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Vertical Plume Velocity Assessment

Willow Rock Energy Storage Center

Rosamond, California

Submitted to California Energy Commission

Submitted by

GEM A-CAES LLC

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ATMOSPHERIC DYNAMICS, INC Meteorological & Air Quality Modeling

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Introduction

This report presents the evaluation of the Willow Rock Energy Storage Center (WRESC) project and its potential to generate vertical turbulence from exhaust plumes from the three (3) Koehler 2.5-megawatt (MW) diesel engines, four (4) air turbine exhaust stacks, and the three (3) air cooled heat exchangers which are part of the facility's Thermal Management System (TMS). This analysis can be used to assess whether there may be any potential effects on airport/aircraft operations from exhaust plumes associated with WRESC operations. This report is based upon an analysis prepared by Atmospheric Dynamics, Inc. in furtherance of the Supplemental Application for Certification (SAFC) for the WRESC pending before the California Energy Commission (CEC)

Using stack parameter data and employing the screening model previously used by the Commission, an analysis of the potential plume characteristics from the routine operations of the air turbines, diesel engines and heat exchangers on vertical winds was prepared and compared to the CEC Staff's exhaust plume velocity 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 by Australian authorities 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 model assessment is to conservatively determine the potential for turbulence generated by the turbines, diesel engines and heat exchanger 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 in the CEC Staff's analysis is 5.3 meters per second* (m/s).

It should be noted that the basis of the original CASA derived threshold of 4.3 m/s has been lost and that CASA no longer relies on the 1998 and 2004 regulations that established this critical threshold, other than to note that an additional 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 at altitudes that have the potential to affect aviation. Further, this 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, even though these worst-case conditions typically only occur during a few hours each year. Accordingly, the screening tool presents results that are extremely "conservative" (i.e., the modeling tool tends to overstate potential impacts compared to actual impacts).

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 turbines and diesel engines, this screening tool assumption was maintained. The minimum separation of the turbine exhaust stacks are 98 meters and while all four (4) turbines will be operational during the same time, the stack separation exceeds the calculated plume radius with height. For the diesel



engines, only one (1) engine stack was modeled consistent with the normal operational testing schedule of the emergency generator engines where only one (1) engine is tested at any one time.

There will be three (3) heat exchangers utilized for the project design. On the plot plan submitted with the Supplemental Application for Certification (SAFC), all three heat exchangers are depicted as being identical in configuration. Hydrostor has further advanced the design of the heat exchangers since the submittal of the SAFC, and this thermal plume analysis reflects this most up-to-date heat exchanger information. The updated heat exchanger design will reflect a smaller, more compact configuration than depicted on the original plot plan, another conservative modeling assumption. All three heat exchangers will be located in the same general area within the facility but will occupy a smaller footprint. No other changes to the plot plan are necessitated by this minor design refinement. The updated heat exchanger design information relevant to this analysis is described below.

Two (2) of the heat exchangers in the southern portion of the project layout each consist of 36 fans, each with a 3.96-meter diameter, organized in a 12x3 arrangement. Each of these two (2) heat exchangers are separated by 36 meters. The single heat exchanger in the northern portion of the project layout consists of a single heat exchanger with 42 fans, each with a 3.96-meter diameter, organized in a 14 x 3 arrangement. For the heat exchangers, a conservative assumption was made in order to use the Spillane methodology. Here, the methodology, as described below, assumed that all 36 fans for each heat exchanger were merged into a single stack with an effective diameter based on the combined fan area of all 36 cells. In other words, a single stack was assumed to initially describe the release parameters of the combined heat exchanger fans, when in fact two exchangers are located to the south and one to the north, a conservative assumption for the screening tool inputs. During the winter months when fewer fans are operational, the effective diameter was then based on the anticipated number of operating fans given ambient temperature and metrological data. The effective stack diameter is an appropriate modeling assumption for each individual heat exchanger based on the close proximity and arrangement of the fans.

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 rise, 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

 $\{00637381;1\}$

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:

 $a = 0.16(z - z_v)$ V = {(Va)o³ + 0.12Fo [(z - zv)² - (6.25D - zv)²]}^{1/3} / a

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 (or fan) 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.

For the analysis, two ambient conditions were considered: 33.0°F, the minimum monthly mean of daily minimum temperatures, and 99.0°F, the maximum monthly mean of daily maximum temperatures for the blended data sets from Edwards Air Force Base and Mojave Air & Space Port (*"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)

Vertical Plume Velocity Calculations for the Air Turbines

The WRESC is comprised of four individual air turbine stacks. Turbine stack parameter data (plume exit velocity, plume exit temperature and stack exit diameter) were provided by Kiewit, the project engineer. Four (4) turbine stacks will be constructed with the minimum lateral distance between the turbine stacks at 98 meters. Stack parameter data for the turbines are summarized in Table 1.

	Table 1 for Vertical Plume Velocity Analys	sis
Ambient Temperature (°F)	33.0	99.0
Stack Diameter (m)	3.62	3.62
Exhaust Velocity (m/s)*	30.70	30.70
Exhaust Temperature (K)*	284.15	284.15
Stack Release Height (m)	30.5	30.5
Stack Buoyancy Flux (m ⁴ /s ³)	36.25	-91.04*
*Negative buoyancy as stack temperature is less than a	ambient temperature for the summer case	9

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 the maximum velocity expected during normal operations.

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 172.4 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 320 ft-agl for the winter case and 306 ft-agl for the summer case.

Table 2 Turbine Vertical Plume Velocity Analysis Resu	Its for Reference	Height
Ambient Temperature (°F)	33.0	99.0
Single Plume Results:		
Plume-Averaged Vertical Velocity at 500 feet-agl (m/s)	3.13	1.69
Height of 5.3 m/s Plume-Averaged Vertical Velocity (feet-agl)	319.5	305.8

These screening results indicate that mechanical and thermal turbulence levels due to the flow from the turbines always remain in the light turbulence category and below the significance level of 5.3 m/s at all heights above about 320 ft-agl. The maximum plume radius where the plumes

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from two (2) or more turbine stacks would start to merge would be 48 meters, but at this stage of the plume growth, the vertical velocity is less than 2.0 m/s, well below the 5.3 m/s significance threshold. Based on this, plume merging from multiple turbine stacks was not assessed.

Vertical Plume Velocity Calculations for the 2.5 MW Diesel Engines

The WRESC is comprised of three (3) individual 2.5 MW diesel engines and one (1) small diesel emergency fire pump. The small diesel emergency generator was not assessed as it would have much smaller plume vertical velocities than the 2.5 MW engines. The 2.5 MW generator stack parameter data (plume exit velocity, plume exit temperature and stack exit diameter) were provided by Koehler. 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 nevertheless utilized for the worst-case plume analysis. The stack data is summarized in Table 3.

Ta Koehler Diesel Stack Characteristic	ble 3 s for Vertical Plume Velocity An	alysis
Ambient Temperature (°F)*	33.0	99.0
Stack Diameter (m)	0.4453	0.4453
Exhaust Velocity (m/s)*	59.0	59.0
Exhaust Temperature (K)*	763.15	763.15
Stack Release Height (m)	22.93	22.93
Stack Buoyancy Flux (m ⁴ /s ³)	18.4016	17.0233
*Stack data provided by Koehler at 100% load		

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 3 which are based on 100 percent load.

The results based on the two ambient conditions are presented in Table 4 and the output from the calculation spreadsheet provided in Attachment A. The initial jet phase extends to a height of about 84 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 114 ft-agl for the winter case and 115 ft-agl for the summer case.

Table 4 Diesel Engine Vertical Plume Velocity Analysis Re	sults for Referen	ce Height
Ambient Temperature (°F)	33.0	99.0
Single Plume Results:		
Plume-Averaged Vertical Velocity at 300 feet-agl (m/s)	2.03	1.99
Height of 5.3 m/s Plume-Averaged Vertical Velocity (feet-agl)	113.7	114.9

These screening results indicate that mechanical and thermal turbulence levels due to the flow from the diesel engines always remain in the light turbulence category and below the significance level of 5.3 m/s at all heights above about 115 ft-agl.

Vertical Plume Velocity Calculations for the Heat Exchangers

The three (3) heat exchangers will be comprised of the following: two 36-cell systems each at 56.6 meters in length and 18.6 meters in width (in the southern portion of the facility arrangement) and a 16-cell system at 65.9 meters in length and 18.6 meters in width (in the northern portion of



the facility arrangement). The 36 cell heat exchangers are arranged with 12 cells along the longer building length by three (3) along the shorter building width. There is a 36-meter separation between the two 36-cell heat exchangers. The northern 42-cell heat exchanger is arranged in a 14 x 3 pattern with 14 cells along the length and three (3) cells along with width. There are no other heat exchangers within several hundred meters of this system.

Based on the groupings of heat exchangers and the number of operational fans during the summer and winter months, the screening tool analyses were based on the following:

Two 36 cell heat exchangers

- 72 operational fans during the summer months
- 22 operational fans during the winter months
- 3.96 meter cell diameter •

One 42 cell heat exchanger

- 42 operational fans during the summer months •
- 8 operational fans during the winter month
- 3.96 meter cell diameter

The merging of plumes between adjacent heat exchangers was based on the two 36 heat exchanger arrangements for both summer and winter conditions. Heat exchanger stack parameter data (exit velocity and temperature) were provided by the applicant. An effective stack diameter was calculated based on the number of operating fans (cells). The heat exchangers will utilize single speed fans and the number of fans that are operational are dependent upon ambient temperature and plant load. However, to be conservative, the fans/cells were assumed to be operating at full load during the summer and winter periods. This data are summarized in Table 5 for the same ambient temperatures used for the turbine and engine analyses.

Tal Heat Exchanger Stack Characteristic	ole 5 es for Vertical Plume Velocity A	nalvsis
Ambient Temperature (°F)*	33.0	99.0
12 x 3 Heat Exchanger		
Effective Stack Diameter (m)**	13.142	23.774
Exhaust Velocity (m/s)*	9.91	9.91
Exhaust Temperature (K)*	312.04	327.04
Stack Release Height (m)	9.91	9.91
Stack Buoyancy Flux (m ⁴ /s ³)	466.75	633.84
14 x 3 Heat Exchanger		
Effective Stack Diameter (m)**	11.21	25.68
Exhaust Velocity (m/s)*	7.83	7.83
Exhaust Temperature (K)*	312.04	318.15
Stack Release Height (m)	8.36	8.36
Stack Buoyancy Flux (m ⁴ /s ³)	296.29	309.68
*Heat exchanger stack data provided by the applicant. Ve	locity based on ACFM per fan multipli	ed by the number of

operating fans. * As an example the calculated value based on the cell diameter multiplied by the square of the number of operating

cells, or for Case 2 Summer for the 12x3 heat exchanger, $D_{eff} = 3.96"^*\sqrt{36} = 23.774$

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 {00637381;1}



above, the heat exchangers are arranged in a 12 x 3 and 14 x 3 pattern. For the individual heat exchangers, all operating cells were merged into a single effective stack, thus each temperature case with different operational fans have a different effective stack diameter. In other words, each individual heat exchanger was modeled as a single merged stack based on the number of operational cells. For the merging of plumes between the two 12 x 3 heat exchangers, the enhanced Spillane methodology was based on calculating the total merging height for the linear y direction (separation) of 36 meters between each of the 12 x 3 heat exchangers. Thus, the merged plume analysis was based on the two effective stack diameters for winter and summer conditions. The largest grouping of 72 cells ($12 \times 3 \times 2$ heat exchangers) during the summer 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 with the effective single stack diameter of each heat exchanger based on the combined 36 cells each. The winter case used a grouping of 22 cells (11 from each heat exchanger) with the effective diameter based on the combined 11 cells for each unit.

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 6 and the output from the calculation spreadsheets are provided in Attachment A.

For the 12 x 3 heat exchangers, the initial jet phase extends to a height of about 302 ft-agl for the winter case and 520 ft-agl for the summer case. The critical plume-averaged vertical velocity of 5.3 m/s occurs in the jet phase at about 253 ft-agl for winter and 431.5 ft-agl for summer. The plumes touch (begin to merge) at about 414 ft-agl and are fully merged at about 788 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).

For the 14 x 3 heat exchanger, the initial jet phase extends to a height of about 257.2 ft-agl for the winter case and 554 ft-agl for the summer case. The critical plume-averaged vertical velocity of 5.3 m/s occurs in the jet phase at about 176 ft-agl for winter and at 368 ft-agl for summer. Plume merging with adjacent heat exchangers was not assumed as noted above.

Table 6 Heat Exchanger Vertical Plume Velocity Analysis R	esults for Referen	ce Height
Ambient Temperature (°F)	33.0	99.0
12 x 3 Heat Exchanger		
Single Plume Results:		
Height of 5.3 m/s Plume-Averaged Vertical Velocity (Within the Jet Phase, feet-agl)	253.0	431.5
Merged Plume Results:		
Plume-Averaged Vertical Velocity at 600 feet-agl (m/s)	4.20	4.27
14 x 3 Heat Exchanger		
Single Plume Results:		
Height of 5.3 m/s Plume-Averaged Vertical Velocity (Within the Jet Phase, feet-agl)	124.8	376.1
Merged Plume Results:		
Plume-Averaged Vertical Velocity at 600 feet-agl (m/s)	NA	NA

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 432 ft-agl for either type of the heat exchangers. The heights at which plume-averaged vertical velocities exceed 5.3 m/s only occur during the jet phase for all heat exchanger cases.

Conclusion

These modeled cases all represent worst-case conditions of calm winds at all vertical levels of a neutral atmosphere. These results indicate that mechanical and thermal turbulence levels due to the exhaust flow from the turbines, diesel engines or heat exchangers will always remain in the light turbulence category and below the significance level of 5.3 m/s at all heights above 432 ft-agl. Additionally, the plume radius for all assessments results in small plume diameters. The calculated vertical plume velocities of the WRESC conclude that none are expected to generate severe turbulence at altitudes for normal aircraft operations.

It should be further noted that 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. The calculations, as shown in the tables above, are likely to overestimate the expected vertical velocities, for the following principal 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.



Attachment A Spillane Method Plume Velocity Calculations



	"Aviation Sa	fety and Buo	yant Plumes	," Peter Be	st, et. al.			
	"The Evaluat	ion of Maxin	num Updraft	Speeds for	Calm Con	ditions at V	arious Heights in the Plum	e
		from a Gas-	Turbine Pow	er Station a	at Oakey, Q	ueensland	Australia," Dr. K.T. Spilla	ne
mbient Conditions:					Constants:	Assume ne	eutral conditions (d0/dz=0 or	θ _a =θ _e)
Ambient Potential Temp θ_a	273.71	Kelvins	33.0	°F		0.3048	meters/feet	
lume Exit Conditions:					Gravity g	9.81	m/s ²	
Maximum Stack Height hs	30.48	meters	100	feet-inches	λ			
Stack Diameter D	3.6200	meters	142.5	inches	λο	~1.0		
Stack Velocity V _{exit}	30.70	m/s	100.72	ft/sec				
Volumetric Flow		cu.m/sec	669,497		πV _{exit} D ² /4			Sect.2/¶1
Stack Potential Temp θ _s		Kelvins		°F	···· exit= / ·			
Initial Stack Buoyancy Flux Fo	36.2508		02		aVD ² (1.4) A V4 = V	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	
No.of Stacks N	1			1 000			cation Factor (N ^{0.25})	
NU.UI STACKS N				1.000	wuttpie St	аск мишри	cation Factor (N)	
onditions at End (Top) of Jet Phase:								
	22.025		74.0	6	- 0.055		matara ahara atash tan	Cash 2/E4
Height above Stack z _{jet}		meters*	174.2	feet*	Zjet = 0.25L	J, meters =	meters above stack top	Sect.3/¶1
Height above Ground z _{jet} +h _s		meters			V 0.5V	N/ 10		
Vertical Velocity V _{jet}	15.350			ft/sec		_{exit} = V _{exit} /2	0	
Plume Top-Hat Diameter 2a _{jet}	7.240	meters	23.8	teet	2a _{jet} = 2D		Conservation of momentum	"
pillane Methodology - Analytical Solutions f			-					
Single Plume-averaged Vertical Velocity		-		er where P			•	
Plume Top-Hat Radius a	S	olutions in T	able Below				crease with height	Sect.2/Eq.6
Virtual Source Height z _v	0.420	meters*	1.4	feet*	6.25D[1-(θ	$(\theta_{s})^{1/2}$], met	ers*=meters above stack top	Sect.2/Eq.6
Height above Ground zv+hs	30.900	meters	101.4	feet			where $(\theta_a/\theta_s)^{1/2} = (\theta_e/\theta_s)^{1/2} =$	0.9815
Vertical Velocity V	S	olutions in T	able Below		${(Va)_0}^3 + 0$	12F _o [(z-z.	/) ² - (6.25D-z _v) ²]) ^(1/3) / a	Sect.2.1(6)
Product (Va) _o	54.537	m²/s			V _{exit} D/2(θ _e /			
Solve for plume-averaged vertical veloc	city at height	500.0	feet	152.4	meters abo	ve ground (z'+h₀)	
Gives the following Height above Stack z'	121.920		400.0		meters abe	vic ground (2 (11s)	
Plume Top-Hat Diameter 2a'		meters	127.6		2a'=2*0.16	(Sect.2/Eq.6
							2 (0.05D -) ² 1) ^(1/3) ((0-1(0))	
Vertical Velocity V	3.125	m/s	10.25	ft/sec	v={(va) ₀ *+	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			m/s plume-a	-				/ > Top of Jet (Spillar
Find Height above Stack z _{crit}	66.916	meters	219.5	feet	Solve for x:	=(z-z _v) simu	Itaneously in both eqs. (i.e.,	Va and a)
Height above Ground zcrit+hs	97.396	meters	319.5	feet	for V=4.3 n	n/s using th	e cubic equation ax3+bx2+cx	(+d=0, where
						-	and b=-(0.12Fo)/(4.330.163)=	
Interpolated Height of critical vertical ve	locity in Jet	Phase:			and o		.25D-z _v) ² -(Va) _o ³]/(4.3 ³ 0.16 ³)=	
Find Height above Stack z _{crit}		meters	#N/A	feet		. [/www.1728.org/cubic.h
Height above Ground z _{crit} +h _s	·			1001				
rieigin above oround zent ms			#N/Δ	foot		nive	is the real solution x - 7-7v -	66.40
	#IN/A	meters	#N/A	feet		give	is the real solution $x = z - zv =$	
	#IN/A	meters	#N/A	feet		give	or z(m/above stack) =	66.9
able of Plume Ton-Hat Diamotors (20) and P					d of ist st			66.9
	lume-Averag	ed Vertical	Velocities sta	arting at er	nd of jet ph		or z(m/above stack) =	66.9
Height (feet)	lume-Averag (meters)	ed Vertical ' Plume	Velocities sta SingleStk	arting at er Plume			or z(m/above stack) =	66.9
Height (feet) above ground	lume-Averag (meters) above stack	ed Vertical Plume Radius(m)	Velocities sta SingleStk VertVel(m/s)	arting at er Plume Temp(K)			or z(m/above stack) =	66.9
Height (feet) above ground <u>Stack.Rel.Ht = 100.0</u>	lume-Averag (meters) above stack <i>0.00</i>	ed Vertical Plume Radius(m) 1.810	Velocities sta SingleStk VertVel(m/s) 30.70	arting at er Plume Temp(K)			or z(m/above stack) = z(ft/above ground) =	- 66.9 - 31
Height (feet) above ground Stack. Rel. Ht = 100.0 110.0	lume-Averag (meters) above stack <i>0.00</i> 3.05	ed Vertical Plume Radius(m) 1.810 2.054	Velocities sta SingleStk VertVel(m/s) 30.70 28.63	arting at er Plume Temp(K)			or z(m/above stack) = z(ft/above ground) = Jet Phase Eqs:	66.9 31
Height (feet) above ground <u>Stack.Rel.Ht = 100.0</u>	lume-Averag (meters) above stack <i>0.00</i>	ed Vertical Plume Radius(m) 2.054 2.316	Velocities sta SingleStk VertVel(m/s) 28.63 26.58	arting at er Plume Temp(K)			or z(m/above stack) = z(ft/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R	66.1 31
Height (feet) above ground Stack.Rel.Ht = 100.0 110.0	lume-Averag (meters) above stack <i>0.00</i> 3.05	ed Vertical Plume Radius(m) 2.054 2.316	Velocities sta SingleStk VertVel(m/s) 28.63 26.58	arting at er Plume Temp(K)			or z(m/above stack) = z(ft/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations:	66. 31 10 foot Interv ReLHt to Top of Jet
Height (feet) above ground Stack. Rel. Ht = 100.0 110.0 120.0	lume-Averag (meters) above stack 0.00 3.05 6.10	ed Vertical ' Plume Radius(m) 2.054 2.316 2.569	Velocities sta SingleStk VertVel(m/s) 28.63 26.58 24.53	arting at er Plume Temp(K)			or z(m/above stack) = z(ft/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R	66. 31 10 foot Interv ReLHt to Top of Jet
Height (feet) above ground <i>Stack. Rel. Ht = 100.0</i> 110.0 120.0 130.0	lume-Averag (meters) above stack 0.00 3.05 6.10 9.14	ed Vertical ' Plume Radius(m) 2.054 2.316 2.569 2.822	Velocities sta SingleSta VertVel(m/s) 28.63 26.58 24.53 22.47	arting at er Plume Temp(K)			or z(m/above stack) = z(ft/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations:	31 31 10 foot Interv ReLHt to Top of Jet
Height (feet) above ground Stack. Rel. Ht = 100.0 110.0 120.0 130.0 140.0	lume-Averag (meters) above stack 0.00 3.05 6.10 9.14 12.19	ed Vertical 1 Plume Radius(m) 2.054 2.316 2.569 2.822 3.075	Velocities sta SingleStk VertVel(m/s) 28.63 26.58 24.53 22.47 20.41	arting at er Plume Temp(K)			or z(m/above stack) = z(ft/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: V _{plume} =((Va) _o ³ +0.12F _n ((z-z _v) ² -(6.2 a = 0.16(z-z _v)	10 foot Interv tel-Ht to Top of Jet 25D-z,) ²]) ¹⁰ / a 20 foot Interv
Height (feet) above ground Stack.Rel.Ht = 100.0 110.0 120.0 130.0 140.0 150.0	lume-Averag (meters) above stack 0.00 3.05 6.10 9.14 12.19 15.24	ed Vertical 1 Plume Radius(m) 2.054 2.316 2.569 2.822 3.075 3.328	Velocities sta SingleStk VertVel(m/s) 28.63 26.58 24.53 22.47 20.41 18.35	arting at er Plume Temp(K)			or z(m/above stack) = z(ft/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: V _{plums} =((Va) ₀ ³ +0.12F ₀ ((z-z,) ² -(6.2	10 foot Interv tel-Ht to Top of Jet 25D-z,) ²]) ¹⁰ / a 20 foot Interv
Height (feet) above ground Stack. Rel. Ht = 100.0 110.0 120.0 130.0 140.0 150.0 160.0 170.0	lume-Averag (meters) above stack 0.00 3.05 6.10 9.14 12.19 15.24 18.29 21.34	ed Vertical 1 Plume Radius(m) 2.054 2.316 2.569 2.822 3.075 3.328 3.581	Velocities sta SingleStk VertVel(m/s) 28.63 26.58 24.53 22.47 20.41 18.35 16.29	arting at er Plume Temp(K)			or z(m/above stack) = z(ft/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: V _{plume} =((Va) _o ³ +0.12F _n ((z-z _v) ² -(6.2 a = 0.16(z-z _v)	10 foot Interv tel-Ht to Top of Jet 25D-z,) ²]) ¹⁰ / a 20 foot Interv
Height (feet) above ground Stack.Rel.Ht = 100.0 110.0 120.0 130.0 140.0 150.0 160.0 177.0 Top of jet = 174.2	lume-Averag (meters) above stack 0.00 3.05 6.10 9.14 12.19 15.24 18.29 21.34 22.62	ed Vertical ¹ Plume Radius(m) 2.054 2.316 2.659 2.822 3.075 3.328 3.581 3.620	Velocities sta SingleStk VertVel(m/s) 30.70 28.63 26.58 24.53 22.47 20.41 18.35 16.29 15.35	arting at er Plume Temp(K)			or z(m/above stack) = z(ft/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: V _{plume} =((Va) _o ³ +0.12F _n ((z-z _v) ² -(6.2 a = 0.16(z-z _v)	10 foot Interv tel-Ht to Top of Jet 25D-z,) ²]) ¹⁰ / a 20 foot Interv
above ground Stack. Rel. Ht = 10.0 110.0 120.0 130.0 140.0 150.0 160.0 170.0 Top of jet = 174.2 180.0	lume-Averag (meters) above stack 0.00 3.305 6.10 9.14 12.19 15.24 18.29 21.34 22.62 24.38	ed Vertical 1 Plume Radius(m) 2.054 2.316 2.569 2.822 3.075 3.328 3.581 3.620 3.834	Velocities stat SingleStak VertVel(m/s) 30.707 28.63 26.58 24.53 22.47 20.41 18.35 16.29 15.35 14.23	Plume Temp(K)			or z(m/above stack) = z(ft/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: V _{plume} =((Va) _o ³ +0.12F _n ((z-z _v) ² -(6.2 a = 0.16(z-z _v)	: 66: : 31 10 foot Interv keLH to Top of Jet 20 foot Interv m ^a ^{1a} ^a ^x ²)))
Height (feet) above ground Stack. Rel. Ht = 100.0 110.0 120.0 130.0 140.0 150.0 160.0 160.0 170.0 Top of jet = 174.2 180.0 200.0	lume-Averag (meters) above stack 0.00 3.05 6.10 9.14 12.19 15.24 18.29 21.34 22.62 24.33 30.48	ed Vertical Plume Radius(m) 2.054 2.316 2.822 3.075 3.328 3.581 3.620 3.834 4.810	Velocities stat Single Stk VertVel(m/s) 28.63 26.58 24.453 22.47 20.41 18.35 16.29 15.35 14.23 11.38	arting at er Plume Temp(K) 277.63 276.83			or z(m/above stack) = z(ft/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: V _{plume} =((Va) _o ³ +0.12F _n ((z-z _v) ² -(6.2 a = 0.16(z-z _v)	: 66: : 31 10 foot Interv keLH to Top of Jet 20 foot Interv m ^a ^{1a} ^a ^x ²)))
Height (feet) above ground Stack. Rel. Ht = 100.0 110.0 120.0 130.0 140.0 150.0 160.0 170.0 Top of jet = 174.2 180.0 200.0 220.0	lume-Averagg (meters) above stack 0.00 3.05 6.10 9.14 12.19 15.24 18.29 21.34 22.62 24.38 3.0.48 3.6.58	ed Vertical 1 Plume Radius(m) 2.054 2.316 2.569 2.822 3.075 3.328 3.581 3.620 3.834 4.810 5.785	Velocities sta SingleStk VertVel(m/s) 28.63 26.58 22.47 20.41 18.35 16.29 15.35 14.23 11.38 9.50	arting at er Plume Temp(K) 277.63 276.83 276.29			or z(m/above stack) = z(ft/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: V _{plume} =((Va) _o ³ +0.12F _n ((z-z _v) ² -(6.2 a = 0.16(z-z _v)	: 66. : 31 10 foot Interv keLH to Top of Jet E(D-z,) ²) ^{1/3} / a 20 foot Interv m ^a ¹ ^{a²} ³ ²)))
Height (feet) above ground Stack. Rel. Ht = 100.0 110.0 120.0 130.0 140.0 150.0 160.0 170.0 Top of jet = 174.2 180.0 220.0 220.0 240.0	lume-Averagy (meters) above stack 0.00 3.05 6.10 9.14 12.19 15.24 18.29 21.34 22.62 24.38 30.44 36.58 30.42	ed Vertical 1 Plume Radius(m) 2.054 2.316 2.569 2.822 3.075 3.328 3.581 3.620 3.834 4.810 5.785 6.760	Velocities sta SingleStk VertVel(m/s) 28.63 26.58 24.53 22.47 20.41 18.35 16.29 15.35 14.23 11.38 9.50 8.16	277.63 276.83 276.29 275.91			or z(m/above stack) = z(ft/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: V _{plume} =((Va) _o ³ +0.12F _n ((z-z _v) ² -(6.2 a = 0.16(z-z _v)	: 66. : 31 10 foot Interv keLH to Top of Jet E(D-z,) ²) ^{1/3} / a 20 foot Interv m ^a ¹ ^{a²} ³ ²)))
Height (feet) above ground Stack.Rel.Ht = 100.0 110.0 120.0 130.0 140.0 150.0 160.0 177.0 Top of jet = 174.2 180.0 200.0 220.0 240.0 260.0	lume-Averag (meters) above stack 0.000 3.005 6.10 9.14 12.19 15.24 18.29 21.34 22.62 24.38 30.48 30.48 36.58 42.67 48.77	ed Vertical 1 Plume Radius(m) 1.8:10 2.054 2.316 2.569 2.822 3.075 3.328 3.581 3.620 3.834 4.810 5.785 6.760 7.736	Velocities stat SingleStk VertVel(m/s) 28.63 26.58 24.53 22.47 20.41 18.85 16.29 15.35 14.23 11.38 9.500 8.16 7.16	277.63 276.83 276.83 276.92 275.91 275.62			or z(m/above stack) = z(ft/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: V _{plume} =((Va) _o ³ +0.12F _n ((z-z _v) ² -(6.2 a = 0.16(z-z _v)	: 66: : 31 10 foot Interv tel/H to Top of Jet 25D z.) ²]) ^{1/2} / a 20 foot Interv me [*] a ² *A ²))) Max<5.30 f
Height (feet) above ground Stack. Rel. Ht = 100.0 110.0 120.0 130.0 140.0 150.0 160.0 170.0 Top of jet = 174.2 180.0 220.0 240.0 260.0 280.0	lume-Averagy (meters) above stack 0.000 3.05 6.10 9.14 12.19 15.24 18.22 21.34 22.62 24.38 30.48 36.58 30.48 36.58 42.67 48.77 54.86	ed Vertical 1 Plume Radius(m) 1.8:10 2.054 2.316 2.569 2.822 3.075 3.328 3.3266 3.3266 3.32666 3.32666 3.3266 3.32666 3.32666 3.32	Velocities stat Single Stk VertVel(m/s) 28.63 24.63 24.53 22.47 20.41 18.35 16.29 15.53 14.23 11.38 9.55 8.16 7.16 6.40	arting at er Plume Temp(K) 277.63 276.83 276.29 275.91 275.62 275.91 275.62 275.40			or z(m/above stack) = z(ft/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: V _{plume} =((Va) _o ³ +0.12F _n ((z-z _v) ² -(6.2 a = 0.16(z-z _v)	: 66. 31 10 foot Interv telH to Top of Jet 25D z.) ²] ^{1/3} / a 20 foot Interv 20 foot Interv me [*] a [*] ³ ³)))
Height (feet) above ground Stack.Rel.Ht = 100.0 110.0 120.0 130.0 140.0 150.0 160.0 170.0 Top of jet = 174.2 180.0 200.0 220.0 240.0 260.0	lume-Averag (meters) above stack 0.000 3.005 6.10 9.14 12.19 15.24 18.29 21.34 22.62 24.38 30.48 30.48 36.58 42.67 48.77	ed Vertical 1 Plume Radius(m) 1.8:10 2.054 2.316 2.569 2.822 3.075 3.322 3.3581 3.620 3.834 4.810 5.785 6.760 7.736 8.711	Velocities stat Single Stk VertVel(m/s) 28.63 24.63 24.53 22.47 20.41 18.35 16.29 15.53 14.23 11.38 9.55 8.16 7.16 6.40	277.63 276.83 276.29 275.62 275.62 275.91			or z(m/above stack) = z(ft/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: V _{plume} =((Va) _o ³ +0.12F _n ((z-z _v) ² -(6.2 a = 0.16(z-z _v)	: 66. 31 10 foot Interv telH to Top of Jet 25D z.) ²] ^{1/3} / a 20 foot Interv 20 foot Interv me [*] a [*] ³ ³)))
Height (feet) above ground Stack. Rel. Ht = 100.0 110.0 120.0 130.0 140.0 150.0 160.0 170.0 Top of jet = 174.2 180.0 220.0 240.0 260.0 280.0	lume-Averagy (meters) above stack 0.000 3.05 6.10 9.14 12.19 15.24 18.22 21.34 22.62 24.38 30.48 36.58 30.48 36.58 42.67 48.77 54.86	ed Vertical Plume Radius(m) 1.810 2.054 2.316 2.569 2.822 3.075 3.328 3.620 3.834 4.810 5.785 6.760 7.736 8.711 9.686	Velocities stat Single Stk VertVel(m/s) 28.63 26.58 24.53 22.47 20.41 18.35 16.29 15.35 14.23 11.38 9.50 8.16 7.16 6.40 5.79	277.63 276.83 276.29 275.62 275.62 275.62 275.62 275.64 275.62 275.40 275.22			or z(m/above stack) = z(ft/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: V _{plume} =((Va) _o ³ +0.12F _n ((z-z _v) ² -(6.2 a = 0.16(z-z _v)	: 66. 31 10 foot Interv telH to Top of Jet 25D z.) ²] ^{1/3} / a 20 foot Interv 20 foot Interv me [*] a [*] ³ ³)))
Height (feet) above ground Stack. Rel. Ht = 100.0 110.0 130.0 140.0 150.0 160.0 160.0 160.0 160.0 160.0 200.0 220.0 240.	lume-Averag (meters) above stack 0.00 3.05 6.10 9.14 12.19 15.24 18.29 21.34 22.62 24.33 30.48 36.58 42.67 48.77 54.86 60.96	ed Vertical 1 Plume Radius(m) 2.054 2.316 2.569 2.822 3.075 3.328 3.581 3.620 3.834 4.810 5.785 6.760 7.736 8.711 9.665 10.639	Velocities stat SingleStat VertVel(m(s)) 28.63 26.58 22.473 22.474 20.41 18.35 16.29 15.35 14.23 11.38 9.50 8.16 7.16 6.40 5.79 5.30	arting at er Plume Temp(K) 277.63 276.83 276.29 275.91 275.62 275.40 275.22 275.40 275.20			or z(m/above stack) = z(ft/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: V _{plume} =((Va) _o ³ +0.12F _n ((z-z _v) ² -(6.2 a = 0.16(z-z _v)	10 foot Interv tel-Ht to Top of Jet 25D-z,) ²]) ¹⁰ / a 20 foot Interv
Height (feet) above ground Stack. Rel. Ht = 100.0 110.0 120.0 130.0 140.0 150.0 160.0 170.0 Top of jet = 174.2 180.0 220.0 240.0 240.0 260.0 280.0 300.0 Spillane 5.3 m/s Height = 319.5	lume-Averagg (meters) above stack 0.00 3.05 6.10 9.14 12.19 15.24 18.29 21.34 22.62 24.33 3.0.48 3.0.48 3.6.58 4.2.67 4.8.77 5.4.86 6.0.96 6.6.92	ed Vertical 1 Plume Radius(m) 1.8:10 2.054 2.366 2.569 2.822 3.075 3.328 3.581 3.620 3.834 4.810 5.785 6.760 7.736 8.711 9.666 10.639 12.125	Velocities stat SingleStak VertVel(m/s) 28.63 26.68 24.53 22.47 20.41 18.35 16.29 15.55 14.23 11.38 9.50 8.16 7.16 6.40 5.79 5.30 4.70	277.63 276.83 276.83 276.29 275.91 275.62 275.40 275.20 275.20 275.20 275.20 275.20 275.20 275.20 275.20 275.20 275.20 275.20 275.20 274.90			or z(m/above stack) = z(ft/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: V _{plume} =((Va) _o ³ +0.12F _n ((z-z _v) ² -(6.2 a = 0.16(z-z _v)	: 66. 31 10 foot Interv telH to Top of Jet 25D z.) ²] ^{1/3} / a 20 foot Interv 20 foot Interv me [*] a [*] ³ ³)))
Height (feet) above ground Stack. Rel. Ht = 100.0 110.0 120.0 130.0 140.0 150.0 160.0 170.0 Top of jet = 174.2 180.0 220.0 240.0 280.0 280.0 300.0 Spillane 5.3 m/s Height = 319.5	lume-Averagy (meters) above stack 0.00 3.05 6.10 9.14 11.2.19 11.5.24 11.8.29 2.1.34 22.62 2.4.38 3.0.48 3.0.48 3.0.48 3.0.48 4.2.67 4.8.77 5.4.86 6.0.92 7.6.20	ed Vertical 1 Plume Radius(m) 2.054 2.316 2.569 2.822 3.075 3.328 3.581 3.620 3.834 4.810 5.785 6.760 7.736 8.711 9.686 10.639 12.125 13.078	Velocities stat SingleStak VertVel(m/s) 28.63 26.68 24.53 22.47 20.41 18.35 16.29 15.35 14.23 11.38 9.550 8.16 7.16 6.40 5.79 5.30 4.70 4.30	277.63 276.83 276.83 276.83 276.29 275.91 275.62 275.40 275.22 275.00 274.90 274.90 274.80			or z(m/above stack) = z(ft/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: V _{plume} =((Va) _o ³ +0.12F _n ((z-z _v) ² -(6.2 a = 0.16(z-z _v)	: 66. 31 10 foot Interv telH to Top of Jet 25D z.) ²] ^{1/3} / a 20 foot Interv 20 foot Interv me [*] a [*] ³ ³)))
Height (feet) above ground Stack. Rel. Ht = 100.0 110.0 120.0 130.0 140.0 150.0 160.0 170.0 Top of jet = 174.2 180.0 220.0 2240.0 2240.0 2240.0 280.0 300.0 Spillane 5.3 m/s Height = 319.5 350.0	lume-Averag (meters) above stack 0.00 3.05 6.10 9.14 12.19 15.24 18.29 22.62 21.34 22.62 24.38 30.48 36.58 42.67 48.77 54.86 60.99 48.77 54.86 60.99 48.75	ed Vertical Plume Radius(m) 1.810 2.054 2.316 2.569 2.822 3.075 3.328 3.581 3.620 3.834 4.810 5.785 6.760 6.760 1.736 8.711 9.666 10.639 12.125 13.078 14.053	Velocities stat SingleStk VertVel(m/s) 28.63 26.58 24.53 22.47 20.41 18.35 16.29 15.53 14.23 11.38 9.50 8.16 6.40 5.79 5.30 4.70 4.70 4.70 4.73 4.72	277.63 277.63 276.29 275.91 275.22 275.08 274.90 274.90 274.90 274.80 274.72			or z(m/above stack) = z(ft/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: V _{plume} =((Va) _o ³ +0.12F _n ((z-z _v) ² -(6.2 a = 0.16(z-z _v)	: 66. 31 10 foot Interv لاه الله الله الله الله الله الله الله
Height (feet) above ground Stack. Rel. Ht = 100.0 110.0 120.0 130.0 140.0 150.0 160.0 160.0 160.0 200.0 220.0 240.0 220.0 240.0 220.0 240.0 220.0 240.0 220.0 300.0 5pillane 5.3 m/s Height = 319.5 350.0 389.5 389.5	lume-Averag (meters) above stack 0.00 3.05 6.10 9.14 12.19 15.24 18.29 22.62 24.33 30.48 36.58 42.67 48.77 54.86 60.96 66.92 76.20 82.16 88.25 94.35	ed Vertical Plume Radius(m) 2.054 2.316 2.569 2.822 3.075 3.328 3.620 3.834 4.810 5.785 6.760 7.736 8.711 9.686 10.639 12.125 13.078 14.059 14.059 15.028 15.0	Velocities stat Single Stk VertVel(m/s) 28.63 22.647 20.41 18.35 16.29 15.35 14.23 11.38 9.50 8.16 7.16 6.40 5.79 5.30 4.70 4.39 4.212 3.88	277.63 276.83 276.83 276.29 275.62 275.40 275.22 275.08 274.90 274.90 274.90 274.90 274.90 274.92 275.48			or z(m/above stack) = z(ft/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: V _{plume} =((Va) _o ³ +0.12F _n ((z-z _v) ² -(6.2 a = 0.16(z-z _v)	: 66. : 31 10 foot interv Rel H to Top of Jet : 20 foot interv : ************************************
Height (feet) above ground Stack. Rel. Ht = 100.0 110.0 120.0 130.0 140.0 150.0 160.0 160.0 160.0 160.0 200.0 220.0 240.0 240.0 240.0 260.0 280.0 300.0 Spillane 5.3 m/s Height = 319.5 350.0 369.5 389.5 409.5	lume-Averag (meters) above stack 0.00 3.05 6.10 9.14 12.19 15.24 18.29 21.34 22.62 24.38 30.48 30.64 36.58 42.67 48.77 54.86 60.96 66.92 76.20 82.16 82.25 43.53 100.44	ed Vertical 1 Plume Radius(m) 1.8:10 2.054 2.316 2.569 2.822 3.075 3.328 3.581 3.620 3.834 4.810 5.785 6.760 7.736 8.711 9.666 10.639 12.125 13.078 14.053 15.028 16.004	Velocities stat SingleSta VertVel(m/s) 28.63 26.58 22.473 22.474 20.41 18.35 16.29 15.35 14.223 11.38 9.50 8.16 7.16 6.404 5.79 5.30 4.70 4.39 4.12 3.888 3.68	277.63 276.83 276.83 276.92 275.91 275.62 275.40 275.22 275.40 274.90 274.80 274.80 274.80 274.80 274.80 274.80 274.58			or z(m/above stack) = z(ft/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: V _{plume} =((Va) _o ³ +0.12F _n ((z-z _v) ² -(6.2 a = 0.16(z-z _v)	: 66. : 3: 10 foot Intern Rel H to Top of Jet (۲) (۲) (۲) (۲) (۲) (۲) (۲) (۲) (۲) (۲)
Height (feet) above ground Stack.Rel.Ht = 100.0 110.0 120.0 130.0 140.0 150.0 170.0 Top of jet = 174.2 180.0 200.0 220.0 240.0 280	lume-Averag (meters) above stack 0.00 3.05 6.10 9.14 115.24 118.29 2.1.34 22.62 2.4.38 3.0.48 3.0.48 3.0.48 4.2.67 4.8.77 5.4.86 6.0.92 7.6.20 8.2.16 8.8.25 9.4.35 1.00.44 1.06.54	ed Vertical 1 Plume Radius(m) 1.8:10 2.054 2.366 2.569 2.822 3.075 3.328 3.581 3.620 3.834 4.810 5.785 6.760 7.736 8.711 9.666 10.639 12.125 13.078 14.053 15.028 16.004 16.979	Velocities stat SingleStk VertVel(m/s) 28.63 26.68 24.53 22.47 20.41 18.35 16.29 15.35 14.23 11.38 9.50 8.16 7.16 6.40 5.79 5.30 4.70 4.70 4.38 8.388 3.686 3.50	277.63 276.83 276.83 276.83 276.29 275.91 275.62 275.40 275.40 274.80 274.80 274.80 274.80 274.85 274.65 274.65 274.58			or z(m/above stack) = z(ft/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: V _{plume} =((Va) _o ³ +0.12F _n ((z-z _v) ² -(6.2 a = 0.16(z-z _v)	: 66. : 3: 10 foot Intern Rel H to Top of Jet (۲) (۲) (۲) (۲) (۲) (۲) (۲) (۲) (۲) (۲)
Height (feet) above ground Stack. Rel. Ht = 100.0 110.0 120.0 130.0 140.0 150.0 160.0 170.0 Top of jet = 174.2 180.0 220.0 220.0 220.0 220.0 220.0 220.0 240.0 260.0 280.0 300.0 Spillane 5.3 m/s Height = 319.5 350.0 369.5 389.5 449.5	lume-Averag (meters) above stack 0.000 3.05 6.10 9.14 11.2.19 11.5.24 21.34 22.62 24.38 30.49 30.48 30.49 30.49 30.49 30.49 30.49 30.49 30	ed Vertical 1 Plume Radius(m) 1.810 2.054 2.366 2.569 2.822 3.075 3.328 3.581 3.620 3.834 4.810 5.785 6.760 7.736 8.711 9.686 10.639 12.125 13.078 14.053 15.028 16.004 16.099 17.955	Velocities stat SingleSik VertVel(m/s) 28.63 26.58 24.53 22.47 20.41 18.35 16.29 15.35 14.23 11.38 9.50 8.16 7.76 6.40 5.79 5.30 4.70 4.39 4.12 3.88 3.666 3.360 3.34	277.63 276.83 276.83 276.83 276.29 275.91 275.62 275.40 274.90 274.90 274.80 274.72 274.65 274.65 274.65 274.52 274.65 274.52 274.65 274.52 275.52 27			or z(m/above stack) = z(ft/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: V _{plume} =((Va) _o ³ +0.12F _n ((z-z _v) ² -(6.2 a = 0.16(z-z _v)	: 66. : 3: 10 foot Intern Rel H to Top of Jet (۲) (۲) (۲) (۲) (۲) (۲) (۲) (۲) (۲) (۲)
Height (feet) above ground Stack.Rel.Ht = 100.0 110.0 120.0 130.0 140.0 150.0 160.0 170.0 Top of jet = 174.2 180.0 220.0 220.0 220.0 240.0 260.0 280.0 300.0 Spillane 5.3 m/s Height = 319.5 355.0 369.5 389.5 409.5 429.5 449.5	lume-Averag (meters) above stack 0.00 3.05 6.10 9.14 12.19 15.24 18.29 2.1.34 2.262 2.2.34 3.0.48 3.6.58 4.2.67 4.8.77 5.4.86 6.9.96 6.92 7.6.20 8.2.16 8.8.25 9.4.35 10.0.44 10.6.54 112.2.64 1	ed Vertical Plume Radius(m) 1.810 2.054 2.316 2.569 2.822 3.075 3.328 3.581 3.620 3.834 4.810 5.785 6.760 7.736 8.711 9.686 10.639 11.2125 13.078 14.053 15.028 16.004 16.079 17.955 18.930	Velocities stat SingleStk VertVel(m/s) 28.63 26.58 24.53 22.47 20.41 18.35 16.29 15.53 14.23 11.38 9.50 8.16 6.40 5.79 5.30 4.70 4.70 4.70 4.33 8.88 3.68 3.50 3.34	277.63 276.83 276.83 276.29 275.91 275.62 275.40 275.22 275.08 274.90 274.80 274.52 274.65 274.58 274.52 274.43			or z(m/above stack) = z(ft/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: V _{plume} =((Va) _o ³ +0.12F _n ((z-z _v) ² -(6.2 a = 0.16(z-z _v)	: 66. : 31 10 foot interv Rel H to Top of Jet : 20 foot interv : ************************************
Height (feet) above ground Stack. Rel. Ht = 100.0 110.0 120.0 130.0 140.0 150.0 160.0 170.0 Top of jet = 174.2 180.0 220.0 220.0 220.0 220.0 220.0 220.0 240.0 260.0 280.0 300.0 Spillane 5.3 m/s Height = 319.5 350.0 369.5 389.5 449.5	lume-Averag (meters) above stack 0.000 3.05 6.10 9.14 11.2.19 11.5.24 21.34 22.62 24.38 30.49 30.48 30.49 30.49 30.49 30.49 30.49 30.49 30	ed Vertical Plume Radius(m) 1.810 2.054 2.316 2.569 2.822 3.075 3.328 3.581 3.620 3.834 4.810 5.785 6.760 7.736 8.711 9.686 10.639 11.2125 13.078 14.053 15.028 16.004 16.079 17.955 18.930	Velocities stat SingleStk VertVel(m/s) 28.63 26.58 24.53 22.47 20.41 18.35 16.29 15.53 14.23 11.38 9.50 8.16 6.40 5.79 5.30 4.70 4.70 4.70 4.33 8.88 3.68 3.50 3.34	277.63 277.63 276.83 276.83 276.29 275.91 275.62 275.40 274.90 274.80 274.90 274.85 274.52 274.47 274.65 274.52 274.47			or z(m/above stack) = z(ft/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: V _{plume} =((Va) _o ³ +0.12F _n ((z-z _v) ² -(6.2 a = 0.16(z-z _v)	: 66. : 31 10 foot interv Rel H to Top of Jet : 20 foot interv : ************************************
Height (feet) above ground Stack.Rel.Ht = 100.0 110.0 120.0 130.0 140.0 150.0 160.0 170.0 Top of jet = 174.2 180.0 220.0 220.0 220.0 240.0 220.0 280.0 300.0 Spillane 5.3 m/s Height = 319.5 389.5 409.5 429.5 449.5	lume-Averag (meters) above stack 0.00 3.05 6.10 9.14 12.19 15.24 18.29 2.1.34 2.262 2.2.34 3.0.48 3.6.58 4.2.67 4.8.77 5.4.86 6.9.96 6.92 7.6.20 8.2.16 8.8.25 9.4.35 10.0.44 10.6.54 112.2.64 1	ed Vertical Plume Radius(m) 2.054 2.316 2.569 2.822 3.075 3.328 3.581 3.620 3.834 4.810 5.785 6.760 7.736 8.711 9.686 10.639 12.125 13.078 14.053 15.028 16.004 16.979 17.955 18.930 19.905	Velocities stat SingleStk VertVel(m/s) 28.63 22.64 23.22.47 20.41 18.35 16.29 15.35 14.23 11.38 9.50 8.16 7.16 6.40 4.579 5.30 4.70 4.70 4.388 3.66 3.50 3.34 3.91 4.12 3.888 3.60 3.34 3.91 3.07	277.63 276.83 276.83 276.83 276.29 275.91 275.62 275.94 275.22 275.00 274.90 274.90 274.90 274.52 274.55 274.55 274.55 274.52 274.47 274.43			or z(m/above stack) = z(ft/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: V _{plume} =((Va) _o ³ +0.12F _n ((z-z _v) ² -(6.2 a = 0.16(z-z _v)	: 66:: : 31 : 31 : 10 foot Interv tel/H to Top of Jet : 50D-z.,) ²) ^{1/3} / a 20 foot Interv : ************************************
Height (feet) above ground Stack. Rel. Ht = 100.0 110.0 120.0 130.0 140.0 150.0 160.0 160.0 160.0 200.0 220.0 220.0 220.0 220.0 220.0 220.0 220.0 220.0 220.0 220.0 220.0 220.0 220.0 220.0 280.0 300.0 5pillane 5.3 m/s Height = 319.5 350.0 389.5 409.5 449.5 449.5 449.5 449.5	lume-Averag (meters) above stack 0.00 3.05 6.10 9.14 12.19 15.24 18.29 21.34 22.62 24.33 30.48 36.58 42.67 48.77 54.86 60.96 66.92 7.6.20 82.16 88.25 94.35 100.44 112.64 112.64 112.64	ed Vertical 1 Plume Radius(m) 1.8:10 2.054 2.316 2.569 2.822 3.075 3.328 3.581 3.620 3.834 4.810 5.785 6.760 7.736 8.711 9.666 10.639 12.125 13.078 14.053 15.028 16.004 16.979 17.955 18.930 19.905 20.881	Velocities stat SingleStat VertVel(m/s) 28.63 22.647 22.4.53 22.474 20.41 18.35 16.29 15.35 14.223 11.38 9.50 8.16 7.16 6.404 5.79 5.30 4.70 4.39 4.12 3.888 3.68 3.50 3.34 3.19 3.070	277.63 276.83 276.83 276.83 276.92 275.91 275.62 275.62 275.62 275.54 274.90 274.90 274.80 274.90 274.80 274.52 274.65 274.58 274.58 274.59 274.43 274.43 274.43 274.35			or z(m/above stack) = z(ft/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: V _{plume} =((Va) _o ³ +0.12F _n ((z-z _v) ² -(6.2 a = 0.16(z-z _v)	: 66: : 31 10 foot Interv tel/H to Top of Jet 25D z.) ²]) ^{1/2} / a 20 foot Interv me [*] a ² *A ²))) Max<5.30 f
Height (feet) above ground Stack. Rel. Ht = 100.0 110.0 120.0 130.0 140.0 150.0 160.0 160.0 160.0 200.0 220.0 240.0 220.0 240.0 280.0 280.0 300.0 Spillane 5.3 m/s Height = 319.5 350.0 369.5 389.5 449.5 449.5 449.5 449.5 449.5 449.5	lume-Averag (meters) above stack 0.00 3.05 6.10 9.14 12.19 15.24 18.29 21.34 22.62 24.38 3.0.48 3.0.48 3.6.58 4.2.67 4.8.77 5.4.66 6.6.92 7.6.20 8.2.16 8.8.25 9.4.35 100.44 110.654 112.64 112	ed Vertical 1 Plume Radius(m) 1.8:10 2.054 2.366 2.569 2.822 3.075 3.328 3.581 3.620 3.834 4.810 5.785 6.760 7.736 8.711 9.686 10.639 12.125 13.078 14.053 15.028 16.004 16.079 17.955 18.930 19.905 20.881 21.856	Velocities stat SingleStat VertVel(m/s) 28.63 22.647 22.4.53 22.474 20.41 18.35 16.29 15.35 14.223 11.38 9.50 8.16 7.16 6.404 5.79 5.30 4.70 4.39 4.12 3.888 3.68 3.50 3.34 3.19 3.070	277.63 276.83 276.83 276.83 276.29 275.91 275.62 275.62 275.62 275.62 275.62 275.62 274.80 274.90 274.80 274.92 274.65 274.58 274.58 274.53 274.43 274.43 274.43 274.35			or z(m/above stack) = z(ft/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: V _{plume} =((Va) _o ³ +0.12F _n ((z-z _v) ² -(6.2 a = 0.16(z-z _v)	: 66. : 31 10 foot interv tel/H to Top of Jet 50-z-,) ²) ^{1/3} / a 20 foot interv m ^a ² ⁽² ⁽) ⁽³⁾) Max<5.30 (

Heating and Cooling Degree Days, 1971-2000 California" and Climatography of the United States No. 20 "Monthly Station Climate Summaries, 1971-2000 California"

	r Single WRE "Aviation Sa							
		-	-			litions at V	arious Heights in the Plume	9
			•	•			, Australia," Dr. K.T. Spilla	
Ambient Conditions:							eutral conditions (dθ/dz=0 or	
Ambient Potential Temp θ _a	310.37	Kelvins	99.0				meters/feet	
Plume Exit Conditions:					Gravity q		m/s ²	
Maximum Stack Height h	30.48	meters	100	feet-inches	λ	1.11		
Stack Diameter D	3.6200	meters	142.5	inches	λο	~1.0		
Stack Velocity V _{exit}	30.70	m/s	100.72	ft/sec				
Volumetric Flow		cu.m/sec	669,497		πV _{exit} D ² /4			Sect.2/¶1
Stack Potential Temp θ_s		Kelvins		°F				
Initial Stack Buoyancy Flux Fo	-91.0436		02		αVD ² (1-€	$\partial_{\alpha}/\partial_{\alpha}/4 = V$	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	
No.of Stacks N	1			1 000			cation Factor (N ^{0.25})	,
					maniple ou			
Conditions at End (Top) of Jet Phase:								
Height above Stack z _{iet}	22.625	meters*	74.2	feet*	Zin = 6.250), meters*=	meters above stack top	Sect.3/¶1
Height above Ground z _{iet} +h _s		meters	174.2		-jet - 0.202	, 1101010 =		"
Vertical Velocity V _{iet}	15.350			ft/sec	$V_{jet} = 0.5V_{e}$	$u = \frac{1}{2}$		
Plume Top-Hat Diameter 2a _{iet}		meters	23.8		$v_{jet} = 0.5 v_e$ $2a_{iet} = 2D$	exit = vexit/∠	Conservation of momentum	"
Fiume Top-hat Diameter Zajet	7.240	meters	23.0	leel	za _{jet} = 2D		Conservation of momentum	
Spillane Methodology - Analytical Solutions f	as Calm Can	ditions for D	luma Haiahte	a hava lai	Dham			
						uluan hu a	nuotiene heleuu	
Single Plume-averaged Vertical Velocity		-	-	er where P	-		-	0+0/E 0
Plume Top-Hat Radius a		olutions in T		foot*			crease with height	Sect.2/Eq.6
Virtual Source Height zv		meters*	-3.3	feet*	υ.∠ວ⊔[1-(θ ₆	/ʊs/¨=], met	ers*=meters above stack top where $(\theta_a/\theta_s)^{1/2} = (\theta_e/\theta_s)^{1/2} =$	Sect.2/Eq.6
Height above Ground zv+hs		meters olutions in T		IEEL	(0.(a) 3 : 0	40F I /-	where $(\theta_a/\theta_s)^{1/2} = (\theta_e/\theta_s)^{1/2} = (\theta_e/\theta_s)^{1/2} = (\theta_s/\theta_s)^{1/2} = (\theta_s/\theta_s)^{1/2} + (\theta_s/\theta_s)^{1/2} = (\theta_s$	
Vertical Velocity V			able BelOW				,) - (0.25U-z _v) ⁻]} ^(***) / a	Sect.2.1(6)
Product (Va) _o	58.074	m²/s			$V_{exit}D/2(\theta_e/$	⊎ _s)‴∸		
Only for all the first for			• •					
Solve for plume-averaged vertical veloc					meters abo	ve ground (z'+h _s)	
Gives the following Height above Stack z'	121.920		400.0					
Plume Top-Hat Diameter 2a'		meters	129.1		2a'=2*0.16(2 2 (1/2)	Sect.2/Eq.6
Vertical Velocity V	1.692	m/s	5.55	ft/sec	V={(Va) _o ³ +	0.12F _o [(z-z	v) ² -(6.25D-zv) ²]} ^(1/3) /(2a ¹ /2)	Sect.2/Eq.6
Solve for Height of CASC critical vertical			m/s plume-a					> Top of Jet (Spillan
Find Height above Stack z _{crit}	62.681	meters	205.6				ultaneously in both eqs. (i.e.,	
Height above Ground z _{crit} +h _s	93.161	meters	305.6	feet	for V=4.3 m	-	e cubic equation ax3+bx2+cx	
						a=1. c=0.	and b=-(0.12F _o)/(4.3 ³ 0.16 ³)=	17.91
Interpolated Height of critical vertical ve								
	locity in Jet	Phase:			and d		.25D-z _v) ² -(Va) _o ³]/(4.3 ³ 0.16 ³)=	-331204.
Find Height above Stack z _{crit}	-	Phase: meters	#N/A	feet	and d			
	#N/A		#N/A #N/A		and d	l=[0.12F _o (6		/www.1728.org/cubic.ht
Find Height above Stack z _{crit}	#N/A	meters			and d	l=[0.12F _o (6	http://	-331204. /www.1728.org/cubic.ht 63.70 62.64
Find Height above Stack z _{crit}	#N/A	meters			and d	l=[0.12F _o (6	http:// es the real solution x = z-zv =	/www.1728.org/cubic.ht 63.70 62.6
Find Height above Stack z _{crit}	#N/A #N/A	meters meters	#N/A	feet		l=[0.12F _o (6 give	http:// es the real solution x = z-zv = or z(m/above stack) =	/www.1728.org/cubic.ht 63.70
Find Height above Stack z_{crit} Height above Ground $z_{crit} + h_{\rm s}$	#N/A #N/A	meters meters ed Vertical	#N/A Velocities sta	feet arting at en		l=[0.12F _o (6 give	http:// es the real solution x = z-zv = or z(m/above stack) =	/www.1728.org/cubic.ht 63.70 62.6
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s Table of Plume Top-Hat Diameters (2a) and P	#N/A #N/A lume-Averag (meters)	meters meters ed Vertical Plume	#N/A Velocities sta	feet arting at en Plume		l=[0.12F _o (6 give	http:// es the real solution x = z-zv = or z(m/above stack) =	/www.1728.org/cubic.ht 63.70 62.6
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s Fable of Plume Top-Hat Diameters (2a) and P Height (feet)	#N/A #N/A lume-Averag (meters)	meters meters ed Vertical Plume	#N/A Velocitiessta SingleStk VertVel(m/s)	feet arting at en Plume Temp(K)		l=[0.12F _o (6 give	http:// es the real solution x = z-zv = or z(m/above stack) =	/www.1728.org/cubic.ht 63.70 62.6
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s Fable of Plume Top-Hat Diameters (2a) and P Height (feet) above ground	#N/A #N/A lume-Averag (meters) above stack	meters meters ed Vertical Plume Radius(m) 1.810	#N/A Velocities sta SingleStk VertVel(m/s) 30.70	feet arting at en Plume Temp(K)		l=[0.12F _o (6 give	http:// es the real solution x = z-zv = or z(m/above stack) =	/www.1728.org/cubic.h 63.70 62.6 309
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s Table of Plume Top-Hat Diameters (2a) and P Height (feet) above ground <u>Stack.Rel.Ht = 100.0</u>	#N/A #N/A lume-Averag (meters) above stack 0.00	meters meters ed Vertical Plume Radius(m) 1.810 2.054	#N/A Velocities sta SingleStk VertVel(m/s) 30.70 28.63	feet arting at en Plume Temp(K)		l=[0.12F _o (6 give	http:// s the real solution x = z-zv = or z(m/above stack) = z(ft/above ground) =	/www.1728.org/cubic.hi 63.70 62.6 305 10 foot Interva
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s Table of Plume Top-Hat Diameters (2a) and P Height (feet) above ground Stack.Rel.Ht = 100.0 110.0 120.0	#N/A #N/A lume-Averag (meters) above stack 0.00 3.05	meters meters ed Vertical Plume Radius(m) 1.810 2.054 2.374	#N/A Velocities sta SingleStk VertVel(m/s) 28.63 26.59	feet arting at en Plume Temp(K)		l=[0.12F _o (6 give	http:// es the real solution x = z-zv = or z(m/above stack) = z(ft/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R	/www.1728.org/cubic.h 63.70 62.6 309 10 foot Interva
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s Table of Plume Top-Hat Diameters (2a) and P Height (feet) above ground Stack.Rel.Ht = 100.0 110.0 120.0 130.0	#N/A #N/A lume-Averag (meters) above stack 0.00 3.05 6.10 9.14	meters meters ed Vertical Plume Radius(m) 1.810 2.054 2.374 2.656	#N/A Velocities sta SingleStk VertVel(m/s) 30.70 28.63 26.59 24.54	feet arting at en Plume Temp(K)		l=[0.12F _o (6 give	http:// es the real solution x = z-zv = or z(m/above stack) = z(ft/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations:	Www.1728.org/cubic.h 63.70 62.6 305 305 10 foot Interva el.Ht to Top of Jet
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s Table of Plume Top-Hat Diameters (2a) and P Height (feet) above ground <i>Stack.Rel.Ht</i> = 100.0 120.0 130.0 140.0	#N/A #N/A lume-Averag (meters) above stack 0.00 3.05 6.10 9.14 12.19	meters meters ed Vertical Plume Radius(m) 1.810 2.054 2.374 2.656 2.937	#N/A Velocities sta SingleStk VertVel(m/s) 30.70 28.63 26.59 24.54 22.48	feet arting at en Plume Temp(K)		l=[0.12F _o (6 give	http:// es the real solution x = z-zv = or z(m/above stack) = z(ft/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: V _{plume} =((Va) ₀ ³ +0.12F _n](z-z ₁) ² -(6.2)	www.1728.org/cubic.h 63.70 62.6 305 10 foot Interva el.Ht to Top of Jet 5D-z,) ²]) ^{1/2} / a
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s Table of Plume Top-Hat Diameters (2a) and P Height (feet) above ground <i>Stack.Rel.Ht</i> = 100.0 110.0 120.0 130.0 140.0 150.0	#N/A #N/A lume-Averag (meters) above stack 0.00 3.05 6.10 9.14 12.19 15.24	meters meters ed Vertical Plume Radius(m) 2.054 2.374 2.656 2.937 3.219	#N/A Velocities sta SingleStk VertVel(m/s) 28.63 26.59 24.54 22.48 20.43	feet arting at en Plume Temp(K)		l=[0.12F _o (6 give	$\begin{array}{l} \label{eq:starsest} http:// \\ http:// \\ \mbox{is the real solution x = z-zv = } \\ \mbox{or } z(m/above stack) = \\ \mbox{z}(ft/above ground) = \\ \mbox{z}(ft/above ground) = \\ \mbox{Jet Phase Eqs:} \\ \mbox{Linearly interpolated from Stack R} \\ \mbox{Spillane Equations:} \\ \mbox{Spillane Equations:} \\ \mbox{V}_{plums} = (Va)_{0}^{-1} 40.12 F_{ul}(z-z_{v})^{2} (6.2 a) \\ \mbox{a = 0.16}(z-z_{v}) \end{array}$	(www.1728.org/cubic.h 63.70 62.6 300 10 foot Interve el.Ht to Top of Jet 5(D-z,) ²)) ¹³ / a 20 foot Interve
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s Table of Plume Top-Hat Diameters (2a) and P Height (feet) above ground <i>Stack.Rel.Ht = 100.0</i> 110.0 120.0 130.0 140.0 150.0 160.0	#N/A #N/A lume-Averag (meters) above stack 0.00 3.05 6.10 9.14 12.19 15.24 18.29	meters meters ed Vertical Plume Radius(m) 2.054 2.656 2.937 3.219 3.501	#N/A Velocities sta SingleStk VertVel(m/s) 28.63 26.59 24.54 22.48 20.43 18.37	feet arting at en Plume Temp(K)		l=[0.12F _o (6 give	http:// es the real solution x = z-zv = or z(m/above stack) = z(ft/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: V _{plume} =((Va) ₀ ³ +0.12F _n](z-z ₁) ² -(6.2)	(www.1728.org/cubic.h 63.70 62.6 300 10 foot Interva el.H to Top of Jet 5(D-z,) ²)) ¹³ / a 20 foot Interva
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s Fable of Plume Top-Hat Diameters (2a) and P Height (feet) above ground <i>Stack.Rel.Ht = 100.0</i> 110.0 120.0 130.0 150.0 150.0 170.0	#N/A #N/A lume-Averag (meters) above stack 0.00 3.05 6.10 9.14 12.19 15.24 18.29 21.34	meters meters ed Vertical Plume Radius(m) 1.810 2.054 2.374 2.656 2.337 3.219 3.501 3.501 3.783	#N/A Velocities sta SingleStk VertVel(m/s) 30.70 28.63 26.59 24.54 22.48 20.43 18.37 16.32	feet arting at en Plume Temp(K)		l=[0.12F _o (6 give	$\begin{array}{l} \label{eq:starsest} http:// \\ http:// \\ \mbox{is the real solution x = z-zv = } \\ \mbox{or } z(m/above stack) = \\ \mbox{z}(ft/above ground) = \\ \mbox{z}(ft/above ground) = \\ \mbox{Jet Phase Eqs:} \\ \mbox{Linearly interpolated from Stack R} \\ \mbox{Spillane Equations:} \\ \mbox{Spillane Equations:} \\ \mbox{V}_{plums} = (Va)_{0}^{-1} 40.12 F_{ul}(z-z_{v})^{2} (6.2 a) \\ \mbox{a = 0.16}(z-z_{v}) \end{array}$	(www.1728.org/cubic.h 63.70 62.6 300 10 foot Interve el.Ht to Top of Jet 5(D-z,) ²)) ¹³ / a 20 foot Interve
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s Table of Plume Top-Hat Diameters (2a) and P Height (feet) above ground Stack.Rel.Ht = 100.0 110.0 120.0 130.0 140.0 150.0 160.0 170.0 Top of jet = 174.2	#N/A #N/A lume-Averag (meters) above stack 0.00 3.05 6.10 9.14 12.19 15.24 18.29 21.34 22.62	meters meters ed Vertical Plume Radius(m) 2.054 2.374 2.656 2.937 3.501 3.501 3.503 3.500	#N/A Velocities sta SingleStk VertVel(m/s) 30.70 28.63 26.59 24.54 22.48 20.43 18.37 16.32 15.35	feet arting at en Plume Temp(K)	nd of jet pha	l=[0.12F _o (6 give	$\begin{array}{l} \label{eq:starsest} http:// \\ http:// \\ \mbox{is the real solution x = z-zv = } \\ \mbox{or } z(m/above stack) = \\ \mbox{z}(ft/above ground) = \\ \mbox{z}(ft/above ground) = \\ \mbox{Jet Phase Eqs:} \\ \mbox{Linearly interpolated from Stack R} \\ \mbox{Spillane Equations:} \\ \mbox{Spillane Equations:} \\ \mbox{V}_{plums} = (Va)_{0}^{-1} 40.12 F_{ul}(z-z_{v})^{2} (6.2 a) \\ \mbox{a = 0.16}(z-z_{v}) \end{array}$	(www.1728.org/cubic.h 63.7(62.6 30: 10 foot Interv el.H to Top of Jet 5(D-z,) ²)) ¹³ / a 20 foot Interv
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Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s Table of Plume Top-Hat Diameters (2a) and P Height (feet) above ground Stack. Rel. Ht = 100.0 110.0 120.0 130.0 140.0 150.0 160.0 1700 160.0 170.0 200.0 220.0 240.0 280.0 300.0 Spillane 5.3 m/s Height = 305.6 375.6	#N/A #N/A #N/A above stack 0.00 3.05 6.10 9.14 12.19 15.24 18.29 21.34 22.62 24.38 30.48 30.48 30.48 36.58 42.67 48.77 54.86 60.96 62.68 76.20 77.92 84.02	meters meters meters ed Vertical Plume Radius(m) 2.054 2.374 2.656 2.937 3.219 3.501 3.783 3.620 4.065 5.040 6.015 6.991 7.966 8.942 9.917 10.192 12.355 12.631 13.606	#N/A Velocities sta SingleStk VertVel(m/s) 30.70 28.63 26.59 24.54 22.48 20.43 18.37 16.32 15.35 14.26 9.50 8.09 7.02 6.17 5.30 4.17 4.05 3.65	feet arting at en Plume Temp(K) 300.45 302.32 303.67 304.46 305.12 305.63 306.03 306.12 306.75 306.75 306.91	d of jet pha	l=[0.12F _o (6 give	$\begin{array}{l} \label{eq:starsest} http:// \\ http:// \\$	(۱۹۹۸ ۲۹۵۵ ۲۹۵۵ ۲۹۵۵ ۲۹۵۵ ۲۹۵۵ ۲۹۵۵ ۲۹۵۵ ۲
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s fable of Plume Top-Hat Diameters (2a) and P Height (feet) above ground Stack. Rel. Ht = 100.0 110.0 120.0 130.0 140.0 150.0 160.0 170.0 Top of jet = 174.2 180.0 200.0 240.0 240.0 240.0 260.0 280.0 300.0 Spillane 5.3 m/s Height = 305.6 355.6	#N/A #N/A #N/A lume-Averag (meters) above stack 0.00 3.05 6.10 9.14 12.19 15.24 18.29 21.34 22.62 24.38 30.48 36.58 42.67 48.77 54.86 60.96 62.68 76.20 77.92 84.02 90.11	meters meters meters ed Vertical Plume Radius(m) 1.810 2.054 2.374 2.656 2.377 3.219 3.501 3.783 3.620 4.065 5.040 6.015 6.091 7.966 8.942 9.917 10.192 12.355 12.631 13.606 14.581	#N/A Velocities stat Single Stik VertVel((m/s)) 30.70 28.63 26.59 24.54 22.48 20.43 18.37 16.32 15.35 14.26 11.43 9.50 8.09 7.02 6.17 5.47 5.30 4.17 4.05 3.65 3.30	feet arting at en Plume Temp(K) 300.45 302.32 303.57 304.46 305.12 305.63 306.03 306.70 306.70 306.71 306.71 306.71 307.04	d of jet pha	l=[0.12F _o (6 give	$\begin{array}{l} \label{eq:starsest} http:// \\ http:// \\ \mbox{is the real solution x = z-zv = } \\ \mbox{or } z(m/above stack) = \\ \mbox{z}(ft/above ground) = \\ \mbox{z}(ft/above ground) = \\ \mbox{Jet Phase Eqs: } \\ \mbox{Linearly interpolated from Stack R } \\ \mbox{Spillane Equations: } \\ \mbox{Spillane Equations: } \\ \mbox{V}_{plums} = (Va)_{0}^{-1} 40.12 F_{ul}(z-z_{v})^{2} (6.2 \mbox{a})^{2} (6.2$	(۱۹۹۸ ۲۹۵۵ ۲۹۵۵ ۲۹۵۵ ۲۹۵۵ ۲۹۵۵ ۲۹۵۵ ۲۹۵۵ ۲
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Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s Table of Plume Top-Hat Diameters (2a) and P Height (feet) above ground Stack. Rel. Ht = 100.0 110.0 120.0 130.0 140.0 150.0 160.0 170.0 Top of jet = 174.2 200.0 300.0 300.0 300.0 355.6	#W/A #N/A #N/A above stack 0.00 3.05 6.10 9.14 12.19 15.24 18.29 21.34 22.62 24.38 30.48 30.48 36.58 42.67 48.77 54.86 60.96 62.68 76.20 77.92 84.02 90.11 96.21 102.31 108.40 114.50	meters meters meters ed Vertical Plume Radius(m) 1.810 2.054 2.374 2.656 2.337 3.219 3.501 3.783 3.620 4.065 5.040 6.015 6.991 7.966 8.942 9.917 10.192 12.355 12.631 13.606 14.581 15.557 16.532 17.500 18.483 319.458	#N/A Velocities stat Single Stk VertVel(m/s) 30.70 28.63 26.59 24.54 22.48 20.43 18.37 16.32 15.35 14.26 11.43 9.50 8.09 7.02 6.17 5.30 4.17 4.05 3.65 3.30 2.97 2.66 2.37 2.07 1.76	feet Temp(K) 300.45 302.32 303.57 304.46 305.12 305.63 306.03 306.612 306.75 306.75 306.91 307.04 307.15 307.04	d of jet pha 	l=[0.12F _o (6 give	$\begin{array}{l} \label{eq:starsest} http:// \\ http:// \\ \mbox{is the real solution x = z-zv = } \\ \mbox{or } z(m/above stack) = \\ \mbox{z}(ft/above ground) = \\ \mbox{z}(ft/above ground) = \\ \mbox{Jet Phase Eqs: } \\ \mbox{Linearly interpolated from Stack R } \\ \mbox{Spillane Equations: } \\ \mbox{Spillane Equations: } \\ \mbox{V}_{plums} = (Va)_{0}^{-1} 40.12 F_{ul}(z-z_{v})^{2} (6.2 \mbox{a})^{2} (6.2$	(۱۹۹۸ کی معرفی کی معرفی کی محمد کی



	"Aviation Sat	fety and Buo	yant Plumes		Load, and I st, et. al.			
		-	-			litions at V	arious Heights in the Plume	9
	rno Erandad						Australia," Dr. K.T. Spillar	
mbient Conditions:							eutral conditions (dθ/dz=0 or	
Ambient Potential Temp θ_a	273.71	Kelvins	33.0				meters/feet	
Plume Exit Conditions:					Gravity g	9.81	m/s ²	
Maximum Stack Height hs	22.93	meters	75 3/12	feet-inches	λ	1.11		
Stack Diameter D	0.4453	meters	17.5	inches	λο	~1.0		
Stack Velocity V _{exit}	59.00	m/s	193.56	ft/sec				
Volumetric Flow	9.19	cu.m/sec	19,467	ACFM	πV _{exit} D ² /4			Sect.2/¶1
Stack Potential Temp θ _s	763.15	Kelvins	914					
Initial Stack Buoyancy Flux Fo	18.4016	m ⁴ /s ³			gV _{exit} D ² (1-6	$\theta_a/\theta_s)/4 = V$	ol.Flow(g/π)(1-θ _a /θ _a)	Sect.2/¶1
Plume Buoyancy Flux F	N/A	m ⁴ /s ³			$\lambda^2 q V a^2 (1 - \theta_z)$, (θ _n) for a,V	,θ _p at plume height (see belo	w)
No.of Stacks N	1			1.000			cation Factor (N ^{0.25})	
							,	
Conditions at End (Top) of Jet Phase:								
Height above Stack ziet	2.783	meters*	9.1	feet*	z _{iet} = 6.25D	, meters*=	meters above stack top	Sect.3/¶1
Height above Ground ziet+hs		meters	84.4	feet	,			
Vertical Velocity Viet	29.500	m/s	96.78	ft/sec	$V_{jet} = 0.5V_{e}$	axit = V _{exit} /2		
Plume Top-Hat Diameter 2ajet	0.891	meters	2.9	feet	2a _{iet} = 2D		Conservation of momentum	
					- jer			
pillane Methodology - Analytical Solutions f	or Calm Con	ditions for P	ume Heights	above Je	t Phase			
Single Plume-averaged Vertical Velocity	/ given by Ar	alytical Sol	ution in Pape	er where P	roduct Va	qiven by e	quations below:	
Plume Top-Hat Radius a		olutions in T					crease with height	Sect.2/Eq.6
Virtual Source Height z _v		meters*		feet*			ers*=meters above stack top	Sect.2/Eq.6
Height above Ground zv+hs		meters	78.9				where $(\theta_a/\theta_s)^{1/2} = (\theta_e/\theta_s)^{1/2} =$	
Vertical Velocity V		olutions in T			{(Va) ₀ ³ + 0.		$(1200 - (1200 - 2000)^2)^{(1/3)} / a$	Sect.2.1(6)
Product (Va) _o	7.867				V _{exit} D/2(θ _e /			1-7
						-/		
Solve for plume-averaged vertical velo	city at height	300.0	feet	91 44	meters abo	ve ground (z'+h。)	
Gives the following Height above Stack z'		meters*	224.8			- 5.00mm (.01	
Plume Top-Hat Diameter 2a'	21.566		70.8		2a'=2*0.16(z'-z,,)		Sect.2/Eq.6
Vertical Velocity V	21.566			ft/sec			() ² -(6.25D-z _y) ²]} ^(1/3) /(2a'/2)	Sect.2/Eq.6
	2.031	11/3	0.00	10/300	v={(va) ₀ +	0.121 0[(2-2)	/) -(0.23D-2 _V)]/ /(2a/2)	0001.2/Eq.0
Solve for Height of CASC critical vertical	volocity V	E 20	m/o niumo o	waragad	ortical vala	aite	Critical V/V	> Top of Jet (Spillar
-			m/s plume-a	-		-		
Find Height above Stack z _{crit}	11.733		38.5				Itaneously in both eqs. (i.e.,	
Height above Ground z _{crit} +h _s	34.663	meters	113.7	teet	tor V=4.3 m		e cubic equation ax ³ +bx ² +cx	
		D 1					and b=-(0.12F _o)/(4.3 ³ 0.16 ³)=	
Interpolated Height of critical vertical ve					and d	l=[0.12⊦₀(6.	.25D-z _v) ² -(Va) _o ³]/(4.3 ³ 0.16 ³)=	-788.
Find Height above Stack z _{crit}		meters	#N/A					/www.1728.org/cubic.h
Height above Ground z _{crit} +h _s	#N/A	meters	#N/A	feet		give	s the real solution x = z-zv =	10.61
							or z(m/above stack) =	11.7
							z(ft/above ground) =	113
able of Plume Top-Hat Diameters (2a) and P						ase:	z(ft/above ground) =	
Height (feet)	(meters)	Plume	SingleStk	Plume		ise:	z(ft/above ground) =	
Height (feet) above ground	(meters) above stack	Plume Radius(m)	SingleStk /ertVel(m/s)	Plume		ase:	z(ft/above ground) =	
Height (feet) above ground <u>Stack.Rel.Ht = 75.2</u>	(meters) above stack 0.00	Plume Radius(m) 0.223	SingleStk /ertVel(m/s) 59.00	Plume		150:		113
Height (feet) above ground <i>Stack.Rel.Ht</i> = 75.2 80.0	(meters) above stack 0.00 1.45	Plume Radius(m) 0.223 0.338	SingleStk VertVel(m/s) 59.00 43.65	Plume		150:	Jet Phase Eqs:	113 5 foot Interva
Height (feet) above ground Stack.Rel.Ht = 75.2 80.0 85.0	(meters) above stack 0.00 1.45 2.98	Plume Radius(m) 0.223 0.338 0.460	SingleStk VertVel(m/s) 59.00 43.65 27.57	Plume		150:	Jet Phase Eqs: Linearly interpolated from Stack R	113 5 foot Interva
Height (feet) above ground Stack.Rel. Ht = 75.2 80.0 85.0 Top of jet = 84.4	(meters) above stack 0.00 1.45 2.98 2.80	Plume Radius(m) 0.223 0.338 0.460 0.445	SingleStk /ertVel(m/s) 59.00 43.65 27.57 29.50	Plume Temp(K)		150:	Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations:	11: 5 foot Interve
Height (feet) above ground Stack.Rel.Ht = 75.2 80.0 85.0 Top of jet = 84.4 90.0	(meters) above stack 0.00 1.45 2.98 2.80 4.50	Plume Radius(m) 0.223 0.338 0.460 0.445 0.542	SingleStk /ertVel(m/s) 59.00 43.65 27.57 29.50 14.71	Plume Temp(K) 370.24		390:	Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: Vpinn=E(Va),°40.12F.j(z-z.)²-(6.2	5 foot Interva el.Ht to Top of Jet 5D-z,)?]) ¹⁰ / a
Height (feet) above ground Stack.Rel.Ht = 75.2 80.0 85.0 Top of jet = 84.4 90.0 100.0	(meters) above stack 0.00 1.45 2.98 2.80 4.50 7.55	Plume Radius(m) 0.223 0.338 0.460 0.445 0.542 1.029	SingleStk /ertVel(m/s) 43.65 27.57 29.50 14.71 8.06	Plume Temp(K) 370.24 322.47		150:	Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: V_mm={(Va),+0.12F_d[(z-z_v)^2(6.2 a - 0.16(z-z_v)	5 foot Interv 5 foot Interv eI.Ht to Top of Jet 5Dr2,) ²]) ¹³ / a 10 foot Interv
Height (feet) above ground Stack.Rel.Ht = 75.2 80.0 85.0 Top of jet = 84.4 90.0 100.0 110.0	(meters) above stack 0.00 1.45 2.98 2.80 4.50 7.55 10.60	Plume Radius(m) 0.223 0.338 0.460 0.445 0.542 1.029 1.517	SingleStk /ertVel(m/s) 59.00 43.65 27.57 29.50 14.71 8.06 5.79	Plume Temp(K) 370.24 322.47 304.96		150:	Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: Vpinn=E(Va),°40.12F.j(z-z.)²-(6.2	5 foot Interv el.Ht to Top of Jet 5D-z,) ² D ^{1/3} /a 10 foot Interv
Height (feet) above ground Stack.Rel.Ht = 75.2 80.0 85.0 Top of jet = 84.4 90.0 100.0	(meters) above stack 0.00 1.45 2.98 2.80 4.50 7.55	Plume Radius(m) 0.223 0.338 0.460 0.445 0.542 1.029	SingleStk /ertVel(m/s) 43.65 27.57 29.50 14.71 8.06	Plume Temp(K) 370.24 322.47		150:	Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: V_mm={(Va),+0.12F_d[(z-z_v)^2(6.2 a - 0.16(z-z_v)	5 foot Interv el.Ht to Top of Jet 5D-z,) ² D ^{1/3} /a 10 foot Interv
Height (feet) above ground Stack.Rel.Ht = 75.2 80.0 85.0 Top of jet = 84.4 90.0 100.0 110.0 Spillane 5.3 m/s Height = 113.7 120.0	(meters) above stack 0.00 1.45 2.98 2.80 4.50 7.55 10.60	Plume Radius(m) 0.223 0.338 0.460 0.445 0.542 1.029 1.517 1.699 2.005	SingleStk VertVel(m/s) 59.00 43.65 27.57 29.50 14.71 8.06 5.79 5.30 4.68	Plume Temp(K) 370.24 322.47 304.96 300.96 295.85		356:	Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: V_mm={(Va),+0.12F_d[(z-z_v)^2(6.2 a - 0.16(z-z_v)	5 foot Interv el.Ht to Top of Jet 5D-z,) ² D ^{1/3} /a 10 foot Interv
Height (feet) above ground Stack.Rel.Ht = 75.2 80.0 65.0 Top of jet = 84.4 90.0 100.0 110.0 Spillane 5.3 m/s Height = 113.7 120.0 130.0	(meters) above stack 0.00 1.45 2.98 2.80 4.50 7.55 10.60 11.73 13.65 16.69	Plume Radius(m) 0.223 0.338 0.460 0.445 0.542 1.029 1.517 1.699 2.005 2.492	Single Stk VertVel(m/s) 59.00 43.65 27.57 29.50 14.71 8.06 5.79 5.30 4.68 4.03	Plume Temp(K) 370.24 322.47 304.96 300.96 295.85 290.34		350:	Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: V_mm={(Va),+0.12F_d[(z-z_v)^2(6.2 a - 0.16(z-z_v)	11 5 foot Interv el.Ht to Top of Jet 5D-z,) ² J) ¹⁰³ / a 10 foot Interv m ² ¹² ^{(A²})))
Height (feet) above ground Stack.Rel.Ht = 75.2 80.0 85.0 Top of jet = 84.4 90.0 100.0 110.0 Spillane 5.3 m/s Height = 113.7 120.0 130.0 140.0	(meters) above stack 0.00 1.45 2.98 2.80 4.50 7.55 10.60 11.73 13.65 16.69 19.74	Plume Radius(m) 0.223 0.338 0.460 0.445 0.542 1.029 1.517 1.699 2.005 2.492 2.980	Single Stk VertVel(m/s) 59.00 43.65 27.57 29.50 14.71 8.06 5.79 5.30 4.68 4.03 3.61	Plume Temp(K) 370.24 322.47 304.96 300.96 295.85 290.34 286.70		150:	Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: V_mm={(Va),+0.12F_d[(z-z_v)^2(6.2 a - 0.16(z-z_v)	11 5 foot Interv el.Ht to Top of Jet 5D-z,) ² J) ¹⁰³ / a 10 foot Interv m ² ¹² ^{(A²})))
Height (feet) above ground Stack.Rel.Ht = 75.2 80.0 85.0 Top of jet = 84.4 90.0 100.0 110.0 Spillane 5.3 m/s Height = 113.7 120.0 130.0 130.0	(meters) above stack 0.00 1.45 2.98 2.80 4.50 7.55 10.60 11.73 13.65 16.69 19.74 22.79	Plume Radius(m) 0.223 0.338 0.460 0.445 0.542 1.029 1.517 1.699 2.005 2.492 2.980 3.468	SingleStk VertVel(m/s) 59.00 43.65 27.57 29.50 14.71 8.06 5.79 5.30 4.68 4.03 3.61 3.31	Plume Temp(K) 370.24 322.47 304.96 300.96 295.85 290.34 286.70 284.17		350:	Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: V_mm={(Va),+0.12F_d[(z-z_v)^2(6.2 a - 0.16(z-z_v)	11 5 foot Interv el.Ht to Top of Jet 5D-z,) ² J) ¹⁰³ / a 10 foot Interv m ² ¹² ^{(A²})))
Height (feet) above ground Stack.Rel.Ht = 75.2 80.0 85.0 Top of jet = 84.4 90.0 100.0 100.0 Spillane 5.3 m/s Height = 113.7 120.0 130.0 140.0 140.0 140.0	(meters) above stack 0.00 1.45 2.98 2.80 4.50 10.60 11.73 13.65 16.69 19.74 22.79 25.84	Plume Radius(m) 0.223 0.338 0.460 0.445 0.542 1.029 1.517 1.699 2.005 2.492 2.980 3.468 3.955	SingleStk /ertVel(m/s) 59.00 43.65 27.57 29.50 14.71 8.06 5.79 5.30 4.68 4.63 3.61 3.31 3.09	Plume Temp(K) 370.24 322.47 304.96 300.96 295.85 290.34 286.70 284.17 282.32		350:	Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: V_mm={(Va),+0.12F_d[(z-z_v)^2(6.2 a - 0.16(z-z_v)	11 5 foot Interv el.Ht to Top of Jet 5D-z,) ² J) ¹⁰³ / a 10 foot Interv m ² ¹² ^{(A²})))
Height (feet) above ground Stack.Rel.Ht = 75.2 80.0 55.0 70p of jet = 84.4 90.0 100.0 110.0 Spillane 5.3 m/s Height = 113.7 120.0 130.0 140.0 150.0 140.0	(meters) above stack 0.00 1.45 2.88 2.80 4.50 7.55 10.60 11.03 13.65 16.69 19.74 2.279 25.84 28.89	Plume Radius(m) 0.223 0.388 0.460 0.445 0.542 1.029 1.517 1.699 2.005 2.492 2.980 3.965 3.965 4.443	SingleStk VertVel(m/s) 59.00 43.65 27.57 29.50 14.71 8.06 5.79 5.30 4.68 4.03 3.61 3.31 3.09 2.92	Plume Temp(K) 370.24 322.47 304.96 300.96 295.85 290.34 286.70 284.17 282.32 280.94		356:	Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: V_mm={(Va),+0.12F_d[(z-z_v)^2(6.2 a - 0.16(z-z_v))	11 5 foot Interv el.Ht to Top of Jet 5D-z,)*D ^{1/23} / a 10 foot Interv ma [*] ¹² ^(2,K)))) Max<5.30 r
Height (feet) above ground Stack.Rel.Ht = 75.2 80.0 55.0 Top of jet = 84.4 90.0 100.0 110.0 Spillane 5.3 m/s Height = 113.7 120.0 130.0 140.0 150.0 170.0 220.0	(meters) above stack 0.00 1.45 2.80 4.50 7.55 10.60 11.73 13.65 16.69 19.74 2.279 2.5.84 2.89 4.4.3	Plume Radius(m) 0.223 0.338 0.460 0.445 0.542 1.029 1.517 1.699 2.005 2.492 2.980 3.468 3.955 4.443	SingleStk VertVel(m/s) 59.00 43.65 27.57 29.50 14.71 8.06 5.79 5.30 4.68 4.03 3.61 3.31 3.90 2.92 2.41	Plume Temp(K) 370.24 322.47 304.96 295.85 290.34 286.70 284.17 282.32 280.94 277.36		356:	Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: V_mm={(Va),+0.12F_d[(z-z_v)^2(6.2 a - 0.16(z-z_v))	11 5 foot Interv el.Ht to Top of Jet 5D-z,)*D ^{1/23} / a 10 foot Interv ma [*] ¹² ^(2,K)))) Max<5.30 r
Height (feet) above ground Stack.Rel.Ht = 75.2 80.0 55.0 70p of jet = 84.4 90.0 100.0 110.0 Spillane 5.3 m/s Height = 113.7 120.0 130.0 140.0 150.0 140.0 150.0	(meters) above stack 0.00 1.45 2.88 2.80 4.50 7.55 10.60 11.03 13.65 16.69 19.74 2.279 25.84 28.89	Plume Radius(m) 0.223 0.338 0.460 0.445 0.542 1.029 1.517 1.699 2.005 2.492 2.980 3.965 3.955 4.443	SingleStk VertVel(m/s) 59.00 43.65 27.57 29.50 14.71 8.06 5.79 5.30 4.68 4.03 3.61 3.31 3.90 2.92 2.41	Plume Temp(K) 370.24 322.47 304.96 295.85 290.34 286.70 284.17 282.32 280.94 277.36			Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: V_mm={(Va),+0.12F_d[(z-z_v)^2(6.2 a - 0.16(z-z_v))	11 5 foot Interv el.Ht to Top of Jet 5D-z,)*D ^{1/23} / a 10 foot Interv ma [*] ¹² ^(2,K)))) Max<5.30 r
Height (feet) above ground Stack.Rel.Ht = 75.2 80.0 55.0 Top of jet = 84.4 90.0 100.0 110.0 Spillane 5.3 m/s Height = 113.7 120.0 130.0 140.0 150.0 170.0 220.0	(meters) above stack 0.00 1.45 2.80 4.50 7.55 10.60 11.73 13.65 16.69 19.74 2.279 2.5.84 2.89 4.4.3	Plume Radius(m) 0.223 0.338 0.460 0.445 0.542 1.029 1.517 1.699 2.005 2.492 2.980 3.468 3.955 4.443	SingleStk VertVel(m/s) 59.00 43.665 27.57 29.50 14.71 8.806 5.79 5.30 4.68 4.03 3.61 3.31 3.09 2.92 2.414 2.14	Plume Temp(K) 370.24 322.47 300.96 295.85 290.34 286.70 284.17 282.32 280.94 277.36 275.95			Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: V_mm={(Va),+0.12F_d[(z-z_v)^2(6.2 a - 0.16(z-z_v))	11 5 foot Interv el.Ht to Top of Jet 5D-z,)*D ^{1/23} / a 10 foot Interv ma [*] ¹² ^(2,K)))) Max<5.30 r
Height (feet) above ground Stack.Rel.Ht = 75.2 80.0 55.0 70p of jet = 84.4 90.0 100.0 100.0 5pillane 5.3 m/s Height = 113.7 120.0 130.0 140.0 150.0 160.0 170.0 220.0 270.0 320.0 370.0	(meters) above stack 0.00 1.454 2.98 4.50 7.555 10.60 11.73 13.65 19.64 19.74 22.79 25.84 28.89 4.4.13 59.37	Plume Radius(m) 0.223 0.338 0.460 0.445 0.542 1.029 1.517 1.699 2.005 2.492 2.980 3.468 3.955 4.443 6.882 9.320 11.758 14.197	SingleStk VertVel(m/s) 59.00 43.65 27.57 29.50 14.71 8.06 5.79 5.30 4.68 4.03 3.61 3.31 3.09 2.92 2.41 1.97 1.84	Plume Temp(K) 370.24 322.47 304.96 295.85 290.34 286.70 284.17 282.32 280.94 277.36 275.95 275.24			Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: V_mm={(Va),+0.12F_d[(z-z_v)^2(6.2 a - 0.16(z-z_v))	11 5 foot Interv el.Ht to Top of Jet 5D-z,)*D ^{1/23} / a 10 foot Interv ma [*] ¹² ^(2,K)))) Max<5.30 r
Height (feet) above ground Stack.Rel.H = 75.2 80.0 85.0 Top of jet = 84.4 90.0 100.0 100.0 Spillane 5.3 m/s Height = 113.7 120.0 130.0 130.0 130.0 130.0 220.0	(meters) above stack 0.00 1.64 2.98 2.98 1.0.60 11.73 13.65 16.69 19.74 22.79 2.5.84 2.8.89 4.13 5.9.37 7.4.61	Plume Radius(m) 0.223 0.388 0.460 0.445 0.542 1.029 1.517 1.699 2.005 2.492 2.980 3.955 4.443 6.882 9.320 11.758 14.197 16.635	SingleStk VertVel(m/s) 59.00 43.65 27.57 29.50 14.71 8.06 5.79 5.30 4.68 4.03 3.61 3.31 3.90 2.92 2.41 2.14 1.97 1.84 4.1.71	Plume Temp(K) 370.24 322.47 304.96 300.96 295.85 290.34 286.70 284.17 282.32 280.94 277.36 275.24 277.36 275.24			Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: V_mm={(Va),+0.12F_d[(z-z_v)^2(6.2 a - 0.16(z-z_v))	11 5 foot interv el.Ht to Top of Jet 5D-z,)")) ^{1/29} / a 10 foot interv می [*] (²⁴ λ ²))) Max<5.30 r
Height (feet) above ground Stack.Rel.Ht = 75.2 80.0 55.0 70p of jet = 84.4 90.0 100.0 100.0 5pillane 5.3 m/s Height = 113.7 120.0 130.0 140.0 150.0 160.0 170.0 220.0 270.0 320.0 370.0	(meters) above stack 0.00 1.45 2.989 2.80 1.450 1.60 1.1.73 1.3.65 1.6.69 1.9.74 2.2.79 2.5.84 2.8.99 4.4.13 5.9.37 7.4.61 8.9.85	Plume Radius(m) 0.223 0.338 0.460 0.445 0.542 1.029 1.517 1.699 2.005 2.492 2.980 3.468 3.955 4.443 6.882 9.320 11.758 14.197	SingleStk VertVel(m/s) 59.00 43.65 27.57 29.50 14.71 8.06 5.79 5.30 4.68 4.03 3.61 3.31 3.90 2.92 2.41 2.14 1.97 1.84 4.1.71	Plume Temp(K) 370.24 322.47 304.96 300.96 295.85 290.34 286.70 284.17 282.32 280.94 277.36 275.95 275.24 274.83 274.57 275.24			Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: V_mm={(Va),+0.12F_d[(z-z_v)^2(6.2 a - 0.16(z-z_v))	11 5 foot interv el.Ht to Top of Jet 5D-z,)")) ^{1/29} / a 10 foot interv می [*] (²⁴ λ ²))) Max<5.30 r
Height (feet) above ground Stack.Rel.Ht = 75.2 80.0 55.0 70p of jet = 84.4 90.0 100.0 110.0 Spillane 5.3 m/s Height = 113.7 120.0 130.0 140.0 150.0 170.0 220.0 270.0 320.0 370.0	(meters) above stack 0.00 1.45 2.88 2.80 4.50 7.55 10.60 11.03 13.65 16.69 19.74 22.54 28.89 4.4.13 59.37 74.61 89.85 105.09	Plume Radius(m) 0.223 0.388 0.460 0.445 0.542 1.029 1.517 1.699 2.005 2.492 2.980 3.955 4.443 6.882 9.320 11.758 14.197 16.635	SingleStk VertVel(m/s) 59.00 43.665 27.57 29.50 14.71 8.806 5.79 5.30 4.68 4.03 3.61 4.68 4.03 3.61 4.03 2.92 2.41 1.214 1.97 1.84 1.74 5.16	Plume Temp(K) 370.24 322.47 304.96 300.96 295.85 290.34 286.70 284.17 282.32 280.94 277.36 275.95 275.24 277.24 274.83 274.57 274.40			Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: V_mm={(Va),+0.12F_d[(z-z_v)^2(6.2 a - 0.16(z-z_v))	11 5 foot interv el.Ht to Top of Jet 5D-z,)")) ^{1/29} / a 10 foot interv می [*] (²⁴ λ ²))) Max<5.30 r
Height (feet) above ground Stack.Rel.H = 75.2 80.0 85.0 Top of jet = 84.4 90.0 110.0 Spillane 5.3 m/s Height = 113.7 120.0 130.0 140.0 150.0 160.0 220.0 270.0 320.0 370.0 370.0 420.0	(meters) above stack 0.00 1.454 2.98 4.50 7.555 10.60 11.73 13.65 16.69 19.74 22.79 25.84 28.89 44.13 59.37 7.4.61 89.85 105.09 120.33	Plume Radius(m) 0.223 0.383 0.460 0.445 1.029 1.517 1.699 2.005 2.980 3.468 3.955 4.443 6.882 9.320 11.758 14.197 16.633 19.074	SingleStk VertVel(m/s) 59.00 43.665 27.57 29.50 14.71 8.06 5.79 5.30 4.68 4.03 3.661 3.31 3.31 3.39 2.92 2.41 1.21 4.14 1.97 1.84 1.74 1.66 5.160	Plume Temp(K) 370.24 322.47 304.96 300.96 295.85 290.34 286.70 284.17 282.32 280.94 277.36 275.95 275.24 277.24 274.83 274.57 274.40			Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: V_mm={(Va),+0.12F_d[(z-z_v)^2(6.2 a - 0.16(z-z_v))	11 5 foot Interv البلاد to Top of Jet 5D-z,) ²]) ^{10/} /a 10 foot Interv س ^a (a ² ² ² ²))) Max<5.30 r 50 foot Interv
Height (feet) above ground Stack.Rel.Ht = 75.2 80.0 85.0 Top of jet = 84.4 90.0 100.0 100.0 Spillane 5.3 m/s Height = 113.7 120.0 130.0 100.0 100.0 100.0 100.	(meters) above stack 0.60 4.50 7.55 10.660 11.73 13.65 16.69 19.74 22.79 25.84 22.89 4.89 3.59.37 7.4.61 89.85 120.30 120.33 135.57	Plume Radius(m) 0.223 0.388 0.460 0.445 0.542 1.517 1.699 2.005 2.492 2.980 3.468 3.955 4.443 6.882 9.320 11.758 14.197 16.674 1.517	SingleStk VertVel(m/s) 59.00 43.65 27.57 29.50 14.71 8.06 5.79 5.30 4.68 4.03 3.61 3.31 3.09 2.92 2.41 2.41 1.97 1.84 1.77 1.84 1.74 1.66 1.60 9.149	Plume Temp(K) 370.24 322.47 304.96 295.85 290.34 286.70 284.17 282.32 280.94 277.36 275.95 275.24 274.83 275.95 275.24 274.83 274.57 274.40 274.57			Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: V_mm={(Va),+0.12F_d[(z-z_v)^2(6.2 a - 0.16(z-z_v))	11 5 foot Interv البلاد Top of Jet 5D-z,) ²]) ¹⁰ /a 10 foot Interv س ^a ^{a²²λ²}))) Max<5.30 r
Height (feet) above ground Stack.Rel.H = 75.2 80.0 55.0 70p of jet = 84.4 90.0 100.0 100.0 5pillane 5.3 m/s Height = 113.7 120.0 130.0 140.0 150.0 160.0 170.0 220.0 330.0 370.0 320.0 370.0 420.0 420.0 520.0 520.0	(meters) above stack 0.00 1.45 2.88 2.80 1.669 11.73 13.65 16.69 19.74 22.79 225.84 22.89 44.13 59.37 74.61 89.85 105.09 120.33 135.57 166.05	Plume Radius(m) 0.223 0.388 0.460 0.445 0.542 1.517 1.699 2.005 2.492 2.980 3.365 4.433 6.882 9.320 11.758 14.197 16.635 19.074 26.389	SingleStk VertVel(m/s) 59.00 43.65 27.57 29.50 14.71 8.06 5.79 5.30 4.68 4.03 3.61 3.31 3.09 2.92 2.41 2.14 1.97 1.84 1.77 1.84 1.77 1.84 1.74 1.66 1.60 1.49	Plume Temp(K) 370.24 322.47 304.96 295.85 290.34 286.70 284.17 282.32 280.94 277.36 275.24 274.83 275.24 274.40 274.40			Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: V_mm={(Va),+0.12F_d[(z-z_v)^2(6.2 a - 0.16(z-z_v))	11 5 foot Interv البلاد to Top of Jet 5D-z,) ²]) ^{10/} /a 10 foot Interv س ^a (a ² ² ² ²))) Max<5.30 r 50 foot Interv
Height (feet) above ground Stack.Rel.Ht = 75.2 80.0 55.0 70p of jet = 84.4 90.0 100.0 100.0 5pillane 5.3 m/s Height = 113.7 120.0 133.0 140.0 150.0 160.0 170.0 220.0 370.0 370.0 420.0 520.0 520.0	(meters) above stack 0.00 1.45 2.989 2.80 1.450 1.60 1.1.73 13.65 16.69 19.74 2.279 2.5.84 2.8.89 4.4.13 5.9.37 7.4.61 89.85 105.09 1120.33 1135.57 166.05	Plume Radius(m) 0.223 0.338 0.460 0.445 0.542 1.029 1.517 1.699 2.005 2.492 2.980 3.466 3.3955 4.443 6.882 9.320 11.758 14.197 16.635 19.074 21.512 26.389 31.266	SingleStk VertVel(m/s) 59.00 43.65 27.57 29.50 14.71 8.00 5.79 5.30 4.68 4.03 3.61 3.31 3.09 2.92 2.41 1.214 1.97 1.84 1.74 1.66 1.60 1.49 1.41 1.49	Plume Temp(K) 370.24 322.47 304.96 295.85 290.34 286.70 284.17 282.32 280.94 277.36 275.24 274.83 275.24 274.40 274.40			Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: V_mm={(Va),+0.12F_d[(z-z_v)^2(6.2 a - 0.16(z-z_v))	11 5 foot Interv البلاد to Top of Jet 5D-z,) ²]) ^{10/} /a 10 foot Interv س ^a (a ² ² ² ²))) Max<5.30 r 50 foot Interv
Height (feet) above ground Stack.Rel.H = 75.2 80.0 85.0 70p of jet = 84.4 90.0 110.0 50.0 110.0 50.0 130.0 1	(meters) above stack 0.00 1.454 2.98 2.80 10.60 11.73 13.65 16.69 19.74 25.84 22.79 25.84 28.89 14.41 359.37 74.61 89.85 105.09 120.33 135.57 166.05 196.63 227.01	Plume Radius(m) 0.223 0.383 0.460 0.445 0.542 1.029 1.517 1.699 2.005 2.980 3.468 3.955 4.443 6.882 9.320 11.758 14.197 16.633 19.074 21.512 26.389 31.266 36.142	SingleStk VertVel(m/s) 59.00 43.665 27.57 29.50 4.86 4.68 4.03 3.61 3.31 3.31 3.09 2.92 2.41 2.14 1.97 1.84 1.77 1.66 1.60 1.49 1.41 1.41 1.44	Plume Temp(K) 370.24 322.47 304.96 295.85 290.34 286.70 284.17 282.32 284.17 282.32 275.95 275.24 274.83 275.95 275.24 274.83 274.54 274.83 274.54 274.40 274.41 273.95 273.90			Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: V_mm={(Va),+0.12F_d[(z-z_v)^2(6.2 a - 0.16(z-z_v))	11 5 foot Interv البلاد to Top of Jet 5D-z,) ²]) ^{10/} /a 10 foot Interv س ^a (a ² ² ² ²))) Max<5.30 r 50 foot Interv
Height (feet) above ground Stack.Rel.H = 75.2 80.0 85.0 70p of jet = 84.4 90.0 100.0 100.0 5pillane 5.3 m/s Height = 113.7 120.0 130.0 100.0 100.0 100	(meters) above stack 0.60 4.50 1.669 1.1.73 1.3.65 1.6.69 1.9.74 2.2.79 2.5.84 2.2.79 2.5.84 2.2.79 2.5.84 2.8.99 1.9.74 6.8.95 1.9.77 4.61 8.9.85 1.20.30 1.20.33 1.35.57 1.66.05 1.20.57.49	Plume Radius(m) 0.223 0.388 0.460 0.445 0.542 1.517 1.699 2.005 2.492 2.980 3.468 3.955 4.443 3.955 4.443 3.955 1.4197 1.6197 2.980 3.166 3.166 3.166 3.166 3.166 3.166 3.166 3.166 3.166 3.166 3.166 3.166 3.166 3.166 3.166 3.166 3.166 3.167 3.1	SingleStk VertVel(m/s) 59.00 43.65 27.57 29.50 14.71 8.06 5.79 5.30 4.68 4.03 3.61 3.31 3.09 2.92 2.41 2.41 1.97 1.84 1.74 1.66 1.60 1.49 1.41 1.74 1.64 1.42 1.44 1.22 1.44	Plume Temp(K) 370.24 322.47 304.96 295.85 290.34 286.70 284.17 282.32 284.17 282.32 275.95 275.24 274.83 275.95 275.24 274.83 274.54 274.61 274.54 274.41 274.41 274.41 274.41 273.95 273.90			Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: V_mm={(Va),+0.12F_d[(z-z_v)^2(6.2 a - 0.16(z-z_v))	11 5 foot Interv البلاد to Top of Jet 5D-z,) ²]) ^{10/} /a 10 foot Interv س ^a (a ² ² ² ²))) Max<5.30 r 50 foot Interv
Height (feet) above ground Stack.Rel.H = 75.2 80.0 55.0 70p of jet = 84.4 90.0 100.0 100.0 5pillane 5.3 m/s Height = 113.7 120.0 130.0 140.0 130.0 140.0 130.0 140.0 130.0 140.0 130.0 140.0 130.0 140.0 130.0 140.0 130.0 140.0 130.0 140.0 130.0 140.0 100	(meters) above stack 0.60 4.50 7.55 10.060 111.73 13.65 16.69 19.74 22.79 25.84 22.89 44.13 59.37 74.61 89.85 105.09 120.33 135.57 166.05 19.65 19.55 19.65 19.55	Plume Radius(m) 0.223 0.388 0.460 0.445 0.542 1.517 1.699 2.005 2.492 2.980 3.468 3.955 4.433 6.882 9.320 11.758 14.197 16.635 19.074 21.512 26.389 31.266 34.126 3.126 3.126 3.126 3.126 3.126 3.126 3.126 3.126 3.126 3.126 3.126 3.126 3.126 3.126 3.126 3.126 3.126 3.127 3.12	SingleStk VertVel(m/s) 59.00 43.65 27.57 29.50 14.71 8.06 5.79 5.30 4.68 4.63 3.61 3.31 3.09 2.92 2.41 2.41 4.197 1.84 1.77 1.84 1.74 1.66 1.660 1.49 1.41 1.42 1.44 1.28 1.24 1.28	Plume Temp(K) 370.24 322.47 304.96 295.85 290.34 286.70 284.17 282.32 280.94 277.36 275.24 275.24 274.83 275.24 274.40 274.57 274.40 274.27 274.11 273.95 273.90 273.85			Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: V_mm={(Va),+0.12F_d[(z-z_v)^2(6.2 a - 0.16(z-z_v))	11 5 foot Interv البلاد to Top of Jet 5D-z,) ²]) ^{10/} /a 10 foot Interv س ^a (a ² ² ² ²))) Max<5.30 r 50 foot Interv
Height (feet) above ground Stack.Rel.Ht = 75.2 80.0 55.0 70p of jet = 84.4 90.0 100.0 50.0 50.0 50.0 50.0 50.0 100.0 50.0 5	(meters) above stack 0.00 1.45 2.88 2.80 1.45 1.66 1.1.73 1.3.65 1.6.69 1.9.74 2.27 2.5.84 2.8.89 4.4.13 5.9.37 7.4.61 8.9.85 1.05.09 1.02.33 1.35.57 1.166.05 1.166.05 1.165.53 1.227.01 2.27.49 2.27	Plume Radius(m) 0.223 0.338 0.460 0.445 0.542 1.029 1.517 1.699 2.005 2.492 2.980 3.468 3.955 4.443 6.882 9.320 1.1788 14.197 16.635 19.074 2.6.389 3.1.266 3.6.142 2.6.389 3.1.266 3.6.142 2.6.389 3.1.266 3.6.142 3.6.142 5.6.773 3.5	SingleStk VertVel(m/s) 59.00 43.65 27.57 29.50 14.71 8.00 5.79 5.30 4.68 4.03 3.61 3.31 3.09 2.92 2.41 1.21 4.17 1.84 1.74 1.66 1.60 1.49 1.41 1.34 1.28 1.24 1.24 1.24 1.24 1.24 1.24 1.24 1.24	Plume Temp(K) 370.24 322.47 304.96 300.96 295.85 290.34 286.70 284.17 282.32 280.94 277.36 275.95 275.24 274.40 274.27 274.40 274.27 274.11 274.01 273.95 273.90 273.87 273.85 273.83			Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: V_mm={(Va),+0.12F_d[(z-z_v)^2(6.2 a - 0.16(z-z_v))	11: 5 foot Interv البلاد Top of Jet 5D-z,) ²]) ¹⁰ /a 10 foot Interv س ^a ^a ² ^x ²))) Max<5.30 n
Height (feet) above ground Stack.Rel.H = 75.2 80.0 85.0 7op of jet = 84.4 90.0 100.0 110.0 Spillane 5.3 m/s Height = 113.7 120.0 130.0 120.0 120.0 120.0 120.0 120.0 120.0 120.0 122.0 122.0	(meters) above stack 0.00 1.450 2.98 1.9.00 1.11.73 1.3.65 1.6.69 1.9.74 2.2.79 2.5.84 2.2.79 2.5.84 2.2.79 2.5.84 2.2.79 2.5.84 2.2.79 2.5.84 2.2.79 1.9.74.61 8.9.85 1.05.09 1.20.33 1.35.57 1.66.05 1.25.7.49 2.27.49 2.27.97 3.13.557 1.66.05 3.227.01 2.25.7.49 2.25.	Plume Radius(m) 0.223 0.383 0.460 0.445 1.027 1.699 2.005 2.492 2.980 3.468 3.955 4.443 3.955 4.443 3.955 4.443 1.027 1.517 1.633 19.074 21.512 26.389 36.126 35.166	SingleStk VertVel(m/s) 59.00 43.665 27.57 29.50 4.468 4.03 3.61 3.31 3.09 2.92 2.41 2.14 1.77 1.84 1.74 1.66 1.60 1.49 1.41 1.44 1.28 1.42 1.41 1.54 1.52 1.52 1.52 1.53 1.54 1.54 1.55 1.54 1.55 1.54 1.55 1.55	Plume Temp(K) 370.24 322.47 304.96 295.85 290.34 286.70 284.17 282.32 275.95 275.24 274.83 274.55 275.24 274.40 274.27 274.40 274.27 274.40 274.27 274.41 273.95 273.90 273.87 273.85 273.85 273.85 273.81			Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: V_mm={(Va),+0.12F_d[(z-z_v)^2(6.2 a - 0.16(z-z_v))	11 5 foot Interv البلاد to Top of Jet 5D-z,) ²]) ^{10/} /a 10 foot Interv س ^a (a ² ² ² ²))) Max<5.30 r 50 foot Interv
Height (feet) above ground Stack.Rel.H = 75.2 80.0 85.0 70p of jet = 84.4 90.0 100.0 100.0 5pillane 5.3 m/s Height = 113.7 120.0 130.0 100	(meters) above stack 0.60 4.50 7.55 10.060 111.73 13.65 16.69 19.74 22.79 25.84 22.89 44.13 59.37 74.61 89.85 105.09 120.33 135.57 166.05 19.63 135.57 166.05 19.63 135.57 166.05 19.63 135.57 166.05 19.63 135.57 166.05 19.63 135.57 166.05 19.63 135.57 166.05 19.63 135.57 166.05 19.63 135.57 166.05 19.63 135.57 166.05 19.63 135.57 166.05 19.63 135.57 166.05 19.63 135.57 166.05 19.63 135.57 166.05 19.63 135.57 166.05 19.63 19.55 19	Plume Radius(m) 0.223 0.388 0.460 0.445 0.542 1.517 1.699 2.005 2.492 2.980 3.468 3.955 4.443 6.822 9.320 11.758 14.197 16.637 19.074 21.512 26.389 31.266 36.142 36.	SingleStk VertVel(m/s) 59.00 43.65 5.27.57 29.50 4.4.68 4.68 4.03 3.61 3.31 3.09 2.92 2.41 2.41 1.97 1.84 1.74 1.66 1.60 1.49 1.41 1.74 1.62 1.42 1.41 1.34 1.28 1.24 1.13 1.10	Plume Temp(K) 370.24 322.47 304.96 295.85 290.34 286.70 284.17 282.32 280.94 277.36 275.24 274.83 275.24 274.43 274.57 274.41 274.57 274.41 274.92 273.90 273.87 273.85 273.83 273.81 273.85			Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: V_mm={(Va),+0.12F_d[(z-z_v)^2(6.2 a - 0.16(z-z_v))	11: 5 foot Interv البلاد Top of Jet 5D-z,) ²]) ¹⁰ /a 10 foot Interv س ^a ^a ² ^x ²))) Max<5.30 n
Height (feet) above ground Stack.Rel.H = 75.2 80.0 55.0 70p of jet = 84.4 90.0 100.0 50.0 50.0 50.0 50.0 50.0 50.0	(meters) above stack 0.00 1.45 2.88 2.80 1.0.60 11.73 13.65 16.69 19.74 22.79 225.84 22.89 44.13 59.37 74.61 89.85 105.03 135.57 166.05 196.53 135.57 166.05 196.53 227.01 2257.49 287.97 318.45 348.93 379.41 409.89 440.37	Plume Radius(m) 0.223 0.388 0.465 0.542 1.029 1.517 1.699 2.005 2.492 2.930 3.468 3.955 4.443 6.882 9.320 11.758 14.197 16.635 19.074 26.389 31.266 35.630 6.142 26.389 31.266 50.773 35.5650 60.526 65.403 70.280	SingleStk VertVel(m/s) 59.00 43.665 27.57 29.50 14.71 8.06 5.79 5.30 4.68 4.03 3.61 3.31 3.09 2.92 2.41 2.41 1.97 1.84 1.97 1.84 1.197 1.44 1.197 1.44 1.197 1.44 1.109 1.41 1.24 1.24 1.24 1.24 1.24 1.24 1.24	Plume Temp(K) 370.24 322.47 304.96 295.85 290.34 286.92 280.94 276.95 275.24 274.83 274.57 274.40 274.57 274.40 274.27 274.11 274.00 273.85 273.85 273.83 273.85 273.83 273.81 273.80 273.79			Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: V_mm={(Va),+0.12F_d[(z-z_v)^2(6.2 a - 0.16(z-z_v))	11: 5 foot Interva البلا to Top of Jet 5D-z_J ²]) ¹⁰ / a 10 foot Interva سر ¹ a [*] λ ²))) Max<5.30 n 50 foot Interva
Height (feet) above ground Stack.Rel.H = 75.2 80.0 85.0 7op of jet = 84.4 90.0 110.0 5pillane 5.3 m/s Height = 113.7 120.0 130.0 140.0 150.0 160.0 170.0 220.0 270.0 320.0 370.0 320.0 370.0 420.0 470.0 522.0 102.0 120	(meters) above stack 0.00 1.454 2.98 2.60 10.60 11.73 13.65 16.69 19.74 22.79 22.54 22.84 22.89 14.41 35.937 74.61 89.85 105.09 120.33 135.57 166.05 196.63 1227.01 2257.49 196.53 1257.49 196.53 1257.49 196.53 1257.49 196.53 1257.49 196.53 1257.49 196.53 1257.49 196.55 196.53 1257.49 196.55 196.5	Plume Radius(m) 0.223 0.388 0.460 0.445 1.029 1.517 1.699 2.492 2.980 3.468 3.955 4.443 6.822 9.320 11.758 14.197 16.635 19.074 21.512 26.389 31.266 3.6.142 41.019 45.5650 60.526 65.403 75.5650	SingleStk VertVel(m/s) 59.00 43.65 27.57 29.50 4.68 4.03 3.61 3.31 3.09 2.92 2.41 1.71 1.84 1.74 1.66 1.60 1.49 1.41 1.74 1.84 1.74 1.84 1.74 1.66 1.60 1.49 1.41 1.34 1.28 1.24 1.97 1.84 1.74 1.97 1.84 1.74 1.97 1.84 1.74 1.97 1.84 1.74 1.97 1.84 1.74 1.97 1.84 1.74 1.97 1.84 1.74 1.97 1.84 1.74 1.97 1.84 1.74 1.97 1.94 1.94 1.94 1.97 1.94 1.94 1.94 1.94 1.94 1.94 1.94 1.94	Plume Temp(K) 370.24 322.47 304.96 295.85 290.34 286.70 284.17 282.32 280.94 277.36 275.95 275.24 274.83 276.57 274.40 274.27 274.11 274.01 273.95 273.90 273.87 273.87 273.83 273.81 273.80 273.78			Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: V_mm={(Va),+0.12F_d[(z-z_v)^2(6.2 a - 0.16(z-z_v))	11: 5 foot Interva الله ان Top of Jet 50-د.) ²)) ¹⁰ / a 10 foot Interva
Height (feet) above ground Stack.Rel.H = 75.2 80.0 85.0 7op of jet = 84.4 90.0 110.0 5pillane 5.3 m/s Height = 113.7 120.0 130.0 120	(meters) above stack 0.00 1.454 2.98 2.80 10.60 11.73 13.65 16.69 19.74 22.79 25.84 22.89 19.74 61 89.85 105.09 120.33 135.57 166.05 125.74 227.01 227.40 125.74 287.97 318.45 3227.01 227.49 287.97 318.45 3379.41 409.89 3379.41 409.89 3379.41	Plume Radius(m) 0.223 0.383 0.460 0.445 0.542 1.027 1.699 2.005 2.492 2.980 3.468 3.955 4.443 3.955 4.443 3.955 4.443 1.027 1.517 1.633 19.074 21.512 26.389 36.126 37.157 35.650 36.000 37.157 37.157 38.0004 37.157 38.0004 37.157	SingleStk VertVel(m/s) 59.00 43.665 27.57 29.50 4.468 4.03 3.61 3.31 3.09 2.92 2.41 2.14 1.77 1.84 1.74 1.66 1.60 1.49 1.41 1.44 1.28 1.24 1.41 1.44 1.54 1.28 1.24 1.19 1.61 1.13 1.10 1.07 1.05 5.10 1.03	Plume Temp(K) 370.24 322.47 304.96 295.85 290.34 286.70 284.17 282.32 275.95 275.24 274.83 274.57 274.40 274.27 274.40 274.27 274.40 273.95 273.95 273.90 273.87 273.85 273.80 273.87 273.80 273.87 273.80 273.77			Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: V_mm={(Va),+0.12F_d[(z-z_v)^2(6.2 a - 0.16(z-z_v))	11: 5 foot Interva البلا to Top of Jet 5D-z_J ²]) ¹⁰ / a 10 foot Interva سر ¹ a [*] λ ²))) Max<5.30 n 50 foot Interva
Height (feet) above ground Stack.Rel.H = 75.2 80.0 85.0 7op of jet = 84.4 90.0 110.0 5pillane 5.3 m/s Height = 113.7 120.0 130.0 140.0 150.0 160.0 170.0 220.0 270.0 320.0 370.0 320.0 370.0 420.0 470.0 522.0 102.0 120	(meters) above stack 0.00 1.454 2.98 2.60 10.60 11.73 13.65 16.69 19.74 22.79 22.54 22.84 22.89 14.41 35.937 74.61 89.85 105.09 120.33 135.57 166.05 196.63 1227.01 2257.49 196.53 1257.49 196.53 1257.49 196.53 1257.49 196.53 1257.49 196.53 1257.49 196.53 1257.49 196.55 196.53 1257.49 196.55 196.5	Plume Radius(m) 0.223 0.388 0.460 0.445 1.029 1.517 1.699 2.492 2.980 3.468 3.955 4.443 6.822 9.320 11.758 14.197 16.635 19.074 21.512 26.389 31.266 3.6.142 41.019 45.5650 60.526 65.773 55.650	SingleStk VertVel(m/s) 59.00 43.665 27.57 29.50 4.4.68 4.03 3.661 3.30 4.68 4.03 3.61 3.31 3.31 3.09 2.92 2.41 4.2.14 1.97 1.84 1.77 1.66 1.60 1.49 1.41 1.34 1.28 1.24 1.19 1.10 1.10 1.10 1.07 1.05 1.03 1.01	Plume Temp(K) 370.24 322.47 304.96 295.85 290.34 286.70 284.17 282.32 280.94 277.36 275.95 275.24 274.83 276.57 274.40 274.27 274.11 274.01 273.95 273.90 273.87 273.87 273.83 273.81 273.80 273.78			Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: V_mm={(Va),+0.12F_d[(z-z_v)^2(6.2 a - 0.16(z-z_v))	11: 5 foot Interv البلاد Top of Jet 5D-z,) ²]) ¹⁰ /a 10 foot Interv س ^a ^a ² ^x ²))) Max<5.30 n



	"Aviation Sa	-	-				Stack Height - Summer Ma	
		-	-			litions at V	arious Heights in the Plume	9
							Australia," Dr. K.T. Spilla	
Ambient Conditions:							eutral conditions (dθ/dz=0 or	
Ambient Potential Temp θ_a	310.37	Kelvins	99.0	°F		0.3048	meters/feet	
Plume Exit Conditions:					Gravity g		m/s ²	
Maximum Stack Height hs		meters		feet-inches	λ	1.11		
Stack Diameter D		meters		inches	λο	~1.0		
Stack Velocity V _{exit}	59.00		193.56		N 5214			0
Volumetric Flow		cu.m/sec	19,467		πV _{exit} D ² /4			Sect.2/¶1
Stack Potential Temp θ _s Initial Stack Buoyancy Flux F _o	17.0233	Kelvins	914	F	aV D ² (1.6	(0)/(1 - 1)/	ol.Flow(g/π)(1-θ _a /θ _a)	Sect.2/¶1
Plume Buoyancy Flux F		m ⁴ /s ³					,θ _p at plume height (see belo	
No.of Stacks N	1			1.000			cation Factor (N ^{0.25})	
					indiapio ote	aon manipi		
Conditions at End (Top) of Jet Phase:								
Height above Stack z _{jet}	2.783	meters*	9.1	feet*	z _{jet} = 6.25D	, meters*=	meters above stack top	Sect.3/¶1
Height above Ground zjet+hs	25.713	meters	84.4	feet				
Vertical Velocity V _{jet}	29.500	m/s	96.78	ft/sec	$V_{jet} = 0.5V_{e}$	$e_{xit} = V_{exit}/2$		
Plume Top-Hat Diameter 2ajet	0.891	meters	2.9	feet	2a _{jet} = 2D		Conservation of momentum	
pillane Methodology - Analytical Solutions f	or Calm Con	ditions for P	lume Heights	above Je	t Phase			
Single Plume-averaged Vertical Velocity				er where P	-			
Plume Top-Hat Radius a		olutions in T					crease with height	Sect.2/Eq.6
Virtual Source Height z_{ν}		meters*		feet*	6.25D[1-(θ _e		ers*=meters above stack top	Sect.2/Eq.6
Height above Ground z_v + h_s		meters	78.5	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	8.377	m²/s			$V_{exit}D/2(\theta_e/$	θ _s) ^{1/2}		
Solve for plume-averaged vertical veloc		300.0			meters abo	ve ground (z'+h _s)	
Gives the following Height above Stack z'		meters*	224.8					0
Plume Top-Hat Diameter 2a	21.601		70.9		2a'=2*0.16(2 (0 05D 22)(1/3)	Sect.2/Eq.6
Vertical Velocity V	1.987	m/s	6.52	ft/sec	V={(Va) ₀ ³ +0	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			m/s plume-a	-		-		> Top of Jet (Spillar
Find Height above Stack z _{crit}	12.103		39.7				Itaneously in both eqs. (i.e.,	
Height above Ground z _{crit} +h _s	35.033	meters	114.9	feet	for V=4.3 m		e cubic equation ax ³ +bx ² +cx	
		Dh e e e .					and b=- $(0.12F_0)/(4.3^30.16^3)$ =	
Interpolated Height of critical vertical ve	-				and d	I=[0.12⊢₀(б.	.25D-z _v) ² -(Va) _o ³]/(4.3 ³ 0.16 ³)=	-953. /www.1728.org/cubic.ht
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s		meters meters	#N/A #N/A					11.09
Height above Ground 2 _{crit} +hs	#IN/A	meters	#N/A	leel		give	s the real solution x = z-zv =	12.1
							or z(m/above stack) = z(ft/above ground) =	12.1
							z(ii/above ground) =	114
able of Plume Ten-Hat Diameters (2a) and P	lumo-Avorag	od Vortical	Volocitios etc	rting at or	d of iot pha	100.		
able of Plume Top-Hat Diameters (2a) and P						ase:		
Height (feet)	(meters)	Plume	SingleStk	Plume		ise:		
Height (feet) above ground	(meters) above stack	Plume Radius(m)	SingleStk /ertVel(m/s)	Plume		ise:		
Height (feet) above ground <u>Stack.Rel.Ht = 75.2</u>	(meters) above stack <i>0.00</i>	Plume Radius(m) 0.223	SingleStk /ertVel(m/s) 59.00	Plume		ase:	Jet Phase Eos:	5 foot Interva
Height (feet) above ground Stack.Rel.Ht = 75.2 80.0	(meters) above stack 0.00 1.45	Plume Radius(m) 0.223 0.338	SingleStk VertVel(m/s) 59.00 43.65	Plume		ase:	Jet Phase Eqs: Linearly interpolated from Stack R	
Height (feet) above ground <i>Stack.Rel.Ht</i> = 75.2 80.0 85.0	(meters) above stack <i>0.00</i>	Plume Radius(m) 0.223	SingleStk /ertVel(m/s) 59.00	Plume		150:	Linearly interpolated from Stack R	
Height (feet) above ground Stack.Rel.Ht = 75.2 80.0	(meters) above stack 0.00 1.45 2.98	Plume Radius(m) 0.223 0.338 0.460	SingleStk VertVel(m/s) 59.00 43.65 27.57	Plume Temp(K)		150:		el.Ht to Top of Jet
Height (feet) above ground Stack.Rel.Ht = 75.2 80.0 85.0 Top of jet = 84.4	(meters) above stack 0.00 1.45 2.98 2.80	Plume Radius(m) 0.223 0.338 0.460 0.445	SingleStk /ertVel(m/s) 59.00 43.65 27.57 29.50	Plume Temp(K)		150:	Linearly interpolated from Stack R Spillane Equations:	el.Ht to Top of Jet 5D-z _v) ²]} ^{1/3} / a
Height (feet) above ground Stack.Rel.Ht = 75.2 80.0 85.0 7op of jet = 84.4 90.0	(meters) above stack 0.00 1.45 2.98 2.80 4.50	Plume Radius(m) 0.223 0.338 0.460 0.445 0.559	SingleStk /ertVel(m/s) 59.00 43.65 27.57 29.50 15.14	Plume Temp(K) 402.76		358:	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 Interva
Height (feet) above ground Stack.Rel.Ht = 75.2 80.0 85.0 Top of jet = 84.4 90.0 100.0	(meters) above stack 0.00 1.45 2.98 2.80 4.50 7.55	Plume Radius(m) 0.223 0.338 0.460 0.445 0.559 1.047	SingleStk /ertVel(m/s) 43.65 27.57 29.50 15.14 8.36	Plume Temp(K) 402.76 358.13		358:	Linearly interpolated from Stack R Spillane Equations: $V_{plume} = \{(Va)_o^3 + 0.12F_o[(z \cdot z_v)^2 - (6.2 \cdot z_v)^2 + (6.$	el.Ht to Top of Jet (5D-z _v) ²]) ^{1/3} / a 10 foot Interva
Height (feet) above ground Stack.Rel.Ht = 75.2 80.0 85.0 Top of jet = 84.4 90.0 100.0 110.0	(meters) above stack 0.00 1.45 2.98 2.80 4.50 7.55 10.60	Plume Radius(m) 0.223 0.338 0.460 0.445 0.559 1.047 1.534 1.775	Single Stk VertVel(m/s) 59.00 43.65 27.57 29.50 15.14 8.36 5.97 5.30	Plume Temp(K) 402.76 358.13 341.46		150:	Linearly interpolated from Stack R Spillane Equations: $V_{plume} = \{(Va)_o^3 + 0.12F_o[(z \cdot z_v)^2 - (6.2 \cdot z_v)^2 + (6.$	el.Ht to Top of Jet (5D-z _v) ²]) ^{1/3} / a 10 foot Interv a
Height (feet) above ground Stack.Rel.Ht = 75.2 80.0 85.0 Top of jet = 84.4 90.0 110.0 111.0 Spillane 5.3 m/s Height = 114.9	(meters) above stack 0.00 1.45 2.98 2.80 4.50 7.55 10.60 12.10	Plume Radius(m) 0.223 0.338 0.460 0.445 0.559 1.047 1.534 1.775	Single Stk VertVel(m/s) 59.00 43.65 27.57 29.50 15.14 8.36 5.97 5.30 4.79	Plume Temp(K) 402.76 358.13 341.46 336.54 332.70		350:	Linearly interpolated from Stack R Spillane Equations: $V_{plume} = \{(Va)_o^3 + 0.12F_o[(z \cdot z_v)^2 - (6.2 \cdot z_v)^2 + (6.$	el.Ht to Top of Jet (5D-z _v) ²]) ^{1/3} / a 10 foot Interv a
Height (feet) above ground Stack.Rel.Ht = 75.2 80.0 85.0 Top of jet = 84.4 90.0 100.0 110.0 Spillane 5.3 m/s Height = 114.9 120.0	(meters) above stack 0.00 1.45 2.98 2.80 4.50 7.55 10.60 12.10 13.65	Plume Radius(m) 0.223 0.338 0.460 0.445 0.559 1.047 1.534 1.775 2.022	Single Stk VertVel(m/s) 59.00 43.65 27.57 29.50 15.14 8.36 5.97 5.30 4.79 4.09	Plume Temp(K) 402.76 358.13 341.46 336.54 332.70 327.33		150:	Linearly interpolated from Stack R Spillane Equations: $V_{plume} = \{(Va)_o^3 + 0.12F_o[(z \cdot z_v)^2 - (6.2 \cdot z_v)^2 + (6.$	el.Ht to Top of Jet 5D-z _γ) ²]) ¹³ / a 10 foot Interv _{me} *a ² λ ²)))
Height (feet) above ground Stack.Rel.Ht = 75.2 80.0 85.0 Top of jet = 84.4 90.0 100.0 110.0 Spillane 5.3 m/s Height = 114.9 120.0 130.0	(meters) above stack 0.00 1.45 2.98 2.80 4.50 7.55 10.60 12.10 13.65 16.69	Plume Radius(m) 0.223 0.338 0.460 0.445 0.559 1.047 1.534 1.775 2.022 2.510	Single Stk VertVel(m/s) 59.00 43.65 27.57 29.50 15.14 8.36 5.97 5.30 4.79 4.09 3.64	Plume Temp(K) 402.76 358.13 341.46 336.54 332.70 327.33 323.74		150:	Linearly interpolated from Stack R Spillane Equations: $V_{plume} = \{(Va)_o^3 + 0.12F_o[(z \cdot z_v)^2 - (6.2 \cdot z_v)^2 + (6.$	el.Ht to Top of Jet 5D-z ₁ ,2]) ¹³ / a 10 foot Interva me*a ² a ^λ 2)))
Height (feet) above ground Stack.Rel.Ht = 75.2 80.0 85.0 Top of jet = 84.4 90.0 100.0 110.0 Spillane 5.3 m/s Height = 114.9 120.0 130.0 140.0	(meters) above stack 0.00 1.45 2.98 2.80 4.50 10.60 12.10 13.65 16.69 19.74	Plume Radius(m) 0.223 0.338 0.460 0.445 0.559 1.047 1.534 1.534 1.775 2.022 2.510 2.997	SingleStk VertVel(m/s) 59.00 43.65 27.57 29.50 15.14 8.36 5.97 5.30 4.79 4.09 3.64 3.32	Plume Temp(K) 402.76 358.13 341.46 336.54 332.70 327.33 323.74		150: 	Linearly interpolated from Stack R Spillane Equations: $V_{plume} = \{(Va)_o^3 + 0.12F_o[(z \cdot z_v)^2 - (6.2 \cdot z_v)^2 + (6.$	el.Ht to Top of Jet 5D-z ₁ ,2]) ¹³ / a 10 foot Interva me*a ² a ^λ 2)))
Height (feet) above ground Stack.Rel.Ht = 75.2 80.0 85.0 Top of jet = 84.4 90.0 110.0 111.0 Spillane 5.3 m/s Height = 114.9 120.0 130.0 130.0	(meters) above stack 0.00 1.45 2.98 2.80 4.50 7.55 10.60 12.10 13.65 16.69 19.74 22.79	Plume Radius(m) 0.223 0.338 0.460 0.445 0.559 1.534 1.534 1.775 2.022 2.510 2.997 3.485	SingleStk /ertVel(m/s) 59.00 43.65 27.57 29.50 15.14 8.36 5.97 5.30 4.79 4.09 3.64 3.32 3.08	Plume Temp(K) 402.76 358.13 341.46 336.54 332.70 327.33 323.74 321.21 319.35		150: 	Linearly interpolated from Stack R Spillane Equations: $V_{plume} = \{(Va)_o^3 + 0.12F_o[(z \cdot z_v)^2 - (6.2 \cdot z_v)^2 + (6.$	el.Ht to Top of Jet 5D-z _γ) ²]) ¹³ / a 10 foot Interv _{me} *a ² λ ²)))
Height (feet) above ground Stack.Rel.Ht = 75.2 80.0 85.0 Top of jet = 84.4 90.0 100.0 110.0 Spillane 5.3 m/s Height = 114.9 120.0 130.0 140.0 150.0 160.0 177.0	(meters) above stack 0.00 1.45 2.80 4.50 7.55 10.660 12.10 13.65 16.69 19.74 22.79 25.84	Plume Radius(m) 0.223 0.338 0.460 0.445 1.559 1.047 1.534 1.775 2.022 2.510 2.997 3.485 3.973 4.460 6.899	SingleStk VertVel(m/s) 59.00 43.65 27.57 29.50 15.14 8.36 5.97 5.97 4.09 3.64 3.32 3.08 2.30 2.30	Plume Temp(K) 402.76 358.13 341.46 336.54 332.70 327.33 323.74 321.21 319.35 317.94		150 :	Linearly interpolated from Stack R Spillane Equations: $V_{plume} = \{(Va)_o^3 + 0.12F_o[(z \cdot z_v)^2 - (6.2 \cdot z_v)^2 + (6.$	el.Hi to Top of Jet 5D-z.) ²) ¹⁰³ / a 10 foot Interv m [*] ^{2a*} λ ²))) Max<5.30 r
Height (feet) above ground Stack.Rel.Ht = 75.2 80.0 85.0 Top of jet = 84.4 90.0 110.0 111.0 Spillane 5.3 m/s Height = 114.9 120.0 130.0 140.0 150.0 160.0 220.0 227.0	(meters) above stack 0.00 1.454 2.98 0.2.60 1.55 10.60 1.2.10 1.365 1.9.74 2.2.79 2.5.84 2.8.89 4.4.13 5.9.37	Plume Radius(m) 0.223 0.383 0.460 0.445 0.559 1.047 1.534 1.775 2.022 2.510 2.977 3.485 3.973 4.460 6.899 9.337	SingleStk VertVel(m/s) 59.00 43.665 27.57 29.50 15.14 8.36 5.97 5.30 4.79 4.09 3.644 3.32 3.08 2.90 2.37 2.10	Plume Temp(K) 402.76 358.13 341.46 336.54 332.70 327.33 323.74 321.21 319.35 317.94 314.24 312.76		150 :	Linearly interpolated from Stack R Spillane Equations: $V_{plume} = \{(Va)_o^3 + 0.12F_o[(z \cdot z_v)^2 - (6.2 \cdot z_v)^2 + (6.$	el.Hi to Top of Jet 5D-z.) ²) ¹⁰³ / a 10 foot Interv m [*] ^{2a*} λ ²))) Max<5.30 r
Height (feet) above ground Stack.Rel.Ht = 75.2 80.0 85.0 Top of jet = 84.4 90.0 110.0 Spillane 5.3 m/s Height = 114.9 120.0 130.0 130.0 130.0 130.0 130.0 130.0 220.0 270.0 270.0	(meters) above stack 0.00 1.64 2.98 0.280 1.92 1.060 1.210 1.365 1.9.60 1.9.74 2.2.79 2.5.84 2.8.89 4.13 5.9.37 7.4.61	Plume Radius(m) 0.223 0.388 0.460 0.659 1.047 1.534 1.775 2.022 2.510 2.997 3.485 3.973 4.460 6.899 9.337 11.776	SingleStk VertVel(m/s) 59.00 43.665 27.57 29.50 15.14 8.36 5.39 4.79 4.09 3.644 3.32 3.08 2.90 2.37 2.101 1.92	Plume Temp(K) 402.766 358.13 341.46 336.54 332.70 327.33 323.74 321.21 319.35 317.94 314.24 312.76 312.01		156 :	Linearly interpolated from Stack R Spillane Equations: $V_{plume} = \{(Va)_o^3 + 0.12F_o[(z \cdot z_v)^2 - (6.2 \cdot z_v)^2 + (6.$	el.Hi to Top of Jet 5D-z.) ²) ¹⁰³ / a 10 foot Interv m [*] ^{2a*} λ ²))) Max<5.30 r
Height (feet) above ground Stack.Rel.Ht = 75.2 80.0 85.0 Top of jet = 84.4 90.0 100.0 110.0 Spillane 5.3 m/s Height = 114.9 120.0 130.0 140.0 150.0 160.0 170.0 220.0 370.0	(meters) above stack 0.00 1.45 2.80 4.50 7.55 10.060 12.10 13.65 16.69 19.74 22.79 25.84 28.89 44.13 59.37 74.61 89.85	Plume Radius(m) 0.223 0.338 0.460 0.445 0.559 1.047 1.534 1.775 2.022 2.510 2.997 3.485 3.973 4.460 6.899 9.337 11.776 14.214	SingleStk VertVel(m/s) 59.00 43.65 27.57 29.50 15.14 8.36 5.30 4.79 4.09 3.64 3.32 3.08 2.90 2.37 2.10 1.922 1.80	Plume Temp(K) 402.76 358.13 341.46 336.54 332.70 327.33 323.74 321.21 319.35 317.94 314.24 312.21 311.57		198 :	Linearly interpolated from Stack R Spillane Equations: $V_{plume} = \{(Va)_o^3 + 0.12F_o[(z \cdot z_v)^2 - (6.2 \cdot z_v)^2 + (6.$	el.Hi to Top of Jet 5D-z.) ²) ¹⁰³ / a 10 foot Interv m [*] ^{2a*} λ ²))) Max<5.30 r
Height (feet) above ground Stack.Rel.Ht = 75.2 80.0 85.0 7op of jet = 84.4 90.0 100.0 110.0 Spillane 5.3 m/s Height = 114.9 120.0 130.0 140.0 150.0 170.0 220.0 270.0 320.0 370.0	(meters) above stack 0.00 1.45 2.88 2.80 4.50 7.55 10.60 12.10 13.65 16.69 19.74 2.544 2.889 4.4.13 59.37 7.4.61 89.85 105.09	Plume Radius(m) 0.223 0.338 0.460 0.445 0.559 1.047 1.534 1.775 2.022 2.510 2.997 3.973 4.460 6.899 9.337 11.776 14.214 16.652	SingleStk VertVel(m/s) 59.00 43.65 27.57 29.50 15.14 8.36 5.97 5.30 4.79 4.09 3.64 3.32 3.08 2.90 2.37 2.10 1.92 1.80 1.92 1.80 1.70	Plume Temp(K) 402.76 358.13 341.46 332.70 327.33 323.74 321.21 319.35 317.94 314.24 312.76 312.01 311.57 311.30			Linearly interpolated from Stack R Spillane Equations: $V_{plume} = \{(Va)_o^3 + 0.12F_o[(z \cdot z_v)^2 - (6.2 \cdot z_v)^2 + (6.$	el.Hi to Top of Jet 5D-z.) ²) ¹⁰³ / a 10 foot Interv m [*] ^{2a*} λ ²))) Max<5.30 r
Height (feet) above ground Stack.Rel.H = 75.2 80.0 85.0 70p of jet = 84.4 90.0 110.0 110.0 5pillane 5.3 m/s Height = 114.9 120.0 130.0 140.0 150.0 160.0 270.0 320.0 370.0 370.0 420.0	(meters) above stack 0.00 1.454 2.98 2.60 10.60 12.10 13.65 16.609 19.74 22.79 25.84 28.89 44.13 59.37 74.61 89.85 105.00 120.33	Plume Radius(m) 0.223 0.383 0.460 0.445 0.559 1.047 1.534 1.775 2.022 2.510 2.977 3.485 3.973 4.460 6.899 9.337 11.776 14.214 16.652 19.091	SingleStk VertVel(m/s) 59.00 43.665 27.57 29.50 15.14 8.36 5.97 5.30 4.79 4.09 3.644 3.32 3.08 2.90 2.37 2.10 1.92 1.80 1.70 1.62	Plume Temp(K) 402.76 358.13 341.46 336.54 332.70 327.33 323.74 319.35 317.94 314.24 312.76 312.01 311.57 311.30 311.11			Linearly interpolated from Stack R Spillane Equations: $V_{plume} = \{(Va)_o^3 + 0.12F_o[(z \cdot z_v)^2 - (6.2 \cdot z_v)^2 + (6.$	el.Hi to Top of Jet 5D-z.) ²) ¹⁰³ / a 10 foot Interv m [*] ^{2a*} λ ²))) Max<5.30 r
Height (feet) above ground Stack.Rel.H = 75.2 80.0 85.0 70p of jet = 84.4 90.0 100.0 100.0 100.0 5pillane 5.3 m/s Height = 114.9 120.0 130	(meters) above stack 0.00 1.450 2.98 0.260 1.2.60 1.3.65 1.6.69 1.9.74 22.79 2.5.84 2.2.79 2.5.84 2.8.99 1.9.74 2.5.937 7.4.61 8.9.85 1.0.5.09 1.20.33 1.35.57	Plume Radius(m) 0.223 0.388 0.460 0.445 0.559 1.544 1.775 2.022 2.510 2.977 3.485 3.973 4.460 6.899 9.337 11.776 14.214 16.652 19.091 9.1529	SingleStk VertVel(m/s) 59.00 43.665 27.57 29.50 15.14 8.36 5.97 5.30 4.79 4.09 3.644 3.32 3.00 2.90 2.90 2.90 1.92 1.80 1.92 1.80 1.70 1.62 5.80 5.97 5.30 5.30 5.97 5.30 5.30 5.30 5.30 5.30 5.30 5.30 5.30	Plume Temp(K) 402.766 358.13 341.46 336.54 332.70 327.33 323.74 321.21 319.35 317.94 314.24 312.76 311.01 311.157 311.30 311.111 310.98			Linearly interpolated from Stack R Spillane Equations: $V_{plume} = \{(Va)_o^3 + 0.12F_o[(z \cdot z_v)^2 - (6.2 \cdot z_v)^2 + (6.$	el.Ht to Top of Jet 5D-2,) ² J ^{1/3} / a 10 foot interv m ² ^{a² (Å²))) Max<5.30 r 50 foot interv}
Height (feet) above ground Stack.Rel.H = 75.2 80.0 85.0 Top of jet = 84.4 900 100.0 100.0 Spillane 5.3 m/s Height = 114.9 120.0 130.0 140.0 150.0 160.0 170.0 220.0 330.0 370.0 420.0 370.0 420.0 370.0 420.0 520.0	(meters) above stack 0.00 1.450 2.80 1.600 12.10 13.65 10.600 12.10 13.65 10.600 12.70 25.84 2.8.89 4.4.13 59.37 7.4.61 89.85 10.0.09 120.33 135.57 166.05	Plume Radius(m) 0.223 0.388 0.460 0.445 0.559 1.047 1.534 1.775 2.022 2.510 2.977 3.485 3.973 4.460 6.899 9.337 11.776 14.214 16.652 11.776 14.214 16.652 14.214 16.652 14.214 16.652 14.214 16.652 14.214 16.652 14.214 16.652 14.214 16.652 14.214 16.652 14.214 16.652 14.214 16.652 14.214 14.7757 14.775 14.77577 14.77577 14.77577 14.775777 14.775777 14.7757777777 14.7757777777777777777777777777777777777	SingleStk VertVel(m/s) 59.00 43.65 27.57 29.50 15.14 8.36 5.37 4.79 4.09 3.64 4.332 3.08 2.90 2.37 2.10 1.92 1.80 1.70 1.62 1.65 5.145 1.65 1.455	Plume Temp(K) 402.76 358.13 341.46 336.54 332.70 327.33 323.74 312.76 312.01 311.57 312.01 311.57 311.30 311.11 310.88 310.80			Linearly interpolated from Stack R Spillane Equations: $V_{plume} = \{(Va)_o^3 + 0.12F_o[(z \cdot z_v)^2 - (6.2 \cdot z_v)^2 + (6.$	el.H to Top of Jet 5D-2,j ²]) ¹⁰³ / a 10 foot Interv: m ² ^{12²/Å²))) Max<5.30 n 50 foot Interv:}
Height (feet) above ground Stack.Rel.H = 75.2 80.0 55.0 70p of jet = 84.4 90.0 100.0 5pillane 5.3 m/s Height = 114.9 120.0 130.0 140.0 150.0 160.0 170.0 220.0 270.0 3370.0 420.0 370.0 420.0 620.0 520.0	(meters) above stack 0.00 1.45 2.89 2.80 1.0.60 12.10 13.65 16.69 19.74 22.79 25.84 22.79 25.84 28.89 4.4.13 59.37 74.61 89.85 105.09 1120.33 1135.57 166.05 196.53	Plume Radius(m) 0.223 0.338 0.460 0.445 0.559 1.047 1.534 1.775 2.022 2.510 2.997 3.485 3.973 4.460 6.899 9.337 11.776 14.214 16.652 19.091 21.529 2.6406 31.283	SingleStk VertVel(m/s) 59.00 43.65 27.57 29.50 15.14 8.36 5.30 4.79 4.09 3.64 3.32 3.08 2.90 2.37 2.10 1.92 1.80 1.92 1.80 1.52 1.80 1.77 1.62 1.66 1.45 1.37	Plume Temp(K) 402.76 358.13 341.46 336.54 332.70 327.33 323.74 321.21 319.35 317.94 314.24 312.21 311.57 311.30 311.11 310.98 310.80 310.70			Linearly interpolated from Stack R Spillane Equations: $V_{plume} = \{(Va)_o^3 + 0.12F_o[(z \cdot z_v)^2 - (6.2 \cdot z_v)^2 + (6.$	el.Ht to Top of Jet 5D-2,) ² J ^{1/3} / a 10 foot interv m ² ^{a² (Å²))) Max<5.30 r 50 foot interv}
Height (feet) above ground Stack.Rel.H = 75.2 80.0 85.0 70p of jet = 84.4 90.0 110.0 110.0 5pillane 5.3 m/s Height = 114.9 120.0 130	(meters) above stack 0.00 1.454 2.98 0.2.60 10.60 12.10 13.65 16.60 9.19.74 22.79 25.84 28.89 14.413 59.37 74.61 89.85 105.09 120.33 135.57 166.05 19.66.35 227.01	Plume Radius(m) 0.223 0.388 0.460 0.445 0.559 1.047 1.534 1.775 2.022 2.510 2.977 3.485 3.973 4.460 6.899 9.337 11.776 14.214 16.652 19.091 21.529 26.406 31.283 3.6.160	SingleStk VertVel(m/s) 59.00 43.65 27.57 29.50 15.14 8.83 5.97 5.30 4.79 4.09 3.64 3.32 3.08 2.90 2.37 2.10 1.92 1.80 1.70 1.62 1.65 1.45 1.45 1.37 1.30	Plume Temp(K) 402.76 358.13 341.46 336.54 332.70 327.37 323.74 319.35 317.94 314.24 312.01 311.57 311.30 311.17 311.30 311.17 311.30 310.70 310.83			Linearly interpolated from Stack R Spillane Equations: $V_{plume} = \{(Va)_o^3 + 0.12F_o[(z \cdot z_v)^2 - (6.2 \cdot z_v)^2 + (6.$	el.Ht to Top of Jet 5D-2,) ² J ^{1/3} / a 10 foot interv m ² ^{a² (Å²))) Max<5.30 r 50 foot interv}
Height (feet) above ground Stack.Rel.Ht = 75.2 80.0 85.0 7op of jet = 84.4 90.0 100.0 110.0 5pillane 5.3 m/s Height = 114.9 120.0 13	(meters) above stack 0.00 1.450 1.98 1.98 1.96 1.96 1.97 1.97 1.97 1.97 1.97 1.97 1.97 1.97	Plume Radius(m) 0.223 0.388 0.460 0.445 0.559 1.047 1.554 1.775 2.022 2.510 2.977 3.485 3.973 4.460 6.899 9.337 11.776 14.214 16.652 19.001 21.529 26.406 31.283 36.160 (0.415) 21.529 26.406 31.283 36.160 (0.415) 21.529 26.406 31.283 36.160 (0.415) 21.529 26.406 26.41,036 27.529 26.406 27.529 26.406 27.529 26.406 27.529 26.406 27.529 27.529 26.406 27.529	SingleStk VertVel(m/s) 59.00 43.665 27.57 29.50 15.14 8.36 5.97 5.30 4.79 4.09 3.644 3.32 2.90 2.90 2.90 2.90 1.92 1.80 1.70 1.62 1.66 1.45 1.37 1.30 1.25	Plume Temp(K) 402.766 358.13 341.46 336.54 332.70 327.33 323.74 321.21 319.35 317.94 314.24 312.76 312.01 311.57 311.30 311.11 310.98 310.80 310.70 310.58			Linearly interpolated from Stack R Spillane Equations: $V_{plume} = \{(Va)_o^3 + 0.12F_o[(z \cdot z_v)^2 - (6.2 \cdot z_v)^2 + (6.$	el.Ht to Top of Jet 5D-2,) ² J ^{1/3} / a 10 foot interv m ² ^{a² (Å²))) Max<5.30 r 50 foot interv}
Height (feet) above ground Stack.Rel.Ht = 75.2 80.0 85.0 7op of jet = 84.4 90.0 100.0 110.0 5pillane 5.3 m/s Height = 114.9 120.0 130.0 10	(meters) above stack 0.00 14.50 7.55 10.060 12.10 13.65 16.69 19.74 22.79 25.84 22.89 44.13 59.37 74.61 89.85 10.509 120.33 135.57 166.05 19.63 125.74 227.01 225.44 228.99	Plume Radius(m) 0.223 0.388 0.460 0.445 0.559 1.047 1.534 1.775 2.022 2.510 2.977 3.485 3.973 4.460 6.899 9.337 11.776 14.214 16.652 19.001 21.529 26.406 31.283 36.160 31.283 31.2	SingleStk VertVel(m/s) 59.00 43.665 27.57 29.50 15.14 8.36 5.30 4.79 4.09 3.644 3.32 3.08 2.90 2.37 2.10 1.92 1.80 1.70 1.62 1.56 1.45 1.77 1.30 1.25 1.20	Plume Temp(K) 402.766 358.13 341.46 336.54 332.70 327.33 323.74 321.21 319.35 317.94 312.76 312.01 311.57 311.30 311.11 310.98 310.80 310.70 310.63 310.54			Linearly interpolated from Stack R Spillane Equations: $V_{plume} = \{(Va)_o^3 + 0.12F_o[(z \cdot z_v)^2 - (6.2 \cdot z_v)^2 + (6.$	el.Ht to Top of Jet 5D-2,) ² J ^{1/3} / a 10 foot interv m ² ^{a² (Å²))) Max<5.30 r 50 foot interv}
Height (feet) above ground Stack.Rel.Ht = 75.2 8.00 85.0 Top of jet = 84.4 9.00 100.0 110.0 Spillane 5.3 m/s Height = 114.9 120.0 130.0 140.0 150.0 160.0 170.0 220.0 320.0 370.0 420.0 370.0 420.0 370.0 420.0 370.0 420.0 170.0 220.0 170.0 320.0 370.0 420.0 170.0 120.0 120.0 120.0 120.0	(meters) above stack 0.00 1.45 2.80 4.50 10.60 12.10 13.65 16.69 19.74 22.79 225.84 22.89 4.13 59.37 7.4.61 89.85 105.09 1120.33 135.57 166.05 1196.53 227.01 227.49 23.84 5.84 5.84 5.85 5.85 5.85 5.85 5.85 5	Plume Radius(m) 0.223 0.388 0.460 0.445 0.559 1.047 1.534 1.775 2.022 2.510 2.997 3.455 3.973 4.460 6.899 9.337 11.776 14.214 16.652 19.091 12.529 26.406 31.283 36.160 41.036 45.913 50.790	SingleStk VertVel(m/s) 59.00 43.65 27.57 29.50 15.14 8.36 5.37 4.79 4.09 3.64 3.32 3.08 2.90 2.37 2.10 1.92 1.80 1.70 1.62 1.86 1.45 1.37 1.30 1.25 1.20 1.25 1.20 1.25 1.20 1.55 1.20 1.55 1.20 1.55 1.20 1.55 1.20 1.55 1.20 1.55 1.20 1.55 1.20 1.55 1.20 1.55 1.20 1.55 1.20 1.55 1.20 1.55 1.20 1.55 1.55 1.55 1.55 1.55 1.55 1.55 1.5	Plume Temp(K) 402.76 358.13 341.46 336.54 332.70 327.33 323.74 319.35 317.94 312.76 312.01 311.57 311.30 311.11 310.88 310.60 310.54 310.52			Linearly interpolated from Stack R Spillane Equations: $V_{plume} = \{(Va)_o^3 + 0.12F_o[(z \cdot z_v)^2 - (6.2 \cdot z_v)^2 + (6.$	el.Hi to Top of Jet 5D-z.) ²] ^{1/3} / a 10 foot interv m ² ^{2a² \²))) Max<5.30 r}
Height (feet) above ground Stack.Rel.H = 75.2 80.0 85.0 7op of jet = 84.4 90.0 110.0 110.0 5pillane 5.3 m/s Height = 114.9 120.0 130.0 130.0 130.0 130.0 130.0 130.0 160.0 170.0 270.0 320.0 370	(meters) above stack 0.00 1.454 2.98 0.2.60 10.60 12.10 13.65 16.69 19.74 22.79 22.584 22.84 28.89 14.413 59.37 74.61 89.85 105.09 120.33 135.57 166.05 19.66.35 19.66.35 19.66.35 19.66.35 19.67.4919.57.49 19.67.49 19.67.49 19.67.4919.5	Plume Radius(m) 0.223 0.388 0.460 0.445 0.559 1.047 1.534 1.775 2.202 2.510 2.997 3.455 3.973 4.460 0.899 9.337 11.776 14.214 16.652 19.091 21.529 22.6406 31.223 3.6.160 41.036 45.913 3.6.170 25.5667	SingleStk VertVel(m/s) 59.00 43.65 27.57 29.50 15.14 8.83 5.97 5.30 4.79 4.09 3.64 3.32 3.08 2.90 3.64 3.32 3.08 2.90 1.92 1.80 1.70 1.62 1.65 1.33 1.30 1.72 1.65 1.33 1.30 1.25 1.20 1.12	Plume Temp(K) 402.76 358.13 341.46 336.54 332.70 327.33 323.74 319.35 317.94 314.24 312.76 312.01 311.57 311.30 311.11 310.88 310.88 310.58 310.54 310.54 310.54			Linearly interpolated from Stack R Spillane Equations: $V_{plume} = \{(Va)_o^3 + 0.12F_o[(z \cdot z_v)^2 - (6.2 \cdot z_v)^2 + (6.$	el.Hi to Top of Jet 5D-z.) ²] ^{1/3} / a 10 foot interv m ² ^{2a² \²))) Max<5.30 r}
Height (feet) above ground Stack.Rel.Ht = 75.2 80.0 85.0 7op of jet = 84.4 90.0 110.0 5pillane 5.3 m/s Height = 114.9 120.0 130.0 130.0 130.0 130.0 130.0 130.0 130.0 130.0 140.0 150.0 120.0 270.0 320.0 320.0 370.0 37	(meters) above stack 0.00 1.45 2.98 2.60 1.55 10.60 1.97 1.97 4.55 1.95 1.97 4.61 8.98 1.95 7.461 8.985 1.05.09 1.20.33 1.35.57 1.66.05 1.05.09 1.20.33 1.35.57 1.66.05 1.05.09 1.20.33 1.35.57 1.66.05 1.05.09 1.20.33 1.35.57 1.66.05 1.05.09 1.20.33 1.35.57 1.66.05 1.05.09 1.20.33 1.35.57 1.66.05 1.05.09 1.20.33 1.35.57 1.66.05 1.05.09 1.20.33 1.35.57 1.66.05 1.25.44 1.35.57 1.66.05 1.25.44 1.35.57 1.66.05 1.25.749 2.27.99 1.25.44 1.35.57 1.66.05 1.25.749 2.27.99 1.25.749 1.25.749 2.27.99 1.25.749 1.25.749 2.27.94 1.25.749 1.25.75	Plume Radius(m) 0.223 0.383 0.460 0.445 0.559 1.047 1.534 1.775 2.022 2.510 2.977 3.485 3.973 4.460 6.899 9.337 11.776 14.214 16.652 19.091 21.529 26.406 31.283 36.160 41.036 45.913 36.160 41.036 45.913 36.566 41.036 45.913 36.566 41.036 45.913 36.569 45.913 45.9	SingleStk VertVel(m/s) 59.00 43.66 27.57 29.50 15.14 8.83 5.97 4.09 3.64 4.09 3.64 3.32 3.08 2.90 2.37 2.10 1.92 1.80 1.70 1.62 1.66 1.45 1.45 1.45 1.45 1.45 1.45 1.45 1.45	Plume Temp(K) 402.76 358.13 341.46 336.54 332.70 327.33 323.74 321.21 319.35 317.94 314.24 312.76 312.01 311.57 311.30 311.11 310.88 310.80 310.76 310.52 310.55 310.54 310.54 310.54			Linearly interpolated from Stack R Spillane Equations: $V_{plume} = \{(Va)_o^3 + 0.12F_o[(z \cdot z_v)^2 - (6.2 \cdot z_v)^2 + (6.$	el.Ht to Top of Jet 5D-2,) ² J ^{1/3} / a 10 foot interv m ² ^{a² (Å²))) Max<5.30 r 50 foot interv}
Height (feet) above ground Stack.Rel.Ht = 75.2 80.0 85.0 Top of jet = 84.4 90.0 100.0 110.0 Spillane 5.3 m/s Height = 114.9 120.0 130.0 130.0 130.0 130.0 130.0 130.0 130.0 130.0 130.0 130.0 130.0 130.0 130.0 130.0 130.0 130.0 130.0 140.0 170.0 220.0 270.0 320.0 270.0 320.0 270.0 320.0 270.0 320.0 270.0 320.0 1720.0 120.0 120.0 120.0 120.0 120.0 120.0 120.0 120.0 120.0	(meters) above stack 0.00 1.450 1.280 1.060 1.210 1.365 1.669 1.9.74 22.79 2.5.84 2.8.89 4.4.13 5.9.37 7.4.61 8.9.65 1.05.09 1.20.33 1.35.57 1.66.05 1.96.53 1.227.01 2.257.49 2.829 1.20.33 1.35.57 1.66.05 1.257.49 2.829 1.20.33 1.35.57 1.66.05 1.257.49 2.829 1.20.33 1.35.57 1.66.05 1.257.49 2.829 1.257.49 1.257	Plume Radius(m) 0.223 0.388 0.460 0.445 0.559 1.047 1.534 1.775 2.022 2.510 2.977 3.485 3.973 4.460 6.837 9.937 11.776 14.214 16.652 19.091 21.529 26.406 31.283 36.160 41.036 45.913 35.667 60.5444 65.420	SingleStk VertVel(m/s) 59.00 43.665 27.57 29.50 15.14 8.36 5.30 4.79 4.09 3.644 3.32 3.08 2.90 2.37 2.10 1.92 1.80 1.70 1.62 1.56 1.45 1.37 1.30 1.25 1.20 1.125 1.20 1.131 1.25 1.20	Plume Temp(K) 402.766 358.13 341.46 336.54 332.70 327.33 323.74 321.21 319.35 317.94 314.24 312.76 312.01 311.157 311.30 310.80 310.80 310.80 310.70 310.58 310.58 310.54 310.52 310.54 310.54 310.54 310.54 310.54 310.54 310.54 310.54 310.54 310.54 310.54 310.54 310.54 310.55 310.54 310.55			Linearly interpolated from Stack R Spillane Equations: $V_{plume} = \{(Va)_o^3 + 0.12F_o[(z \cdot z_v)^2 - (6.2 \cdot z_v)^2 + (6.$	el.H to Top of Jet 5D-2,j ²]) ¹⁰³ / a 10 foot Interv: m ² ^{12²/Å²))) Max<5.30 n 50 foot Interv:}
Height (feet) above ground Stack.Rel.Ht = 75.2 8.00 85.0 7op of jet = 84.4 9.00 100.0 110.0 5.pillane 5.3 m/s Height = 114.9 120.0 130.0 140.0 150.0 160.0 160.0 160.0 160.0 170.0 220.0 200.0 2	(meters) above stack 0.00 1.45 2.80 1.66 10.660 12.10 13.65 16.69 19.74 22.79 225.84 22.89 44.13 59.37 74.61 89.85 105.03 135.57 166.05 196.53 227.01 225.74 287.97 318.45 348.93 348.93 348.93 348.93 348.93 349.41 409.88 348.93 349.41 409.88 348.93 349.41 409.88 348.93 349.41 349.41 349.41 348.93 349.41	Plume Radius(m) 0.223 0.388 0.465 0.559 1.047 1.534 1.775 2.022 2.510 2.977 3.485 3.973 4.460 6.899 9.337 11.776 14.214 16.652 14.214 16.652 36.160 31.283 36.160 41.039 55.667 60.544 65.420 70.297	SingleStk VertVel(m/s) 59.00 43.665 27.57 29.50 15.14 8.36 5.37 4.79 4.09 3.64 4.322 3.08 2.90 2.37 2.10 1.92 1.80 1.70 1.92 1.66 1.45 1.37 1.30 1.25 1.20 1.10 1.07 1.02	Plume Temp(K) 402.76 358.13 341.46 336.54 332.70 327.33 323.74 312.21 319.35 317.94 312.76 312.01 311.57 312.01 311.57 311.30 310.80 310.70 310.63 310.54 310.55 310.48 310.47 310.45			Linearly interpolated from Stack R Spillane Equations: $V_{plume} = \{(Va)_o^3 + 0.12F_o[(z \cdot z_v)^2 - (6.2 \cdot z_v)^2 + (6.$	el.H to Top of Jet 50-z,j ²]) ¹³ / a 10 foot Interva m ² ^{12²/Å²}))) Max<5.30 n 50 foot Interva
Height (feet) above ground Stack.Rel.Ht = 75.2 80.0 85.0 7op of jet = 84.4 90.0 110.0 5pillane 5.3 m/s Height = 114.9 120.0 130.0 140.0 150.0 140.0 150.0 160.0 170.0 220.0 270.0 320.0 270.0 320.0 270.0 320.0 270.0 320.0 100.0 120.0	(meters) above stack 0.00 1.454 2.98 0.2.60 10.60 12.10 13.65 16.69 19.74 22.79 22.5.84 22.79 22.5.84 28.89 14.4.13 59.37 74.61 89.85 105.09 120.33 135.57 166.05 19.66.55 19.67.55 19.	Plume Radius(m) 0.223 0.388 0.460 0.445 0.559 1.047 1.534 1.775 2.202 2.510 2.997 3.485 3.973 4.460 6.899 9.337 11.776 14.214 16.652 19.091 21.529 26.406 31.283 36.160 41.036 45.913 36.160 41.036 45.913 36.770 255.667	SingleStk VertVel(m/s) 59.00 43.65 27.57 29.50 15.14 8.83 5.97 5.30 4.79 4.09 3.64 3.32 3.08 2.99 2.37 2.10 1.92 1.80 1.70 1.62 1.55 1.33 1.30 1.70 1.62 1.55 1.33 1.30 1.72 1.20 1.66 1.33 1.30 1.25 1.20 1.66 1.33 1.30 1.25 1.20 1.66 1.33 1.20 1.62 1.20 1.62 1.20 1.62 1.20 1.62 1.20 1.62 1.20 1.62 1.20 1.62 1.20 1.62 1.20 1.62 1.20 1.62 1.20 1.62 1.63 1.64 1.65 1.65 1.65 1.65 1.65 1.65 1.65 1.65	Plume Temp(K) 402.76 358.13 341.46 336.54 332.70 327.33 323.74 319.35 317.94 314.24 312.01 311.57 311.30 311.157 311.30 311.17 310.88 310.88 310.54 310.54 310.54 310.54 310.48 310.47			Linearly interpolated from Stack R Spillane Equations: $V_{plume} = \{(Va)_o^3 + 0.12F_o[(z \cdot z_v)^2 - (6.2 \cdot z_v)^2 + (6.$	el.H to Top of Jet 50-z,j ²]) ¹³ / a 10 foot Interva m ² ^{12²/Å²}))) Max<5.30 n 50 foot Interva
Height (feet) above ground Stack.Rel.Ht = 75.2 80.0 85.0 7op of jet = 84.4 90.0 110.0 5pillane 5.3 m/s Height = 114.9 120.0 130.0 140.0 150.0 140.0 150.0 140.0 150.0 120.0 227.0 227.0 227.0 227.0 227.0 227.0 227.0 227.0 220.0 277.0 220.0 277.0 220.0 270.0 270.0 27	(meters) above stack 0.00 1.45 2.98 2.60 1.55 10.60 12.10 13.65 16.69 19.74 22.79 25.84 22.89 19.74 61 89.85 105.09 120.33 135.57 166.05 125.749 227.01 227.40 125.749 228.79 318.45 3227.01 227.49 228.79 318.45 337.941 40.9.89 337.941	Plume Radius(m) 0.223 0.383 0.460 0.445 0.559 1.047 1.534 1.775 2.022 2.510 2.977 3.485 3.973 4.460 6.899 9.337 11.776 14.214 16.652 19.091 21.529 26.406 31.283 36.160 41.036 45.913 55.667 60.544 65.420 75.174 80.051	SingleStk VertVel(m/s) 59.00 43.665 27.57 29.50 15.14 8.836 5.97 5.30 4.79 4.09 3.64 3.32 3.08 2.90 2.37 2.10 1.92 1.80 1.70 1.62 1.65 1.45 1.45 1.45 1.45 1.37 1.30 1.25 1.20 1.16 1.13 1.10 1.07 1.04 1.07 1.04 1.07 1.04 1.00 1.00 1.00	Plume Temp(K) 358.13 341.46 336.54 332.70 327.33 323.74 321.21 319.35 317.94 314.24 312.76 312.01 311.57 311.30 311.17 310.80 310.73 310.63 310.54 310.54 310.54 310.44 310.45 31			Linearly interpolated from Stack R Spillane Equations: $V_{plume} = \{(Va)_o^3 + 0.12F_o[(z \cdot z_v)^2 - (6.2 \cdot z_v)^2 + (6.$	(5D-z _v) ²]} ^{1/3} / a 10 foot Interva
Height (feet) above ground Stack.Rel.Ht = 75.2 80.0 85.0 7op of jet = 84.4 90.0 110.0 5pillane 5.3 m/s Height = 114.9 120.0 130.0 140.0 150.0 140.0 150.0 160.0 170.0 220.0 270.0 320.0 270.0 320.0 270.0 320.0 270.0 320.0 100.0 120.0	(meters) above stack 0.00 1.454 2.98 0.2.60 10.60 12.10 13.65 16.69 19.74 22.79 22.5.84 22.79 22.5.84 28.89 14.4.13 59.37 74.61 89.85 105.09 120.33 135.57 166.05 19.66.55 19.67.55 19.	Plume Radius(m) 0.223 0.388 0.460 0.445 0.559 1.047 1.534 1.775 2.202 2.510 2.997 3.485 3.973 4.460 6.899 9.337 11.776 14.214 16.652 19.091 21.529 26.406 31.283 36.160 41.036 45.913 36.160 41.036 45.913 36.770 255.667	SingleStk VertVel(m/s) 59.00 43.665 27.57 29.50 15.14 8.36 5.97 4.09 3.644 3.32 3.00 2.37 2.00 1.92 1.80 1.70 1.92 1.80 1.70 1.62 1.56 1.45 1.45 1.37 1.30 1.25 1.20 1.10 1.07 1.00 1.00	Plume Temp(K) 402.766 358.13 341.46 336.54 332.70 327.33 323.74 321.21 319.35 317.94 314.24 312.76 312.01 311.157 311.30 311.11 310.98 310.80 310.52 310.54 310.54 310.45 310.45 310.45 310.45 310.45			Linearly interpolated from Stack R Spillane Equations: $V_{plume} = \{(Va)_o^3 + 0.12F_o[(z \cdot z_v)^2 - (6.2 \cdot z_v)^2 + (6.$	el.H to Top of Jet 50-z,j ²)j ¹⁰ / a 10 foot interva m ² ^{2α²λ²))) Max<5.30 m 50 foot interva}



SINGLE/Approximated Plume Average Vert Based on 11 cells/heat exchanger. Calc'	"Aviation Sa				st, et. al.			
eff.diam for each heat exchanger with each fan		-	-			ditions at V	arious Heights in the Plume	•
at 13' ID (234,400 ACFM total for each fan). 11	/						Australia," Dr. K.T. Spillar	
Ambient Conditions:							eutral conditions (dθ/dz=0 or	
Ambient Potential Temp 6	a 273.71	Kelvins	33.0	°F		0.3048	meters/feet	
Plume Exit Conditions:					Gravity g	9.81	m/s ²	
Stack Height h		meters	32.50		λ	1.11		
Merged Stack Diameter				inches	λο	~1.0		
Stack Velocity Velo		m/s		ft/sec	4Vol/(60πE))		Cost 0/61
Individual Heat Exchanger Volumetric Flo		cu.m/sec	2,578,400		πV _{exit} D ² /4			Sect.2/¶1
Stack Potential Temp 6		Kelvins	102.0		a)/ D ² (1)	(0) (4 - 1)	ol.Flow(g/π)(1-θ _a /θ _s)	Sect.2/¶1
Initial Stack Buoyancy Flux F Plume Buoyancy Flux	-	m /s m ⁴ /s ³	09.0	ΔT(°F)			,θ _p at plume height (see belo	
Number of Heat Exchangers		111 /5		1 000			cation Factor (n ^{0.25})	vv)
Hamber of Hoar Excitaligoro					watipic of			
Conditions at End (Top) of Jet Phase:								
Height above Stack z	at 82.136	meters*	269.5	feet*	z _{jet} = 6.250), meters*=	meters above stack top	Sect.3/¶1
Height above Ground z _{jet} +h	s 92.042	meters	302.0	feet				
Vertical Velocity V	et 4.486	m/s	14.72	ft/sec	$V_{jet} = 0.5V$	_{exit} = V _{exit} /2		
Plume Top-Hat Diameter 2a	at 26.283	meters	86.2	feet	$2a_{jet} = 2D$		Conservation of momentum	"
Spillane Methodology - Analytical Solution								
Single Plume-averaged Vertical Velocity				er where P			•	a
Plume Top-Hat Radius		olutions in T					crease with height	Sect.2/Eq.6
Virtual Source Height z		meters*		feet*	6.25D[1-(θ _e	/θ _s)'' ²], met	ers*=meters above stack top	Sect.2/Eq.6
Height above Ground zv+H		meters	49.6	reet	(0/=) 3	105 11	where $(\theta_a/\theta_s)^{1/2} = (\theta_e/\theta_s)^{1/2} =$	
Vertical Velocity		olutions in T	able Below		$\{(Va)_o^3 + 0$ $V_{exit}D/2(\theta_e/$		/) ² - (6.25D-z _v) ²]} ^(1/3) / a	Sect.2.1(6)
Product (Va	。 55.209	m*/s			V _{exit} D/2(θ _e /	⊎ _s)		
Single Heat Exchanger Results: Solve for plume-averaged vertical vel	ocity at height	600.0	feet	182 89	meters abo	we ground (z'+h_)	
Gives the following Height above Stack			567.5		merers and	ve ground (د · · ·s/	
Plume Top-Hat Diameter 2		meters	176.1		2a'=2*0.16	'z'-z,,)		Sect.2/Eq.6
Vertical Velocity				ft/sec			v)2-(6.25D-zv)2]}(1/3)/(2a/2)	Sect.2/Eq.6
Solve for Height of CASC critical vertication	I velocity V _{crit}	5.30	m/s plume-a	veraged v	ertical velo	ocity	Critical	VV < Top of J
Find Height above Stack z _c	it #N/A	meters	#N/A	feet	Solve for x	=(z-z _v) simu	ultaneously in both eqs. (i.e.,	Va and a)
Height above Ground zcrit+h		motoro	#N/Δ	feet	for V=V _{crit}	using the cu	ubic equation ax ³ +bx ² +cx+d=	0, where
i ieigin autive Gituliu Z _{crit} +f	s #N/A	meters	#110.0					
rieigin auove Ground Z _{crit} +r	s #N/A	meters	#1VC				and b=-(0.12F _o)/(V _{crit} ³ 0.16 ³)=	-91.848
Interpolated Height of critical vertical			#IVA		and d		and b=-(0.12F _o)/(V _{crit} ³ 0.16 ³)= 25D-z _v) ² -(Va) _o ³]/(V _{crit} ³ 0.16 ³)=	
	velocity in Jet		220.5		and d		25D-z _v) ² -(Va) _o ³]/(V _{crit} ³ 0.16 ³)=	267567.8
Interpolated Height of critical vertical	velocity in Jet it 67.223	Phase:		feet	and d	=[0.12F _o (6.	25D-z _v) ² -(Va) _o ³]/(V _{crit} ³ 0.16 ³)=	267567.0 28.org/cubic.ht
Interpolated Height of critical vertical Find Height above Stack $z_{\rm c}$	velocity in Jet it 67.223	Phase: meters	220.5	feet	and d	=[0.12F _o (6.	25D-z _v) ² -(Va) _o ³]/(V _{crit} ³ 0.16 ³)= http://www.17	267567.8 28.org/cubic.ht -44.326
Interpolated Height of critical vertical Find Height above Stack z _c Height above Ground z _{crit} +f	velocity in Jet it 67.223 s 77.129	Phase: meters meters	220.5 253.0	feet feet		=[0.12F _o (6.	25D-z _v) ² -(Va) _o ³]/(V _{crit} ³ 0.16 ³)= <u>http://www.17</u> is the real solution x = z-zv =	-91.8488 267567.8 28.org/cubic.ht -44.326 -39.11 -95
Interpolated Height of critical vertical Find Height above Stack z _c Height above Ground z _{crit} +f Table of Plume Top-Hat Diameters (2a) and	velocity in Jet it 67.223 s 77.129 Plume-Averag	Phase: meters meters ed Vertical	220.5 253.0 Velocities sta	feet feet arting at en	nd of jet ph	=[0.12F _o (6.	$25D-z_v)^2 - (Va)_o^3 / (V_{crit}^{-3} 0.16^3) = \frac{http://www.17}{sthe real solution x = z-zv = or z(m/above stack) = 0$	267567.8 28.org/cubic.ht -44.320 -39.1
Interpolated Height of critical vertical Find Height above Stack z _c Height above Ground z _{crit} +1 Table of Plume Top-Hat Diameters (2a) and Height (fee	velocity in Jet 67.223 s 77.129 Plume-Averag) (meters)	Phase: meters meters ed Vertical Plume	220.5 253.0 Velocities sta SingleStk	feet feet arting at en Plume	nd of jet ph	=[0.12F _o (6.	$25D-z_v)^2 - (Va)_o^3 / (V_{crit}^{-3} 0.16^3) = \frac{http://www.17}{sthe real solution x = z-zv = or z(m/above stack) = 0$	267567.3 28.org/cubic.ht -44.32 -39.1
Interpolated Height of critical vertical Find Height above Stack z _c Height above Ground z _{crit} +f Table of Plume Top-Hat Diameters (2a) and Height (fee above groun	Plume-Averag (meters) (meters)	Phase: meters meters ed Vertical Plume Radius(m)	220.5 253.0 Velocities sta SingleStk VertVel(m/s)	feet feet arting at en Plume	nd of jet ph	=[0.12F _o (6.	$25D-z_v)^2 - (Va)_o^3 / (V_{crit}^{-3} 0.16^3) = \frac{http://www.17}{sthe real solution x = z-zv = or z(m/above stack) = 0$	267567. 28.org/cubic.ht -44.32 -39.1
Interpolated Height of critical vertical Find Height above Stack z _c Height above Ground z _{cra} +f Table of Plume Top-Hat Diameters (2a) and Height (fee above groun Stack.Rel.Ht = 32.	velocity in Jet it 67.223 s 77.129 Plume-Averag) (meters) d above stack 5 0.00	Phase: meters meters ed Vertical Plume Radius(m) 6.571	220.5 253.0 Velocities st SingleStk VertVel(m/s) 8.97	feet feet arting at en Plume Temp(K)	nd of jet ph	=[0.12F _o (6.	25D-z _v) ² -(Va ₀ ³)/(V _{crit} ³ 0.16 ³)= http://www.17 is the real solution x = z-zy = or z(m/above stack) = z(ft/above ground) =	267567. 28.org/cubic.ht -44.32 -39.1 -95
Interpolated Height of critical vertical Find Height above Stack z _c Height above Ground z _{crit} +f Table of Plume Top-Hat Diameters (2a) and Height (fe above groun Stack.Rel.Ht = 32. 40.	velocity in Jet it 67.223 s 77.129 Plume-Averag) (meters) d above stack 5 0.000 0 2.29	Phase: meters meters ed Vertical Plume Radius(m) 6.571 6.754	220.5 253.0 Velocities sta SingleStk VertVel(m/s) 8.97 8.85	feet feet arting at en Plume Temp(K)	nd of jet ph	=[0.12F _o (6.	25D-z _v) ² -{Va ₀ ³ }/{V _{crt} ³ 0.16 ³ }= <u>http://www.17</u> is the real solution x = z-zv = or z(m/above stack) = z(tt/above ground) = Jet Phase Eqs:	267567. 28.org/cubic.ht -44.32 -39.1 -96 20 ft Intervals
Interpolated Height of critical vertical Find Height above Stack z _c Height above Ground z _{crit} +f Table of Plume Top-Hat Diameters (2a) and Height (fee above groun Stack.Rel.H = 32. 40.	velocity in Jet ti 67.223 s 77.129 Plume-Averag) (meters) d above stack 5 0.00 0 2.29 0 8.38	Phase: meters meters ed Vertical Plume Radius(m) 6.571 6.754 7.241	220.5 253.0 Velocities sta SingleStk VertVel(m/s) 8.97 8.85 8.51	feet feet arting at en Plume Temp(K)	nd of jet ph	=[0.12F _o (6.	25D-z _v) ² -{Va ₀ ³ }/{V _{crt} ³ 0.16 ³ }= <u>http://www.17</u> is the real solution x = z-zv = or z(m/above stack) = z(tt/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R	267567. 28.org/cubic.h -44.32 -39.1 -90 20 ft Interval:
Interpolated Height of critical vertical Find Height above Stack z _c Height above Ground z _{crit} +f Table of Plume Top-Hat Diameters (2a) and Height (fe above groun Stack.Rel.Ht = 32. 40.	Plume-Average (meters) (meters	Phase: meters meters ed Vertical Plume Radius(m) 6.571 6.754 7.241	220.5 253.0 Velocities sta SingleStk VertVel(m/s) 8.97 8.85 8.51 8.18	feet feet arting at en Plume Temp(K)	nd of jet ph	=[0.12F _o (6.	25D-z _v) ² -{Va ₀ ³ }/{V _{crt} ³ 0.16 ³ }= <u>http://www.17</u> is the real solution x = z-zv = or z(m/above stack) = z(tt/above ground) = Jet Phase Eqs:	267567. 28.org/cubic.ht -44.32 -39.1 -96 20 ft Intervals
Interpolated Height of critical vertical Find Height above Stack z _c Height above Ground z _{crit} +1 Table of Plume Top-Hat Diameters (2a) and Height (fee above groun <i>Stack.Rel.Ht</i> = 32. 40. 60. 80.	Plume-Average (meters) above stack comparison blue stack comparison comp	Phase: meters meters ed Vertical Plume Radius(m) 6.571 6.754 7.241 7.729	220.5 253.0 Velocities sta SingleSta VertVel(m/s) 8.97 8.85 8.51 8.18 7.85	feet feet arting at en Plume Temp(K)	nd of jet ph	=[0.12F _o (6.	25D-z _v) ² -{Va ₀ ³ }/{V _{crt} ³ 0.16 ³ }= <u>http://www.17</u> is the real solution x = z-zv = or z(m/above stack) = z(tt/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R	267567. 28.org/cubic.ht -44.32 -39.1 -95 -95 -95 -95 -95 -95 -95 -95
Interpolated Height of critical vertical Find Height above Stack z _c Height above Ground z _{crit} +H Table of Plume Top-Hat Diameters (2a) and Height (fee above groun Stack. Rel. Ht = 32. 40. 60. 80. 100.	velocity in Jet it 67.223 s 77.129 Plume-Averagy) (meters) d above stack 5 0.000 0 2.29 0 8.38 0 14.48 0 20.57 0 26.67	Phase: meters meters ed Vertical Plume Radius(m) 6.571 6.754 7.241 7.729 8.217	220.5. 253.0 Velocities str SingleStk VertVel(m/s) 8.85 8.85 8.85 8.85 8.7.85 7.51	feet feet arting at en Plume Temp(K)	nd of jet ph	=[0.12F _o (6.	25D-z _y) ² -{Va} ₀ ³ }/{V _{crit} ³ 0.16 ³ } = <u>http://www.17</u> is the real solution x = z-zy = or z(m/above stack) = z(ft/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations:	267567. 28.org/cubic.h -44.32 -39.1 -9! 20 ft Interval el.Ht to Top of Jet
Interpolated Height of critical vertical Find Height above Stack z _c Height above Ground z _{cra} +f Table of Plume Top-Hat Diameters (2a) and Height (fee above groun Stack.Rel.Ht = 32. 40. 60. 80. 80. 100.	velocity in Jet it 67.223 a 77.129 Plume-Average) (meters) d above stack d above stack 0 2.29 0 8.38 0 14.48 0 20.67 0 26.67 0 32.77	Phase: meters meters ed Vertical Plume Radius(m) 6.574 6.754 7.241 7.729 8.704 9.192	220.5 253.0 Velocities st. SingleStk VertVel(m/s) 8.85 8.85 8.85 8.85 8.18 7.85 7.85 7.75 7.18	feet feet arting at en Plume Temp(K)	nd of jet ph	=[0.12F _o (6.	25D-z _y) ² -{Va ₀ ³ }/{V _{crtt} ³ 0.16 ³ }= <u>http://www.17</u> is the real solution x = z-zy = or z(m/above stack) = z(ft/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: V _{plume} =((Va ₀) ³ +0.12F ₀ (z-z ₁) ² -(6.2)	267567. 28.org/cubic.h -44.32 -39.1 -9. 20 ft interval el.Ht to Top of Jet 50-z_v) ²]) ¹⁰ / a
Interpolated Height of critical vertical Find Height above Stack z _c Height above Ground z _{crit} +f Table of Plume Top-Hat Diameters (2a) and Height (fee above groun Stack.Rel.Ht = 32. 40, 60, 80, 100, 120, 140,	Plume-Average (meters) above stack boxes b	Phase: meters meters ed Vertical Plume Radius(m) 6.574 7.241 7.729 8.217 8.704 9.192 9.680	220.5 253.0 Velocitie s sta Single Stk VertVel(m/s) 8.85 8.85 8.85 8.85 8.85 8.85 8.85 8.8	feet feet rting at em Plume Temp(K)	nd of jet ph	=[0.12F _o (6.	$25D \cdot z_y)^2 - (Va_0,^3) / (V_{crit}^3 0.16^3) = \\ http://www.17$ is the real solution x = z-zv = or z(m/above stack) = z(tr/above ground) = z(tr/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: $V_{pluma} = (Va_0,^3+0.12F_d(z-z_v)^2 \cdot (6.2a))$	267567. 28.org/cubic.h -44.32 -39.1 -95 20 ft interval el.Ht to Top of Jet 50-z_,) ²]) ^{1/3} / a
Interpolated Height of critical vertical Find Height above Stack z _c Height above Ground z _{crit} +f Table of Plume Top-Hat Diameters (2a) and Height (fee above groun Stack. Rel. H = 32. 40. 60. 80. 100. 120. 140.	velocity in Jet (c) 67.223 (c) 77.129 Plume-Average (c) 0 (meters) (c) 0	Phase: meters meters ed Vertical Plume Radius(m) 6.754 7.241 7.729 8.217 8.704 9.192 9.680 10.167	220.5 253.0 Velocities sta SingleStk VertVel(m/s) 8.97 8.858 8.51 8.18 7.48 7.51 7.18 6.652	feet feet rrting at en Plume Temp(K)	nd of jet ph	=[0.12F _o (6.	$25D \cdot z_{y})^{2} - \{Va_{0}s^{3}\}/(V_{crit}^{3}0.16^{3}) = \frac{http://www.17}{s}$ is the real solution x = z-zv = or z(m/above stack) = z(ft/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: V _{plum} =((Va)_{s}^{3}+0.12F_{d}(z-z_{v})^{2}-(6.2 a = 0.16(z-z_{v}) $\theta_{p}=\theta_{s}(1+(1-(\theta_{0}/\theta_{s}))^{*}(V_{exth}D^{2})(t)$	267567. 28.org/cubic.h -44.32 -39.1 -95 20 ft interval el.Ht to Top of Jet 50-z_,) ²]) ^{1/3} / a
Interpolated Height of critical vertical Find Height above Stack z _c Height above Ground z _{crn} +H Table of Plume Top-Hat Diameters (2a) and Height (fee above groun Stack. Rel. Ht = 32. 40. 60. 100. 120. 140. 180.	velocity in Jet it 67.223 s 77.129 Plume-Average d above stack 5 0.000 0 2.29 0 8.38 0 14.48 0 20.57 0 26.67 0 32.777 0 38.86 0 44.96 0 44.96 0 51.05	Phase: meters meters ed Vertical Plume Radius(m) 6.571 6.754 7.241 7.729 8.217 8.704 9.192 9.680 10.167 10.655	220.5 253.0 Velocities stat SingleStk VertVel(m/s) 8.97 8.85 8.97 8.85 8.97 8.85 7.51 7.18 6.85 6.625 6.525 6.18	feet feet rting at en Plume Temp(K)	nd of jet ph	=[0.12F _o (6.	$25D \cdot z_{v})^{2} - (Va_{0}^{-3}) \cdot (V_{crit}^{3} 0.16^{3}) = \frac{http://www.17}{10}$ is the real solution x = z-zv = or z(m/above stack) = z(tl/above ground) = z(tl/above ground) = $Jet Phase Eqs:$ Linearly interpolated from Stack R Spillane Equations: $V_{pluma} = ((Va)_{0}^{3} + 0.12F_{a}(z-z_{v})^{2} - (6.2$ $a = 0.16(z-z_{v})$ $\theta_{p} = \theta_{a}(1 + (1 - (\theta_{p}/\theta_{b}))^{*} (V_{exit}D^{2}/(c))$ CEC Staff Equation: $V_{mp} = n^{0.27} V_{xp}$ Brigg's Equation:	267567. 28. org/cubic. h. -44. 32 -39. 1 -9! 20 ft Interval el.Ht to Top of Jet 5D:z,,) ²) ^{1/3} / a
Interpolated Height of critical vertical Find Height above Stack z _c Height above Ground z _{cra} +f Table of Plume Top-Hat Diameters (2a) and Height (fee above groun Stack.Rel.Ht = 32. 40. 60. 100. 120. 140. 180. 200.	velocity in Jet It 67.223 a 77.129 Plume-Average 1 a) (metrs) a) above stack 5 0.000 0 2.29 0 8.38 0 14.48 0 26.67 0 38.86 0 44.96 0 44.96 0 45.05 0 57.15	Phase: meters meters red Vertical Plume Radius(m) 6.574 7.241 7.729 8.217 8.704 9.8217 8.704 9.192 9.680 10.167 10.655 11.143	220.5 253.0 Velocities st. SingleStk VertVel(m/s) 8.85 8.85 8.85 7.85 7.751 7.18 6.85 6.52 6.18 5.85	feet feet rting at en Plume Temp(K)	nd of jet ph	=[0.12F _o (6.	$\begin{split} 25D \cdot z_{\nu})^2 - (Va_0, \sigma^3)/(V_{ext}^3 0.16^3) = \\ & & & & & & & & & & & & & & & & & &$	267567. 28.org/cubic.h -44.32 -39.1 -95 20 ft interval 20 ft interval 50-z,) ²]) ¹³ / a 50-z,) ²]) ¹³ / a
Interpolated Height of critical vertical Find Height above Stack z _c Height above Ground z _{crit} +f Table of Plume Top-Hat Diameters (2a) and Height (fee above groun Stack.Rel.Ht = 32. 40, 60, 80, 100, 120, 140, 140, 160, 180, 200, 220, Single Jet 5.3 m/s Height = 253. 260,	velocity in Jet II 67.223 77.129 77.129 II (metrs) J above stack J above stack J 20.57 J 20.57 J 20.57 J 38.86 J 38.86 J 51.05 J 67.223 J 69.34	Phase: meters meters ed Vertical Plume Radius(m) 6.574 7.241 7.729 8.217 8.704 9.192 9.680 10.167 10.655 11.143 11.949	220.5 253.0 Velocitie s st: SingleStk VertVel(m/s) 8.855 8.51 8.85 7.55 7.51 7.54 6.85 6.52 6.52 6.18 5.85 5.30	feet feet rrting at em Plume Temp(K)	nd of jet ph	=[0.12F _o (6.	$25D \cdot z_{v})^{2} - (Va_{0}^{-3}) \cdot (V_{crit}^{3} 0.16^{3}) = \frac{http://www.17}{10}$ is the real solution x = z-zv = or z(m/above stack) = z(tl/above ground) = z(tl/above ground) = $Jet Phase Eqs:$ Linearly interpolated from Stack R Spillane Equations: $V_{pluma} = ((Va)_{0}^{3} + 0.12F_{a}(z-z_{v})^{2} - (6.2$ $a = 0.16(z-z_{v})$ $\theta_{p} = \theta_{a}(1 + (1 - (\theta_{p}/\theta_{b}))^{*} (V_{exit}D^{2}/(c))$ CEC Staff Equation: $V_{mp} = n^{0.27} V_{xp}$ Brigg's Equation:	267567. 28.org/cubic.h -44.32 -39.1 -95 20 ft interval 20 ft interval 50-z,) ²]) ¹³ / a 50-z,) ²]) ¹³ / a
Interpolated Height of critical vertical Find Height above Stack z _c Height above Ground z _{crit} +f Table of Plume Top-Hat Diameters (2a) and Height (fee above groun Stack. Rel. Ht = 32. 40. 60. 100. 120. 140. 180. 200. 220. Single Jet 5.3 m/s Height = 253. 280. 280.	velocity in Jet it 67.223 s 77.129 Plume-Average above stack 5 0.000 0 2.29 0 8.38 0 14.48 0 20.57 0 26.67 0 32.77 0 38.66 0 44.96 0 51.05 0 57.15 7 67.22 0 69.34 0 75.44	Phase: meters meters ed Vertical Plume Radius(m) 6.574 6.754 7.241 7.729 8.217 8.704 9.680 9.680 10.1655 11.143 11.949 12.118 12.606	220.53 253.0 Velocities stat SingleStk VertVel(m/s) 8.97 8.85 8.97 8.85 8.97 8.85 7.85 7.75 7.75 7.75 7.75 7.75 7.7	feet feet rting at en Plume Temp(K)	nd of jet ph	=[0.12F _o (6.	$25D \cdot z_{v})^{2} - \{Va_{0}a_{j}^{3}\}/(V_{crit}^{3}0.16^{3}) = \frac{http://www.17}{http://www.17}$ is the real solution x = z-zv = or z(m/above stack) = z(tt/above ground) = $z(tt/above ground) =$ $Linearly interpolated from Stack R Spillane Equations: V_pluma=((Va)_{a_{j}}^{3}+0.12F_{a_{j}}(z-z_{v})^{2}-(6.2$ $a = 0.16(z-z_{v})$ $\theta_{p} = \theta_{a}(1+(1-(\theta_{a}/\theta_{a}))^{*}(V_{exit}D^{2})/(CEC Staff Equation: V_mp=n^{22V_{exp}} Brigg's Equation: V_bages = (2/3) \times 1.6^{(2/2)} \times F_{ep}^{(2/2)} \times t$	267567. 28.org/cubic.h -44.32 -39.1 -95 20 ft interval 20 ft interval 50-z,) ²]) ¹³ / a 50-z,) ²]) ¹³ / a
Interpolated Height of critical vertical Find Height above Stack z _c Height above Ground z _{cra} +f Table of Plume Top-Hat Diameters (2a) and Height (fee above groun Stack. Rel. Ht = 32. 40. 60. 100. 120. 140. 160. 180. 200. 220. Single Jet 5.3 m/s Height = 253. 260. 280. Top of Single jet = 302.	velocity in Jet it 67.223 s 77.129 Plume-Average d above stack 5 0.000 0 2.29 0 8.38 0 24.57 0 26.67 0 26.67 0 32.77 0 38.86 0 44.96 0 57.15 0 67.32 0 69.34 0 69.34 0 75.44 0 75.44	Phase: meters meters ed Vertical Plume Radius(m) 6.571 6.754 7.241 7.729 8.217 8.704 9.680 10.167 10.655 11.143 11.949 12.118 12.606 13.142	220.5 253.0 Velocities sta SingleStk VertVel(m/s) 8.897 8.85 8.51 7.85 7.51 7.85 6.525 6.625 6.618 5.85 5.18 5.18 4.85 4.49	feet feet Plume Temp(K)	nd of jet ph	=[0.12F _o (6.	$25D \cdot z_{v})^{2} - \{Va_{0}a_{j}^{3}\}/(V_{crit}^{3}0.16^{3}) = \frac{http://www.17}{http://www.17}$ is the real solution x = z-zv = or z(m/above stack) = z(tt/above ground) = $z(tt/above ground) =$ $Linearly interpolated from Stack R Spillane Equations: V_pluma=((Va)_{a_{j}}^{3}+0.12F_{a_{j}}(z-z_{v})^{2}-(6.2$ $a = 0.16(z-z_{v})$ $\theta_{p} = \theta_{a}(1+(1-(\theta_{a}/\theta_{a}))^{*}(V_{exit}D^{2})/(CEC Staff Equation: V_mp=n^{22V_{exp}} Brigg's Equation: V_bages = (2/3) \times 1.6^{(2/2)} \times F_{ep}^{(2/2)} \times t$	267567. 28.org/cubic.h -44.32 -39.1 -39.1 -9. 20 ft Interval: bl.Ht to Top of Jet 5D-z,γ ²]) ^{1/2} / a 4V _{plume} *a ² λ ²)))
Interpolated Height of critical vertical Find Height above Stack z _c Height above Ground z _{crit} +f Table of Plume Top-Hat Diameters (2a) and Height (fee above groun Stack. Rel. Ht = 32. 40, 60, 80, 80, 100, 120, 140, 160, 120, 120, 140, 160, 120, 120, 120, 120, 120, 120, 120, 12	velocity in Jet it 67.223 s 77.129 Plume-Average (meters) j (meters) j above stack j 0.000 j 2.29 j 8.38 j 14.48 j 2.26.67 j 32.77 j 38.86 j 44.96 j 67.15 j 67.22 j 69.34 j 75.44 j 82.14 j 96.77	Phase: meters meters ed Vertical Radius(m) 6.571 6.754 7.241 7.729 8.217 8.704 9.192 9.680 10.167 10.655 11.143 11.949 12.118 12.066 13.142 14.650	220.5 253.0 Velocities st. SingleStk VertVel(m/s) 8.85 8.85 8.85 7.85 7.55 7.18 6.85 6.52 6.18 5.85 5.30 6.18 5.85 5.44 4.85	feet feet Plume Temp(K)	nd of jet ph	=[0.12F _o (6.	$25D \cdot z_{y}^{2} - \{Va_{0}, {}^{3}\}/(V_{crit}^{3}0.16^{3}) = \frac{http://www.12}{http://www.12}$ is the real solution x = z-zv = or z(m/above stack) = z(tl/above ground) = z(tl/above ground) = $z(tl/above ground) = \frac{1}{2}$ Linearly interpolated from Stack R Spillane Equations: $V_{pluma} = (Va_{0}, {}^{3}+0.12F_{a} (z-z_{v})^{2}-(6.2$ a = 0.16(z-z_{v}) $\theta_{p} = \theta_{a}(1+(1-(\theta_{a}/\theta_{b}))^{*}(V_{exit}D^{2}/(CEC Staff Equation:))$ $V_{plugr} = Equation:$ $V_{plugr} = Equation:$ $V_{plugr} = (2/3) \times 1.6^{(2/2)} \times F_{exp}^{(1/2)} \times 1.$ where $F_{exp} = nF_{ap}$	267567 28. org/cubic. f: -44. 32 -39. 1 -9 20 ft Interval el.Ht to Top of Jet 5D-z,) [*]] ¹³ / a 5D-z,) [*]] ¹³ / a (¹⁴² x z ⁽¹²⁾) ¹⁴³ / x z ⁽¹²⁾
Interpolated Height of critical vertical Find Height above Stack z _c Height above Ground z _{crit} +f Table of Plume Top-Hat Diameters (2a) and Height (fee above groun Stack. Rel. Ht = 32. 40, 60, 80, 100, 120, 140, 160, 180, 200, 200, 200, 200, 200, 200, 200, 2	velocity in Jet it 67.223 a 77.129 Plume-Averag d above stack d above stack 5 0.00 0 2.29 0 8.38 0 14.48 0 20.57 0 22.667 0 32.77 0 38.66 0 44.96 0 51.05 0 51.05 0 57.15 0 69.34 0 57.44 0 75.44 0 96.77 0 96	Phase: meters meters ed Vertical Plume Radius(m) 6.571 6.754 7.241 7.729 8.217 8.704 9.192 9.680 10.167 11.143 11.949 12.118 12.606 13.142 14.655 11.143	220.5 253.0 Velocities st: SingleStk VertVel(m/s) 8.87 8.85 8.85 8.85 7.515 7.18 6.88 6.52 6.18 6.52 6.18 6.530 5.18 4.85 5.449 4.65	feet feet Temp(K)	d of jet ph	=[0.12F _o (6.	$25D \cdot z_{v})^{2} - \{Va_{0}a_{j}^{3}\}/(V_{crit}^{3}0.16^{3}) = \frac{http://www.17}{http://www.17}$ is the real solution x = z-zv = or z(m/above stack) = z(tt/above ground) = $z(tt/above ground) =$ $Linearly interpolated from Stack R Spillane Equations: V_pluma=((Va)_{a_{j}}^{3}+0.12F_{a_{j}}(z-z_{v})^{2}-(6.2$ $a = 0.16(z-z_{v})$ $\theta_{p} = \theta_{a}(1+(1-(\theta_{a}/\theta_{a}))^{*}(V_{exit}D^{2})/(CEC Staff Equation: V_mp=n^{22V_{exp}} Brigg's Equation: V_bages = (2/3) \times 1.6^{(2/2)} \times F_{ep}^{(2/2)} \times t$	267567. 28. org/cubic. h -44. 32 -39. 1 -9! 20 ft Interval el.Ht to Top of Jet 5D.z.,1 ²) ^{1/3} / a 5D.z.,1 ²) ^{1/3} / a (^{1/2}) x z ^(1/2) 50 ft Interval
Interpolated Height of critical vertical Find Height above Stack z _c Height above Ground z _{crit} + Table of Plume Top-Hat Diameters (2a) and Height (fee above groun Stack. Rel. Ht = 32. 40. 60. 100. 120. 100. 120. 100. 120. 100. 120. 100. 120. 100. 120. 100. 10	velocity in Jet a 67.223 77.129 Plume-Average above stack 5 0.000 0 2.29 0 8.38 0 14.48 0 20.57 0 28.67 0 32.77 0 38.86 0 44.96 0 51.05 0 57.15 0 67.22 0 69.34 0 75.44 0 82.14 0 96.77 0 112.01 0 127.25	Phase: meters meters ed Vertical Plume Radius(m) 6.574 6.754 7.241 7.729 8.217 8.704 9.680 10.167 10.655 11.143 11.949 12.118 12.606 13.142 14.650 13.142 14.650 17.089 19.527	220.5.3 253.0 Velocities stat SingleStk VertVel(m/s) 8.97 8.85 8.51 8.18 7.85 7.51 7.18 6.85 6.52 6.18 6.52 6.18 6.52 6.18 6.53 0 5.18 4.48 4.60 4.45 4.48	feet feet Temp(K) 287.35 284.41 281.63	Id of jet ph	=[0.12F _o (6.	$25D \cdot z_{y}^{2} - \{Va_{0}, {}^{3}\}/(V_{crit}^{3}0.16^{3}) = \frac{http://www.12}{http://www.12}$ is the real solution x = z-zv = or z(m/above stack) = z(tl/above ground) = z(tl/above ground) = $z(tl/above ground) = \frac{1}{2}$ Linearly interpolated from Stack R Spillane Equations: $V_{pluma} = (Va_{0}, {}^{3}+0.12F_{a} (z-z_{v})^{2}-(6.2$ a = 0.16(z-z_{v}) $\theta_{p} = \theta_{a}(1+(1-(\theta_{a}/\theta_{b}))^{*}(V_{exit}D^{2}/(CEC Staff Equation:))$ $V_{plugr} = Equation:$ $V_{plugr} = Equation:$ $V_{plugr} = (2/3) \times 1.6^{(2/2)} \times F_{exp}^{(1/2)} \times 1.$ where $F_{exp} = nF_{ap}$	267567 28. org/cubic. f: -44. 32 -39. 1 -9 20 ft Interval el.Ht to Top of Jet 5D-z,) [*]] ¹³ / a 5D-z,) [*]] ¹³ / a (¹⁴² x z ⁽¹²⁾) ¹⁴³ / x z ⁽¹²⁾
Interpolated Height of critical vertical Find Height above Stack z _c Height above Ground z _{crit} +f Table of Plume Top-Hat Diameters (2a) and Height (fee above groun Stack. Rel. Ht = 32. 40. 60. 100. 120. 140. 180. 200. 220. Single Jet 5.3 m/s Height = 253. 280. 280. Top of Single jet = 302. 390. 400. 450. 450. 450.	velocity in Jet it 67.223 s 77.129 Plume-Average (meters) d above stack 5 0.000 0 2.29 0 8.38 0 20.57 0 26.67 0 38.86 0 51.05 0 57.15 0 69.34 0 67.22 0 82.14 0 96.77 0 112.01 0 127.25 0 142.49	Phase: meters meters ed Vertical Plume Radius(m) 6.571 6.754 7.241 7.228 8.217 8.704 9.680 10.167 10.655 11.143 11.949 12.118 12.606 13.142 14.650 13.142 14.650 19.527 21.965	220.5 253.0	feet feet Plume Temp(K) 287.35 284.41 281.63 279.89	Id of jet ph	=[0.12F _o (6.	$25D \cdot z_{y}^{2} - \{Va_{0}, {}^{3}\}/(V_{crit}^{3}0.16^{3}) = \frac{http://www.12}{http://www.12}$ is the real solution x = z-zv = or z(m/above stack) = z(tl/above ground) = z(tl/above ground) = $z(tl/above ground) = \frac{1}{2}$ Linearly interpolated from Stack R Spillane Equations: $V_{pluma} = (Va_{0}, {}^{3}+0.12F_{a} (z-z_{v})^{2}-(6.2$ a = 0.16(z-z_{v}) $\theta_{p} = \theta_{a}(1+(1-(\theta_{a}/\theta_{b}))^{*}(V_{exit}D^{2}/(CEC Staff Equation:))$ $V_{plugr} = Equation:$ $V_{plugr} = Equation:$ $V_{plugr} = (2/3) \times 1.6^{(2/2)} \times F_{exp}^{(1/2)} \times 1.$ where $F_{exp} = nF_{ap}$	267567. 28. org/cubic. h -44. 32 -39. 1 -9! 20 ft Interval el.Ht to Top of Jet 5D.z.,1 ²) ^{1/3} / a 5D.z.,1 ²) ^{1/3} / a (^{1/2}) x z ^(1/2) 50 ft Interval
Interpolated Height of critical vertical Find Height above Stack z _c Height above Ground z _{cra} +f Table of Plume Top-Hat Diameters (2a) and Height (fee above groun Stack. Rel. Ht = 32. 40. 60. 100. 120. 121. 122. 123. 120.	velocity in Jet it 67.223 a 77.129 plume-Average (metros) a) (metros) a) (metros) b) (metros) a) 2.99 0 2.99 0 2.90 0 2.667 0 2.667 0 38.86 0 44.96 0 57.15 0 67.22 0 67.22 0 67.22 0 57.15 0 67.22 0 67.22 0 67.22 0 75.44 0 96.77 0 112.01 0 127.25 0 142.49 0 157.73	Phase: meters meters ed Vertical Plume Radius(m) 6.571 6.754 7.241 7.729 8.217 8.704 9.8217 8.704 9.192 9.680 10.167 10.655 11.143 11.949 12.118 12.606 13.142 14.650 13.142 14.650 13.142 14.650 13.142	220.5 253.0 Velocities str SingleStk VertVel(m/s) 8.85 7.85 7.51 7.18 6.85 6.52 6.18 5.85 5.18 5.18 5.18 5.18 5.44 4.49 4.460 4.457 4.48 4.48 4.48 4.48 4.48 4.48 4.48 4.4	feet feet Plume Temp(K) 287.35 284.41 281.63 279.89 278.71	id of jet ph.	=[0.12F _o (6.	$25D \cdot z_{y}^{2} - \{Va_{0}, {}^{3}\}/(V_{crit}^{3}0.16^{3}) = \frac{http://www.12}{http://www.12}$ is the real solution x = z-zv = or z(m/above stack) = z(tl/above ground) = z(tl/above ground) = $z(tl/above ground) = \frac{1}{2}$ Linearly interpolated from Stack R Spillane Equations: $V_{pluma} = (Va_{0}, {}^{3}+0.12F_{a} (z-z_{v})^{2}-(6.2$ a = 0.16(z-z_{v}) $\theta_{p} = \theta_{a}(1+(1-(\theta_{a}/\theta_{b}))^{*}(V_{exit}D^{2}/(CEC Staff Equation:))$ $V_{plugr} = Equation:$ $V_{plugr} = Equation:$ $V_{plugr} = (2/3) \times 1.6^{(2/2)} \times F_{exp}^{(1/2)} \times 1.$ where $F_{exp} = nF_{ap}$	267567. 28. org/cubic. h -44. 32 -39. 1 -9! 20 ft Interval el.Ht to Top of Jet 5D.z.,1 ²) ^{1/3} / a 5D.z.,1 ²) ^{1/3} / a (^{1/2}) x z ^(1/2) 50 ft Interval
Interpolated Height of critical vertical Find Height above Stack z _c Height above Ground z _{crit} +I Table of Plume Top-Hat Diameters (2a) and Height (fee above groun Stack. Rel. Ht = 32. 40, 60, 80, 100, 120, 140, 120, 220, 220, 220, 220, 220, 220, 220, 220, 220, 220, 220, 220, 220,	velocity in Jet iii 67.223 o 77.129 velocity in Jet o 77.129 velocity in Jet o o ji above stack o 0	Phase: meters meters ed Vertical Plume Radius(m) 6.571 6.754 7.241 7.729 8.217 8.704 9.192 9.680 10.167 10.6655 11.143 11.949 12.118 12.606 13.142 14.650 13.122 14.650 13.221 14.650 13.221 14.650 13.221 14.650 14	220.5 253.0 Velocities st. SingleStk VertVel(m/s) 8.85 7.85 7.51 7.18 6.85 6.52 6.18 5.85 5.30 5.18 4.49 4.60 4.57 4.48 4.22 4.18	feet feet Plume Temp(K) 287.35 284.41 281.63 278.71 277.86	d of jet ph	=[0.12F _o (6.	$25D \cdot z_{y}^{2} - \{Va_{0}, {}^{3}\}/(V_{crit}^{3}0.16^{3}) = \frac{http://www.12}{http://www.12}$ is the real solution x = z-zv = or z(m/above stack) = z(tl/above ground) = z(tl/above ground) = $z(tl/above ground) = \frac{1}{2}$ Linearly interpolated from Stack R Spillane Equations: $V_{pluma} = (Va_{0}, {}^{3}+0.12F_{a} (z-z_{v})^{2}-(6.2$ a = 0.16(z-z_{v}) $\theta_{p} = \theta_{a}(1+(1-(\theta_{a}/\theta_{b}))^{*}(V_{exit}D^{2}/(CEC Staff Equation:))$ $V_{plugr} = Equation:$ $V_{plugr} = Equation:$ $V_{plugr} = (2/3) \times 1.6^{(2/2)} \times F_{exp}^{(1/2)} \times 1.$ where $F_{exp} = nF_{ap}$	267567 28. org/cubic. f: -44. 32 -39. -9 20 ft Interval el.H to Top of Je 5D-z,) ²) ¹³ / a 5D-z,) ²) ¹³ / a (¹⁴² x z ⁽¹²⁾) 50 ft Interval
Interpolated Height of critical vertical Find Height above Stack z _c Height above Ground z _{crit} + Fable of Plume Top-Hat Diameters (2a) and Height deo above groun Stack. Rel. Ht = 32. 40. 60. 100. 120.	velocity in Jet a 67.223 77.129 Plume-Averag a 0.000 0 2.29 0 2.29 0 2.83 0 14.48 0 20.57 0 28.57 0 28.57 0 28.57 0 38.86 0 44.96 0 57.15 0 57.15 0 69.34 0 75.44 0 96.77 0 112.01 0 127.25 0 142.49 0 157.73 0 127.45 0 127.25 0 127.55 0 127.	Phase: meters meters ed Vertical Plume Radius(m) 6.574 6.754 7.241 7.729 8.217 8.704 9.192 9.680 10.167 10.655 11.949 12.118 12.606 13.142 14.650 13.142 14.650 17.089 19.527 21.965 24.404 26.842 31.719	220.5 253.0 Velocities st: SingleStk VertVel(m/s) 8.87 8.85 8.85 7.515 7.18 6.85 6.52 6.18 6.52 6.18 6.52 6.18 6.530 5.18 4.485 4.49 4.65 4.65 5.10 5.10 5.10 5.10 5.10 5.10 5.10 5.1	feet feet Temp(K) 287.35 284.41 281.63 279.89 278.71.22	d of jet ph.	=[0.12F _o (6.	$25D \cdot z_{y}^{2} - \{Va_{0}, {}^{3}\}/(V_{crit}^{3}0.16^{3}) = \frac{http://www.12}{http://www.12}$ is the real solution x = z-zv = or z(m/above stack) = z(tl/above ground) = z(tl/above ground) = $z(tl/above ground) = \frac{1}{2}$ Linearly interpolated from Stack R Spillane Equations: $V_{pluma} = (Va_{0}, {}^{3}+0.12F_{a} (z-z_{v})^{2}-(6.2$ a = 0.16(z-z_{v}) $\theta_{p} = \theta_{a}(1+(1-(\theta_{a}/\theta_{b}))^{*}(V_{exit}D^{2}/(CEC Staff Equation:))$ $V_{plugr} = Equation:$ $V_{plugr} = Equation:$ $V_{plugr} = (2/3) \times 1.6^{(2/2)} \times F_{exp}^{(1/2)} \times 1.$ where $F_{exp} = nF_{ap}$	267567 28. org/cubic. f: -44. 32 -39. -9 20 ft Interval el.H to Top of Je 5D-z,) ²) ¹³ / a 5D-z,) ²) ¹³ / a (¹⁴² x z ⁽¹²⁾) 50 ft Interval
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Interpolated Height of critical vertical Find Height above Stack z _c Height above Ground z _{cra} +f Table of Plume Top-Hat Diameters (2a) and Height (fee above groun <i>Stack. Rel.Ht = 32.</i> 40, 60, 80, 100, 120, 140, 160, 180, 200, 220, <i>Single Jet 5.3 m/s Height = 253.</i> 260, 200, 200, 200, 200, 200, 200, 200,	velocity in Jet iii 67.223 s 77.129 Plume-Average j) (meters) d above stack 5 0.000 0 2.29 0 8.38 0 26.67 0 26.67 0 32.77 0 38.86 0 44.96 0 51.05 0 57.15 0 69.34 0 75.44 0 96.77 0 112.01 0 127.25 0 142.49 0 157.73 0 23.393 0 264.41	Phase: meters	220.5 253.0 Velocities str SingleSitk VertVel(m/S) 8.87 7.88 8.87 7.88 7.88 7.751 7.18 6.85 6.525 6.18 5.86 5.30 5.18 4.85 4.49 4.60 4.57 4.44 4.38 4.28 4.28 4.18 4.28 4.18 4.28 4.18 4.28 4.18 4.28 4.18 4.28 4.18 4.28 4.18 4.28 4.18 4.28 4.18 4.28 4.18 4.28 4.18 4.28 4.18 4.28 4.18 4.28 4.28 4.28 4.28 4.28 4.28 4.28 4.2	feet feet Plume Temp(K) 287.35 284.41 281.63 279.89 278.71 277.86 277.22 276.34 275.77	Image: second	=[0.12F _o (6.	$25D \cdot z_{y}^{2} - \{Va_{0}, {}^{3}\}/(V_{crit}^{3}0.16^{3}) = \frac{http://www.12}{http://www.12}$ is the real solution x = z-zv = or z(m/above stack) = z(tl/above ground) = z(tl/above ground) = $z(tl/above ground) = \frac{1}{2}$ Linearly interpolated from Stack R Spillane Equations: $V_{pluma} = (Va_{0}, {}^{3}+0.12F_{a} (z-z_{v})^{2}-(6.2$ a = 0.16(z-z_{v}) $\theta_{p} = \theta_{a}(1+(1-(\theta_{a}/\theta_{b}))^{*}(V_{exit}D^{2}/(CEC Staff Equation:))$ $V_{plugr} = Equation:$ $V_{plugr} = Equation:$ $V_{plugr} = (2/3) \times 1.6^{(2/2)} \times F_{exp}^{(1/2)} \times 1.$ where $F_{exp} = nF_{ap}$	267567 28. org/cubic. F. -44. 33 -39. -9 20 ft Interval el-ht to Top of Ja 5D:z_i) ² j1 ^{1/2} / a 4V _{plume} *a ² x ²)) ^(4/2) x z ^(4/2)
Interpolated Height of critical vertical Find Height above Stack z _c Height above Ground z _{cra} +f fable of Plume Top-Hat Diameters (2a) and Height (fee above groun Stack.Rel.Ht = 32. 40, 60, 100, 120, 120, 120, 120, 120, 120, 12	velocity in Jet iii 67.223 a 77.129 plume-Average ji above stack 5 0.000 0 2.290 0 8.380 0 2.4667 0 2.667 0 3.8.86 0 2.6.67 0 3.8.86 0 44.96 0 45.05 0 69.34 0 75.44 0 96.77 0 112.01 0 127.25 0 142.49 0 157.73 0 127.05 0 127.25 0 142.49 0 157.73 0 23.933 0 244.89	Phase: meters meters Radius(m) 6.571 6.754 7.241 7.729 8.217 8.704 9.680 10.655 11.143 11.949 12.118 12.606 13.142 14.650 13.142 14.650 13.142 14.650 13.142 14.650 13.142 14.650 13.142 14.650 13.596 14.147 15.596	220.5 253.0 Velocities st. SingleStk VertVel(m/s) 8.85 7.85 7.751 7.18 6.85 6.85 6.85 5.85 5.30 5.18 4.85 4.49 4.60 4.57 4.48 4.83 4.28 4.83 4.28 4.18 4.85 4.49 4.60 4.57 4.48 4.83 4.28 4.18 4.85 4.85 5.18 5.18 5.18 5.18 5.18 5.18 5.18 5	feet feet Temp(K) 287.35 284.41 281.63 278.89 278.71 277.86 277.22 276.34 275.37	d of jet ph.	=[0.12F _o (6.	$25D \cdot z_{y}^{2} - \{Va_{0}, {}^{3}\}/(V_{crit}^{3}0.16^{3}) = \frac{http://www.12}{http://www.12}$ is the real solution x = z-zv = or z(m/above stack) = z(tl/above ground) = z(tl/above ground) = $z(tl/above ground) = \frac{1}{2}$ Linearly interpolated from Stack R Spillane Equations: $V_{pluma} = (Va_{0}, {}^{3}+0.12F_{a} (z-z_{v})^{2}-(6.2$ a = 0.16(z-z_{v}) $\theta_{p} = \theta_{a}(1+(1-(\theta_{a}/\theta_{b}))^{*}(V_{exit}D^{2}/(CEC Staff Equation:))$ $V_{plugr} = Equation:$ $V_{plugr} = Equation:$ $V_{plugr} = (2/3) \times 1.6^{(2/2)} \times F_{exp}^{(1/2)} \times 1.$ where $F_{exp} = nF_{ap}$	267567 28. org/cubic. F. -44. 33 -39. -9 20 ft Interval el-ht to Top of Ja 5D:z_i) ² j1 ^{1/2} / a 4V _{plume} *a ² x ²)) ^(4/2) x z ^(4/2)
Interpolated Height of critical vertical Find Height above Stack z _c Height above Ground z _{crn} +H Fable of Plume Top-Hat Diameters (2a) and Height (fee above groun Stack. Rel. Ht = 32. 40, 60, 100, 120, 100, 120, 100, 120, 100, 120, 100, 120, 100, 120, 100, 10	velocity in Jet a 67.223 a 77.129 Plume-Average a b a c 0.000 above stack 5 c 0.000 0 2.290 0 8.38 0 2.677 0 22.677 0 32.777 0 38.86 0 44.96 0 57.15 0 69.34 0 75.44 0 96.77.22 0 112.01 0 127.25 0 127.25 0 172.97 0 172.97 0 172.97 0 172.97 0 172.97 0 172.97 0 233.93 0 264.41 0 264.41 0 264.41 0 264.41	Phase: meters meters ed Vertical Plume Radius(m) 6.571 6.754 7.241 7.729 8.277 8.704 9.192 9.680 10.167 10.6655 11.143 11.949 12.118 12.606 13.142 14.650 13.142 14.650 13.142 14.650 13.142 14.650 13.142 14.650 13.142 14.650 13.142 14.650 13.142 14.650 13.142 14.650 13.142 14.650 13.142 14.650 14.719 14.650 14.719 14.650 14.650 14.719 14.650 14.719 14.650 14.719 14.650 14.719 14.650 14.719 14.650 14.719 14.650 14.719 14.650 14.719 14.650 14.719 14.650 14.719 14.719 14.650 14.719 14.650 14.719 14	220.5 253.0 Velocities st. SingleStk VertVel(m/s) 8.87 7.85 7.51 7.18 6.85 6.52 6.18 5.85 5.30 5.18 4.49 4.60 4.57 4.48 4.85 4.49 4.60 4.57 4.48 4.22 4.18 4.38 4.370 3.84	feet feet Temp(K) 287.35 284.41 281.63 279.89 278.71 277.86 277.22 276.34 276.34 277.27 275.77 275.09	Image: state	=[0.12F _o (6.	$25D \cdot z_{y}^{2} - \{Va_{0}, {}^{3}\}/(V_{crit}^{3}0.16^{3}) = \frac{http://www.12}{http://www.12}$ is the real solution x = z-zv = or z(m/above stack) = z(tl/above ground) = z(tl/above ground) = $z(tl/above ground) = \frac{1}{2}$ Linearly interpolated from Stack R Spillane Equations: $V_{pluma} = (Va_{0}, {}^{3}+0.12F_{a} (z-z_{v})^{2}-(6.2$ a = 0.16(z-z_{v}) $\theta_{p} = \theta_{a}(1+(1-(\theta_{a}/\theta_{b}))^{*}(V_{exit}D^{2}/(CEC Staff Equation:))$ $V_{plugr} = Equation:$ $V_{plugr} = Equation:$ $V_{plugr} = (2/3) \times 1.6^{(2/2)} \times F_{exp}^{(1/2)} \times 1.$ where $F_{exp} = nF_{ap}$	267567 28. org/cubic. F. -44. 33 -39. -9 20 ft Interval el-ht to Top of Ja 5D:z_i) ² j1 ^{1/2} / a 4V _{plume} *a ² x ²)) ^(4/2) x z ^(4/2)
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Interpolated Height of critical vertical Find Height above Stack z _c Height above Ground z _{craf} + Table of Plume Top-Hat Diameters (2a) and Height (fee above groun Stack. Rel. Ht = 32. 40. 60. 100. 120. 101. 120. 120. 120. 120. 120. 120. 120. 120. 120. 120. 120. 120. 120. 120. 120. 120. 120. 120. 220. 220. 220. 220. 220. 220. 220. 220. 220. 220. 220. 230. 240. 250. 260. 260. 260. 260. 260.	velocity in Jet iii 67.223 s 77.129 velocity in Gr.223 s 77.129 velocity in Gr.223 s 77.129 velocity in Gr.223 above stack 5 0.000 0 2.290 0 8.380 0 14.48 0 26.67 0 38.86 0 44.96 0 57.15 0 67.22 0 69.34 0 57.15 0 67.72 0 120.16 0 96.77 0 127.25 0 142.49 0 157.73 0 203.45 0 234.41 0 264.41 0 256.85 0 386.33 0 365.85 0 386.33 0 365.85 0	Phase: meters meters ed Vertical Plume Radius(m) 6.571 6.754 7.241 7.729 8.217 8.704 9.627 9.680 10.165 11.143 11.949 12.118 12.606 13.142 14.650 13.142 14.650 19.527 21.965 24.404 26.842 31.719 36.556 24.404 26.842 31.719 36.556 24.404 26.842 31.719 36.556 24.404 26.842 31.719 36.556 24.404 26.842 31.719 36.556 21.226 36.103 36.574 36.103 36.575 36.103 36.575 36.103 36.575 36.103 36.575 36.103 36.575 36.103 36.575 36.103 36.575 36.103 36.575 36.103 36.575 36.103 36.575 36.103 36.575 36.103 36.575 37.103 37.103 36.575 36.103 36.575 36.103 37.	220.5 253.0 Velocities str SingleStk VertVel(m(%)2 8.897 8.85 7.551 7.18 6.85 6.522 6.18 5.18 5.18 5.18 5.18 5.18 5.18 4.485 4.49 4.60 4.57 4.48 4.48 4.48 4.33 4.28 4.33 4.28 4.33 7.51 5.11 5.11 5.12 5.12 5.12 5.12 5.12 5	feet feet Temp(K) 287.35 284.41 277.86 278.79 278.71 277.50 276.37 275.09 276.37 275.17 275.37 275.19 274.87 274.87	d of jet ph.	=[0.12F _o (6.	$25D \cdot z_{y}^{2} - \{Va_{0}, {}^{3}\}/(V_{crit}^{3}0.16^{3}) = \frac{http://www.12}{http://www.12}$ is the real solution x = z-zv = or z(m/above stack) = z(tl/above ground) = z(tl/above ground) = $z(tl/above ground) = \frac{1}{2}$ Linearly interpolated from Stack R Spillane Equations: $V_{pluma} = (Va_{0}, {}^{3}+0.12F_{a} (z-z_{v})^{2}-(6.2$ a = 0.16(z-z_{v}) $\theta_{p} = \theta_{a}(1+(1-(\theta_{a}/\theta_{b}))^{*}(V_{exit}D^{2}/(CEC Staff Equation:))$ $V_{plugr} = Equation:$ $V_{plugr} = Equation:$ $V_{plugr} = (2/3) \times 1.6^{(2/2)} \times F_{exp}^{(1/2)} \times 1.$ where $F_{exp} = nF_{ap}$	267567. 28. org/cubic.b -44, 32 -39. 1 -98 -98 -98 -98 -98 -98 -98 -98
Interpolated Height of critical vertical Find Height above Stack z _c Height above Ground z _{cra} +f Table of Plume Top-Hat Diameters (2a) and Height (fee above groun Stack. Rel. Ht = 32. 40, 60, 100, 120, 120, 120, 120, 120, 120, 12	velocity in Jet iii 67.223 a 77.129 velocity in Jet 67.223 a 77.129 velocity in Jet 67.223 a 77.129 velocity in Jet a 77.129 a b b a a a a b b b b b b b b	Phase: meters meters Radius(m) 6.571 6.754 7.241 7.729 8.217 8.704 9.192 9.680 10.655 11.143 12.946 13.142 14.650 13.142 14.650 13.142 14.650 13.142 14.650 13.143 14.949 15.27 21.966 24.404 26.842 31.719 36.596 6.103 6.596 34.404 26.842 31.719 35.27 21.965 24.404 26.842 31.719 35.27 21.965 24.404 26.842 31.719 35.27 21.965 21.225 22.404 26.842 31.719 35.27 21.965 21.225 22.404 25.596 21.225 21.2555 21.2555 21.2555 21.2555 21.25555 21.25555 21.25555555555	220.5 253.0 Velocities st. SingleStk VertVel(m/s) 8.87 7.86 6.85 7.751 7.18 6.85 6.52 6.18 5.85 5.30 5.18 4.48 4.85 5.53 5.18 4.48 4.48 4.48 4.48 4.48 4.48 4.48 4	feet feet feet Plume Temp(K) 287.35 284.41 281.63 278.27 275.37 275.09 278.71 277.86 277.22 276.34 277.27 5.37 275.09 274.87 275.37 275.09 274.87 277.27 5.37 275.09 274.87 277.27 5.37 275.09 274.87 277.27 5.37 275.09 274.87 277.27 5.37 275.09 274.87 277.27 5.37 275.09 274.87 277.27 275.37 275.09 274.87 277.27 275.37 275.09 274.87 277.27 275.37 275.09 274.87 277.27 275.37 275.09 274.87 277.27 275.37 275.09 274.87 277.27 275.37 275.37 275.39 274.87 277.27 275.37 275.39 274.87 277.27 275.37 275.39 277.27 275.37 275.39 274.87 277.27 275.37 277.27 275.37 277.27 277.27 275.37 277.27 275.37 277.27 277.37 277.27 277.37 277.277.	d of jet ph.	=[0.12F _o (6.	$25D \cdot z_{y}^{2} - \{Va_{0}, {}^{3}\}/(V_{crit}^{3}0.16^{3}) = \frac{http://www.12}{http://www.12}$ is the real solution x = z-zv = or z(m/above stack) = z(tl/above ground) = z(tl/above ground) = $z(tl/above ground) = \frac{1}{2}$ Linearly interpolated from Stack R Spillane Equations: $V_{pluma} = (Va_{0}, {}^{3}+0.12F_{a} (z-z_{v})^{2}-(6.2$ a = 0.16(z-z_{v}) $\theta_{p} = \theta_{a}(1+(1-(\theta_{a}/\theta_{b}))^{*}(V_{exit}D^{2}/(CEC Staff Equation:))$ $V_{plugr} = Equation:$ $V_{plugr} = Equation:$ $V_{plugr} = (2/3) \times 1.6^{(2/2)} \times F_{exp}^{(1/2)} \times 1.$ where $F_{exp} = nF_{ap}$	267567. 28. org/cubic.b -44, 32 -39. 1 -98 -98 -98 -98 -98 -98 -98 -98
Interpolated Height of critical vertical Find Height above Stack z _c Height above Ground z _{crit} +f Table of Plume Top-Hat Diameters (2a) and Height (fee above groun Stack. Rel. Ht = 32. 40. 60. 100. 120. 120. 120. 120. 120. 120. 12	velocity in Jet a 67.223 a 77.129 b (meters) a above stack 5 0.000 0 2.29 0 2.83 0 2.83 0 2.67 0 2.67 0 32.77 0 38.86 0 44.96 0 57.15 0 67.22 0 67.22 0 67.22 0 67.22 0 67.22 0 67.22 0 67.22 0 67.22 0 127.25 0 127.25 0 127.25 0 127.25 0 127.27 0 203.45 0 264.41 0 264.33 0 264.33 0 264.32 0 </td <td>Phase: meters meters ed Vertical Plume Radius(m) 6.574 6.754 7.241 7.729 8.217 8.704 9.192 9.680 10.167 10.655 11.143 12.118 12.606 13.142 14.650 13.142 14.650 13.142 14.650 14.045 24.044 26.842 31.719 36.596 41.473 46.349 51.225 56.103 60.980 70.733 95.117 119.501</td> <td>220.53 253.0 Velocities stat SingleStk VertVel(m/s) 8.97 8.85 8.51 8.84 7.85 7.751 7.78 6.652 6.18 6.652 6.18 6.52 6.18 7.57 7.56 7.57 7.57 6.18 7.57 7.3.44 8.3.36 7.22 7.22 7.22 7.22 7.22 7.22 7.22 7.2</td> <td>feet feet Plume Temp(K) 287.35 284.41 281.63 279.89 278.71 277.64 277.63 276.34 277.27 275.379 274.71 275.379 274.71 274.58 274.71 274.58 274.71 274.58 274.71</td> <td>Image: section of the sectio</td> <td>=[0.12F_o(6.</td> <td>$25D \cdot z_{y}^{2} - \{Va_{0}, {}^{3}\}/(V_{crit}^{3}0.16^{3}) = \frac{http://www.12}{http://www.12}$ is the real solution x = z-zv = or z(m/above stack) = z(tl/above ground) = z(tl/above ground) = $z(tl/above ground) = \frac{1}{2}$ Linearly interpolated from Stack R Spillane Equations: $V_{pluma} = (Va_{0}, {}^{3}+0.12F_{a} (z-z_{v})^{2}-(6.2$ a = 0.16(z-z_{v}) $\theta_{p} = \theta_{a}(1+(1-(\theta_{a}/\theta_{b}))^{*}(V_{exit}D^{2}/(CEC Staff Equation:))$ $V_{plugr} = Equation:$ $V_{plugr} = Equation:$ $V_{plugr} = (2/3) \times 1.6^{(2/2)} \times F_{exp}^{(1/2)} \times 1.$ where $F_{exp} = nF_{ap}$</td> <td>267567. 28. org/cubic. ft -44. 32 -39. 1 -9! 20 ft Interval el.Ht to Top of Jet 50 z.,)²)^{1/3} / a 50 z.,)²)^{1/3} / a 50 ft Interval 50 ft Interval</td>	Phase: meters meters ed Vertical Plume Radius(m) 6.574 6.754 7.241 7.729 8.217 8.704 9.192 9.680 10.167 10.655 11.143 12.118 12.606 13.142 14.650 13.142 14.650 13.142 14.650 14.045 24.044 26.842 31.719 36.596 41.473 46.349 51.225 56.103 60.980 70.733 95.117 119.501	220.53 253.0 Velocities stat SingleStk VertVel(m/s) 8.97 8.85 8.51 8.84 7.85 7.751 7.78 6.652 6.18 6.652 6.18 6.52 6.18 7.57 7.56 7.57 7.57 6.18 7.57 7.3.44 8.3.36 7.22 7.22 7.22 7.22 7.22 7.22 7.22 7.2	feet feet Plume Temp(K) 287.35 284.41 281.63 279.89 278.71 277.64 277.63 276.34 277.27 275.379 274.71 275.379 274.71 274.58 274.71 274.58 274.71 274.58 274.71	Image: section of the sectio	=[0.12F _o (6.	$25D \cdot z_{y}^{2} - \{Va_{0}, {}^{3}\}/(V_{crit}^{3}0.16^{3}) = \frac{http://www.12}{http://www.12}$ is the real solution x = z-zv = or z(m/above stack) = z(tl/above ground) = z(tl/above ground) = $z(tl/above ground) = \frac{1}{2}$ Linearly interpolated from Stack R Spillane Equations: $V_{pluma} = (Va_{0}, {}^{3}+0.12F_{a} (z-z_{v})^{2}-(6.2$ a = 0.16(z-z_{v}) $\theta_{p} = \theta_{a}(1+(1-(\theta_{a}/\theta_{b}))^{*}(V_{exit}D^{2}/(CEC Staff Equation:))$ $V_{plugr} = Equation:$ $V_{plugr} = Equation:$ $V_{plugr} = (2/3) \times 1.6^{(2/2)} \times F_{exp}^{(1/2)} \times 1.$ where $F_{exp} = nF_{ap}$	267567. 28. org/cubic. ft -44. 32 -39. 1 -9! 20 ft Interval el.Ht to Top of Jet 50 z.,) ²) ^{1/3} / a 50 z.,) ²) ^{1/3} / a 50 ft Interval 50 ft Interval
Interpolated Height of critical vertical Find Height above Stack z _c Height above Ground z _{crn} +H Table of Plume Top-Hat Diameters (2a) and Height (fee above groun Stack. Rel. Ht = 32. 40. 60. 100. 120. 140. 180. 200. 220. 201. 201. 202. 203. 203. 203. 203. 203. 203. 203	velocity in Jet # 67.223 \$ 77.129 Plume-Average	Phase: meters meters meters ed Vertical Plume Radius(m) 6.571 6.754 7.241 7.722 9.680 10.167 10.655 11.143 11.949 12.118 12.606 13.142 14.650 19.527 21.965 24.404 26.842 31.719 36.596 41.473 46.349 51.226 56.103 60.980 70.733 95.117 119.501 143.885	220.53 253.0 253.0 Velocities stat SingleStk VertVel(m(s) 8.97 8.85 7.51 7.85 7.51 7.85 6.855 6.855 6.855 6.855 6.855 6.85 5.850 5.84 4.85 4.49 4.60 4.57 4.44 4.38 4.22 4.18 4.33 7.7 3.64 3.36 3.28 4.33 7.34 4.33 7.357 3.44 4.357 3.44 3.357 3.347	feet feet Plume Temp(K) 287.35 284.45 284.45 284.63 279.89 278.71 287.64 277.22 276.34 277.57 275.37 275.37 275.37 275.37 275.37 275.37 274.71 277.58 274.39 274.58 274.39	Image: section of the sectio	=[0.12F _o (6.	$25D \cdot z_{y}^{2} - \{Va_{0}, {}^{3}\}/(V_{crit}^{3}0.16^{3}) = \frac{http://www.12}{http://www.12}$ is the real solution x = z-zv = or z(m/above stack) = z(tl/above ground) = z(tl/above ground) = $Jet Phase Eqs:$ Linearly interpolated from Stack R Spillane Equations: $V_{pluma} = (Va_{0}, {}^{3}+0.12F_{a}](z-z_{v})^{2}-(6.2$ $a = 0.16(z-z_{v})$ $\theta_{p} = \theta_{a}(1+(1-(\theta_{a}/\theta_{b}))^{*}(V_{exit}D^{2}/(CEC Staff Equation: V_{mp} = n^{5}S_{vp} = Brigg's Equation:$ $V_{begg's} = (2/3) \times 1.6^{(2/2)} \times F_{mp}^{(1/2)} \times 1.6^{(2/2)}$	267567. 28.org/cubic.h -44.32 -39.1 -9 20 ft Interval: 20 ft Interval: 50-z.,) ²]) ^{1/3} / a 4V _{plume} *a ²⁺ λ ²))) 50 ft Interval: 50 ft Interval:
Interpolated Height of critical vertical Find Height above Stack z _c Height above Ground z _{cra} +H Table of Plume Top-Hat Diameters (2a) and Height (fee above groun Stack. Rel.Ht = 32. 40. 60. 100. 12	velocity in Jet iii 67.223 a 77.129 b 77.129 c 0.000 c 0.000 c 0.000 c 0.000 c 2.290 c 8.38 c 0.000 c 2.677 c 38.86 c 0.10257 c 51.05 c 57.44 c 96.77 c 38.86 c 4.392 c 75.44 c 96.77 c 112.01 c 142.49 c 142.49 c 23.33 c 244.41 c 325.37 c 336.86 c 386.33 c 344.7.29 c 355.85 c 386.33 c 447.29	Phase: meters meters meters ed Vertical Plume Radius(m) 6.571 6.754 7.241 7.729 8.217 8.704 9.182 9.680 10.1675 11.143 11.949 12.218 12.118 12.606 13.142 14.650 19.557 21.965 24.404 26.842 31.719 36.556 41.473 46.349 51.226 56.103 60.980 70.733 95.117 119.501 1143.885 168.269	220.5. 253.0 Velocities st. SingleSitk VertVel(m(%)2 8.97 8.85 7.51 7.85 6.525 6.18 5.85 5.18 4.457 4.44 4.55 4.49 4.60 4.57 4.44 4.38 4.28 4.28 4.18 4.28 4.28 4.18 4.28 4.28 4.18 4.28	feet feet Plume Temp(K) 287.35 284.41 281.63 279.89 278.71 277.66 277.22 276.34 275.77 275.37 275.09 274.87 274.71 274.58 274.39 274.42 274.39 274.42 273.92 273.92	Image: section of the sectio	=[0.12F _o (6.	$25D \cdot z_{y}^{2} - \{Va_{0}, {}^{3}\}/(V_{crit}^{3}0.16^{3}) = \frac{http://www.12}{http://www.12}$ is the real solution x = z-zv = or z(m/above stack) = z(tl/above ground) = z(tl/above ground) = $Jet Phase Eqs:$ Linearly interpolated from Stack R Spillane Equations: $V_{pluma} = (Va_{0}, {}^{3}+0.12F_{a}](z-z_{v})^{2}-(6.2$ $a = 0.16(z-z_{v})$ $\theta_{p} = \theta_{a}(1+(1-(\theta_{a}/\theta_{b}))^{*}(V_{exit}D^{2}/(CEC Staff Equation: V_{mp} = n^{5}S_{vp} = Brigg's Equation:$ $V_{begg's} = (2/3) \times 1.6^{(2/2)} \times F_{mp}^{(1/2)} \times 1.6^{(2/2)}$	267567. 28.org/cubic.ht -44.32 -39.1 -9 20 ft intervals 20 ft intervals 50-z,\ ²]) ¹³ / a 4V _{plume} *a ²⁺ λ ²))) 50 ft intervals



MERGED (along length) Plume Average Verti			oyant Plumes					
						ditions at \	Various Heights in the Merg	ed
				Turbine P	ower Statio	n at Oakey	/, Queensland, Australia ," [Dr. K.T. Spilla
Ambient Conditions:					Constants:		eutral conditions (d0/dz=0 or	θ _a =θ _e)
Ambient Potential Temp θ _a Plume Exit Conditions:	273.71	Kelvins	33.0	°F	Gravity g		meters/feet m/s ²	
Stack Height h _s	9.91	meters	32 6/12	feet-inches	Οιανιτγ φ	1.11		
Individual Stack Diameter D	13.141706			inches	λο	~1.0		
Stack Velocity V _{exit}	8.97	m/s	29.43	ft/sec	4Vol/(60πE) ²)		
Individual Volumetric Flow	1,216.87	cu.m/sec	2,578,400	ACFM	$\pi V_{exit} D^2/4$			Sect.2/¶1
Stack Potential Temp θs	312.04	Kelvins	102.0	°F				
Initial Stack Buoyancy Flux Fo	466.75		69.0	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 Average Adjacent Stack Separation d	36.00	meters	118.1	feet	Calcs base	d on multipl	e plume treatment in Peter Be	st Paner
Number of Stacks along Orientation N	2	motoro		1001			ased by N ^{0.25} at the height whe	•
,							low ht, single merged stack a	
Conditions at End (Top) of Jet Phase:								
Height above Stack z _{jet}		meters*	269.5		z _{jet} = 6.250), meters*=	meters above stack top	Sect.3/¶1
Height above Ground zjet+hs		meters	302.0					•
Vertical Velocity V _{jet}	4.486			ft/sec	V _{jet} = 0.5V	_{exit} = V _{exit} /2	Conservation of momentum	
Plume Top-Hat Diameter 2a _{jet}	20.203	meters	86.2	Ieel	2a _{jet} = 2D		Conservation of momentum	
pillane Methodology - Analytical Solutions	for Calm Con	ditions for	Plume Heiaht	s above Je	t and Mero	ing Phase	s	
Single Plume-averaged Vertical Velocity			-		-	-		
Single Plume Values: Plume Top-Hat Radius a			Merging Onl		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	49.6		101 1 2		where $(\theta_a/\theta_s)^{1/2} = (\theta_e/\theta_s)^{1/2} =$	
Single Plume Values: Vertical Velocity V			e Merging Onl	У			_v) ² - (6.25D-z _v) ²]) ^(1/3) / a	Sect.2.1(6)
Product (Va) _o	55.209	10 /S			V _{exit} (D/2)(θ	eros)		
Plume Merging - Based on Single Plume Cal	culations wh	ere:						Sect.3/¶3
Begin Merging Plume Top-Hat Diameter 2atouch		meters	118.1	feet	2a _{touch} =d, (or atouch=d/	(2)	
Height above Stack ztouch	117.710		386.2				meters*=meters above stack	top
Height above Ground z _{touch} +h _s	127.616		418.7	feet				
Vertical Velocity Vtouch	4.540			ft/sec			$F_0 [(z-z_v)^2 - (6.25D-z_v)^2]^{(1/3)}$	
Total Merging Plume Top-Hat Diameter 2a _{full}	72.000		236.2				ull=d(N-1)/2) FOR 2 STACKS,	
Height above Stack z _{full} Height above Ground z _{full} +hs	230.210 240.116		755.3 787.8		$z_{full} = z_v + 2$	d/(2*0.16),	meters*=meters above stack	top
Vertical Velocity V _{full} +n _s	3.855			ft/sec	$V_{i,n} = i(V_i)$	³ + 0 12E	$((z_{full}-z_v)^2 - (6.25D-z_v)^2))^{(1/3)}$	/a
Product (V ³ a) _{full}		m ⁴ /s ³	12.1	10000	Truit – t(Tru	10 T O. 121 ((crui 20) (0.200 20) []	, crui
Conditions at End (Top) of Merging Phase - D			ind a _{full} in Merg	ed Plume c	alculations	(based on T	OTAL number of stacks):	
Merged Plume Values: Plume Diameter 2a	S	olutions in	Table Below		2a = 2 x (a	m + 0.16(z-	z _{full})), or linear increase with	height
Revised Merged Plume Radius am	36.000	meters	118.1	feet			here Total Merging Occurs	
Revised Merged Plume Velocity V _m	3.855			ft/sec			where Total Merging Occurs	
Revised Virtual Source Height zfull	230.210		755.3	feet*			nere Total Merging Occurs (sh	
Revised Vertical Velocity V	5	Diutions in	Tables Below				eights above total merging ele z-z _{touch})/(z _{full} -z _{touch})	evation
Multiple Plume Calculations					V=V _{touch} +(Vm ^{-V} touch) (for heights below total mergi	na elevation
Solve for plume-averaged vertical veloc	ity at height	600.0	feet	182.88	meters abo	ve ground (ing clovation
Gives the following Height above Stack z	172.974	meters*	567.5				MERGING PHASE-INTERPO	DLATE
Plume Top-Hat Radius a	#N/A	meters	#N/A	feet	a=am+0.16	(z-z _{full}) if z:	>Z _{full}	
Vertical Velocity V	4.203	m/s	13.79	ft/sec	V={n(V ³ a) _f			
							(z'-z _{touch})/(z _{full} z _{touch}) if z _{touch} .	<z<z<sub>full</z<z<sub>
Solve for Height of CASC critical vertical	velocity V	5.30	mla		V'=single p BEFORE T		s if z <z<sub>touch</z<sub>	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>	vv < rop or .
Height above Ground z _{crit} +h _s		meters		feet			*(Vcrit-Vtouch)/(Vm-Vtouch) if Vc	rit>Vm
					-chi -touch	(-run -touch)		
Table of MERGED Plume-Averaged Vertical	/elocities sta	rting at Tou	ching Height		Single Plur	ne Eqns (s	ee Single Plume spreadsheel	:)
Height (feet)							_v) ² -(6.25D-z _v) ²]} ^{1/3} / a	
above ground					a = 0.16(z-			
Begin Merging (touch) = 418.7	117.71	18.000	4.54				_{exit} D ² /(4V _{plume} *a ² *λ ²)))	10.61
440.0 480.0	124.21 136.40	#N/A #N/A	4.50		Interpolate		rs (z'-z _{touch})/(z _{full} -z _{touch})	40 ft Interval
480.0		#N/A #N/A	4.43		• - • touch+(• m ⁻ • touch) (touch/ (-tulltouch/	
560.0	140.33	#N/A	4.28					
600.0	172.97	#N/A	4.20					
640.0		#N/A	4.13					
600.0	197.36	#N/A	4.05					
680.0		#N/A	3.98					
720.0	209.55				Merged Plu			50.41
720.0 760.0	221.74	#N/A	3.91		V_1-A3.>			50 ft Interva
720.0 760.0 750.0	221.74 218.69	#N/A #N/A	3.92		$V = \{n(V^3a)_{f_1}$			
720.0 760.0 750.0 End Merging (full/mp) = 787.8	221.74 218.69 230.22	#N/A #N/A 36.000	3.92 3.85		V={n(V ³ a) _f , a=a _m +0.16			
720.0 760.0 750.0	221.74 218.69 230.22	#N/A #N/A 36.000	3.92 3.85					
720.0 760.0 750.0 End Merging (full/mp) = 787.8 800.0	221.74 218.69 230.22 233.93	#N/A #N/A 36.000 36.596	3.92 3.85 3.83					
720.0 760.0 750.0 End Merging (full/mp) = 787.8 800.0 850.0	221.74 218.69 230.22 233.93 249.17 264.41	#N/A #N/A 36.000 36.596 39.034	3.92 3.85 3.83 3.75 3.68					100 ft Interv
720.0 760.0 750.0 End Merging (full/mp) = 787.8 800.0 850.0 900.0 1000.0 1100.0	221.74 218.69 230.22 233.93 249.17 264.41 294.89 325.37	#N/A #N/A 36.000 36.596 39.034 41.473 46.349 51.226	3.92 3.85 3.83 3.75 3.68 3.54 3.54					100 ft Interv
720.0 760.0 750.0 End Merging (full/mp) = 787.8 800.0 850.0 900.0 1000.0 1100.0 1200.0	221.74 218.69 230.22 233.93 249.17 264.41 294.89 325.37 355.85	#N/A #N/A 36.000 36.596 39.034 41.473 46.349 51.226 56.103	3.92 3.85 3.83 3.75 3.68 3.54 3.43 3.32					100 ft Interve
720.0 760.0 750.0 End Merging (tull/mp) = 787.8 800.0 850.0 9000.0 1000.0 11000.0 11000.0 11000.0	221.74 218.69 230.22 233.93 249.17 264.41 294.89 325.37 355.85 386.33	#N/A #N/A 36.000 36.596 39.034 41.473 46.349 51.226 56.103 60.980	3.92 3.85 3.83 3.75 3.68 3.54 3.43 3.32 3.23					100 ft Interv
720.0 760.0 750.0 End Merging (full/mp) 787.8 800.0 850.0 900.0 1000.0 1100.0 1100.0 11200.0 1300.0 1300.0	221.74 218.69 230.22 233.93 249.17 264.41 294.89 325.37 355.85 386.33 416.81	#N/A #N/A 36.000 36.596 39.034 41.473 46.349 51.226 56.103 60.980 65.857	3.92 3.85 3.83 3.75 3.68 3.54 3.43 3.32 3.23 3.15					100 ft Interv
720.0 760.0 750.0 End Merging (full/mp) = 787.8 800.0 900.0 1000.0 11000.0 11200.0 11200.0 11200.0 11200.0	221.74 218.69 230.22 233.93 249.17 264.41 294.89 325.37 355.85 3366.33 416.81 447.29	#N/A #N/A 36.000 36.596 39.034 41.473 46.349 51.226 56.103 60.980 65.857 70.733	3.92 3.85 3.83 3.75 3.68 3.54 3.43 3.32 3.23 3.15 3.08					100 ft Interv
720.0 760.0 750.0 End Merging (full/mp) = 787.8 800.0 800.0 900.0 1000.0 1100.0 1100.0 11200.0 1300.0 1400.0 1500.0	221.74 218.69 230.22 233.93 249.17 264.41 294.89 325.37 355.85 3366.33 416.81 447.29 477.77	#N/A #N/A 36.000 36.596 39.034 41.473 46.349 51.226 56.103 60.980 65.857 70.733 75.610	3.92 3.85 3.83 3.75 3.68 3.54 3.43 3.32 3.23 3.15 3.08 3.01					100 ft Interv
720.0 760.0 750.0 End Merging (full/mp) = 787.8 800.0 900.0 1000.0 11000.0 11200.0 11200.0 11200.0 11200.0	221.74 218.69 230.22 233.93 249.17 264.41 294.89 325.37 335.85 336.33 416.81 447.29 477.77 508.25	#N/A #N/A 36.000 36.596 39.034 41.473 46.349 51.226 56.103 56.0380 65.857 70.733 75.610 80.487	3.92 3.85 3.83 3.75 3.68 3.54 3.43 3.32 3.23 3.15 3.08					
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720.0 760.0 750.0 End Merging (full/mp) = 787.8 800.0 900.0 1000.0 1000.0 1000.	221.74 218.69 230.22 233.39 249.17 264.41 294.89 355.85 386.33 416.81 447.29 477.77 508.25 538.73 599.69 599.69 592.59 592.59 593.59 595.59 593.59 595.59 593.59 595.59 593.59 595.59 593.59 595.59 593.59 595.59 593.59 595.59 593.59 595.59 593.59 595.59 593.59 593.59 595.59 593.59 595.59 59	#N/A #N/A 36.596 39.034 41.473 46.349 51.226 56.103 60.980 65.857 70.733 75.610 80.487 85.364 95.117 119.501 143.885 168.269 192.653	3.92 3.85 3.83 3.54 3.44 3.43 3.32 3.51 3.00 3.01 2.95 2.89 2.79 2.58 2.43 2.43 2.43 2.43 2.43 2.43 2.43 2.43 2.43 2.43 2.43 2.43 2.43 2.43 2.43 2.43 2.43 2.45					100 ft interva

SINGLE/Approximated Plume Average Vertic Based on 36 cells/heat exchanger. Calc'	"Aviation Sa				st, et. al.			
eff.diam for each heat exchanger with each fan		-	-			litions at V	arious Heights in the Plume	•
at 13' ID (234,400 ACFM total for each fan). 36 fans			-				, Australia," Dr. K.T. Spilla	
Ambient Conditions:							eutral conditions (dθ/dz=0 or	
Ambient Potential Temp θ _a	310.37	Kelvins	99.0				meters/feet	u ()
Plume Exit Conditions:					Gravity g		m/s ²	
Stack Height hs	9 91	meters	32.50	feet	λ	1.11		
Merged Stack Diameter D	23.7744			inches	λο	~1.0		
v								
Stack Velocity V _{exit}	8.97			ft/sec	4Vol/(60πE	~)		
Individual Heat Exchanger Volumetric Flow		cu.m/sec	8,438,400		πV _{exit} D ² /4			Sect.2/¶1
Stack Potential Temp θ _s		Kelvins	129.0	°F				
Initial Stack Buoyancy Flux F _o	633.8407	m ⁴ /s ³	30.0	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			$\lambda^2 g V a^2 (1-\theta)$	_a /θ _p) for a,V	,θ _p at plume height (see belo	w)
Number of Heat Exchangers n	1			1.000	Multiple Sta	ack Multipli	cation Factor (n ^{0.25})	
							. , ,	
Conditions at End (Top) of Jet Phase:								
Height above Stack z _{iet}	148.590	meters*	487.5	foot*	7 6 250) meters*-	meters above stack top	Sect.3/¶1
			520.0		2jet = 0.202	, motors =		"
Height above Ground z _{jet} +h _s	158.496				V 0.5V	V /0		
Vertical Velocity V _{jet}	4.486			ft/sec	$V_{jet} = 0.5V_{i}$	$x_{it} = V_{exit}/2$		-
Plume Top-Hat Diameter 2a _{jet}	47.549	meters	156.0	feet	2a _{jet} = 2D		Conservation of momentum	
Spillane Methodology - Analytical Solutions f	or Calm Con	ditions for P	ume Heights	s above Jet	t Phase			
Single Plume-averaged Vertical Velocity	V given by Ar	nalytical Sol	ution in Pap	er where P	roduct Va	given by e	quations below:	
Plume Top-Hat Radius a	S	olutions in T	able Below		0.16(z-z _v),	or linear ind	crease with height	Sect.2/Eq.6
Virtual Source Height zv	3.836	meters*	12.6	feet*			ers*=meters above stack top	Sect.2/Eq.6
Height above Ground zv+hs		meters	45.1			2, 2, 1.00	where $(\theta_a/\theta_s)^{1/2} = (\theta_e/\theta_s)^{1/2} =$	
Vertical Velocity V		olutions in T			{(Va) 3 ± 0	12F. [(7.7	$(0_{a}^{0}/0_{s}^{0})^{2} = (0_{a}^{0}/0_{s}^{0})^{2} = (0_{a}^{0}/0_{s}^{0})^{2}$	Sect.2.1(6)
			DCIUW		$\{(va)_0^+ \neq 0.$ $V_{exit}D/2(\theta_e/$		v, (0.200-2v)]; '/d	JUUI.2. ((U)
Product (Va) _o	103.888	111 ^{-/} S			v _{exit} D/2(θ _e /	o _s)		
Heat Exchanger Results:								
Solve for plume-averaged vertical velo		600.0			meters abo	ve ground (z'+h _s)	
Gives the following Height above Stack z'	172.974	meters*	567.5	feet*				
Plume Top-Hat Diameter 2a'	54.124	meters	177.6	feet	2a'=2*0.16	z'-z _v)		Sect.2/Eq.6
Vertical Velocity V	4.413	m/s	14.48	ft/sec	V={(Va) ₀ ³ +	0.12F _o [(z-z	$(1/3)^{2} - (6.25D - z_{y})^{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 、
Find Height above Stack z _{crit}		meters	#N/A	-		-	ultaneously in both eqs. (i.e.,	
-		meters	#N/A				ubic equation ax ³ +bx ² +cx+d=	
Height above Ground z _{crit} +h _s	#IN/A	meters	#N/A	leet	IOF V=V _{crit}	-		
							and b=-(0.12F _o)/(V _{crit} ³ 0.16 ³)=	
Interpolated Height of critical vertical ve	locity in Jet	Phase:			and d		25D-z _v) ² -(Va) _o ³]/(V _{crit} ³ 0.16 ³)=	774874.
Interpolated Height of critical vertical vertica	elocity in Jet 121.610		399.0	feet	and d		25D-z _v) ² -(Va) _o ³]/(V _{crit} ³ 0.16 ³)=	-124.730 774874. 28.org/cubic.ht
		meters	399.0 431.5		and d	=[0.12F _o (6.	25D-z _v) ² -(Va) _o ³]/(V _{crit} ³ 0.16 ³)=	774874. 28.org/cubic.h
Find Height above Stack z _{crit}	121.610	meters			and d	=[0.12F _o (6.	25D-z _v) ² -(Va) _o ³]/(V _{crit} ³ 0.16 ³)= http://www.17	774874. 28.org/cubic.h -64.06
Find Height above Stack z _{crit}	121.610	meters			and d	=[0.12F _o (6.	$25D-z_v)^2 - (Va)_o^3 / (V_{crit}^{30.163}) = \frac{http://www.17}{structure}$ es the real solution x = z-zv = or z(m/above stack) =	774874.
Find Height above Stack z_{crit} Height above Ground $z_{crit}\text{+}h_s$	121.610 131.516	meters meters	431.5	feet		=[0.12F _o (6.	25D-z _v) ² -(Va) _o ³]/(V _{crit} ³ 0.16 ³)= <u>http://www.17</u> es the real solution x = z-zv =	774874. 28.org/cubic.h -64.06 -60.2
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s Table of Plume Top-Hat Diameters (2a) and P	121.610 131.516 Iume-Averag	meters meters ed Vertical	431.5 Velocities sta	feet arting at en		=[0.12F _o (6.	$25D-z_v)^2 - (Va)_o^3 / (V_{crit}^{30.163}) = \frac{http://www.17}{structure}$ es the real solution x = z-zv = or z(m/above stack) =	774874. 28.org/cubic.h -64.06 -60.2
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s Table of Plume Top-Hat Diameters (2a) and P Height (feet)	121.610 131.516 Iume-Averag (meters)	meters meters ed Vertical 1 Plume	431.5 Velocities sta SingleStk	feet arting at en Plume	nd of jet pha	=[0.12F _o (6.	$25D-z_v)^2 - (Va)_o^3 / (V_{crit}^{30.163}) = \frac{http://www.17}{structure}$ es the real solution x = z-zv = or z(m/above stack) =	774874. 28.org/cubic.h -64.06 -60.2
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s Table of Plume Top-Hat Diameters (2a) and P Height (feet) above ground	121.610 131.516 Iume-Averag (meters) above stack	meters meters ed Vertical Plume Radius(m)	431.5 Velocitiessta SingleStk VertVel(m/s)	feet arting at en Plume Temp(K)	nd of jet pha	=[0.12F _o (6.	$25D-z_v)^2 - (Va)_o^3 / (V_{crit}^{30.163}) = \frac{http://www.17}{structure}$ es the real solution x = z-zv = or z(m/above stack) =	774874. 28.org/cubic.h -64.06 -60.2
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s Table of Plume Top-Hat Diameters (2a) and P Height (feet) above ground Stack.Rel.Ht = 32.5	121.610 131.516 lume-Averag (meters) above stack 0.00	meters meters ed Vertical ¹ Plume Radius(m) 11.887	431.5 Velocities sta SingleStk VertVel(m/s) 8.97	feet arting at en Plume Temp(K)	nd of jet pha	=[0.12F _o (6.	25D-z _y) ² -(Va) _o ³)/(V _{cri} ³ 0.16 ³)= <u>http://www.17</u> es the real solution x = z-zy = or z(m/above stack) = z(ft/above ground) =	774874 28.org/cubic.h -64.06 -60.2 -16:
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s Fable of Plume Top-Hat Diameters (2a) and P Height (feet) above ground Stack.Rel.Ht = 32.5 40.0	121.610 131.516 lume-Averag (meters) above stack 0.00 2.29	meters meters ed Vertical ¹ Plume Radius(m) 11.887 12.070	431.5 Velocities sta SingleStk VertVel(m/s) 8.97 8.90	feet arting at en Plume Temp(K)	nd of jet pha	=[0.12F _o (6.	25D-z _v) ² -{Va ₀ ³ }/{V _{crt} ³ 0.16 ³ }= <u>http://www.17</u> es the real solution x = z-zv = or z(m/above stack) = z(tr/above ground) = Jet Phase Eqs:	774874 28.org/cubic.h -64.00 -60.2 -16 20 ft Interval
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s Table of Plume Top-Hat Diameters (2a) and P Height (feet) above ground Stack.Rel.Ht = 32.5	121.610 131.516 lume-Averag (meters) above stack 0.00	meters meters ed Vertical ¹ Plume Radius(m) 11.887	431.5 Velocities sta SingleStk VertVel(m/s) 8.97	feet arting at en Plume Temp(K)	nd of jet pha	=[0.12F _o (6.	25D-z _v) ² -{Va ₀ ³ }/{V _{crt} ³ 0.16 ³ }= <u>http://www.17</u> es the real solution x = z-zv = or z(m/above stack) = z(ft/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R	774874 28.org/cubic.h -64.00 -60.2 -16 20 ft Interval
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s Table of Plume Top-Hat Diameters (2a) and P Height (feet) above ground Stack.Rel.Ht = 32.5 40.0	121.610 131.516 lume-Averag (meters) above stack 0.00 2.29	meters meters ed Vertical ' Plume Radius(m) 11.887 12.070 12.558	431.5 Velocities sta SingleStk VertVel(m/s) 8.97 8.90	feet arting at en Plume Temp(K)	nd of jet pha	=[0.12F _o (6.	25D-z _v) ² -{Va ₀ ³ }/{V _{crt} ³ 0.16 ³ }= <u>http://www.17</u> es the real solution x = z-zv = or z(m/above stack) = z(tr/above ground) = Jet Phase Eqs:	774874 28.org/cubic.h -64.00 -60.2 -16 20 ft Interval
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s Table of Plume Top-Hat Diameters (2a) and P Height (feet) above ground <i>Stack.Rel.Ht</i> = 32.5 40.0 60.0	121.610 131.516 lume-Averag (meters) above stack 0.00 2.29 8.38	meters meters ed Vertical ' Plume Radius(m) 11.887 12.070 12.558	431.5 Velocities sta SingleStk VertVel(m/s) 8.90 8.90 8.72	feet arting at en Plume Temp(K)	nd of jet pha	=[0.12F _o (6.	25D-z _v) ² -{Va ₀ ³ }/{V _{crt} ³ 0.16 ³ }= <u>http://www.17</u> es the real solution x = z-zv = or z(m/above stack) = z(ft/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R	774874 28.org/cubic.h -64.00 -60.2 -16 20 ft Interval
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s Table of Plume Top-Hat Diameters (2a) and P Height (feet) above ground <i>Stack.Rel.Ht</i> = 32.5 40.0 60.0 80.0	121.610 131.516 lume-Averag (meters) above stack 0.00 2.29 8.38 14.48	meters meters ed Vertical V Plume Radius(m) 11.887 12.070 12.558 13.045 13.533	431.5 Velocities sta SingleStk VertVel(m/s) 8.90 8.72 8.53 8.35	feet arting at en Plume Temp(K)	nd of jet pha	=[0.12F _o (6.	25D-z _v) ² -{Va ₀ ³ }/{V _{crt} ³ 0.16 ³ }= <u>http://www.17</u> es the real solution x = z-zv = or z(m/above stack) = z(ft/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R	774874 28.org/cubic.h -64.06 -60.2 -16 -16 20 ft Interval
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s Table of Plume Top-Hat Diameters (2a) and P Height (feet) above ground Stack.Rel.Ht = 32.5 40.0 60.0 80.0 100.0 120.0	121.610 131.516 Jume-Averag (meters) above stack 0.00 2.29 8.38 14.48 20.57 26.67	meters meters ed Vertical Plume Radius(m) 11.887 12.070 12.558 13.045 13.533 14.021	431.5 Velocities sta SingleStk VertVel(m/s) 8.90 8.72 8.53 8.35 8.17	feet arting at en Plume Temp(K)	nd of jet pha	=[0.12F _o (6.	25D-z _y) ² -{Va ₀ ³ }/{V _{crt} ³ 0.16 ³ } = <u>http://www.17</u> es the real solution x = z-zy = or z(m/above stack) = z(ft/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: V _{pume} =((Va ₀) ³ +0.12F ₀ (z-z _y) ² -(6.2)	774874 28.org/cubic.h -64.06 -60.2 -16 -16 20 ft Interval
Find Height above Stack z _{ent} Height above Ground z _{ent} +h _s Table of Plume Top-Hat Diameters (2a) and P Height (feet) above ground <i>Stack.Rel.Ht</i> = 32.5 40.0 60.0 80.0 100.0 120.0 140.0	121.610 131.516 (ume-Averag (meters) above stack 0.00 2.29 8.38 14.48 20.57 26.67 32.77	meters meters ed Vertical ' Plume Radius(m) 11.887 12.070 12.558 13.533 14.021 14.508	431.5 Velocities sta SingleStk VertVel(m/s) 8.97 8.90 8.72 8.53 8.53 8.53 8.17 7.98	feet arting at en Plume Temp(K)	nd of jet pha	=[0.12F _o (6.	$25D \cdot z_{v})^{2} - (Va)_{o}^{3}) (V_{crt}^{3} 0.16^{3}) = \frac{http://www.17}{2}$ es the real solution x = z-zv = or z(m/above stack) = z(tr/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: V _{pluma} =(Va)_{o}^{3}+0.12F_{o}(z-z_{v})^{2}-(6.2) a = 0.16(z-z_v)	774874 28.org/cubic.t -64.06 -60.2 -16 20 ft Interval el.Ht to Top of Je 5D-z_v) ²]) ¹⁰ / a
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s Table of Plume Top-Hat Diameters (2a) and P Height (feet) above ground <i>Stack.Rel.Ht</i> = 32.5 40.0 60.0 80.0 100.0 120.0 140.0 160.0	121.610 131.516 lume-Averag (meters) above stack 0.00 2.29 8.38 14.48 20.57 26.67 32.77 38.86	meters meters ed Vertical ' Plume Radius(m) 11.887 12.070 12.558 13.045 13.533 14.021 14.508 14.996	431.5 Velocities sta SingleStk VertVel(m/s) 8.97 8.90 8.72 8.53 8.35 8.17 7.98 7.80	feet arting at em Plume Temp(K)	nd of jet pha	=[0.12F _o (6.	$\begin{aligned} &25D\cdot z_{v})^{2} - \{Va_{0},^{3}\}/(V_{crit}^{3}0.16^{3}) = \\ & & & & & & & & & & & & & & & & & &$	774874 28.org/cubic.t -64.06 -60.2 -16 20 ft Interval el.Ht to Top of Je 5D-z_v) ²]) ¹⁰ / a
Find Height above Stack z _{crit} Height above Ground z _{crit} +h ₈ Table of Plume Top-Hat Diameters (2a) and P Height (feet) above ground <i>Stack.Rel.Ht</i> = 32.5 40.0 60.0 80.0 100.0 120.0 140.0 180.0	121.610 131.516 ume-Averag (meters) above stack 0.00 2.29 8.33 14.48 20.57 26.67 38.86 44.96	meters meters ed Vertical Plume Radius(m) 12.558 13.045 13.533 14.021 14.508 14.996 15.484	431.5 Velocitie s sta SingleStk VertVel(m/s) 8.90 8.72 8.53 8.53 8.53 8.35 8.35 8.35 8.35 8.77 7.98 7.80 7.61	feet arting at em Plume Temp(K)	nd of jet pha	=[0.12F _o (6.	$25D \cdot z_{v})^{2} (Va)_{o}^{3}) (V_{crit}^{3} 0.16^{3}) = \\ http://www.17$ as the real solution $x = z \cdot zv =$ or $z(m/above stack) =$ z(ft/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: $V_{plums} = (Va)_{o}^{3} + 0.12F_{o}(z \cdot z_{v})^{2} - (6.2$ $a = 0.16(z \cdot z_{v})$ $\rho = \Theta_{a}(1 + (1 - (\Theta_{c}\Theta_{b}))^{*} (V_{exit}D^{2})(C$ CEC Staff Equation:	774874 28.org/cubic.t -64.06 -60.2 -16 20 ft Interval el.Ht to Top of Je 5D-z_v) ²]) ¹⁰ / a
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s Fable of Plume Top-Hat Diameters (2a) and P Height (feet) above ground <i>Stack.Rel.Ht</i> = 32.5 40.0 60.0 80.0 100.0 120.0 140.0 160.0 180.0 200.0	121.610 131.516 ////////////////////////////////////	meters meters ed Vertical ' Plume Radius(m) 11.887 12.070 12.558 13.045 13.533 14.021 14.508 14.966 15.484 15.972	431.5 Velocities stat SingleStk VertVel(m/s) 8.90 8.90 8.90 8.90 8.90 8.90 8.90 8.90	feet arting at en Plume Temp(K)	nd of jet pha	=[0.12F _o (6.	$25D\cdot z_{v})^{2} (Va)_{o}^{3}) (V_{crit}^{3} 0.16^{3}) = \\ http://www.17$ as the real solution x = z-zv = or z(m/above stack) = z(ft/above ground) = z(ft/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: V _{pluma} =(Va)_{o}^{3}+0.12F_{d}(z-z_{v})^{2} (6.2 a = 0.16(z-z_{v}) $\theta_{p}=\theta_{s}(1+(1-(\theta_{v}\theta_{s}))^{s})(V_{oxit}D^{2})/(CEC Staff Equation: V_{mp}=n^{0.27}V_{sp}$	774874 28.org/cubic.t -64.06 -60.2 -16 20 ft Interval el.Ht to Top of Je 5D-z_v) ²]) ¹⁰ / a
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Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s Table of Plume Top-Hat Diameters (2a) and P Height (feet) above ground <i>Stack.Rel.Ht</i> = 32.5 40.0 60.0 80.0 100.0 120.0 140.0 160.0 180.0 200.0	121.610 131.516 ////////////////////////////////////	meters meters ed Vertical Plume Radius(m) 11.887 12.070 12.558 13.045 13.045 13.045 13.045 13.045 13.4450 15.444 15.972 16.459	431.5 Velocities stat SingleStk VertVel(m/s) 8.90 8.90 8.90 8.90 8.90 8.90 8.90 8.90	feet arting at en Plume Temp(K)	nd of jet pha	=[0.12F _o (6.	$25D\cdot z_{v})^{2} (Va)_{o}^{3}) (V_{crit}^{3} 0.16^{3}) = \\ http://www.17$ as the real solution x = z-zv = or z(m/above stack) = z(ft/above ground) = z(ft/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: V _{pluma} =(Va)_{o}^{3}+0.12F_{d}(z-z_{v})^{2} (6.2 a = 0.16(z-z_{v}) $\theta_{p}=\theta_{s}(1+(1-(\theta_{v}\theta_{s}))^{s})(V_{oxit}D^{2})/(CEC Staff Equation: V_{mp}=n^{0.27}V_{sp}$	774874 28. org/cubic. I: -64. 00 -60. 2 -16 -16 -16 -16 -20 ft Interval eLH to Top of Je SD-z,,) ²) ¹⁰ / a
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Find Height above Stack z _{crit} Height above Ground z _{crit} +h ₈ Table of Plume Top-Hat Diameters (2a) and P Height (feet) above ground Stack.Rel.Ht = 32.5 40.0 60.0 80.0 100.0 120.0 140.0 140.0 180.0 220.0 220.0 240.0 260.0	121.610 131.516 (meters) above stack 0.00 2.22 8.38 14.48 20.57 26.67 32.77 38.86 44.96 51.05 51	meters meters ed Vertical Plume Radius(m) 12.558 13.045 13.533 14.021 14.500 14.996 15.484 15.972 16.947 16.459 16.947 17.435	431.5 Velocities sta SingleStk VertVel(m/s) 8.97 8.90 8.72 8.53 8.35 8.17 7.98 7.80 7.61 7.43 7.25 7.06 6.88	feet arting at em Plume Temp(K)	nd of jet pha	=[0.12F _o (6.	$25D \cdot z_{v})^{2} - \{Va_{0}a^{3}\}/(V_{crit}^{3}0.16^{3}) = \frac{http://www.17}{2}$ is the real solution x = z-zv = or z(m/above stack) = z(ft/above ground) = z(ft/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: V_pum={(Va)}a^{3}+0.12F_{a}(z-z_{v})^{2}-(6.2 a = 0.16(z-z_{v}) 0_{p}=0_{a}(1+(1-(0_{a}/0_{a}))^{*}(V_{exit}D^{2})/(CEC Staff Equation: V_mp=n^{0.27}V_{up} Brigg's Equation: V_Bigg's Equation:	774874 28. org/cubic. I: -64. 00 -60. 2 -16 -16 -16 -16 -20 ft Interval eLH to Top of Je SD-z.,) ²) ¹⁰ / a
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Find Height above Stack z _{erit} Height above Ground z _{erit} +h _s Table of Plume Top-Hat Diameters (2a) and P Height (feet) above ground Stack.Rel.Ht = 32.5 40.0 60.0 80.0 100.0 120.0 140.0 180.0 220.0 240.0 220.0 240.0 280.0 300.0 300.0 300.0 300.0	121.610 131.516 (meters) above stack 0.00 2.29 8.38 14.48 20.57 32.77 38.66 44.96 57.15 63.25 69.34 75.44 81.53 87.63	meters meters ed Vertical Plume Radius(m) 11.887 12.070 12.558 13.045 13.045 13.045 13.045 14.996 15.484 15.972 16.499 16.947 17.435 17.922 18.410 18.898	431.5 Velocities stat SingleStk VertVel(m/s) 8.97 8.90 8.53 8.35 8.17 7.88 7.80 7.61 7.43 7.25 7.06 6.88 6.69 6.51 6.33	feet Plume Temp(K)	nd of jet pha	=[0.12F _o (6.	$25D \cdot z_{\nu})^{2} - (Va)_{0}^{3}) (V_{crit}^{3} 0.16^{3}) = \frac{http://www.17}{http://www.17}$ es the real solution x = z-zv = or z(m/above stack) = z(tl/above ground) = z(tl/above ground) = $Jet Phase Eqs:$ Linearly interpolated from Stack R Spillane Equations: $V_{pluma} = (Va)_{0}^{3} + 0.12F_{a}(z-z_{\nu})^{2} - (6.2$ $a = 0.16(z-z_{\nu})$ $\theta_{p} = \theta_{a}(1 + (1 - (\theta_{p}/\theta_{b}))^{*} (V_{exit}D^{2})(C$ ECE Staff Equation: $V_{pupen} = Brigg's Equation:$ $V_{segrs} = (2/3) \times 1.6^{(3/2)} \times F_{mp}^{(1/2)} \times 1$ where $F_{mp} = nF_{ap}$	774874 28. org/cubic. f: -64. 00 -60.2 -16 -20 ft Interval el.Ht to Top of Je SD-z,,) ²) ^{1/3} / a SD-z,,) ²) ^{1/3} / a (^{4/2} x z ^(4/2)) -50 ft Interval
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s fable of Plume Top-Hat Diameters (2a) and P Height (feet) above ground <i>Stack.Rel.Ht</i> = 32.5 40.0 60.0 80.0 100.0 120.0 140.0 160.0 180.0 220.0 2240.0 220.0 2240.0 280.0 300.0 300.0 300.0 300.0 300.0 300.0 300.0 300.0 300.0	121.610 131.516 (meters) above stack 0.00 2.22 8.38 14.48 20.57 32.77 38.86 44.96 57.16 63.25 57.16 63.25 69.34 75.44 81.53 87.63 93.73	meters meters Plume Radius(m) 11.887 12.070 12.558 13.045 13.533 14.508 14.996 15.484 15.972 16.459 16.947 17.435 17.922 16.449 16.947 17.435 17.922 18.410 18.84	431.5 Velocities stat SingleStk VertVel(m/s) 8.97 8.90 8.72 8.53 8.53 8.53 8.53 8.53 8.54 7.98 7.80 7.61 7.43 7.25 7.06 6.88 6.69 6.51 6.33 6.14	feet arting at en Plume Temp(K)	nd of jet pha	=[0.12F _o (6.	$25D \cdot z_{v})^{2} - \{Va_{0}a^{3}\}/(V_{crit}^{3}0.16^{3}) = \frac{http://www.17}{2}$ is the real solution x = z-zv = or z(m/above stack) = z(ft/above ground) = z(ft/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: V_pum={(Va)}a^{3}+0.12F_{a}(z-z_{v})^{2}-(6.2 a = 0.16(z-z_{v}) 0_{p}=0_{a}(1+(1-(0_{a}/0_{a}))^{*}(V_{exit}D^{2})/(CEC Staff Equation: V_mp=n^{0.27}V_{up} Brigg's Equation: V_Bigg's Equation:	774874 28. org/cubic.t -64. 00 -66. 02 -16 -16 -16 -16 -20 ft Interval -16 -20 ft Interval -16 -20 ft Interval -16 -20 ft Interval -20 ft Int
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Find Height above Stack z _{crit} Height above Ground z _{crit} +h ₈ 'able of Plume Top-Hat Diameters (2a) and P Height (feet) above ground <i>Stack.Rel.Ht</i> = 32.5 40.0 60.0 80.0 100.0 120.0 140.0 160.0 180.0 220.0 2240.0 220.0 2240.0 280.0 300.0 300.0 300.0 300.0 300.0 300.0 300.0 300.0 300.0	121.610 131.516 (meters) above stack 0.00 2.22 8.38 14.48 20.57 32.77 38.86 44.96 57.16 63.25 57.16 63.25 69.34 75.44 81.53 87.63 93.73	meters meters ed Vertical Plume Radius(m) 11.887 12.558 13.045 13.533 14.021 14.509 14.996 15.484 15.972 16.459 16.947 17.435 17.922 18.410 18.898 19.385 19.873	431.5 Velocities stat SingleStk VertVel(m/s) 8.97 8.90 8.72 8.53 8.53 8.53 8.53 8.53 8.54 7.98 7.80 7.61 7.43 7.25 7.06 6.88 6.69 6.51 6.33 6.14	feet arting at en Plume Temp(K)	nd of jet pha	=[0.12F _o (6.	$25D \cdot z_{\nu})^{2} - (Va)_{0}^{3}) (V_{crit}^{3} 0.16^{3}) = \frac{http://www.17}{http://www.17}$ es the real solution x = z-zv = or z(m/above stack) = z(tl/above ground) = z(tl/above ground) = $Jet Phase Eqs:$ Linearly interpolated from Stack R Spillane Equations: $V_{pluma} = (Va)_{0}^{3} + 0.12F_{a}(z-z_{\nu})^{2} - (6.2$ $a = 0.16(z-z_{\nu})$ $\theta_{p} = \theta_{a}(1 + (1 - (\theta_{p}/\theta_{b}))^{*} (V_{exit}D^{2})(C$ ECE Staff Equation: $V_{pupen} = Brigg's Equation:$ $V_{segrs} = (2/3) \times 1.6^{(3/2)} \times F_{mp}^{(1/2)} \times 1$ where $F_{mp} = nF_{ap}$	774874 28. org/cubic.t -64. 00 -66. 02 -16 -16 -16 -16 -20 ft Interval -16 -20 ft Interval -16 -20 ft Interval -16 -20 ft Interval -20 ft Int
Find Height above Stack z _{crit} Height above Ground z _{crit} +h ₈ 'able of Plume Top-Hat Diameters (2a) and P Height (feet) above ground <i>Stack.Rel.Ht = 32:5</i> 40.0 60.0 80.0 100.0 120.0 120.0 120.0 120.0 230.0 20.0 2	121.610 131.516 (meters) above stack 0.00 2.29 8.838 14.48 20.57 32.77 38.86 44.96 51.05 57.15 63.25 69.34 75.44 81.53 87.63 99.32	meters meters ed Vertical Plume Radius(m) 11.887 12.578 13.045 13.533 14.021 14.509 14.996 15.484 15.972 16.459 16.947 17.435 17.922 18.410 18.898 19.855 19.873	431.5 Velocities sta SingleStk VertVel(m/s) 8.97 8.90 8.72 8.53 8.35 8.17 7.98 7.80 7.61 7.43 7.43 7.45 7.66 6.88 6.69 6.51 6.33 6.14 5.96	feet Plume Temp(K)	nd of jet pha	=[0.12F _o (6.	$25D \cdot z_{\nu})^{2} - (Va)_{0}^{3}) (V_{crit}^{3} 0.16^{3}) = \frac{http://www.17}{http://www.17}$ es the real solution x = z-zv = or z(m/above stack) = z(tl/above ground) = z(tl/above ground) = $Jet Phase Eqs:$ Linearly interpolated from Stack R Spillane Equations: $V_{pluma} = (Va)_{0}^{3} + 0.12F_{a}(z-z_{\nu})^{2} - (6.2$ $a = 0.16(z-z_{\nu})$ $\theta_{p} = \theta_{a}(1 + (1 - (\theta_{p}/\theta_{b}))^{*} (V_{exit}D^{2})(C$ ECE Staff Equation: $V_{pupen} = Brigg's Equation:$ $V_{segrs} = (2/3) \times 1.6^{(3/2)} \times F_{mp}^{(1/2)} \times 1$ where $F_{mp} = nF_{ap}$	774874 28. org/cubic.t -64. 00 -66. 02 -16 -16 -16 -16 -20 ft Interval -16 -20 ft Interval -16 -20 ft Interval -16 -20 ft Interval -20 ft Int
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s *able of Plume Top-Hat Diameters (2a) and P Height (feet) above ground Stack.Rel.Ht = 32.5 40.0 60.0 80.0 100.0 120.0 140.0 120.0 120.0 240.0 220.0 240.0 220.0 240.0 220.0 300.0	121.610 131.516 1ume-Averag (meters) above stack 2.29 8.33 14.48 20.57 2.6.67 32.77 38.866 44.96 51.05 57.15 63.25 69.34 75.44 81.53 87.63 93.73 99.82 20.75 44.81 51.592	meters meters ed Vertical Plume Radius(m) 11.887 12.070 12.558 13.045 13.533 14.021 14.508 14.906 15.484 15.972 16.947 16.947 17.435 17.922 18.410 18.898 19.855 19.873 20.361	431.5 Velocities stat SingleStk VertVel(m/s) 8.90 8.72 8.53 8.35 8.77 7.88 7.80 7.61 7.43 7.725 7.06 6.88 8.669 6.61 6.33 6.14 5.56 5.77	feet Plume Temp(K)	nd of jet pha	=[0.12F _o (6.	$25D \cdot z_{\nu})^{2} - (Va)_{0}^{3}) (V_{crit}^{3} 0.16^{3}) = \frac{http://www.17}{http://www.17}$ es the real solution x = z-zv = or z(m/above stack) = z(tl/above ground) = z(tl/above ground) = $Jet Phase Eqs:$ Linearly interpolated from Stack R Spillane Equations: $V_{pluma} = (Va)_{0}^{3} + 0.12F_{a}(z-z_{\nu})^{2} - (6.2$ $a = 0.16(z-z_{\nu})$ $\theta_{p} = \theta_{a}(1 + (1 - (\theta_{p}/\theta_{b}))^{*} (V_{exit}D^{2})(C$ ECE Staff Equation: $V_{pupen} = Brigg's Equation:$ $V_{segrs} = (2/3) \times 1.6^{(3/2)} \times F_{mp}^{(1/2)} \times 1$ where $F_{mp} = nF_{ap}$	774874 28. org/cubic. f: -64. 00 -60.2 -16 -20 ft Interval el.Ht to Top of Je SD-z,,) ²) ^{1/3} / a SD-z,,) ²) ^{1/3} / a (^{4/2} x z ^(4/2)) -50 ft Interval
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s Table of Plume Top-Hat Diameters (2a) and P Height (feet) above ground <i>Stack.Rel.Ht = 32.5</i> 40.0 60.0 80.0 100.0 100.0 120.0 140.0 160.0 180.0 200.0 220.0 240.0 280.0 300.0 320.0 340.0	121.610 131.516 (meters) above stack 0.00 2.22 8.38 14.48 20.57 32.67 32.77 38.86 44.96 57.15 63.25 69.34 75.44 81.53 87.63 93.73 99.82 93.73 99.82 91.05.92 112.01 118.11	meters meters ed Vertical Plume Radius(m) 11.867 12.070 12.558 13.045 13.045 13.045 13.045 13.045 14.508 14.996 15.484 14.996 15.484 15.972 16.459 16.947 17.435 17.922 18.410 18.898 19.355 19.873 20.361 20.848 21.336	431.5 Velocities stat SingleStk VertVel(m/s) 8.97 8.90 8.72 8.53 8.35 8.53 8.53 8.53 8.54 7.98 7.80 7.61 7.43 7.62 7.06 6.88 6.69 6.51 6.33 6.14 5.96 5.77 5.59 5.41	feet arting at em Plume Temp(K)	nd of jet pha	=[0.12F _o (6.	$25D \cdot z_{\nu})^{2} - (Va)_{0}^{3}) (V_{crit}^{3} 0.16^{3}) = \frac{http://www.17}{http://www.17}$ es the real solution x = z-zv = or z(m/above stack) = z(tl/above ground) = z(tl/above ground) = $Jet Phase Eqs:$ Linearly interpolated from Stack R Spillane Equations: $V_{pluma} = (Va)_{0}^{3} + 0.12F_{a}(z-z_{\nu})^{2} - (6.2$ $a = 0.16(z-z_{\nu})$ $\theta_{p} = \theta_{a}(1 + (1 - (\theta_{p}/\theta_{b}))^{*} (V_{exit}D^{2})(C$ ECE Staff Equation: $V_{pupen} = Brigg's Equation:$ $V_{segrs} = (2/3) \times 1.6^{(3/2)} \times F_{mp}^{(1/2)} \times 1$ where $F_{mp} = nF_{ap}$	774874 28. org/cubic.t -64. 00 -66. 02 -16 -16 -16 -16 -20 ft Interval -16 -20 ft Interval -16 -20 ft Interval -16 -20 ft Interval -20 ft Int
Find Height above Stack z _{crit} Height above Ground z _{crit} +h ₈ 'able of Plume Top-Hat Diameters (2a) and P Height (feet) above ground Stack.Rel.Ht = 32:5 40.0 60.0 80.0 100.0 120.0 140.0 160.0 180.0 220.0 2240.0 2240.0 2240.0 2240.0 2240.0 2240.0 2240.0 2240.0 2240.0 2240.0 2240.0 2240.0 2240.0 2240.0 2240.0 2240.0 2240.0 2260.0 2240.0 2260.0 2240.0 2260.0 2360.	121.610 131.516 (meters) above stack 0.00 2.29 8.38 14.48 20.57 32.77 38.86 44.96 57.16 57.15 63.25 69.34 75.44 81.53 87.63 93.73 99.82 115.92 112.01 118.11 118.11	meters meters ed Vertical Plume Radius(m) 11.887 12.070 12.558 13.045 13.533 14.021 14.508 14.996 15.484 15.972 16.459 16.947 17.435 17.922 18.410 18.898 19.873 20.361 20.848 21.365 21.616	431.5 Velocities sta SingleStk VertVel(m/s) 8.97 8.90 8.72 8.53 8.35 8.17 7.98 7.80 7.61 7.43 7.61 7.43 7.65 7.66 6.88 6.69 6.51 6.33 6.14 5.39 5.41 5.59 5.41 5.30	feet Plume Temp(K)	nd of jet pha	=[0.12F _o (6.	$25D \cdot z_{\nu})^{2} - (Va)_{0}^{3}) (V_{crit}^{3} 0.16^{3}) = \frac{http://www.17}{http://www.17}$ es the real solution x = z-zv = or z(m/above stack) = z(tl/above ground) = z(tl/above ground) = $Jet Phase Eqs:$ Linearly interpolated from Stack R Spillane Equations: $V_{pluma} = (Va)_{0}^{3} + 0.12F_{a}(z-z_{\nu})^{2} - (6.2$ $a = 0.16(z-z_{\nu})$ $\theta_{p} = \theta_{a}(1 + (1 - (\theta_{p}/\theta_{b}))^{*} (V_{exit}D^{2})(C$ ECE Staff Equation: $V_{pupen} = Brigg's Equation:$ $V_{segrs} = (2/3) \times 1.6^{(3/2)} \times F_{mp}^{(1/2)} \times 1$ where $F_{mp} = nF_{ap}$	774874 28. org/cubic.t -64. 00 -66. 02 -16 -16 -16 -16 -20 ft Interval -16 -20 ft Interval -16 -20 ft Interval -16 -20 ft Interval -20 ft Int
Find Height above Stack z _{crit} Height above Ground z _{crit} +h ₈ Table of Plume Top-Hat Diameters (2a) and P Height (feet) above ground Stack.Rel.Ht = 32:5 40.0 60.0 80.0 100.0 120.0 140.0 160.0 180.0 220.0 224.0 226.0 224.0 224.0 226	121.610 131.516 Jume-Averag (meters) above stack 0.00 2.29 8.38 14.48 20.57 22.67 32	meters meters ed Vertical Plume Radius(m) 11.887 12.558 13.045 13.533 14.021 14.509 15.484 15.972 16.459 16.947 17.435 17.922 18.410 18.898 19.385 19.873 20.361 20.848 21.336 21.616 21.824	431.5 Velocities sta SingleStk VertVel(m/s) 8.97 8.90 8.72 8.53 8.53 8.73 7.88 7.80 7.61 7.43 7.25 7.06 6.88 6.69 6.51 6.33 6.141 5.96 5.59 5.41 5.30 5.22	feet arring at en Plume Temp(K)	nd of jet pha	=[0.12F _o (6.	$25D \cdot z_{\nu})^{2} - (Va)_{0}^{3}) (V_{crit}^{3} 0.16^{3}) = \frac{http://www.17}{http://www.17}$ es the real solution x = z-zv = or z(m/above stack) = z(tl/above ground) = z(tl/above ground) = $Jet Phase Eqs:$ Linearly interpolated from Stack R Spillane Equations: $V_{pluma} = (Va)_{0}^{3} + 0.12F_{a}(z-z_{\nu})^{2} - (6.2$ $a = 0.16(z-z_{\nu})$ $\theta_{p} = \theta_{a}(1 + (1 - (\theta_{p}/\theta_{b}))^{*} (V_{exit}D^{2})(C$ ECE Staff Equation: $V_{pupen} = Brigg's Equation:$ $V_{segrs} = (2/3) \times 1.6^{(3/2)} \times F_{mp}^{(1/2)} \times 1$ where $F_{mp} = nF_{ap}$	774874 28. org/cubic. f -64.00 -60.2 -16 -16 -16 -16 -16 -16 -17 -16 -17 -16 -17 -17 -17 -17 -17 -17 -17 -17 -17 -17
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s "able of Plume Top-Hat Diameters (2a) and P Height (feet) above ground Stack.Rel.Ht = 32.5 40.0 60.0 80.0 100.0 120.0 140.0 120.0 140.0 120.0 240.0 220.0 240.0 220.0 240.0 220.0 240.0 220.0 30.	121.610 131.516 1000 2.29 8.33 14.48 20.57 26.67 38.86 44.96 51.05 57.15 63.25 69.34 75.44 81.53 87.63 99.82 105.92 112.01 118.11 121.16 124.21 130.30	meters meters ed Vertical Plume Radius(m) 11.887 12.070 12.558 13.045 13.533 14.021 14.508 14.996 15.484 15.972 16.947 17.435 17.922 18.410 18.898 19.835 19.835 20.361 20.848 21.336 21.616 21.824 22.311	431.5 Velocities stat SingleStk VertVel(m/s) 8.97 8.90 8.90 8.90 8.90 8.90 8.90 8.90 8.90	feet Plume Temp(K)	nd of jet pha	=[0.12F _o (6.	$25D \cdot z_{\nu})^{2} - (Va)_{0}^{3}) (V_{crit}^{3} 0.16^{3}) = \frac{http://www.17}{http://www.17}$ es the real solution x = z-zv = or z(m/above stack) = z(tl/above ground) = z(tl/above ground) = $Jet Phase Eqs:$ Linearly interpolated from Stack R Spillane Equations: $V_{pluma} = (Va)_{0}^{3} + 0.12F_{a}(z-z_{\nu})^{2} - (6.2$ $a = 0.16(z-z_{\nu})$ $\theta_{p} = \theta_{a}(1 + (1 - (\theta_{p}/\theta_{b}))^{*} (V_{exit}D^{2})(C$ ECE Staff Equation: $V_{pupen} = Brigg's Equation:$ $V_{segrs} = (2/3) \times 1.6^{(3/2)} \times F_{mp}^{(1/2)} \times 1$ where $F_{mp} = nF_{ap}$	774874 28. org/cubic.t -64.00 -60.7 -16 -16 -17 -16 -17 -16 -17 -17 -17 -17 -17 -17 -17 -17 -17 -17
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s fable of Plume Top-Hat Diameters (2a) and P Height (feet) above ground Stack.Rel.Ht = 32:5 40.0 60.0 80.0 100.0 120.0 120.0 120.0 120.0 120.0 230.0 240.0 240.0 240.0 240.0 240.0 240.0 240.0 240.0 240.0 240.0 240.0 240.0 240.0 240	121.610 131.516 Jume-Averag (meters) above stack 0.00 2.29 8.38 14.48 20.57 22.67 32	meters meters ed Vertical Plume Radius(m) 11.887 12.070 12.558 13.045 13.533 14.021 14.508 14.996 15.484 15.972 16.947 17.435 17.922 18.410 18.898 19.835 19.835 20.361 20.848 21.336 21.616 21.824 22.311	431.5 Velocities sta SingleStk VertVel(m/s) 8.97 8.90 8.72 8.53 8.53 8.73 7.88 7.80 7.61 7.43 7.25 7.06 6.88 6.69 6.51 6.33 6.141 5.96 5.59 5.41 5.30 5.22	feet Plume Temp(K)	nd of jet pha	=[0.12F _o (6.	$25D \cdot z_{\nu})^{2} - (Va)_{0}^{3}) (V_{crit}^{3} 0.16^{3}) = \frac{http://www.17}{http://www.17}$ es the real solution x = z-zv = or z(m/above stack) = z(tl/above ground) = z(tl/above ground) = $Jet Phase Eqs:$ Linearly interpolated from Stack R Spillane Equations: $V_{pluma} = (Va)_{0}^{3} + 0.12F_{a}(z-z_{\nu})^{2} - (6.2$ $a = 0.16(z-z_{\nu})$ $\theta_{p} = \theta_{a}(1 + (1 - (\theta_{p}/\theta_{b}))^{*} (V_{exit}D^{2})(C$ ECE Staff Equation: $V_{pupen} = Brigg's Equation:$ $V_{segrs} = (2/3) \times 1.6^{(3/2)} \times F_{mp}^{(1/2)} \times 1$ where $F_{mp} = nF_{ap}$	774874 28. org/cubic.t -64.00 -60.7 -16 -16 -17 -16 -17 -16 -17 -17 -17 -17 -17 -17 -17 -17 -17 -17
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s "able of Plume Top-Hat Diameters (2a) and P Height (feet) above ground Stack.Rel.Ht = 32.5 40.0 60.0 80.0 100.0 120.0 140.0 120.0 140.0 120.0 240.0 220.0 240.0 220.0 240.0 220.0 240.0 220.0 30.	121.610 131.516 1000 2.29 8.33 14.48 20.57 26.67 38.86 44.96 51.05 57.15 63.25 69.34 75.44 81.53 87.63 99.82 105.92 112.01 118.11 121.16 124.21 130.30	meters meters meters ed Vertical Plume Radius(m) 11.867 12.070 12.558 13.045 13.045 13.045 13.045 14.996 15.484 15.972 16.459 16.947 17.435 17.922 18.410 18.898 19.365 19.873 20.361 20.848 21.336 21.824 22.311 22.799	431.5 Velocities stat SingleStk VertVel(m/s) 8.97 8.90 8.90 8.90 8.90 8.90 8.90 8.90 8.90	feet Plume Temp(K)	nd of jet pha	=[0.12F _o (6.	$25D \cdot z_{\nu})^{2} - (Va)_{0}^{3}) (V_{crit}^{3} 0.16^{3}) = \frac{http://www.17}{http://www.17}$ es the real solution x = z-zv = or z(m/above stack) = z(tl/above ground) = z(tl/above ground) = $Jet Phase Eqs:$ Linearly interpolated from Stack R Spillane Equations: $V_{pluma} = (Va)_{0}^{3} + 0.12F_{a}(z-z_{\nu})^{2} - (6.2$ $a = 0.16(z-z_{\nu})$ $\theta_{p} = \theta_{a}(1 + (1 - (\theta_{p}/\theta_{b}))^{*} (V_{exit}D^{2})(C$ ECE Staff Equation: $V_{pupen} = Brigg's Equation:$ $V_{segrs} = (2/3) \times 1.6^{(3/2)} \times F_{mp}^{(1/2)} \times 1$ where $F_{mp} = nF_{ap}$	774874 28. org/cubic.t -64.00 -60.7 -16 -16 -17 -16 -17 -16 -17 -17 -17 -17 -17 -17 -17 -17 -17 -17
Find Height above Stack z _{ert} Height above Ground z _{ert} +h _s "able of Plume Top-Hat Diameters (2a) and P Height (feet) above ground Stack.Rel.Ht = 32.5 40.0 60.0 80.0 100.0 100.0 120.0 140.0 160.0 140.0 160.0 220.0 240.0 220.0 240.0 220.0 240.0 280.0 280.0 280.0 330.0 330.0 330.0 330.0 330.0 330.0 340.0 360.0	121.610 131.516 (meters) above stack 0.00 2.29 8.38 14.48 20.57 32.77 38.66 44.96 57.15 63.25 69.34 75.44 81.53 87.63 93.73 99.82 112.01 118.11 12.01 118.11 121.61 130.30 136.40	meters meters meters Plume Radius(m) 11.887 12.070 12.558 13.045 13.533 14.021 14.508 14.996 15.484 15.484 15.972 16.459 16.947 17.435 17.922 16.459 16.947 17.435 17.922 16.459 16.947 17.435 17.922 16.459 16.947 17.435 17.922 16.459 16.947 17.435 17.922 16.459 16.947 17.435 17.922 16.459 16.947 17.435 17.922 16.459 16.947 17.435 17.922 16.459 16.947 17.435 17.922 16.459 16.947 17.435 17.922 16.459 16.947 17.435 17.922 16.459 16.947 17.435 17.922 16.459 16.947 17.435 17.922 18.410 18.840 19.857 20.616 21.844 21.366 21.845 22.847 23.287 24.585 24.585 25.58	431.5 Velocities stat SingleStk VertVel(m/s) 8.97 8.90 8.53 8.35 8.77 7.88 7.80 7.61 7.43 7.25 7.06 6.88 6.69 6.51 6.33 6.14 5.96 6.577 5.59 5.41 5.30 5.42 5.42 5.42	feet rrting at em Plume Temp(K)	nd of jet pha	=[0.12F _o (6.	$25D \cdot z_{\nu})^{2} - (Va)_{0}^{3}) (V_{crit}^{3} 0.16^{3}) = \frac{http://www.17}{http://www.17}$ es the real solution x = z-zv = or z(m/above stack) = z(tl/above ground) = z(tl/above ground) = $Jet Phase Eqs:$ Linearly interpolated from Stack R Spillane Equations: $V_{pluma} = (Va)_{0}^{3} + 0.12F_{a}(z-z_{\nu})^{2} - (6.2$ $a = 0.16(z-z_{\nu})$ $\theta_{p} = \theta_{a}(1 + (1 - (\theta_{p}/\theta_{b}))^{*} (V_{exit}D^{2})(C$ ECE Staff Equation: $V_{pupen} = Brigg's Equation:$ $V_{segrs} = (2/3) \times 1.6^{(3/2)} \times F_{mp}^{(1/2)} \times 1$ where $F_{mp} = nF_{ap}$	774874 28. org/cubic.1 -64.0 -60. -16 -16 -17 20 ft Interva et ht to Top of Ja Dz. ₂ / ² /J) ^{1/2} / a 4V _{plume} *a ² x ² /2) 50 ft Interva
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s 'able of Plume Top-Hat Diameters (2a) and P Height (feet) above ground Stack.Rel.Ht = 32.5 40.0 60.0 80.0 100.0 120.0 120.0 120.0 120.0 120.0 120.0 240.0 220.0 220.0 240.0 220.0 240.0 250.0 240.0 250	121.610 131.516 ume-Averag (meters) above stack 0.00 2.29 8.38 14.48 20.57 26.67 32.77 38.86 44.96 51.05 57.15 63.25 69.34 45.51 63.25 69.34 75.44 81.53 87.63 93.73 99.82 105.92 112.01 118.11 12.01 136.40 136.40 136.40 136.40 142.49 136.40 136.40 142.49 136.40	meters meters meters Plume Radius(m) 11.887 12.070 12.558 13.045 13.533 14.021 14.508 14.996 15.484 15.972 16.947 17.435 16.947 17.435 17.922 18.410 18.889 19.385 19.873 20.361 20.848 21.336 21.616 21.824 22.311 22.799 23.277	431.5 Velocities sta SingleStk VertVel(m/s) 8.97 8.90 8.72 8.53 8.35 8.17 7.98 7.80 7.61 7.43 7.25 7.06 6.88 6.69 6.51 6.33 6.14 5.96 6.51 6.33 6.14 5.96 5.59 5.44 5.30 5.22 5.04 4.85	feet Tring at en Plume Temp(K)	d of jet ph: 	=[0.12F _o (6.	$25D \cdot z_{\nu})^{2} - (Va)_{0}^{3}) (V_{crit}^{3} 0.16^{3}) = \frac{http://www.17}{http://www.17}$ es the real solution x = z-zv = or z(m/above stack) = z(tl/above ground) = z(tl/above ground) = $Jet Phase Eqs:$ Linearly interpolated from Stack R Spillane Equations: $V_{pluma} = (Va)_{0}^{3} + 0.12F_{a}(z-z_{\nu})^{2} - (6.2$ $a = 0.16(z-z_{\nu})$ $\theta_{p} = \theta_{a}(1 + (1 - (\theta_{p}/\theta_{b}))^{*} (V_{exit}D^{2})(C$ ECE Staff Equation: $V_{pupen} = Brigg's Equation:$ $V_{segrs} = (2/3) \times 1.6^{(3/2)} \times F_{mp}^{(1/2)} \times 1$ where $F_{mp} = nF_{ap}$	774874 28. org/cubic.t -64.00 -60.7 -16 -16 -17 -16 -17 -16 -17 -17 -17 -17 -17 -17 -17 -17 -17 -17
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s fable of Plume Top-Hat Diameters (2a) and P Height (feet) above ground Stack.Rel.Ht = 32:5 40.0 60.0 80.0 100.0 120.0 120.0 120.0 120.0 120.0 200.0 220.0 20.	121.610 131.516 Jume-Averag (meters) above stack 2.29 8.38 14.48 20.57 26.67 38.86 44.96 51.05 57.15 63.25 69.34 75.44 81.53 87.63 99.82 112.01 118.11 121.61 124.21 130.30 142.49 148.49 148.49 12.97 12.97	meters meters meters Plume Radius(m) 11.887 12.070 12.558 13.045 13.045 13.533 14.021 14.508 15.484 15.972 16.947 17.435 17.922 18.410 18.898 19.365 19.873 20.361 20.848 21.366 21.824 22.311 22.799 23.774 27.062	431.5 Velocities sta SingleStk VertVel(m/s) 8.97 8.90 8.72 8.53 8.77 8.90 7.80 7.80 7.80 7.80 7.61 7.43 7.25 7.06 6.88 6.69 6.51 6.33 6.14 5.59 5.41 5.59 5.41 5.30 5.22 5.04 4.85 4.67 4.85 4.67 4.41	feet Plume Temp(K)	d of jet ph:	=[0.12F _o (6.	$25D \cdot z_{\nu})^{2} - (Va)_{0}^{3}) (V_{crit}^{3} 0.16^{3}) = \frac{http://www.17}{http://www.17}$ es the real solution x = z-zv = or z(m/above stack) = z(tl/above ground) = z(tl/above ground) = $Jet Phase Eqs:$ Linearly interpolated from Stack R Spillane Equations: $V_{pluma} = (Va)_{0}^{3} + 0.12F_{a}(z-z_{\nu})^{2} - (6.2$ $a = 0.16(z-z_{\nu})$ $\theta_{p} = \theta_{a}(1 + (1 - (\theta_{p}/\theta_{b}))^{*} (V_{exit}D^{2})(C$ ECE Staff Equation: $V_{pupen} = Brigg's Equation:$ $V_{segrs} = (2/3) \times 1.6^{(3/2)} \times F_{mp}^{(1/2)} \times 1$ where $F_{mp} = nF_{ap}$	774874 28. org/cubic.t -64.00 -60.7 -16 -16 -17 -16 -17 -16 -17 -17 -17 -17 -17 -17 -17 -17 -17 -17
Find Height above Stack z _{ett} Height above Ground z _{ent} +h _s Table of Plume Top-Hat Diameters (2a) and P Height (feet) above ground Stack.Rel.Ht = 32.5 (300,000,000,000,000,000,000,000,000,000	121.610 131.516 (meters) above stack 0.00 2.29 2.8.38 14.48 20.57 32.77 38.66 44.96 51.05 57.15 63.25 69.34 75.44 81.53 87.63 93.73 99.82 112.01 118.11 124.21 21.61 0.52 115.25 112.01 118.11 124.21 130.30 136.40 148.59 172.297 294.89	meters meters meters Radius(m) 11.867 12.070 12.558 13.045 13.045 13.045 13.045 13.045 14.996 15.972 16.459 16.947 17.435 17.922 18.410 18.898 19.385 19.385 19.385 19.385 19.385 20.3616 21.824 22.3111 22.799 23.277 23.774 27.062 46.569	431.5 Velocities stat SingleStk VertVel(m/s) 8.97 8.90 8.90 8.90 8.90 8.90 8.90 8.90 8.90	feet Plume Temp(K)	d of jet ph: 	=[0.12F _o (6.	$25D \cdot z_{\nu})^{2} - (Va)_{0}^{3}) (V_{crit}^{3} 0.16^{3}) = \frac{http://www.17}{http://www.17}$ es the real solution x = z-zv = or z(m/above stack) = z(tl/above ground) = z(tl/above ground) = $Jet Phase Eqs:$ Linearly interpolated from Stack R Spillane Equations: $V_{pluma} = (Va)_{0}^{3} + 0.12F_{a}(z-z_{\nu})^{2} - (6.2$ $a = 0.16(z-z_{\nu})$ $\theta_{p} = \theta_{a}(1 + (1 - (\theta_{p}/\theta_{b}))^{*} (V_{exit}D^{2})(C$ ECE Staff Equation: $V_{pupen} = Brigg's Equation:$ $V_{segrs} = (2/3) \times 1.6^{(3/2)} \times F_{mp}^{(1/2)} \times 1$ where $F_{mp} = nF_{ap}$	774874 28. org/cubic. f -64.00 -60.2 -16 -16 -16 -16 -16 -16 -17 -16 -17 -16 -17 -17 -17 -17 -17 -17 -17 -17 -17 -17
Find Height above Stack z _{ent} Height above Ground z _{ent} +h _s fable of Plume Top-Hat Diameters (2a) and P Height (feet) above ground Stack.Rel.Ht = 32.5 40.0 60.0 80.0 100.0 120.0 140.0 160.0 120.0 140.0 160.0 220.0 2240.0 2240.0 2240.0 2240.0 220.0 2440.0 280.0 300.0	121.610 131.516 (meters) above stack 0.00 2.22 8.38 14.48 20.57 726.67 32.77 38.86 44.96 57.15 63.25 69.34 75.44 81.53 87.63 93.73 99.82 91.05.92 112.01 118.11 121.61 118.11 121.61 118.11 121.61 124.24 130.30 136.40 142.49 148.59 136.40 142.49 148.59 136.40 142.49 148.59 136.40 142.49 148.59 142.51 142.51 143.51 145	meters meters meters Plume Radius(m) 11.867 12.070 12.558 13.045 13.045 13.045 13.045 13.045 13.045 14.508 14.996 15.484 15.972 16.459 16.947 17.435 17.922 18.410 18.898 19.355 19.873 20.848 21.336 21.616 21.824 22.311 22.799 23.287 23.774 27.062 46.559 70.053	431.5 Velocities stat SingleStk VertVel(m/s) 8.97 8.90 8.72 8.53 8.53 8.53 8.53 8.53 8.77 7.989 7.80 7.61 7.43 7.25 7.66 6.88 6.69 6.51 6.33 6.14 5.96 5.41 5.30 5.22 5.04 4.85 4.47 3.90 3.44	feet arting at em Plume Temp(K) arting at en arting at en arting at en article arting at en article ar	d of jet ph: 	=[0.12F _o (6.	$25D \cdot z_{\nu})^{2} - (Va)_{0}^{3}) (V_{crit}^{3} 0.16^{3}) = \frac{http://www.17}{http://www.17}$ es the real solution x = z-zv = or z(m/above stack) = z(tl/above ground) = z(tl/above ground) = $Jet Phase Eqs:$ Linearly interpolated from Stack R Spillane Equations: $V_{pluma} = (Va)_{0}^{3} + 0.12F_{a}(z-z_{\nu})^{2} - (6.2$ $a = 0.16(z-z_{\nu})$ $\theta_{p} = \theta_{a}(1 + (1 - (\theta_{p}/\theta_{b}))^{*} (V_{exit}D^{2})(C$ ECE Staff Equation: $V_{pupen} = Brigg's Equation:$ $V_{segrs} = (2/3) \times 1.6^{(3/2)} \times F_{mp}^{(1/2)} \times 1$ where $F_{mp} = nF_{ap}$	774874 28. org/cubic. f -64.00 -60.2 -16 -16 -16 -16 -16 -16 -17 -16 -17 -16 -17 -17 -17 -17 -17 -17 -17 -17 -17 -17
Find Height above Stack z _{ett} Height above Ground z _{ent} +h _s Table of Plume Top-Hat Diameters (2a) and P Height (feet) above ground Stack.Rel.Ht = 32.5 (0.0000) (0.00000) (0.00000) (0.00000) (0.00000) (0.0000000000	121.610 131.516 (meters) above stack 0.00 2.29 2.8.38 14.48 20.57 32.77 38.66 44.96 51.05 57.15 63.25 69.34 75.44 81.53 87.63 93.73 99.82 112.01 118.11 124.21 21.61 0.52 115.25 112.01 118.11 124.21 130.30 136.40 148.59 172.297 294.89	meters meters meters Plume Radius(m) 11.867 12.070 12.558 13.045 13.045 13.045 13.045 13.045 13.045 14.508 14.996 15.484 15.972 16.459 16.947 17.435 17.922 18.410 18.898 19.355 19.873 20.848 21.336 21.616 21.824 22.311 22.799 23.287 23.774 27.062 46.559 70.053	431.5 Velocities stat SingleStk VertVel(m/s) 8.97 8.90 8.90 8.90 8.90 8.90 8.90 8.90 8.90	feet arting at em Plume Temp(K) arting at en arting at en arting at en article arting at en article ar	d of jet ph: 	=[0.12F _o (6.	$25D \cdot z_{\nu})^{2} - (Va)_{0}^{3}) (V_{crit}^{3} 0.16^{3}) = \frac{http://www.17}{http://www.17}$ es the real solution x = z-zv = or z(m/above stack) = z(tl/above ground) = z(tl/above ground) = $Jet Phase Eqs:$ Linearly interpolated from Stack R Spillane Equations: $V_{pluma} = (Va)_{0}^{3} + 0.12F_{a}(z-z_{\nu})^{2} - (6.2$ $a = 0.16(z-z_{\nu})$ $\theta_{p} = \theta_{a}(1 + (1 - (\theta_{p}/\theta_{b}))^{*} (V_{exit}D^{2})(C$ ECE Staff Equation: $V_{pupen} = Brigg's Equation:$ $V_{segrs} = (2/3) \times 1.6^{(3/2)} \times F_{mp}^{(1/2)} \times 1$ where $F_{mp} = nF_{ap}$	774874 28. org/cubic. f: -64. 06 -60. 2 -16 -16 -16 -16 -16 -17 -16 -17 -16 -17 -16 -17 -16 -17 -16 -17 -16 -17 -16 -17 -16 -17 -16 -16 -16 -16 -16 -16 -16 -16 -16 -16
Find Height above Stack z _{ert} Height above Ground z _{ert} +h _s Table of Plume Top-Hat Diameters (2a) and P Height (feet) above ground Stack.Rel.Ht = 32.5 40.0 60.0 80.0 100.0 120.0 140.0 160.0 120.0 140.0 160.0 220.0 2240.0 2240.0 2240.0 2240.0 2240.0 220.0 2440.0 280.0 300.0	121.610 131.516 (meters) above stack 0.00 2.22 8.38 14.48 20.57 726.67 32.77 38.86 44.96 57.15 63.25 69.34 75.44 81.53 87.63 93.73 99.82 91.05.92 112.01 118.11 121.61 118.11 121.61 118.11 121.61 124.24 130.30 136.40 142.49 148.59 136.40 142.49 148.59 136.40 142.49 148.59 136.40 142.49 148.59 142.51 142.51 143.51 145	meters meters meters Plume Radius(m) 11.887 12.070 12.558 13.045 13.533 14.021 14.508 14.996 15.484 15.972 16.459 16.947 17.435 17.922 18.410 18.888 19.873 20.361 21.824 22.311 22.799 23.287 23.774 27.062 45.659 95.337	431.5 Velocities stat SingleStk VertVel(m/s) 8.97 8.90 8.72 8.53 8.53 8.53 8.53 8.53 8.77 7.989 7.80 7.61 7.43 7.25 7.66 6.88 6.69 6.51 6.33 6.14 5.96 5.41 5.30 5.22 5.04 4.85 4.47 3.90 3.44	feet arting at em Plume Temp(K) 316.79 315.41 312.30 311.31	d of jet ph: 	=[0.12F _o (6.	$25D \cdot z_{\nu})^{2} - (Va)_{0}^{3})/(V_{crit}^{3}0.16^{3}) = \frac{http://www.17}{2}$ is the real solution x = z-zv = or z(m/above stack) = z(tr/above stack) = z(tr/above ground) = $\frac{Jet Phase Eqs:}{Linearly interpolated from Stack R}$ Spillane Equations: $V_{pluma} = (Va)_{0}^{3} + 0.12F_{a}(z-z_{\nu})^{2} - (6.2 a) = 0.16(z-z_{\nu})$ $\theta_{p} = \theta_{a}(1 + (1 - (\theta_{p}/\theta_{b}))^{*} (V_{exit}D^{2})/(CEC Staff Equation: V_{mp} = n(5z)_{vp}$ Brigg's Equation: $V_{pluma} = (2/3) \times 1.6^{(3/2)} \times F_{mp}^{(1/2)} \times 1$ where $F_{mp} = nF_{ap}$	774874, 28. org/cubic. h -64. 06 -60. 2 -161
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s Table of Plume Top-Hat Diameters (2a) and P Height (feet) above ground Stack.Rel.Ht = 32:5 40.0 60.0 80.0 100.0 120.0 140.0 160.0 120.0 140.0 180.0 220.0 2240.0 2440.0	121.610 131.516 ume-Averag (meters) above stack 0.00 2.22 8.38 14.48 20.57 3.2.77 3.8.86 44.96 5.7.15 6.3.25 6.9.34 7.5.44 8.153 87.63 9.3.73 9.9.82 105.92 112.01 118.11 121.61 124.21 112.01 118.11 121.61 124.29 112.97 129.69 130.40 142.49 148.59 136.40 142.49 136.40 142.49 136.40 142.49 136.40 142.49 136.40 142.49 136.40 142.49 136.40 142.49 136.40 142.49 136.40 142.49 136.40 142.49 136.40 142.49 136.40 142.49 136.40 142.49 136.40 142.49 136.40 142.49 136.40 142.49 136.40 142.49 136.40 142.49 136.40 136.40 142.49 136.40 136.40 142.49 136.40 136.40 142.49 136.40 136.40 136.40 136.40 137.40 147.40	meters meters meters ed Vertical Plume Radius(m) 11.867 12.558 13.045 13.533 14.021 14.500 14.996 15.484 15.972 16.459 16.947 17.435 17.922 18.410 18.898 19.335 19.873 20.361 21.824 22.311 22.799 23.287 23.774 27.062 46.569 70.953 95.337 119.721	431.5 Velocities sta SingleStk VertVel(m/s) 8.97 8.90 8.72 8.53 8.35 8.47 7.98 7.80 7.61 7.43 7.745 7.66 6.88 6.69 6.51 6.33 6.14 5.96 6.51 6.33 6.14 5.96 5.59 5.41 5.59 5.41 5.59 5.41 5.59 5.44 5.59 5.59 5.44 5.59 5.59 5.44 5.59	feet arring at em Plume Temp(K) 316.79 315.41 312.30 311.31 310.94	d of jet ph: 	=[0.12F _o (6.	$25D \cdot z_{\nu})^{2} - (Va)_{0}^{3})/(V_{crit}^{3}0.16^{3}) = \frac{http://www.17}{2}$ is the real solution x = z-zv = or z(m/above stack) = z(tr/above stack) = z(tr/above ground) = $\frac{Jet Phase Eqs:}{Linearly interpolated from Stack R}$ Spillane Equations: $V_{pluma} = (Va)_{0}^{3} + 0.12F_{a}(z-z_{\nu})^{2} - (6.2 a) = 0.16(z-z_{\nu})$ $\theta_{p} = \theta_{a}(1 + (1 - (\theta_{p}/\theta_{b}))^{*} (V_{exit}D^{2})/(CEC Staff Equation: V_{mp} = n(5z)_{vp}$ Brigg's Equation: $V_{pluma} = (2/3) \times 1.6^{(3/2)} \times F_{mp}^{(1/2)} \times 1$ where $F_{mp} = nF_{ap}$	774874, 28. org/cubic. h -64. 06 -60. 2 -161
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s Table of Plume Top-Hat Diameters (2a) and P Height (feet) above ground Stack.Rel.Ht = 32:5 40:0 80:0 100:0 120:0 140:0 12	121.610 131.516 Jume-Averag (meters) above stack 0.00 2.22 8.33 14.48 20.57 22.67 32.77 38.86 44.96 51.05 57.15 63.25 69.34 75.44 81.53 87.63 25 69.34 75.44 81.53 87.63 25 69.34 75.44 81.53 87.63 99.82 105.92 112.01 118.111 124.21 130.30 112.47 129.489 142.97 599.66 599.66 599.65 599.55 5	meters meters meters ed Vertical Plume Radius(m) 11.867 12.558 13.045 13.533 14.021 14.500 14.996 15.484 15.972 16.459 16.947 17.435 17.922 18.410 18.898 19.335 19.873 20.361 21.824 22.311 22.799 23.287 23.774 27.062 46.569 70.953 95.337 119.721	431.5 Velocities sta SingleStk VertVel(m/s) 8.97 8.90 8.72 8.53 8.53 8.53 8.77 7.88 7.80 7.61 7.43 7.25 7.06 6.88 6.69 6.51 6.33 6.14 5.96 5.59 5.41 5.30 5.22 5.44 7.59 5.44 3.00 5.22 5.44 4.85	feet Plume Temp(K) 316.79 315.41 312.30 311.31 310.94 310.76	d of jet ph: 	=[0.12F _o (6.	$25D \cdot z_{\nu})^{2} - (Va)_{0}^{3})/(V_{crit}^{3}0.16^{3}) = \frac{http://www.17}{2}$ is the real solution x = z-zv = or z(m/above stack) = z(tr/above stack) = z(tr/above ground) = $\frac{Jet Phase Eqs:}{Linearly interpolated from Stack R}$ Spillane Equations: $V_{pluma} = (Va)_{0}^{3} + 0.12F_{a}(z-z_{\nu})^{2} - (6.2 a) = 0.16(z-z_{\nu})$ $\theta_{p} = \theta_{a}(1 + (1 - (\theta_{p}/\theta_{b}))^{*} (V_{exit}D^{2})/(CEC Staff Equation: V_{mp} = n(5z)_{vp}$ Brigg's Equation: $V_{pluma} = (2/3) \times 1.6^{(3/2)} \times F_{mp}^{(1/2)} \times 1$ where $F_{mp} = nF_{ap}$	774874. 28.org/cubic.h -64.06 -60.2 -165 20 ft interval: 20 ft interval: 50-z,,) ²)) ¹³ / a 50-z,) ²)) ¹³ / a 4V _{plume} *a ² Å ²))) 50 ft interval:



MERGED (along length) Plume Average Vert			oyant Plumes		est, et. al.			
		tion of Max	imum Updraft	Speeds fo	r Calm Con		arious Heights in the Merg	
					ower Statio	n at Oakey	, Queensland, Australia," [Dr. K.T. Spilla
Ambient Conditions:		14.1.1		٥ ٢	Constants:		eutral conditions (dθ/dz=0 or	$\theta_a = \theta_e$)
Ambient Potential Temp θ _a Plume Exit Conditions:	310.37	Kelvins	99.0	-1-	Gravity g		meters/feet m/s ²	
Stack Height h.	9.91	meters	32 6/12	feet-inches	διανίτη σ	1.11	m/s	
Individual Stack Diameter D	23.7744			inches	λο	~1.0		
Stack Velocity Vexit	8.97	m/s		ft/sec	4Vol/(60πD			
Individual Volumetric Flow	3,982.48	cu.m/sec	8,438,400	ACFM	$\pi V_{exit} D^2/4$			Sect.2/¶1
Stack Potential Temp θ _s		Kelvins	129.0					
Initial Stack Buoyancy Flux Fo	633.84		30.0	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	₂ /θ _p) for a,V	,θ _p at plume height (see belo	w)
Total Number of Stacks n Average Adjacent Stack Separation d	36.00	meters	118.1	feet	Calce base	d on multipl	e plume treatment in Peter Be	et Paner
Number of Stacks along Orientation N	30.00	meters	110.1	leet	-		sed by N ^{0.25} at the height whe	
······································							low ht, single merged stack a	
Conditions at End (Top) of Jet Phase:								
Height above Stack z _{jet}	148.590	meters*	487.5	feet*	$z_{jet} = 6.25D$, meters*=	meters above stack top	Sect.3/¶1
Height above Ground z _{jet} +hs	158.496		520.0					•
Vertical Velocity V _{jet}	4.486		14.72		$V_{jet} = 0.5V_e$	$e_{xit} = V_{exit}/2$		
Plume Top-Hat Diameter 2a _{jet}	47.549	meters	156.0	teet	2a _{jet} = 2D		Conservation of momentum	
Spillane Methodology - Analytical Solutions	for Calm Con	ditions for	Plume Height	e above le	t and Merci	ing Phase		
Single Plume-averaged Vertical Velocit								
Single Plume Values: Plume Top-Hat Radius a			e Merging Onl				r increase with height	Sect.2/Eq.6
Virtual Source Height zv		meters*		feet*			, meters*=meters above stack top	
Height above Ground zv+hs		meters	45.1	feet			where $(\theta_a/\theta_s)^{1/2} = (\theta_e/\theta_s)^{1/2} =$	
Single Plume Values: Vertical Velocity V	Use	ed in Plume	e Merging Onl	у) ² - (6.25D-z _v) ²]) ^(1/3) / a	Sect.2.1(6)
Product (Va)	103.888	m²/s			V _{exit} (D/2)(0	s/θ _s) ^{1/2}		
								-
Plume Merging - Based on Single Plume Ca				f	0.		2	Sect.3/¶3
Begin Merging Plume Top-Hat Diameter 2atouch		meters	118.1		2a _{touch} =d, (2) meters*=meters above stack	, top
Height above Stack z _{touch} Height above Ground z _{touch} +h _s	116.336 126.242		381.7 414.2		$z_{touch} = z_v +$	•ur(∠⁼U.16),	meters =meters above stack	, iob
Vertical Velocity Vtouch	4.380			ft/sec	$M_{\rm emb} = I M$	$(3)^{3} \pm 0.12$	= _o [(z-z _v) ² - (6.25D-z _v) ²]) ^(1/3)	/ 9
Total Merging Plume Top-Hat Diameter 2aful		meters	236.2				=d(N-1)/2) FOR 2 STACKS,	
Height above Stack z _{ful}	228.836		750.8				meters*=meters above stack	
Height above Ground z _{full} +h _s	238.742		783.3		Tun V			
Vertical Velocity V _{ful}	4.168	m/s	13.7	ft/sec	V _{full} = {(Va)	_o ³ + 0.12F _c	$[(z_{full}-z_v)^2 - (6.25D-z_v)^2]$	/ a _{full}
Product (V ³ a) _{full}	2,607	m ⁴ /s ³						
Conditions at End (Top) of Merging Phase - D	efine new valu	ies for V _{full} a	ind a _{full} in Merg	ed Plume o	alculations (based on T	OTAL number of stacks):	
Merged Plume Values: Plume Diameter 2a	s	olutions in	Table Below				z _{full})), or linear increase with	height
Revised Merged Plume Radius am		meters	118.1				nere Total Merging Occurs	
Revised Merged Plume Velocity Vm	4.168		13.67				here Total Merging Occurs	
Revised Virtual Source Height zful		meters*	750.8 Tables Below	feet*			ere Total Merging Occurs (sh	
Revised Vertical Velocity V	5	olutions in	lables Below				eights above total merging el	evation
Multiple Plume Calculations					v=v _{touch} +(v	/m ^{-v} touch) (z-z _{touch})/(z _{full} -z _{touch}) for heights below total mergi	ing clauption
Solve for plume-averaged vertical velo	itv at height	600.0	feet	182.88	meters abo	ve around (ing elevation
Gives the following Height above Stack z	172.974		567.5				MERGING PHASE-INTERPO	DLATE
Plume Top-Hat Radius a	#N/A	meters	#N/A	feet	a=am+0.16	(z-z _{full}) if z >	Zfull	
Vertical Velocity V	4.273	m/s	14.02	ft/sec	$V = \{n(V^3a)_{fu}$			
							$z'-z_{touch})/(z_{full}-z_{touch})$ if z_{touch}	<z<z<sub>full</z<z<sub>
					V'=single pl			
Solve for Height of CASC critical vertical					BEFORE T			VV < Top of J
Find Height above Stack z _{crit} Height above Ground z _{crit} +hs		meters meters	JET	feet			/(V _{crit}) ³]-a _m)/0.16 if V _{crit} <v<sub>m *(V_{crit}-V_{touch})/(V_m-V_{touch}) if V_c</v<sub>	- W
Height above Ground Zent+Ns	JEI	meters	JEI	leet	Zcrit=Ztouch+	(∠full*∠touch)	(Vcrit-Vtouch)/(Vm-Vtouch) II Vc	rit>¥m
Table of MERGED Plume-Averaged Vertical	/elocities sta	rting at Tou	uchina Heiaht		Sinale Plun	ne Eans (se	ee Single Plume spreadsheel	t)
Height (feet)			Vert.				,) ² -(6.25D-z _v) ²]} ^{1/3} / a	
above ground			Vel(m/s)		a = 0.16(z-z			
Begin Merging (touch) = 414.2	116.34	18.000	4.38				_{xit} D ² /(4V _{plume} *a ² *λ ²)))	
440.0	124.21	#N/A	4.37		Interpolated	d Layer Eqr	s	40 ft Interval
480.0	136.40		4.34		V'=V _{touch} +(V _m -V _{touch})*(z'-z _{touch})/(z _{full} -z _{touch})	
520.0	148.59		4.32					
560.0	160.78		4.30					
600.0 640.0		#N/A #N/A	4.27					
680.0	185.17		4.25					
720.0	209.55		4.23					
760.0	203.33		4.18		Merged Plu	me Eqns		
End Merging (full/mp) = 783.3	228.84		4.17		V={n(V ³ a) _{fu}			50 ft Interval
800.0			4.14		a=a _m +0.16			
850.0		39.254	4.05					
900.0	264.41	41.692	3.97					
950.0			3.89					
1000.0	294.89		3.83					100 ft Interva
1100.0	325.37	51.446	3.70					
1200.0			3.59					
1300.0	386.33		3.49					
1400.0	416.81	66.076	3.40					
1500.0 1600.0	447.29		3.32					
1700.0	508.25	75.830 80.707	3.25					
1700.0 1800.0			3.18					500 ft Interva
2000.0	538.73		3.12					Soo it niterva
2500.0	752.09		2.79					
3000.0			2.79					
	1056.89		2.02					
3500.0								
3500.0 4000.0		192.873	2.38					
	1209.29		2.38 2.29					



Based on 1 cell/heat exchanger. Calc' eff.diam	"Aviation Sa	fety and Buo	yant Plumes	" Peter Be	st, et. al.			
for each heat exchanger with each fan at 13' ID		-	-			ditions at V	arious Heights in the Plum	e
(204,600 ACFM total for each fan). 42 fans		from a Gas-	Turbine Pow	er Station a	at Oakey, Q	ueensland	Australia," Dr. K.T. Spilla	ne
Ambient Conditions:					Constants:	Assume ne	eutral conditions (d0/dz=0 or	θ _a =θ _e)
Ambient Potential Temp θ _a	273.71	Kelvins	33.0	°F		0.3048	meters/feet	
Plume Exit Conditions:					Gravity g	9.81	m/s ²	
Stack Height hs	8.36	meters	27.42	feet	λ	1.11		
Merged Stack Diameter D	11.2075	meters	441.2	inches	λο	~1.0		
Stack Velocity V _{exit}	7.83	m/s	25.69	ft/sec	4Vol/(60πD	²)		
Individual Heat Exchanger Volumetric Flow	772.48	cu.m/sec	1,636,800	ACFM	πV _{exit} D ² /4			Sect.2/¶1
Stack Potential Temp θ _s	312.04	Kelvins	102.0	°F				
Initial Stack Buoyancy Flux Fo	296.2961	m ⁴ /s ³	69.0	ΔT(°F)	gV _{exit} D ² (1-6	$\theta_a/\theta_a)/4 = V$	ol.Flow(g/π)(1-θ _a /θ _a)	Sect.2/¶1
Plume Buoyancy Flux F	N/A	m ⁴ /s ³			$\lambda^2 q V a^2 (1-\theta)$, (θ _n) for a,V	,θ _p at plume height (see belo	
Number of Heat Exchangers n	1			1.000			cation Factor (n ^{0.25})	,
Conditions at End (Top) of Jet Phase:								
Height above Stack z _{jet}	70.047	meters*	229.8	feet*	Zigt = 6,250). meters*=	meters above stack top	Sect.3/¶1
Height above Ground z _{jet} +h _s		meters	257.2		ju			
Vertical Velocity V _{jet}	3.915			ft/sec	V _{jet} = 0.5V	nuit = Vauit/2		
Plume Top-Hat Diameter 2a _{jet}		meters	73.5		2a _{iet} = 2D	SAIL - BAIL -	Conservation of momentum	
	22.110	motoro	10.0	1001	Ediat - ED			
Spillane Methodology - Analytical Solutions	or Calm Con	ditions for P	lume Height	above .let	Phase			
Single Plume-averaged Vertical Velocity						aiven by o	quations below:	
Plume Top-Hat Radius a		olutions in T		F			crease with height	Sect.2/Eq.6
Virtual Source Height z _v		meters*		feet*			ers*=meters above stack top	Sect.2/Eq.6
					0.20D[I-(θ _€	γu _s) j, met	where $(\theta_a/\theta_s)^{1/2} = (\theta_e/\theta_s)^{1/2} =$	
Height above Ground z _v +h _s		meters olutions in T	42.0	ICCL	(1/2) 3 . 2	125 [/-	where $(\theta_a/\theta_s)^{1/2} = (\theta_e/\theta_s)^{1/2} = (\theta_e/\theta_s)^{1/2} = (0.25D-z_v)^2 + $	
Vertical Velocity V			able BelOW				/) - (0.200-2v) ⁻]} ^{,,} / a	Sect.2.1(6)
Product (Va) _o	41.096	m*/s			$V_{exit}D/2(\theta_e/$	⊎s)		
Single Heat Exchanger Results:								
Solve for plume-averaged vertical velo		600.0			meters abo	ve ground (z'+h _s)	
Gives the following Height above Stack z'	174.522	meters*	572.6	feet*				
Plume Top-Hat Diameter 2a'	54.425	meters	178.6	feet	2a'=2*0.16			Sect.2/Eq.6
Vertical Velocity V	3.606	m/s	11.83	ft/sec	V={(Va) _o ³ +	0.12F _o [(z-z	v) ² -(6.25D-zv) 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	ocity	Critical	VV < Top of 、
Find Height above Stack z _{crit}	#N/A	meters	#N/A	feet	Solve for x=	=(z-z _v) simu	ultaneously in both eqs. (i.e.,	Va and a)
Height above Ground zcrit+hs	#N/A	meters	#N/A	feet	for V=V _{crit} (using the cu	ubic equation ax ³ +bx ² +cx+d=	0, where
						a=1, c=0,	and b=-(0.12F _o)/(V _{crit} ³ 0.16 ³)=	-58.306
Interpolated Height of critical vertical vertica	elocity in Jet	Phase:			and d			
			148.5	feet	and d		25D-z _v) ² -(Va) _o ³]/(V _{crit} ³ 0.16 ³)=	137127.
Find Height above Stack z _{crit}	45.271	Phase: meters meters	148.5 175.9		and d	=[0.12F _o (6.	25D-z _v) ² -(Va) _o ³]/(V _{crit} ³ 0.16 ³)= <u>http://www.17</u>	137127. 28.org/cubic.h
	45.271	meters			and d	=[0.12F _o (6.	25D-z _v) ² -(Va) _o ³]/(V _{crit} ³ 0.16 ³)= <u>http://www.17</u> is the real solution x = z-zv =	137127. 728.org/cubic.h -37.77
Find Height above Stack z _{crit}	45.271	meters			and d	=[0.12F _o (6.	$25D-z_v)^2 - (Va)_o^3 / (V_{crit}^{3}0.16^3) = \frac{http://www.17}{s}$ is the real solution x = z-zv = or z(m/above stack) =	137127. 728.org/cubic.h -37.77 -33.3
Find Height above Stack z_{crit} Height above Ground $z_{crit} + h_s$	45.271 53.629	meters meters	175.9	feet		=[0.12F _o (6.	25D-z _v) ² -(Va) _o ³]/(V _{crit} ³ 0.16 ³)= <u>http://www.17</u> is the real solution x = z-zv =	137127. 728.org/cubic.h -37.77 -33.3
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s Table of Plume Top-Hat Diameters (2a) and F	45.271 53.629 Iume-Averag	meters meters ed Vertical	175.9 Velocities sta	feet arting at en		=[0.12F _o (6.	$25D-z_v)^2 - (Va)_o^3 / (V_{crit}^{3}0.16^3) = \frac{http://www.17}{s}$ is the real solution x = z-zv = or z(m/above stack) =	137127. 28.org/cubic.ht -37.77
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s Fable of Plume Top-Hat Diameters (2a) and F Height (feet)	45.271 53.629 Plume-Averag (meters)	meters meters ed Vertical Plume	175.9 Velocities sta SingleStk	feet arting at en Plume		=[0.12F _o (6.	$25D-z_v)^2 - (Va)_o^3 / (V_{crit}^{3}0.16^3) = \frac{http://www.17}{s}$ is the real solution x = z-zv = or z(m/above stack) =	137127. 728.org/cubic.h -37.77 -33.3
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s Table of Plume Top-Hat Diameters (2a) and P Height (feet) above ground	45.271 53.629 Plume-Averag (meters) above stack	meters meters ed Vertical Plume Radius(m)	175.9 Velocities sta SingleStk VertVel(m/s)	feet arting at en Plume		=[0.12F _o (6.	$25D-z_v)^2 - (Va)_o^3 / (V_{crit}^{3}0.16^3) = \frac{http://www.17}{s}$ is the real solution x = z-zv = or z(m/above stack) =	137127. 728.org/cubic.h -37.77 -33.3
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s Fable of Plume Top-Hat Diameters (2a) and P Height (feet) above ground Stack.Rel.Ht = 27.4	45.271 53.629 Plume-Averag (meters) above stack 0.00	meters meters ed Vertical Plume Radius(m) 5.604	175.9 Velocities sta SingleStk VertVel(m/s) 7.83	feet arting at en Plume Temp(K)		=[0.12F _o (6.	25D-z _v) ² -(Va) _o ³)/(V _{crit} ³ 0.16 ³)= <u>http://www.17</u> is the real solution x = z-zv = or z(m/above stack) = z(ft/above ground) =	137127 28.org/cubic.h -37.77 -33.3
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s Fable of Plume Top-Hat Diameters (2a) and F Height (feet) above ground Stack.Rel.Ht = 27.4 40.0	45.271 53.629 Iume-Averag (meters) above stack 0.00 3.83	meters meters ed Vertical ¹ Plume Radius(m) 5.604 5.910	Velocities sta SingleStk VertVel(m/s) 7.83 7.62	feet arting at en Plume Temp(K)		=[0.12F _o (6.	25D-z _y) ² -(Va ₀ ^a ³).(V _{crit} ³ 0.16 ³)= <u>http://www.17</u> is the real solution x = z-zy = or z(m/above stack) = z(tl/above ground) = Jet Phase Eqs:	137127. 28.org/cubic.h -37.77 -33.3 -8 20 ft Interval
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s Table of Plume Top-Hat Diameters (2a) and F Height (feet) above ground <i>Stack.Rel.Ht</i> = 27.4 40.0 60.0	45.271 53.629 Iume-Averag (meters) above stack 0.00 3.83 9.93	meters meters ed Vertical ¹ Plume Radius(m) 5.604 5.910 6.398	175.9 Velocities sta SingleStk VertVel(m/s) 7.83 7.62 7.28	feet arting at en Plume Temp(K)		=[0.12F _o (6.	25D-z _y) ² -(Va ₀ ³)/(V _{crit} ³ 0.16 ³)= <u>http://www.17</u> is the real solution x = z-zy = or z(m/above stack) = z(ft/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R	137127 28.org/cubic.h -37.77 -33.3 -8 20 ft Interval
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s fable of Plume Top-Hat Diameters (2a) and F Height (feet) above ground <i>Stack.Rel.Ht</i> = 27.4 40.0 60.0 80.0	45.271 53.629 Jume-Averag (meters) above stack 0.00 3.83 9.93 16.03	meters meters ed Vertical V Plume Radius(m) 5.604 5.910 6.398 6.886	Velocities sta SingleStk VertVel(m/s) 7.83 7.62 7.28 6.93	feet arting at en Plume Temp(K)		=[0.12F _o (6.	25D-z _v) ² -(Va ₀ ^a)/(V _{crit} ³ 0.16 ³)= <u>http://www.17</u> is the real solution x = z-zv = or z(m/above stack) = z(tt/above ground) = Jet Phase Eqs:	137127 28.org/cubic.h -37.77 -33.3 -8 20 ft Interval
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s Table of Plume Top-Hat Diameters (2a) and F Height (feet) above ground Stack.Rel.Ht = 27.4 40.0 60.0 80.0 100.0	45.271 53.629 Plume-Averag (meters) above stack 0.00 3.83 9.93 16.03 22.12	meters meters ed Vertical 1 Plume Radius(m) 5.604 5.910 6.398 6.886 7.374	175.9 Velocities sta SingleStk VertVel(m/s) 7.83 7.62 7.28 6.93 6.59	feet arting at en Plume Temp(K)		=[0.12F _o (6.	25D-z _y) ² -{Va}o ³ }/{V _{crt} ³ 0.16 ³ }= <u>http://www.17</u> is the real solution x = z-zy = or z(m/above stack) = z(ft/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations:	137127 28.org/cubic.h -37.77 -33.3 -8 -20 ft Interval el Ht to Top of Jet
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s Fable of Plume Top-Hat Diameters (2a) and P Height (feet) above ground Stack.Rel.Ht = 27.4 40.0 60.0 100.0 120.0	45.271 53.629 (meters) above stack 0.00 3.83 9.93 16.03 22.12 28.22	meters meters ed Vertical Plume Radius(m) 5.604 6.398 6.886 7.374 7.861	Velocities sta SingleStk VertVel(m/s) 7.83 7.62 7.28 6.93 6.59 6.25	feet arting at en Plume Temp(K)		=[0.12F _o (6.	25D-z _y ² -{Va ₀ ^a }/{V _{crt} ³ 0.16 ³ } = <u>http://www.17</u> is the real solution x = z-zv = or z(m/above stack) = z(ft/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: V _{pluma} =((Va ₀) ^a +0.12F _a ((z-z,) ² -(6.2))	137127 '28.org/cubic.F -37.71 -33.3 -8 -8 20 ft Interval el.Ht to Top of Je
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s Fable of Plume Top-Hat Diameters (2a) and P Height (feet) above ground Stack.Rel.Ht = 27.4 40.0 60.0 100.0 120.0 140.0	45.271 53.629 (meters) above stack 0.00 3.83 9.93 16.03 22.12 28.22 34.31	meters meters ed Vertical 1 Plume Radius(m) 5.604 5.910 6.388 6.886 7.374 7.861 8.349	Velocities sta SingleStk VertVel(m/s) 7.83 7.62 7.28 6.93 6.59 6.25 5.91	feet arting at en Plume Temp(K)		=[0.12F _o (6.	$25D \cdot z_y)^2 - (Va_0)^3 J \cdot (V_{crit}^3 0.16^3) = \\ http://www.17 \\ http://wwww.17 \\ http://www.17 \\ http://www.17 \\ http://www.17 \\ http://$	137127 28.org/cubic.t -37.77 -33.3 -8 20 ft Interval el.Ht to Top of Je (5D-z,) ²)) ¹⁰ / a
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s Table of Plume Top-Hat Diameters (2a) and F Height (feet) above ground <i>Stack.Rel.Ht = 27.4</i> 40.0 60.0 80.0 100.0 120.0 140.0 160.0	45.271 53.629 Plume-Averag (meters) above stack 0.00 3.83 9.93 16.03 22.12 28.22 28.22 24.31 40.41	meters meters ed Vertical Plume Radius(m) 5.604 5.910 6.398 6.886 7.374 7.861 8.349 8.837	Velocities sta SingleStk VertVel(m/s) 7.83 7.62 7.28 6.93 6.59 6.25 5.91 5.57	feet Irting at en Plume Temp(K)		=[0.12F _o (6.	$25D \cdot z_{v})^{2} - (Va)_{o}^{3}) (V_{crit}^{3} 0.16^{3}) = \frac{http://www.12}{bttp://www.12}$ is the real solution x = z-zy = or z(m/above stack) = z(ft/above ground) = z(ft/above ground) = Linearly interpolated from Stack R Spillane Equations: $V_{plams} = (Va)_{o}^{3} + 0.12F_{o}[(z - z_{v})^{2} - (6.2)$ $a = 0.16(z - z_{v})$ $\theta_{p} = \theta_{o}(1 + (1 - (\theta_{o}/\theta_{o}))^{v} (V_{ext}D^{2}/t)$	137127 28.org/cubic.t -37.77 -33.3 -8 20 ft Interval el.Ht to Top of Je (5D-z,) ²)) ¹⁰ / a
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s fable of Plume Top-Hat Diameters (2a) and F Height (feet) above ground <i>Stack.Rel.Ht = 27.4</i> 40.0 60.0 80.0 100.0 120.0 140.0 120.0 5 <i>ingle Jet 5.3 m/s Height = 175.9</i>	45.271 53.629 Jume-Averag (meters) above stack 0.00 3.83 9.933 16.03 22.12 28.22 34.31 40.41 45.27	meters meters ed Vertical ' Plume Radius(m) 5.604 5.910 6.388 6.886 7.374 7.861 8.349 8.837 9.225	Velocities stat SingleStk VertVel(m/s) 7.62 7.28 6.33 6.59 6.25 5.51 5.57 5.30	feet rrting at en Plume Temp(K)		=[0.12F _o (6.	$25D \cdot z_{v})^{2} - (Va)_{o}^{3}) (V_{crit}^{3} 0.16^{3}) = \frac{http://www.12}{bttp://www.12}$ is the real solution x = z-zv = or z(m/above stack) = z(ft/above ground) = $2(ft/above ground) = \frac{1}{bttp://www.12} + \frac{1}{bttp://wwww.12} + \frac{1}{bttp://wwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwww$	137127 28.org/cubic.h -37.77 -33.3 -8 20 ft Interval el.Ht to Top of Jet (5D-z,) ²]) ¹⁰ / a
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s Fable of Plume Top-Hat Diameters (2a) and F Height (feet) above ground <i>Stack.Rel.Ht</i> = 27.4 40.0 60.0 80.0 100.0 120.0 140.0 140.0 150.0 <i>Single Jet 5.3 m/s Height</i> = 175.9 180.0	45.271 53.629 Jume-Averagg (meters) above stack 0.00 3.83 9.939 16.03 22.12 28.22 34.31 40.41 45.27 46.51	meters meters ed Vertical Plume Radius(m) 5.604 5.910 6.886 7.374 7.861 8.349 8.837 9.225 11.711	175.9 Velocities stat SingleStk VertVel(m/s) 7.83 7.62 7.28 6.639 6.25 5.91 5.57 5.30 6.89	feet rting at en Plume Temp(K)		=[0.12F _o (6.	$25D \cdot z_{\nu}^{2} - (Va)_{o}^{3}/(V_{crt}^{3}0.16^{3}) = \frac{http://www.17}{http://www.17}$ is the real solution x = z-zv = or z(m/above stack) = z(ft/above ground) = Z(ft/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: V _{plame} =((Va)_{o}^{3}+0.12F_{o}[(z-z_{v})^{2}-(6.2 a = 0.16[z-z_{v}) $\theta_{p}=\theta_{o}(1+(1-(\theta_{o}/\theta_{o}))^{v}/(V_{ext}D^{2}/(CEC Staff Equation: V_{mp}=n^{0.27}V_{ap}$	137127 28.org/cubic.t -37.77 -33.3 -8 20 ft Interval el.Ht to Top of Je (5D-z,) ²)) ¹⁰ / a
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s Fable of Plume Top-Hat Diameters (2a) and P Height (feet) above ground Stack.Rel.Ht = 27.4 40.0 60.0 60.0 100.0 120.0 140.0 5 <i>single Jet 5.3 m/s Height</i> = 175.9 180.0 200.0	45.271 53.629 Jume-Averag (meters) above stack 0.00 3.83 9.93 16.03 22.12 28.22 34.31 40.41 45.27 46.51 52.60	meters meters ed Vertical ' Plume Radius(m) 5.604 5.910 6.886 7.374 7.861 8.349 8.837 9.225 11.711 12.512	175.9 Velocities stat SingleStk VertVel(m/s) 7.83 7.62 7.28 6.93 6.63 6.635 6.55 5.51 5.57 5.30 6.89 6.696 6.89 6.676	feet rrting at en Plume Temp(K)		=[0.12F _o (6.	$25D \cdot z_{v})^{2} - (Va)_{o}^{3}) (V_{crit}^{3} 0.16^{3}) = \frac{http://www.17}{2}$ is the real solution x = z-zy = or z(m/above stack) = z(tl/above ground) = Z(tl/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: V _{pluma} =((Va)_{o}^{3}+0.12F_{a}((z-z_{v})^{2}-(6.2 a = 0.16(z-z_{v}) \theta_{p}=\theta_{a}(1+(1-(\theta_{w}/\theta_{a}))^{*}(V_{oxit}D^{2}/(CEC Staff Equation: V_{pg=n}^{23}V_{xp} Brigg's Equation:	137127 28. crg/c.ubic. F. -37. 77. -33. (-3 20 ft interval 20 ft interval 50-z.,) ²) ^{1/3} / a 4V _{plume} *a ² +λ ²))
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s Table of Plume Top-Hat Diameters (2a) and F Height (feet) above ground <i>Stack.Rel.Ht</i> = 27.4 40.0 60.0 80.0 100.0 120.0 140.0 140.0 150.0 <i>Single Jet 5.3 m/s Height</i> = 175.9 180.0	45.271 53.629 Jume-Averagg (meters) above stack 0.00 3.83 9.939 16.03 22.12 28.22 34.31 40.41 45.27 46.51	meters meters ed Vertical ' Plume Radius(m) 5.604 5.910 6.886 7.374 7.861 8.349 8.837 9.225 11.711 12.512	175.9 Velocities stat SingleStk VertVel(m/s) 7.83 7.62 7.28 6.93 6.63 6.635 6.55 5.51 5.57 5.30 6.89 6.696 6.89 6.676	feet rrting at en Plume Temp(K)		=[0.12F _o (6.	$25D \cdot z_{\nu}^{2} - (Va)_{o}^{3}/(V_{crt}^{3}0.16^{3}) = \frac{http://www.17}{http://www.17}$ is the real solution x = z-zv = or z(m/above stack) = z(ft/above ground) = Z(ft/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: V _{plame} =((Va)_{o}^{3}+0.12F_{o}[(z-z_{v})^{2}-(6.2 a = 0.16[z-z_{v}) $\theta_{p}=\theta_{o}(1+(1-(\theta_{o}/\theta_{o}))^{v}/(V_{ext}D^{2}/(CEC Staff Equation: V_{mp}=n^{0.27}V_{ap}$	137127 28. crg/c.ubic. F. -37. 77. -33. (-3 20 ft interval 20 ft interval 50-z.,) ²) ^{1/3} / a 4V _{plume} *a ² +λ ²))
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s Fable of Plume Top-Hat Diameters (2a) and P Height (feet) above ground Stack.Rel.Ht = 27.4 40.0 60.0 60.0 100.0 120.0 140.0 5 <i>single Jet 5.3 m/s Height</i> = 175.9 180.0 200.0	45.271 53.629 Jume-Averag (meters) above stack 0.00 3.83 9.93 16.03 22.12 28.22 34.31 40.41 45.27 46.51 52.60	meters meters ed Vertical Plume Radius(m) 5.604 5.910 6.398 6.886 7.374 7.861 8.349 8.837 9.225 11.711 12.512 13.313	175.9 Velocities stat SingleStk VertVel(m/s) 7.83 7.62 7.28 6.93 6.63 6.635 6.55 5.51 5.57 5.30 6.89 6.696 6.89 6.676	feet Inting at en Plume Temp(K)		=[0.12F _o (6.	$25D \cdot z_{v})^{2} - (Va)_{o}^{3}) (V_{crit}^{3} 0.16^{3}) = \frac{http://www.17}{2}$ is the real solution x = z-zy = or z(m/above stack) = z(tl/above ground) = Z(tl/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: V _{pluma} =((Va)_{o}^{3}+0.12F_{a}((z-z_{v})^{2}-(6.2 a = 0.16(z-z_{v}) \theta_{p}=\theta_{a}(1+(1-(\theta_{w}/\theta_{a}))^{*}(V_{oxit}D^{2}/(CEC Staff Equation: V_{pg=n}^{23}V_{xp} Brigg's Equation:	137127 28. crg/c.ubic. F. -37. 77. -33. (-3 20 ft interval 20 ft interval 50-z.,) ²) ^{1/3} / a 4V _{plume} *a ² +λ ²))
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Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s fable of Plume Top-Hat Diameters (2a) and F Height (feet) above ground Stack.Rel.Ht = 27.4 40.0 60.0 80.0 100.0 120.0 130.0 130.0 130.0 140.0 160.0 Single Jet 5.3 m/s Height = 175.9 180.0 200.0 220.0 240.0	45.271 53.629 Jume-Averag (meters) above stack 0.00 3.83 9.93 16.03 22.12 28.22 34.31 40.41 45.27 46.51 58.70 64.79	meters meters ed Vertical ' Plume Radius(m) 5.604 5.910 6.388 6.886 7.374 7.861 8.837 9.225 11.711 12.512 13.313 14.113 11.207	175.9 Velocities sta SingleStk VertVel(m/s) 7.83 7.62 7.28 6.633 6.59 6.25 5.91 5.57 5.30 6.89 6.64 6.64 6.62 3.92	feet rrting at en Plume Temp(K)	d of jet ph	=[0.12F _o (6.	$\label{eq:second} \begin{split} &25D\cdot z_y)^2 - (Va_0)^3 J \cdot (V_{crit}^3 0.16^3) = \\ & & & & & & & & & & & & & & & & & &$	137127 28. crg/c.ubic. F. -37. 77. -33. (-3 20 ft interval 20 ft interval 50-z.,) ²) ^{1/3} / a 4V _{plume} *a ² +λ ²))
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s fable of Plume Top-Hat Diameters (2a) and F Height (feet) above ground Stack.Rel.Ht = 27.4 40.0 60.0 80.0 100.0 120.0 140.0 120.0 120.0 200	45.271 53.629 Jume-Averag (meters) above stack 0.00 3.83 9.933 16.03 22.12 28.22 34.31 40.41 45.27 46.51 52.60 58.70 64.79 70.05	meters meters ed Vertical ¹ Plume Radius(m) 5.604 5.910 6.3896 6.886 7.374 7.861 8.839 8.837 9.225 11.711 12.512 13.313 14.1130 14.1130	175.9 Velocities sta SingleStk VertVel(m/s) 7.83 7.62 7.28 6.633 6.59 6.25 5.91 5.57 5.30 6.89 6.64 6.64 6.62 3.92	feet Plume Temp(K)	d of jet ph	=[0.12F _o (6.	$\label{eq:second} \begin{split} &25D\cdot z_y)^2 - (Va_0)^3 J \cdot (V_{crit}^3 0.16^3) = \\ & & & & & & & & & & & & & & & & & &$	137127 28.org/cubic. F -37.7/ -33.(-3 -8 -8 -8 -8 -8 -8 -8 -8 -8 -8
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Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s fable of Plume Top-Hat Diameters (2a) and F Height (feet) above ground Stack.Rel.Ht = 27.4 40.0 60.0 80.0 100.0 120.0 120.0 120.0 120.0 200.0 220.0 240.0 Top of Single jet = 257.2 300.0 350.0 400.0 450.0	45.271 53.629 Jume-Averag (meters) above stack 0.00 3.83 9.933 16.03 22.12 28.22 34.321 40.41 45.27 46.51 52.60 58.70 64.79 70.05 83.08 98.32 113.56 128.80	meters meters ed Vertical 1 Plume Radius(m) 5.604 5.910 6.388 6.886 7.374 7.861 8.837 9.225 11.711 12.512 13.313 14.113 1	175.9 Velocities stat SingleStk VertVel(m/s) 7.83 6.639 6.25 5.91 5.57 5.30 6.89 6.64 6.62 6.64 6.62 3.92 4.09 4.08 4.00 3.90 3.80	feet rting at en Plume Temp(K) 287.35 284.07 281.00 279.22 278.06	d of jet ph:	=[0.12F _o (6.	$\label{eq:second} \begin{split} 25D\cdot z_{v}^{2} - (Va)_{o}^{3}) (V_{crit}^{3}0.16^{3}) = \\ & \underline{htp:}//www.17\\ \\ btp://www.17\\ \\ btp://www.17\\ \\ btp://www.17\\ \\ btp://www.17\\ \\ btp://www.17\\ \\ btp://www.17\\ \\ critical \\ c$	137127 28. crg/c.ubic. I. -37.7. -33.: -8 20 ft Interval BLH to Top of Je 50-z,) ² p ¹³ / a 4V _{plume} *a ²⁺ λ ²) y ⁽¹²⁾ x z ⁽¹²⁾ 50 ft Interval
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Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s fable of Plume Top-Hat Diameters (2a) and F Height (feet) above ground Stack.Rel.Ht = 27.4 40.0 60.0 80.0 100	45.271 53.629 Iume-Averag (meters) above stack 0.00 3.83 9.93 16.03 22.12 28.22 34.31 40.41 45.27 46.51 58.70 64.79 70.05 83.00 98.32 113.56 128.80 113.56 128.80 115.28 128.80 115.28 128.80 115.28 128.80 115.28 128.80 115.28 128.80 115.28 128.80 115.28 128.80 115.28 128.80 115.28 128.80 1	meters meters ed Vertical Plume Radius(m) 5.604 5.910 6.398 6.866 7.374 7.861 8.349 8.837 9.225 11.711 12.512 13.313 14.113 11.207 12.582 15.021 17.459 19.888 22.336 24.774 27.213	175.9 Velocities sta SingleStk VertVel(m/s) 7.83 7.62 7.28 6.93 6.69 6.69 6.69 6.69 6.69 6.69 6.69	feet rting at en Plume Temp(K) 287.35 284.07 281.00 279.22 278.06 277.25 276.67	d of jet ph	=[0.12F _o (6.	$\label{eq:second} \begin{split} 25D\cdot z_{v}^{2} - (Va)_{o}^{3}) (V_{crit}^{3}0.16^{3}) = \\ & \underline{htp:}//www.17\\ \\ btp://www.17\\ \\ btp://www.17\\ \\ btp://www.17\\ \\ btp://www.17\\ \\ btp://www.17\\ \\ btp://www.17\\ \\ critical \\ c$	137127 28.crg/cubic.f: -37.77 -33.(-3 -8 -8 20 ft Interval BLHt to Top of Je 50-z,) ²) ^{1/3} / a 4V _{plume} *a ² A ²)) ⁽¹⁰² x z ^(1/2) 50 ft Interval
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s Table of Plume Top-Hat Diameters (2a) and F Height (feet) above ground Stack.Rel.Ht = 27.4 40.0 60.0 80.0 100.0 120.0 140.0 180.0 500.0 200	45.271 53.629 (meters) above stack 0.00 3.83 9.93 16.03 22.12 28.22 34.31 40.41 45.27 46.51 58.70 64.79 70.05 83.08 98.32 113.56 128.80 114.04 115.28 128.80 113.56 128.80 114.04 115.28 113.56 128.80 114.04 115.28	meters meters ed Vertical ' Plume Radius(m) 5.604 5.604 5.604 6.398 6.886 7.374 7.861 8.349 8.837 9.225 11.711 12.512 13.313 14.113 11.207 12.582 15.021 17.459 19.888 22.336 22.336 24.774 27.213 29.651	175.9 Velocities sta SingleStk VertVel(m/s) 7.83 7.62 7.28 6.93 6.63 6.65 6.64 6.65 6.64 6.65 2.3.92 4.09 4.00 4.00 3.90 3.80 3.70 3.61 3.52	feet rrting at en Plume Temp(K) 287.35 284.07 281.00 279.22 278.06 277.25 276.62	d of jet phi	=[0.12F _o (6.	$\label{eq:second} \begin{split} 25D\cdot z_{v}^{2} - (Va)_{o}^{3}) (V_{crit}^{3}0.16^{3}) = \\ & \underline{htp:}//www.17\\ \\ btp://www.17\\ \\ btp://www.17\\ \\ btp://www.17\\ \\ btp://www.17\\ \\ btp://www.17\\ \\ btp://www.17\\ \\ critical \\ c$	137127 28. crg/c.ubic. I. -37.7. -33.: -8 20 ft Interval BLH to Top of Je 50-z,) ² p ¹³ / a 4V _{plume} *a ²⁺ λ ²) y ⁽¹²⁾ x z ⁽¹²⁾ 50 ft Interval
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s fable of Plume Top-Hat Diameters (2a) and F Height (feet) above ground Stack.Rel.Ht = 27.4 40.0 60.0 80.0 120.0 120.0 120.0 120.0 120.0 200.0 220.0 220.0 220.0 220.0 220.0 220.0 200	45.271 53.629 Iume-Averag (meters) above stack 0.00 3.83 9.933 16.03 22.12 28.22 34.31 40.41 45.27 46.51 52.60 58.70 64.79 70.05 83.08 98.32 113.56 128.80 144.04 159.28 113.56 211.52.80	meters meters ed Vertical ' Plume Radius(m) 5.604 5.910 6.388 6.886 7.374 7.861 8.837 9.225 11.711 12.512 13.313 14.113 11.207 12.552 15.021 17.459 19.898 22.336 24.774 32.690	175.9 Velocities sta SingleStk VertVel(m/s) 7.83 7.62 7.28 6.93 6.59 6.25 5.91 5.57 5.30 6.89 6.64 6.62 4.09 4.08 4.00 3.90 3.80 3.30 3.80 3.70 3.61 3.52 3.44	feet rting at en Plume Temp(K) 287.35 284.00 279.22 278.06 277.25 276.67 276.67 276.25 275.88	d of jet ph	=[0.12F _o (6.	$\label{eq:second} \begin{split} 25D\cdot z_{v}^{2} - (Va)_{o}^{3}) (V_{crit}^{3}0.16^{3}) = \\ & \underline{htp:}//www.17\\ \\ btp://www.17\\ \\ btp://www.17\\ \\ btp://www.17\\ \\ btp://www.17\\ \\ btp://www.17\\ \\ btp://www.17\\ \\ critical \\ c$	137127 28. org/cubic. I: -37.7. -33.: -8 20 ft Interval Bel/t to Top of Ja 50 z,) ²) ^{1/2} / a 4V _{plume} *a ² x ²) ²) 50 ft Interval 50 ft Interval
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s fable of Plume Top-Hat Diameters (2a) and F Height (feet) above ground Stack.Rel.Ht = 27.4 40.0 60.0 80.0 100	45.271 53.629 Iume-Averag (meters) above stack 0.00 3.83 9.93 16.03 22.12 28.22 34.31 40.41 45.27 46.51 52.60 58.70 64.79 70.05 83.00 98.32 113.56 128.80 144.04 159.28 114.52 113.56 128.80 144.04 159.28	meters meters meters ed Vertical Plume Radius(m) 5.604 5.910 6.388 6.886 7.374 7.861 8.837 9.225 11.711 12.512 13.313 14.113 14.113 14.2582 15.021 17.459 19.888 22.336 24.774 27.213 32.090 34.528	175.9 Velocities stat SingleStk VertVel(m/s) 7.28 6.59 6.25 5.91 5.57 5.30 6.89 6.64 6.62 3.92 4.09 4.00 3.90 3.80 3.30 3.80 3.70 3.61 3.52 3.44 4.337	feet Plume Temp(K) 287.35 284.07 281.00 279.25 278.66 277.25 276.67 276.62 275.88 275.60	d of jet ph:	=[0.12F _o (6.	$\label{eq:second} \begin{split} 25D\cdot z_{v}^{2} - (Va)_{o}^{3}) (V_{crit}^{3}0.16^{3}) = \\ & \underline{htp:}//www.17\\ \\ btp://www.17\\ \\ btp://www.17\\ \\ btp://www.17\\ \\ btp://www.17\\ \\ btp://www.17\\ \\ btp://www.17\\ \\ critical \\ c$	137127 28. org/cubic. I: -37.7. -33.: -8 20 ft Interval Bel/t to Top of Ja 50 z,) ²) ^{1/2} / a 4V _{plume} *a ² x ²) ²) 50 ft Interval 50 ft Interval
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s fable of Plume Top-Hat Diameters (2a) and F Height (feet) above ground Stack.Rel.Ht = 27.4 40.0 60.0 80.0 100	45.271 53.629 (meters) above stack 0.00 3.83 9.93 16.03 22.12 28.22 34.31 40.41 45.27 46.51 52.60 58.70 64.79 70.05 83.00 98.32 113.56 128.80 98.32 113.56 128.80 114.40 159.28 114.52 189.76 20.50.00 220.24 225.48	meters meters ed Vertical ' Plume Radius(m) 5.604 5.910 6.398 6.866 7.374 7.861 8.349 8.837 9.225 11.711 12.512 13.313 14.113 11.207 12.582 15.021 17.459 19.898 22.336 24.774 27.213 29.661 32.090 34.528 36.966	175.9 Velocities sta SingleStk VertVel(m/s) 7.83 6.93 6.69 6.625 6.93 6.55 6.64 6.64 6.62 8.99 6.76 6.64 4.00 3.80 3.80 3.80 3.80 3.370 3.61 3.52 3.44 3.37 3.30	feet rting at em Plume Temp(K) 287.35 284.07 281.00 279.22 278.06 277.28 276.67 276.22 276.88 277.588 275.88 27	d of jet phi	=[0.12F _o (6.	$\label{eq:second} \begin{split} 25D\cdot z_{v}^{2} - (Va)_{o}^{3}) (V_{crit}^{3}0.16^{3}) = \\ & \underline{htp:}//www.17\\ \\ btp://www.17\\ \\ btp://www.17\\ \\ btp://www.17\\ \\ btp://www.17\\ \\ btp://www.17\\ \\ btp://www.17\\ \\ critical \\ c$	137127 28. org/cubic. I: -37.7. -33.: -8 20 ft Interval Bel/t to Top of Ja 50 z,) ²) ^{1/2} / a 4V _{plume} *a ² x ²) ²) 50 ft Interval 50 ft Interval
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s fable of Plume Top-Hat Diameters (2a) and F Height (feet) above ground Stack.Rel.Ht = 27.4 40.0 60.0 80.0 100.0 120.0 130.0 100.0 120.0 140.0 100.0 5 <i>single Jet 5.3 m/s Height</i> = 175.9 180.0 200.0 220.0 240.0 Top of Single jet = 257.0 300.0 350.0 400.0 550.0 600.0 650.0 700.0 800.0 650.0 700.0 800.0 800.0 800.0 850.0	45.271 53.629 (meters) above stack 0.00 3.383 9.93 16.03 22.12 28.22 34.31 40.41 45.27 46.51 52.60 58.70 64.79 70.55 8.308 98.32 113.56 128.40 113.56 128.40 14.04 159.22 113.56 20.50 20.20.24 20.50.72	meters meters ed Vertical ' Plume Radius(m) 5.604 5.910 6.398 6.886 7.374 7.861 8.349 8.837 9.225 11.711 12.512 13.313 14.113 11.207 15.021 17.459 19.888 22.336 24.774 27.213 29.651 32.090 34.528 36.966 39.405	175.9 Velocities sta SingleStk VertVel(m/s) 7.83 7.62 7.28 6.93 6.69 6.65 6.64 6.65 3.92 4.09 4.00 3.80 3.80 3.80 3.80 3.70 3.80 3.70 3.81 3.52 3.44 3.37 3.30 3.24	feet Plume Temp(K) 287.35 284.07 281.00 279.22 278.06 277.25 276.62 276.88 275.60 275.88 275.60	d of jet phi	=[0.12F _o (6.	$\label{eq:second} \begin{split} 25D\cdot z_y)^2 - (Va_0^{-3})(V_{crit}^{-3}0.16^3) = \\ & http://www.17\\ est he real solution x = z-zy = \\ & or z(m/above stack) = \\ & z(t/above ground) = \\ $	137127 28. org/cubic.1 -37.7 -33 -8 -9 -9 -9 -9 -9 -9 -9 -9 -9 -9
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s Table of Plume Top-Hat Diameters (2a) and F Height (feet) above ground Stack.Rel.Ht = 27.4 40.0 60.0 80.0 100.0 120.0 120.0 120.0 120.0 200.0 220.0 240.0 Top of Single jet = 257.2 300.0 350.0 400.0 550.0 600.0 650.0 600.0 650.0 600.0 650.0 700.0 750.0 800.0 8	45.271 53.629 (meters) above stack 0.00 3.83 9.93 16.03 22.12 28.22 34.31 40.41 45.27 46.51 52.60 58.70 64.79 70.05 83.00 98.32 113.56 128.80 98.32 113.56 128.80 114.40 4159.28 114.52 139.76 20.548	meters meters ed Vertical ' Plume Radius(m) 5.604 5.910 6.398 6.886 7.374 7.861 8.349 8.837 9.225 11.711 12.512 13.313 14.113 11.207 15.021 17.459 19.888 22.336 24.774 27.213 29.651 32.090 34.528 36.966 39.405	175.9 Velocities sta SingleStk VertVel(m/s) 7.83 7.62 7.28 6.93 6.59 6.59 6.59 6.59 6.59 6.64 6.64 6.62 3.92 4.09 4.08 4.00 3.90 3.80 3.70 3.61 3.52 3.44 3.37 3.30 3.24 4.337 3.30 3.24 4.318 3.25 3.25 3.25 3.25 3.25 3.25 3.25 3.25	feet Plume Temp(K) 287.35 284.07 281.00 279.22 278.06 277.25 276.62 275.88 275.60 275.38 275.60 275.38	d of jet phi	=[0.12F _o (6.	$\label{eq:second} \begin{split} 25D\cdot z_y)^2 - (Va_0^{-3})(V_{crit}^{-3}0.16^3) = \\ & http://www.17\\ est he real solution x = z-zy = \\ & or z(m/above stack) = \\ & z(t/above ground) = \\ $	137127 28. org/cubic.1 -37.7 -33 -8 -9 -9 -9 -9 -9 -9 -9 -9 -9 -9
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Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s Table of Plume Top-Hat Diameters (2a) and F Height (feet) above ground Stack.Rel.Ht = 27.4 40.0 60.0 80.0 100.0 120.0 120.0 120.0 120.0 200.0 220.0 240.0 Top of Single jet = 257.2 300.0 350.0 400.0 550.0 600.0 650.0 600.0 650.0 600.0 650.0 700.0 750.0 800.0 8	45.271 53.629 (meters) above stack 0.00 3.833 9.833 16.03 22.12 28.22 34.31 40.41 45.27 46.51 58.70 64.79 70.05 83.08 98.32 113.56 128.80 144.04 159.28 113.56 128.80 144.04 159.28 113.56 20.00 20.20,24 20.50,00 220.24 255.48 256.56	meters meters meters Plume Radius(m) 5.604 5.910 6.388 6.886 7.374 7.861 8.837 9.225 11.711 12.512 13.313 14.113 11.207 12.582 15.021 17.459 19.898 22.336 24.774 32.090 34.528 36.966 39.405 39.405 41.843 44.282	175.9 Velocities sta SingleStk VertVel(m/s) 7.83 7.62 7.28 6.93 6.59 6.59 6.59 6.59 6.59 6.64 6.64 6.62 3.92 4.09 4.08 4.00 3.90 3.80 3.70 3.61 3.52 3.44 3.37 3.30 3.24 4.337 3.30 3.24 4.318 3.25 3.25 3.25 3.25 3.25 3.25 3.25 3.25	feet Plume Temp(K) 287.35 284.07 284.07 284.07 279.22 278.06 277.25 276.67 276.22 275.88 275.60 275.38 275.20 275.38 275.20 275.38	d of jet ph:	=[0.12F _o (6.	$\label{eq:second} \begin{split} 25D\cdot z_y)^2 - (Va_0^{-3})(V_{crit}^{-3}0.16^3) = \\ & http://www.17\\ est he real solution x = z-zy = \\ & or z(m/above stack) = \\ & z(t/above ground) = \\ $	137127 28. org/cubic. I: -37.7. -33.: -8 20 ft Interval Bel/t to Top of Ja 50 z,) ²) ^{1/2} / a 4V _{plume} *a ² x ²) ²) 50 ft Interval 50 ft Interval
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Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s Table of Plume Top-Hat Diameters (2a) and F Height (feet) above ground Stack.Rel.Ht = 27.4 40.0 60.0 80.0 100.0 120.0 20.0 20.0 20.0 20.0 20.0	45.271 53.629 (meters) above stack 0.00 3.83 9.93 16.03 22.12 28.22 34.31 40.41 45.27 46.61 52.60 58.70 64.79 70.05 83.08 98.32 113.65 128.80 144.04 159.28 113.55 128.80 144.04 159.28 113.55 265.96 220.24 235.48 250.72 265.96 220.24 235.48 250.72 265.96 220.24 235.48 250.72 265.96 220.24 235.48 250.72 265.96 220.24 235.48 250.72 265.96 220.24 210.25	meters meters meters ed Vertical ' Plume Radius(m) 5.604 5.910 6.388 6.886 7.374 7.861 8.349 8.837 9.225 11.711 12.512 13.313 14.113 11.207 12.582 15.021 17.459 19.898 22.336 24.774 27.213 29.651 32.090 34.528 36.966 32.090 34.528 36.966 39.405 41.843 44.282 46.720 49.158 51.597 54.035	175.9 Velocities sta SingleStk VertVel(m/s) 7.83 7.62 7.28 6.93 6.69 6.659 6.591 5.57 5.30 6.89 6.64 4.00 4.00 4.00 3.90 3.80 3.80 3.80 3.30 3.61 3.52 3.31 3.32 3.31 3.32 3.32 3.32 3.32 3.3	feet Plume Temp(K) 287.35 284.00 279.22 278.06 277.25 276.62 275.88 275.60 275.38 275.60 275.38 275.60 275.38 275.60 275.38 275.60 275.38 275.60 275.38 275.60 275.38 275.60 275.38 275.60 275.38 275.60 275.38 275.60 275.38 275.60 275.38 275.60 275.38 275.60 275.38 275.60 275.38 275.60 275.38 275.60 275.38 275.60 275.40 277.40 275.	d of jet ph:	=[0.12F _o (6.	$\label{eq:second} \begin{split} 25D\cdot z_y)^2 - (Va_0^{-3})(V_{crit}^{-3}0.16^3) = \\ & http://www.17\\ est he real solution x = z-zy = \\ & or z(m/above stack) = \\ & z(t/above ground) = \\ $	137127 28.org/cubic.ft -37.77 -33.3 -8 20 ft Interval idel:Ht to Top of Jet (100 ft Interval 100 ft Interval 100 ft Interval
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s fable of Plume Top-Hat Diameters (2a) and F Height (feet) above ground Stack.Rel.Ht = 27.4 40.0 60.0 80.0 100.0 120	45.271 53.629 (meters) above stack 0.00 3.383 9.93 16.03 22.12 28.22 34.31 40.41 45.27 46.51 58.70 64.79 70.05 83.08 98.32 113.56 128.80 144.04 159.28 113.56 28.20 20.24 25.54 225.59 226.59 226.59 226.44 311.68 326.92	meters meters ed Vertical ' Plume Radius(m) 5.604 5.910 6.398 6.886 7.374 7.861 8.349 8.837 9.225 11.711 12.512 13.313 14.113 12.512 13.313 14.113 12.512 15.021 17.459 19.898 22.336 15.021 17.459 19.898 22.336 15.021 17.459 19.898 22.336 15.021 17.459 19.898 22.336 15.021 17.459 19.898 22.356 13.021 17.459 19.898 22.356 13.021 17.459 19.898 22.356 13.021 17.459 19.898 22.356 13.021 17.459 19.898 22.356 13.021 17.459 13.021 14.133 24.774 27.213 29.651 39.005 41.843 34.528 36.966 39.405 41.843 44.222 46.720 49.158 51.597 54.035 56.474	175.9 Velocities sta SingleStk VertVel(m/s) 7.28 6.59 6.25 5.91 6.57 5.30 6.89 6.64 6.62 6.64 6.62 3.92 4.09 4.09 4.08 4.00 3.80 3.80 3.30 3.80 3.30 3.30 3.30 3	feet Plume Temp(K) 287.35 284.07 284.07 284.07 278.22 278.06 277.25 276.67 277.25 275.88 275.60 275.20 275.20 275.20 275.20 275.20 275.20 275.20 275.48 275.20 276.49 274.49 274.63 274.63 274.63 274.63	d of jet ph:	=[0.12F _o (6.	$\label{eq:second} \begin{split} 25D\cdot z_y)^2 - (Va_0^{-3})(V_{crit}^{-3}0.16^3) = \\ & http://www.17\\ est he real solution x = z-zy = \\ & or z(m/above stack) = \\ & z(t/above ground) = \\ $	137127 28. crg/c.ubic. f. -37. 77 -33. (-8

SINGLE/Approximated Plume Average Vertic Based on 1 cell/heat exchanger. Calc' eff.diam	"Aviation Sal							
for each heat exchanger with each fan at 13' ID		-	-			ditions at V	arious Heights in the Plume	9
204,600 ACFM total for each fan). 42 fans							Australia," Dr. K.T. Spilla	
Ambient Conditions:					-		eutral conditions (d0/dz=0 or	
Ambient Potential Temp θ_a	310.37	Kelvins	99.0	°F		0.3048	meters/feet	
Plume Exit Conditions:					Gravity g	9.81	m/s ²	
Stack Height hs	8.36	meters	27.42	feet	λ	1.11		
Merged Stack Diameter D	25.6791	meters	1011.0	inches	λο	~1.0		
Stack Velocity V _{exit}	7.83	m/s	25.69	ft/sec	4Vol/(60πD) ²)		
Individual Heat Exchanger Volumetric Flow	4,055.54	cu.m/sec	8,593,200	ACFM	πV _{exit} D ² /4			Sect.2/¶1
Stack Potential Temp θ _s	318.15	Kelvins	113.0	°F				
Initial Stack Buoyancy Flux Fo	309.6816	m ⁴ /s ³	14.0	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 belo	w)
Number of Heat Exchangers n	1			1.000			cation Factor (n ^{0.25})	
conditions at End (Top) of Jet Phase:								
Height above Stack z _{jet}	160.495	meters*	526.6	feet*	z _{jet} = 6.250), meters*=	meters above stack top	Sect.3/¶1
Height above Ground ziet+hs	168.852	meters	554.0	feet				
Vertical Velocity V _{iet}	3.915	m/s	12.85	ft/sec	V _{jet} = 0.5V	_{exit} = V _{exit} /2		
Plume Top-Hat Diameter 2a _{jet}	51.358	meters	168.5	feet	2a _{jet} = 2D		Conservation of momentum	
. ,-					,			
pillane Methodology - Analytical Solutions	or Calm Con	ditions for P	ume Heights	above Jet	Phase			
Single Plume-averaged Vertical Velocity						given by e	quations below:	
Plume Top-Hat Radius a	• •	olutions in T	•				rease with height	Sect.2/Eq.6
Virtual Source Height z _v	1.975	meters*	6.5	feet*			ers*=meters above stack top	Sect.2/Eq.6
Height above Ground zv+hs		meters	33.9			-, ,,	where $(\theta_a/\theta_s)^{1/2} = (\theta_e/\theta_s)^{1/2} =$	
Vertical Velocity V		olutions in T			${(Va)_{n}^{3} + 0}$	12F. [(z-7.	$(0_{2}, 0_{3})^{2} - (6.25\text{D}-z_{v})^{2}]^{(1/3)} / a$	Sect.2.1(6)
Product (Va) _o	99.305				V _{exit} D/2(θ _e /			
Single Heat Exchanger Results:	25.000				unit (0.6/			
Solve for plume-averaged vertical velo	city at height	600.0	feet	182.88	meters abo	ve around (z'+h。)	
Gives the following Height above Stack z'	174.522		572.6				<i>u</i> /	
Plume Top-Hat Diameter 2a'		meters	181.2		2a'=2*0.16	7'-7)		Sect.2/Eq.6
Vertical Velocity V	3.797			ft/sec			() ² -(6.25D-z _v) ²]) ^(1/3) /(2a'/2)	Sect.2/Eq.6
	0.101		12.10	10000	1-((10))	0.1210[(2.2)	// (0.200 20/ jj /(20/2)	
Solve for Height of CASC critical vertical	velocity V aria	5 30	m/s plume-a	veraged v	ertical velo	city	Critical	VV < Top of J
Find Height above Stack z _{crit}		meters	#N/A	_		-	Itaneously in both eqs. (i.e.,	
Height above Ground z _{crit} +h _s	7	meters	#N/A				bic equation ax ³ +bx ² +cx+d=	
neight above cround zent ms		meters	#1 V A	1001	ion v = v crit v	-		o, where
						a-1 c-0	and b(0.12E)/(V 30.163)-	-60 940
Internolated Height of critical vertical ve		Phase ·			and d		and b=-(0.12F _o)/(V _{crit} ³ 0.16 ³)= 25D ₂ 7_) ² -(Va) ³]/(V ³ 0.16 ³)=	
Interpolated Height of critical vertical ve	locity in Jet		340 3	feet	and d		25D-z _v) ² -(Va) _o ³]/(V _{crit} ³ 0.16 ³)=	-74564.
Find Height above Stack z _{crit}	elocity in Jet	meters	340.3		and d	=[0.12F _o (6.2	25D-z _v) ² -(Va) _o ³]/(V _{crit} ³ 0.16 ³)= http://www.17	-74564. 28.org/cubic.ht
	locity in Jet	meters	340.3 367.8		and d	=[0.12F _o (6.2	25D-z _v) ² -(Va) _o ³]/(V _{crit} ³ 0.16 ³)= <u>http://www.17</u> s the real solution x = z-zv =	-74564. 28.org/cubic.ht 74.40
Find Height above Stack z _{crit}	elocity in Jet	meters			and d	=[0.12F _o (6.2	$25D-z_v)^2 - (Va)_o^3 / (V_{crit}^{-3}0.16^3) = \frac{http://www.17}{s}$ s the real solution x = z-zv = or z(m/above stack) =	-74564. 28.org/cubic.ht 74.40 76.3
Find Height above Stack z_{crit} Height above Ground $z_{crit} + h_s$	elocity in Jet 103.735 112.092	meters meters	367.8	feet		=[0.12F _o (6.2	25D-z _v) ² -(Va) _o ³]/(V _{crit} ³ 0.16 ³)= <u>http://www.17</u> s the real solution x = z-zv =	-74564. 28.org/cubic.ht 74.40 76.3
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s Table of Plume Top-Hat Diameters (2a) and F	elocity in Jet 103.735 112.092	meters meters ed Vertical	367.8 Velocities sta	feet arting at en		=[0.12F _o (6.2	$25D-z_v)^2 - (Va)_o^3 / (V_{crit}^{-3}0.16^3) = \frac{http://www.17}{s}$ s the real solution x = z-zv = or z(m/above stack) =	-60.940 -74564. 28.org/cubic.ht 74.40 76.3 278
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s able of Plume Top-Hat Diameters (2a) and F Height (feet)	locity in Jet 103.735 112.092 ume-Averag (meters)	meters meters ed Vertical ¹ Plume	367.8 Velocitiessta SingleStk	feet arting at en Plume		=[0.12F _o (6.2	$25D-z_v)^2 - (Va)_o^3 / (V_{crit}^{-3}0.16^3) = \frac{http://www.17}{s}$ s the real solution x = z-zv = or z(m/above stack) =	-74564. 28.org/cubic.h 74.40 76.3
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s able of Plume Top-Hat Diameters (2a) and P Height (feet) above ground	locity in Jet 103.735 112.092 lume-Averag (meters) above stack	meters meters ed Vertical Plume Radius(m)	367.8 Velocitiessta SingleStk VertVel(m/s)	feet arting at en Plume		=[0.12F _o (6.2	$25D-z_v)^2 - (Va)_o^3 / (V_{crit}^{-3}0.16^3) = \frac{http://www.17}{s}$ s the real solution x = z-zv = or z(m/above stack) =	-74564. 28.org/cubic.h 74.40 76.3
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s able of Plume Top-Hat Diameters (2a) and P Height (feet) above ground Stack.Rel.Ht = 27.4	locity in Jet 103.735 112.092 ume-Averag (meters) above stack 0.00	meters meters ed Vertical Plume Radius(m) 12.840	367.8 Velocities sta SingleStk VertVel(m/s) 7.83	feet arting at en Plume Temp(K)		=[0.12F _o (6.2	25D-z _v) ² -(Va ₀ ³)/(V _{crt} ³ 0.16 ³)= http://www.17 s the real solution x = z-zv = or z(m/above stack) = z(ft/above ground) =	-74564. 28.org/cubic.h 74.40 76.3 278
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s able of Plume Top-Hat Diameters (2a) and P Height (feet) above ground Stack.Rel.Ht = 27.4 40.0	elocity in Jet 103.735 112.092 Hume-Averag (meters) above stack 0.00 3.83	meters meters ed Vertical ¹ Plume Radius(m) 12.840 13.146	367.8 Velocities sta SingleStk VertVel(m/s) 7.83 7.74	feet arting at en Plume Temp(K)		=[0.12F _o (6.2	25D-z _v) ² -(Va ₀ ³)/(V _{crt} ³ 0.16 ³)= <u>http://www.17</u> s the real solution x = z-zv = or z(m/above stack) = z(tl/above ground) = Jet Phase Eqs:	-74564. 28.org/cubic.h 74.40 76.3 27/ 20 ft Interval
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s able of Plume Top-Hat Diameters (2a) and F Height (feet) above ground <i>Stack.Rel.Ht</i> = 27.4 40.0 60.0	locity in Jet 103.735 112.092 (uume-Averag (meters) above stack 0.00 3.83 9.93	meters meters ed Vertical ¹ Plume Radius(m) 12.840 13.146 13.634	367.8 Velocities sta SingleStk VertVel(m/s) 7.83 7.74 7.59	feet arting at en Plume Temp(K)		=[0.12F _o (6.2	25D-z _v) ² -(Va ₀ ³)/(V _{crt} ³ 0.16 ³)= <u>http://www.17</u> s the real solution x = z-zy = or z(m/above stack) = z(ft/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R	-74564. 28.org/cubic.h 74.40 76.3 27/ 20 ft Interval
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s able of Plume Top-Hat Diameters (2a) and F Height (feet) above ground <i>Stack.Rel.Ht</i> = 27.4 40.0 60.0 80.0	locity in Jet 103.735 112.092 (meters) above stack 0.00 3.83 9.93 16.03	meters meters ed Vertical Plume Radius(m) 12.840 13.146 13.634 14.122	367.8 Velocities sta SingleStk VertVel(m/s) 7.83 7.74 7.59 7.44	feet arting at en Plume Temp(K)		=[0.12F _o (6.2	25D-z _v) ² -(Va ₀ ³)/(V _{crt} ³ 0.16 ³)= <u>http://www.17</u> s the real solution x = z-zv = or z(m/above stack) = z(tl/above ground) = Jet Phase Eqs:	-74564. 28.org/cubic.h 74.40 76.3 27/ 20 ft Interval
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s able of Plume Top-Hat Diameters (2a) and F Height (feet) above ground Stack.Rel.Ht = 27.4 40.0 60.0 80.0 100.0	elocity in Jet 1 103.735 112.092 'lume-Averag (meters) above stack 0.00 3.83 9.93 16.03 22.12	meters meters ed Vertical Plume Radius(m) 12.840 13.146 13.634 14.122 14.609	367.8 Velocities sta SingleStk VertVel(m/s) 7.83 7.74 7.59 7.44 7.29	feet arting at en Plume Temp(K)		=[0.12F _o (6.2	25D-z _v) ² -(Va ₀ ⁻³)/(V _{crt} ³ 0.16 ³)= <u>http://www.17</u> s the real solution x = z-zy = or z(m/above stack) = z(ft/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations:	-74564 (28.org/cubic.h 74.40 76.3 27 20 ft Interval
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s able of Plume Top-Hat Diameters (2a) and P Height (feet) above ground Stack.Rel.Ht = 27.4 40.0 60.0 100.0 120.0	elocity in Jet 1 103.735 112.092 lume-Averag (meters) above stack 0.00 3.83 9.93 16.03 22.12 28.22	meters meters ed Vertical ¹ Plume Radius(m) 12.840 13.146 13.634 14.122 14.609 15.097	367.8 Velocities sta SingleStk VertVel(m/s) 7.83 7.74 7.59 7.44 7.29 7.14	feet arting at en Plume Temp(K)		=[0.12F _o (6.2	25D-z _v) ² -{Va ₀ ³ }/{V _{crt} ³ 0.16 ³ } = <u>http://www.17</u> s the real solution x = z-zv = or z(m/above stack) = z(ft/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: V _{plum} =((Va ₀) ³ +0.12F ₀ (z-z _v) ² -(6.2)	-74564 (28.org/cubic.h 74.40 76.3 27 20 ft Interval
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s able of Plume Top-Hat Diameters (2a) and P Height (feet) above ground <i>Stack.Rel.Ht</i> = 27.4 40.0 60.0 80.0 100.0 120.0 140.0	Alocity in Jet 103.735 112.092 Jume-Averag (meters) above stack 0.000 3.83 9.93 16.03 22.12 2.8.22 34.31	meters meters ed Vertical Plume Radius(m) 12.840 13.634 14.122 14.609 15.097 15.585	367.8 Velocities sta SingleStk VertVel(m/s) 7.83 7.74 7.59 7.44 7.29 7.14 6.99	feet Irting at en Plume Temp(K)		=[0.12F _o (6.2	25D-z _v) ² -(Va ₀ , ³)/(V _{crt} ³ 0.16 ³)= http://www.17 s the real solution x = z-zv = or z(m/above stack) = z(tr/above ground) = Jet Phase Eqs: Linearly interpolated from Stack R Spillane Equations: V _{plom} =((Va) ₀ ³ +0.12F ₀ (z-z _v) ² -(6.2 a = 0.16(z-z _v)	-74564 28.org/cubic.h 74.4(76.3 27 20 ft Interval el-Ht to Top of Jet 50-z.,) ²]) ¹⁰ / a
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s able of Plume Top-Hat Diameters (2a) and F Height (feet) above ground Stack.Rel.Ht = 27.4 40.0 60.0 80.0 100.0 120.0 140.0 160.0	elocity in Jet 103.735 112.092 lume-Averag (meters) above stack 0.000 3.83 9.93 16.03 22.12 28.222 34.31 40.41	meters meters ed Vertical Plume Radius(m) 12.840 13.146 13.634 14.609 15.097 15.585 16.072	367.8 Velocities sta SingleStk VertVel(m/s) 7.83 7.74 7.59 7.44 7.29 7.14 6.99 6.84	feet trting at em Plume Temp(K)		=[0.12F _o (6.2	$25D \cdot z_y)^2 - (Va_0,^3) \cdot (V_{crit}^3 0.16^3) = \\ http://www.17 \\ s the real solution x = z - z y = \\ or z(m/above stack) = \\ z(tr/above ground) = \\ z(tr/above ground) = \\ \\ Jet Phase Eqs: \\ Linearly interpolated from Stack R \\ Spillane Equations: \\ V_{stams} = (Va_0,^3 + 0.12F_a](z - z_y)^2 - (6.2 \\ a = 0.16(z - z_y) \\ \theta_p = \theta_s(1 + (1 - (\theta_0/\theta_s))^* (V_{ext}D^2)/(V_{ext}D^2)) \\ \end{cases}$	-74564 28.org/cubic.h 74.4(76.3 27 20 ft Interval el-Ht to Top of Jet 50-z.,) ²]) ¹⁰ / a
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s able of Plume Top-Hat Diameters (2a) and F Height (feet) above ground <i>Stack.Rel.Ht</i> = 27.4 40.0 60.0 80.0 100.0 120.0 140.0 180.0	elocity in Jet 103.755 112.092 lume-Averag (meters) above stack 0.00 3.833 9.933 16.03 22.12 28.22 34.31 40.41 46.51	meters meters ed Vertical ' Plume Radius(m) 12.840 13.634 14.122 14.609 15.097 15.585 16.072 16.560	367.8 Velocities stat SingleStk VertVel(m/s) 7.73 7.74 7.29 7.14 6.99 6.84 6.70	feet Irting at en Plume Temp(K)		=[0.12F _o (6.2	$25D \cdot z_{v})^{2} - (Va_{0}^{-3}) \cdot (V_{crit}^{3} 0.16^{3}) = \\ http://www.17$ s the real solution x = z-zv = or z(m/above stack) = z(ft/above ground) = $2(ft/above ground) = \\ Lihearly interpolated from Stack R Spillane Equations: Vpluma=((Va)_{0}^{3}+0.12F_{d}(z-z_{v})^{2}-(6.2$ a = 0.16(z-z_{v}) a = 0.16(z-z_{v}) + 0 + 0 + 0 + 0 + 0 + 0 + 0 + 0 + 0 +	-74564 28.org/cubic.h 74.4(76.3 27 20 ft Interval el-Ht to Top of Jet 50-z.,) ²]) ¹⁰ / a
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s able of Plume Top-Hat Diameters (2a) and F Height (feet) above ground <i>Stack.Rel.Ht</i> = 27.4 40.0 60.0 80.0 100.0 120.0 140.0 160.0 180.0 200.0	elocity in Jet 103.735 112.092 lume-Averag (meters) above stack 0.00 3.83 9.93 16.03 22.12 28.22 34.31 4.6.51 52.60	meters meters ed Vertical ' Plume Radius(m) 12.840 13.634 14.122 14.609 15.097 15.585 16.072 16.560 17.048	367.8 Velocities sta SingleStk VertVel(m/s) 7.43 7.74 7.29 7.14 6.99 6.84 6.70 6.55	feet rting at en Plume Temp(K)		=[0.12F _o (6.2	$\begin{split} 25D-z_v)^2 - (Va_0,^3)/(V_{ext}^3 0.16^3) = \\ & http://www.17 \\ s the real solution x = z-zv = \\ or z(m/above stack) = \\ z(ft/above ground) = \\ & z(ft/above ground) = \\ & \\ \hline \\ Jet Phase Eqs: \\ Linearly interpolated from Stack R \\ Spillane Equations: \\ & \\ V_{plame} = ((Va_0,^3+0.12F_d)(z-z_v)^2 - (6.2 a = 0.16(z-z_v)) \\ & \\ & \theta_0 = \theta_0(1+(1-(\theta_0/\theta_0))^*(V_{ext}D^2/t) \\ & CEC Staff Equation: \\ & V_{mp} = n^{0.25}V_{xp} \end{split}$	-74564 28.org/cubic.h 74.4(76.3 27 20 ft Interval el-Ht to Top of Jet 50-z.,) ²]) ¹⁰ / a
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s Table of Plume Top-Hat Diameters (2a) and P Height (feet) above ground <i>Stack.Rel.Ht</i> = 27.4 40.0 60.0 80.0 100.0 120.0 140.0 160.0 180.0 220.0	elocity in Jet 103.735 112.092 lume-Averag (metrs) above stack 0.00 3.83 9.93 16.03 22.12 28.22 34.31 40.41 40.651 52.60 58.70	meters meters ed Vertical / Plume Radius(m) 12.840 13.146 13.146 13.146 14.122 14.609 15.097 15.585 16.072 16.560 17.048 17.535	367.8 Velocities stat SingleStk VertVel(m/s) 7.83 7.74 7.59 7.44 7.29 7.44 6.99 6.84 6.70 6.55 6.40	feet rting at en Plume Temp(K)		=[0.12F _o (6.2	$25D \cdot z_v)^2 - (Va_0, \sigma^3) / (V_{crit}^3 0.16^3) = \\ http://www.17 \\ s the real solution x = z \cdot zv = \\ or z (m/above stack) = \\ z (tl/above ground) = \\ z (tl/above ground) = \\ linearly interpolated from Stack R \\ Spillane Equations: \\ V_{pluma} = ((Va)_0^3 + 0.12F_3 ((z \cdot z_v)^2 - (6.2 a = 0.16 (z \cdot z_v) - (6.2 a = 0.16 (z \cdot z_v) - (6.2 c Staff Equation: V_{mp} = 0.2 V_{sp} = \\ Brigg's Equation: \\ V_{mp} = R (z \cdot z_v) = \\ Reig's Equation: \\ V_{mp} = R (z \cdot z_v) = \\ Reig's Equation: \\ V_{mp} = R (z \cdot z_v) = \\ Reig's Equation: \\ V_{mp} = R (z \cdot z_v) = \\ Reig's Equation: \\ Reig's Reig's Equation: \\ Reig's Reig's Equation: \\ Reig's Reig's Equation: \\ Reig's Rei$	-74564 28.org/cubic.h 74.40 76.5 20 ft Interval el.Ht to Top of Jet 5D-z_J) [*]] ¹⁰ / a
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s able of Plume Top-Hat Diameters (2a) and F Height (feet) above ground <i>Stack.Rel.Ht</i> = 27.4 40.0 60.0 80.0 100.0 120.0 140.0 160.0 120.0 220.0 220.0 224.0	Alocity in Jet 103.735 112.092 Iume-Averag (meters) above stack 0.000 3.83 9.93 16.03 22.12 28.22 34.31 40.41 46.51 52.60 58.70 64.79	meters meters ed Vertical Plume Radius(m) 13.146 13.634 14.122 14.609 15.097 15.585 16.072 16.560 17.048 17.535 18.023	367.8 Velocities stat SingleStk VertVel(m/s) 7.83 7.74 7.59 7.44 7.29 7.44 6.99 6.84 6.70 6.55 6.40 6.55 6.40	feet Inting at en Plume Temp(K)		=[0.12F _o (6.2	$25D \cdot z_v)^2 - (Va_0, s^3) / (V_{crit}^3 0.16^3) = \\ http://www.17 \\ s the real solution x = z \cdot zv = \\ or z (m/above stack) = \\ z (tr/above ground) = \\ z (tr/above ground)$	-74564 28.org/cubic.h 74.40 76.5 20 ft Interval el.Ht to Top of Jet 5D-z_J) [*]] ¹⁰ / a
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s able of Plume Top-Hat Diameters (2a) and F Height (feet) above ground Stack.Rel.Ht = 27.4 40.0 60.0 80.0 100.0 120.0 140.0 180.0 220.0 224.0 240.0 260.0	elocity in Jet 103.735 112.092 lume-Averag (meters) above stack 0.000 3.83 9.93 16.03 22.12 28.22 34.31 40.41 46.51 52.60 58.70 64.79 70.89	meters meters ed Vertical ' Plume Radius(m) 13.146 13.634 14.122 14.609 15.585 16.072 16.560 17.048 17.048 17.048 17.035 18.023 18.511	367.8 Velocities sta SingleStk VertVel(m/s) 7.83 7.74 7.55 7.44 7.55 7.44 7.59 7.44 7.59 7.44 7.59 7.44 7.59 7.44 7.59 7.44 7.59 6.84 6.70 6.55 6.40 6.25 6.40	feet Inting at em Plume Temp(K)		=[0.12F _o (6.2	$25D \cdot z_v)^2 - (Va_0, \sigma^3) / (V_{crit}^3 0.16^3) = \\ http://www.17 \\ s the real solution x = z \cdot zv = \\ or z (m/above stack) = \\ z (tl/above ground) = \\ z (tl/above ground) = \\ linearly interpolated from Stack R \\ Spillane Equations: \\ V_{pluma} = ((Va)_0^3 + 0.12F_3 ((z \cdot z_v)^2 - (6.2 a = 0.16 (z \cdot z_v) - (6.2 a = 0.16 (z \cdot z_v) - (6.2 c Staff Equation: V_{mp} = 0.2 V_{sp} = \\ Brigg's Equation: \\ V_{mp} = R (z \cdot z_v) = \\ Reig's Equation: \\ V_{mp} = R (z \cdot z_v) = \\ Reig's Equation: \\ V_{mp} = R (z \cdot z_v) = \\ Reig's Equation: \\ V_{mp} = R (z \cdot z_v) = \\ Reig's Equation: \\ Reig's Reig's Equation: \\ Reig's Reig's Equation: \\ Reig's Reig's Equation: \\ Reig's Rei$	-74564 28.org/cubic.h 74.40 76.5 20 ft Interval el.Ht to Top of Jet 5D-z_J) [*]] ¹⁰ / a
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s able of Plume Top-Hat Diameters (2a) and F Height (feet) above ground Stack.Rel.Ht = 27.4 40.0 60.0 80.0 100.0 120.0 140.0 120.0 140.0 120.0 240.0 220.0 240.0 220.0 280.0	elocity in Jet 103.735 112.092 lume-Averag (meters) above stack 0.00 3.83 9.93 16.03 22.12 28.22 34.31 40.41 46.51 52.60 58.70 64.79 70.89 76.99	meters meters ed Vertical ' Plume Radius(m) 12.840 13.634 14.122 14.609 15.097 15.585 16.072 16.560 17.048 17.535 18.023 18.511 18.998	367.8 Velocities sta SingleStk VertVel(m/s) 7.83 7.74 7.59 7.44 7.59 7.44 7.59 7.44 6.99 6.84 6.70 6.65 6.40 6.25 6.10 5.95	feet Inting at en Plume Temp(K)		=[0.12F _o (6.2	$25D \cdot z_v)^2 - (Va_0, s^3) / (V_{crit}^3 0.16^3) = \\ http://www.17 \\ s the real solution x = z \cdot zv = \\ or z (m/above stack) = \\ z (tr/above ground) = \\ z (tr/above ground)$	-74564 28.org/cubic.h 74.40 76.5 20 ft Interval el.Ht to Top of Jet 5D-z_J) [*]] ¹⁰ / a
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s able of Plume Top-Hat Diameters (2a) and F Height (feet) above ground Stack.Rel.Ht = 27.4 40.0 60.0 80.0 100.0 120.0 140.0 160.0 140.0 200.0 220.0 240.0 240.0 240.0 260.0 280.0 300.0	elocity in Jet 103.735 112.092 lume-Averagg (meters) above stack 0.000 3.83 9.93 16.03 22.12 28.22 34.31 40.41 46.51 52.60 58.70 64.79 70.89 70.89 70.89 83.08	meters meters ed Vertical ' Plume Radius(m) 12.840 13.634 14.122 14.609 15.097 15.585 16.072 16.560 17.048 17.535 18.023 18.511 18.998 19.486	367.8 Velocities stat SingleStk VertVel(m/s) 7.43 7.74 7.29 7.14 6.99 6.84 6.70 6.55 6.40 6.25 6.10 5.55 5.80	feet rrting at en Plume Temp(K)		=[0.12F _o (6.2	$25D \cdot z_v)^2 - (Va_0, s^3) / (V_{crit}^3 0.16^3) = \\ http://www.17 \\ s the real solution x = z \cdot zv = \\ or z (m/above stack) = \\ z (tr/above ground) = \\ z (tr/above ground)$	-74564 28. org/cubic. h 74. 40 76. 3 20 ft Interval el.ht to Top of Jet 5D:z,y ²) ^{1/0} / a 4V _{plume} *a ² x ²))
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s able of Plume Top-Hat Diameters (2a) and F Height (feet) above ground <i>Stack.Rel.Ht</i> = 27.4 40.0 60.0 80.0 100.0 120.0 140.0 160.0 140.0 220.0 240.0 280.0 280.0 300.0 300.0 300.0 320.0	Alocity in Jet 103.735 112.092 1ume-Averag (meters) above stack 0.000 3.83 9.93 16.03 22.12 28.22 34.31 40.41 46.51 52.60 58.70 64.79 70.89 70.89 83.08 89.18	meters meters ed Vertical Plume Radius(m) 13.146 13.634 14.122 14.609 15.097 15.585 16.072 16.560 17.048 17.535 18.023 18.511 18.998 19.946 19.974	367.8 Velocities stat SingleStk VertVel(m/s) 7.83 7.74 7.59 7.44 7.29 7.14 6.99 6.84 6.70 6.55 6.40 6.25 6.40 6.25 6.10 5.95 5.580 5.566	feet rrting at en Plume Temp(K)		=[0.12F _o (6.2	$25D \cdot z_{v}^{2} - (Va)_{o}^{3}/(V_{crit}^{3}0.16^{3}) = \frac{http://www.17}{bttp://www.17}$ is the real solution x = z-zv = or z(m/above stack) = z(tl/above ground) = $z(tl/above ground) = \frac{1}{bttp://www.17}$ Linearly interpolated from Stack R Spillane Equations: $V_{pluma} = (Va)_{o}^{3} + 0.12F_{o}(z-z_{v})^{2} - (6.2$ $a = 0.16(z-z_{v})$ $\theta_{p} = \theta_{o}(1+(1-(\theta_{p}/\theta_{p}))^{*}(V_{exit}D^{2}/(CEC Staff Equation: V_{mp} = n^{2}S_{v,p} - Brigg's Equation:$ $V_{mpenp} = (2/3) \times 1.6^{(2/2)} \times F_{mp}^{(1/2)} \times 1$ $w here F_{mp} = nF_{s,p}$	-74564 28. crg/cubic. f. 74. 44 76. 3 20 ft Interval el.Ht to Top of Je 5D-z.,) ²) ¹⁵ / a 5D-z.,) ²) ¹⁵ / a 4V plume [*] a ² A ²))
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s able of Plume Top-Hat Diameters (2a) and F Height (feet) above ground Stack.Rel.Ht = 27.4 40.0 60.0 80.0 100.0 120.0 140.0 180.0 220.0 2240.	Alocity in Jet 103.735 112.092 1ume-Averag (meters) above stack 0.000 3.83 9.93 16.03 22.12 28.22 34.31 40.41 40.51 52.60 58.70 64.79 70.89 76.99 83.08 89.18 95.27	meters meters ed Vertical Plume Radius(m) 13.146 13.634 14.122 14.609 15.585 16.072 16.560 17.048 17.535 18.023 18.511 18.998 19.486 19.974 20.462	367.8 Velocities stat SingleStk VertVel(m/s) 7.74 7.55 7.44 7.55 7.44 7.59 7.44 7.59 7.44 7.59 6.84 6.55 6.40 6.55 6.40 6.55 6.10 5.80 5.80 5.61	feet Irting at em Plume Temp(K)		=[0.12F _o (6.2	$25D \cdot z_v)^2 - (Va_0, s^3) / (V_{crit}^3 0.16^3) = \\ http://www.17 \\ s the real solution x = z \cdot zv = \\ or z (m/above stack) = \\ z (tr/above ground) = \\ z (tr/above ground)$	-74564 28. crg/cubic. f. 74. 44 76. 3 20 ft Interval el.Ht to Top of Je 5D-z.,) ²) ¹⁵ / a 5D-z.,) ²) ¹⁵ / a 4V plume [*] a ² A ²))
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s able of Plume Top-Hat Diameters (2a) and F Height (feet) above ground Stack.Rel.Ht = 27.4 40.0 60.0 80.0 100.0 120.0 120.0 120.0 120.0 200.0 200.	elocity in Jet 103.735 112.092 lume-Averag (meters) above stack 0.00 3.83 9.93 16.03 22.12 28.22 28.22 34.31 40.41 46.51 52.60 58.70 64.79 70.89 76.99 83.08 89.18 95.27 103.73	meters meters ed Vertical ' Plume Radius(m) 12.840 13.634 14.122 14.609 15.097 15.585 16.072 16.560 17.048 17.548 18.998 19.486 19.974 20.462 21.138	367.8 Velocities sta SingleStk VertVel(m/s) 7.83 7.74 7.59 7.44 7.59 7.44 7.59 6.84 6.99 6.84 6.70 6.55 6.40 6.25 6.10 5.95 5.80 5.510	feet Irting at em Plume Temp(K)		=[0.12F _o (6.2	$25D \cdot z_{v}^{2} - (Va)_{o}^{3}/(V_{crit}^{3}0.16^{3}) = \frac{http://www.17}{bttp://www.17}$ is the real solution x = z-zv = or z(m/above stack) = z(tl/above ground) = $z(tl/above ground) = \frac{1}{bttp://www.17}$ Linearly interpolated from Stack R Spillane Equations: $V_{pluma} = (Va)_{o}^{3} + 0.12F_{o}(z-z_{v})^{2} - (6.2$ $a = 0.16(z-z_{v})$ $\theta_{p} = \theta_{o}(1+(1-(\theta_{p}/\theta_{p}))^{*}(V_{exit}D^{2}/(CEC Staff Equation: V_{mp} = n^{2}S_{v,p} - Brigg's Equation:$ $V_{mpenp} = (2/3) \times 1.6^{(2/2)} \times F_{mp}^{(1/2)} \times 1$ $w here F_{mp} = nF_{s,p}$	-74564 28. crg/cubic. f. 74. 44 76. 3 20 ft Interval el.Ht to Top of Je 5D-z.,) ²) ¹⁵ / a 5D-z.,) ²) ¹⁵ / a 4V plume [*] a ² A ²))
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s able of Plume Top-Hat Diameters (2a) and F Height (feet) above ground Stack.Rel.Ht = 27.4 40.0 60.0 80.0 100.0 120.0 140.0 140.0 180.0 220.0 240.0 220.0 240.0 220.0 240.0 240.0 240.0 240.0 240.0 280.0 300.0 300.0 320.0 300.0 320.	elocity in Jet 103.735 112.092 lume-Averag (meters) above stack 0.00 3.83 9.93 16.03 22.12 28.22 34.31 40.51 52.60 58.70 64.79 70.89 76.99 83.08 89.18 95.27 103.73 107.47	meters meters ed Vertical ' Plume Radius(m) 12.840 13.634 14.122 14.609 15.097 15.585 16.072 16.560 17.048 17.535 18.023 18.511 18.998 19.486 19.974 20.462 21.133 21.437	367.8 Velocities sta SingleStk VertVel(m/s) 7.43 7.74 7.29 7.14 7.29 7.14 6.99 6.84 6.99 6.84 6.670 6.55 6.010 5.95 5.80 5.61 5.51 5.30	feet Inting at en Plume Temp(K)		=[0.12F _o (6.2	$25D \cdot z_{v}^{2} - (Va)_{o}^{3}/(V_{crit}^{3}0.16^{3}) = \frac{http://www.17}{bttp://www.17}$ is the real solution x = z-zv = or z(m/above stack) = z(tl/above ground) = $z(tl/above ground) = \frac{1}{bttp://www.17}$ Linearly interpolated from Stack R Spillane Equations: $V_{pluma} = (Va)_{o}^{3} + 0.12F_{o}(z-z_{v})^{2} - (6.2$ $a = 0.16(z-z_{v})$ $\theta_{p} = \theta_{o}(1+(1-(\theta_{p}/\theta_{p}))^{*}(V_{exit}D^{2}/(CEC Staff Equation: V_{mp} = n^{2}S_{v,p} - Brigg's Equation:$ $V_{mpenp} = (2/3) \times 1.6^{(2/2)} \times F_{mp}^{(1/2)} \times 1$ $w here F_{mp} = nF_{s,p}$	-74564 28. crg/cubic. f. 74. 44 76. 3 20 ft Interval el.Ht to Top of Je 5D-z.,) ²) ¹⁵ / a 5D-z.,) ²) ¹⁵ / a 4V plume [*] a ² A ²))
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s able of Plume Top-Hat Diameters (2a) and F Height (feet) above ground Stack.Rel.Ht = 27.4 40.0 60.0 80.0 100.0 100.0 120.0 140.0 180.0 220.0 240.0 280.0 280.0 380.0 300.	elocity in Jet 103.735 112.092 lume-Averag (meters) above stack 0.000 3.83 9.93 16.03 22.12 28.22 34.31 40.41 46.51 52.60 58.70 64.79 76.89 83.08 89.18 95.27 103.73 107.47 113.56	meters meters ed Vertical ' Plume Radius(m) 13.146 13.634 14.122 14.609 15.097 15.585 16.072 16.560 17.048 17.535 18.023 18.511 19.974 20.462 21.437 21.925	367.8 Velocities stat SingleStk VertVel(m/s) 7.43 7.74 7.29 7.14 6.99 6.84 6.70 6.55 6.40 6.25 6.10 5.55 5.80 5.51 5.30 5.21 5.30	feet Inting at en Plume Temp(K)		=[0.12F _o (6.2	$\label{eq:starter} \begin{split} &25D\cdot z_v)^2 - (Va_0,^3) / (V_{crit}^3 0.16^3) = \\ & http://www.17 \\ &s the real solution x = z - zv = \\ & or z (m/above stack) = \\ & z (tr/above ground) = \\ & z (tr/above groun$	-74564 28. crg/cubic. f. 74. 44 76. 3 20 ft Interval el.Ht to Top of Je 5D-z.,) ²) ¹⁵ / a 5D-z.,) ²) ¹⁵ / a 4V plume [*] a ² A ²))
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s able of Plume Top-Hat Diameters (2a) and F Height (feet) above ground Stack.Rel.Ht = 27.4 40.0 60.0 80.0 100.0 100.0 120.0 140.0 160.0 180.0 200.0 220.0 240.0 280.0 300.0 320.0 340.0 Single Jet 5.3 m/s Height = 387.8 388.0 400.0	elocity in Jet 103.735 112.092 lume-Averag (meters) above stack 0.00 3.83 9.93 16.03 22.12 28.22 34.31 40.51 52.60 58.70 64.79 70.89 76.99 83.08 89.18 95.27 103.73 107.47	meters meters ed Vertical Plume Radius(m) 12.840 13.146 13.634 14.122 14.609 15.565 16.072 16.560 17.048 17.535 18.023 18.511 18.998 19.446 19.974 20.462 21.138 21.437 21.925 22.2412	367.8 Velocities stat SingleStk VertVel(m/s) 7.83 7.74 7.59 7.44 7.59 7.44 7.59 7.44 7.59 6.84 6.84 6.70 6.55 6.40 6.55 6.40 6.55 6.40 6.55 5.80 5.66 5.51 5.30 5.61 5.21 5.21 5.21 5.24	feet rting at em Plume Temp(K)		=[0.12F _o (6.2	$\label{eq:starter} \begin{split} &25D\cdot z_v)^2 - (Va_0,^3) / (V_{crit}^3 0.16^3) = \\ & http://www.17 \\ &s the real solution x = z - zv = \\ & or z (m/above stack) = \\ & z (tr/above ground) = \\ & z (tr/above groun$	-74564 28. crg/cubic. f. 74. 44 76. 3 20 ft Interval el.Ht to Top of Je 5D-z.,) ²) ¹⁵ / a 5D-z.,) ²) ¹⁵ / a 4V plume [*] a ² A ²))
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s able of Plume Top-Hat Diameters (2a) and F Height (feet) above ground Stack.Rel.Ht = 27.4 40.0 60.0 80.0 100.0 100.0 120.0 140.0 180.0 220.0 240.0 280.0 280.0 380.0 300.	elocity in Jet 103.735 112.092 lume-Averag (meters) above stack 0.000 3.83 9.93 16.03 22.12 28.22 34.31 40.41 46.51 52.60 58.70 64.79 76.89 83.08 89.18 95.27 103.73 107.47 113.56	meters meters ed Vertical ' Plume Radius(m) 13.146 13.634 14.122 14.609 15.097 15.585 16.072 16.560 17.048 17.535 18.023 18.511 19.974 20.462 21.437 21.925	367.8 Velocities stat SingleStk VertVel(m/s) 7.83 7.74 7.59 7.44 7.59 7.44 7.59 7.44 7.59 6.84 6.84 6.70 6.55 6.40 6.55 6.40 6.55 6.40 6.55 5.80 5.66 5.51 5.30 5.61 5.21 5.21 5.21 5.24	feet rting at em Plume Temp(K)		=[0.12F _o (6.2	$\label{eq:starter} \begin{split} &25D\cdot z_v)^2 - (Va_0,^3) / (V_{crit}^3 0.16^3) = \\ & http://www.17 \\ &s the real solution x = z - zv = \\ & or z (m/above stack) = \\ & z (tr/above ground) = \\ & z (tr/above groun$	-74564 28. crg/cubic. f. 74. 44 76. 3 20 ft Interval el.Ht to Top of Je 5D-z.,) ²) ¹⁵ / a 5D-z.,) ²) ¹⁵ / a 4V plume [*] a ² A ²))
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s able of Plume Top-Hat Diameters (2a) and F Height (feet) above ground Stack.Rel.Ht = 27.4 40.0 60.0 80.0 100.0 100.0 120.0 140.0 160.0 180.0 200.0 220.0 240.0 280.0 300.0 320.0 340.0 Single Jet 5.3 m/s Height = 387.8 388.0 400.0	Alocity in Jet 103.735 112.092 1ume-Averag (meters) above stack 0.000 3.83 9.93 16.03 22.12 28.22 34.31 40.41 46.51 52.60 58.70 64.79 70.99 70.99 70.99 83.08 89.18 95.27 103.73 113.66 119.66	meters meters ed Vertical Plume Radius(m) 12.840 13.146 13.634 14.122 14.609 15.565 16.072 16.560 17.048 17.535 18.023 18.511 18.998 19.446 19.974 20.462 21.138 21.437 21.925 22.2412	367.8 Velocities sta SingleStk VertVel(m/s) 7.74 7.55 7.44 7.55 7.44 7.55 7.44 7.55 7.44 7.55 7.44 7.55 7.44 7.55 6.80 6.84 6.55 6.40 6.25 6.610 5.55 5.80 5.66 5.51 5.30 5.21 5.06 4.91 4.76	feet rting at em Plume Temp(K)		=[0.12F _o (6.2	$\label{eq:starter} \begin{split} &25D\cdot z_v)^2 - (Va_0,^3) / (V_{crit}^3 0.16^3) = \\ & http://www.17 \\ &s the real solution x = z - zv = \\ & or z (m/above stack) = \\ & z (tr/above ground) = \\ & z (tr/above groun$	-74564 28. crg/cubic. f. 74. 44 76. 3 20 ft Interval el.Ht to Top of Je 5D-z.,) ²) ¹⁵ / a 5D-z.,) ²) ¹⁵ / a 4V plume [*] a ² A ²))
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s able of Plume Top-Hat Diameters (2a) and F Height (feet) above ground Stack.Rel.Ht = 27.4 40.0 60.0 80.0 100.0 120.0 120.0 120.0 120.0 120.0 120.0 220.0 220.0 220.0 220.0 220.0 220.0 220.0 240.0 280.0 300.	elocity in Jet 103.735 112.092 (ume-Averag (meters) above stack 0.00 3.83 9.93 16.03 22.12 28.22 34.31 40.41 46.51 52.60 58.70 70.89 76.99 83.08 89.18 95.27 103.73 107.47 113.66 119.66 119.65 119.65 119.65 119.575	meters meters ed Vertical Plume Radius(m) 12.840 13.144 13.634 14.122 14.609 15.585 16.072 16.560 17.048 17.535 18.023 18.511 18.998 19.974 20.462 21.138 21.437 21.925 22.412 22.900	367.8 Velocities sta SingleStk VertVel(m/s) 7.83 7.74 7.59 7.44 7.59 7.44 7.59 6.40 6.55 6.40 6.25 6.40 6.55 6.40 6.55 6.40 6.55 6.40 6.55 6.40 6.55 6.60 6.55 6.60 6.55 6.60 6.55 6.60 6.55 6.60 6.55 6.40 6.55 6.60 6.55 6.60 6.55 6.60 6.55 6.60 6.55 6.60 6.55 6.60 6.55 6.60 6.55 6.60 6.55 6.40 6.55 6.60 6.49 6.60 6.55 6.60 6.49 6.65 6.60 6.49 6.65 6.60 6.55 6.60 6.60 6.55 6.55	feet Irting at em Plume Temp(K)		=[0.12F _o (6.2	$\label{eq:starter} \begin{split} &25D\cdot z_v)^2 - (Va_0,^3) / (V_{crit}^3 0.16^3) = \\ & http://www.17 \\ &s the real solution x = z - zv = \\ & or z (m/above stack) = \\ & z (tr/above ground) = \\ & z (tr/above groun$	-74564 28. org/cubic. F 74. 40 76. 27 20 ft Interval el.Ht to Top of Ja 5Dz., ²] ^{1/14} / a 4V _{plume} *a ² x ²) ¹ 50 ft Interval
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s able of Plume Top-Hat Diameters (2a) and F Height (feet) above ground Stack.Rel.Ht = 27.4 40.0 60.0 80.0 100.0 120.0 140.0 140.0 180.0 220.0 240.0 220.0 240.0 220.0 240.0 220.0 340.0 300.	elocity in Jet 103.735 112.092 lume-Averag (meters) above stack 0.00 3.83 9.93 16.03 22.12 28.22 34.31 40.51 52.60 58.70 64.79 70.89 8.308 89.18 95.27 103.73 107.47 113.56 112.575 131.85	meters meters ed Vertical ' Plume Radius(m) 12.840 13.634 14.122 14.609 15.585 16.072 16.560 17.048 17.535 18.023 18.511 18.998 19.466 19.974 20.462 21.138 21.437 21.925 22.4102 23.388	367.8 Velocities sta SingleStk VertVel(m/s) 7.43 7.74 7.59 7.44 7.29 7.44 7.29 7.44 6.99 6.84 6.99 6.84 6.670 6.55 6.010 5.95 5.80 5.66 5.51 5.30 5.61 5.30 5.21 5.30 5.31 5.30 5.21 5.30 5.31 5.30 5.31 5.30 5.31 5.30 5.31 5.31 5.31 5.31 5.31 5.31 5.31 5.31	feet rrting at en Plume Temp(K)	d of jet phi	=[0.12F _o (6.2	$\label{eq:starter} \begin{split} &25D\cdot z_v)^2 - (Va_0,^3) / (V_{crit}^3 0.16^3) = \\ & http://www.17 \\ &s the real solution x = z - zv = \\ & or z (m/above stack) = \\ & z (tr/above ground) = \\ & z (tr/above groun$	-74564 28. org/cubic. F 74. 40 76. 27 20 ft Interval el.Ht to Top of Ja 5Dz., ²] ^{1/14} / a 4V _{plume} *a ² x ²) ¹ 50 ft Interval
Find Height above Stack Z _{crit} Height above Ground Z _{crit} +h _s able of Plume Top-Hat Diameters (2a) and F Height (feet) above ground Stack.Rel.Ht = 27.4 40.0 60.0 80.0 100.0 120.0 140.0 120.0 140.0 120.0 240.0 220.0 240.0 220.0 240.0 220.0 240.0 220.0 300.0 240.0 240.0 220.0 300.0 240.0 240.0 280.0 300.	elocity in Jet 103.735 112.092 lume-Averag (meters) above stack 0.000 3.83 9.933 16.03 22.12 28.22 34.31 40.51 52.60 58.70 64.79 70.89 76.99 83.08 89.18 99.33 107.47 113.66 119.66 1	meters meters ed Vertical ' Plume Radius(m) 12.840 13.634 14.122 14.609 15.097 15.585 16.072 16.560 17.048 17.535 18.023 18.511 18.998 19.466 19.974 20.4628 21.437 21.925 22.412 22.900 23.388 25.679	367.8 Velocities sta SingleStk VertVel(m/s) 7.83 7.74 7.59 7.44 7.59 7.44 7.59 6.84 6.84 6.55 6.40 6.55 6.40 6.55 6.40 6.55 5.80 5.50 5.51 5.50 5.21 5.00 6.4.91 4.76 4.61 3.92 3.80	feet rting at en Plume Temp(K)	d of jet phi	=[0.12F _o (6.2	$\label{eq:starter} \begin{split} &25D\cdot z_v)^2 - (Va_0,^3) / (V_{crit}^3 0.16^3) = \\ & http://www.17 \\ &s the real solution x = z - zv = \\ & or z (m/above stack) = \\ & z (tr/above ground) = \\ & z (tr/above groun$	-74564 28. org/cubic.t 74. 44 76. : 20 ft Interval el.Ht to Top of Ja 5D z., ² /j) ^{1/2} / a 4V _{plume} *a ² x ² /) 1 ^{4/2} x z ^{14/2}
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s able of Plume Top-Hat Diameters (2a) and F Height (feet) above ground Stack.Rel.Ht = 27.4 40.0 60.0 80.0 100.0 100.0 100.0 100.0 100.0 100.0 100.0 100.0 100.0 200.0 220.0 240.0 280.0 280.0 280.0 340.0 Single Jet 5.3 m/s Height = 367.8 380.0 400.0	elocity in Jet 103.735 112.092 lume-Averag (meters) above stack 0.00 3.83 9.93 16.03 22.12 28.22 34.31 40.41 46.51 52.60 58.70 64.79 76.89 76.89 76.89 89.18 95.27 103.73 107.47 113.56 119.66 119.66 119.66 119.66 119.66 119.75 160.42 112.75 160.42 112.75 160.42 112.75 160.42 112.75 160.42 112.75 160.42 112.75 160.42 112.75 160.42 112.75 160.42 112.75 160.42 112.75 160.42 112.75 160.42 112.75 160.42 172.75 160.42 172.75 173.75 172.75 173.75 172.	meters meters ed Vertical ' Plume Radius(m) 13.146 13.634 14.122 14.609 15.085 16.072 16.560 17.535 18.023 18.511 18.998 19.446 19.974 20.462 21.138 21.437 21.925 22.412 22.900 23.388 25.679 27.608	367.8 Velocities sta SingleStk VertVel(m/s) 7.74 7.55 7.44 7.55 7.44 7.55 7.44 7.55 6.40 6.25 6.40 6.25 6.40 6.25 6.40 6.25 6.40 6.25 5.61 5.50 5.51 5.30 5.62 5.51 5.30 6.49 4.91 4.76 4.61 5.52 5.21 5.00 4.91 4.76 5.53 5.21 5.22 5.21 5.23 5.23 5.21 5.23 5.23 5.21 5.23 5.23 5.23 5.21 5.23 5.23 5.23 5.23 5.23 5.23 5.23 5.23	feet rting at en Plume Temp(K)	d of jet phi	=[0.12F _o (6.2	$\label{eq:starter} \begin{split} &25D\cdot z_v)^2 - (Va_0,^3) / (V_{crit}^3 0.16^3) = \\ & http://www.17 \\ &s the real solution x = z - zv = \\ & or z (m/above stack) = \\ & z (tr/above ground) = \\ & z (tr/above groun$	-74564 28. org/cubic.t 74. 44 76. : 20 ft Interval el.Ht to Top of Ja 5D z., ² /j) ^{1/2} / a 4V _{plume} *a ² x ² /) 1 ^{4/2} x z ^{14/2}
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s able of Plume Top-Hat Diameters (2a) and F Height (feet) above ground Stack.Rel.Ht = 27.4 40.0 60.0 80.0 100.0 120.0 140.0 160.0 120.0 140.0 160.0 220.0 2240.0 220.0 2240.0 220.0 240.0 260.0 28	Alocity in Jet 103.735 112.092 112.0	meters meters meters ed Vertical Plume Radius(m) 12.840 13.146 13.634 14.122 14.609 15.585 16.072 16.560 17.048 17.535 18.023 18.511 18.998 19.974 20.462 21.138 21.437 21.925 22.2412 22.900 23.388 25.679 27.608 32.484	367.8 Velocities sta SingleStk VertVel(m/s) 7.74 7.59 7.44 7.59 7.44 7.59 7.44 7.59 7.44 7.59 7.44 7.59 7.44 7.59 7.44 7.59 6.80 6.55 6.40 6.55 6.40 6.55 6.60 5.51 5.80 5.51 5.00 6.51 5.00 6.4.91 4.76 4.61 3.80 3.80 3.58 3.41	feet rting at em Plume Temp(K)	d of jet phi	=[0.12F _o (6.2	$\label{eq:starter} \begin{split} &25D\cdot z_v)^2 - (Va_0,^3) / (V_{crit}^3 0.16^3) = \\ & http://www.17 \\ &s the real solution x = z - zv = \\ & or z (m/above stack) = \\ & z (tr/above ground) = \\ & z (tr/above groun$	-74564 28. org/cubic.t 74. 44 76. : 20 ft Interval el.Ht to Top of Ja 5D z., ² /j) ^{1/2} / a 4V _{plume} *a ² x ² /) 1 ^{4/2} x z ^{14/2}
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s able of Plume Top-Hat Diameters (2a) and F Height (feet) above ground Stack.Rel.Ht = 27.4 40.0 80.0 100.0 120.0 140.0 120.0 280.0 280	elocity in Jet 103.735 112.092 lume-Averag (meters) above stack 0.00 3.83 9.93 16.03 22.12 28.22 34.31 40.51 52.60 58.70 64.79 70.89 83.08 89.18 95.27 103.73 107.47 113.56 119.66 125.75 131.85 160.49 125.75 131.85 160.49 125.57 131.85 160.49 125.50 131.85 160.49 125.50 131.85 160.49 174.52 131.85 160.49 174.52 131.85 160.49 174.52 131.85 160.49 174.52 131.85 160.49 174.52 131.85 160.49 174.52 131.85 160.49 174.52 131.85 160.49 174.52 131.85 160.49 174.52 131.85 160.49 174.52 131.85 160.49 174.52 175.13 160.49 174.52 175.13 175.15 17	meters meters ed Vertical Plume Radius(m) 12.840 13.634 14.122 14.609 15.097 15.585 16.072 16.560 17.048 17.048 17.535 18.023 18.511 18.998 19.466 19.974 20.462 21.138 21.437 21.925 22.412 22.900 23.388 25.679 27.608 32.484 37.361 42.238	367.8 Velocities sta SingleStk VertVel(m/s) 7.78 7.74 7.59 7.44 7.59 7.44 7.59 7.44 7.59 6.84 6.99 6.84 6.70 6.55 6.00 6.55 6.00 5.95 5.80 5.66 5.51 5.30 5.21 5.00 6.491 4.76 4.91 4.76 4.91 4.76 4.91 5.95 5.80 5.80 5.95 5.80 5.95 5.80 5.95 5.80 5.95 5.95 5.80 5.95 5.80 5.95 5.80 5.80 5.80 5.80 5.80 5.80 5.80 5.8	feet rrting at en Plume Temp(K) 313.45 313.12 312.47 312.04	d of jet ph:	=[0.12F _o (6.2	$\label{eq:starter} \begin{split} &25D\cdot z_v)^2 - (Va_0,^3) / (V_{crit}^3 0.16^3) = \\ & http://www.17 \\ &s the real solution x = z - zv = \\ & or z (m/above stack) = \\ & z (tr/above ground) = \\ & z (tr/above groun$	-74564 28. org/cubic. F 74. 40 76. 27 20 ft Interval el.Ht to Top of Ja 5Dz., ²] ^{1/14} / a 4V _{plume} *a ² x ²) ¹ 50 ft Interval
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s fable of Plume Top-Hat Diameters (2a) and F Height (feet) above ground Stack.Rel.Ht = 27.4 40.0 60.0 80.0 100.0 100.0 100.0 100.0 100.0 100.0 100.0 100.0 200.0 220.0 240.0 280.0 280.0 280.0 280.0 280.0 330.0 330.0 330.0 330.0 330.0 5 <i>ingle Jet 5.3 m/s Height</i> = 367.8 380.0 400.0 400.0 400.0 400.0 700 of Single jet = 554.0 600.0 700.0 8	elocity in Jett 103.735 112.092 lume-Averag (meters) above stack 0.000 3.83 9.93 16.03 22.12 28.22 34.31 40.61 52.60 58.70 64.79 76.99 83.08 89.18 95.27 103.73 107.47 113.56 119.66 119.66 119.66 119.66 119.66 119.65 160.49 174.52 205.00 205.48	meters meters meters Radius(m) 12.840 13.146 13.634 14.122 14.609 15.087 15.585 16.072 16.560 17.535 18.023 18.511 18.998 19.466 19.974 20.462 21.138 19.4746 21.437 21.925 22.412 22.900 23.388 21.437 21.925 22.412 22.900 23.388 24.443 37.361 42.238 47.115	367.8 Velocities sta SingleStk VertVel(m/s) 7.43 7.74 7.29 7.14 7.29 7.14 6.99 6.84 6.70 6.55 6.00 6.55 6.00 6.55 5.80 5.51 5.30 5.51 5.30 5.521 5.30 5.51 5.30 5.21 5.21 5.21 5.21 5.21 5.21 5.21 5.21	feet rrting at en Plume Temp(K) 313.45 313.45 313.42 312.47 312.04 311.73	d of jet ph:	=[0.12F _o (6.2	$\label{eq:starter} \begin{split} &25D\cdot z_v)^2 - (Va_0,^3) / (V_{crit}^3 0.16^3) = \\ & http://www.17 \\ &s the real solution x = z - zv = \\ & or z (m/above stack) = \\ & z (tr/above ground) = \\ & z (tr/above groun$	-74564 28.org/cubic.h 74.40 76.3 20 ft Interval eHt to Top of Jet 5Dz. ₂ / ² / ^{1/10} / a 4V _{plume} *a ² a ² λ ²))
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s able of Plume Top-Hat Diameters (2a) and F Height (feet) above ground Stack.Rel.Ht = 27.4 40.0 60.0 80.0 100.0 120.0 140.0 160.0 120.0 140.0 160.0 280.0 220.0 2240.0 220.0 240.0 280.0 300.0 320.0 340.0 5 <i>single Jet 5.3 m/s Height = 387.0</i> 380.0 400.0 400.0 400.0 5 <i>single Jet 5.3 m/s Height = 387.0</i> 400.0 4	elocity in Jett 103.735 112.092 lume-Averag (meters) above stack 0.000 3.83 9.93 16.03 22.12 28.22 34.31 40.41 40.41 46.51 52.60 58.70 64.79 76.99 76.99 76.89 76.89 76.89 76.99 76.93 107.47 113.56 61.03,73 107.47 113.56 119.66 125.75 131.85 160.32 107.44 113.56 119.66 125.75 131.85 160.32 107.44 114.52 205.00 235.48 265.64 265.75 265.64 265.75 265.64 265.75 265.64 265.75 265.64 265.75 265.75 265.75 265.75 265.64 275.75 265.64 275.75 265.64 275.75 275	meters meters meters Plume Radius(m) 12.840 13.146 13.634 14.122 14.609 15.565 16.072 16.560 17.048 17.535 18.023 18.511 18.998 19.466 19.974 20.462 21.138 21.437 22.412 22.900 23.388 25.679 27.608 32.444 37.361 42.238 47.115 14.998 14.978 15.978 16.580 17.535 18.072 18.511 18.978 19.446 19.974 19.974 19.974 19.974 19.974 19.974 19.974 19.974 19.974 19.974 19.974 19.974 19.974 19.977 19.97	367.8 Velocities stat SingleStk VertVel(m/s) 7.74 7.74 7.74 7.74 7.74 7.74 6.99 6.84 6.70 6.55 6.40 6.655 6.40 6.655 6.40 6.55 5.61 5.80 5.66 5.51 5.30 5.51 5.21 5.00 4.91 4.76 4.61 3.92 3.80 3.58 3.41 3.27 3.155	feet rting at en Plume Temp(K) 313.45 313.12 312.47 312.04 311.73 311.51	d of jet phi	=[0.12F _o (6.2	$eq:started_st$	-74564 28.org/cubic.h 74.40 76.3 20 ft Interval eHt to Top of Jet 5Dz. ₂ / ² / ^{1/10} / a 4V _{plume} *a ² a ² λ ²))
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s able of Plume Top-Hat Diameters (2a) and F Height (feet) above ground Stack.Rel.Ht = 27.4 40.0 60.0 80.0 100.0 120.	elocity in Jet i 103.735 112.092 lume-Averag (meters) above stack 0.00 3.83 9.93 16.03 22.12 28.22 28.22 28.22 28.22 34.31 40.41 46.51 52.60 58.70 64.79 70.99 83.08 89.18 95.27 103.73 107.47 113.66 119.66 113.65 114.64 113.66 114.65 115.75 113.65 114.64 115.75 113.65 114.64 115.75 113.65 114.64 115.75 114.65 115.75 113.65 114.64 115.75 114.65 115.75 115.	meters meters meters ed Vertical ' Plume Radius(m) 13.144 13.634 14.122 14.609 15.585 16.072 16.560 17.048 17.035 18.023 18.511 18.998 19.974 20.462 21.138 21.437 21.925 22.412 22.900 23.388 25.679 27.600 32.484 37.361 42.238 47.115 71.499 95.883	367.8 Velocities sta SingleStk VertVel(m/s) 7.74 7.55 7.44 7.55 7.44 7.55 7.44 7.55 7.44 7.55 7.44 7.55 7.44 7.55 7.44 7.55 7.44 6.99 6.84 6.70 6.55 6.40 6.25 6.40 6.25 6.40 6.25 6.51 5.50 6.55 5.51 5.30 5.66 5.51 5.30 5.21 5.30 6.21 5.30 5.21 5.21 5.21 5.21 5.21 5.21 5.21 5.21	feet rting at en Plume Temp(K) 313.45 313.12 312.04 311.73 311.51 310.94	d of jet ph:	=[0.12F _o (6.2	$eq:started_st$	-74564. 28.org/cubic.h 74.40 76.3 271 20 ft Interval el.Ht to Top of Jet 50-z., ²]) ^{1/3} / a 4V _{plume} *a ²⁺ λ ²)) 50 ft Interval 50 ft Interval
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s able of Plume Top-Hat Diameters (2a) and F Height (feet) above ground Stack.Rel.Ht = 27.4 40.0 60.0 80.0 100.0 120.0 140.0 120.0 220.0 220.0 2240.0 220.0 220.0 220.0 220.0 220.0 240.0 220.0 220.0 240.0 220.0 240.0 220.0 240.0 220.0 240.0 220.0 240.0 200.0 240.0 200.0 240.0 200.0 240.0 260.0 280.0 280.0 300.0 300.0 300.0 200.0 280.0 280.0 280.0 280.0 280.0 280.0 280.0 280.0 280.0 280.0 290.0 200	elocity in Jet 103.735 112.092 lume-Averag (meters) above stack 0.00 3.83 9.93 16.03 22.12 28.22 34.31 40.51 52.60 58.70 64.79 70.89 8.308 89.18 95.27 103.73 107.47 113.56 119.66 119.67 125.75 131.85 160.49 125.57 131.85 160.49 125.54 205.04 205.04 205.04 205.05 205.04 205.05 20	meters meters meters Plume Radius(m) 12.840 13.664 13.664 14.122 14.609 15.097 15.565 16.072 16.560 17.048 17.048 17.048 17.048 19.974 20.462 21.138 21.437 21.925 22.412 22.900 23.388 25.679 27.608 32.444 37.361 42.238 47.115 71.499 95.883 120.267	367.8 Velocities sta SingleStk VertVel(m/s) 7.78 7.74 7.59 7.44 7.59 7.44 7.59 7.44 7.59 6.40 6.25 6.40 6.25 6.40 6.25 6.40 6.25 6.40 6.551 5.30 5.21 5.30 5.21 5.30 5.22 5.30 5.27 5.27 5.27 5.27 5.27 5.27 5.27 5.27	feet rrting at em Plume Temp(K) 313.45 313.42 313.42 313.42 313.12 313.42 313.12 313.42 313.12 313.42 313.12 313.45 313.12 31	d of jet ph:	=[0.12F _o (6.2	$eq:started_st$	-74564 28. org/cubic. h 74. 4ζ 76. ; 20 ft Interval eLH to Top of Jat 50-z,j°)1 ⁽ⁿ / a 50-z,j°)1 ⁽ⁿ⁾ / a 50-z,j
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s fable of Plume Top-Hat Diameters (2a) and F Height (feet) above ground Stack.Rel.Ht = 27.4 40.0 60.0 80.0 100.0 120	elocity in Jet i 103.735 112.092 lume-Averag (meters) above stack 0.00 3.83 9.93 16.03 22.12 28.22 28.22 28.22 28.22 34.31 40.41 46.51 52.60 58.70 64.79 70.99 83.08 89.18 95.27 103.73 107.47 113.66 119.66 113.65 114.64 113.66 114.65 115.75 113.65 114.64 115.75 113.65 114.64 115.75 113.65 114.64 115.75 114.65 115.75 113.65 114.64 115.75 114.65 115.75 115.	meters meters meters ed Vertical ' Plume Radius(m) 13.144 13.634 14.122 14.609 15.585 16.072 16.560 17.048 17.035 18.023 18.511 18.998 19.974 20.462 21.138 21.437 21.925 22.412 22.900 23.388 25.679 27.600 32.484 37.361 42.238 47.115 71.499 95.883	367.8 Velocities sta SingleStk VertVel(m/s) 7.74 7.59 7.44 7.59 7.44 7.59 7.44 7.59 6.84 6.99 6.84 6.70 6.55 6.40 6.55 6.40 6.55 6.610 5.95 5.80 5.66 5.51 5.95 5.80 5.61 5.95 5.521 5.06 4.91 4.76 4.91 4.76 4.91 4.75 5.21 5.00 5.21 5.00 5.21 5.00 5.21 5.00 5.21 5.00 5.21 5.00 5.21 5.00 5.21 5.21 5.00 5.21 5.21 5.21 5.21 5.21 5.21 5.21 5.21	feet rrting at en Plume Temp(K) 313.45 313.45 313.12.47 312.47 312.47 312.47 312.47 312.47 313.45 315.45	d of jet ph:	=[0.12F _o (6.2	$eq:started_st$	-74564. 28.org/cubic.h 74.40 76.3 271 20 ft Interval el.Ht to Top of Jet (5D-z,) ²]) ^{1/2} / a 4V _{plume} *a ² *λ ²)) 50 ft Interval 50 ft Interval

