.85 15.85 15.85 15.85 15.85 15.85 15.85 15.85 15.85 15.9	ed Vertical Plume Radius(m) 1.832 2.566 2.931 3.208 3.664 5.787 6.762 7.737 8.713 9.688 10.663 11.639 13.102 15.540 17.979 20.417 22.855 25.224	Velocities st: SingleStk VertVel(m/s) 11.51 8.66 7.19 6.91 5.76 2.69 2.49 2.32 2.95 2.49 2.32 2.95 2.49 1.61 1.51 1.51 1.44 1.38	306.75 306.68 306.68 304.45 304.45 303.65 303.65 303.48 303.65 303.48 303.42 303.27 302.82 302.72 302.64 302.57		350:	or z(m/above stack) = z(t/above ground) = z(t/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: $V_{plant} = [(Va)_n^{-1} 0.12F_3](z-z_1)^2 (-6.2 a)$ $a = 0.16(z-z_2)$ $\theta_p = \theta_n(1+(1-(\theta_0/\theta_n))^*(Vacc)^2/(CEC Staff Equation:V_{ab}qn^{-25}V_{ab}Brigg's Equation:V_{ab}qn^{-25}V_{ab}Brigg's Equation:V_{ab}qn^{-25} \times F_{ab}$	24.5 16 20 ft Interval el.Ht to Top of Je 5D.z., ²] ^{1/3} / a 4V _{plume} *a ² *λ ²)) ^(A2) χ.z ^(1/2) 50 ft Interval
able of Plume Top-Hat Diameters (2a) and H Height (feet) above ground Stack. Rel. Ht = 80.0 100.0 120.0 Top of Single jet = 155.1 160.0 280.0 280.0 280.0 280.0 280.0 280.0 300.0 350.0 350.0 400.0 400.0 550.0 650.0 650.0 650.0 650.0	Plume-Averag (meters) above stack 0.00 6.10 12.19 18.29 22.90 24.38 36.68 42.67 48.77 54.86 60.95 67.06 67.315 82.30 97.54 112.78 128.02 143.26 115.850 173.74 18.898	ed Vertical Plume Radius(m) 1.832 2.198 2.565 2.931 3.208 3.208 3.208 3.664 5.787 6.762 7.737 8.713 9.688 10.663 11.639 13.102 15.540 17.979 20.417 22.855 25.294 27.732 30.171	Velocities st SingleStk VertVel(m/s) 11.51 10.36 9.21 8.66 7.19 6.91 5.76 3.747 3.28 2.95 2.69 2.49 2.32 2.19 2.03 1.84 1.70 1.59 1.51 1.51 1.44 1.38 1.34	306.75 306.65 306.68 304.89 304.45 303.65 303.48 303.65 303.48 303.65 303.48 303.27 302.82 302.72 302.82 302.72 302.53		350:	or z(m/above stack) = z(t/above ground) = z(t/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: $V_{plant} = [(Va)_n^{-1} 0.12F_3](z-z_1)^2 (-6.2 a)$ $a = 0.16(z-z_2)$ $\theta_p = \theta_n(1+(1-(\theta_0/\theta_n))^*(Vacc)^2/(CEC Staff Equation:V_{ab}qn^{-25}V_{ab}Brigg's Equation:V_{ab}qn^{-25}V_{ab}Brigg's Equation:V_{ab}qn^{-25} \times F_{ab}$	24.5 16 20 ft Interval el.Ht to Top of Je 5D.z., ²] ^{1/3} / a 4V _{plume} *a ² *λ ²)) ^(A2) χ.z ^(1/2) 50 ft Interval
able of Plume Top-Hat Diameters (2a) and I Height (feet) above ground Stack. Rel. Ht = 80.0 100.0 120.0 Top of Single jet = 155.1 160.0 280.0 220.0 240.0 280.0 30	Plume-Averag (meters) above stack 0.00 6.10 12.19 18.22 22.90 22.30 42.67 48.77 54.86 67.06 67.06 67.05 73.15 82.30 97.54 112.78 41.12.78 41.26 67.06 67.05 11.28 42.90 97.54 112.80 12.80	ed Vertical Plume Radius(m) 1.832 2.198 2.565 2.931 3.208 3.208 3.664 5.767 6.762 7.737 8.713 9.688 10.663 11.639 13.102 15.540 17.979 20.417 22.855 25.294 27.732 30.171 35.047	Velocities str SingleStk VertVel(m/s) 11.51 10.36 9.21 8.60 7.19 6.91 5.76 3.74 3.22 2.69 2.49 2.23 2.49 2.23 2.19 2.03 1.84 1.770 1.59 1.51 1.44 1.78 1.44 1.38 1.34	arting at er Plume Temp(K) 306.75 306.68 306.68 304.85 304.45 304.45 303.65 303.48 303.65 303.48 303.34 303.22 302.72 302.64 302.57 302.63 302.49		350:	or z(m/above stack) = z(t/above ground) = z(t/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: $V_{plant} = [(Va)_n^{-1} 0.12F_3](z-z_1)^2 (-6.2 a)$ $a = 0.16(z-z_2)$ $\theta_p = \theta_n(1+(1-(\theta_0/\theta_n))^*(Vacc)^2/(CEC Staff Equation:V_{ab}qn^{-25}V_{ab}Brigg's Equation:V_{ab}qn^{-25}V_{ab}Brigg's Equation:V_{ab}qn^{-25} \times F_{ab}$	24.5 16 20 ft Interval el.H to Top of Je 5D z.,1 ²) ^{1/2} / a 4V _{plume} *a ² *A ²)) 50 ft Interval
able of Plume Top-Hat Diameters (2a) and Height (feet) above ground Stack. Rei. Ht = 80.0 100.0 140.0 Top of Single jet = 155.1 160.0 200.0 220.0 240.0 220.0 240.0 280.0 300.	Plume-Averag (meters) above stack 0.00 6.10 12.19 18.29 22.90 22.9	ed Vertical Plume Radius(m) 1.832 2.565 2.931 3.208 3.664 5.787 6.762 7.737 8.713 9.688 10.663 11.639 13.102 15.540 17.979 22.855 25.294 27.732 30.171 35.047 39.924	Velocities st SingleStk VertVel(m/s) 11.51 10.36 9.21 8.06 7.19 6.91 5.767 2.69 2.49 2.32 2.49 2.32 2.49 2.32 2.49 2.32 2.49 2.32 1.84 1.77 1.59 1.51 1.44 1.38 1.34 1.26 1.34 1.26 1.34 1.26 1.34 1.26 1.34 1.26 1.34 1.26 1.34 1.26 1.34 1.26	306.75 306.68 306.68 306.68 306.68 304.45 304.41 303.86 303.48 303.48 303.44 303.17 302.97 302.62 302.72 302.64 302.53 302.49 302.43		350:	or z(m/above stack) = z(t/above ground) = z(t/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: $V_{plant} = [(Va)_n^{-1} 0.12F_3](z-z_1)^2 (-6.2 a)$ $a = 0.16(z-z_2)$ $\theta_p = \theta_n(1+(1-(\theta_0/\theta_n))^*(Vacc)^2/(CEC Staff Equation:V_{ab}qn^{-25}V_{ab}Brigg's Equation:V_{ab}qn^{-25}V_{ab}Brigg's Equation:V_{ab}qn^{-25} \times F_{ab}$	24.5 16 20 ft Interval el.H to Top of Je 5D z.,1 ²) ^{1/2} / a 4V _{plume} *a ² *A ²)) 50 ft Interval
able of Plume Top-Hat Diameters (2a) and I Height (feet) above ground Stack. Rel. Ht = 80.0 100.0 120.0 Top of Single jet = 155.1 160.0 280.0 220.0 240.0 280.0 30	Plume-Averag (meters) above stack 0.00 6.10 12.19 18.22 22.90 22.30 42.67 48.77 54.86 67.06 67.06 67.05 73.15 82.30 97.54 112.78 41.12.78 41.26 67.06 67.05 11.28 42.90 97.54 112.80 12.80	ed Vertical Plume Radius(m) 1.832 2.565 2.931 3.208 3.664 5.787 6.762 7.737 8.713 9.688 10.663 11.639 13.102 15.540 17.979 22.855 25.294 27.732 30.171 35.047 39.924	Velocities str SingleStk VertVel(m/s) 11.51 10.36 9.21 8.60 7.19 6.91 5.76 3.74 3.22 2.69 2.49 2.23 2.49 2.23 2.19 2.03 1.84 1.770 1.59 1.51 1.44 1.78 1.44 1.38 1.34	306.75 306.68 306.68 306.68 306.68 304.45 304.41 303.86 303.48 303.48 303.44 303.17 302.97 302.62 302.72 302.64 302.53 302.49 302.43		350:	or z(m/above stack) = z(t/above ground) = z(t/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: $V_{plant} = [(Va)_n^{-1} 0.12F_3](z-z_1)^2 (-6.2 a)$ $a = 0.16(z-z_2)$ $\theta_p = \theta_n(1+(1-(\theta_0/\theta_n))^*(Vacc)^2/(CEC Staff Equation:V_{ab}qn^{-25}V_{ab}Brigg's Equation:V_{ab}qn^{-25}V_{ab}Brigg's Equation:V_{ab}qn^{-25} \times F_{ab}$	24.5 16 20 ft Interval el.H to Top of Je 5D z.,1 ²) ^{1/2} / a 4V _{plume} *a ² *A ²)) 50 ft Interval
able of Plume Top-Hat Diameters (2a) and Height (feet) above ground Stack. Rei. Ht = 80.0 100.0 140.0 Top of Single jet = 155.1 160.0 200.0 220.0 240.0 220.0 240.0 280.0 300.	Plume-Averag (meters) above stack 0.00 6.10 12.19 18.29 22.90 22.9	ed Vertical Plume Radius(m) 1.832 2.566 2.931 3.208 3.664 5.767 6.762 7.737 8.713 9.688 10.663 11.639 13.102 15.540 17.979 20.417 22.855 25.224 24,7732 30.171 35.047 39.924 44.801	Velocities st SingleStk VertVel(m/s) 11.51 10.36 9.21 8.06 7.19 6.91 5.767 2.69 2.49 2.32 2.49 2.32 2.49 2.32 2.49 2.32 2.49 2.32 1.84 1.77 1.59 1.51 1.44 1.38 1.34 1.26 1.34 1.26 1.34 1.26 1.34 1.26 1.34 1.26 1.34 1.26 1.34 1.26 1.34 1.26	306.75 306.68 306.68 304.45 304.45 303.66 303.65 303.48 303.65 303.48 303.47 302.97 302.82 302.72 302.64 302.57 302.53 302.49 302.49 302.49 302.49		350:	or z(m/above stack) = z(t/above ground) = z(t/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: $V_{plant} = [(Va)_n^{-1} 0.12F_3](z-z_1)^2 (-6.2 a)$ $a = 0.16(z-z_2)$ $\theta_p = \theta_n(1+(1-(\theta_0/\theta_n))^*(Vacc)^2/(CEC Staff Equation:V_{ab}qn^{-25}V_{ab}Brigg's Equation:V_{ab}qn^{-25}V_{ab}Brigg's Equation:V_{ab}qn^{-25} \times F_{ab}$	24.5 16 20 ft Interval el.H to Top of Je 5D z.,1 ²) ^{1/2} / a 4V _{plume} *a ² *A ²)) 50 ft Interval
able of Plume Top-Hat Diameters (2a) and Height (feet) above ground Stack.Rel.Ht = 80.0 100.0 120.0 140.0 Top of Single jet = 155.1 160.0 220.0 240.0 220.0 240.0 280.0 300.0 320.0 350.0 450.0 600.0 650.0 600.0 650.0 600.0 650.0 600.0 650.0 600.0 650.0 600.0 650.0 600.0 650.0 700.0 800.0	Plume-Averag (meters) above stack 0.00 6.10 12.19 22.90 22.90 24.38 36.55 42.67 48.77 54.86 60.96 67.06 67.06 73.15 82.30 97.54 82.30 97.54 112.78 128.02 113.74 128.02 113.74 128.02 113.74 128.02 113.74 128.02 113.74 128.02 113.74 128.02 113.74 128.02 113.74 128.02 113.74 128.02 129.02 12	ed Vertical Plume Radius(m) 1.832 2.565 2.931 3.208 3.298 3.664 5.787 6.762 7.737 8.713 9.688 10.663 11.639 13.102 15.540 17.979 20.417 22.855 25.294 27.732 30.171 35.047 39.924 44.801	Velocities st. SingleStk VertVel(m/s) 11.51 8.66 7.19 6.61 5.76 2.69 2.49 2.32 2.95 2.69 2.49 2.32 2.95 2.49 1.51 1.51 1.51 1.44 1.38 1.14 1.26 1.91 1.26 1.91 1.24 1.26 1.91 1.24 1.26 1.91 1.24 1.24 1.25 1.24 1.24 1.24 1.24 1.24 1.24 1.24 1.24	306.75 306.68 306.68 304.89 304.45 303.65 303.48 303.65 303.48 303.65 303.48 303.65 303.48 303.72 302.97 302.82 302.72 302.64 302.53 302.49 302.53 302.49 302.43 302.49 302.43 302.36		350:	or z(m/above stack) = z(t/above ground) = z(t/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: $V_{plant} = [(Va)_n^{-1} 0.12F_3](z-z_1)^2 (-6.2 a)$ $a = 0.16(z-z_2)$ $\theta_p = \theta_n(1+(1-(\theta_0/\theta_n))^*(Vacc)^2/(CEC Staff Equation:V_{ab}qn^{-25}V_{ab}Brigg's Equation:V_{ab}qn^{-25}V_{ab}Brigg's Equation:V_{ab}qn^{-25} \times F_{ab}$	24.5 16 20 ft Interval el.H to Top of Je 5D z.,1 ²) ^{1/2} / a 4V _{plume} *a ² *A ²)) 50 ft Interval
able of Plume Top-Hat Diameters (2a) and H Height (feet) above ground Stack. Rel. Ht = 80.0 100.0 120.0 Top of Single jet = 155.1 160.0 200.0 220.0 240.0 220.0 240.0 280.0 30	Plume-Averag (meters) above stack 0.00 6.10 12.19 18.22 22.90 22.30 30.48 36.68 42.67 48.77 54.66 67.06 77.315 82.30 97.54 112.78 128.02 143.26 115.50 173.74 188.98 219.46 249.44 249.44 249.44 249.44 249.44 230.09 341.38	ed Vertical Plume Radius(m) 1.832 2.198 2.565 2.931 3.208 3.208 3.208 3.664 5.7737 8.713 9.688 10.663 11.639 13.102 15.540 15.540 17.979 20.417 22.855 25.294 27.732 30.171 35.047 39.924 44.801 49.678 39.924	Velocities str SingleStk VertVel(m/s) 11.51 10.36 9.21 8.60 7.19 6.91 5.76 3.74 3.28 2.49 2.49 2.49 2.49 2.23 2.19 2.03 1.84 1.77 1.59 1.51 1.51 1.44 1.38 1.34 1.26 1.19 1.14 1.10 1.06	arting at er Plume Temp(K) 306.75 306.68 304.89 304.45 304.41 303.65 303.48 303.48 303.44 303.34 303.22 302.72 302.64 302.53 302.49 302.43 302.43 302.43 302.43		350:	or z(m/above stack) = z(t/above ground) = z(t/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: $V_{plant} = [(Va)_n^{-1} 0.12F_3](z-z_1)^2 (-6.2 a)$ $a = 0.16(z-z_2)$ $\theta_p = \theta_n(1+(1-(\theta_0/\theta_n))^*(Vacc)^2/(CEC Staff Equation:V_{ab}qn^{-25}V_{ab}Brigg's Equation:V_{ab}qn^{-25}V_{ab}Brigg's Equation:V_{ab}qn^{-25} \times F_{ab}$	24.5 16 20 ft Interval el.H to Top of Je 5D z.,1 ²) ^{1/2} / a 4V _{plume} *a ² *A ²)) 50 ft Interval
Table of Plume Top-Hat Diameters (2a) and Height (feet) above ground Stack. Rei. Ht = 80.0 100.0 120.0 140.0 Top of Single jet = 155.1 160.0 200.0 Top of Single jet = 200.0 220.0 200.0	Plume-Averag (meters) above stack 0.00 6.10 12.19 18.29 22.90 22.9	ed Vertical Plume Radius(m) 1.832 2.565 2.931 3.208 3.664 5.787 6.762 7.737 8.713 9.688 10.663 11.639 13.102 15.540 17.979 22.855 25.294 27.732 30.171 35.047 39.924 44.801 49.678 35.4555 59.431	Velocities st SingleStk VertVel(m/s) 11.51 10.36 9.21 8.06 7.19 6.91 5.767 2.69 2.49 2.32 2.49 2.32 2.49 2.32 2.49 2.32 2.49 2.32 1.84 1.77 1.59 1.51 1.44 1.38 1.34 1.26 1.19 1.14 1.26 1.19 1.14 1.26 1.19 1.14 1.26 1.19 1.14 1.26 1.19 1.14 1.26 1.29 1.57 1.59 1.57 1.44 1.28 1.34 1.28 1.34 1.28 1.34 1.28 1.34 1.29 1.59	306.75 306.675 306.68 306.68 306.56 304.89 304.45 304.11 303.86 303.86 303.86 303.48 303.34 303.17 302.97 302.22 302.72 302.64 302.53 302.49 302.43 302.23 302.43 302.32		350:	or z(m/above stack) = z(t/above ground) = z(t/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: $V_{plant} = [(Va)_n^{-1} 0.12F_3](z-z_1)^2 (-6.2 a)$ $a = 0.16(z-z_2)$ $\theta_p = \theta_n(1+(1-(\theta_0/\theta_n))^*(Vacc)^2/(CEC Staff Equation:V_{ab}qn^{-25}V_{ab}Brigg's Equation:V_{ab}qn^{-25}V_{ab}Brigg's Equation:V_{ab}qn^{-25} \times F_{ab}$	24.9 16 20 ft Interval el.H to Top of Je 5D:z_1) ² 1 ^{1/2} / a 4V _{plume} *a ² *λ ²)) 50 ft Interval
able of Plume Top-Hat Diameters (2a) and Height (feet) above ground Stack. Rel. Ht = 80.0 100.0 120.0 140.0 Top of Single jet = 155.1 160.0 220.0 240.0 220.0 240.0 280.0 300.0 280.0 300.	Plume-Averag (meters) above stack 0.00 6.10 12.19 18.29 22.90 22.90 22.90 22.90 22.90 22.90 22.90 22.90 22.90 22.90 22.90 22.90 24.38 30.48 50.48 60.95 67.06 67.0	ed Vertical Plume Radius(m) 1.832 2.565 2.931 3.208 3.664 5.767 6.762 7.737 8.713 9.688 10.663 11.639 13.102 15.540 17.979 20.417 22.855 25.294 27.732 30.171 35.047 39.924 44.801 49.678 54.555 59.431	Velocities st. SingleStk VertVel(m/s) 11.51 10.36 0.91 5.76 2.69 2.49 2.32 2.95 2.69 2.49 2.32 2.95 2.49 2.32 2.19 2.03 1.84 1.70 1.59 1.51 1.44 1.38 1.14 1.14 1.126 1.91 1.14 1.100 1.000 1.000 1.000	306.75 306.68 306.68 306.66 304.89 304.45 304.45 303.66 303.65 303.48 303.34 303.37 302.97 302.62 302.72 302.64 302.53 302.23 302.23 302.30 302.32 302.30		350:	or z(m/above stack) = z(t/above ground) = z(t/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: $V_{plant} = [(Va)_n^{-1} 0.12F_3](z-z_1)^2 (-6.2 a)$ $a = 0.16(z-z_2)$ $\theta_p = \theta_n(1+(1-(\theta_0/\theta_n))^*(Vacc)^2/(CEC Staff Equation:V_{ab}qn^{-25}V_{ab}Brigg's Equation:V_{ab}qn^{-25}V_{ab}Brigg's Equation:V_{ab}qn^{-25} \times F_{ab}$	24.9 16 20 ft Interval el.H to Top of Je 5D:z_1) ² 1 ^{1/2} / a 4V _{plume} *a ² *λ ²)) 50 ft Interval
able of Plume Top-Hat Diameters (2a) and H Height (feet) above ground Stack. Rel. Ht = 80.0 100.0 120.0 Top of Single jet = 155.1 160.0 200.0 220.0 240.0 220.0 240.0 260.0 280.0 30	Plume-Averag (meters) above stack 0.00 6.10 12.19 18.29 22.90 22.90 24.38 36.65 42.67 48.77 54.86 60.96 67.06 67.06 67.06 67.315 82.30 97.54 82.30 97.54 112.78 128.02 113.26 115.50 173.74 188.98 2219.46 249.94 280.42 310.90 341.38 371.86	ed Vertical Plume Radius(m) 1.832 2.198 2.565 2.931 3.208 3.298 3.664 5.787 6.762 7.737 8.713 9.688 10.663 11.639 13.102 15.540 17.979 20.417 22.855 25.294 27.732 30.171 35.047 39.924 44.801 44.805 54.555 59.431 64.308 69.185	Velocities st SingleStk VertVel(m/s) 9.21 8.06 7.19 6.91 5.76 3.74 3.28 2.95 2.69 2.49 2.32 2.19 2.03 1.84 1.70 1.59 1.61 1.51 1.61 1.14 1.33 1.34 1.26 1.19 1.14 1.33 1.34 1.26 1.19 1.14 1.33 1.34 1.26 1.19 1.14 1.33 1.34 1.26 1.19 1.44 1.33 1.34 1.26 1.19 1.44 1.33 1.34 1.26 1.19 1.51 1.51 1.51 1.51 1.51 1.51 1.51	306.75 306.68 306.68 304.45 304.45 304.45 303.65 303.48 303.65 303.48 303.65 303.48 303.65 303.48 303.29 302.97 302.62 302.72 302.64 302.77 302.62 302.29 302.43 302.29 302.33 302.32 302.32 302.32 302.32 302.32 302.32 302.33 302.32		350:	or z(m/above stack) = z(t/above ground) = z(t/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: $V_{plant} = [(Va)_n^{-1} 0.12F_3](z-z_1)^2 (-6.2 a)$ $a = 0.16(z-z_2)$ $\theta_p = \theta_n(1+(1-(\theta_0/\theta_n))^*(Vacc)^2/(CEC Staff Equation:V_{ab}qn^{-25}V_{ab}Brigg's Equation:V_{ab}qn^{-25}V_{ab}Brigg's Equation:V_{ab}qn^{-25} \times F_{ab}$	24.9 16 20 ft Interval el.H to Top of Je 5D:z_1) ² 1 ^{1/2} / a 4V _{plume} *a ² *λ ²)) 50 ft Interval
able of Plume Top-Hat Diameters (2a) and H Height (feet) above ground Stack. Rel. Ht = 80.0 100.0 120.0 Top of Single jet = 155.1 160.0 280.0 220.0 240.0 280.0 38	Plume-Averag (meters) above stack 0.00 6.10 12.19 18.22 22.90 22.30 30.48 36.68 42.67 48.77 54.86 67.06 73.15 82.30 97.54 112.78 128.02 143.26 158.50 173.74 188.98 2219.46 249.94 249.9	ed Vertical Plume Radius(m) 1.832 2.198 2.565 2.931 3.208 3.208 3.208 3.664 5.787 6.762 7.737 8.713 9.688 10.663 11.639 13.102 15.540 15.540 17.979 20.417 22.855 25.294 27.732 30.171 35.047 39.924 44.801 44.801 64.165 59.431 64.308 64.165 59.431 64.308 64.165 59.431	Velocities str SingleStk VertVel(m/s) 9.21 10.36 9.21 8.06 7.19 6.91 5.76 3.74 3.28 2.49 2.49 2.49 2.49 2.49 2.49 2.49 2.49	arting at er Plume Temp(K) 306.75 306.68 306.83 304.45 304.45 303.48 303.86 303.86 303.81 303.82 303.43 303.44 303.43 302.82 302.72 302.82 302.43 302.43 302.32 302.32 302.32 302.32 302.32 302.32 302.28 302.28 302.29 302.28		350:	or z(m/above stack) = z(t/above ground) = z(t/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: $V_{plant} = [(Va)_a^{-1} 0.12F_a](z-z_i)^2 (-6.2 a)$ $a = 0.16(z-z_i)$ $\theta_p = \theta_n(1+(1-(\theta_i)\theta_n))^*(Vacc)^2 (r)$ CEC Staff Equation: $V_{ab}qn^{-25}V_{ab}$ Brigg's Equation: $V_{ab}qn^{-25}V_{ab}$ Brigg's Equation: $V_{ab}qn^{-25} \times F_{ab}$	24.5 16 20 ft Interval subt to Top of Jet 5D z.,) ^{(1) in} / a 4V _{plume} "a ² *A ²)) (⁶⁵² x z ⁽⁶²⁾ 50 ft Interval 100 ft Interval
Table of Plume Top-Hat Diameters (2a) and Height (feet) above ground Stack. Rei. Ht = 80.0 100.0 120.0 140.0 Top of Single jet = 155.1 160.0 200.0 Top of Single jet = 105.1 160.0 200.0 200.0 <td>Plume-Averag (meters) above stack 0.00 6.10 12.19 18.29 22.90 22.9</td> <td>ed Vertical Plume Radius(m) 1.832 2.565 2.931 3.208 3.664 5.787 6.762 7.737 8.713 9.688 10.663 11.639 13.102 15.540 17.979 20.417 22.855 25.294 27.732 30.171 35.047 39.924 44.801 49.678 35.455 55.9431 64.308 69.185 99.3569 117.953</td> <td>Velocities st SingleStk VertVel(m/s) 11.51 10.36 9.21 8.06 7.19 6.91 5.767 2.69 2.49 2.32 2.49 2.32 2.49 2.32 2.49 2.32 2.49 2.32 1.84 1.77 1.59 1.51 1.44 1.38 1.34 1.26 1.19 1.14 1.26 1.19 1.14 1.26 1.95 1.57 1.95 1.57 1.95 1.57 1.95 1.57 1.95 1.57 1.95 1.57 1.95 1.57 1.95 1.57 1.95 1.57 1.95 1.57 1.95 1.57 1.95 1.57 1.95 1.57 1.95 1.57 1.95 1.57 1.95 1.57 1.95 1.57 1.95 1.57 1.95 1.19</td> <td>306.75 306.675 306.68 306.68 306.56 304.89 304.45 304.41 303.86 303.48 303.44 303.17 302.97 302.29 302.25 302.25 302.24 302.53 302.43 302.43 302.25 302.29 302.28 302.25</td> <td></td> <td>350:</td> <td>or z(m/above stack) = z(t/above ground) = z(t/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: $V_{plant} = [(Va)_a^{-1} 0.12F_a](z-z_i)^2 (-6.2 a)$ $a = 0.16(z-z_i)$ $\theta_p = \theta_n(1+(1-(\theta_i)\theta_n))^*(Vacc)^2 (r)$ CEC Staff Equation: $V_{ab}qn^{-25}V_{ab}$ Brigg's Equation: $V_{ab}qn^{-25}V_{ab}$ Brigg's Equation: $V_{ab}qn^{-25} \times F_{ab}$</td> <td>24.5 16 20 ft Interval al.Ht to Top of Je 5D z, j²j^{1/3} / a 4V_{plume} "a²*A²)) 50 ft Interval 100 ft Interval</td>	Plume-Averag (meters) above stack 0.00 6.10 12.19 18.29 22.90 22.9	ed Vertical Plume Radius(m) 1.832 2.565 2.931 3.208 3.664 5.787 6.762 7.737 8.713 9.688 10.663 11.639 13.102 15.540 17.979 20.417 22.855 25.294 27.732 30.171 35.047 39.924 44.801 49.678 35.455 55.9431 64.308 69.185 99.3569 117.953	Velocities st SingleStk VertVel(m/s) 11.51 10.36 9.21 8.06 7.19 6.91 5.767 2.69 2.49 2.32 2.49 2.32 2.49 2.32 2.49 2.32 2.49 2.32 1.84 1.77 1.59 1.51 1.44 1.38 1.34 1.26 1.19 1.14 1.26 1.19 1.14 1.26 1.95 1.57 1.95 1.57 1.95 1.57 1.95 1.57 1.95 1.57 1.95 1.57 1.95 1.57 1.95 1.57 1.95 1.57 1.95 1.57 1.95 1.57 1.95 1.57 1.95 1.57 1.95 1.57 1.95 1.57 1.95 1.57 1.95 1.57 1.95 1.57 1.95 1.19	306.75 306.675 306.68 306.68 306.56 304.89 304.45 304.41 303.86 303.48 303.44 303.17 302.97 302.29 302.25 302.25 302.24 302.53 302.43 302.43 302.25 302.29 302.28 302.25		350:	or z(m/above stack) = z(t/above ground) = z(t/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: $V_{plant} = [(Va)_a^{-1} 0.12F_a](z-z_i)^2 (-6.2 a)$ $a = 0.16(z-z_i)$ $\theta_p = \theta_n(1+(1-(\theta_i)\theta_n))^*(Vacc)^2 (r)$ CEC Staff Equation: $V_{ab}qn^{-25}V_{ab}$ Brigg's Equation: $V_{ab}qn^{-25}V_{ab}$ Brigg's Equation: $V_{ab}qn^{-25} \times F_{ab}$	24.5 16 20 ft Interval al.Ht to Top of Je 5D z, j ² j ^{1/3} / a 4V _{plume} "a ² *A ²)) 50 ft Interval 100 ft Interval
'able of Plume Top-Hat Diameters (2a) and Height (feet) above ground Stack. Rel. Ht = 80.0 100.0 120.0 120.0 120.0 120.0 120.0 120.0 120.0 120.0 120.0 120.0 120.0 120.0 120.0 220.0 240.0 260.0 280.0 380.0	Plume-Averag (meters) above stack 0.00 6.10 12.19 18.22 22.90 22.30 30.48 36.68 42.67 48.77 54.86 67.06 73.15 82.30 97.54 112.78 128.02 143.26 158.50 173.74 188.98 2219.46 249.94 249.9	ed Vertical Plume Radius(m) 1.832 2.565 2.931 3.208 3.664 5.787 6.762 7.737 8.713 9.688 10.663 11.639 13.102 15.540 17.979 20.417 22.855 25.294 27.732 30.171 35.047 39.924 44.801 49.678 35.455 55.9431 64.308 69.185 99.3569 117.953	Velocities str SingleStk VertVel(m/s) 9.21 10.36 9.21 8.06 7.19 6.91 5.76 3.74 3.28 2.49 2.49 2.49 2.49 2.49 2.49 2.49 2.49	306.75 306.675 306.68 306.68 306.56 304.89 304.45 304.41 303.86 303.48 303.44 303.17 302.97 302.29 302.25 302.25 302.24 302.53 302.43 302.43 302.25 302.29 302.28 302.25		350:	or z(m/above stack) = z(t/above ground) = z(t/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: $V_{plant} = [(Va)_a^{-1} 0.12F_a](z-z_i)^2 (-6.2 a)$ $a = 0.16(z-z_i)$ $\theta_p = \theta_n(1+(1-(\theta_i)\theta_n))^*(Vacc)^2 (r)$ CEC Staff Equation: $V_{ab}qn^{-25}V_{ab}$ Brigg's Equation: $V_{ab}qn^{-25}V_{ab}$ Brigg's Equation: $V_{ab}qn^{-25} \times F_{ab}$	24.5 16 20 ft Interval subt to Top of Jet 5D z.,) ^{(1) in} / a 4V _{plume} "a ² *A ²)) (⁶⁵² x z ⁽⁶²⁾ 50 ft Interval 100 ft Interval
Fable of Plume Top-Hat Diameters (2a) and Height (feet) above ground Stack. Rel. Ht = 80.0 100.0 120.0 140.0 Top of Single jet = 155.1 160.0 200.0 220.0 220.0 220.0 220.0 240.0 280.0	Plume-Averag (meters) above stack 0.00 6.10 12.19 18.29 22.90 22.9	ed Vertical Plume Radius(m) 1.832 2.565 2.931 3.208 3.664 5.767 6.762 7.737 8.713 9.688 10.663 11.639 13.102 15.540 17.979 20.417 22.855 25.294 27.732 30.171 35.047 39.924 44.801 49.678 54.555 59.431 64.308 69.185 93.569 31.172 31.2732 30.184 31.2732 31.2732 31.2732 31.2732 31.2732 31.2732 31.2732 32.2732 33.	Velocities st SingleStk VertVel(m/s) 11.51 10.36 9.21 8.06 7.19 6.91 5.767 2.69 2.49 2.32 2.49 2.32 2.49 2.32 2.49 2.32 2.49 2.32 1.84 1.77 1.59 1.51 1.44 1.38 1.34 1.26 1.19 1.14 1.26 1.19 1.14 1.26 1.95 1.57 1.95 1.57 1.95 1.57 1.95 1.57 1.95 1.57 1.95 1.57 1.95 1.57 1.95 1.57 1.95 1.57 1.95 1.57 1.95 1.57 1.95 1.57 1.95 1.57 1.95 1.57 1.95 1.57 1.95 1.57 1.95 1.57 1.95 1.57 1.95 1.19	306.75 306.68 306.68 306.66 304.89 304.45 304.45 303.66 303.65 303.48 303.65 303.48 303.47 302.97 302.62 302.72 302.64 302.57 302.53 302.49 302.43 302.30 302.32 302.30 302.32 302.30 302.24 302.24 302.25 302.24		350:	or z(m/above stack) = z(t/above ground) = z(t/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: $V_{plant} = [(Va)_a^{-1} 0.12F_a](z-z_i)^2 (-6.2 a)$ $a = 0.16(z-z_i)$ $\theta_p = \theta_n(1+(1-(\theta_i)\theta_n))^*(Vacc)^2 (r)$ CEC Staff Equation: $V_{ab}qn^{-25}V_{ab}$ Brigg's Equation: $V_{ab}qn^{-25}V_{ab}$ Brigg's Equation: $V_{ab}qn^{-25} \times F_{ab}$	24.9 16 ⁻ 20 ft interval elft to Top of Jett 5D.z, λ ²) ^{1/0} / a 4V _{plume} *a ²⁺ λ ²)) ^{6/42} χ z ^(1/2) 50 ft Interval
fable of Plume Top-Hat Diameters (2a) and Height (feet) above ground Stack. Rel. Ht = 80.0 100.0 120.0 120.0 140.0 Top of Single jet = 155.1 160.0 Top of Single jet = 155.1 160.0 220.0 240.0 220.0 240.0 3000.0 220.0 240.0 260.0 280.0 300.0 300.0 350.0 660.0 500.0 500.0 660.0 700.0 660.0 700.0 800.0 1100.0 1100.0 1200.0 13000.0 25000.0 2500.0 3500.0	Plume-Averag (meters) above stack 0.00 6.10 12.19 18.29 22.90 22.90 24.38 36.65 42.67 48.77 54.86 60.95 67.06 67.06 67.06 67.315 82.30 97.54 82.30 97.54 112.78 128.02 113.74 188.98 219.46 249.94 280.42 310.90 341.38 371.86 249.94 432.85 229.74 280.42 280.42 280.42 280.42 285.52 22 77.62 880.02 1042.42	ed Vertical Plume Radius(m) 1.832 2.198 2.565 2.931 3.208 3.207 3.	Velocities st SingleStk VertVel(m/s) 11.51 10.36 9.21 18.66 7.19 6.91 5.76 3.74 2.49 2.49 2.49 2.49 2.32 2.49 2.49 2.32 2.19 2.03 1.84 1.70 1.59 1.51 1.44 1.33 1.44 1.33 1.44 1.33 1.44 1.36 1.19 1.44 1.00 1.00 0.98 0.88 0.81 0.77 0.72	306.75 306.65 304.89 304.45 304.45 303.65 303.48 303.65 303.48 303.65 303.48 303.65 303.48 303.65 303.48 303.72 302.67 302.62 302.72 302.64 302.72 302.63 302.93 302.49 302.49 302.23 302.23 302.24 302.23 302.24 302.23 302.24 302.23 302.24 302.23 302.24 302.24 302.23 302.24 302.25 302.25 302.24 302.25 30		350:	or z(m/above stack) = z(t/above ground) = z(t/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: $V_{plant} = [(Va)_a^{-1} 0.12F_a](z-z_i)^2 (-6.2 a)$ $a = 0.16(z-z_i)$ $\theta_p = \theta_n(1+(1-(\theta_i)\theta_n))^*(Vacc)^2 (r)$ CEC Staff Equation: $V_{ab}qn^{-25}V_{ab}$ Brigg's Equation: $V_{ab}qn^{-25}V_{ab}$ Brigg's Equation: $V_{ab}qn^{-25} \times F_{ab}$	24.9 16 ⁻ 20 ft Interval eta
able of Plume Top-Hat Diameters (2a) and Height (feet) above ground Stack. Rel. Ht = 80.0 100.0 120.0 140.0 Top of Single jet = 155.1 160.0 220.0 240.0 220.0 240.0 280.0 390.0 390.0 450.0 500.0 650.0 700.0 800.0 600.0 1000.0 1000.0 1000.0 1000.0 1000.0 1000.0 1000.0 <tr< td=""><td>Plume-Averag (meters) above stack 0.00 6.10 12.19 18.29 22.90 22.90 22.90 22.90 22.90 30.48 30.48 30.48 30.48 42.67 48.77 54.86 60.95 67.06 67.06 67.06 67.06 73.15 82.30 97.54 82.30 97.54 82.30 97.54 82.30 97.54 82.30 97.54 82.30 97.54 82.30 97.54 82.30 97.54 82.30 97.54 82.30 97.54 82.30 97.54 82.30 97.54 82.30 97.54 82.30 97.54 82.30 97.54 82.30 97.55 82.50 97.55 82.50 80.50 80.5</td><td>ed Vertical Plume Radius(m) 1.832 2.198 2.565 2.931 3.208 3.208 3.208 3.664 5.787 6.762 7.737 8.713 9.688 9.688 9.688 9.688 9.688 9.15540 17.979 20.417 22.855 25.294 27.732 30.171 35.047 39.924 44.801 49.678 54.555 59.431 64.308 69.185 93.569 117.953 1142.337 116.721 191.105</td><td>Velocities st: SingleStk VertVel(m/s) 11.51 10.36 0.691 5.76 2.69 2.49 2.32 2.99 2.03 1.84 1.70 1.59 1.51 1.44 1.38 1.34 1.26 1.51 1.51 1.44 1.38 1.34 1.26 1.91 1.54 1.92 1.55 1.51 1.44 1.10 1.00 1.00 0.88 0.88 0.88 0.81 0.076</td><td>306.75 306.68 306.68 306.66 304.89 304.45 304.45 303.66 303.65 303.48 303.65 303.48 303.47 302.97 302.62 302.72 302.64 302.57 302.53 302.49 302.43 302.30 302.32 302.30 302.32 302.30 302.24 302.24 302.25 302.24</td><td></td><td>350:</td><td>or z(m/above stack) = z(t/above ground) = z(t/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: $V_{plant} = [(Va)_a^{-1} 0.12F_a](z-z_i)^2 (-6.2 a)$ $a = 0.16(z-z_i)$ $\theta_p = \theta_n(1+(1-(\theta_i)\theta_n))^*(Vacc)^2 (r)$ CEC Staff Equation: $V_{ab}qn^{-25}V_{ab}$ Brigg's Equation: $V_{ab}qn^{-25}V_{ab}$ Brigg's Equation: $V_{ab}qn^{-25} \times F_{ab}$</td><td>24.9 16⁻ 20 ft Interval eta eta eta eta eta eta eta eta eta eta</td></tr<>	Plume-Averag (meters) above stack 0.00 6.10 12.19 18.29 22.90 22.90 22.90 22.90 22.90 30.48 30.48 30.48 30.48 42.67 48.77 54.86 60.95 67.06 67.06 67.06 67.06 73.15 82.30 97.54 82.30 97.54 82.30 97.54 82.30 97.54 82.30 97.54 82.30 97.54 82.30 97.54 82.30 97.54 82.30 97.54 82.30 97.54 82.30 97.54 82.30 97.54 82.30 97.54 82.30 97.54 82.30 97.54 82.30 97.55 82.50 97.55 82.50 80.50 80.5	ed Vertical Plume Radius(m) 1.832 2.198 2.565 2.931 3.208 3.208 3.208 3.664 5.787 6.762 7.737 8.713 9.688 9.688 9.688 9.688 9.688 9.15540 17.979 20.417 22.855 25.294 27.732 30.171 35.047 39.924 44.801 49.678 54.555 59.431 64.308 69.185 93.569 117.953 1142.337 116.721 191.105	Velocities st: SingleStk VertVel(m/s) 11.51 10.36 0.691 5.76 2.69 2.49 2.32 2.99 2.03 1.84 1.70 1.59 1.51 1.44 1.38 1.34 1.26 1.51 1.51 1.44 1.38 1.34 1.26 1.91 1.54 1.92 1.55 1.51 1.44 1.10 1.00 1.00 0.88 0.88 0.88 0.81 0.076	306.75 306.68 306.68 306.66 304.89 304.45 304.45 303.66 303.65 303.48 303.65 303.48 303.47 302.97 302.62 302.72 302.64 302.57 302.53 302.49 302.43 302.30 302.32 302.30 302.32 302.30 302.24 302.24 302.25 302.24		350:	or z(m/above stack) = z(t/above ground) = z(t/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: $V_{plant} = [(Va)_a^{-1} 0.12F_a](z-z_i)^2 (-6.2 a)$ $a = 0.16(z-z_i)$ $\theta_p = \theta_n(1+(1-(\theta_i)\theta_n))^*(Vacc)^2 (r)$ CEC Staff Equation: $V_{ab}qn^{-25}V_{ab}$ Brigg's Equation: $V_{ab}qn^{-25}V_{ab}$ Brigg's Equation: $V_{ab}qn^{-25} \times F_{ab}$	24.9 16 ⁻ 20 ft Interval eta



(arong	I length) Plume Average Vert								
			-	ioyant Plumes imum Undrafi			ditions of 1	/arious Heights in the Merg	ued .
		ine Evalua						/arious Heights in the Merg v, Queensland, Australia," [
mbient Condit	tions:		Traine					eutral conditions (dθ/dz=0 or	
and sent contait	Ambient Potential Temp θ _a	302.21	Kelvins	84.3		oonatanta.		meters/feet	o _a -o _e)
lume Exit Con		002.21	rtoruno	01.0		Gravity g		m/s ²	
	Stack Height h	24.38	meters	80	feet-inches	λ	1.11		
	Individual Stack Diameter D	3.6639445			inches	λο	~1.0		
	Stack Velocity Vexit	11.51			ft/sec	4Vol/(60πE	-		
	Individual Volumetric Flow		cu.m/sec	257,143		πV _{exit} D ² /4	.,		Sect.2/¶1
	Stack Potential Temp θs		Kelvins	104.3		n v _{exit} o /+			0000.2/ [[1
						-V D2/1 (10 14 - 14		Sect.2/¶1
	Initial Stack Buoyancy Flux Fo Plume Buoyancy Flux F		m ⁴ /s ³	20.0	ΔT(°F)			ol.Flow(g/π)(1-θ _a /θ _s)	
			m ⁴ /s ³			v-gva-(1-0	₃ /e _p) for a, v	,θ _p at plume height (see belo	w)
	Total Number of Stacks n	42							
	ge Adjacent Stack Separation d		meters	44.1	feet			e plume treatment in Peter Be	
Numbe	er of Stacks along Orientation N	6						used by N ^{0.25} at the height when	
						fully merge	d (interp. be	low ht, single merged stack a	bove ht)
Conditions at E	nd (Top) of Jet Phase:								
	Height above Stack z _{jet}	22.900	meters*	75.1	feet*	z _{jet} = 6.250), meters*=	meters above stack top	Sect.3/¶1
	Height above Ground zjet+hs	47.284	meters	155.1	feet				•
	Vertical Velocity V _{jet}	5.755	m/s	18.88	ft/sec	V _{jet} = 0.5V _e	$_{exit} = V_{exit}/2$		•
	Plume Top-Hat Diameter 2ajet	7.328	meters	24.0	feet	2a _{jet} = 2D		Conservation of momentum	
pillane Metho	dology - Analytical Solutions	for Calm Con	ditions for	Plume Heigh	s above Je	et and Merg	ing Phase	s	
	me-averaged Vertical Velocit								
-	alues: Plume Top-Hat Radius a		-	e Merging On				r increase with height	Sect.2/Eq.6
	Virtual Source Height z _v		meters*		feet*			, meters*=meters above stack top	
	Height above Ground zv+hs		meters		feet	., 0.200	, (-er≌s) .	where $(\theta_a/\theta_s)^{1/2} = (\theta_a/\theta_s)^{1/2} =$	
Single Divers						1(V/a) 3 · A	12E 1/	$(\theta_a/\theta_s)^2 = (\theta_e/\theta_s)^2 = $	
Single Plume V				e Merging On	7			/) - (0.20D-2v)]}, / a	Sect.2.1(6)
	Product (Va)	20.709	m*/s			V _{exit} (D/2)(θ	e/ʊs)``*		
	_								a
	- Based on Single Plume Ca								Sect.3/¶3
Begin Merging	Plume Top-Hat Diameter 2atouch		meters	44.1		2a _{touch} =d, (
	Height above Stack z _{touch}		meters*	139.1		$z_{touch} = z_v +$	d/(2*0.16),	meters*=meters above stack	top
	Height above Ground ztouch+hs	66.794	meters	219.1	feet				
	Vertical Velocity V _{touch}	3.300	m/s	10.8	ft/sec	V _{touch} = {(V	a) _o ³ + 0.12	$F_o [(z-z_v)^2 - (6.25D-z_v)^2]$	/ a
Fotal Merging	Plume Top-Hat Diameter 2afull	67.200	meters	220.5	feet	2a _{full} =2d(N-	1)/2, (or a _{ft}	II=d(N-1)/2) FOR 2 STACKS,	2a _{full} =2d
	Height above Stack zfull	210.410	meters*	690.3	feet*	$z_{full} = z_v + 2$	d/(2*0.16),	meters*=meters above stack	top
	Height above Ground zful+hs	234.794	meters	770.3	feet				
	Vertical Velocity V _{ful}	1.278	m/s	4.2	ft/sec	V _{full} = {(Va	³ + 0.12F	$[(z_{full}-z_v)^2 - (6.25D-z_v)^2]^{(1/3)}$	/ and
	Product (V ³ a) _{full}		m ⁴ /s ³			Tun ((- Tun
Conditions at F	nd (Top) of Merging Phase - D			and arm in Merr	ed Plume c	alculations	based on T	OTAL number of stacks)	
	e Values: Plume Diameter 2a			Table Below				z _{full})), or linear increase with I	height
-					last			here Total Merging Occurs	neigin
	vised Merged Plume Radius am		meters	280.6					
	ised Merged Plume Velocity V _m	3.253			ft/sec			here Total Merging Occurs	
Re	evised Virtual Source Height z _{full}		meters*	690.3	feet*			ere Total Merging Occurs (sh	
	Revised Vertical Velocity V	S	olutions in	Tables Below				eights above total merging ele	evation
						V=V _{touch} +(V	/ _m -V _{touch})*(z-z _{touch})/(z _{full} -z _{touch})	
Multiple Plume								for heights below total mergi	ng elevation
Solve for p	olume-averaged vertical velo	ity at height	540.0	feet	164.592	meters abo			
Gives the	e following Height above Stack z	140.208	meters*	460.0	feet*	LESS THA	N TOP OF	MERGING PHASE-INTERPO	DLATE
	Plume Top-Hat Radius a	#N/A	meters	#N/A	feet	a=a _m +0.16	(z-z _{full}) if z>	≥z _{full}	
	Vertical Velocity V	3.273	m/s	10.74	ft/sec	V={n(V3a)fL	"/a} ^{1/3} if z>	Z _{full}	
						V'=Vtouch+(V _m -V _{touch})*(z'-z _{touch})/(z _{full} -z _{touch}) if z _{touch}	<z<z<sub>full</z<z<sub>
						V'=single p	lume values	s if z <z<sub>touch</z<sub>	
Solve for He	eight of CASC critical vertical	velocity V _{crit}	5.30	m/s		BEFORE T			VV < Top of
	Find Height above Stack z _{crit}		meters		feet			/(V _{crit}) ³]-a _m }/0.16 if V _{crit} <v<sub>m</v<sub>	
	Height above Ground z _{crit} +h _s		meters		feet			*(V _{crit} -V _{touch})/(V _m -V _{touch}) if V _c	
	Theight above Ground Zent The	JE I	motora	JEI	1001	Zent-Ztouch	(4 ull'4 touch)	(v cnt v touch) (v m v touch) II v c	rit" • m
Table of MERCH	ED Blume Averaged Vertical	/olocition ato	rting at Ta	Johing Holgh		Single Plur	no Eana (a	no Singlo Blumo oproadahoot	6)
able OF MERGE	ED Plume-Averaged Vertical							ee Single Plume spreadsheet	<i>.</i> ,
	Height (feet)			Vert.				_v) ² -(6.25D-z _v) ²]} ^{1/3} / a	
	above ground	above stack				a = 0.16(z-		-2	
			6.720	3.30				_{xit} D ² /(4V _{plume} *a ² *λ ²)))	
E	Begin Merging (touch) = 219.1	42.40				Interpolated	d Laver Ear		20 ft Interva
E	Begin Merging (touch) = 219.1 220.0	42.67		3.30				z'-z .)/(zz)	
E	Begin Merging (touch) = 219.1 220.0 240.0	42.67 48.77	#N/A	3.30		V'=V _{touch} +(<pre>2 touch / (2 full 2 touch /</pre>	
E	Begin Merging (touch) = 219.1 220.0	42.67	#N/A					<pre>~ touch) (* full* touch)</pre>	
E	Begin Merging (touch) = 219.1 220.0 240.0	42.67 48.77	#N/A #N/A	3.30				<pre>~touch/\2full*_touch/</pre>	
E	Begin Merging (touch) = 219.1 220.0 240.0 260.0	42.67 48.77 54.86	#N/A #N/A #N/A	3.30 3.30				∠ ~Louch / (Liuli ~Louch /	
E	Begin Merging (touch) = 219.1 220.0 240.0 240.0 260.0 280.0 300.0 300.0	42.67 48.77 54.86 60.96 67.06	#N/A #N/A #N/A #N/A	3.30 3.30 3.30 3.29				2 - Louch / (21 ull 2 touch)	
E	Begin Merging (touch) = 219.1 220.0 240.0 240.0 260.0 280.0 300.0 320.0	42.67 48.77 54.86 60.96 67.06 73.15	#N/A #N/A #N/A #N/A	3.30 3.30 3.30 3.29 3.29				2 ~2touch/(21ull*2touch/	
E	Begin Merging (touch) = 219.1 220.0 240.0 240.0 260.0 280.0 380.0 380.0 390.0 390.0 390.0 390.0 390.0	42.67 48.77 54.86 60.96 67.06 73.15 79.25	#N/A #N/A #N/A #N/A #N/A	3.30 3.30 3.29 3.29 3.29				<pre>~ ~Louch/(<!--ull^Llouch/)</pre--></pre>	
E	Begin Merging (louch) = 219.1 220.0 240.0 280.0 280.0 300.0 320.0 330.0 340.0 340.0 340.0 360.0	42.67 48.77 54.86 60.96 67.06 73.15 79.25 85.34	#N/A #N/A #N/A #N/A #N/A #N/A	3.30 3.30 3.29 3.29 3.29 3.29 3.29		V'=V _{touch} +(Vm-Vtouch)*(
E	Begin Merging (touch) ⁻ 219.1 220.0 240.0 280.0 280.0 3300.0 340.0 340.0 380.0 380.0 380.0	42.67 48.77 54.86 60.96 67.06 73.15 79.25 85.34 91.44	#N/A #N/A #N/A #N/A #N/A #N/A	3.30 3.30 3.29 3.29 3.29 3.29 3.29 3.29 3.29 3.29		V'=V _{touch} +(V _m -V _{touch})*(me Eqns	<pre>~~louch/Velum2louch/</pre>	50 ft later
E	Begin Merging (touch) 219.1 220.0 220.0 240.0 240.0 260.0 260.0 300.0 300.0 320.0 340.0 3800.0 3800.0 3400.0 340.0	42.67 48.77 54.86 60.96 67.06 73.15 79.25 85.34 91.44 97.54	#N/A #N/A #N/A #N/A #N/A #N/A #N/A	3.30 3.30 3.29 3.29 3.29 3.29 3.29 3.29 3.29 3.29		V'=V _{touch} +(Merged Plu V={n(V ³ a) _{ft}	Vm-Vtouch)*(me Eqns ull/a) ^{1/3}	(ouch) ((u) -(ouch))	50 ft Interv
E	Begin Merging (touch) = 219.1 220.0 240.0 240.0 240.0 240.0 240.0 260.0 300.0 320.0 340.0 340.0 380.0 360.0	42.67 48.77 54.86 60.96 67.06 73.15 79.25 85.34 91.44 97.54 112.78	#N/A #N/A #N/A #N/A #N/A #N/A #N/A #N/A	3.30 3.30 3.29 3.29 3.29 3.29 3.29 3.29 3.29 3.29		V'=V _{touch} +(Vm-Vtouch)*(me Eqns ull/a) ^{1/3}		50 ft Interv
E	Begin Merging (touch) - 219.1 220.0 240.0 280.0 280.0 3300.0 340.0 340.0 340.0 360.	42.67 48.77 54.86 60.96 67.06 73.15 79.25 85.34 91.44 97.54 112.78 128.02	#N/A #N/A #N/A #N/A #N/A #N/A #N/A #N/A	3.30 3.30 3.29 3.29 3.29 3.29 3.29 3.29 3.29 3.28 3.28 3.28 3.28 3.28		V'=V _{touch} +(Merged Plu V={n(V ³ a) _{ft}	Vm-Vtouch)*(me Eqns ull/a) ^{1/3}		50 ft Interv
E	Begin Merging (touch) 219.1 220.0 220.0 240.0 240.0 280.0 280.0 300.0 320.0 340.0 340.0 380.0 380.0 400.0 460.0 550.0 550.0	42.67 48.77 54.86 60.96 67.06 73.15 79.25 85.34 91.44 97.54 112.78 128.02 143.26	#N/A #N/A #N/A #N/A #N/A #N/A #N/A #N/A	3.30 3.30 3.22 3.29 3.29 3.29 3.29 3.29 3.29 3.29		V'=V _{touch} +(Merged Plu V={n(V ³ a) _{ft}	Vm-Vtouch)*(me Eqns ull/a) ^{1/3}		50 ft Interv
E	Begin Merging (touch) - 219.1 220.0 240.0 280.0 280.0 3300.0 340.0 340.0 340.0 360.	42.67 48.77 54.86 60.96 67.06 73.15 79.25 85.34 91.44 97.54 112.78 128.02	#N/A #N/A #N/A #N/A #N/A #N/A #N/A #N/A	3.30 3.30 3.29 3.29 3.29 3.29 3.29 3.29 3.29 3.28 3.28 3.28 3.28 3.28		V'=V _{touch} +(Merged Plu V={n(V ³ a) _{ft}	Vm-Vtouch)*(me Eqns ull/a) ^{1/3}		50 ft Interv
	Begin Merging (touch) 219.1 220.0 220.0 240.0 240.0 280.0 280.0 300.0 320.0 340.0 340.0 380.0 380.0 400.0 460.0 550.0 550.0	42.67 48.77 54.86 60.96 67.06 73.15 79.25 85.34 91.44 97.54 112.78 128.02 143.26	#NVA #NVA #NVA #NVA #NVA #NVA #NVA #NVA	3.30 3.30 3.22 3.29 3.29 3.29 3.29 3.29 3.29 3.29		V'=V _{touch} +(Merged Plu V={n(V ³ a) _{ft}	Vm-Vtouch)*(me Eqns ull/a) ^{1/3}		
	Begin Merging (touch) = 219.1 220.0 2240.0 2460.0 260.0 260.0 320.0 340.0 340.0 340.0 340.0 340.0 360.0	42.67 48.77 54.86 67.06 73.15 79.25 85.34 91.44 97.54 112.78 128.02 143.26 158.50	#NVA #NVA #NVA #NVA #NVA #NVA #NVA #NVA	3.30 3.30 3.29 3.29 3.29 3.29 3.29 3.29 3.28 3.28 3.28 3.28 3.28 3.28 3.28 3.27 3.27		V'=V _{touch} +(Merged Plu V={n(V ³ a) _{ft}	Vm-Vtouch)*(me Eqns ull/a) ^{1/3}		
	Begin Merging (touch) = 219.1 220.0 240.0 280.0 280.0 3300.0 340.0 340.0 340.0 340.0 340.0 360.0 360.0 560.0 560.0 700.0	42.67 48.77 54.86 60.96 67.06 73.15 79.25 85.34 91.44 97.54 112.78 128.02 143.26 158.50 188.98	#NVA #NVA #NVA #NVA #NVA #NVA #NVA #NVA	3.30 3.30 3.29 3.29 3.29 3.29 3.29 3.28 3.28 3.28 3.28 3.28 3.28 3.27 3.27 3.27 3.27		V'=V _{touch} +(Merged Plu V={n(V ³ a) _{ft}	Vm-Vtouch)*(me Eqns ull/a) ^{1/3}		
	Begin Merging (touch) = 219.1 220.0 240.0 240.0 260.0 260.0 3300.0 340.	42.67 48.77 54.86 60.95 67.06 73.15 79.25 85.34 91.44 97.54 112.78 128.02 143.26 158.50 188.98 210.40 219.46	#NVA #NVA #NVA #NVA #NVA #NVA #NVA #NVA	3.30 3.30 3.29 3.29 3.29 3.29 3.28 3.28 3.28 3.28 3.22 3.22 3.22 3.22		V'=V _{touch} +(Merged Plu V={n(V ³ a) _{ft}	Vm-Vtouch)*(me Eqns ull/a) ^{1/3}		
	Begin Merging (touch) = 219.1 220.0 240.0 280.0 280.0 280.0 3300.0 340.0 340.0 340.0 340.0 340.0 360.0 360.0 550.	42.67 48.77 54.86 60.99 67.06 73.15 79.25 85.34 91.44 97.54 112.78 128.02 143.25 158.50 188.98 210.40 219.46 249.94	#NVA #NVA #NVA #NVA #NVA #NVA #NVA #NVA	3 30 3 30 3 22 3 22		V'=V _{touch} +(Merged Plu V={n(V ³ a) _{ft}	Vm-Vtouch)*(me Eqns ull/a) ^{1/3}		
	Begin Merging (touch) = 219.1 220.0 2240.0 240.0 240.0 240.0 240.0 240.0 260.0 280.0 320.0 320.0 340.0 380.0 380.0 560.0 600.0 560.0 600.0 560.0	42.67 48.77 54.86 60.96 67.06 73.15 79.25 85.34 91.44 97.54 112.78 128.02 143.26 158.50 158.50 158.50 210.40 219.46 229.44 229.44 2280.42	#NVA #NVA #NVA #NVA #NVA #NVA #NVA #NVA	3 30 3 30 3 22 3 3 22 3 3 3 2 3 3 2 3 3 2 3 3 3 2 3 3 2 3 3 2 3 3 3 2 3 3 2 3 3 3 3 3		V'=V _{touch} +(Merged Plu V={n(V ³ a) _{ft}	Vm-Vtouch)*(me Eqns ull/a) ^{1/3}		
	Begin Merging (touch) = 219.1 220.0 240.0 240.0 260.0 280.0 300.0 340.0	42.67 48.77 54.86 60.96 67.06 73.15 79.25 85.34 97.54 112.78 128.02 143.26 143.26 143.26 143.26 143.26 143.26 143.26 143.26 219.40 219.46 249.94 229.42 2310.90	#NVA #NVA #NVA #NVA #NVA #NVA #NVA #NVA	3 30 3 30 3 22 3 32 3 22 3 22		V'=V _{touch} +(Merged Plu V={n(V ³ a) _{ft}	Vm-Vtouch)*(me Eqns ull/a) ^{1/3}		
	Begin Merging (touch) = 219.1 220.0 240.0 280.0 280.0 280.0 3300.0 340.0 340.0 340.0 340.0 360.0 550.	42.67 48.77 54.86 60.96 67.06 73.15 79.25 85.34 91.44 97.54 112.78 128.02 114.326 158.50 188.98 210.40 219.46 249.94 280.42 310.99 310.99 311.38	#N/A #N/A #N/A #N/A #N/A #N/A #N/A #N/A	3.30 3.30 3.29 3.29 3.29 3.29 3.29 3.29 3.29 3.29		V'=V _{touch} +(Merged Plu V={n(V ³ a) _{ft}	Vm-Vtouch)*(me Eqns ull/a) ^{1/3}		
	Begin Merging (touch) = 219.1 220.0 224.0 220.0 240.0 240.0 280.0 280.0 280.0 280.0 280.0 380.0 380.0 380.0 380.0 380.0 560.0 600.0 600.0 700.0 End Merging (full/mp) = 770.3 900.0 1000.0 1100.0 1300.0	42.67 48.77 54.86 60.96 67.06 79.25 85.34 91.44 97.54 112.78 112.78 112.80 210.40 219.46 210.40 219.46 210.40 219.46 310.90 371.86	#N/A #N/A #N/A #N/A #N/A #N/A #N/A #N/A	3,30 3,30 3,22 3,22 3,22 3,22 3,22 3,22		V'=V _{touch} +(Merged Plu V={n(V ³ a) _{ft}	Vm-Vtouch)*(me Eqns ull/a) ^{1/3}		100 ft Inter
	Begin Merging (touch) = 219.1 220.0 240.0 280.0 280.0 280.0 3300.0 340.0 340.0 340.0 340.0 360.0 550.	42.67 48.77 54.86 60.96 67.06 73.15 79.25 85.34 91.44 97.54 112.78 128.02 114.326 158.50 188.98 210.40 219.46 249.94 280.42 310.99 310.99 311.38	#N/A #N/A #N/A #N/A #N/A #N/A #N/A #N/A	3.30 3.30 3.29 3.29 3.29 3.29 3.29 3.29 3.29 3.29		V'=V _{touch} +(Merged Plu V={n(V ³ a) _{ft}	Vm-Vtouch)*(me Eqns ull/a) ^{1/3}		100 ft Inter
	Begin Merging (touch) = 219.1 220.0 224.0 220.0 240.0 240.0 280.0 280.0 280.0 280.0 280.0 380.0 380.0 380.0 380.0 380.0 560.0 600.0 600.0 700.0 End Merging (full/mp) = 770.3 900.0 1000.0 1100.0 1300.0	42.67 48.77 54.86 60.96 67.06 79.25 85.34 91.44 97.54 112.78 128.02 143.26 158.50 143.26 158.50 210.40 219.46 220.42 230.42 310.90 371.86	#N/A #N/A #N/A #N/A #N/A #N/A #N/A #N/A	3,30 3,30 3,22 3,22 3,22 3,22 3,22 3,22		V'=V _{touch} +(Merged Plu V={n(V ³ a) _{ft}	Vm-Vtouch)*(me Eqns ull/a) ^{1/3}		100 ft Inter
	Begin Merging (touch) = 219.1 220.0 240.0 240.0 260.0 280.0 300.0 340.0	42.67 48.77 54.86 60.96 67.06 79.25 85.34 91.44 97.54 112.78 128.02 143.26 158.50 188.98 210.40 219.46 249.94 2219.46 249.94 2310.90 341.38 371.86 402.34	#N/A #N/A #N/A #N/A #N/A #N/A #N/A #N/A	3.30 3.30 3.29 3.29 3.29 3.29 3.29 3.28 3.28 3.28 3.28 3.28 3.27 3.27 3.22 3.22 3.22 3.22 3.22 3.22		V'=V _{touch} +(Merged Plu V={n(V ³ a) _{ft}	Vm-Vtouch)*(me Eqns ull/a) ^{1/3}		100 ft Inter
	Begin Merging (touch) = 219.1 220.0 2240.0 2420.0 2420.0 2420.0 2420.0 280.0 280.0 280.0 280.0 380.0 380.0 380.0 380.0 380.0 380.0 500.0 1000.0 11000.0 1200.0 1400.0 1500.0 2000.0	42.67 48.77 54.86 60.96 67.06 73.15 79.25 85.34 97.54 112.78 128.02 143.26 158.50 210.40 219.46 229.94 280.42 310.90 371.86 402.34 371.86 402.34 402.34 402.34 285.522	#NVA #NVA #NVA #NVA #NVA #NVA #NVA #NVA	3,30 3,30 3,29 3,29 3,29 3,22 3,22 3,22 3,22 3,22		V'=V _{touch} +(Merged Plu V={n(V ³ a) _{ft}	Vm-Vtouch)*(me Eqns ull/a) ^{1/3}		100 ft Intern
	Begin Merging (touch) = 219.1 220.0 240.0 240.0 260.0 280.0 320.0 340.0	42.67 48.77 54.86 60.96 67.06 79.25 85.34 97.44 97.54 112.78 128.02 143.26 219.40 210.40 219.	#NVA #NVA #NVA #NVA #NVA #NVA #NVA #NVA	3,30 3,30 3,29 3,29 3,29 3,29 3,29 3,22 3,22 3,22		V'=V _{touch} +(Merged Plu V={n(V ³ a) _{ft}	Vm-Vtouch)*(me Eqns ull/a) ^{1/3}		100 ft Inter
	Begin Merging (touch) = 219.1 220.0 2240.0 2260.0 2280.0 2380.0 3300.0 340.0 340.0 340.0 360.0	42.67 48.77 54.86 60.96 67.06 73.15 79.25 85.34 91.44 97.54 112.78 128.02 1143.26 1158.50 188.98 220.40 2219.46 2249.94 2280.42 310.99 311.99 317.86 337.186 249.54 249.54 249.54 249.54 249.54 249.55 22 310.99 317.86 249.54 249.55 25 25 317.86 317.	#NVA #NVA #NVA #NVA #NVA #NVA #NVA #NVA	3,300 3,300 3,229 3,229 3,229 3,229 3,229 3,229 3,229 3,229 3,229 3,229 3,229 3,229 3,229 3,229 3,229 3,229 3,229 2,290 2,270 2,270 2,255 2,247		V'=V _{touch} +(Merged Plu V={n(V ³ a) _{ft}	Vm-Vtouch)*(me Eqns ull/a) ^{1/3}		100 ft Intern
	Begin Merging (touch) = 219.1 220.0 240.0 240.0 280.0 280.0 320.0 320.0 340.0 340.0 380.0 390.0 300.0 300.0	42.67 48.77 54.86 60.96 67.06 79.25 85.34 91.44 97.54 112.78 112.78 112.78 112.80 210.40 219.46 210.40 219.46 229.94 2280.42 310.90 371.86 402.34 41.33 371.86 402.34 41.32 586.52 573.76 586.22 573.76 586.22 573.76 586.22 573.76 586.22 573.76 576.57 576.57 576.57 576.57 576.57 576.57 576.57 576.57 576.57 576.57 576.57 576.57 576.57 576.57 576.57 577.577 577.57 5777.57 577.5777.5777.577777.577777777	#N/A #N/A #N/A #N/A #N/A #N/A #N/A #N/A	3,30 3,30 3,29 2,94		V'=V _{touch} +(Merged Plu V={n(V ³ a) _{ft}	Vm-Vtouch)*(me Eqns ull/a) ^{1/3}		100 ft Intern
	Begin Merging (touch) = 219.1 220.0 2240.0 2260.0 2280.0 2380.0 3300.0 340.0 340.0 340.0 360.0	42.67 48.77 54.86 60.96 67.06 73.15 79.25 85.34 91.44 97.54 112.78 128.02 1143.26 1158.50 188.98 220.40 2219.46 2249.94 2280.42 310.99 311.99 317.86 337.186 249.54 249.54 249.54 249.54 249.54 249.55 22 310.99 317.86 249.54 249.55 25 25 317.86 317.	#NVA #NVA #NVA #NVA #NVA #NVA #NVA #NVA	3,30 3,30 3,20 3,22		V'=V _{touch} +(Merged Plu V={n(V ³ a) _{ft}	Vm-Vtouch)*(me Eqns ull/a) ^{1/3}		50 ft interva



			ioyant Plumes			ditie - · · ·	Various Heinter in the M	ad .
	rnē ⊵valua						Various Heights in the Merg /, Queensland, Australia," [
Ambient Conditions:							eutral conditions (dθ/dz=0 or	
Ambient Potential Temp θ_a	302.21	Kelvins	84.3	°F			meters/feet	
Plume Exit Conditions:	04.00				Gravity g		m/s ²	
Stack Height hs Individual Stack Diameter D		meters	80	feet-inches inches	λ	1.11		
Stack Velocity Vexil	11.51			ft/sec	λ _o 4Vol/(60πE			
Individual Volumetric Flow		cu.m/sec	257,143		πV _{exit} D ² /4	/		Sect.2/¶1
Stack Potential Temp θ _s	313.32	Kelvins	104.3	°F				
Initial Stack Buoyancy Flux F		m ⁴ /s ³	20.0	ΔT(°F)			ol. Flow(g/ π)(1- θ_a/θ_s)	Sect.2/¶1
Plume Buoyancy Flux F		m ⁴ /s ³			λ ² gVa ² (1-θ	_a /θ _p) for a,V	,θ _p at plume height (see belo	w)
Total Number of Stacks n		meters	07.4	feet	Calas hass	d on multipl	e plume treatment in Peter Be	ot Donori
Average Adjacent Stack Separation d Number of Stacks along Orientation N	0.23	meters	21.1	IBEL			ased by N ^{0.25} at the height whe	
Number of Otacks along Orientation N							blow ht, single merged stack a	
Conditions at End (Top) of Jet Phase:								
Height above Stack z _{jet}	22.900	meters*	75.1	feet*	z _{jet} = 6.250), meters*=	meters above stack top	Sect.3/¶1
Height above Ground z _{jet} +hs		meters	155.1					
Vertical Velocity V _{jet}	5.755			ft/sec	V _{jet} = 0.5V	_{exit} = V _{exit} /2	Conservation of momentum	
Plume Top-Hat Diameter 2ajet	7.320	meters	24.0	feet	2a _{jet} = 2D		Conservation of momentum	
pillane Methodology - Analytical Solutions	for Calm Cor	ditions for	Plume Heigh	s above Je	t and Merg	ing Phase	S	
Single Plume-averaged Vertical Velocit			-					
Single Plume Values: Plume Top-Hat Radius a	Us	d in Plum	e Merging On		a = 0.16(z-	z _v), or linea	ar increase with height	Sect.2/Eq.6
Virtual Source Height z _v		meters*		feet*	z _v = 6.25D	$[1-(\theta_{e}/\theta_{s})^{1/2}]$], meters*=meters above stack top	
Height above Ground zv+hs		meters		feet	(04) 3	405 7 1	where $(\theta_a/\theta_s)^{1/2} = (\theta_e/\theta_s)^{1/2} =$	
Single Plume Values: Vertical Velocity V Product (Va) _o			e Merging On	y	{(Va) _o ³ + 0 V _{exit} (D/2)(θ		_v) ² - (6.25D-z _v) ²]} ^(1/3) / a	Sect.2.1(6)
Product (Va)	20.709	111 / 5			* exit(⊡/∠)(0	er Vs/		
Plume Merging - Based on Single Plume Ca	culations wh	ere:						Sect.3/¶3
Begin Merging Plume Top-Hat Diameter 2atouch		meters	27.1	feet	2a _{touch} =d,	or a _{touch} =d/	2)	
Height above Stack z _{touch}	26.191	meters*		feet*			meters*=meters above stack	top
Height above Ground ztouch+hs		meters	165.9					
Vertical Velocity V _{touch}	5.068			ft/sec			F _o [(z-z _v) ² - (6.25D-z _v) ²]} ^(1/3)	
Total Merging Plume Top-Hat Diameter 2a _{full} Height above Stack z _{full}		meters meters*	189.5				ull=d(N-1)/2) FOR 2 STACKS	
Height above Ground z _{full} +hs	205.262		673.4		$z_{full} = z_v + z$	u/(2 0.10),	meters*=meters above stack	top
Vertical Velocity V _{full}				ft/sec	V _{full} = {(Va) _o ³ + 0.12F	$[(z_{full}-z_y)^2 - (6.25D-z_y)^2])^{(1/3)}$	/ a _{full}
Product (V ³ a) _{ful}		m ⁴ /s ³						
Conditions at End (Top) of Merging Phase - D	efine new valu	ies for V _{full} a	and a _{full} in Merç	ed Plume c	alculations	(based on 1	TOTAL number of stacks):	
Merged Plume Values: Plume Diameter 2a			Table Below				z _{full})), or linear increase with	neight
Revised Merged Plume Radius am		meters	241.2				here Total Merging Occurs	
Revised Merged Plume Velocity V _m Revised Virtual Source Height z _{ful}	3.462	m/s meters*	593.4	ft/sec			where Total Merging Occurs nere Total Merging Occurs (st	our abour)
Revised Vertical Velocity V			Tables Below				eights above total merging el	
							z-z _{touch})/(z _{full} -z _{touch})	
Multiple Plume Calculations					, , ,		for heights below total mergi	ng elevation
Solve for plume-averaged vertical velo	city at height	540.0	feet	164.592	meters abo			
Gives the following Height above Stack z	140.208		460.0				MERGING PHASE-INTERPO	LATE
Plume Top-Hat Radius a Vertical Velocity V	#N/A 3.885	meters	#N/A	feet ft/sec	a=a _m +0.16 V={n(V ³ a) _f			
Venteal Velocity V	0.000	11/3	12.14	10300			ztull (z'-Ztouch)/(Zfull-Ztouch) if Ztouch	Z <zfull< td=""></zfull<>
							s if z <z<sub>touch</z<sub>	
Solve for Height of CASC critical vertical	velocity V _{crit}	5.30	m/s		BEFORE 1	OUCHING	Critical	VV < Top of
Find Height above Stack z _{crit}	JET	meters		feet			/(V _{crit}) ³]-a _m }/0.16 if V _{crit} <v<sub>m</v<sub>	
Height above Ground z _{crit} +hs	JET	meters	JET	feet	Z _{crit} =Z _{touch} 4	(Zfull=Ztouch)	*(V _{crit} -V _{touch})/(V _m -V _{touch}) if V _c	rit>Vm
	(- iti te		abias Heisbe		Cinela Dhu		an Cinala Divana anaradahan	
Table of MERGED Plume-Averaged Vertical Height (feet)			Vert.				ee Single Plume spreadsheet _) ² -(6.25D-z_) ²]} ^{1/3} / a)
above ground	. ,				a = 0.16(z-		v) (0.202 20/ <u>1</u>) / 2	
Begin Merging (touch) = 165.9	26.18	4.125					$_{xxit}D^2/(4V_{plume}*a^2*\lambda^2)))$	
180.0	30.48	#N/A	5.02		Interpolate	d Layer Eqr	15	20 ft Interva
200.0					V'=V _{touch} +(V _m -V _{touch})*	(z'-z _{touch})/(z _{full} -z _{touch})	
220.0								
240.0 260.0								
280.0								
300.0								50 ft Interva
350.0								
400.0								
450.0								
500.0								
550.0								
650.0								
End Merging (full/mp) = 673.4								
700.0								100 ft Interv
800.0								
900.0								
1000.0								
1100.0					Merged Plu	ime Fans		
1200.0					V={n(V ³ a) _f			
1300.0					a=a _m +0.16			
1500.0								
2000.0								
2500.0								500 ft Interv
3000.0								
3500.0								
		235.738	2 35					
4000.0 4500.0								

